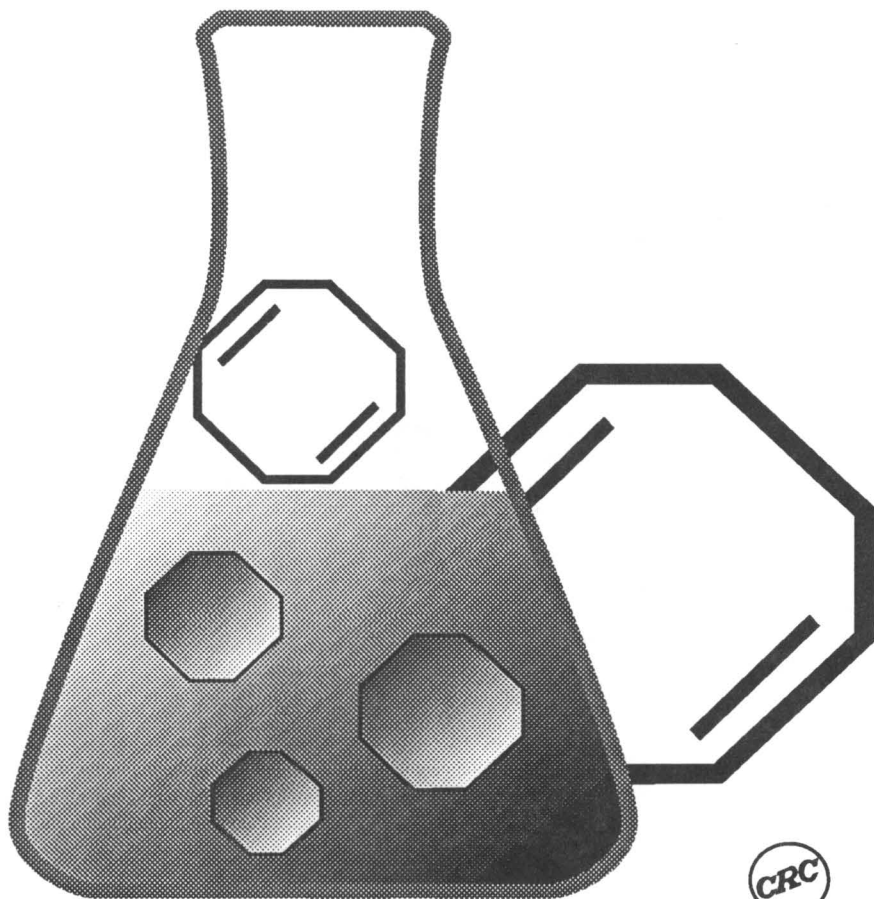


ILLUSTRATED CHEMISTRY LABORATORY TERMINOLOGY

Herbert W. Ockerman



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PURPOSE

This manual is intended for chemists whose first language is not English and who are attempting to expand their English vocabulary in the chemical laboratory area. It will be of most use to students who have a moderate knowledge of the English language and who have had some practical experience in a chemistry laboratory. It should be extremely useful to non-English-speaking students who plan to teach chemistry (in English) or who are required to write in English a thesis or dissertation on a chemically-related topic.

Items in parentheses indicate British English term or British English spelling or American English alternate term or American English alternate spelling.

Suggestions for improvement of this book are welcomed by the author.

Herbert W. Ockerman, Ph.D.

Professor

SAFETY EQUIPMENT	1
First Aid Kit	1
Fire Extinguisher	1
Fire Blanket	1
Shower	1
Eye Wash	2
Telephone (Phone)	2
Warning Labels, Warning Signs	2
caution	2
explosive	2
biohazard	2
radiation hazard	3
wear your goggles	3
danger	3
flammable	3
corrosive	3
poison	3
use in hood	3
under high pressure	3
under low pressure	3
caustic	3
avoid contact with skin	3
hot	3
sterile	3
keep in refrigerator	3
out of order	3
Safety Goggles	4
Respirator	4
Discussion	5
LABORATORY FURNITURE	6
Fume Hood (Fume cupboard)	6
Base Unit	6
Storage Cabinet	6
Floor Case	7
Desk	7
Table	7
Filing Cabinet	7
Discussion	8
PORTABLE LABORATORY FURNITURE	9
Laboratory Cart (Laboratory trolley)	9
Laboratory Chair or Stool	9
Ladder (Steps)	9
Discussion	10
FIXTURES	11
Faucet (Tap)	11
Mixing Faucet (Mixer tap)	11
Sink	11
Stopcock	12
Cold Water	12
Hot Water	12
Distilled Water	12
Steam	12
Air	12

FIXTURES (Cont'd)	
Gas	13
Oxygen (O ₂)	13
Nitrogen (N ₂)	13
Vacuum	13
Needle Valve	13
Siphon	13
Discussion	14
ELECTRICAL	15
Electrical Outlet (Electrical sockets)	15
Outlet Box or Strip (Distribution board or box)	15
Variable Transformer or Powerstat ("Variac")	15
Battery; Chargeable and Non-chargeable	16
Battery Charger	16
Discussion	17
CYLINDER GAS	18
Gas Cylinder or Tank	18
Pressure Regulator	18
Gas Cylinder Clamp	18
Discussion	19
VACUUM AND AIR PUMPS	20
Vacuum and Pressure Pump	20
Vane Pump Movement	20
Vacuum Pump (Rotary oil pump)	20
Hand Pump	21
Hand Pump, Floor Model	21
Aspirator (Water pump)	21
Discussion	22
COLD STORAGE	23
Refrigerator-Freezer	23
Dry Ice Storage Container (Solid carbon dioxide storage container)	23
Dry Ice Box (Solid carbon dioxide storage or shipping container)	24
Dewar Flask (Thermos flask)	24
Discussion	25
HAND LABORATORY EQUIPMENT	26
Spatula	26
Scoop	26
Tongs	26
Policeman	26
Notebook	26
Foil	27
Bag	27
Evaporating Dish	27
Apron	27
Asbestos Gloves	28
Rubber Gloves	28
Disposable Gloves	28
Wash Bottle	28
Dropping Bottle	29
Rubber Bulb	29
Brush	29
Cleaning Compound	29

HAND LABORATORY EQUIPMENT (Cont'd)	
Tissue	29
Wall Clock	30
Interval Timer	30
Time Switch	30
Stopwatch	31
Discussion	32
LABORATORY HAND TOOLS	33
Pliers	33
Needle Nose Pliers (Fine nose pliers)	33
Wire Cutter Pliers	33
Tin Snips	33
Shears or Scissors	33
Crescent Wrench (Adjustable wrench)	34
Open-end Wrench	34
Hex Wrench Set	34
Hammer	34
Screwdriver	34
Drill Bit	35
Metal File	35
Vise (Vice)	35
Soldering Gun (Soldering iron)	35
Discussion	36
OFFICE HAND TOOLS	37
Tape Dispenser	37
Label Maker	37
Label	37
Ball Point Pen	37
Wax Pencil	38
Felt Tip Marking Pen	38
Rule or Ruler	38
Calculator	38
Discussion	39
PERIODIC TABLE	40
Periodic Table or Chart	40
Discussion	41
REAGENT	42
Acetic Acid	42
Alcohol	42
Ammonium Hydroxide	42
Calcium Hydroxide	42
Hydrochloric Acid	42
Nitric Acid	42
Potassium Hydroxide	42
Sodium Hydroxide	42
Sulfuric Acid (Sulphuric acid)	42
Reagent Label	43
Discussion	44
MOLECULAR MODELS	45
SUPPORTS	46
Support or Frame	46
Buret Stand (Burette stand)	46
Ring Stand (Retort stand)	46
Tripod	47
Buret Clamp (Burette clamp)	47

SUPPORTS (Cont'd)	
Clamp Holder	47
Clamp	47
Clamp with Holder	48
Discussion	49
GLASS	50
Glass Tubing	50
Capillary Tubing	50
Glass Rod	50
Ball and Socket Joint	51
O-Ring Joint	51
Standard Taper Ground Glass Joint ("Quickfit")	51
Pinch Clamp	51
Glass Stopcock	52
Condenser	52
Test Tube	52
Test Tube Holder	53
Test Tube Rack	53
Watch Glass	53
Safety Hand Grip	53
Glass Tubing Cutter	54
Discussion	55
CONTAINERS AND CLOSURES	56
Beaker	56
Bottle	56
Erlenmeyer Flask (Conical flask)	56
Pail or Bucket	56
Florence Flask	57
Vial	57
Cap	57
Stopper; Rubber or Plastic Stopper	57
Glass Stopper	57
Cork	58
Cork Borer	58
Discussion	59
TUBING	60
Rubber Tubing	60
Plastic Tubing	60
Tubing Clamp	60
Discussion	61
LIQUID VOLUME MEASURING EQUIPMENT	62
Syringe Pipet (Syringe pipette)	62
Transfer or Volumetric Pipet (Transfer or Volumetric pipette)	62
Measuring or Graduated Pipet (Measuring or Graduated pipette)	62
Pipet Filling Attachment or Bulb (Pipette Filling attachment or bulb)	63
Automatic Transfer Pipet (Automatic transfer pipette)	63
Graduated Cylinder	63
Graduate	64
Beaker	64
Graduated Buret (Graduated burette)	64
Automatic Zero Pipet (Automatic zero pipette)	65

LIQUID VOLUME MEASURING EQUIPMENT (Cont'd)	
Stopcock	65
Stopcock Grease	65
Volumetric Flask	66
Pump	66
Discussion	67
WEIGHT AND SAMPLE COMPOSITION	68
Scale	68
Triple Beam Balance	68
Balance	68
Top-Loading Balance	69
Weight Set	69
Specific Gravity Balance	69
Hydrometer	70
Specific Gravity Bottle; Pycnometer	70
Viscometer	70
Polarimeter	71
Refractometer	71
Hand Refractometer	71
Discussion	72
HEATING	73
Oven	73
Hot Plate	73
Incubator	73
Heating Mantle	74
Immersion Heater	74
Heating Tape	74
Muffle Furnace	75
Crucible	75
Water Bath	75
Thermometer	76
Dial Thermometer	76
Thermometer (Electronic)	76
Autoclave or Sterilizer	77
Instrument Sterilizer	77
Burner	77
Alcohol Lamp	78
Gas Lighter	78
Safety Matches	78
Melting Point Bath	79
Melting Point Tube	79
Discussion	80
MIXING AND PRESSING EQUIPMENT	81
Mortar and Pestle	81
Stirrer	81
Magnetic Stirrer	81
Large Size Shaker	82
Shaker ("Whirli mixer")	82
Blender	82
Hand Grinder (Hand mincer)	83
Mill	83
Tissue Grinder	83
Homogenizer	84
Emulsion Homogenizer	84
Hydraulic Press	85

MIXING AND PRESSING EQUIPMENT (Cont'd)	
Discussion	86
MEASUREMENT EQUIPMENT	87
pH Meter	87
Electrode	87
pH Buffer Solution	87
Test Paper or Litmus Paper or Universal Indicator Paper	88
Volt-Ohm-Ammeter (AVO-meter)	88
Barometer	88
Bomb Calorimeter	89
Centrifuge	89
Centrifuge Head (Rotor)	90
Centrifuge Tube	90
Carriers	90
Spectrophotometer	91
Spectro Cell	91
Fluorometer (Fluorimeter)	92
Flowmeter	92
Discussion	93
SEPARATION EQUIPMENT	94
Gel Column Electrophoresis	94
Scanning Densitometer	94
Dialyzer	94
Automatic Sampler	95
Sieve	95
Separatory Funnel (Separating funnel)	95
Chromatography Column	96
Thin Layer Chromatography (TLC)	96
Chromatography Cabinet	96
Soxhlet Extractor	97
Extraction Thimble	97
Goldfish Extractor	97
Babcock Bottle	98
Divider	98
Babcock Centrifuge	98
Aluminum Foil Dish (Aluminium foil dish)	99
Desiccator	99
Drying Oven	99
Vacuum Oven	100
Moisture Balance	100
Freeze Drying	100
Kjeldahl Flask	101
Kjeldahl Digestion Unit	101
Kjeldahl Distilling Unit	101
Recorder	102
Discussion	103
FILTERING	104
Funnel	104
Filter Paper	104
Glass Wool	104
Filtering Flask (Filter flask)	105
Buchner Filter Funnel	105
Crucible	105
Crucible Holder	106

FILTERING (Cont'd)	
Impinger	106
Discussion	107
DISTILLATION	108
Still	108
Distilling Flask (Distillation flask)	108
Water Still	108
Demineralizer	109
Flash Evaporator	109
Discussion	110
GAS MEASUREMENT	111
Respirometer	111
Discussion	112
SMALL ANIMAL EQUIPMENT	113
Animal Cage	113
Drinking Tube	113
Feeding Dish	113
Dissecting Kit	114
Animal Operating Table	114
Discussion	115
MICROSCOPIC EXAMINATION	116
Microscope	116
Slide	116
Magnifier	116
Lens Tissue	117
Micrometer	117
Counting Chamber	117
Staining Dish or Jar	118
Tissue Processing Unit	118
Microtome	118
Discussion	119
MICROBIOLOGY	120
Culture Media	120
Dilution Bottle	120
Petri Dish	120
Petri Dish Sterilizing Box	121
Quebec Colony Counter	121
Counter	121
Inoculating Needle or Loop	122
Culture Tube	122
Discussion	123
WASHING	124
Glassware Washer	124
Pipet Washer (Pipette washer)	124
Draining Rack	125
Discussion	126

中文目錄

安全設施	1
急救箱	1
滅火器	1
防火氈	1
蓮蓬頭(噴水器)	1
眼睛沖洗具	2
電話	2
警告標識、警告記號	2
注意、小心	2
爆炸性	2
生物危險性	2
放射性危險性	3
帶上護目鏡	3
危險	3
易燃的	3
腐蝕性	3
有毒	3
在毒氣室內使用	3
在高壓下	3
在低壓下	3
腐蝕性	3
避免與皮膚接觸	3
熱	3
無菌	3
保存在冰箱	3
壞掉	3

安全護目眼鏡	4
面罩；呼吸器、濾毒罐	4
討 論	5
實驗室器具	6
烟櫥；通風櫥、抽油煙機	6
基本單位	6
儲存櫥（箱、小室）	6
落地櫥	7
實驗檯	7
桌子；實驗桌	7
銼屑櫥	7
討 論	8
輕便的（可移動的）實驗室器具	9
實驗室吊運車	9
實驗室椅子或凳子	9
梯 子	9
討 論	10
裝置品	11
水龍頭（塞子；栓；龍頭）	11
混合水龍頭（混合器龍頭）	11
水槽；水斗、漏水池	11
轉門；（活）栓、活塞	12
冷 水	12
熱 水	12
蒸餾水	12
蒸汽、水蒸汽	12
空 氣	12
氣體；氣態；煤氣；毒氣	13

	氧；氧氣	13
	氮；氮氣	13
	真空	13
	針孔閥	13
	虹吸、虹吸管	13
	討論	14
電	器	15
	電的出口管；插座	15
	插座箱；配線箱	15
	可變的變壓器	15
	電池組（可充電的和不可充電的）	15
	電池充電器	16
	討論	17
汽缸	氣、氣體汽缸（鋼瓶圓筒）	18
	氣體鋼瓶；汽缸（箱）	18
	調壓器	18
	汽缸夾（壓板）	18
	討論	19
真空	空氣唧筒（泵浦）	20
	真空壓氣泵浦	20
	葉輪式可移動泵	20
	真空泵；輪迴抽油機	20
	手動抽水機（泵）	21
	地板式手動抽水機（泵）	21
	吸氣器（水泵）	21
	討論	21
冷	藏	22
	冷凍機—冷藏箱	23
	乾冰貯存器（固體二氧化碳貯存器）	23
	乾冰盒（固體二氧化碳貯存或運輸）容器	24
	真空瓶；杜瓦瓶（保溫瓶）	24
	討論	25

實驗室使用設備	26
刮鏟、鴨舌匙	26
勺、杓、挖空	26
鉗子	26
澱帚	26
筆記簿	26
錫箔片	27
袋子	27
蒸發皿	27
圍裙	27
石棉手套	28
橡膠手套	28
用後可丟棄手套	28
洗滌瓶	28
滴瓶	29
橡膠球管(球)	29
刷子	29
洗滌劑	29
擦拭紙	29
壁鐘	30
間隔計時器	30
定時轉變器	30
碼錶、計時錶	31
討論	32

實驗室使用工具	33
鉗子	33
針孔鉗(細孔鉗)	33
鋼絲鉗	33
剪錫鉗	33
大剪刀、剪刀	33
新月形扳鉗(可調節扳剪)	34
開端扳鉗	34
六扳鉗組	34
錘	34
螺絲起子;螺絲刀	34
螺旋鑽	35
金屬銼刀	35
虎頭鉗	35
焊接槍	35
討論	36
辦公室使用工具	37
紮帶分配器	37
標籤製造器	37
標籤	37
原子筆	37
蠟筆	38
簽字筆	38
尺;米達尺	38
計算機	38
討論	39

週期表	40
週期表(或圖)	40
討論	41
試藥	42
醋酸	42
酒精	42
氫氧化銨	42
氫氧化鈣	42
氫氟酸; 鹽酸	42
硝酸	42
氫氧化鉀	42
氫氧化鈉	42
硫酸	42
試藥標籤	43
討論	44
分子模型	45
架; 支座	46
架; 支座或框	46
滴定管架	46
環架(蒸餾瓶架)	46
三腳架	47
滴定管夾	47
夾子固定器	47
夾子	47
固定夾	48
討論	49

玻璃器具	50
玻璃管	50
毛細管	50
玻璃棒	50
球和套筒聯接	51
O型環聯接	51
標準錐形磨口玻璃接頭	51
捏夾	51
玻璃栓(轉門)	52
冷凝器、電容器	52
試管	52
試管夾	53
試管架	53
表玻璃	53
安全手柄	53
玻璃管切斷機	54
討論	55
容器和密封器	56
燒杯	56
瓶子	56
錐瓶、錐形燒瓶或三角瓶	56
桶;吊桶;斗	56
平底燒瓶	57
管形瓶	57
蓋、帽、罩	57

容器和密閉器(續)

塞子；橡膠或塑膠塞子	57
玻璃塞子	57
軟木塞	58
塞子穿孔器	58
討論	59
試管：管子	60
橡膠試管	60
塑膠試管	60
試管夾	60
討論	61
液體體積測量設備	62
注射吸管(注射筒)	62
可移動的定量吸管	62
測量或有刻度吸管	62
有吸球吸管	63
自動轉移吸管	63
量筒	63
量杯	64
燒杯	64
有刻度定量管(滴定管)	64
自動歸零吸管	65
栓；轉門	65
活栓脂膏	65
定量瓶	66
泵、唧筒	66
討論	67

稱重和樣品組成	68
秤；標度；尺度	68
三角桿秤	68
天平；秤	68
上皿天平	69
法碼組	69
比重計	69
比重計	70
比重瓶	70
粘度計	70
旋光計；旋光測定計	71
折射計	71
手提式折射計	71
討 論	72
加 熱	73
爐；烘箱	73
加熱板	73
孵卵器	73
加熱罩	74
浸液加熱器	74
加熱捲帶	74
隔焰爐；迴熱爐；蒙煇爐	75
坩堝；熔鍋	75
水 浴	75
溫度計	76
刻度溫度計	76
電子溫度計	76

加 熱 (續)

高壓加熱器；壓熱器、高壓殺菌器	77
殺菌器；消毒器	77
燈頭；燃燒器	77
酒精燈	78
瓦斯（氣體）點火器（發光器）	78
安全火柴	78
熔點浴	79
熔點管	79
討 論	80
混合和加壓設備	81
白和杵	81
攪拌器	81
磁性攪拌器	81
大號搖動器	82
搖動器（迴轉混合器）	82
摻合器	82
手動碾磨機（手動絞碎機）	83
磨碾機	83
組織碾磨機	83
均質機	84
乳濁液均質機	84
水壓機	85
討 論	86

測量設備	87
PH 測定器、PH 計	87
電 極	87
PH (酸、鹼) 緩衝液	87
試管或石蕊試紙或通用試紙	88
伏特—歐姆安培計	88
氣壓計	88
彈式量熱器 (熱量測定器)	89
離心機	89
離心機轉頭	90
離心管	90
載體、遞體	90
分光光度計	91
光譜室 (箱)	91
氟量計；螢光計	92
流量計	92
討 論	93
分離設備	94
凝膠柱電泳	94
螢光密度計	94
滲析膜；滲析器	94
自動採樣器	95
篩 子	95
分液漏斗	95
色層吸附柱；色譜柱	96
薄層色層分析法 (TLC)	96
色層分析櫥 (箱)	96

分離設備 (續)

索格利特萃取器	97
提取殼筒	97
Goldfish 萃取器	97
巴希科克乳油管	98
分規；雙腳規	98
巴布科克遠心分離器	98
鋁箔皿 (碟)	99
除濕乾燥器	99
乾燥烘箱	99
真空烘箱	100
測濕器 (水分測定計)	100
冷凍乾燥	100
長頸燒瓶；凱氏燒瓶	101
凱氏分解裝置	101
凱氏蒸餾裝置	101
記錄器	102
討 論	103
過 濾	104
漏 斗	104
濾 紙	104
玻璃棉；玻璃絨	104
吸濾瓶	105
瓷過濾漏斗	105
坩 堝	105

過 濾 (續)

坩堝夾	106
衝擊板；打擊板	106
討 論	107

蒸

餾	108
蒸餾釜；蒸餾鍋	108
蒸餾瓶	108
蒸水器	108
脫礦物質器	109
急驟蒸發器	109
討 論	110

氣體

測量器	111
呼吸計	111
討 論	112

小動物

設備	113
動物籠 (檻)	113
飲水管	114
飼養盤 (槽)	113
解剖用具	114
動物手術檯	114
討 論	115

顯微鏡的檢查

顯微鏡	116
玻璃片；幻燈片	116
放大鏡	116

顯微鏡的檢查(續)

鏡頭擦拭紙	117
測微計	117
計算室	117
染色盤或染色缸	118
組織處理單位	118
切片機	118
討論	119
微生物學	120
培養基	120
稀釋瓶	120
培養皿	120
培養皿殺菌盒	121
Quebec 菌落計數器(計群器)	121
計數器	121
接種針或環、白金耳	122
培養管	122
討論	123
洗滌	124
玻璃儀器洗滌機(器)	124
吸管洗滌機(器)	124
排水架、滴乾架	125
討論	126

MATERIEL DE SECURITE	1
Trousse de premier secours	1
Extincteur	1
Couverture anti-feu	1
Douche	1
Lave-oeil	2
Téléphone	2
Etiquettes et affiches	2
danger	2
explosif	2
risque biologique	2
danger de radiations	3
mettez vos lunettes	3
danger	3
inflammable	3
corrosif	3
poison	3
utiliser sous hotte	3
sous haute pression	3
sous basse pression	3
caustique	3
éviter le contact avec la peau	3
chaud	3
stérile	3
garder au réfrigérateur	3
en panne	3
Lunettes de sécurité	4
Masque	4
Discussion	5
MOBILIER DE LABORATOIRE	6
Hotte de ventilation	6
Socle	6
Placard de rangement	6
Cabinet au sol	7
Bureau	7
Table	7
Meuble de classement	7
Discussion	8
MOBILIER DE LABORATOIRE PORTABLE	9
Charriot de laboratoire	9
Tabouret de laboratoire	9
Escabeau	9
Discussion	10
INSTALLATIONS	11
Robinet	11
Robinet-mélangeur d'eau	11
Evier	11
Bouchon d'arrêt	12
Eau froide	12
Eau chaude	12
Eau distillée	12
Vapeur	12

INSTALLATIONS (suite)	
Air	12
Gaz	13
Oxygène (O ₂)	13
Nitrogène (N ₂)	13
Vide	13
Soupape en aiguille	13
Siphon	13
Discussion	14
APPAREILLAGE ELECTRIQUE	15
Prise électrique	15
Disjoncteur	15
Transformateur variable	15
Batterie, chargeable et non-rechargeable	16
Rechargeur de piles	16
Discussion	17
BOUTEILLE A GAZ	18
Bouteille à gaz	18
Régulateur de pression	18
Support de bouteille à gaz	18
Discussion	19
VIDE ET POMPE A AIR	20
Pompe à vide et à pression	20
Mouvement de pompe à vide	20
Pompe à vide	20
Pompe à main	21
Pompe à main, modèle au sol	21
Aspirateur (pompe à eau)	21
Discussion	22
REFRIGERATION	23
Refrigérateur-congélateur	23
Cuve de stockage de glace sèche	23
Boîte de glace sèche	24
Bouteille Thermos	24
Discussion	25
MATERIEL DE LABORATOIRE A MANIEMENT MANUEL	26
Spatule	26
Cuillère	26
Pincés	26
Agitateur	26
Carnet	26
Papier aluminium	27
Sac en papier	27
Assiette d'évaporation	27
Tablier	27
Gants en amiante	28
Gants de caoutchouc	28
Gants à jeter	28
Flacon laveur	28
Flacon de compte-gouttes	29
Ampoule en caoutchouc	29
Brosse	29
Produit à nettoyer	29

MATERIEL DE LABORATOIRE A MANIEMENT MANUEL (suite)	
Papier-mouchoir	29
Horloge murale	30
Minuteur	30
Interrupteur automatique	30
Chronomètre	31
Discussion	32
INSTRUMENTS DE LABORATOIRE A MAIN	33
Tenailles	33
Tenailles aux pinces en aiguilles	33
Tenailles coupe-fer	33
Sciseaux pour aluminium	33
Sciseaux	33
Clé anglaise	34
Clé anglaise à bout ouvert	34
Trousseau de clés anglaises	34
Marteau	34
Tourne-vis	34
Perceuse	35
Limeuse en métal	35
Vis d'établis	35
Soudeuse	35
Discussion	36
FOURNITURES DE BUREAU	37
Appareil de papier collant	37
Marqueur d'étiquettes	37
Etiquettes	37
Style à bille	37
Crayon à cire	38
Crayon-feutre	38
Règle	38
Calculatrice	38
Discussion	39
TABLEAU PERIODIQUE	40
Tableau ou carte périodique	40
Discussion	41
REACTIF	42
Acide acétique	42
Alcool	42
Hydroxyde d'ammonium	42
Hydroxyde de calcium	42
Acide hydrochlorique	42
Acide nitrique	42
Hydroxyde de potasse	42
Hydroxyde de sodium	42
Acide sulfurique	42
Désignation de reactif	43
Discussion	44
MODELES MOLECULAIRES	45
SUPPORTS	46
Support ou cadre	46
Support de burette	46
Support d'anneaux	46

SUPPORTS (suite)	
Trépied	47
Pince de burette	47
Support de pinces	47
Pince	47
Pince avec support	48
Discussion	49
VERRES	50
Canne de verre	50
Tube capillaire	50
Baguette de verre	50
Raccord et douille	51
Charnière	51
Rodage normalisé	51
Pince de Mohr	51
Robinet d'arrêt en verre	52
Condensateur	52
Eprouvette-test	52
Support d'éprouvette test	53
Support à tubes d'essais	53
Verre de montre	53
Poignée de sécurité	53
Couteau à canne de verre	54
Discussion	55
RECIPIENTS	56
Bécher	56
Bouteille	56
Falçon conique d'Erlenmeyer	56
Seau	56
Flacon de Florence	57
Fiole	57
Couvercle	57
Bouchon d'arrêt en caoutchouc ou plastiue	57
Bouchon d'arrêt en verre	57
Bouchon	58
Tire-bouchon	58
Discussion	59
TUYAUTERIE	60
Tuyauterie en caoutchouc	60
Tuyauterie en plastique	60
Pince de tuyau	60
Discussion	61
INSTRUMENTS DE MESURE DE VOLUME LIQUIDE	62
Pipette en seringue	62
Pipette volumétrique	62
Pipette graduée	62
Ballon de pipette	63
Pipette de transfert automatique	63
Cylindre gradué	63
Réipient gradué	64
Bécher	64
Burette graduée	64
Pipette au zero automatique	65

INSTRUMENTS DE MESURE DE VOLUME LIQUIDE (suite)	
Bouchon d'arrêt	65
Graisse de bouchon d'arrêt	65
Flacon volumétrique	66
Pompe	66
Discussion	67
POIDS ET COMPOSITION D'ECHANTILLON	68
Echelle	68
Balance à trois fléaux	68
Balance	68
Balance électronique	69
Poids	69
Balance à densité spécifique	69
Hydromètre	70
Bouteille à densité spécifique	70
Viscomètre	70
Polarimètre	71
Refractomètre	71
Réfractomètre à main	71
Discussion	72
CHAUFFAGE	73
Etuve	73
Plaque chauffante	73
Incubateur	73
Manchon thermique	74
Chauffage d'immersion	74
Cordon thermique	74
Four à moufle	75
Creuset	75
Bain à eau	75
Thermomètre	76
Thermomètre à cadran	76
Thermomètre électronique	76
Autoclave ou stérilisateur	77
Stérilisateur d'instruments	77
Brûleur	77
Lampe à alcool	78
Briquet à gaz	78
Alumettes	78
Bain à point de fusion	79
Tube à point de fusion	79
Discussion	80
EQUIPEMENT DE COMPRESSION ET DE MELANGE	81
Pilon et mortier	81
Agitateur	81
Agitateur magnétique	81
Grand mixer	82
Mixer	82
Mélangeur	82
Broyeur à main	83
Moulin	83
Broyeur de tissus	83
Homogénéiseur	84

EQUIPEMENT DE COMPRESSION ET DE MELANGE (suite)	
Homogénéiseur à emulsion	84
Presse hydraulique	85
Discussion	86
INSTRUMENTS DE MESURE 87	
Appareil de mesure du pH	87
Electrode	87
Solution tampon pH	87
Papier indicateur	88
Voltmètre Ohm	88
Baromètre	88
Calorimètre	89
Centrifugeuse	89
Tête de centrifugeuse	90
Tube de centrifugeuse	90
Porteurs	90
Spectrophomètre	91
Cellule de spectrophomètre	91
Fluoromètre	92
Débitmètre	92
Discussion	93
INSTRUMENTS DE SEPARATION 94	
Electrophorèse à colonne de gel	94
Densitomètre d'analyse	94
Dialyse	94
Echantillonneur automatique	95
Tamis	95
Filtre de séparation	95
Colonne de chromatographie	96
Chromatographie à couche mince	96
Cabinet de chromatographie	96
Cartouche de Soxhlet	97
Cartouche d'extraction	97
Extracteur de Goldfisch	97
Bouteille de Babcock	98
Diviseur	98
Centrifugeuse de Babcock	98
Assiette en papier aluminium	99
Dessiccateur	99
Etuve	99
Etuve à vide	100
Degré moyen d'humidité	100
Séchage par évaporation de glace	100
Flacon de Kjeldahl	101
Unité de digestion de Kjeldahl	101
Unité de distillation de Kjeldahl	101
Indicateur	102
Discussion	103
FILTRAGE 104	
Entonnoir	104
Papier filtre	104
Laine de verre	104
Ballon filtre	105

FILTRAGE (suite)	
Entonnoir filtre de Buchner	105
Creuset	105
Support de creuset	106
Epurateur	106
Discussion	107
DISTILLATION	108
Alambic	108
Flacon de distillation	108
Alambic à eau	108
Déminéralisateur	109
Evaporateur instantané	109
Discussion	110
MESURE DE GAZ	111
Appareil respiratoire	111
Discussion	112
EQUIPEMENT POUR PETIT ANIMAL	113
Cage	113
Tube d'alimentation en eau	113
Assiette	113
Trousse de dissection	114
Table d'opération pour animaux	114
Discussion	115
EXAMEN MICROSCOPIQUE	116
Microscope	116
Diapositive	116
Loupe	116
Tissu de lentille	117
Micromètre	117
Cuve de comptage	117
Flacon ou plat de coloration	118
Unité de traitement des tissus	118
Microtome	118
Discussion	119
MICROBIOLOGIE	120
Milieu de culture	120
Bouteille de dilution	120
Plat de Petri	120
Boîte de stérilisation du plat de Petri	121
Compteur de la colonie de Québec	121
Compteur	121
Aiguille d'inoculation	122
Tube de culture	122
Discussion	123
LAVAGE	124
Laveur de verres	124
Laveur de pipettes	124
Egoutteur	125
Discussion	126

ARBEITSSICHERHEIT AUSSTATTUNG	1
"Erste Hilfe" Tasche	1
Feuerlöscher	1
Feuerdecke	1
Dusche	1
Augenspülwasser	2
Telefon	2
Warntafeln, Warnzeichen	2
Vorsicht	2
Sprengstoff	2
Gefahr der biologischen Verseuchung	2
Gefahr der radioaktiven Verstrahlung	3
Setz die Schutzbrille auf	3
Gefahr	3
Leicht anzündbar	3
Zerfressend	3
Gift	3
Lüftung nötig	3
Unter hohem Druck	3
Unter niedrigem Druck	3
Kaustisch	3
Berührung der Haut vermeiden	3
Heiß	3
Steril	3
Im Kühlschrank aufbewahren	3
Kaputt	3
Schutzbrille	4
Atemgerät	4
Diskussion	5
LABORMÖBEL	6
Abzug	6
Laborschrank mit Arbeitsbrett	6
Lagerschrank	6
Schrank	7
Schreibtisch	7
Tisch	7
Aktenschrank	7
Diskussion	8
TRAGBARE LABORMÖBEL	9
Laborwagen	9
Laborstuhl	9
Leiter	9
Diskussion	10
ARMATUR	11
Hahn	11
Warm und Kalt Wasserhahn	11
Spülbecken	11
Absperrhahn	12
Kaltes Wasser	12
Heißes Wasser	12
Destilliertes Wasser	12
Dampf	12
Luft	12
Gas	13
ARMATUR (Fortsetzung)	

Sauerstoff (O ₂)	13
Stickstoff (N ₂)	13
Vakuum	13
Nadelventil	13
Siphon	13
Diskussion	14
ELEKTRISCHE AUSSTATTUNG	15
Anschluß	15
Anschlußkasten	15
Variabel Transformator ("Variac")	15
Batterie; Aufladenbar und nichtaufladenbar	16
Ladegerät	16
Diskussion	17
FLASCHENGAS	18
Gasflasche oder Gasbehälter	18
Druckregulator	18
Klammer der Gasflasche	18
Diskussion	19
VAKUUM- UND LUFTPUMPEN	20
Vakuum- und Druckpumpe	20
Bewegung des Pumpenrotors	20
Vakuumpumpe (Drehkolbenölpumpe)	20
Handpumpe	21
Stützbare Handpumpe	21
Aspirator (Wasserpumpe)	21
Diskussion	22
LAGERUNG IN NIEDRIGEN TEMPERATUREN	23
Kühlschrank-Tiefkühltruhe	23
Trockeneisbehälter (Kohlendioxidschneebehälter)	23
Trockeneiskasten (zur Lagerung und Transport)	24
Dewargefäß	24
Diskussion	25
LABOR HANDAUSRÜSTUNG	26
Spachtel	26
Schaufel	26
Zange	26
Rührer	26
Notizheft	26
Folie	27
Tüten	27
Abdampfschale	27
Schürze	27
Asbesthandschuhe	28
Gummihandschuhe	28
Handschuhe zum einmaligen Gebrauch	28
Reinigungsflasche	28
Tropfflasche	29
Gummibirne	29
Bürste	29
Putzmittel	29
Papiertücher	29
Wanduhr	30
Intervalstopuhr	30
Zeitschalter	30
LABOR HANDAUSRÜSTUNG (Fortsetzung)	

Stoppuhr	31
Diskussion	32
LABORWKRZEUG	33
Zange	33
Nadelförmige Zange	33
Drahtschneidende Zange	33
Metalschneidende Schere	33
Schere	33
Schraubenschlüssel (einstellbar)	34
Schraubenschlüssel	34
Flachschlüsselgarnitur	34
Hammer	34
Schraubenzieher	34
Bohrenspitze	35
Metalfeile	35
Aufspannblock	35
Lötpistole	35
Diskussion	36
BÜROWERKZEUG	37
Klebebandverteiler	37
Beschriftungsgerät	37
Aufklebezettel	37
Kugelschreiber	37
Fettstift	38
Filzstift	38
Linial	38
Rechner	38
Diskussion	39
PERIODENSYSTEM	40
Periodensystem oder Tabelle	40
Diskussion	41
REAKTIONSMITTEL	42
Essigsäure	42
Alkohol	42
Ammoniumhydroxid	42
Calciumhydroxid	42
Salzsäure	42
Salpetersäure	42
Kaliumhydroxid	42
Natriumhydroxid	42
Schwefelsäure	42
Reagenspapier	43
Diskussion	44
MOLEKÜLMODELLE	45
Hilfsmittel	46
Stativ	46
Bürettengestell	46
Retortengestell	46
Dreibein	47
Bürettenklammer	47
Klammerhalter	47
Klammer	47
Klammet mit Halter	48
Diskussion	49
GLASS	50

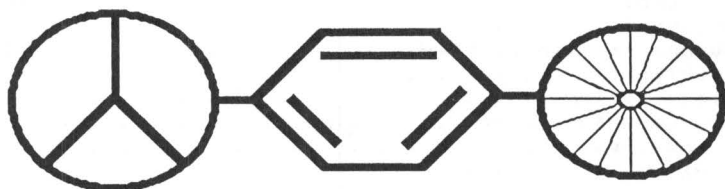
Glassrohr	50
Haarrörchen	50
Glasstab	50
Kugelgelenk	51
O-Ringgelenk	51
Standard Verjüngtes Glasschliff	51
Quetschhahn	51
Glasshahn	52
Kühler	52
Reagenzglass	52
Reagenzglasshalter	53
Reagenzglassgestell	53
Uhrglass	53
Handschutz	53
Glassrohrfräser	54
Diskussion	55
BEHÄLTER UND VERSCHLÜSSE	56
Becher	56
Flasche	56
Erlenmeyerkolben	56
Kübel oder Eimer	56
Flachbodenkolben	57
Ampulle	57
Kappe	57
Stöpsel; Gummi- und Plastikstöpsel	57
Glasstöpsel	57
Korken	58
Korkbohrer	58
Diskussion	59
ROHRLEITUNG	60
Gummischlauch	60
Plastikschlauch	60
Schlauchhahn	60
Diskussion	61
FLÜSSIGKEITSMASSAUSRÜSTUNG	62
Spritpipette	62
Vollpipette	62
Messpipette	62
Pipettenbirne	63
Automatische Vollpipette	63
Messzylinder	63
Messglass	64
Becher	64
Messbürette	64
Automatische Nullpipette	65
Abspeerhahn	65
Abspeerhahnschmiere	65
Messkolben	66
Pumpe	66
Diskussion	67
GEWICHT UND ZUSAMMENSETZUNG DER PROBE	68
Federwaage	68
Hebelwaage	68
Analytische Waage	68
GEWICHT UND ZUSAMMENSETZUNG (Fortsetzung)	

Automatische Waage	69
Gewichtssatz	69
Wichtewaage	69
Hydrometer	70
Pyknometer	70
Viscosimeter	70
Polarimeter	71
Refraktometer	71
Handrefraktometer	71
Diskussion	72
ERHITZEN	73
Ofen	73
Heizplatte	73
Brutapparat	73
Heizpilz	74
Tauchsieder	74
Heizband	74
Muffelofen	75
Schmelztiegel	75
Wasserbad	75
Thermometer	76
Thermometer mit Zifferblatt	76
Elektronisches Thermometer	76
Sterilisator	77
Sterilisator der Instrumente	77
Brenner	77
Spirituslampe	78
Gasanzünder	78
Streichhölzer	78
Schmelzpunktbestimmungsapparat	79
Schmelzpunktröhrchen	79
Diskussion	80
MISCH- UND PRESSAUSTRÜSTUNG	81
Mörser und Mörserkeule	81
Rührer	81
Magnetischer Rührer	81
Grosse Schüttelvorrichtung	82
Schüttelvorrichtung	82
Mixer	82
Handschleifmaschine	83
Mühle	83
Gewbwschleifmaschine	83
Homogenisierapparat	84
Emulsionshomogenisiersapparat	84
Hydraulische Presse	85
Diskussion	86
MEBAUSRÜSTUNG	87
pH-Meter	87
Elektrode	87
pH-Pufferlösung	87
Lackmuspapier	88
Volt-Ohm-Amperemeter	88
Barometer	88
Bombenkalorimeter	89
MEBAUSRÜSTUNG (Fortsetzung)	

Zentrifuge	89
Zentrifugenkopf (Rotor)	90
Zentrifugenglass	90
Träger	90
Spektralphotometer	91
Spektralzelle	91
Fluorometer	92
Durchflußmesser	92
Diskussion	93
TRENNAUSRÜSTUNG	94
Gel-Säulelektrophorese	94
Abtastdenitometer	94
Dialysator	94
Automatischer Probennehmer	95
Sieb	95
Scheidetrichter	95
Trennsäule	96
Dünnschichtchromatographie	96
Chromatographiekammer	96
Soxhlet-Extraktor	97
Extraktionshülse	97
Goldfisch-Extraktor	97
Babcock-Flasche	98
Stechzirkel	98
Babcock-Zentrifuge	98
Behälter aus Aluminiumfolie	99
Exsikkator	99
Trockner	99
Vakuumofen	100
Feuchtigkeitswaage	100
Gefrier-trocknung	100
Kjeldahl-Kolben	101
Kjeldahl-Digestioneinheit	101
Kjeldahl-Destilliereinheit	101
Registrierapparat	102
Diskussion	103
FILTRIEREN	104
Trichter	104
Filterpapier	104
Glasswolle	104
Absaugeflasche	105
Büchner-Filtertrichter	105
Glühtiegel	105
Tiegelhalter	106
Staubprobensammler	106
Diskussion	107
DESTILLATION	108
Retorte	108
Destillierkolben	108
Wasserdestillierapparat	108
Entsättigungsvorrichtung	109
Stoßverdampfer	109
Diskussion	110
GASMESSUNG	111

Respiratometer	111
Diskussion	112
ASRÜSTUNG ZU VERSUCHEN MIT KLEINEN TIEREN	113
Käfig	113
Tränkröhr	113
Fütterschale	113
Präpariersatz	114
Operationstisch für Tiere	114
Diskussion	115
MIKROSKOPISCHE UNTERSUCHUNG	116
Mikroskop	116
Schieber	116
Lupe	116
Linsentuch	117
Mikrometer	117
Zählkammer	117
Färbetopf	118
Gewebebearbeitungseinheit	118
Mikrotom	118
Diskussion	119
MIKROBIOLOGIE	120
Kulturböden	120
Verdünnungsflasche	120
Petrischale	120
Sterilisationskasten für Petrischale	121
Quebec-Kolonienzähler	121
Zähler	121
Impfungsnaedel oder Schlinge	122
Kulturröhrchen	122
Diskussion	123
WASCHEN	124
Waschvorrichtung für Glass	124
Waschvorrichtung für Pipette	124
Trockner für Glass	125
Diskussion	126

COMIC NAME



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WYPOSAŻENIE ZWIĄZANE Z BEZPIECZEŃSTWEM PRACY	1
Zestaw pierwszej pomocy medycznej	1
Gaśnica	1
Koc przeciwpożarowy	1
Prysznic	1
Woda do płukania oczu	2
Telefon	2
Napisy i znaki ostrzegające	2
ostrożnie	2
materiał wybuchowy	2
niebezpieczeństwo skażenia biologicznego	2
zagrożenie promieniowaniem	3
załóż okulary ochronne	3
niebezpieczeństwo	3
zagrożenie pożarowe	3
substancja korozyjna	3
trucizna	3
konieczna odpowiednia wentylacja	3
pod wysokim ciśnieniem	3
pod niskim ciśnieniem	3
żrąca zasada	3
unikaj kontaktu ze skórą	3
wysoka temperatura	3
steryjne	3
przechowywać w lodówce	3
uszkodzona	3
Okulary ochronne	4
Wziwisk	4
Dyskusja	5
MEBLE LABORATORYJNE	6
Wyciąg	6
Szafka laboratoryjna z blatem roboczym	6
Wysoka szafka laboratoryjna	6
Wysoka szafka laboratoryjna z przesuwanymi	
drzwiami	7
Biuorko	7
Stół	7
Szafka z szufladami do przechowywania	
dokumentów	7
Dyskusja	8
PRZENOŚNE MEBLE LABORATORYJNE	9
Ruchomy stolik laboratoryjny	9
Krzesło laboratoryjne	9
Drabinka	9
Dyskusja	10
WYPOSAŻENIE	11
Kran wodociągowy	11
Kran wodociągowy z zimną i ciepłą wodą	11
Zlew	11
Kurek	12
Woda zimna	12
Woda gorąca	12
Woda destylowana	12
Para wodna	12
Powietrze	12
Gaz	13

WYPOSAŻENIE(c.d.)	
Tlen(O ₂)	13
Azot(N ₂)	13
Próżnia	13
Zawór iglicowy	13
Rurka przelewowa, syfon	13
Dyskusja	14
URZĄDZENIA ELEKTRYCZNE	15
Gniazdko elektryczne	15
Rozdzielacz, kontakt przenośny	15
Transformator	15
Bateria	16
Urządzenie do ładowania baterii	16
Dyskusja	17
GAZ W BUTLACH	18
Butla gazowa	18
Regulator ciśnienia	18
Uchwyt do mocowania butli gazowej	18
Dyskusja	19
POMPY PRÓŻNIOWE I POWIETRZNE	20
Pompa próżniowo-ciśnieniowa	20
Ruch wirnika pompy	20
Pompa próżniowa	20
Pompka ręczna	21
Pompka ręczna (opierana o podłogę)	21
Pompka wodna	21
Dyskusja	22
PRZECHOWYWANIE W NISKICH TEMPERATURACH	23
Lodówka z zamrażalnikiem	23
Pojemnik do przechowywania suchego lodu	23
Pudło do transportu i przechowywania suchego lodu	24
Termos	24
Dyskusja	25
PODRĘCZNY SPRZĘT LABORATORYJNY	26
Szpachelka	26
Szufelka	26
Szczypce	26
Mieszadło	26
Notatnik	26
Folia	27
Torebka	27
Parownica	27
Fartuch ochronny	27
Rękawice azbestowe	28
Rękawice gumowe	28
Rękawice jednorazowe	28
Tryskawka	28
Kroplomierz	29
Gruszka gumowa	29
Szczotka	29
Środek zmywający	29
Bibułka do czyszczenia	29
Zegar ścienny	30
Czasomierz, minutnik	30
Wyłącznik zegarowy	30
Stoper	31
Dyskusja	32

PODRĘCZNE NARZĘDZIA LABORATORYJNE	33
Szczypce	33
Szczypce do wyginania i cięcia drutu	33
Szczypce do cięcia drutu	33
Nożyce do cięcia blachy	33
Nożycy	33
Klucz francuski	34
Klucz płaski do nakrętek	34
Zestaw kluczy wpustowych sześciokątnych	34
Młotek	34
Śróbokręt	34
Wiertło	35
Pilnik	35
Imadło	35
Lutownica	35
Dyskusja	36
PRZYBORY BIUROWE	37
Przyrząd do rozwijania i cięcia taśmy klejącej	37
Przyrząd do tłoczenia napisów na plastikowych nalepkach	37
Nalepka	37
Długopis	37
Ołówek woskowy, dermatograf	38
Pisak, flamaster	38
Linijka	38
Kalkulator	38
Dyskusja	39
TABELA UKŁADU OKRESOWEGO	40
Tabela układu okresowego pierwiastków	40
Dyskusja	41
ODCZYNNIKI CHEMICZNE	42
Kwas octowy	42
Alkohol	42
Wodorotlenek amonowy	42
Wodorotlenek wapniowy	42
Kwas solny	42
Kwas azotowy	42
Wodorotlenek potasowy	42
Wodorotlenek sodowy	42
Kwas siarkowy	42
Etykiety na odczynnikach	43
Dyskusja	44
MODELE MOLEKULARNE	45
STATYWY	46
Statyw ramowy	46
Statyw do biuret	46
Statyw laboratoryjny	46
Trójnog	47
Uchwyt, łapa do biuret	47
Łącznik	47
Łapa statywu	47
Łapa statywu z łącznikiem	48
Dyskusja	49

SZKŁO LABORATORYJNE	50
Rurka szklana	50
Rurka kapilarna	50
Bagietka szklana	50
Połączenie na szlif kulisty	51
Łącznik pierścieniowy	51
Połączenie na standardowy szlif stożkowy	51
Klamra zaciskowa	51
Kurek szklany	52
Chłodnica	52
Probówka	52
Uchwyt do probówek	53
Statyw do probówek	53
Szkiełko zegarkowe	53
Ochroniacz dłoni	53
Urządzenie do cięcia szklanych rurek	54
Dyskusja	55
NACZYNNIA I ICH ZAMKNIĘCIA	56
Zlewka	56
Butelka	56
Kolba stożkowa	56
Miadro	56
Kolba płaskodenna	57
Fiolka	57
Wieżko, nakrętka	57
Korek	57
Korek szklany	57
Korek z kory drzewa	58
Korkobór	58
Dyskusja	59
RURKI	60
Rurka gumowa	60
Rurka plastikowa	60
Zaciskacz do rurki	60
Dyskusja	61
SPRZĘT DO MIERZENIA OBJĘTOŚCI CIECZY	62
Pipeta strzykawkowa	62
Pipeta miarowa	62
Pipeta wielomiarowa	62
Pipeta napełniana gruszką gumową	63
Dozownik	63
Cylinder miarowy	63
Menzurka	64
Zlewka	64
Biureta wielomiarowa	64
Pipeta automatyczna jednomiarowa	65
Kurek	65
Smar do uszczelniania kurków	65
Kolba miarowa	66
Pompka	66
Dyskusja	67

CIEŻAR I SKŁAD PRÓBKI	68
Waga sprężynowa	68
Waga trójramienna z przesuwными odważnikami	68
Waga analityczna	68
Waga automatyczna jednoszalkowa	69
Zestaw odważników	69
Waga do określania ciężaru właściwego	69
Areometr	70
Piknometr	70
Wiskozymetr	70
Polarymetr	71
Refraktometr	71
Refraktometr ręczny	71
Dyskusja	72
OGRZEWANIE	73
Suszarka	73
Podgrzewacz	73
Cieplarka	73
Płaszcz grzejny	74
Grzejnik zanurzeniowy	74
Taśma grzejna	74
Piec muflowy	75
Tygiel	75
Łaźnia wodna	75
Termometr	76
Termometr tarczowy	76
Termometr elektroniczny	76
Autoklaw	77
Sterylizator do narzędzi	77
Palnik	77
Lampka spirytusowa	78
Zapalacz do gazu	78
Zapałki	78
Przyrząd do oznaczania temperatury topnienia	79
Probówka do oznaczania temperatury topnienia	79
Dyskusja	80
SPRZĘT DO MIESZANIA I ZGNIATANIA	81
Moździerz i pistolet	81
Mieszadło	81
Mieszadło magnetyczne	81
Duża wstrząsarka	82
Wstrząsarka	82
Mikser	82
Ręczna maszynka do mielenia	83
Młynek	83
Homogenizator szklany do miękkich tkanek	83
Homogenizator	84
Homogenizator emulsyjny	84
Prasa hydrauliczna	85
Dyskusja	86

APARATURA POMIAROWA	87
pH-metr	87
Elektrody	87
Bufory wzorcowe	87
Papiery wskaźnikowe	88
Miernik uniwersalny	88
Barometr	88
Bomba kalorymetryczna	89
Wirówka	89
Głowica wirówki	90
Probówka wirówkowa	90
Gilzy do probówek wirówkowych	90
Spektrofotometr	91
Kuweta	91
Fluorymetr	92
Fleometr	92
Dyskusja	93
APARATURA ROZDZIELCZA	94
Elektroforeza kolumnowa na żelu	94
Desintometr skaningowy	94
Dializator	94
Automat do rotacyjnego przesuwania próbek	95
Sito	95
Lejek rozdzielczy	95
Kolumna chromatograficzna	96
Chromatografia cienkowarstwowa	96
Komora chromatograficzna	96
Aparat Soxhleta	97
Gilza ekstrakcyjna	97
Aparat Goldfische	97
Tłuszczomierz Babcocka	98
Cyrkiel pomiarowy	98
Wirówka Babcocka	98
Naczynko z folii aluminiowej	99
Eksykator	99
Suszarka	99
Suszarka próżniowa	100
Aparat do oznaczania zawartości wody	100
Suszenie sublimacyjne	100
Kolba Kjeldahla	101
Aparat do spalania próbek stosowany w metodzie Kjeldahla	101
Aparat destylacyjny stosowany w metodzie Kjeldahla	101
Rejestратор	102
Dyskusja	103
FILTRACJA	104
Lejek	104
Bibuła filtracyjna	104
Wata szklana	104
Kolba ssawkowa	105
Lejek Büchnera	105
Tygiel	105
Korek z otworem do wprowadzania lejka	106
Płuczka	106
Dyskusja	107

DESTYLACJA	108
Aparat destylacyjny	108
Kolba destylacyjna	108
Destylarka	108
Demineralizator	109
Wyparka	109
Dyskusja	110
BADANIE PRZEMIAN GAZOWYCH	111
Aparat Warburga	111
Dyskusja	112
SPRZĘT DO BADAŃ Z UŻYCIEM MAŁYCH ZWIERZĄT	113
Klatka dla zwierząt	113
Poidełko	113
Karmidełko	113
Zestaw sekcyjny	114
Stoż operacyjny dla zwierząt	114
Dyskusja	115
BADANIA MIKROSKOPOWE	116
Mikroskop	116
Szkieletko podstawowe	116
Lupa	116
Bibułka do czyszczenia soczewek	117
Mikrometr	117
Komora do liczenia krwinek i drobnoustrojów	117
Naczynie do barwienia	118
Aparat do przygotowywania preparatów histologicznych	118
Mikrotom	118
Dyskusja	119
MIKROBIOLOGIA	120
Podłoża	120
Butelka do rozcieńczen	120
Płytki Petriego	120
Pojemnik do sterylizacji płytek Petriego	121
Licznik kolonii	121
Licznik	121
Eza	122
Probówka bakteriologiczna	122
Dyskusja	123
ZMYWANIE	124
Zmywarka do szkła laboratoryjnego	124
Płuczka do pipet	124
Wieszak do suszenia szkła laboratoryjnego	125
Dyskusja	126

EQUIPO DE SEGURIDAD	1
Botiquín	1
Extintor de incendios	1
Manta contra incendios	1
Ducha	1
Lavaojos	2
Teléfono	2
Etiquetas y señales	2
Precaución	2
Explosivo	2
Riesgo Biológico	2
Riesgo Radiactivo	3
Use Gafas	3
Peligro	3
Inflamable	3
Corrosivo	3
Veneno	3
Usar en la vitrina de gases	3
A presión elevada	3
A presión reducida	3
Cáustico	3
Evite el contacto con la piel	3
Caliente	3
Estéril	3
Mantener en refrigeración	3
No Funciona	3
Gafas protectoras	4
Mascarilla	4
Discusión	5
MOBILIARIO DE LABORATORIO	6
Vitrina de gases	6
Módulo de sustentación	6
Armario	6
Estanterfa	7
Mesa de despacho	7
Mesa	7
Archivador	7
Discusión	8
MATERIAL PORTATIL DE LABORATORIO	9
Carro de laboratorio	9
Silla o taburete de laboratorio	9
Escalera	9
Discusión	10
INSTALACION DE FONTANERIA	11
Grifo	11
Grifo combinado	11
Fregadero	11
Grifo	12
Agua fría	12
Agua caliente	12
Agua destilada	12
Vapor	12
Aire	12

INSTALACION DE FONTANERIA	
Gas	13
Oxígeno	13
Nitrógeno	13
Vacío	13
Válvula de aguja	13
Sifón	13
Discusión	14
INSTALACION ELECTRICA	15
Enchufe	15
Caja de conexiones eléctricas	15
Transformador	15
Bateria	16
Cargador de baterías	16
Discusión	17
GASES LICUADOS	18
Cilindro de gas	18
Regulador de presión	18
Pinza de sujeción para cilindros de gas	18
Discusión	19
BOMBAS DE VACIO Y COMPRESORES	20
Bomba de vacío y compresor	20
Bomba Peristáltica	20
Bomba de vacío	20
Bomba manual	21
Bomba de vacío de Agua	21
Discusión	22
ALMACENAMIENTO FRIGORIFICO	23
Frigorífico-Congelador	23
Arcón para hielo seco	23
Recipiente para hielo seco	24
Termo	24
Discusión	25
EQUIPO MANUAL DE LABORATORIO	26
Espátula	26
Cucharón	26
Pinzas para crisoles	26
Cuchara de agitación	26
Libro de notas	26
Hoja de aluminio	27
Bolsa	27
Cápsula	27
Delantal	27
Guantes de amianto	28
Guantes de goma	28
Guantes desechables	28
Frasco lavador	28
Frasco cuentagotas	29
Pera de goma	29
Escobillón	29
Limpiador	29
Pañuelo	29
Reloj de pared	30
Reloj avisador	30
Programador	30

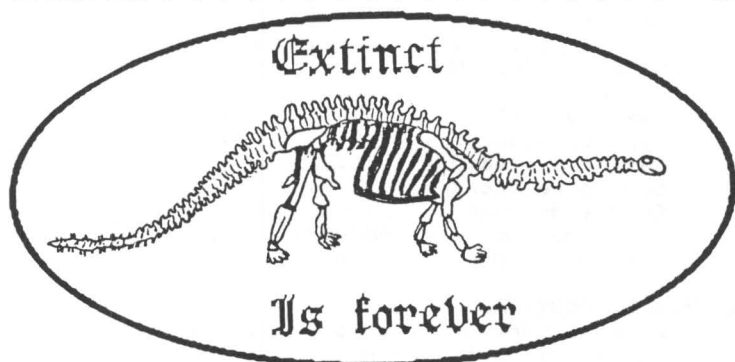
EQUIPO MANUAL DE LABORATORIO	
Cronómetro	31
Discusión	32
HERRAMIENTAS DE LABORATORIO	33
Alicates	33
Alicates de punta fina	33
Tenazas	33
Tijeras	33
Llave Ajustable	34
Llave de dos bocas	34
Llaves para tuercas hexagonales	34
Martillo	34
Destornillador	34
Broca	35
Lima	35
Tornillo de banco	35
Soldador	35
Discusión	36
MATERIAL DE OFICINA	37
Cinta Adhesiva	37
Etiquetador	37
Etiqueta	37
Bolígrafo	37
Lapiz de cera	38
Rotulador	38
Regla	38
Calculadora	38
Discusión	39
TABLA PERIODICA	40
Tabla Periódica	40
Discusión	41
REACTIVOS	42
Acido Acético	42
Alcohol	42
Hidróxido Amónico	42
Hidróxido Cálcico	42
Acido Clorhídrico	42
Acido Nítrico	42
Hidróxido Potásico	42
Hidroxido Sódico	42
Acido Sulfúrico	42
Etiquetado de Reactivos	43
Discusión	44
MODELOS MOLECULARES	45
SOPORTES	46
Soporte o Emparrillado	46
Soporte para buretas	46
Soporte de aro	46
Trípode	47
Pinza para buretas	47
Nuez	47
Pinza	47
Pinza con nuez	48
Discusión	49

MATERIAL DE VIDRIO	50
Tubo de vidrio	50
Tubo Capilar	50
Varilla de vidrio	50
Union de rótula	51
Union plana	51
Union cónica esmerilada	51
Pinza para esmerilados de rótula	51
Llave de paso de vidrio	52
Condensador	52
Tubo de ensayo	52
Pinzas para tubos de ensayo	53
Gradilla	53
Vidrio de reloj	53
Mango de seguridad	53
Cortadora de tubos de vidrio	54
Discusión	55
ENVASES Y RECIPIENTES	56
Vaso de precipitado	56
Botella	56
Matraz erlenmeyer	56
Cubo con asa	56
Matraz de fondo plano	57
Vial	57
Tapa	57
Tapon	57
Tapon de vidrio	57
Corcho	58
Taladratapones	58
Discusión	59
TUBOS	60
Tubo de goma	60
Tubo de plástico	60
Pinza de mohr	60
Discusión	61
EQUIPO PARA VOLUMETRIA	62
Jeringuilla micrométrica	62
Pipeta aforada	62
Pipeta graduada	62
Pera	63
Pipeta automática	63
Probeta	63
Copa graduada	64
Vaso de precipitado	64
Bureta	64
Pipeta automática	65
Llave de vidrio	65
Grasa para buretas	65
Matraz volumétrico	66
Bomba	66
Discusión	67
EQUIPOS PARA PESADA Y MEDIDA	68
Báscula	68
Granatario	68
Balanza analítica	68

EQUIPOS PARA PESADA Y MEDIDA	
Balanza digital	69
Juego de pesas	69
Balanza para densidades	69
Areómetro	70
Picnómetro	70
Viscosímetro	70
Polarímetro	71
Refractómetro	71
Refractómetro manual	71
Discusión	72
CALENTADORES	73
Horno	73
Placa calentadora	73
Estufa	73
Manta calefactora	74
Termostato	74
Cinta calefactora	74
Horno de mufla	75
Crisol	75
Baño maría	75
Termómetro	76
Termómetro industrial	76
Termómetro electrónico	76
Autoclave	77
Esterilizador de instrumentos	77
Mechero	77
Lámpara de alcohol	78
Encendedor	78
Fósforos de seguridad	78
Baño para punto de fusión	79
Tubo para punto de fusión	79
Discusión	80
EQUIPO PARA MEZCLA Y PRENSADO	81
Mortero y mano	81
Agitador	81
Agitador magnético	81
Agitador-Vibrador	82
Agitador-Vibrador	82
Batidora	82
Picadora manual	83
Molino	83
Homogeneizador de vidrio	83
Homogeneizador	84
Emulsificador	84
Prensa hidráulica	85
Discusión	86
EQUIPO DE MEDIDA	87
pH-Metro	87
Electrodo	87
Solución tampón	87
Papel indicador	88
Voltímetro-Amperímetro	88
Barómetro	88

EQUIPO DE MEDIDA	
Bomba calorimétrica	89
Centrífuga	89
Cabezal de centrífuga	90
Tubo de centrífuga	90
Cabezal múltiple (centrífuga)	90
Espectrofotómetro	91
Cubeta para espectrofotometría	91
Espectrofluorímetro	92
Flotámetro	92
Discusión	93
EQUIPO DE SEPARACION	94
Equipo para electroforesis en gel	94
Densitómetro	94
Equipo de diálisis	94
Equipo de muestreo automático	95
Criba	95
Embudo de separación	95
Columna cromatográfica	96
Cromatografía en capa fina	96
Cámara cromatográfica	96
Extractor de Soxhlet	97
Cartucho de extracción	97
Extractor de Goldfisch	97
Matraz de Babcock	98
Compás de puntas	98
Centrífuga de Babcock	98
Platillo de hoja de aluminio	99
Desecador	99
Estufa de desecación	99
Estufa de vacío	100
Balanza para humedad	100
Liofilizador	100
Matraz de Kjeldahl	101
Equipo de digestión de Kjeldahl	101
Equipo de destilación de Kjeldahl	101
Registrador	102
Discusión	103
EQUIPO DE FILTRACION	104
Embudo	104
Papel de filtro	104
Lana de vidrio	104
Matraz Kitasato	105
Embudo de Buchner	105
Crisol de Gooch	105
Conos de goma para embudos Buchner	106
Frasco lavador de gases	106
Discusión	107
EQUIPO DE DESTILACION	108
Aparato para destilación	108
Matraz de destilación	108
Destilador de agua	108
Desmineralizador	109
Evaporador	109
Discusión	110

MEDIDA DE GASES	111
Respirómetro	111
Discusión	112
EQUIPO PARA ANIMALES DE LABORATORIO	113
Jaula	113
Bebedero	113
Comedero	113
Equipo de disección	114
Mesa de operaciones	114
Discusión	115
EQUIPO DE MICROSCOPIA	116
Microscopio	116
Portaobjetos	116
Lupa	116
Papel limpiantes	117
Micrómetro	117
Cámara cuentaglobulos	117
Cubeta de tinción	118
Equipo de inclusión	118
Microtomo	118
Discusión	119
MICROBIOLOGIA	120
Medio de cultivo	120
Frasco de dilución	120
Placa de Petri	120
Cilindros para esterilizar placas	121
Cuenta colonias	121
Contador	121
Asa de platino	122
Tubo de cultivo	122
Discusión	123
EQUIPO PARA LAVAR	124
Lavadora	124
Lavador de pipetas	124
Escurridor	125
Discusión	126



EMNİYET ALET VE EKİPMANLARI

İlk yardım kutusu	1
Yangın söndürücü	1
Yangın örtüsü	1
Duş için çeşme	1
Göz yıkamak için çeşme	2
Telefon	2
Tehlike etiket ve işaretleri	2
tedbirli ol (caution)	2
patlayıcı (explosive)	2
biyolojik tehlike (biohazard)	2
radyasyon tehlikesi (radiation hazard)	3
koruyucu gözlüğünü tak (wear your goggles)	3
tehlike (danger)	3
alevlenebilir (flammable)	3
aşındırıcı (corrosive)	3
zehir (poison)	3
çeker ocağı kullan	3
yüksek basınç	3
alçak basınç	3
kostik (caustic)	3
deri temasından sakın	3
sıcak (hot)	3
steril	3
buzdolabında muhafaza et	3
bozuk	3
Emniyet gözlüğü	4
Teneffüs cihazı	4
Tartışma	5
LABORATUVAR DONANIMI	6
Çeker ocak	6
Çalışma ünitesi	6
Malzeme dolabı	7
Ofis tipi çalışma masası	7
Masa	7
Büro tipi dosya dolabı	7
Tartışma	8
TAŞINABİLİR LABORATUVAR DONANIMI	9
Laboratuvar tipi el arabası	9
Laboratuvar tipi sandalye	9
Merdiven	9
Tartışma	10
SABİT LABORATUVAR DONANIMI	10
Musluk	11
Sıcak soğuk karıştırma musluğu	11
Lavoba	11
Dişli musluk (sızmayı önleyen)	12
Soğuk su	12
Sıcak su	12
Distile su	12

SABİT DONANIM (devam)

Buhar	12
Hava	12
Hava gazı	13
Oksijen (O ₂)	13
Azot (N ₂)	13
Vakum	13
Vana	13
Sifon	13
Tartışma	14

ELEKTRİK DONANIMI

Priz	15
Çoklu priz	15
Transformator	15
Pil (şarj olabilir veya olamaz tip)	16
Pil şarjer (şarj aleti)	16
Tartışma	17

GAZ TÜPLERİ

Tüp	18
Basınç ayarlayıcısı	18
Gaz tüpü emniyet kemeri	18
Tartışma	19

VAKUM ve HAVA POMPALARI

Vakum ve basınç pompası	20
Pompa hareket vanası	20
Vakum pompası	20
El pompası	21
Ayak pompası	21
Su trompu	21
Tartışma	22

SOĞUK DEPOLAMA

Buzdolabı ve derin dondurucu	23
Kuru buz (CO ₂) dolabı	23
Kuru buz kabı	24
Termus	24
Tartışma	25

LABORATUVAR EL ARAÇ ve GEREÇLERİ

Spatula	26
Kepçe	26
Maşa	26
Kazıyıcı (spatula)	26
Not defteri	26
Alüminyum foil	27
Naylon torba	27
Porselen kap	27
Önlük	27
Asbest eldiven	28
Bulaşık eldiveni	28
Kullanılıp atılabilen eldiven	28
Plastik su şişesi	28

LABORATUVAR EL ARAÇ ve GEREÇLERİ (devam)

Damlalık	29
Lastik bulb	29
Fırça	29
Temizlik malzemesi (sabun vb)	29
Kağıt mendil	29
Duvar saati	30
Laboratuvar tipi saat	30
Zamanlayıcı	30
Kronometre	31
Tartışma	32
LABORATUVAR EL ALETLERİ	33
Pense	33
Karga burnu	33
Tel keser (pense)	33
Teneke makası	33
Makas	33
Kurbagacık	34
Anahtar takımı	34
Tornavida tipi anahtar takımı	34
Çekiç	34
Tornavida	34
Matkap (kalem) seti	35
Eğе	35
Mengene	35
Elektrikli havya	35
Tartışma	36
BÜRO MALZEMESİ	37
Seloteyp (bant)	37
Etiket yazıcısı	37
Etiket	37
Kalın uçlu kalem	37
Cama yazar kalem	38
Cetvel	38
Hesap makinası	38
Tartışma	39
PERİYODİK CETVEL	40
Periyodik cetvel	40
Tartışma	41
KİMYASAL MADDELER	42
Asetik asit	42
Alkol	42
Amonyum hidroksit	42
Kalsiyum hidroksit	42
Hidroklorik asit	42
Nitrik asit	42
Potasyum hidroksit	42
Sodyum hidroksit	42
Sülfürik asit	42
Kimyasal madde etiketi	43

KİMYASAL MADDELER (devam)

Tartışma	44
MOLEKÜL MODELLERİ	45
DESTEK veya DAYAMA EKİPMANLARI	46
Dayama çerçevesi	46
Büret ayaklığı	46
Bilezikli dayama ayağı	46
Üç ayak (11 izgara)	47
Büret kiskacı	47
Kıskaç tutucu	47
Kıskaç	47
Kıskaçlı büret tutucu	48
Tartışma	49
CAM MALZEME	50
Cam boru	50
Kapillar cam boru	50
Cam çubuk	50
Top ve yuva şeklinde ek (cam malzelerde)	51
Contalı ekleme	51
Standart traşlı cam ekleme	51
Maşalı kıskaç	51
Cam vana	52
Soğutucu	52
Deney tüpü	52
Deney tüpü maşası	53
Tüp sehpası	53
Saat camı	53
Bir çeşit elcek (cam çubuk için)	53
Cam boru kesicisi	54
Tartışma	55
KAP TİPİ MALZEMELER	56
Beherglas	56
Cam şişe	56
Erlenmayer	56
Kova	56
Cam balon	57
Ufak şişe	57
Kapak	57
Lastik tıpa	57
Cam tıpa	57
Mantar tıpa	58
Mantar delici	58
Tartışma	59
BORU (HORTUM) TAKIMI	60
Lastik hortum	60
Plastik hortum	60
Lastik boru kiskacı	60
Tartışma	61
SIVI HACİM ÖLÇME MALZEMELERİ	62
Şırınga tipi pipet	62
Hacim pipeti	62

SIVI HACİM ÖLÇME MALZEMELERİ (devam)	
Dereceli pipet	62
Pipet emicisi (zararlı sıvılar için)	63
Otomatik pipet	63
Ölçü silindiri	63
Kaba dereceli silindir	64
Dereceli beherglas	64
Büret	64
Otomatik büret	65
Cam musluk	65
Desikatör yağı (gres)	65
Hacimli balon	66
Pompa	66
Tartışma	67
TARTIM ve ÖRNEK KOMPOZİSYONU	68
Terazi	68
Üç kollu terazi	68
Hassas terazi	68
Üstten kefeli hassas terazi	69
Ağırlık seti	69
Özgül ağırlık terazisi	69
Hidrometre	70
Piknometre	70
Viskozimetre	70
Polarimetre	71
Refraktometre	71
El refraktometresi	71
Tartışma	72
ISITMA CİHAZLARI	73
Kurutma fırını	73
Hot plate	73
Inkübator	73
Isı mantosu	74
Su ısıtıcısı	74
Isı kuşağı	74
Yakma fırını	75
Kül kabı	75
Su banyosu	75
Termometre	76
Göstergeli termometre	76
Elektronik termometre	76
Otoklav	77
Kaynatici	77
Bunzen bak	77
Alkol veya gazyağı lambası	78
Çakmak	78
Kiprit	78
Erime noktası tayini için banyo	79
Erime noktası tayin tüpü	79
Tartışma	80

EZME, PARÇALAMA ve KARIŞTIRMA ALETLERİ	81
Havan ve tokmak	81
Karıştırıcı	81
Magnetik karıştırıcı	81
Çalkalayıcı	82
Çalkalayıcı	82
Blender	82
El değirmeni	83
Değirmen	83
Doku öğütücüsü	83
Homojenizatör	84
Emülsiyon homojenizatörü.	84
Hidrolik pres	85
Tartışma	86
ÖLÇÜ ALET ve CİHAZLARI	87
pH metre	87
Elektrot	87
Buffer çözeltisi	87
Turnusol kağıdı	88
Volt metre	88
Barometre	88
Bomb kalorimetresi	89
Santrifüj	89
Santrifüj başı	90
Santrifüj tüpü	90
Taşıyıcı	90
Spektrofotometre	91
Spektrofotometre tüpü	91
Florometre	92
Flowmetre	92
Tartışma	93
AYIRMA ALET VE CİHAZLARI	94
Jel elektroforezi	94
Scanning densitometre	94
Diyaliz cihazı	94
Otomatik örnek alıcı	95
Elek	95
Ayırma hunisi	95
Kromotografi kolonu	96
İnce tabaka kromatografisi	96
Kromotografi kabineti	96
Soksilet cihazı	97
Ekstraksiyon tüpü	97
Eter ekstraksiyon cihazı	97
Babkok şişesi	98
Pergel	98
Babkok santrifüjü	98
Aliminyum kuru madde kabı	99
Desikatör	99
Kurutma dolabı	99
Vakum kurutma dolabı	100

AYIRMA ALET VE CİHAZLARI (devam)	
Nem ölçme terazisi	100
Dondurarak kurutucu	100
Keldal balonu	101
Keldal yakma ünitesi	101
Keldal distilasyon ünitesi	101
Yazıcı	102
Tartışma	103
SÜZME İŞLEMİ	104
Huni	104
Süzgeç kağıdı	104
Cam yünü	104
Süzme erleni	105
Bühner süzgeci	105
Bir çeşit süzgeç	105
Süzgeç desteği	106
İmpinger	106
Tartışma	107
DESTİLASYON	108
İmbik (damıtıcı)	108
Distilasyon balonu	108
Saf su cihazı	108
Mineral uzaklaştırıcı (demineralizatör)	109
Flash evaporatör	109
Tartışma	110
GAZ ÖLÇÜMLERİ	111
Respirometre	111
Tartışma	112
DENEY HAYVANLARI İÇİN ÖZEL ALETLER	113
Kafes	113
İçecek tüpü	113
Yiyecek kabı	113
Ameliyat takımı	114
Ameliyat masası	114
Tartışma	115
MİKROSKOBİK ANALİZLER	116
Mikroskop	116
Lam	116
Büyüteç	116
Lens mendili	117
Mikrometre	117
Sayım haznesi	117
Boyama malzemesi	118
Doku işleme ünitesi	118
Mikrotom (kesit alma cihazı)	118
Tartışma	119
MİKROBİYOLOJİ	120
Besiyeri	120
Dilüsyon şişesi	120
Petri kutusu	120
Petri kutusu sterilizasyon kabı	121

MİKROBİYOLOJİ (devam)

Koloni sayıcısı	121
Sayaç	121
Öze ve iğne	122
Kapaklı deney tüpü	122
Tartışma	123
YIKAMA	124
Bulaşık makinası	124
Pipetlik (yıkama için)	124
Kurutma rafı	125
Tartışma	126

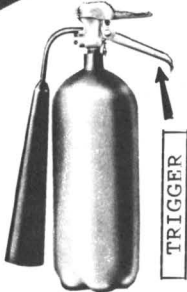


**FIRST AID KIT**

The "first aid" kit contains bandages and other emergency medical equipment.

Get me a band-aid from the "first aid" kit.

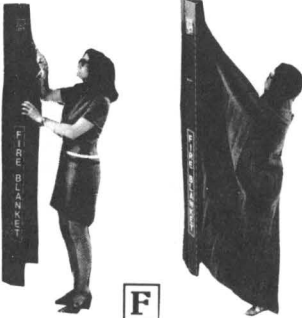
The adhesive tape is in the "first aid" kit.

T**FIRE EXTINGUISHER**

A fire extinguisher is used to put out fires.

Where is the fire extinguisher?

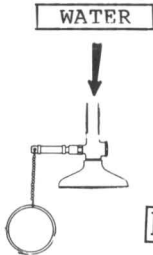
Everyone should know how to use the fire extinguisher.

T**FIRE BLANKET**

A fire blanket is a flame-resistant blanket.

A fire blanket is used to extinguish a person's clothing on fire.

A fire blanket can also be used to smother a fire on a bench or other flat surface.

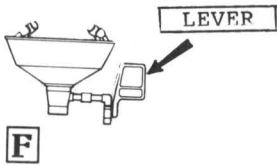
F**SHOWER**

A shower can be used to remove chemicals from the body.

A shower is also effective when clothes catch fire.

Pull the chain to start the shower.

F

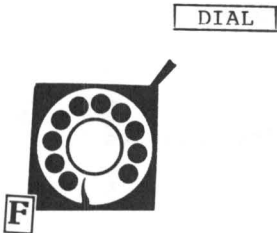


EYE WASH

An **eye wash** is used to dilute and wash away chemicals which have gotten into an eye.

Know where the **eye wash** is located so that you can find it with your eyes closed.

Be sure you know how to operate the **eye wash**.



TELEPHONE (PHONE)

Dial **phone** numbers carefully to prevent reaching a wrong number.

Write the **telephone** number of the fire department here

Write the **phone** number of the emergency squad here



What is the **phone** number of an ambulance?

a doctor?

the police?

WARNING LABELS, WARNING SIGNS

Warning labels or signs can alert the laboratory worker to hazards.



The "**caution**" sign means BE CAREFUL!



T

The "**explosive**" sign means the chemicals can be very reactive and may behave in a manner similar to a bomb.



"**Biohazard**" and the accompanying symbol signify a possible hazard from biological material.



"Radiation hazard" and the accompanying symbol indicate the presence of radioactive material.



"Wear your goggles" to protect your eyes.



"Danger" signifies a hazardous area.



"Flammable" indicates the possibility of fire.



Acid or alkali can be very "Corrosive".



"Poison" can be fatal to people.



"Use in hood" (use in fume cupboard) suggests appropriate ventilation is necessary.

T



"Under high pressure" means the liquid or gas is under pressure and should be handled carefully.



"Caustic" means alkali that can burn the skin.



"Avoid contact with the skin" means do not spill on the body.



"Hot" signifies high temperature and the ability to burn.



If the sample contains no microorganisms, it is said to be "Sterile".

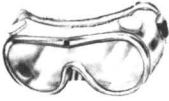


"Keep in refrigerator" suggests the sample should be stored at a low temperature (less than 4 degrees centigrade) but above 0 degrees centigrade.



"Out of order" sign tells you the equipment is broken.

SAFETY GOGGLES



T

Safety goggles are worn to protect the eyes.

Wear **safety goggles** when working with hazardous material.

Where are the **safety goggles** kept?



T

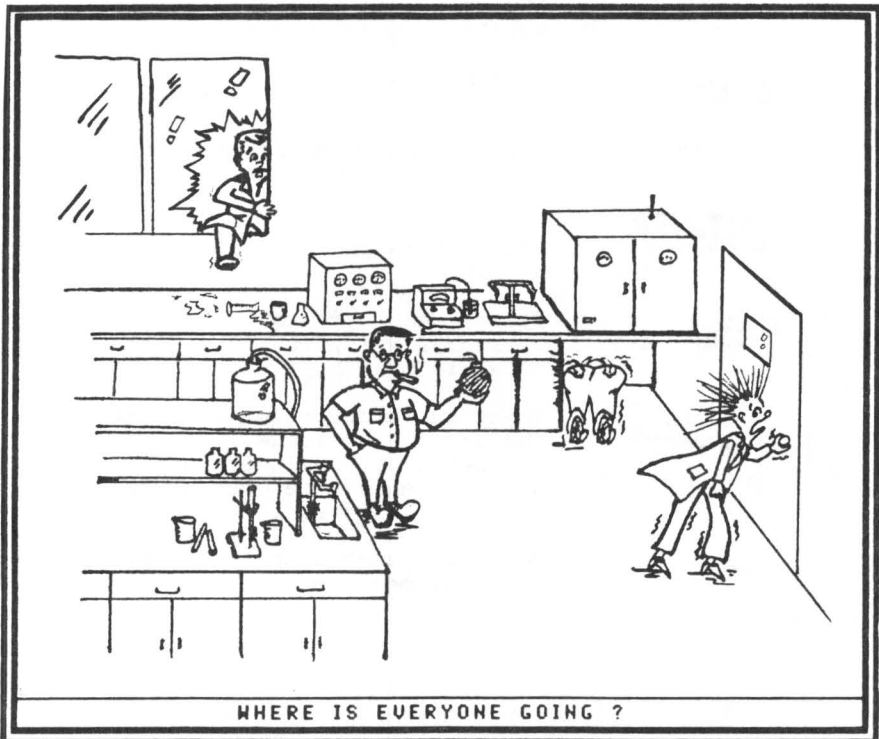
RESPIRATOR

Respirators are worn over the nose to protect the lungs from dust and mist.

Respirators can filter out particles but will not protect against toxic gas or vapors.

Check the filter on the **respirator**.

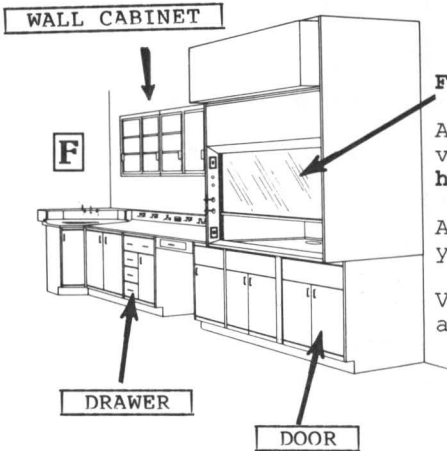
↑
STRAP



WHERE IS EVERYONE GOING ?

The first thing to do when working in a laboratory is to learn the location of the **safety equipment**. Find the "**First Aid Kit**" and determine what medical equipment it contains. For fire protection, you should know how to operate the **fire extinguisher** and the **fire blanket**. A **shower** can be used to extinguish clothing on fire or to dilute chemicals spilled on the body. An "**eye wash**" can be used when the chemical spill is on the face or in the eyes. A very important safety device is the **telephone** which can be used to summon help, so be sure you know how to use it and what the emergency numbers are.

Warning labels and signs can also be helpful in avoiding problems. Such labels as -- "**Caution**", "**Explosive**", "**Biohazard**", "**Radiation**", "**Danger**", "**Flammable**", "**Corrosive**", "**Poison**", and "**Caustic**" -- suggest the material should be handled carefully or the area treated with respect. **Wear goggles!** The sign "**Avoid contact with the skin**" advises you to protect your body. "**Under high and low pressure**" warns you that the liquid or gas is under abnormal or unusual pressure. "**Use in the hood**" (fume cupboard) and "**Keep in refrigeration**" suggest special handling techniques. "**Hot**" is extreme heat and "**Sterile**" is the absence of microorganisms. "**Out of order**" suggests the equipment will not work. **Safety goggles** should be placed over the eyes when washing anything with strong acids or bases and any time when there is a possibility of an explosion. **Respirators** should be used when working in dusty or misty environments.

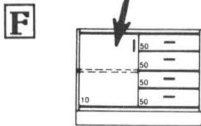


FUME HOOD (Fume cupboard)

All chemical reactions producing vapors should be placed in a **fume hood (fume cupboard)**.

A hood (**fume cupboard**) protects you from fumes.

Volatile chemicals are handled in a **hood (fume cupboard)**.

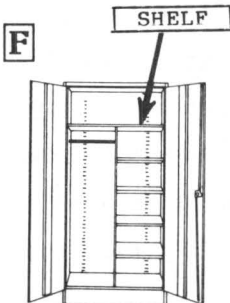


BASE UNIT

This **base unit** has 4 drawers and 1 door.

A shelf is located in the **base unit** behind the door.

A counter (bench) top is normally placed on the **base unit** and this is usually called a laboratory bench.

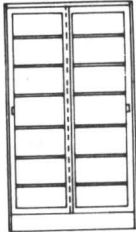


STORAGE CABINET

The **storage cabinet** has 2 doors.

Get the plastic tubing from the **storage cabinet**.

Is it in the **storage cabinet**?



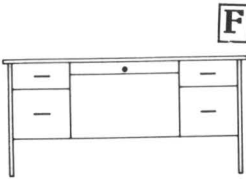
F

FLOOR CASE

Put the chemicals in the **floor case**.

Hand me the bottle that is in the **floor case**.

This **floor case** has 2 sliding doors.



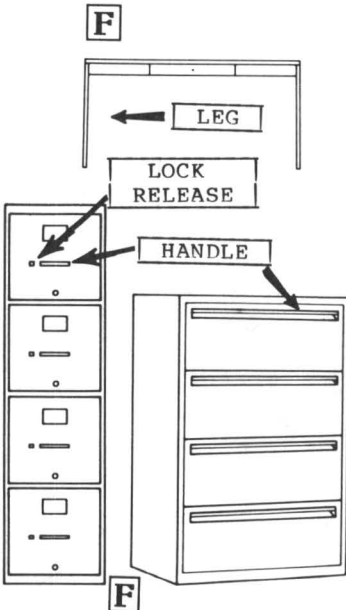
F

DESK

We will do our paperwork at the **desk**.

This **desk** has 5 drawers.

Place the book on the **desk**.



F

TABLE

Set the glassware on the **table**.

We will hold a conference at the **table**.

Let's sit at the **table**.

FILING CABINET

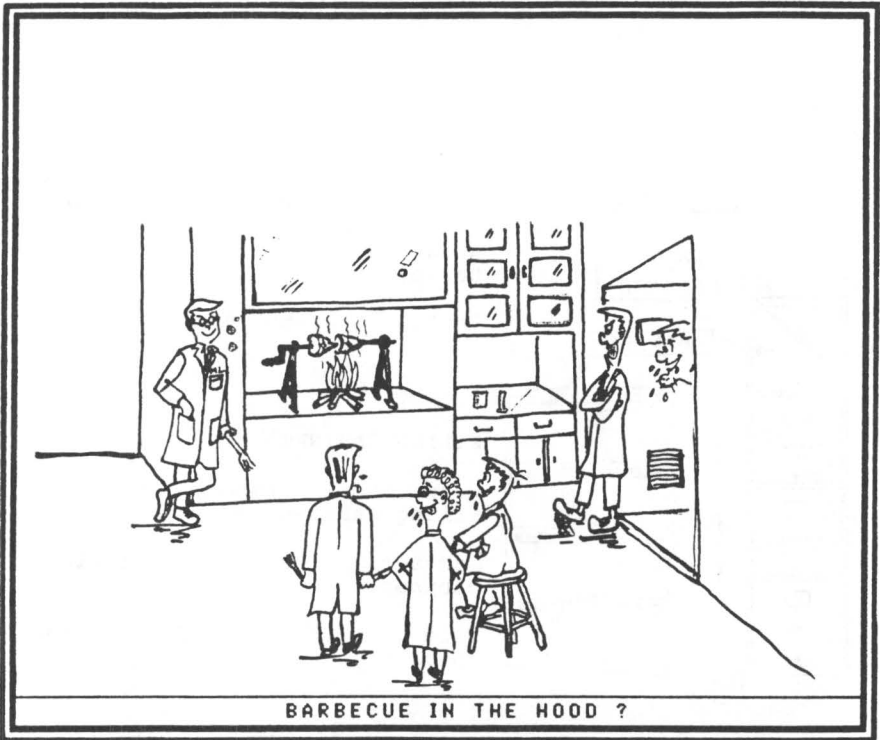
Place the laboratory data in the **filing cabinet**.

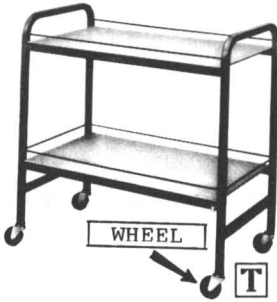
Records are kept in the **filing cabinet**.

File folders in the **file cabinet** contain the letters.

F

The ether extraction experiment is conducted in the **fume hood (fume cupboard)** since ether is very volatile. After the experiment is completed, the clean glassware may be stored in the **wall cabinet, base unit, storage cabinet** or **floor case**. Be sure the doors and drawers are closed after placing the glassware in storage. The next experiment may be set up on top of the **base unit** or on the **table**. After this experiment is completed, be sure to record your data at the **desk** and store the results in the **filing cabinet**.



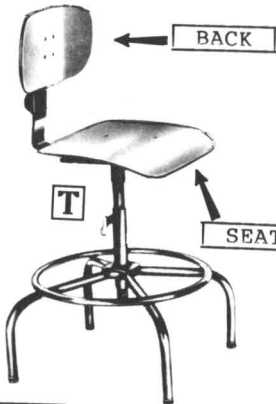


LABORATORY CART (Trolley)

A laboratory (trolley) cart is used to transport supplies.

May I borrow the cart (trolley)?

Where is the laboratory cart (trolley)?



LABORATORY CHAIR (or STOOL)

Please sit in the chair.

May I use the stool while weighing my samples?

It is not safe to stand on a laboratory chair or stool.



LADDER (or Steps)

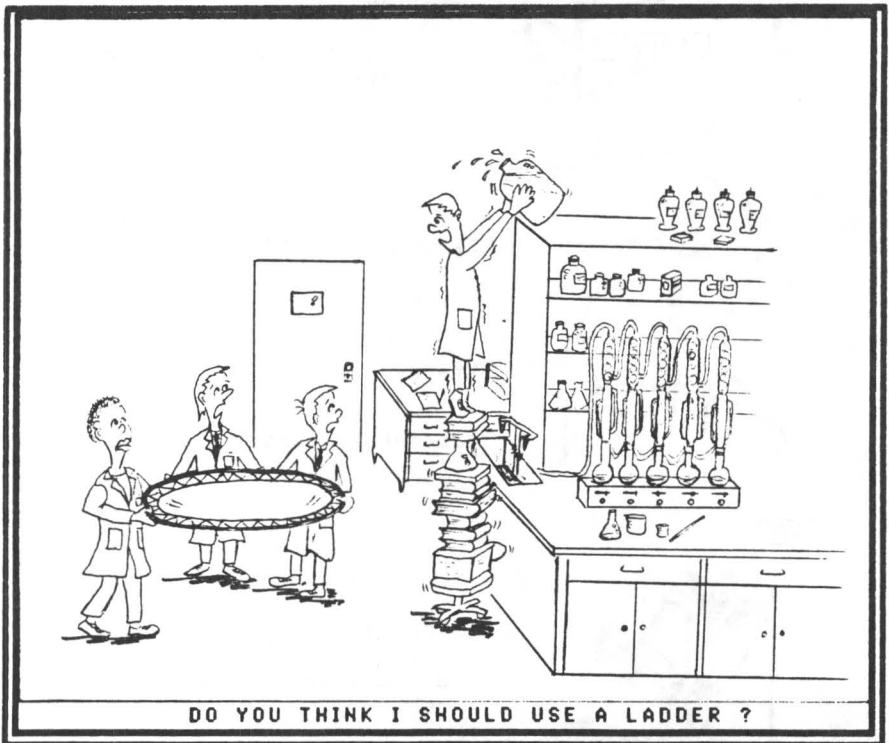
Use a ladder (the steps) to reach the top shelf.

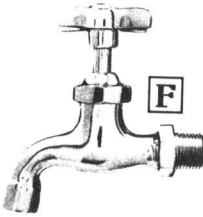
Be careful when using the ladder (steps).

Where do we store the ladder (steps) when it is not in use?

Place glassware on the **laboratory cart (trolley)** so it can be taken to the laboratory bench.

Do not stand on the **laboratory stool** -- use the **ladder (steps)** instead!



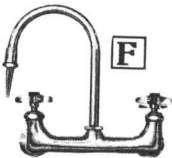


FAUCET (Tap)

Water is transported to the lab in pipes or "mains" and arrives at the **faucet (tap)**.

The **faucet (tap)** is a valve to control the flow of water.

Turn off the **faucet (tap)**.

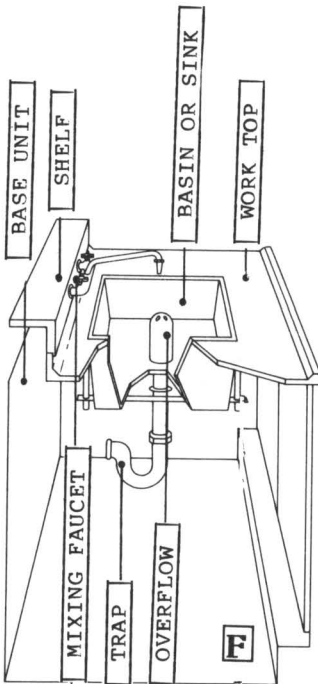


MIXING FAUCET (Mixer Tap)

Both hot and cold water are controlled by the **mixing faucet (mixer tap)**.

This **mixing faucet (mixer tap)** has a swivel gooseneck (spout).

Hot water is controlled by the left valve of the **mixing faucet (mixer tap)** and may be hot enough to burn your hand.



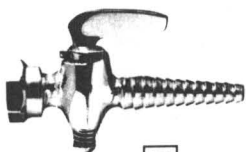
SINK

Wash the glassware in the **sink**.

Water drains (runs) from the **sink** and travels through the trap before going into the drain and then into the main sewer.

The **faucet (tap)** delivers water into the **sink**.

STOPCOCK



F

Stopcocks are used to control the flow of water, gas, or air.

Stopcocks often control the main supplies of water, gas or air and may be used for servicing or emergency use.

A label on a **stopcock** often tells you what the valve controls.



COLD WATER

A **cold water** stopcock controls the flow of cold (unheated) water.



HOT WATER

A **hot water** stopcock controls the flow of **hot water** and the water may be hot enough to burn your hand.

F



DISTILLED WATER

Use **distilled water** in this reaction because it has been distilled and contains no minerals.



STEAM

Steam is water that has been changed to a hot gaseous state (will burn skin rapidly).



AIR

Air is often used to drive stirring devices or to cool hot materials.



GAS

The burner is connected to the **gas** stopcock.



OXYGEN (O₂)

Oxygen is mixed with gas to produce a hotter flame.

F



NITROGEN (N₂)

Nitrogen is often used as a packaging environment to exclude oxygen and prevent oxidation.



VACUUM [Less than normal (atmospheric) pressure]

Vacuum is sometimes used to aid or accelerate filtering.

T

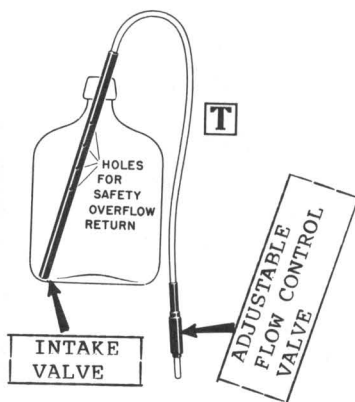


NEEDLE VALVE

A **needle valve** is used when sensitive control of flow rate is desired.

Turn off the **needle valve**.

Connect a **needle valve** to the gas line.



SIPHON

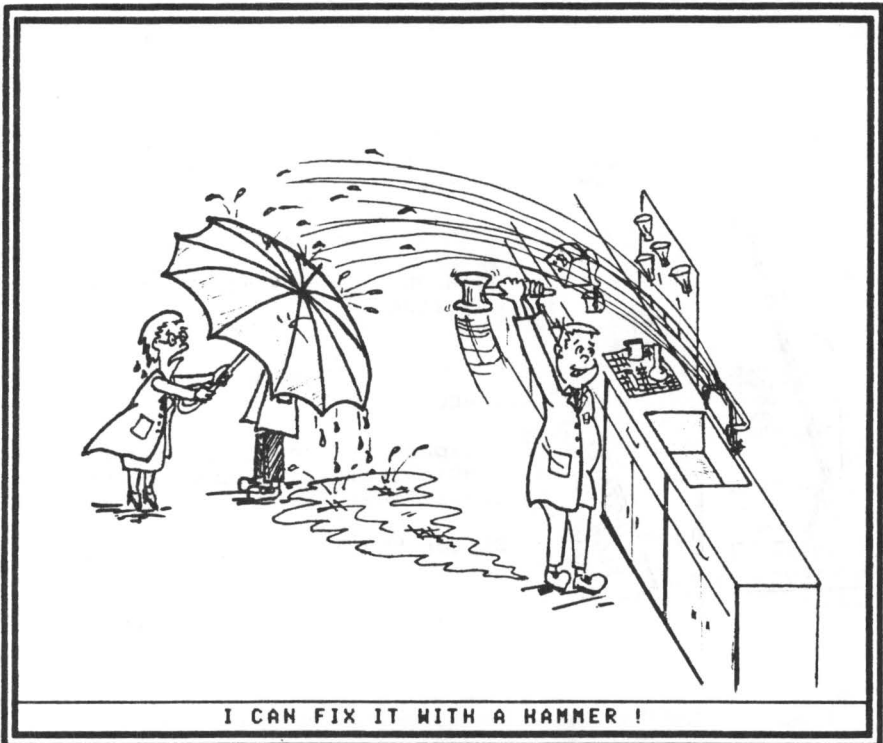
A **siphon** is used to transfer liquid from a higher level to a lower level.

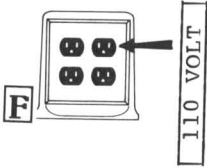
Siphon the distilled water into the beaker.

How do you start the **siphon**?

A **faucet (tap)** may deliver **hot** or **cold water** into a **sink**. A **mixing faucet (mixer tap)** can mix **hot** and **cold water** to produce warm water for washing glassware.

Stopcocks can be used to control a variety of liquids or gases. In addition to **hot** and **cold water**, the **stopcock** might regulate **distilled water** or even **steam**. Gases such as **air**, **burner gas** (flammable), **oxygen** or **nitrogen** are also often controlled by **stopcocks**. A lack of air or **vacuum** can also be controlled by these valves. If finer control is desired, a **needle valve** is often used. If liquid has to be moved from a higher to a lower level and it is not under pressure, a **siphon** is often used.

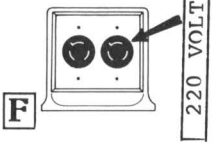




ELECTRICAL OUTLET (Electrical Socket)

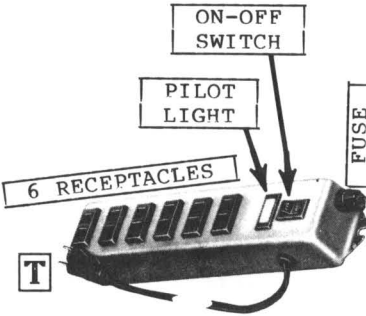
There are four 110-volt **electrical outlets (sockets)** in this box.

Plug the motor into the **electrical outlet (socket)**.



There are two 220-volt **electrical outlets (sockets)** in this box.

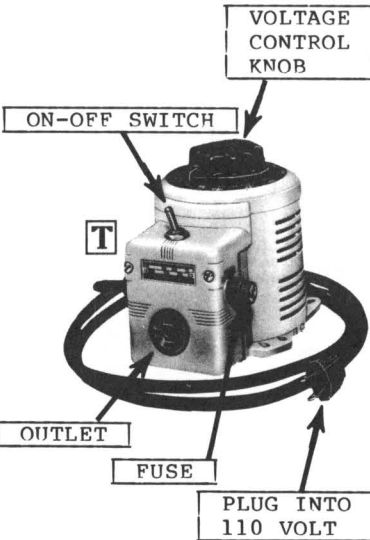
The plug has to be rotated prior to removal from this **electrical outlet (socket)**.



OUTLET BOX OR STRIP [Distribution board (box)]

This **outlet strip (distribution board)** may be moved to the area needed.

In this **outlet strip (distribution box)**, there are six 110-volt **outlets**, a pilot light, an on-off switch and a fuse.



The six 110-volt **outlets** in this **strip (board)** do not have a ground (earth) wire connection; therefore, the equipment will not be grounded (this may be dangerous).

TRANSFORMER OR POWERSTAT ("Variac")

A variable **transformer (Variac)** can be used to control voltage from 0 to 140 volts.

Adjust the **transformer (Powerstat)** to deliver 60 volts.

Plug the heating element into the **transformer (Variac)**.

TERMINALS

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TERMINAL

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TERMINAL

BATTERY

A **battery** is used to store electrical energy.

Batteries supply direct current (d.c.).

Batteries are labeled with the amount of voltage they supply.

This shape of **battery** is often referred to as a flashlight **battery** or a "dry" **battery**.

AMPERE
METER



110 VOLT PLUG

BATTERY
CONNECTIONS

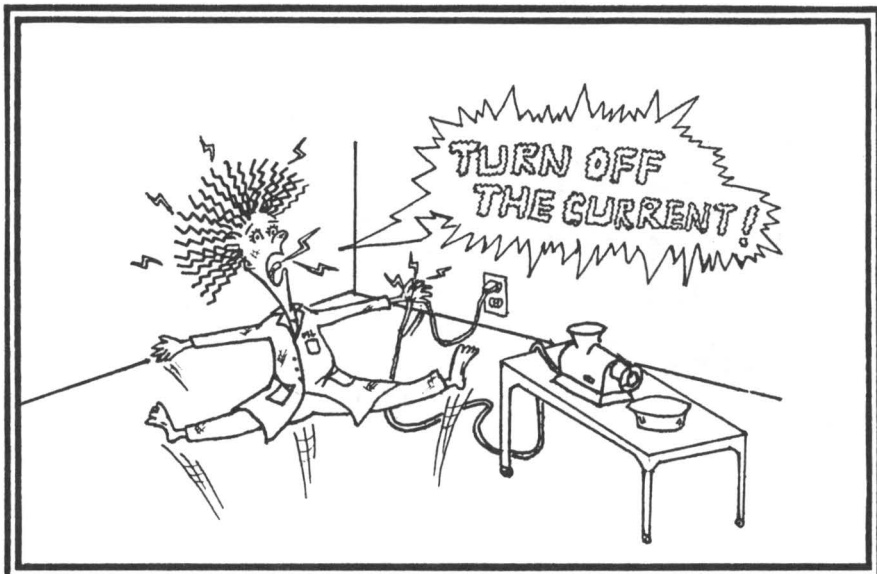
BATTERY CHARGER - for acid batteries and only certain rechargeable "dry" batteries (e.g., nickel-cadmium cells)

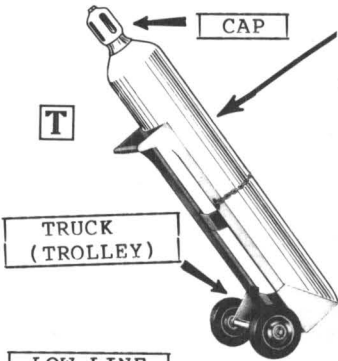
A **battery charger** is used to recharge a battery.

A **battery charger** converts alternating current (a.c.) into direct current (d.c.).

Some batteries cannot be charged and must **not** be connected to a **battery charger**.

The normal American voltage is 110 volts a.c. and can be obtained from **outlets (sockets)** that have 2 parallel openings. If there is a D-shaped opening below and between these parallel openings, this is a ground (earth) connection. A 220-volt **outlet (socket)** has 3 curved openings arranged in a circle. The **electrical outlets (sockets)** may be located in the wall, in a box, on the shelf support above the lab bench or in a portable **outlet strip (distribution box)**. **Variable transformers (Variac)** are used when adjustable voltages are needed. **Batteries** are used to store and supply direct current (d.c.) voltage and the **battery** is selected depending upon the voltage desired. After the **battery** has been used, it will become discharged but some can be recharged by the use of a **battery charger**.





GAS CYLINDER or TANK

Many types of gases may be obtained in gas cylinders (tanks).

Gas cylinders (tanks) are transported by a gas cylinder truck (trolley) equipped with a safety chain.

The cap is removed from the gas cylinder (tank) and a pressure regulator is attached.

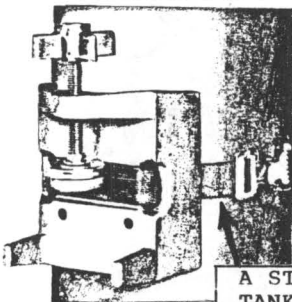


PRESSURE REGULATOR

The pressure regulator is used to reduce the cylinder (tank) pressure and control the gas flow.

The high cylinder (tank) pressure gauge indicates the amount (pressure) of gas in the cylinder (tank).

The low line pressure gauge indicates pressure of gas flow.



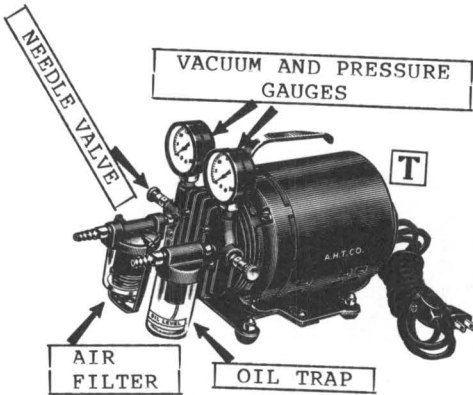
GAS CYLINDER CLAMP

A gas cylinder clamp is used to secure the cylinder (tank) to a solid support such as a bench or wall.

For safety purposes all gas cylinders (tanks) should be secured by gas cylinder clamps.

A STRAP HOLDS THE TANK OR CYLINDER TO THE CYLINDER CLAMP

Gases such as oxygen, nitrogen, carbon dioxide, air, nitric oxide, helium, hydrogen and many others are often available in **gas cylinders (tanks)**. These gases range from very dangerous, if inhaled, through flammable to inert. If the valve on the end of the cylinder (tank) is accidentally broken off, all gases are dangerous since the rapid release from the cylinder (tank) will propel the cylinder (tank) violently in the opposite direction. For this reason, a cap is kept on the **cylinder (tank)** when it is in transit or not in use. **Cylinders (tanks)** are often transported in the laboratory by a 2-wheeled truck (trolley) and secured by a safety chain. When placed in a laboratory, the **cylinder (tank)** is secured to a stationary object with a **gas cylinder clamp** to prevent falling. To control the release of gas from the **cylinder (tank)**, a **pressure regulator** is attached to the **gas cylinder (tank)**. **Pressure regulators** are usually not interchangeable for different types of gases. To prevent their use with the wrong types of **cylinders (tanks)** there are several types of screw threads used on both **cylinders (tanks)** and **regulators**.

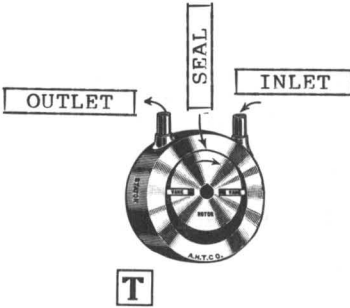


VACUUM AND PRESSURE PUMP

This **pump** can supply a source of air under pressure.

This **pump** can also create a vacuum.

This **vacuum and pressure pump** is portable.

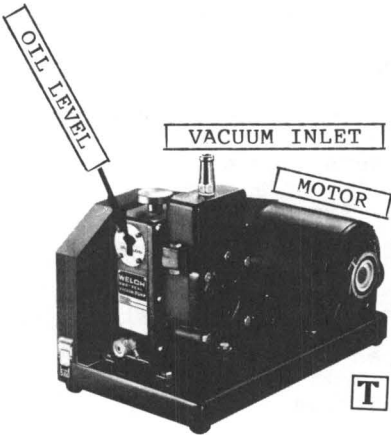


VANE PUMP MOVEMENT

The rotor contains 2 spring-loaded **vanes**.

The **vane pump** contains a crescent-shaped air chamber.

This **vane pump** rotates in a clockwise direction.

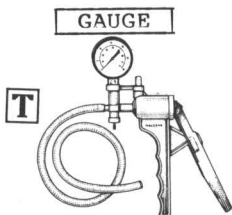


VACUUM PUMP (Rotary Oil Pump)

This **vacuum pump** can be used for vacuum distillation.

The motor is connected to the **vacuum pump** by a V-belt.

This **vacuum pump** contains oil and its level should be maintained.

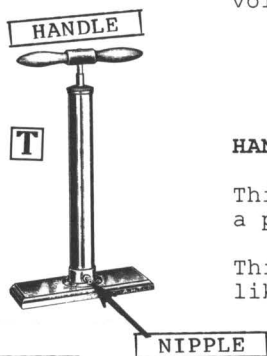


HAND PUMP

This **hand pump** can produce a pressure or a vacuum.

This **hand pump** operates with a finger squeeze-type handle.

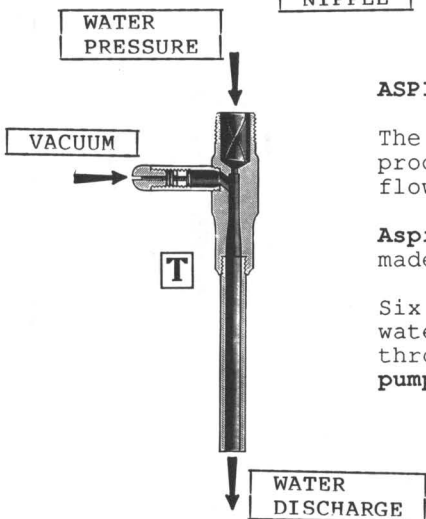
This light-weight portable **hand pump** can be used when small volumes are required.



HAND PUMP (floor model)

This **hand pump** can also produce a pressure or a vacuum.

This **hand pump** looks very much like an automobile tire pump.



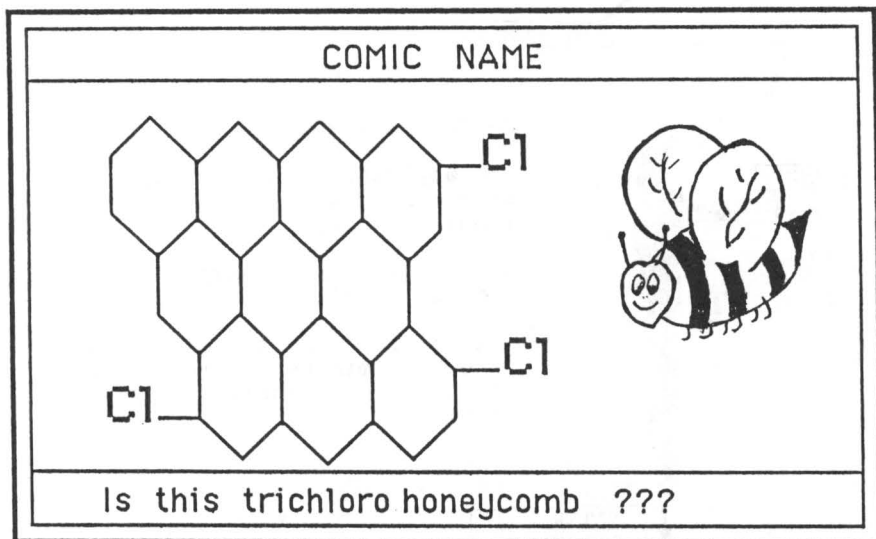
ASPIRATOR (Water Pump)

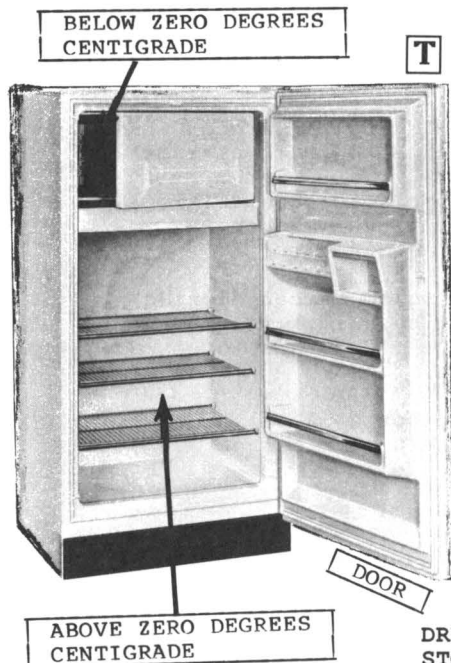
The **aspirator (water pump)** produces a vacuum with the aid of flowing water.

Aspirators (water pumps) are made of metal or of plastic.

Six to nine liters (litres) of water per minute are required (pass through) by an **aspirator (water pump)**.

Vacuum and pressure or air pumps are available in a variety of styles. The motor driven pumps are available in a **vane type** or in a **piston type**. The **hand pumps** of some models can be driven by squeezing a trigger-type device and, in others--by pushing and pulling a plunger attached to a handle. With the **aspirator-type (water pump)**, water is forced through the device and a vacuum is produced.



**T****REFRIGERATOR-FREEZER**

Most **refrigerators** maintain cold temperatures above freezing and have a **freezer** section that maintains temperatures below freezing.

Freezers usually have only one compartment that maintains temperatures below 0 degrees centigrade.

Volatile chemicals placed in a refrigerator may often cause an explosion, unless the **refrigerator** is fitted with sealed electrical switches.

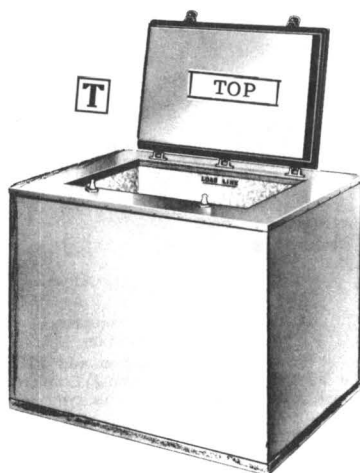
DRY ICE (Solid Carbon Dioxide) STORAGE CONTAINER

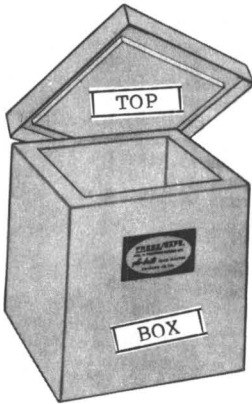
Dry ice (solid carbon dioxide: Care! Temperature -78 degrees centigrade) storage containers are insulated chests used for storage of **dry ice**.

Dry ice (solid carbon dioxide) can freeze the skin and must be handled with gloves.

Insulated **storage containers** retard the loss (sublimation) of **dry ice (solid carbon dioxide)**.

Do not use **dry ice (solid carbon dioxide)** in unventilated spaces.

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DRY ICE BOX (Solid Carbon Dioxide Storage or Shipping Container)

Dry ice (solid carbon dioxide) **boxes** are often made of polystyrene.

Dry ice (solid carbon dioxide) **boxes** can be used for shipment or storage of perishables in a frozen state.

Insulated **boxes** can also be used to keep samples hot.



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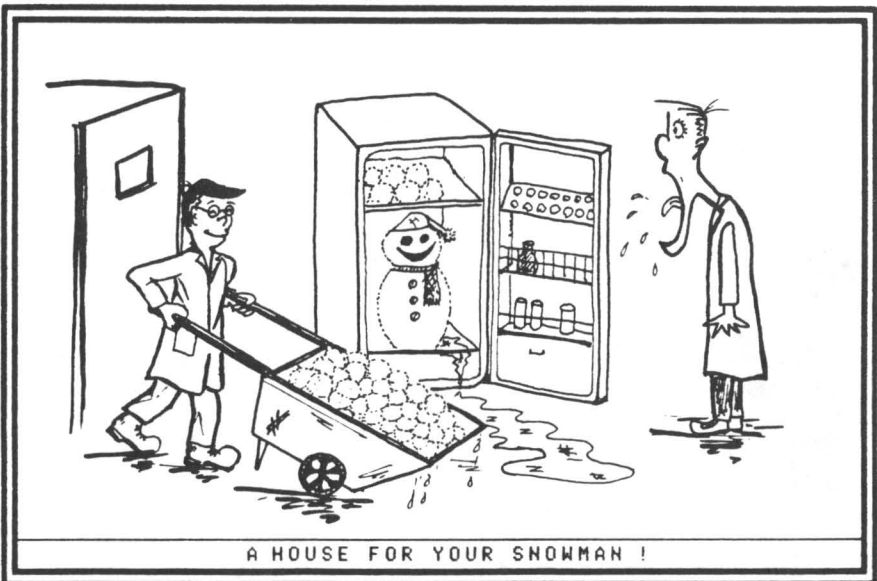
DEWAR FLASK (Thermos Flask)

A Dewar flask (thermos flask) is a double-walled glass container with a vacuum between the walls.

A Dewar thermos flask (thermos flask) can be used to maintain a hot or cold temperature.

The silvered and evacuated glass Dewar flask (thermos flask) is well insulated.

Cold storage may be maintained in the laboratory in a variety of ways. A **refrigerator** maintains temperature above freezing. Below freezing temperatures may be found in the **freezer section** of a **refrigerator** or in a **freezer**. A **freezer** may be an upright model with a vertical door or a chest-type with the door on top. Insulated **containers** are also used to maintain temperature. They may be found in heavy laboratory **dry ice (solid carbon dioxide) boxes** used for storage or shipping. **Dewar flasks (thermos flasks)** are often used to maintain a cold temperature around a cold trap in a distillation unit.



SPATULA



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HANDLE

A **spatula** is used to pick up a chemical sample.

This **spatula** has a steel blade.

Where do you keep the **spatula**?

SCOOP



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A **scoop** is used to transfer larger samples.

This **scoop** is made of aluminum (aluminium).

A **scoop** is a big spoon.

TONGS



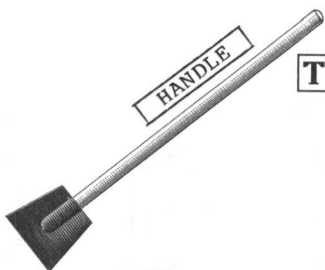
T

Tongs are used to move small items of laboratory equipment.

Use **tongs** to handle hot equipment or to handle items containing hazardous chemicals.

There are many styles of **tongs** to handle equipment of different shapes.

POLICEMAN



HANDLE

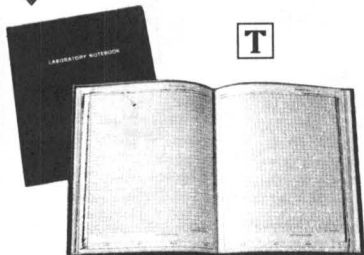
T

A "**policeman**" is used for stirring.

Scrape the sample from the container with the "**policeman**".

The thin rubber blade of the "**policeman**" is flexible.

NOTEBOOK

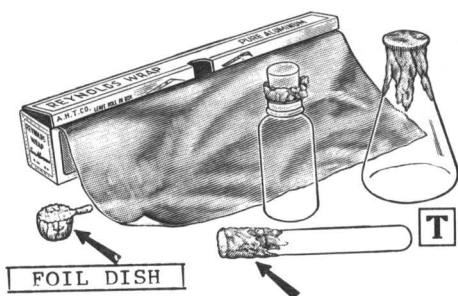


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Record the research data in the **notebook**.

The **notebook** contains all the results of the experiment.

Label all items in the **notebook**.



FOIL

Aluminum **foil** is used in capping glassware.

You can shape a disposable weighing dish from **foil**.

Foil is packed in rolls.

FOIL DISH

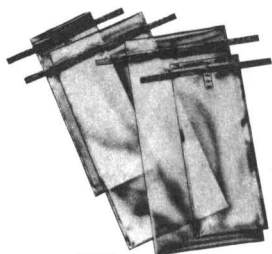
TEST TUBE AND FOIL CAP

BAG

Bags are used to store samples.

Polyethylene (polythene) **bags** are transparent.

Disposable **bags** are convenient sample containers.



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EVAPORATING DISH

Porcelain **evaporation dishes** are placed in the oven.

Place the sample to be evaporated in this **dish**.

Evaporation dishes are available in many sizes.



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APRON

Use the **apron** to protect your clothes.

Some **aprons** are disposable.

Clean **aprons** are located in the cabinet.

ASBESTOS GLOVES

Use **asbestos gloves** when handling hot objects.

The crucible will burn your fingers unless you use **asbestos gloves**.

Asbestos gloves are good heat insulators.

RUBBER GLOVES

Use **rubber gloves** when washing glassware.

Rubber gloves are useful when transferring corrosive chemicals.

Rubber gloves protect your hands.

Do not use **rubber gloves** with hot objects.

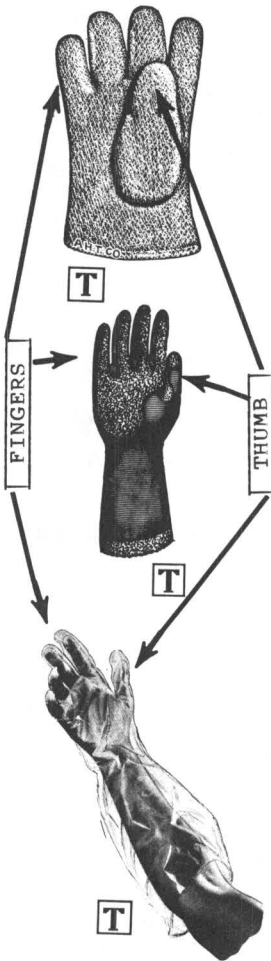
DISPOSABLE GLOVES

Disposable gloves protect against solvents, acids and detergents.

For bacterial protection, use **disposable gloves**.

Disposable gloves allow a great deal of manual dexterity.

Do not use **disposable gloves** with hot objects.

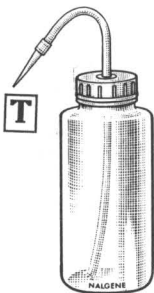


WASH BOTTLE

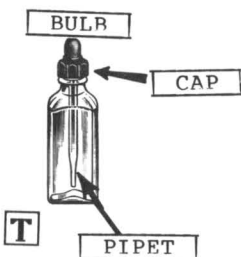
By squeezing the **wash bottle**, a stream of liquid is produced.

Wash bottles are available in many sizes.

Water as well as solutions or solvents can be delivered from a **wash bottle**.



DROPPING BOTTLE



Dropping bottles are often used for reagents.

One drop can be delivered from a dropping bottle.

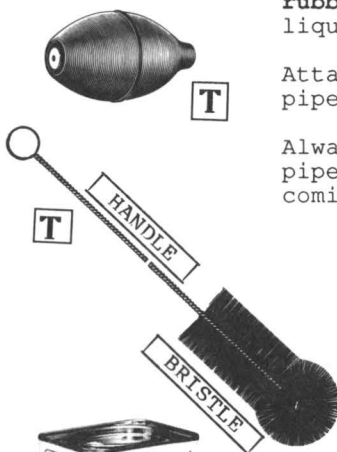
The rubber bulb controls the flow from the dropping bottle.

RUBBER BULB

A pipet (pipette) fitted with a rubber bulb is used to transfer liquids.

Attach the rubber bulb to the pipet (pipette).

Always use a rubber bulb on a pipet (pipette) to avoid liquids coming in contact with your mouth.



BRUSH

Use the brush for cleaning.

Brushes are available in many shapes.

Wash the glassware with the brush.

CLEANING COMPOUND

A detergent is a cleaning compound.

Cleaning compounds may be solid, powder or liquid.

Cleaning compounds are an aid in washing dirt from equipment.

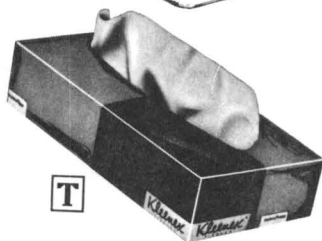


TISSUE

Kleenex tissue is absorbent.

Special tissue is used on optical lens.

Use a paper towel rather than a tissue on large spills.



WALL CLOCK

A **wall clock** is used to tell time.

This **wall clock** indicates it is 12 minutes till (to) 5 (or, four forty-eight).



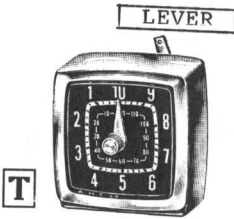
Wall clocks in the U.S. have a 12-hour cycle and p.m. indicates time in the afternoon (4:48 p.m. = 16:48 on a 24-hour clock).

INTERVAL TIMER

An **interval timer** is used to measure the time of a chemical reaction.

Pull the lever down to start this type of **interval timer**.

An alarm in the **interval timer** will sound when the set time has expired.

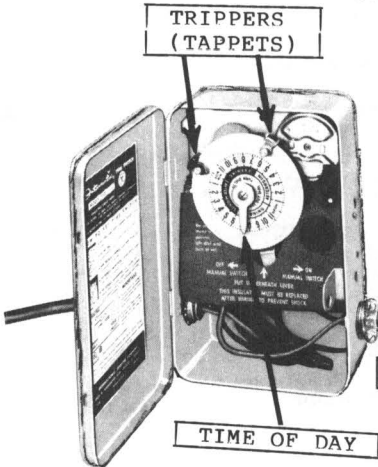


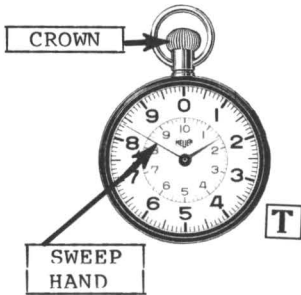
TIME SWITCH

A **time switch** is used to start and stop electrical equipment automatically.

The **time switch** will repeat "on" and "off" cycles every 24 hours.

Trippers (Tappets) in the **time switch** can be adjusted for different time cycles.



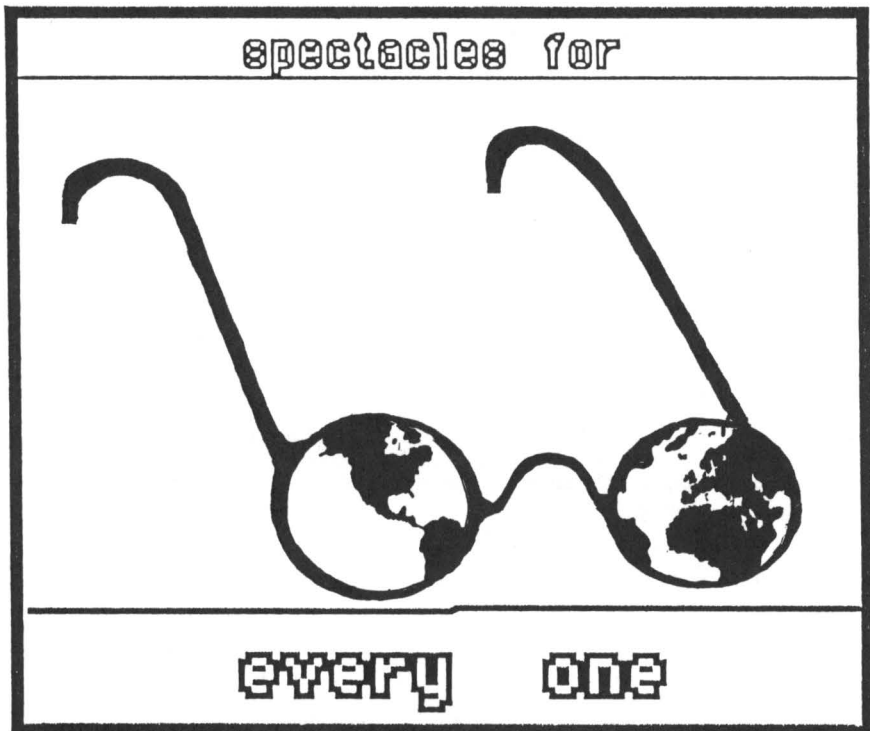


STOPWATCH

Use a **stopwatch** to accurately time an event.

The crown is used to wind the **stopwatch**.

The **stopwatch** crown is also used to stop, start and reset the timer.

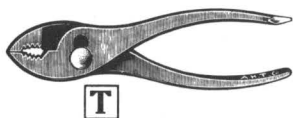


A great deal of **hand laboratory equipment** is located in almost every laboratory and a few examples are as follows. A **spatula** is used to transfer small quantities of a sample but a **scoop** is necessary when dealing with larger quantities. Tweezers or forceps are used to handle very small items but **tongs** are necessary for handling larger pieces of equipment. A "**policeman**" can be used as a stirring rod but it is also helpful when scraping a sample from a container.

Laboratory data should always be recorded in a laboratory **notebook**. **Foil** is useful to make caps or containers or to wrap samples. **Bags** are also used as sample containers. An **evaporating dish** can be heated to drive moisture from the sample. Clothing and the body should be protected with an **apron** and the hands should be protected with **gloves**. **Asbestos, rubber, and disposable gloves** all offer different types of protection. Liquid may be dispensed by a **wash bottle** or a **dropping bottle** or with the aid of a pipet (pipette) and a **rubber bulb**. Dishes may be washed with a **cleaning compound** and a **brush**. A small liquid spill may be absorbed with a **tissue** but disposable paper towels are necessary for larger volumes of liquid.

Timing devices take many forms and the **wall clock** is used to tell the time of day. An **interval timer** tells you when to stop a reaction; a **time switch** starts or stops equipment automatically; and, a **stopwatch** is used when accuracy is required.

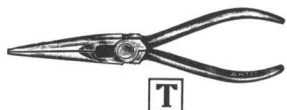
PLIERS



Pliers are used to hold or turn nuts.

These **pliers** have a pipe wrench area.

Wire can be cut with one section of these **pliers**.

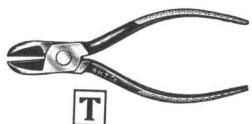


NEEDLE NOSE PLIERS (Fine Nose Pliers)

Needle (fine) nose pliers are used to handle small items.

These **needle (fine) nose pliers** also have a wire cutting section.

Needle (fine) nose pliers are used to bend wire.



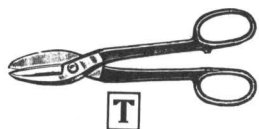
WIRE CUTTER PLIERS

Wire cutter pliers are useful in cutting wire in tight places.

These **wire cutting pliers** are of the diagonal cutting type.

Do not cut heavy wire with these **wire cutter pliers**.

TIN SNIPS



Tin snips are used to cut metal.

Wire can be cut with **tin snips**.

Use the **tin snips** to cut the wire screen.



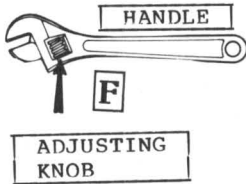
SCISSORS, OR SHEARS (Normally heavier)

Shears or scissors are used to cut paper.

Cardboard can also be cut with **shears** or **scissors**.

Cut the paper with the **scissors** or **shears**.

CRESCENT WRENCH (Adjustable Wrench)

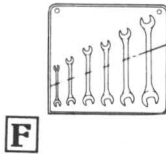


A **crescent wrench** will adjust to fit a square or a hex head nut.

A **crescent wrench** is often called an adjustable wrench.

Use the **adjustable wrench** to tighten the nut.

OPEN-END WRENCH



Select the **open-end wrench** to fit the nut.

The **open-end wrench** is a different size on each end.

A **closed-end wrench** fits around the nut but the **open-end wrench** fits only 2 sides of the nut.

HEX WRENCH SET

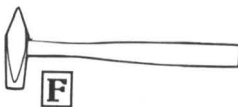


Use a **hex wrench** to turn the setscrew.

A **hex wrench** may be part of a set or may be an individual wrench.

Hex wrenches are available in many sizes.

HAMMER



A **hammer** is used for driving nails.

Don't hit your thumb with the **hammer**.

Break the sample with a **hammer**.

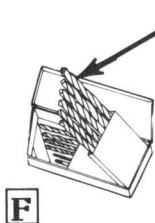
SCREWDRIVER



A **screwdriver** is used to turn screws.

A regular **screwdriver** fits a straight slot.

A **screwdriver** that fits a cross-type slot is called a **Phillips screwdriver**.



DRILL BIT

A **drill bit** is used to bore a hole.

Different sized **drill bits** are available.

Place the **drill bit** in the drill.



METAL FILE

Metal files are available in many shapes.

A **metal file** is used to shape metal.

A **metal file** is also used to etch glass.

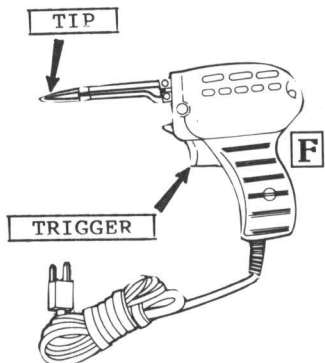


WISE (Vice)

A **vise (vice)** is used to clamp items.

This **vise (vice)** also contains a small anvil.

Clamp the **vise (vice)** to the bench.



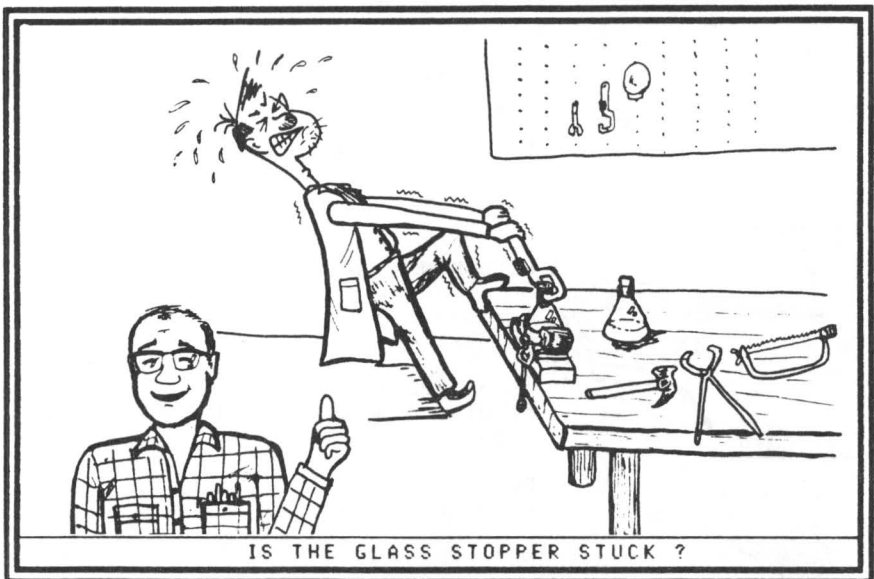
SOLDERING GUN

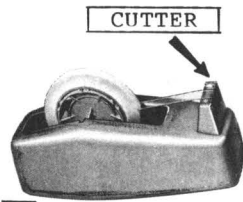
A **soldering gun** is used to melt solder.

A **soldering gun** that is a large pencil shape is called a soldering iron.

Be careful of the hot tip on the **soldering gun**.

Many tools are used in the laboratory. **Pliers** are frequently used. They may be regular **pliers** or **wire cutter pliers**. **Tin snips, shears** or **scissors** are used for cutting. Items are turned with **wrenches** such as an **adjustable** or **crescent wrench**, an **open-end wrench**, a **closed-end wrench** or a **hex wrench**. A **hammer** is used for driving or pounding. A **screwdriver** is a very useful laboratory tool and the two most popular types are regular and Phillips. Holes are drilled with **drill bits** and metal is shaped with a **metal file**. A **vice (vice)** is used to hold items and a **soldering gun** is used to solder wire joints.



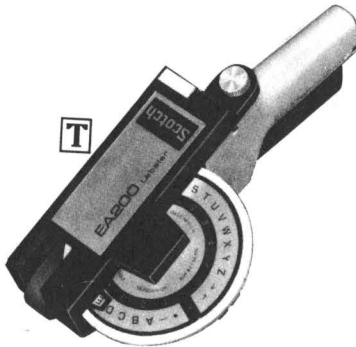


TAPE DISPENSER

Transparent tape is placed in the **tape dispenser**.

The **tape dispenser** has a cutter for cutting the tape.

Masking tape can be obtained from the **tape dispenser**.



LABEL MAKER

A **label maker** embosses plastic tape.

Type the label on a **label maker**.

Squeeze the handle of the **label maker** to emboss a letter on the tape.

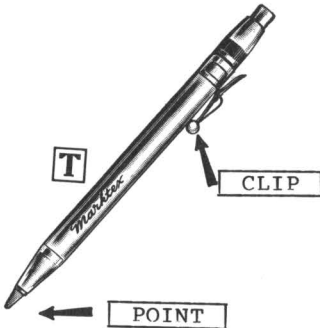


LABEL

Write on the **label**.

The **label** is used to identify the sample.

Some **labels** are gummed.



BALL-POINT PEN

Use the **ball-point pen** for marking.

Ball-point pens are available in many ink colors.

Mark the label with the **ball-point pen**.

**WAX PENCIL**

Use the **wax pencil** to write on glass.

Some **wax pencils** are heat resistant.

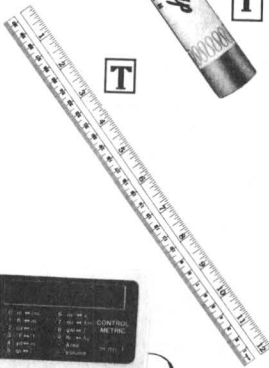
Rolled paper surrounds the wax in a **wax pencil**.

**FELT TIP MARKING PEN**

Keep the cap on the **felt tip marking pen** when it is not in use.

Felt tip marking pens are available in many colors.

Most **felt tip marking pens** are non-refillable.

**RULE OR RULER**

Measure the sample with the **rule**.

The **ruler** is graduated in inches and centimeters.

Length is measured with a **ruler**.

**CALCULATOR**

Add the numbers on the **calculator**.

Calculate the percentage on the **calculator**.

Check the math (maths) on the **calculator**.

Office hand tools are also useful in the laboratory. A **tape dispenser** can be used to dispense a variety of types and widths of tape which is normally used for sealing packages. A **label maker** is a very useful item for printing **labels** so that everyone will know where items are stored. **Gummed labels** are also useful for identification. Writing instruments are available in many types and would include a **pencil**, **ball-point pen**, **wax pencil** and **felt tip marking pen**. A **rule** or **ruler** is used to measure linear distances. The **calculator** has almost replaced the slide rule as a method of figuring mathematics.



PERIODIC TABLE OF THE ELEMENTS

T

PERIODIC TABLE OR CHART

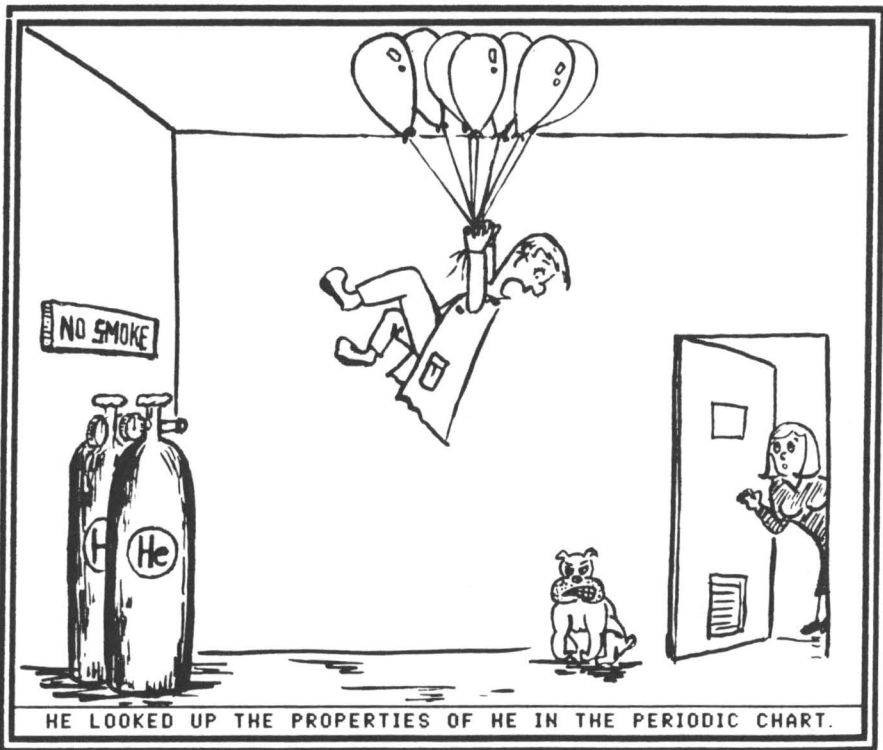
A **periodic table** or **chart** lists all of the elements.

The atomic symbol, atomic number and atomic weight may be found in the **periodic table**.

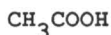
The **periodic table** groups the elements into families.



The **periodic table or chart** is very useful in the laboratory. It places atoms which behave similarly into groups. The **periodic chart** also supplies a great deal of useful information about the elements.

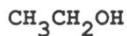


ACETIC ACID



Glacial acetic acid is 99.5% acetic acid.

ALCOHOL



The term alcohol refers to ethyl alcohol.

AMMONIUM HYDROXIDE



Ammonium hydroxide is 29% NH_3 in water solution.

CALCIUM HYDROXIDE



Lime water is a solution of calcium hydroxide.

HYDROCHLORIC ACID



Concentrated hydrochloric acid contains 38% HCl.

NITRIC ACID



Concentrated nitric acid contains 70% HNO_3 .

POTASSIUM HYDROXIDE



Potassium hydroxide is sometimes called caustic potash.

SODIUM HYDROXIDE



Sodium hydroxide is sometimes called caustic soda.

SULFURIC ACID



(SULPHURIC ACID)

Concentrated sulfuric (sulphuric) acid contains 93-98% H_2SO_4 .

REAGENT LABEL

METRICS. Distinctive solid black bar readily identifies metric packaging.

PURITY GRADE

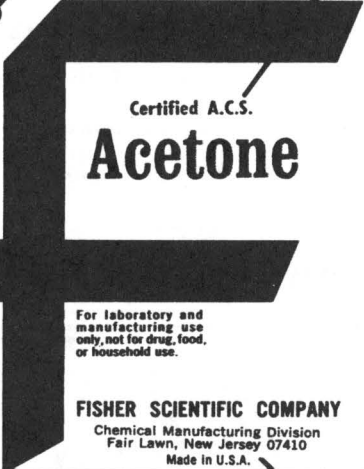
Certified = highest Fisher Grade.

ACS = meets reagent specifications of American Chemical Society, the universal authority.

SIZE stated in both systems of measurement.

CATALOG NUMBER

LOT ANALYSIS

Certificate of Actual Lot Analysis CH₃CO.CH₃ F.W. 58.08		A-18 4 L (1.06 GAL.)	
Color (APHA) Density (g/ml) at 25°C 0.7857 Boiling Point 56.1°C ± 0.1°C Boiling Range (First drop to drypoint) 55.9°-56.3°C Assay (CH ₃ COCH ₃) 99.5% Residue after evaporation 0.0002% Solubility in water P.T. Acidity (as CH ₃ COOH) 0.002% Alkalinity (as NH ₃) 0.0002% Aldehyde (HCHO) 0.0005% Methanol (CH ₃ OH) 0.05% Substances reducing Permanganate P.T. Water (H ₂ O) 0.5% Isopropyl Alcohol 0.01%			
EXTREMELY FLAMMABLE DANGER! FLASH POINT 0°F Keep away from heat, sparks and open flames. Keep container closed. Use with adequate ventilation. Avoid prolonged or repeated contact with skin. KEEP OUT OF REACH OF CHILDREN		LOT 783447 Class 1B	For laboratory and manufacturing use only, not for drug, food, or household use. FISHER SCIENTIFIC COMPANY Chemical Manufacturing Division Fair Lawn, New Jersey 07410 Made in U.S.A.

F

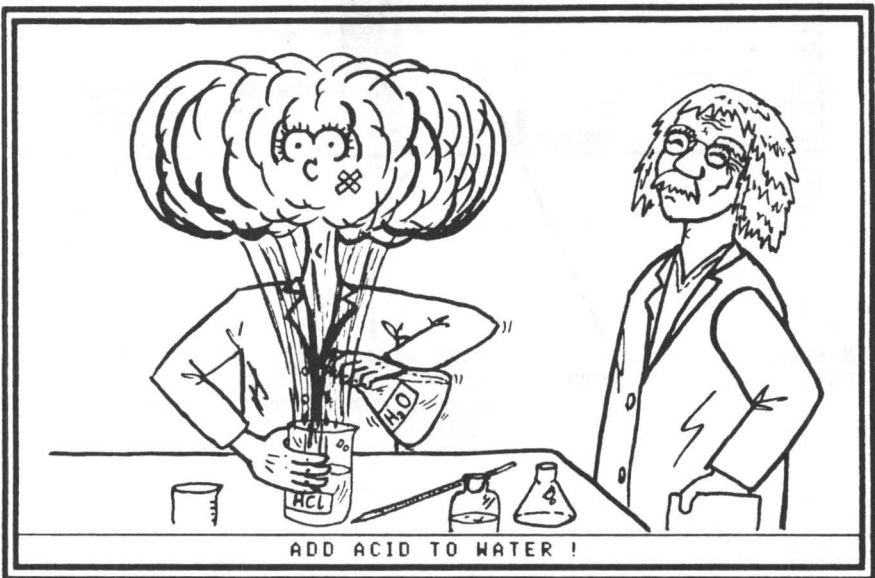
SAFETY DATA

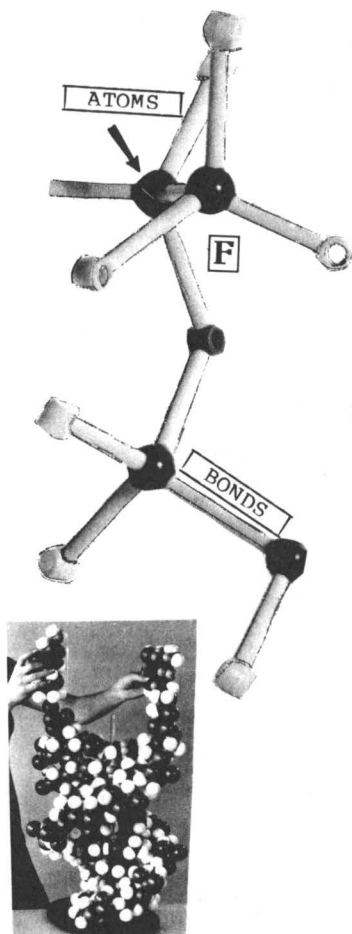
LOT NUMBER

WHERE APPLICABLE; OSHA CLASSIFICATION FOR FLAMMABLE AND COMBUSTIBLE LIQUIDS.

THE SOURCE

Many classes of **reagents** are found in the laboratory. For example, **acids** such as **acetic**, **hydrochloric**, **nitric** and **sulfuric (sulphuric)** are very common. **Bases** such as **ammonium**, **calcium**, **potassium** and **sodium hydroxides** are also available. Many types of **alcohol** are used in the laboratory but if only the word "**alcohol**" is used, it refers to **ethyl alcohol**. **Reagents** arrive at the lab in bottles or cans and they are always **labeled**. The **label** may indicate such things as the **analysis** of the **reagent**, the **size** or **quantity** of the **reagent**, the **purity** of the **reagent**, the **classification** of the **reagent**, the **lot number** of the **reagent** and the **safety data** pertinent to the **reagent**.





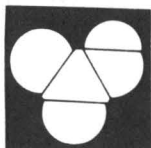
Three types of **molecular models** are shown on this page and they are 3-dimensional representations of organic compounds.

Molecular models not only show the atoms but the bonds between the atoms.

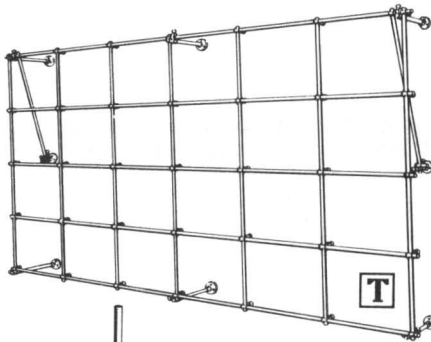
Color (colour) coded atoms of a definite scale are used in **molecular models**.

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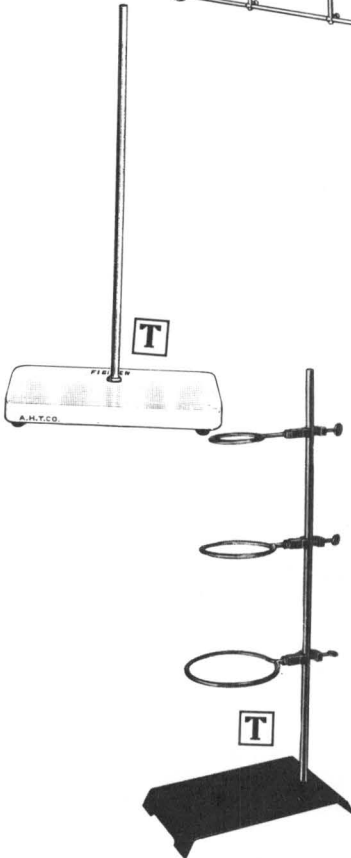
Molecular models are helpful in understanding the 3-dimensional configuration of organic compounds.

**SUPPORT OR FRAME**

A **support unit** or **frame** can be used to mount a chemical apparatus.

A **support** or **frame** can be small and simple or large and complex.

A **frame** can sit on the table or mount on the wall.

**BURET (Burette) STAND**

This **support unit** has a base and a support rod.

This type of **support unit** is sometimes called a **buret (burette) stand**.

This base unit of a **support unit** is sometimes porcelain or it may be enameled steel.

RING STAND (Retort Stand)

The **ring stand (retort stand)** is a **support unit** that is often used to hold rings.

The **ring stand (retort stand)** can also be used to hold other types of clamps.

A **ring stand (retort stand)** and a ring are useful when heating material.

TRIPOD

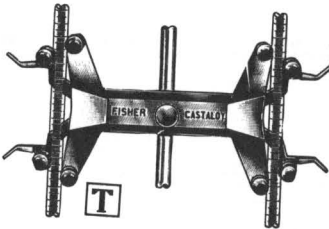


A **tripod** can serve some of the same functions as a **ring stand (retort stand)**.

A **tripod** is not adjustable in height.

This **tripod** is equipped with removable concentric rings.

BURET CLAMP (Burette Clamp)



A **buret (burette) clamp** is attached to a vertical support rod.

The **buret (burette) clamp** holds 2 burets (burettes).

The graduations on the buret (burette) are not obscured by a **buret (burette) clamp**.

CLAMP HOLDER

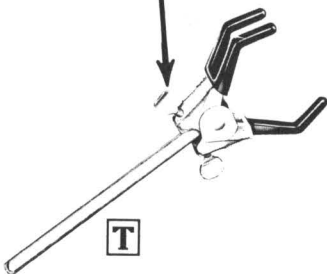


A **clamp holder** which may hold a clamp is attached to a support.

Clamp holders are available in many styles.

A thumbscrew (boss head) is used to secure the **clamp holder** to the support.

CLAMP

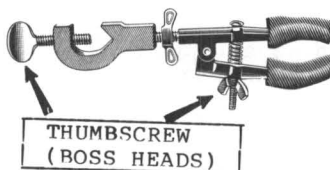


A **clamp** is held by a **clamp holder**.

This **clamp** has 2 adjustable jaws.

Small and medium size objects can be held with this type of **clamp**.

CHECKNUT

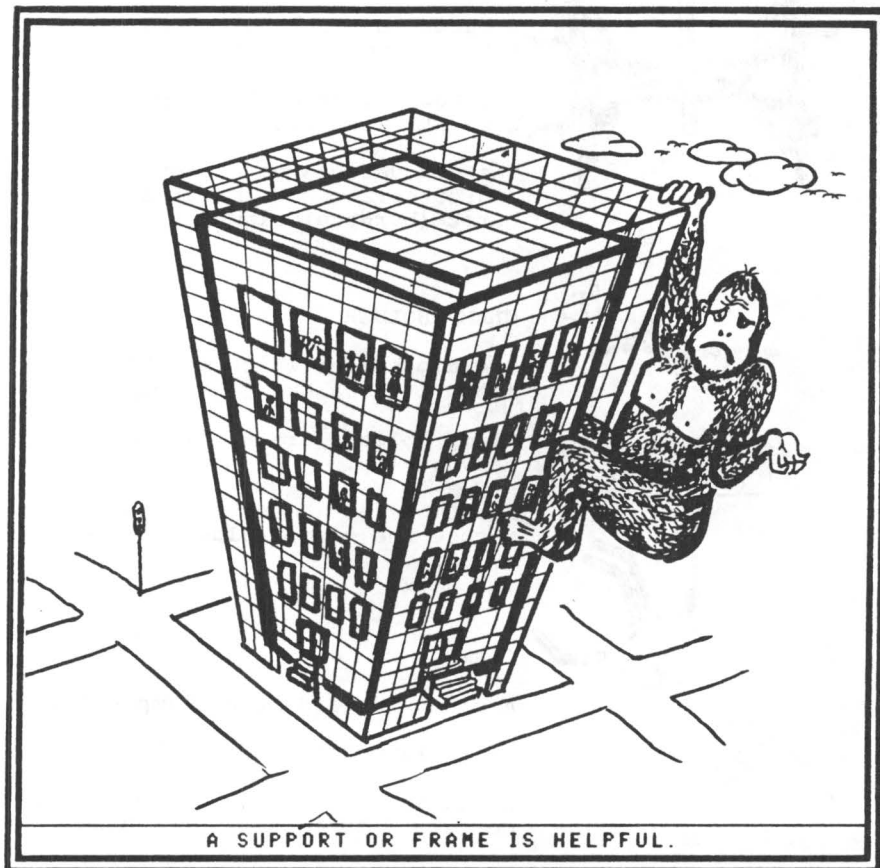


CLAMP WITH HOLDER

Clamp with holder is a clamp and clamp holder in one unit.

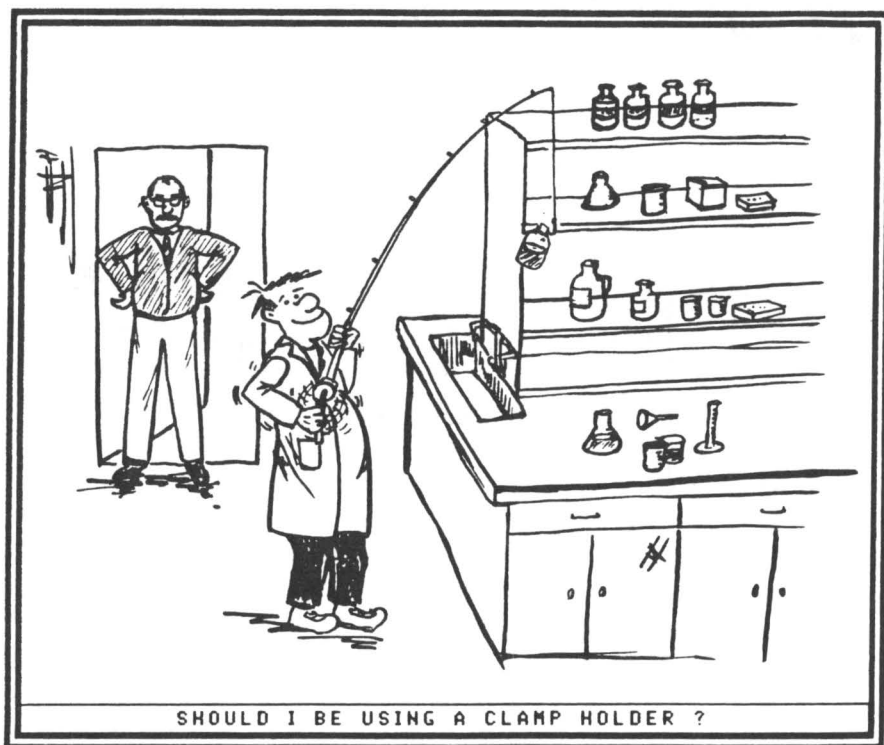
This clamp and holder has a stationary jaw and a movable jaw.

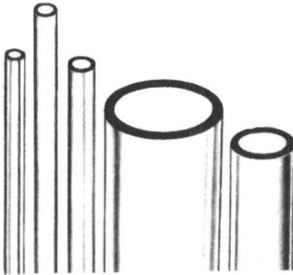
The checknut allows the clamp to be rotated in relation to the holder.



A SUPPORT OR FRAME IS HELPFUL.

A **support** or **frame** is made from vertical and horizontal bars. Small versions are vertical bars attached to a base. These may be called **support units** or **ring stands (retort stands)**. Rings are often attached to the **ring stand (retort stand)**. A ring with 3 legs attached is called a **tripod**. A **buret (burette) clamp** attaches a buret (burette) to a **support rod**. **Clamp holder** and **clamps** or a **clamp with holder** attaches objects to **support units**.



**GLASS TUBING**

Glass tubing is available in many sizes.

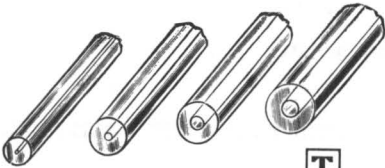
Most **glass tubing** can be softened in a gas-air flame.

Different types of **glass tubing** have different degrees of hardness.

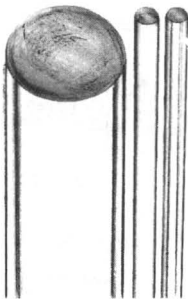
T**CAPILLARY TUBING**

Glass tubing with a small internal bore (hole) is called **capillary tubing**.

Capillary tubing can be used to make capillary pipets (pipettes).

**T**

Melting points are often determined in very thin **capillary tubing**.

**GLASS ROD**

A stirring rod can be made from a **glass rod**.

Glass rods are often made from soft glass.

A **glass rod** does not have a hole in the center.

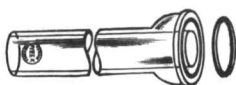
T

BALL AND SOCKET JOINT**T**

A **ball and socket joint** is used to join glass tubing.

A **ball and socket joint** 12/2 indicates a ball of 12 mm in diameter and a bore of 2 mm.

A **ball and socket joint** is useful when alignment is difficult.

O-RING JOINT**T**

An **O-ring joint** provides a rigid, greaseless, vacuum tight seal.

The glass tubing is joined by an **O-ring joint**.

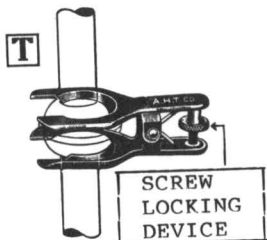
Place the **O-ring** between the **O-ring joint**.

STANDARD TAPER GROUND GLASS JOINT ("Quickfit")**T**

A **standard taper ground glass joint (quickfit)** of 24/40 indicates a 24 mm diameter at the widest point and 40 mm long.

The **standard taper ground glass joint (quickfit)** is often used to connect a flask to a condenser.

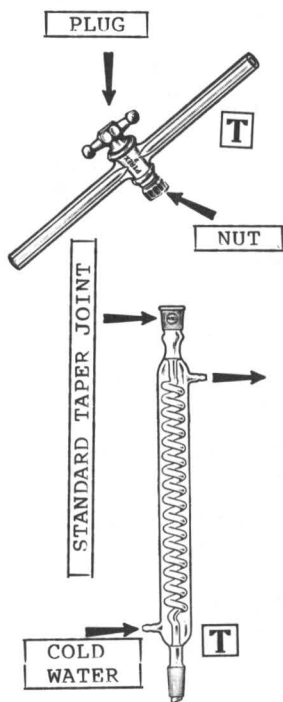
Springs are used on some **standard taper ground glass joints (quickfits)** to hold them together.

**T****PINCH CLAMP**

A **pinch clamp** can be used on a ball and socket and an O-ring joint.

Some **pinch clamps** have a screw locking device.

The **pinch clamp** has a spring closed, forked jaw.

**GLASS STOPCOCK**

A **glass stopcock** may have a teflon or glass plug.

A **glass stopcock** is used to control flow.

A nut often holds the plug in the **stopcock**.

CONDENSER

A **condenser** cools a vapor and changes it into a liquid.

Cold water is circulated through the **condenser**.

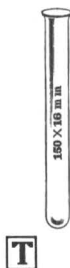
The **condenser** contains a condensing tube surrounded by a water jacket.

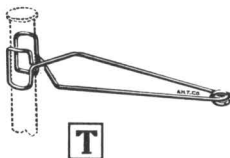
TEST TUBE

A **test tube** is an elongated glass container often used for chemical reactions.

Heat the sample in the **test tube**.

There are many sizes of **test tubes**.





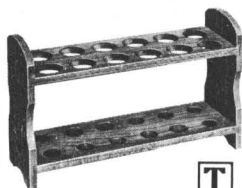
T

TEST TUBE HOLDER

A **test tube holder** is used when heating the tube.

The **test tube holder** has self-closing jaws.

A spring keeps the jaws closed on the **test tube holder**.



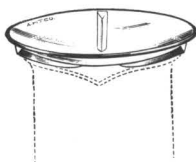
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TEST TUBE RACK

Test tube racks are made of wood, wire, plastic or metal.

This **test tube rack** holds 12 tubes.

This **test tube rack** does not have drying pins.



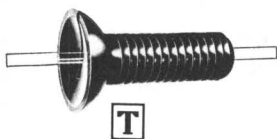
T

WATCH GLASS

The **watch glass** will allow steam to escape from the beaker.

Evaporate the sample in the **watch glass**.

Watch glasses are available in many sizes.



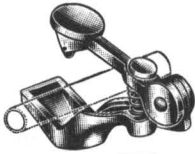
T

SAFETY HAND GRIP

Use the **safety hand grip** when pushing glass tubing through a stopper.

When breaking glass tubing, use the **hand safety grip**.

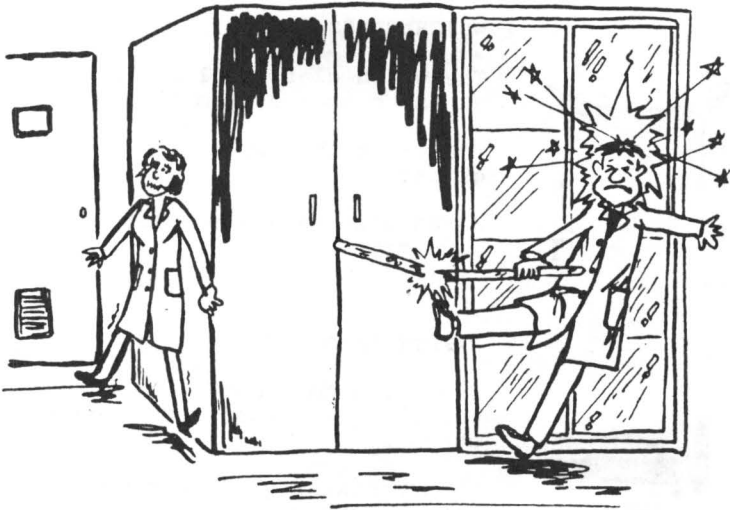
The **safety hand grip** can handle glass tubing of different sizes.

GLASS TUBING CUTTER**T**

The **glass tube cutter** is used for scoring the tube.

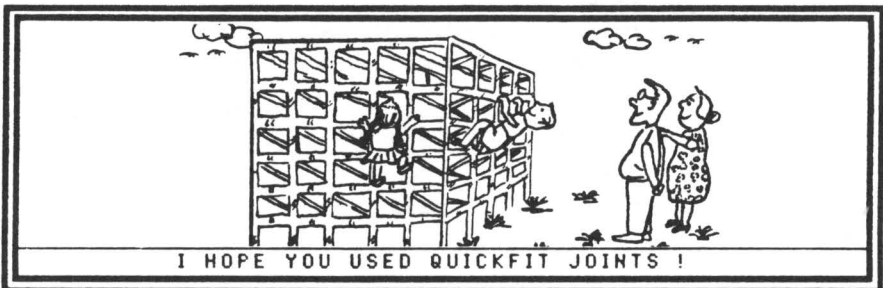
Some **glass tube cutters** contain a hot wire.

After cutting the tube with the **glass tube cutter**, the cut end of the tube should be polished in a flame.



A GLASS TUBING CUTTER WORKS BETTER.

Glass does not react with most chemicals and, therefore, is used in the chemical laboratory. **Glass tubing, capillary tubing and glass rods** are the most common types of glass pieces used in the lab. **Glass tubing** is often joined with **ball and socket, O-ring or standard taper ground glass (quickfit) joints**. The joints are held together by gravity, **springs** or **pinch clamps**. **Stopcocks** are used to control flow through tubing or containers. A **condenser** is tubing fitted with a water jacket. **Test tubes** are small containers and a **test tube holder** is used when heating the tubes. To keep the tubes in order and hold them upright, they are often placed in a **test tube rack**. A **watch glass** is often placed above a beaker to condense some of the boiling material and return it to the beaker. **Hand safety grips** should be used when holding **glass tubing** and a **glass tubing cutter** is used to etch (score) glass prior to breaking.



SPOUT
(LIP)



T

BEAKER

A **beaker** may or may not have a spout (lip).

Beakers are made of glass, plastic or steel.

Many sizes of **beakers** are used.



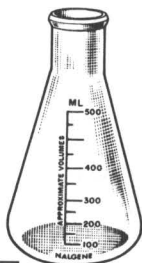
T

BOTTLE

Store the chemical in the **bottle**.

Bottles may be clear or amber or various other colors.

Bottles are made of glass or plastic.



T

ERLENMEYER FLASK (Conical Flask)

An **Erlenmeyer (conical) flask** is a convenient container for mixing chemicals.

The graduations on an **Erlenmeyer (conical) flask** are only approximate.

Some **Erlenmeyer (conical) flasks** have a standard taper joint on the top.

HANDLE
OR BAIL



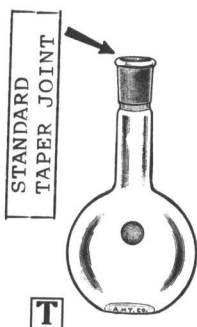
T

PAIL OR BUCKET

Pails or **buckets** are made from metal or plastic.

A large container with a handle is called a **pail** or **bucket**.

Pour the liquid into the **bucket** (or **pail**).

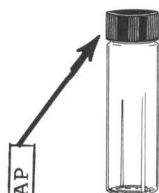


FLORENCE FLASK

Flat bottom **Florence flasks** are used in some experiments.

This **Florence flask** has a standard taper joint but some do not.

Boil the sample on a hot plate in the **Florence flask**.

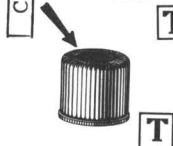


VIAL

A **vial** is a small container.

Store the sample in the **vial**.

This **vial** has a cap but some are closed with a stopper.



CAP

Caps are made of plastic or metal.

Place the **cap** on the bottle.

Most **caps** have a cardboard or foil liner.

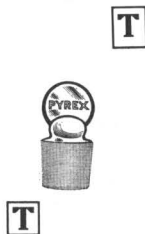


STOPPER (Rubber or Plastic Stopper)

A **stopper** may be solid or contain holes.

The larger the **stopper** number (e.g., #6), the larger the **stopper**.

Close the flask with the **stopper**.



GLASS STOPPER

This **glass stopper** has a penny head.

The standard taper size of a **glass stopper** indicates the diameter of the ground zone at the widest point.

Place the **glass stopper** in the flask.

CORK

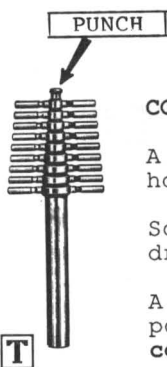


A **cork** is also used as a stopper.

A **cork** is made from the bark of a tree.

T

The larger the **cork** number, the larger the **cork**.

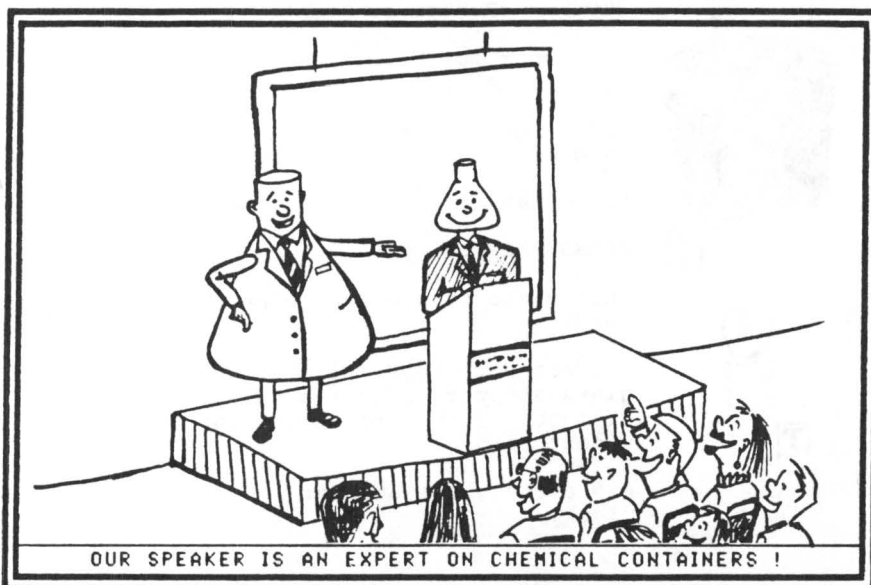


CORK BORER

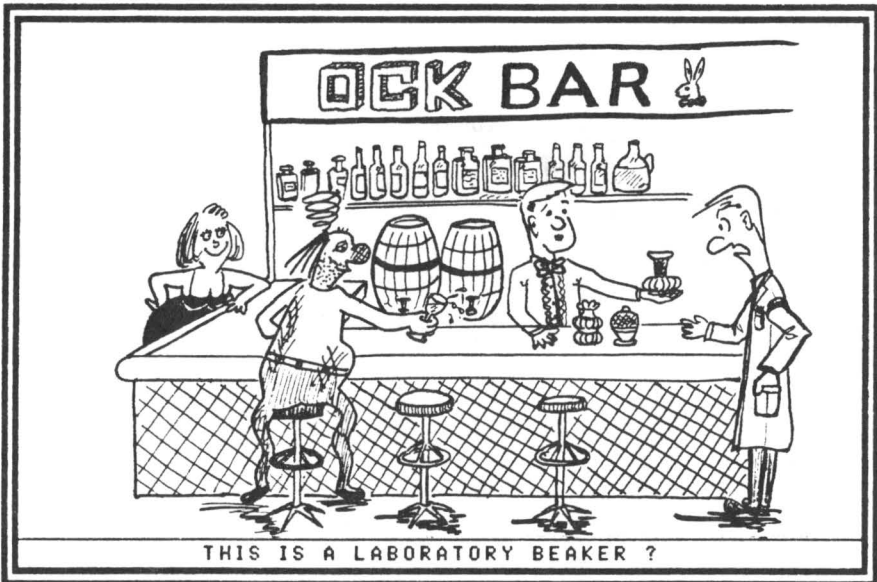
A **cork borer** is used to cut holes in a stopper.

Some **cork borers** are motor driven.

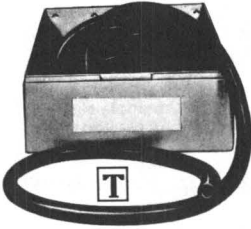
A solid cork punch pushes the cut portion of the stopper from the **cork borer**.



Many types of **containers** are used in the chemical laboratory and a **beaker** is a very popular container. Reagents are usually stored in **bottles** and small samples are stored in **vials**. **Erlenmeyer (conical) flasks** and **Florence flasks** are often used to contain chemical mixtures which are to be heated. A **pail** or **bucket** is used to contain large quantities of materials. Containers are closed with **caps**, **stoppers**, **glass stoppers** or **corks**. A **cork borer** is used to cut holes in corks or rubber stoppers.



RUBBER TUBING

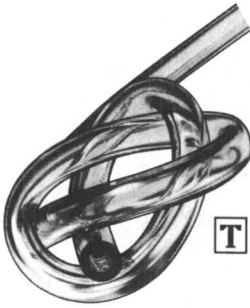


Rubber tubing is used to transfer liquids or gases.

Rubber tubing is available in many bore sizes and wall thicknesses.

Strong, elastic rubber tubing provides a gas-tight connection.

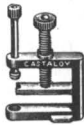
PLASTIC TUBING



Plastic tubing made from tygon or teflon is very chemical resistant.

Polyethylene (Polythene) plastic tubing like rubber tubing is available in many bore and wall thickness sizes.

Plastic tubing is usually transparent.



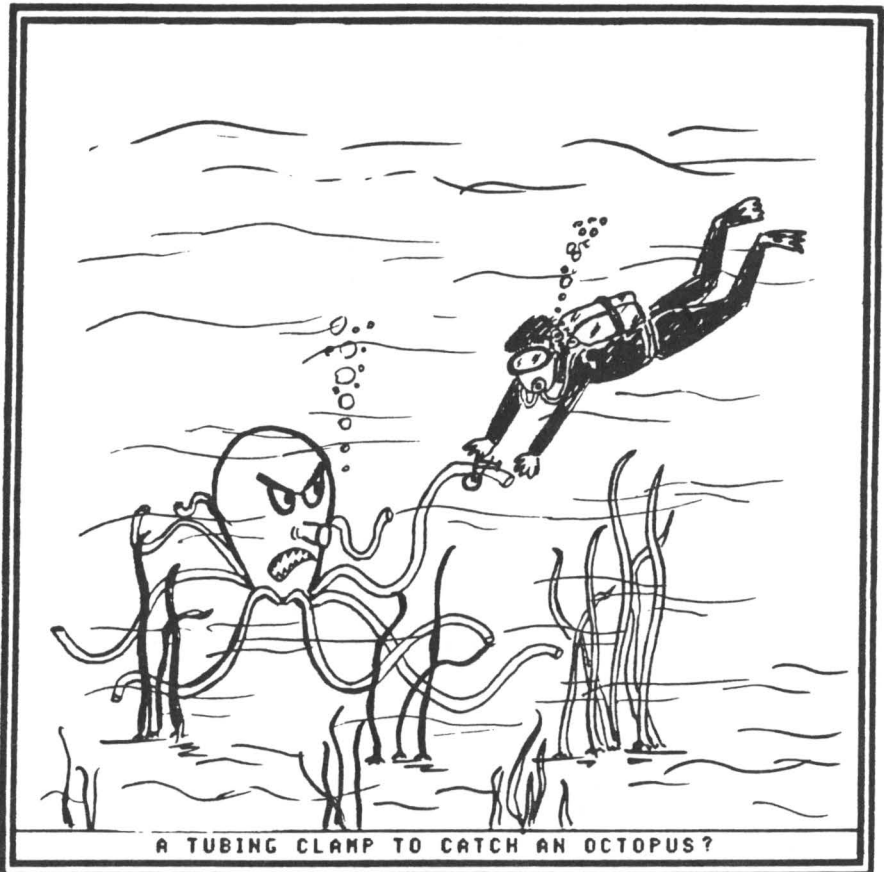
TUBING CLAMP

A tubing clamp is used to stop the flow in tubing.

Regulate the flow with a tubing clamp.

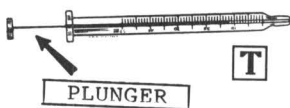
Stop the flow with a tubing clamp.

Rubber or plastic tubing is used to transfer liquids and gases in the laboratory. Flow in the tubing is controlled by a tubing clamp.



A TUBING CLAMP TO CATCH AN OCTOPUS?

SYRINGE PIPET (Syringe Pipette)



T

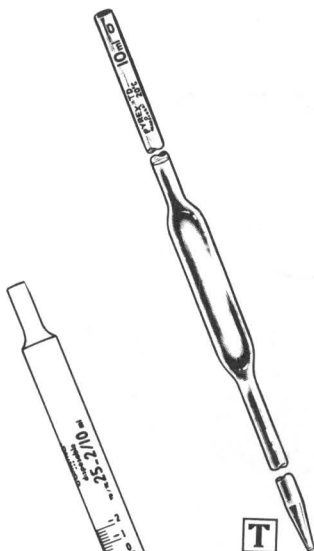
Very small volumes are measured in a **syringe pipet (pipette)**.

A **syringe pipet (pipette)** is often used to inject a sample into a chromatograph.

Some **pipets (pipettes)** have fixed and some have removable needles.

Precision of a **micro syringe pipet (pipette)** is within ± 1%.

TRANSFER OR VOLUMETRIC PIPET (PIPETTE)



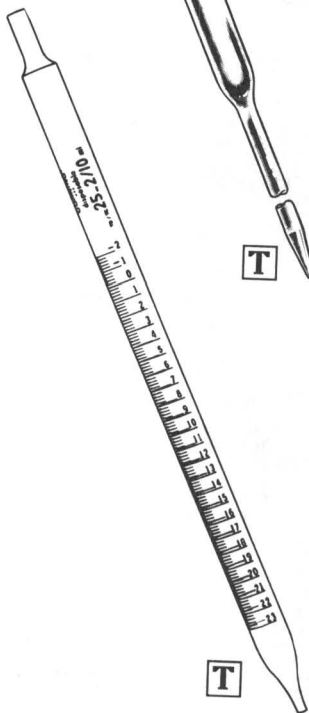
T

A **transfer or volumetric pipet (pipette)** is used to accurately measure a specific volume.

This is a 10 ml **transfer or volumetric pipet (pipette)**.

Measure 50 ml with the **transfer or volumetric pipet (pipette)**.

MEASURING OR GRADUATED PIPET (Measuring or Graduated Pipette)

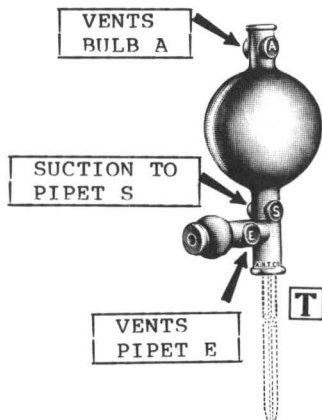


T

Measure 3.4 ml with the **measuring or graduated pipet (pipette)**.

The last 2 ml of this 25 ml **measuring pipet (pipette)** is not graduated.

Each graduation is $\frac{2}{10}$ ml on this **measuring pipet (pipette)**.

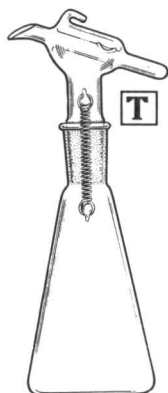


PIPET FILLING ATTACHMENT OR BULB
(Pipette Filling Attachment or Bulb)

Use a pipet (pipette) filling bulb for toxic samples.

When transferring corrosive material, use a pipet (pipette) filling attachment.

Noxious samples can be safely handled with a pipet (pipette) filling bulb.

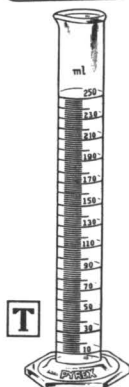


AUTOMATIC TRANSFER PIPET
(Automatic Transfer Pipette)

An automatic transfer pipet (pipette) is used for rapid and reproducible dispensing of liquids.

Approximate accuracy is $\pm 2\%$ for the automatic transfer pipet (pipette).

An automatic transfer pipet (pipette) is used for multiple filling operations.

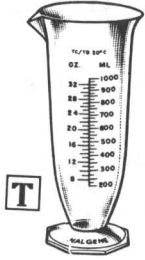


GRADUATED CYLINDER

This is a 250 ml graduated cylinder.

Use the graduated cylinder to measure volume when extreme accuracy is not important.

Some graduated cylinders have stoppers fitted to the top.



GRADUATE

A **graduate** is less accurate than a **graduated cylinder**.

Measure the approximate volume with the **graduate**.

Many **graduates** are calibrated in both fluid ounces and milliliters.



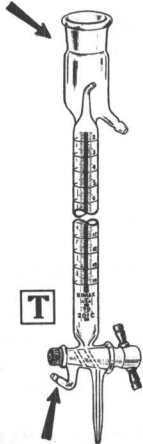
BEAKER

Some **beakers** are calibrated for approximate volume.

Measure approximately 100 ml with the **beaker**.

A **beaker** cannot accurately measure volume.

OVERFLOW CUP



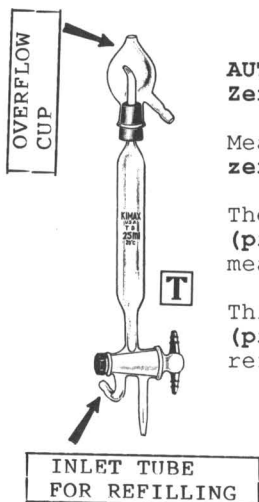
GRADUATED BURET (Graduated Burette)

A **graduated buret (burette)** is used to measure volume.

This **graduated buret (burette)** has an overflow cup and automatically zeros when filled.

Accurately measure the volume with the **graduated buret (burette)**.

INLET TUBE FOR REFILLING

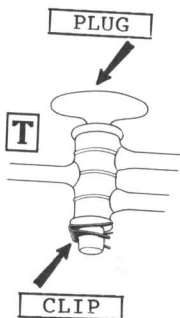


AUTOMATIC ZERO PIPET (Automatic Zero Pipette)

Measure 25 ml with the **automatic zero pipet (pipette)**.

The **automatic zero pipet (pipette)** can accurately measure a specific volume.

This **automatic zero pipet (pipette)** has an inlet tube for refilling.



STOPCOCK

The **stopcock** controls flow in or out of a **buret (burette)**.

The clip on the **stopcock** holds the plug in place.

This type of **stopcock** creates a Y-type connection.

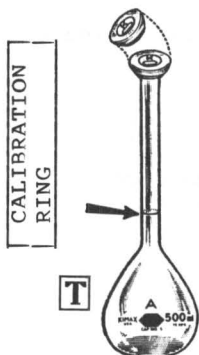
STOPCOCK GREASE



Stopcock grease is used to lubricate stopcocks.

Desiccators can be sealed with **stopcock grease**.

Stopcock grease is acidic and alkaline resistant.

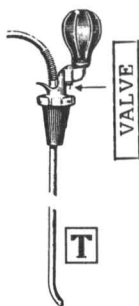


VOLUMETRIC FLASK

This **volumetric flask** contains 500 ml.

Most **volumetric flasks** are calibrated at 20 degrees centigrade.

Measure the volume accurately with the **volumetric flask**.

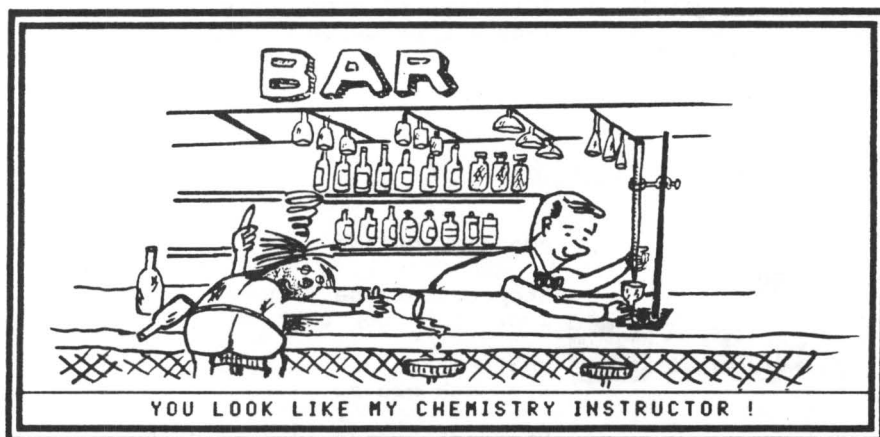


PUMP

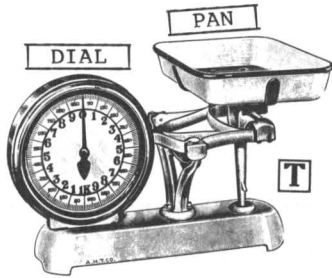
A **pump** is used to transfer chemicals.

An acid can be transferred with a chemical resistant **pump**.

Transfer the solvent with a **pump**.



Measurement of volume is a common laboratory procedure and many instruments are designed to accomplish this task. A **syringe pipet (pipette)** is used to accurately measure small volumes. A **transfer (or volumetric) pipet (pipette)** is used to accurately measure large specific volumes but a **measuring (or graduated) pipet (pipette)** is necessary for measuring varying volumes. If there is fear of getting the chemical in one's mouth, a **pipet (pipette) filling attachment (or bulb)** should be used. An **automatic transfer pipet (pipette)** is useful when a repeated transfer of a specific volume is made. **Graduated cylinders** are less accurate than a **volumetric or measuring pipet (pipette)** but more accurate than a **graduate** or a **calibrated beaker**. A **graduated buret (burette)** or an **automatic zero pipet (pipette)** also accurately measures volume. A **buret (burette)** is fitted with a **stopcock** to meter the liquid from the **buret (burette)** and the **stopcock** is lubricated with **stopcock grease**. A **volumetric flask** is useful when accuracy of large specific volumes is needed. **Pumps** are used in the laboratory to transfer liquids.

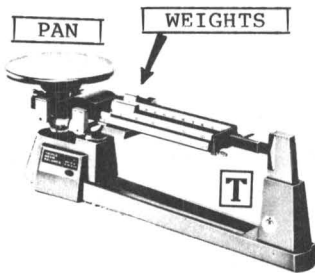


SCALE

Use the **scale** to weigh a sample of medium size.

Some **scales** operate with the aid of a spring.

Scales are usually not as accurate as balances.

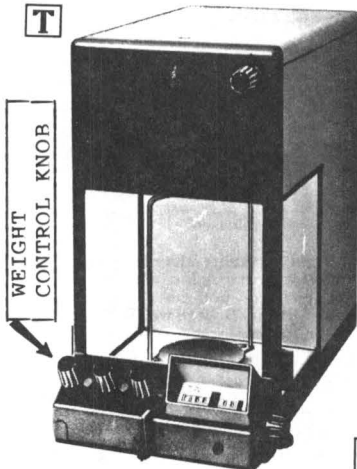


TRIPLE BEAM BALANCE

A **triple beam balance** functions with the aid of a sliding weight on 3 beams.

A sensitivity of 0.1 gram is often obtained with a **triple beam balance**.

Weigh the sample on the **triple beam balance**.

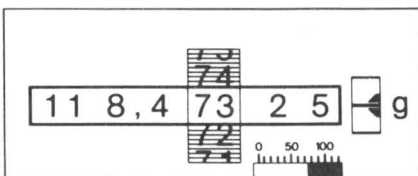


BALANCE

The semi-micro **balance** often has a precision of ± 0.01 mg.

Weights are added or removed from this **balance** by means of dials.

Readout on this **balance** is digital.



reading 118.47325 g



TOP-LOADING BALANCE

This **top-loading balance** is an electronic digital type.

The **top-loading balance** is very easy to use.

Weigh the sample on the **top-loading balance**.

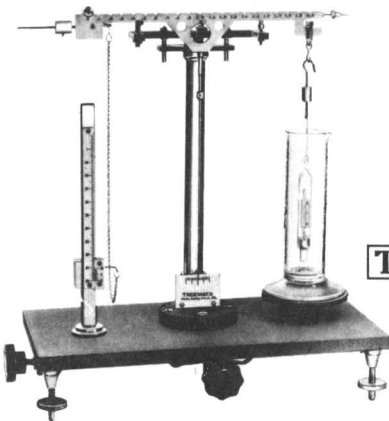


WEIGHT SET

Weight sets are used with some balances.

Do not handle the **weights** with your fingers.

Check this balance with **weight set**.

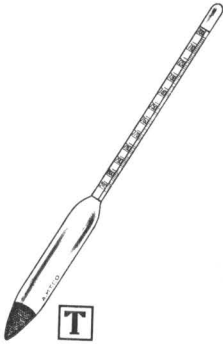


SPECIFIC GRAVITY BALANCE

A **specific gravity balance** has the ability to weigh a sample in a liquid.

Determine the **specific gravity** of the sample with the **balance**.

Lead has a very high **specific gravity** when determined on the **balance**.



HYDROMETER

A **hydrometer** is used to determine specific gravity.

A **hydrometer** is floated in the liquid.

The specific gravity of the salt solution is determined with the **hydrometer**.

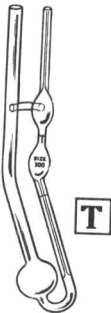


SPECIFIC GRAVITY BOTTLE OR PYCNOMETER

Use the **specific gravity bottle (pycnometer)** to weigh an exact volume of liquid.

Fill the **specific gravity bottle (pycnometer)** with water and then with the sample.

Determine **specific gravity** with the **pycnometer**.

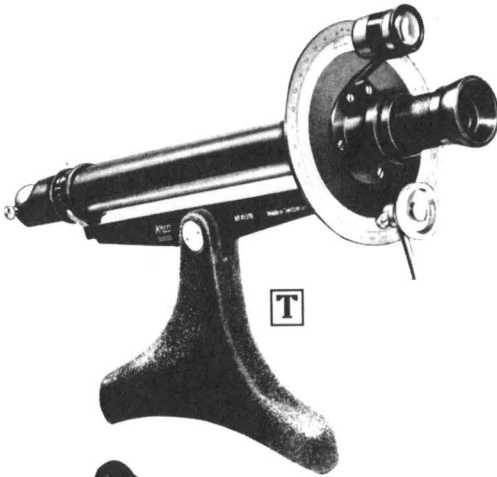


VISCOMETER

Use the **viscometer** to determine viscosity.

Rate of flow is determined by a **viscometer**.

Check the sample with the **viscometer**.

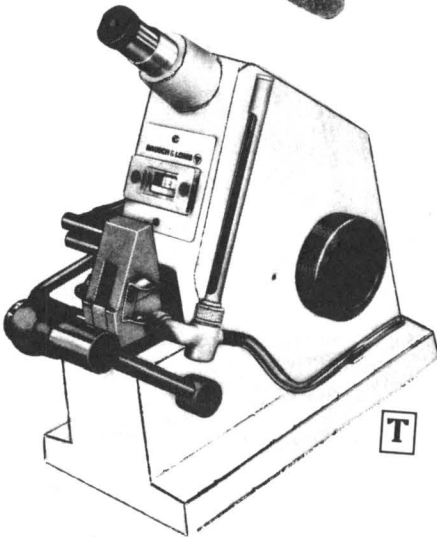


POLARIMETER

Measure the angle of rotation with the **polarimeter**.

Place the optically active sample in the **polarimeter**.

Use the **polarimeter** to check a sugar solution.

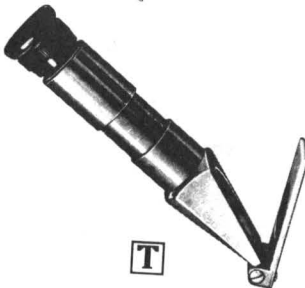


REFRACTOMETER

Measure the percentage of sugar with the **refractometer**.

Use the **refractometer** to measure the total dissolved solids.

Percentage alcohol can be determined with a **refractometer**.



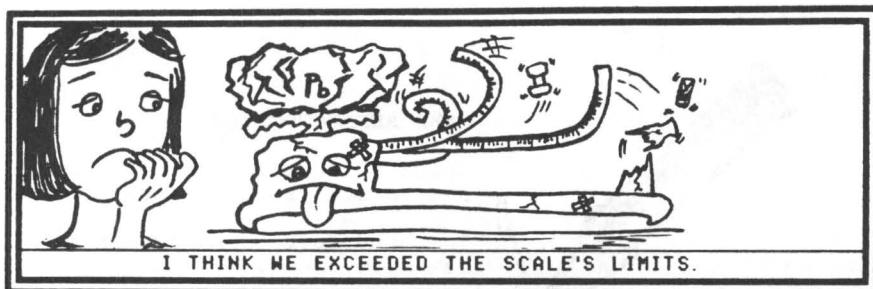
HAND REFRACTOMETER

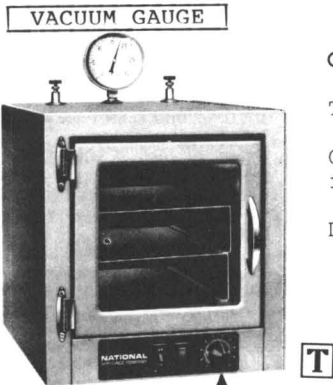
Check alcohol content of a wine sample with a **hand refractometer**.

The **hand refractometer** can be taken to the field for use.

Place the syrup in the **hand refractometer**.

Weighing is an important task performed in the laboratory. Heavy items are weighed on a **scale** and light items are weighed on a **balance**. A **triple beam balance** is used when accuracy is not critical. The electronic digital **top-loading balance** is very easy to use when weighing light objects. **Weight sets** are used on older **balances** and to check the accuracy of **balances**. **Balances** that can weigh the samples suspended in liquid are useful for determining **specific gravity**. The **specific gravity** of a liquid can be determined by a floating **hydrometer**. A **specific gravity bottle** or **pycnometer** allows one to weigh a specific volume of material. The rate of flow of a liquid can be measured with a **viscometer**. A **polarimeter** can be used to measure the rotation of light and a **hand refractometer** can be used to measure light deflection.



**OVEN**

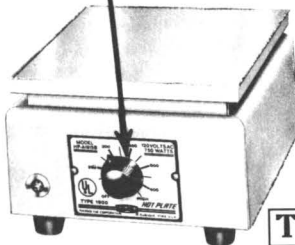
This **oven** is a vacuum **oven**.

Other **ovens** are convection or forced air **ovens**.

Dry the sample in the **oven**.

T

TEMPERATURE CONTROL KNOB

**HOT PLATE**

A **hot plate** is used for heating containers.

The temperature of most **hot plates** is controllable.

A **hot plate** can be used in place of a stove heating element or gas flame.

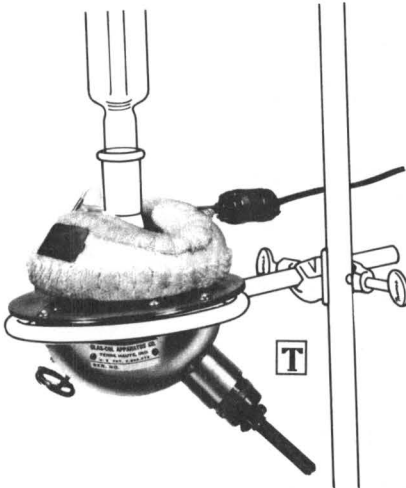
T**INCUBATOR**

This is a CO₂ **incubator**.

Place the petri dish in the **incubator**.

The **incubator** maintains biological growing temperatures.

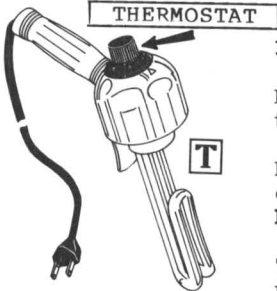
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**HEATING MANTLE**

Place the **heating mantle** around the flask.

Connect the **heating mantle** to a transformer.

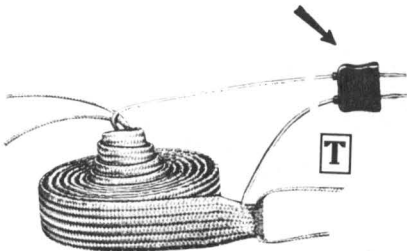
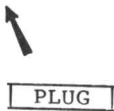
The hemispherical **heating mantle** will enclose the flask.

**IMMERSION HEATER**

Place the **immersion heater** in the water bath.

Keep the liquid temperature constant with the **immersion heater**.

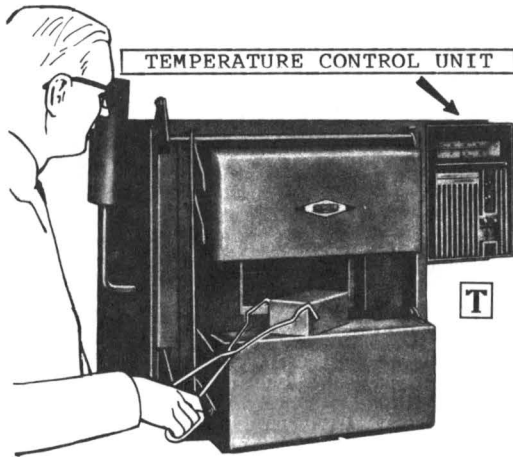
The **immersion heater** is portable.

**HEATING TAPE**

Wrap the **heating tape** around the column.

The flexible flat **heating tape** is useful in heating glassware.

Heating tape is available in many sizes and wattages.

**MUFFLE FURNACE**

A **muffle furnace** is a high temperature furnace.

Determine the ash content of the sample by placing it in the **muffle furnace**.

T

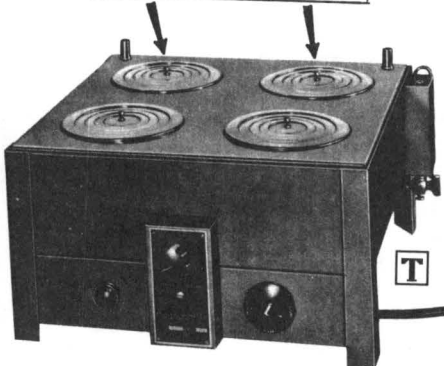
Use tongs when placing samples in the **muffle furnaces**.

T**CRUCIBLE**

A **crucible** is a container that can withstand high temperatures.

A **crucible** may be made from porcelain, graphite, or platinum.

Place the **crucible** in the muffle furnace.

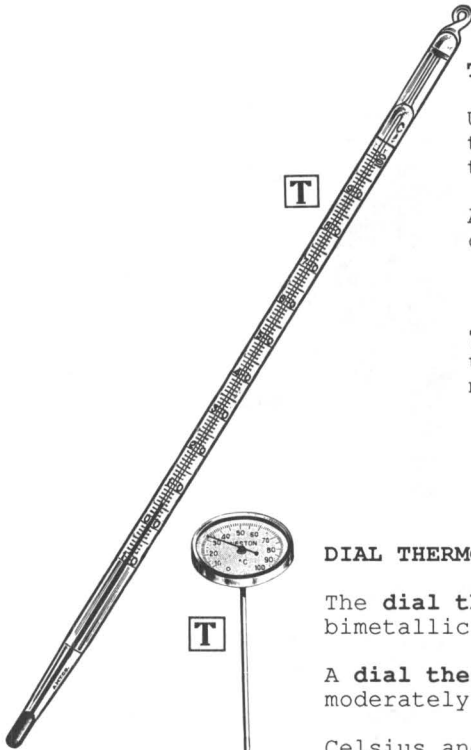
CONCENTRIC RINGS**WATER BATH**

A **water bath** is used to maintain a constant temperature.

T

A **water bath** may be electric, gas or steam heated.

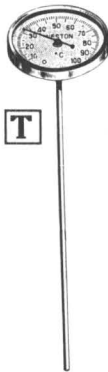
Heat the sample in the **water bath**.

**THERMOMETER**

Use the **thermometer** to measure the temperature.

A **thermometer** may be calibrated in Celsius ($^{\circ}\text{C}$) or Fahrenheit ($^{\circ}\text{F}$).

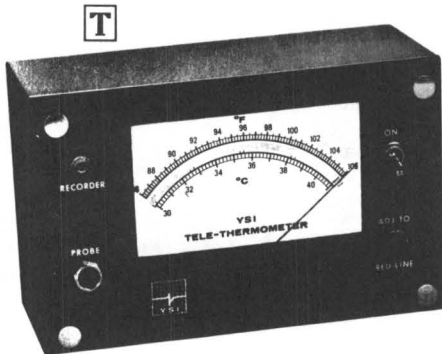
The **thermometer** is usually filled with mercury.

**DIAL THERMOMETER**

The **dial thermometer** contains a bimetallic sensing element.

A **dial thermometer** is moderately rugged.

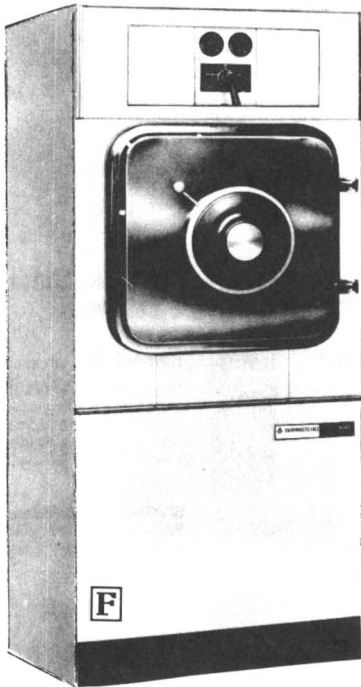
Celsius and Fahrenheit scales are available on **dial thermometers**.

**THERMOMETER (Electrical)**

This **thermometer** allows you to monitor temperature electronically.

This **thermometer** may be attached to a recorder to give a chart of time and temperature.

Some **thermometers** monitor temperature at more than one position with multiple probes.

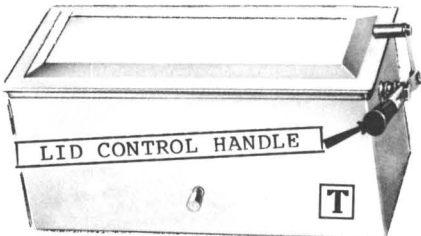


AUTOCLAVE OR STERILIZER

The **autoclave** or **sterilizer** may be electric (generates steam) or steam heated.

Sterilize the microbiological samples in the **autoclave**.

Sterilize at 15 p.s.i. in the **autoclave**.

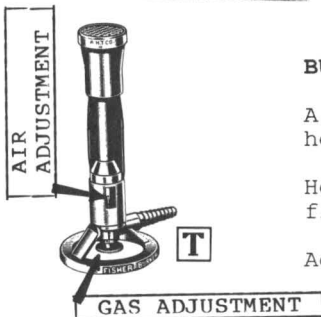


INSTRUMENT STERILIZER

An **instrument sterilizer** uses hot water to sterilize.

Autoclave temperatures are higher than **instrument sterilizers**.

Sterilize the equipment in the **instrument sterilizer**.

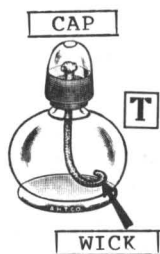


BURNER

A gas **burner** is used for heating samples in the laboratory.

Heat the sample in the **burner** flame.

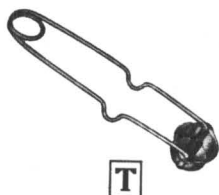
Adjust the air on the **burner**.

**ALCOHOL LAMP**

The **alcohol lamp** gives you a portable flame.

Extinguish the flame and add the cap when you are moving the **alcohol lamp**.

Adjust the wick on the **alcohol lamp**.

**GAS LIGHTER**

The **gas lighter** produces a spark for ignition.

Put a new flint in the **gas lighter**.

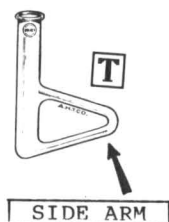
The flint strikes the rasp to produce the spark in the **gas lighter**.

**SAFETY MATCHES**

Light the burner with the **safety matches**.

For the **safety match** to be ignited, it must be struck against the box.

A **gas lighter** may be used instead of **safety matches**.

MELTING POINT BATH

Heat the side arm on the **melting point bath**.

Determine the sample melting point with a **melting point bath**.

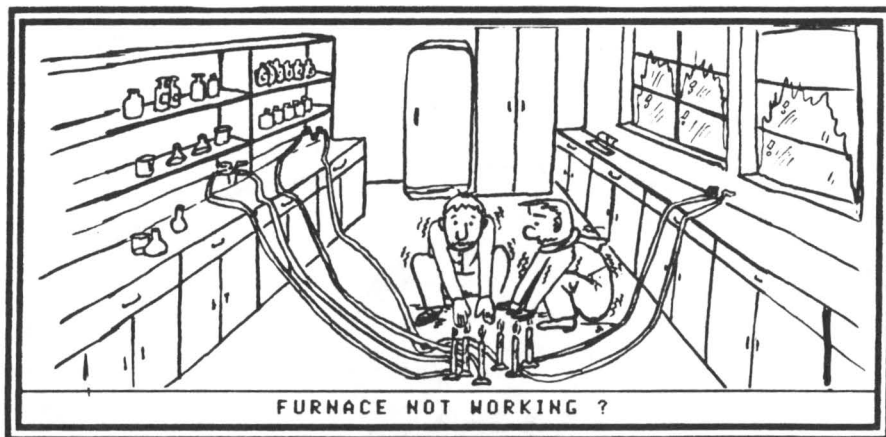
The **melting point bath** is used to raise the temperature slowly.

**MELTING POINT TUBE**

Place the sample in a **melting point tube**.

Place the **melting point tube** in the **melting point bath**.

By slowly heating the **melting point tube**, one can determine the melting point of the sample.

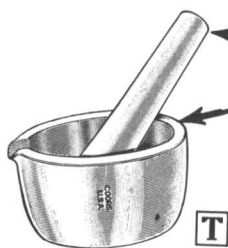


In the laboratory, **heating** can be accomplished with an **oven** or with a **hot plate**. The **incubator** can be used to maintain a constant growing temperature. Glassware may be heated with a **heating mantle** or with a **heating tape**. An **immersion heater** is used to heat liquid. Samples may be heated to a very high temperature by placing them in a **crucible** which is then placed in a **muffle furnace**. A **water bath** is used to maintain a temperature between room temperature and 100°C . Temperature may be measured with a **mercury thermometer**, a **dial thermometer**, or an **electronic thermometer**. Sterilization can be accomplished in a steam **autoclave** or in a hot water **instrument sterilizer**. Flames may be maintained in the laboratory with a gas **burner** or with an **alcohol lamp**. Gas flames may be ignited with a **gas lighter** or with a **safety match**. The melting point of a sample may be determined by using a **melting point tube** in a **melting point bath**.

Please handle with care



It is the only one we have !!!

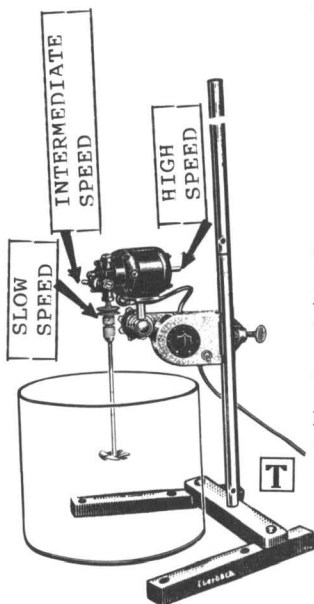


MORTAR AND PESTLE

Mortars and pestles are made of porcelain, glass or metal.

Grind the sample in the mortar and pestle.

Mortars and pestles are available in many sizes.

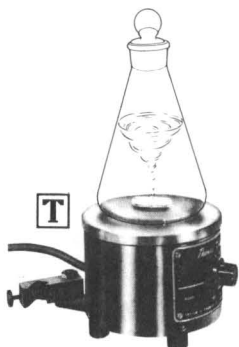


STIRRER

A stirrer may be air driven or electrically driven.

Stir the liquid with the stirrer.

Mix the powder into the liquid with a stirrer.

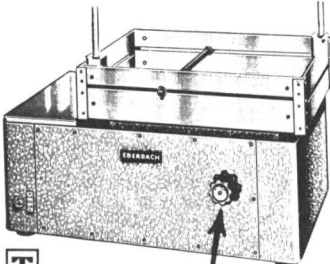


MAGNETIC STIRRER

A magnetic stirrer can be used in a closed vessel.

Some hot plates are equipped with a magnetic stirrer.

A rheostat controls the speed of the magnetic stirrer.

LARGE SIZE SHAKER

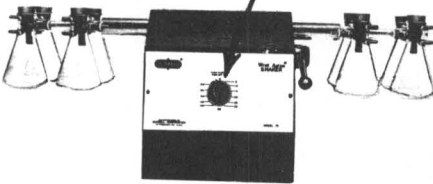
This **large size shaker** can shake large containers.

This **shaker** is of the reciprocating type.

Extract the component from the tissue by using the **large size shaker**.

T

SPEED CONTROL

**SHAKER**

This is a flask-type **shaker**.

The flask **shaker** gives a snap-wrist motion.

The flask **shaker** produces a swirling effect.

T

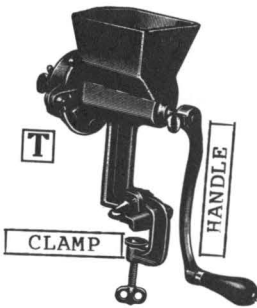
**BLENDER**

Mince the sample in the **blender**.

The **blender** can be used to homogenize the sample.

Blade speed of the **blender** can be as much as 21,000 r.p.m.

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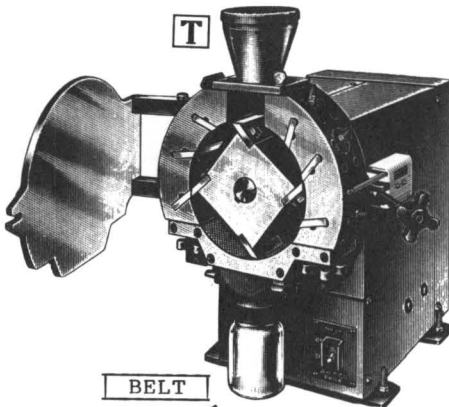


HAND GRINDER (Hand Mincer)

A **hand grinder (mincer)** can be used to grind (mince) dry or wet material.

Grinding plates can be changed on the **hand grinder (mincer)** to change the fineness of grind (mince).

A worm drive moves the sample through the **hand grinder (mincer)**.

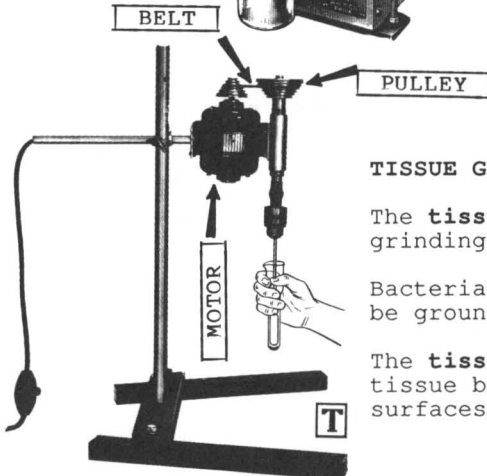


MILL

The **mill** is used for reduction in size of analytical samples.

The **mill** uses a shearing action.

Sieves prevent only small particles from passing through the **mill**.



TISSUE GRINDER

The **tissue grinder** turns a grinding pestle.

Bacterial cells and soft tissue can be ground in a **tissue grinder**.

The **tissue grinder** breaks up tissue between ground glass surfaces.

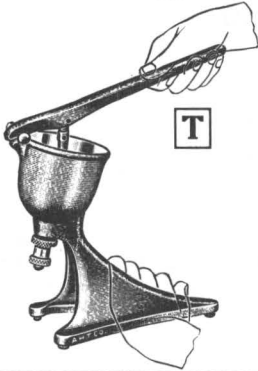


HOMOGENIZER

The sample can be emulsified by using the **homogenizer**.

Disintegration of biological cells can be accomplished by a **homogenizer**.

The **homogenizer** works on a shearing principle.

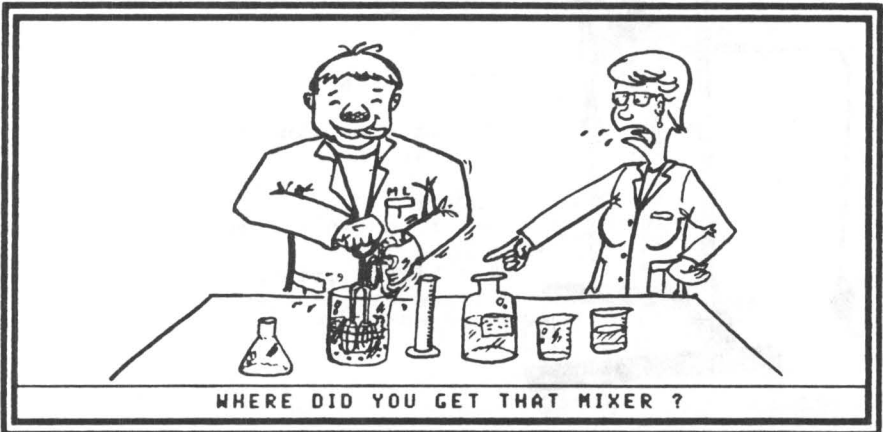


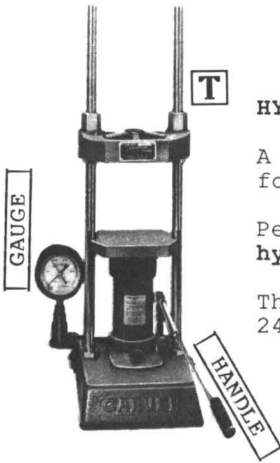
EMULSION HOMOGENIZER

The **emulsion homogenizer** produces a dispersion from immiscible liquids.

High pressure is produced at the orifice of the **emulsion homogenizer**.

The **emulsion homogenizer** is useful for small quantities.

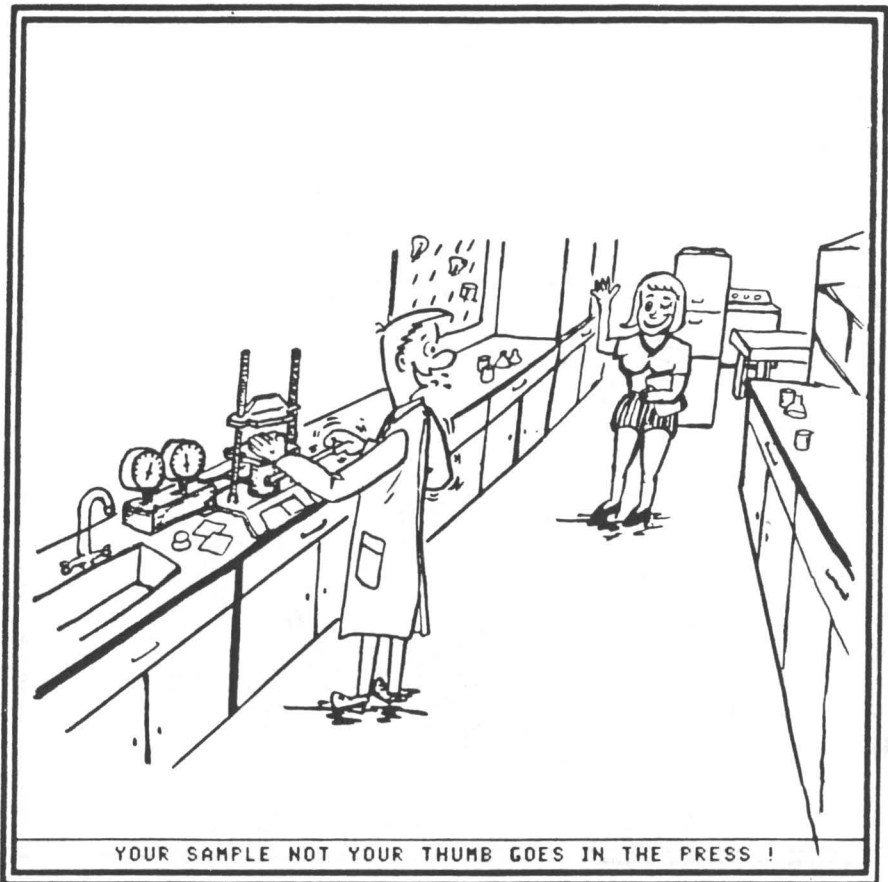


**HYDRAULIC PRESS**

A **hydraulic press** can be used for separating liquid from solid.

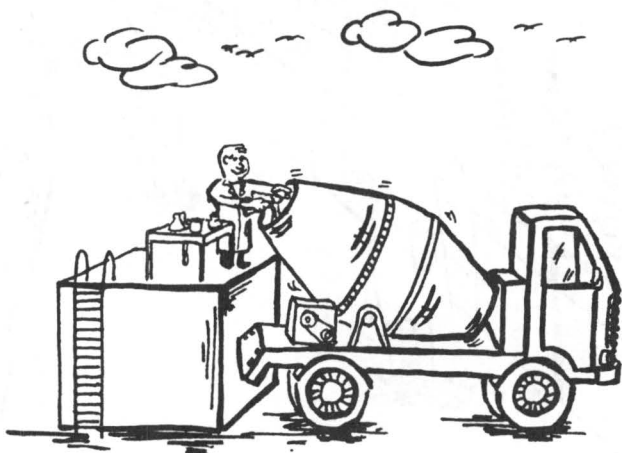
Pellets can be made with a **hydraulic press**.

This **hydraulic press** develops 24,000 p.s.i.

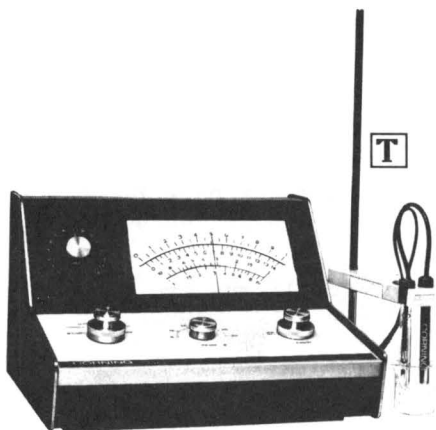


YOUR SAMPLE NOT YOUR THUMB GOES IN THE PRESS !

Mixing and pressing equipment is very useful in the laboratory. The simplest grinding and mixing equipment is a mortar and pestle. Stirrers may be of the propeller type or may be magnetic in style. Shakers may be reciprocating or have a wrist type motion. Blenders can also be used for grinding and mixing. Hand grinders (mincers), mills and tissue grinders are all used to break up a sample. Homogenizers may use a shearing principle or pressure through an orifice to produce a dispersion. Powder may be formed into a pellet with a hydraulic press.



I'LL GET A GOOD MIX OF MY CHEMICALS THIS TIME.



pH METER

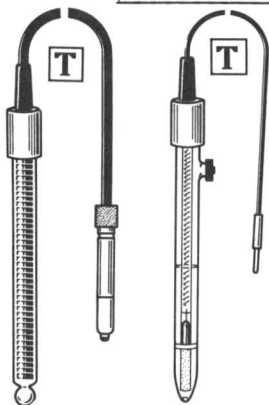
The hydrogen ion concentration is measured with a **pH meter**.

T

Use the **pH meter** to see if the sample is acid.

The pH of the sample is determined with a **pH meter**.

REFERENCE ELECTRODE



Two **electrodes** are attached to the **pH meter**.

A combination **electrode** contains both a glass and a reference electrode in one case.

Keep the **electrodes** clean for accurate pH measurement.

GLASS

pH BUFFER SOLUTION

Use a **pH buffer solution** to standardize the **pH meter**.

Buffer solutions are available in many pH values.



T

Standardize the **pH meter** with a **buffer solution** that has a pH near the pH of the sample to be measured.



T

TEST PAPER OR "LITMUS" PAPER OR UNIVERSAL INDICATOR PAPER

Test paper (or litmus or universal indicator paper) can measure pH by a color change.

Check the pH of the sample with the test paper (or litmus or universal indicator paper).

The pH meter can more accurately determine sample pH than you can with the test paper (or litmus or universal indicator paper).



T

VOLT-OHM-AMMETER (AVO-meter)

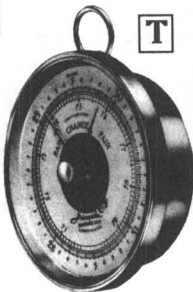
This volt-ohm-ammeter (AVO-meter) can measure voltage, resistance and amperes.

Both a.c. and d.c. voltages can be measured on the volt-ohm-ammeter (AVO-meter).

There are 6 ranges to measure resistance on the volt-ohm-ammeter (AVO-meter).



T



T

BAROMETER

Atmospheric pressure is measured with a barometer.

The barometer on the left is filled with mercury.

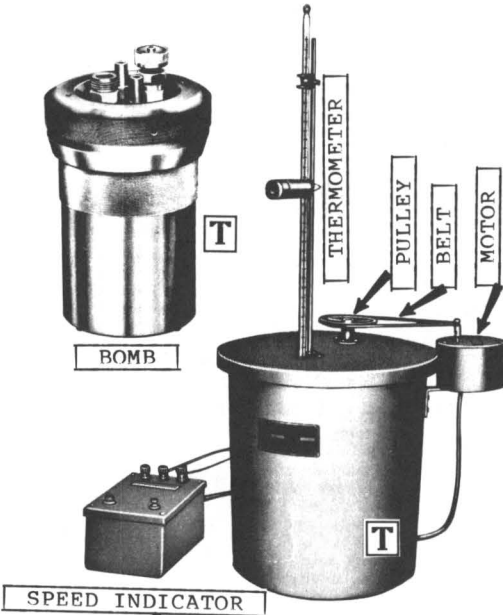
The barometer on the right is actuated by an airtight metal diaphragm.

BOMB CALORIMETER

The **bomb calorimeter** is used to determine the heat of combustion.

Determine the calories in a sample by burning it in a **bomb calorimeter**.

Place the sample and oxygen in the **bomb** and place the **bomb** in the **calorimeter**.



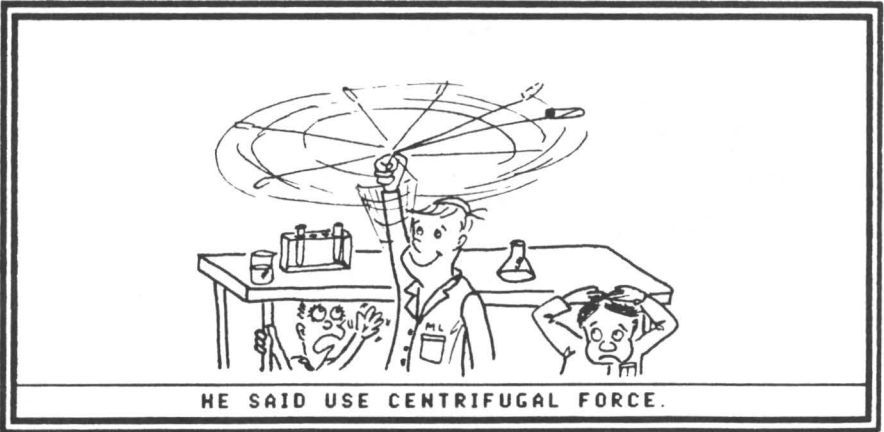
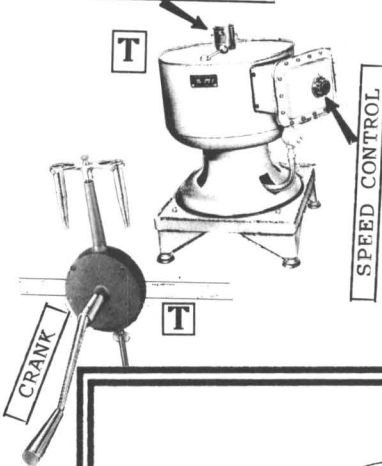
CENTRIFUGE

Spin the sample in the **centrifuge**.

The upper **centrifuge** is motor driven and the lower one is hand-cranked.

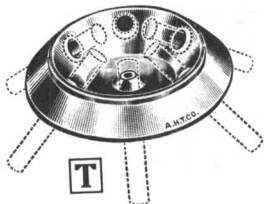
Separate the precipitate by placing the sample in the **centrifuge**.

Some **centrifuges** are refrigerated.



HE SAID USE CENTRIFUGAL FORCE.

CENTRIFUGE HEAD (Rotor)



Place the sample tube in the centrifuge head (rotor).

Different centrifuge heads (rotors) can be placed on the centrifuge.

Different size sample containers may be placed in different centrifuge heads (rotors).

CENTRIFUGE TUBE

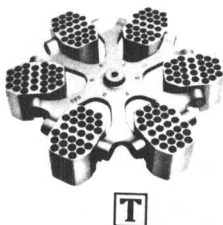


Place the centrifuge tube in the centrifuge head (rotor).

Place centrifuge tubes on opposite sides of the centrifuge head (rotor) to balance the weight during spinning.

Centrifuge tubes may be either glass, plastic or metal.

CARRIERS



Carriers fit on centrifuge heads (rotors) and hold sample containers.

With this head and carriers, the centrifuge will hold 168 small tubes.

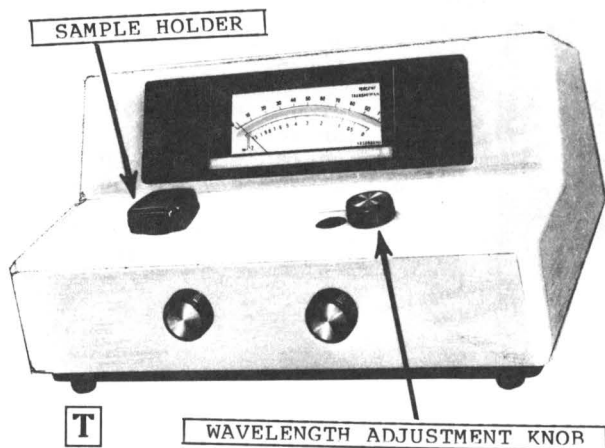
Other carriers will fit this head enabling it to hold 6 large centrifuge bottles.

SPECTROPHOTOMETER

Measure the optical density of the sample with the spectrophotometer.

Set the desired wavelength on the spectrophotometer prior to measuring the sample.

Concentration of samples will influence the spectrophotometer reading.



SPECTRO CELL

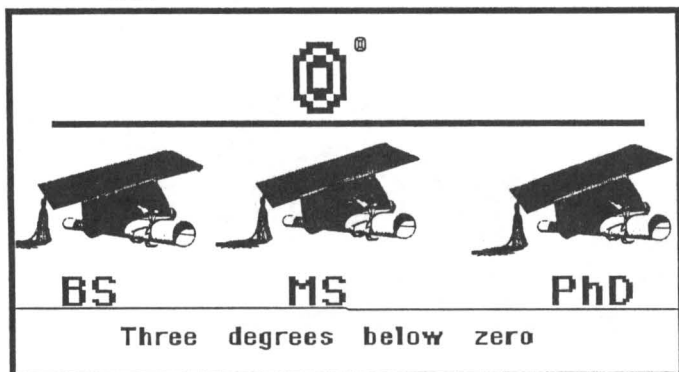
Spectro cells may be round, square or rectangular.

Do not scratch the spectro cells.

Use matched spectro cells for the blank and the sample.



T





FLUOROMETER (Fluorimeter)

The **Fluorometer (fluorimeter)** is used for quantitation of trace materials.

The **fluorometer (fluorimeter)** has controllable emission and excitation wavelengths.

Measure the vitamin content with the **fluorometer (fluorimeter)**.

T



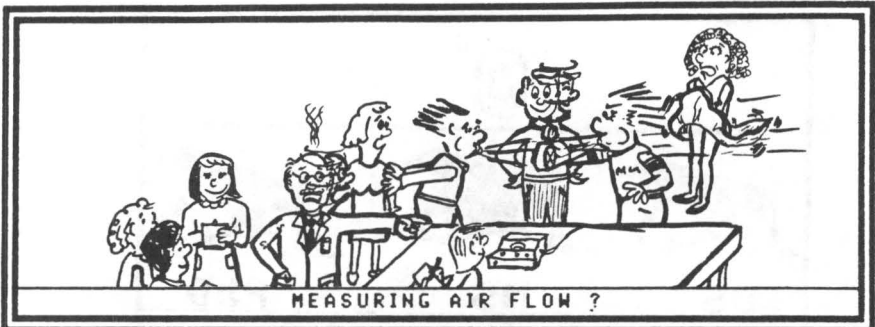
FLOWMETER

A **flowmeter** can measure rate of flow of a gas or of a liquid.

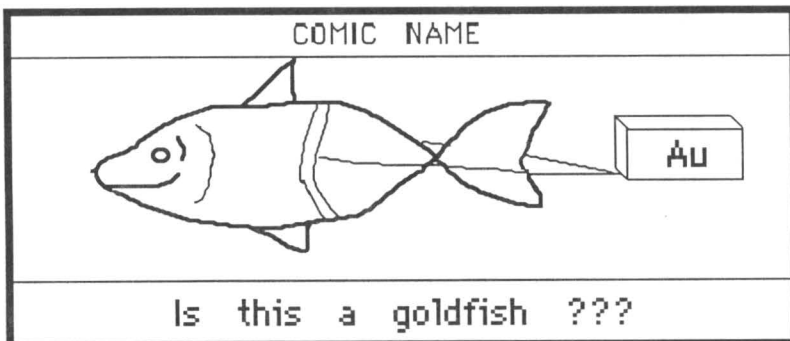
T

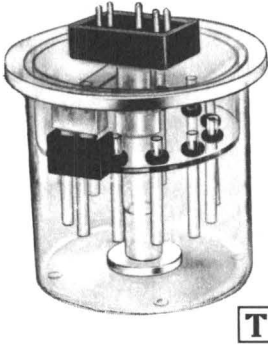
The height of the float in the **flowmeter** indicates flow rate.

Flowmeters are available in a variety of flow rate ranges.



The laboratory is equipped with many instruments for measuring and the **pH meter** with its glass and reference **electrodes** is an example. The **pH meter** should be standardized with **buffer solutions**. The hydrogen ion concentration can also be approximated with **pH test paper** (**litmus or universal indicator paper**). Many electrical measurements can be made with **volt-ohm-ammeter** (**AVO-meter**). A **barometer** is used to measure barometric pressure. Calories can be measured with a **bomb calorimeter**. A **centrifuge** is used to separate materials based on their density and is necessary in many gravimetric analyses. **Centrifuge heads (rotors), carriers and tubes** are interchangeable, giving the **centrifuge** a great deal of flexibility. A **spectrophometer** is a very useful laboratory measuring device, and many types of **spectro cells** can be used. A **fluorometer (fluorimeter)** is often useful in determining concentrations. A **flowmeter** can measure flow rate of a gas or of a liquid.

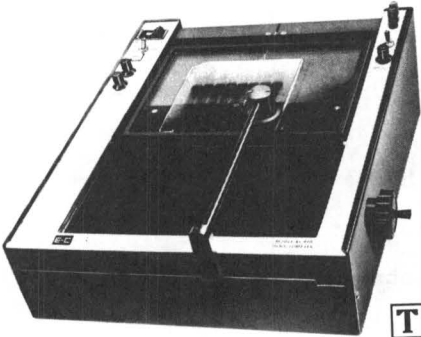


**GEL COLUMN ELECTROPHORESIS**

Use the **gel column electrophoresis** to separate the protein mixture.

Connect the electrical power supply to the **gel column electrophoresis** cell.

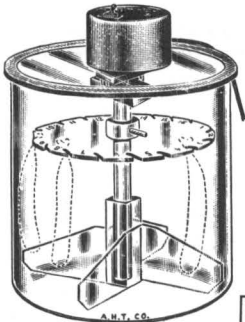
Add the appropriate buffers to the **gel column electrophoresis** cell.

T**SCANNING DENSITOMETER**

Use the **scanning densitometer** to measure the absorbance of the gel column.

Quantitative evaluation of the electrophoretic patterns is possible with a **scanning densitometer**.

Adjust the **scanning** wavelength on the **densitometer**.

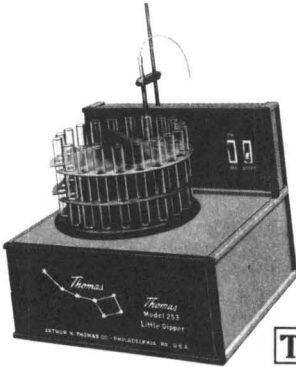
T**DIALYZER**

Use the **dialyzer** for concentration or purification of biological solutions.

Place the tubing containing the sample in the **dialyzer**.

This **dialyzer** rotates the sacs in the bath to stir both the bath and sac contents.

T

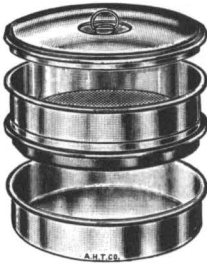


AUTOMATIC SAMPLER

The **automatic sampler** allows for unattended transfer of serial samples.

The electrode can be automatically lowered into serialized samples for measurement with an **automatic sampler**.

T Some **automatic samplers** can be used to fill tubes.



SIEVE

A **sieve** separates samples by particle size.

Size of opening in a **sieve** is often designated as "mesh size".

T **Sieve** size is sometimes specified by National organizations.

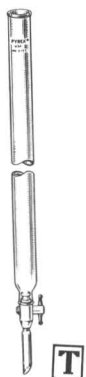
SEPARATORY FUNNEL (Separating Funnel)



A **separatory (separating) funnel** is used to separate immiscible liquids into separate phases (or layers).

Drain the lower liquid (phase) from the **separatory (separating) funnel**.

T Hold the stopper and stopcock when shaking the **separatory (separating) funnel**.



CHROMATOGRAPHY COLUMN

Separate the sample with a **chromatography column**.

Fill the **chromatography column** with solvent and packing material and then add the sample to the top of the column and run more solvent through it.

Collect the effluent as it comes from the **chromatography column**.

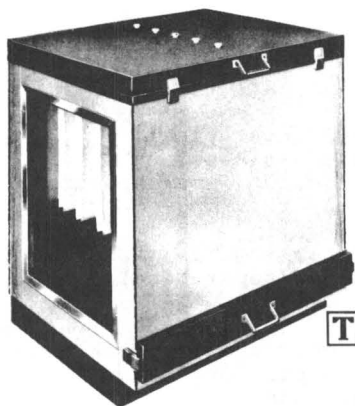


THIN LAYER CHROMATOGRAPHY (TLC)

Thin layer chromatography is usually accomplished on glass plates.

Separate the sample on the **thin layer chromatography plate**.

What solvent should I use for separation of the sample on the **thin layer chromatography plate**?

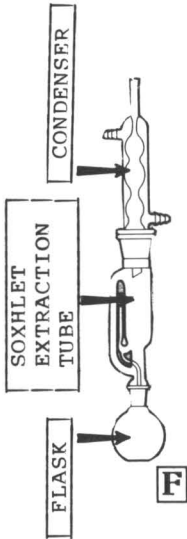


CHROMATOGRAPHY CABINET

Place the filter paper in the **chromatography cabinet**.

Separate the samples by placing them in the **chromatography cabinet**.

The **chromatography cabinet** is solvent tight.

**SOXHLET EXTRACTOR**

Extract the fat from the sample with a **Soxhlet extractor**.

Place the **Soxhlet extractor** on a hot plate.

Pass cold water through the condenser.

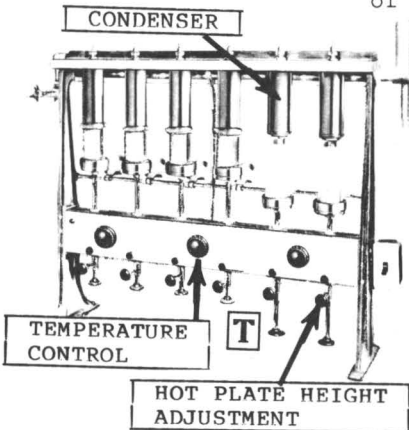
Ether is the solvent most often used in a **Soxhlet extractor**.

EXTRACTION THIMBLE

Place the sample in the **extraction thimble**.

The **extraction thimble** is placed in the extraction tube of the **Soxhlet extractor**.

This **extraction thimble** is made of cellulose.

**GOLDFISCH EXTRACTOR**

Determine the fat in the food sample on the **Goldfish extractor**.

The **Goldfish extractor** normally requires less time than the **Soxhlet extractor**.

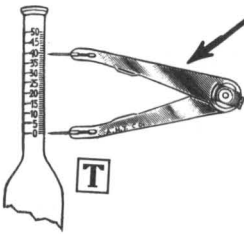
Slide the heater up under the beaker on the **Goldfish extractor**.

BABCOCK BOTTLE**T**

Measure the fat content of the sample with the **Babcock bottle**.

Different styles of **Babcock bottles** are used for different types of samples.

Fat content of dairy products is often measured with **Babcock bottles**.

**DIVIDER**

Measure the fat column with the **divider**.

A **divider** measures linear distance.

Place the points of the **divider** at the top and bottom of the fat column.

**BABCOCK CENTRIFUGE**

Place the **Babcock bottle** in the **centrifuge**.

By using the **Babcock centrifuge**, one obtains better fat separation.

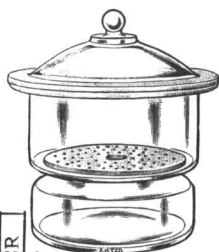
This **Babcock centrifuge** is temperature controlled.

**T****ALUMINUM FOIL DISH (Aluminium Foil Dish)**

A disposable **aluminum (aluminium) foil dish** can be used for drying samples.

Place the **aluminum (aluminium) foil dish** in the drying oven.

Dry the **aluminum (aluminium) foil dish** prior to use.

**T****DESICCATOR**

Allow the **aluminum foil dish** to cool in the **desiccator**.

Some **desiccators** are equipped with a vacuum top.

Place the drying agent in the bottom of the **desiccator**.

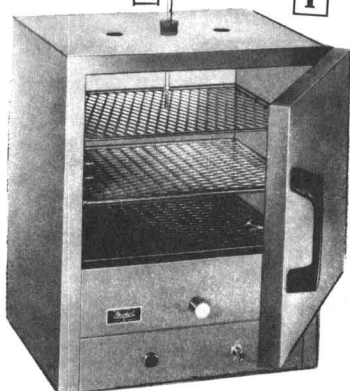
THERMOMETER

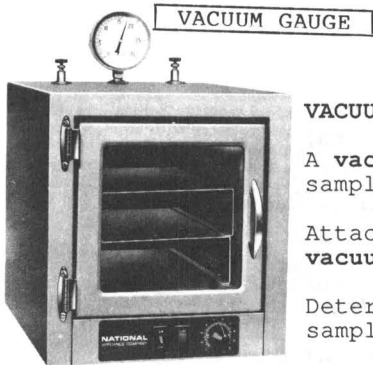
T**DRYING OVEN**

Determine the moisture content of the sample by placing it in the **drying oven**.

Regulate the **drying oven** temperature at 100 degrees centigrade.

Be sure all flammable volatile chemicals have evaporated from the sample prior to placing it in the **drying oven**.





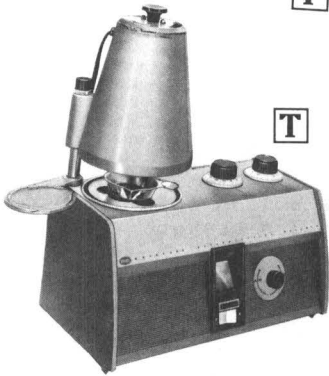
VACUUM OVEN

A **vacuum oven** can accelerate sample drying.

Attach a vacuum pump to the **vacuum oven**.

Determine the moisture level of the sample by using the **vacuum oven**.

T



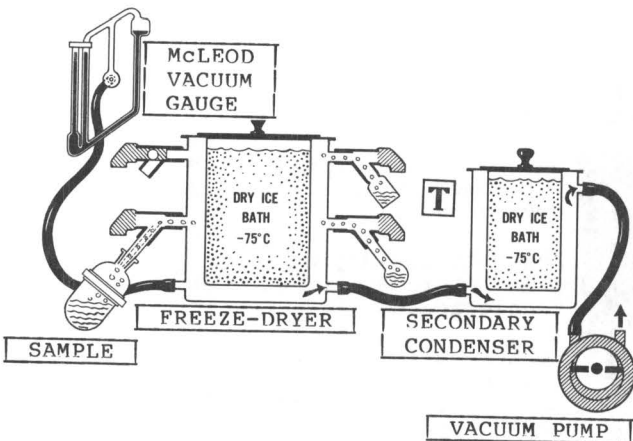
MOISTURE BALANCE

Determine sample moisture on the **moisture balance**.

This **moisture balance** has infrared heating.

Adjust the timer on the **moisture balance**.

T



FREEZE DRYING

Freeze drying is a method of removing water from solid samples.

Moisture level can be determined by **freeze drying**.

Freeze drying is a method of preservation.

Freeze drying of microorganisms is useful when storage is desirable.

T

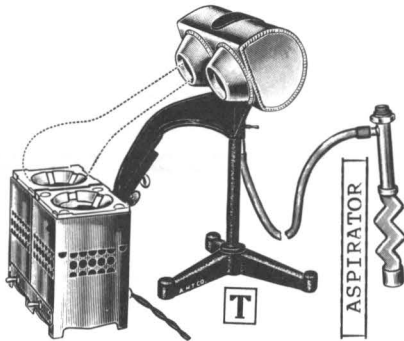


KJELDAHL FLASK

To determine protein, place the sample in the **Kjeldahl flask**.

Kjeldahl flasks are available in several sizes.

Add acid to the **Kjeldahl flask**.

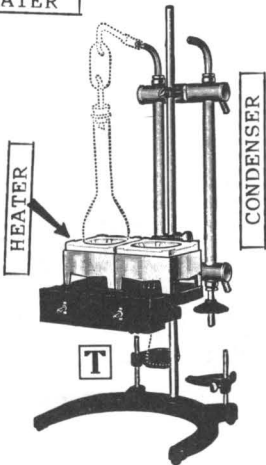


KJELDAHL DIGESTION UNIT

Place the **Kjeldahl flask** on the **Kjeldahl digestion unit**.

The **Kjeldahl digestion unit** heats the flask with gas or with an electric hot plate.

Fumes from the **Kjeldahl digestion unit** must be vented through a hood or down the drain.



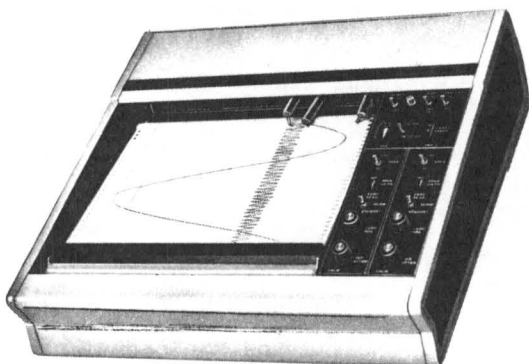
KJELDAHL DISTILLING UNIT

After digestion, place the flask on the **Kjeldahl distilling unit**.

Pass cold water through the condenser of the **Kjeldahl distilling unit**.

Heat the **Kjeldahl flask** on the **Kjeldahl distilling unit**.

RECORDER



The **recorder** can be attached to many types of measurement equipment.

A **recorder** attached to the appropriate measurement equipment can be used to determine concentration in a sample.

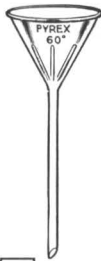
Speed of the **recorder** and deflection sensitivity can be adjusted.

T



I RECORDED U.S.A. ???

Separation equipment performs an important function in the laboratory. **Gel column electrophoresis** separates samples by electrical charges and quantitative information can be obtained by placing the columns on a **scanning densitometer**. The **dialyzer** and **sieve** separate samples by size. The **automatic sampler** is very useful in automating many of the separation instruments. Partitioning of a sample between two liquids can be accomplished by using a **separatory (separating) funnel**. Many types of **chromatography** such as **column, thin layer, paper** or **gas**, can separate a complex sample into components. Fat can be separated by placing a sample in an **extraction thimble** and solvent-extracting the sample in a **Soxhlet extractor** or a **Goldfish extractor**. Fat can also be determined by placing the sample in a **Babcock bottle**; and, after digestion--placing the bottle in a **Babcock centrifuge**. The percentage of fat is determined with the aid of a **divider**. Sample moisture can be determined by placing the sample in an **aluminum (aluminium) foil dish** and placing this in a **drying oven** or in a **vacuum oven**. After drying, the sample is cooled in a **desiccator**. Moisture can also be determined with a heat lamp and a **moisture balance** or by **freeze drying** the sample. For protein determination, place the sample in the **Kjeldahl flask** and place the flask on the **digestion unit**. After digestion, distill the nitrogen on the **distilling unit**. Protein is then determined by titration. A **recorder** is useful in quantifying the results from many of the separation instruments.



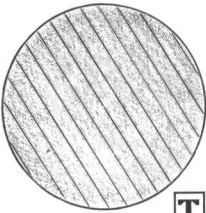
T

FUNNEL

Funnels are available in glass, plastic, porcelain, and metal.

Stem length, angle and diameter of body vary in different **funnels**.

Filter the sample through the **funnel**.



T

FILTER PAPER

Filter paper may be flat or folded.

Number of the **filter paper** indicates filtering speed.

Place the **filter paper** in the **funnel**.



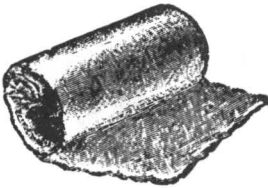
T

GLASS WOOL

Glass wool can be used for a filtering material.

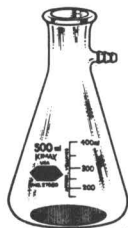
Fiber diameter of **glass wool** is normally between 0.005 to 0.008 mm.

Filter the sample through **glass wool**.



T

FILTERING FLASK (Filter Flask)



T

Attach a vacuum hose to the side arm of the **filtering (filter) flask**.

Vacuum filtering can be accomplished with the aid of a **filter flask**.

The filtering rate can be accelerated by using a vacuum and a **filtering (filter) flask**.

BUCHNER FILTER FUNNEL



T

Place the **Buchner filter funnel** on a **filter flask**.

The **Buchner filter funnel** is used for vacuum filtering.

Buchner filter funnels are usually made of porcelain but sometimes plastic is used.



T

CRUCIBLE

Crucibles are made of porcelain, glass, nickel or iron.



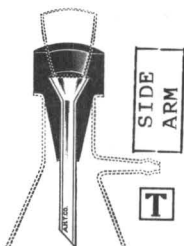
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T

Some **crucibles** have small holes in the bottom and others have fritted glass bottoms.

Filter the sample through the **crucible**.

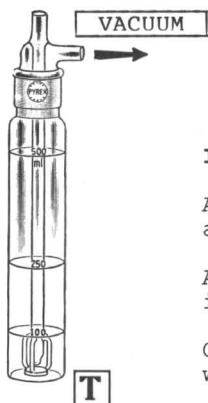


CRUCIBLE HOLDER

Place the **crucible** in the **crucible holder**.

Crucible holders can be placed on a **filter flask** or on a **standard funnel**.

Most **crucible holders** are made of **rubber**.

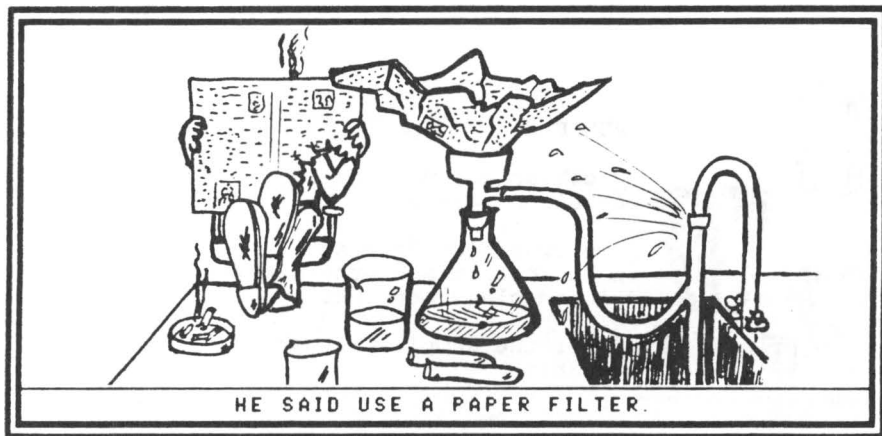


IMPINGER

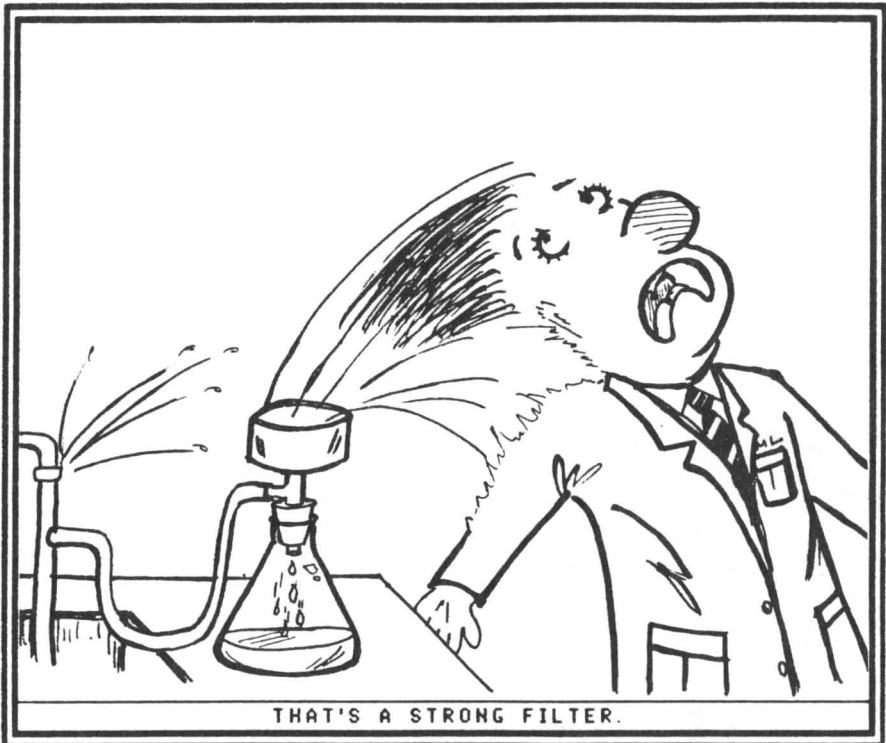
A dust sample collector is called an **impinger**.

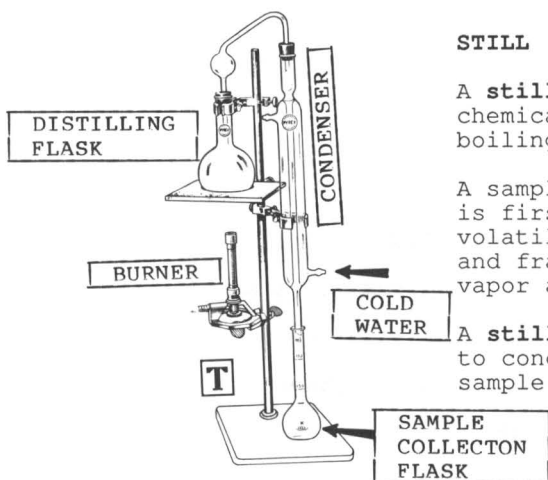
An **impinger** collects particles in the liquid-filled receiver.

Collect dust samples from the air with an **impinger**.



Filtering separates solids from liquids. A **funnel** is used with **filter paper** or **glass wool**. To accelerate filtering, a vacuum is often used with a **filtering (filter) flask** and a **Buchner filter funnel**. A **crucible** and a **crucible holder** can also be used. To collect dust from air, an **impinger** is used.

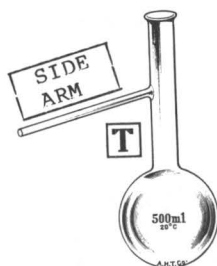


**STILL**

A **still** separates chemicals based on their boiling points.

A sample in a **still** is first changed to a volatile state by heating and fractions of the vapor are then condensed.

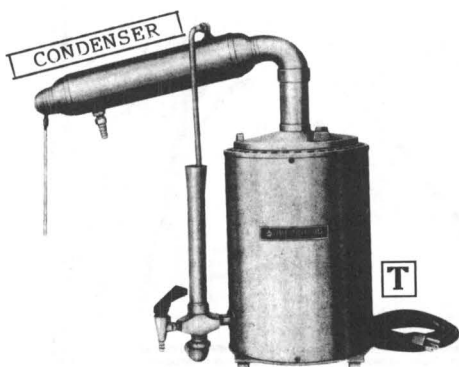
A **still** can be used to concentrate the sample.

**DISTILLING FLASK (Distillation Flask)**

The sample is boiled in the **distilling (distillation) flask**.

Place a thermometer in the top of the **distilling (distillation) flask**.

The **distilling (distillation) flask** has a side arm.

**WATER STILL**

A **water still** is used to produce **distilled water**.

A **water still** removes water from the minerals in tap water.

A **water still** may be electrical, gas or steam heated.



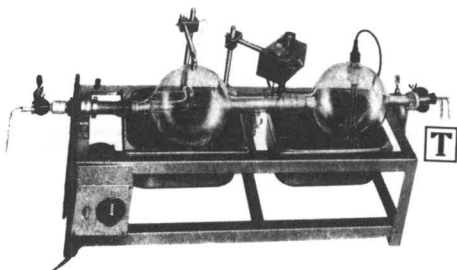
DEMINERALIZER

A **demineralizer** can also remove minerals from water.

Demineralized water is often used in place of **distilled water**.

Most **demineralizers** use a resin type bed.

T



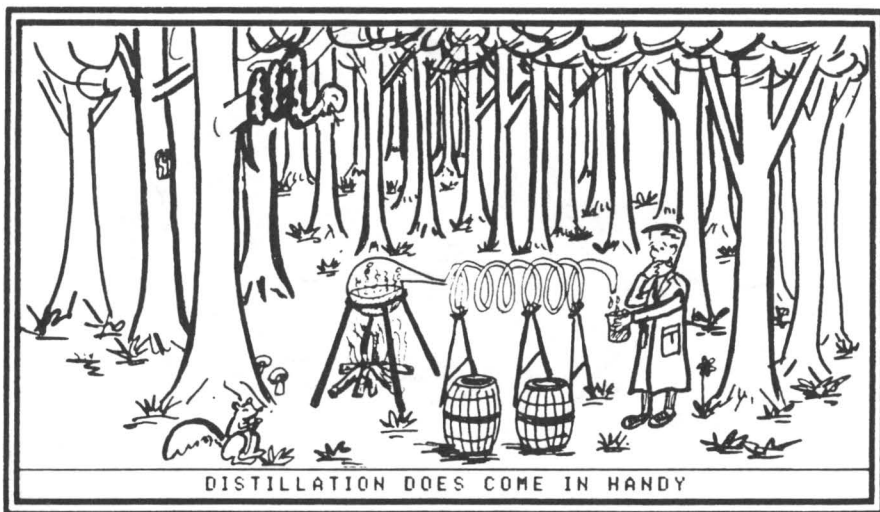
FLASH EVAPORATOR

A **flash evaporator** works like a still.

Remove the solvent with a **flash evaporator**.

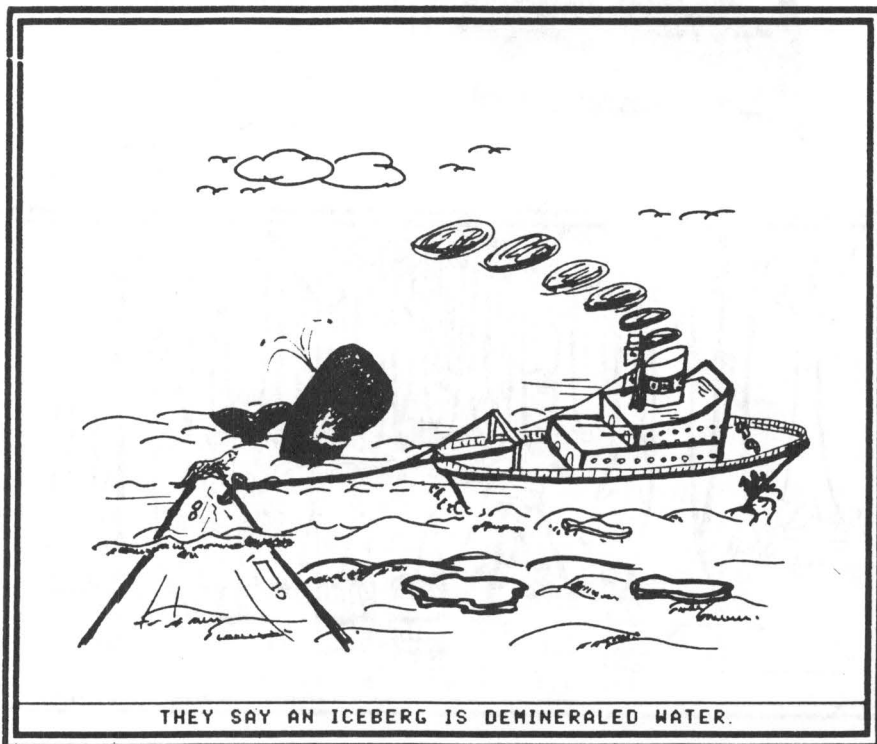
The **flash evaporator** contains an evaporating bath and a condensing bath.

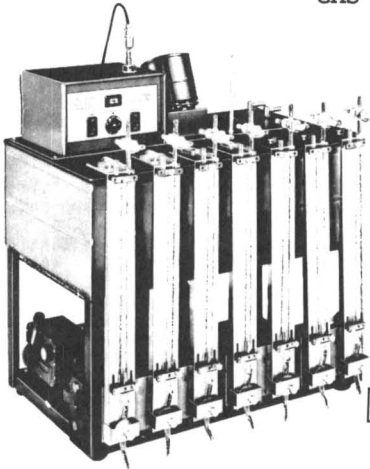
T



DISTILLATION DOES COME IN HANDY

A **distillation unit** or **still** will separate chemicals with different boiling points. The major components of a **still** are a heat source, a **distilling (distillation) flask** and a condenser. **Water stills** are frequently found in a laboratory to produce **distilled water** and **demineralized water** is produced by passing the water through a resin-type bed which traps the minerals. A **flash evaporator** uses the distillation principle to remove a solvent from the sample.



**RESPIROMETER**

Gas exchange studies can be performed on a **respirometer**.

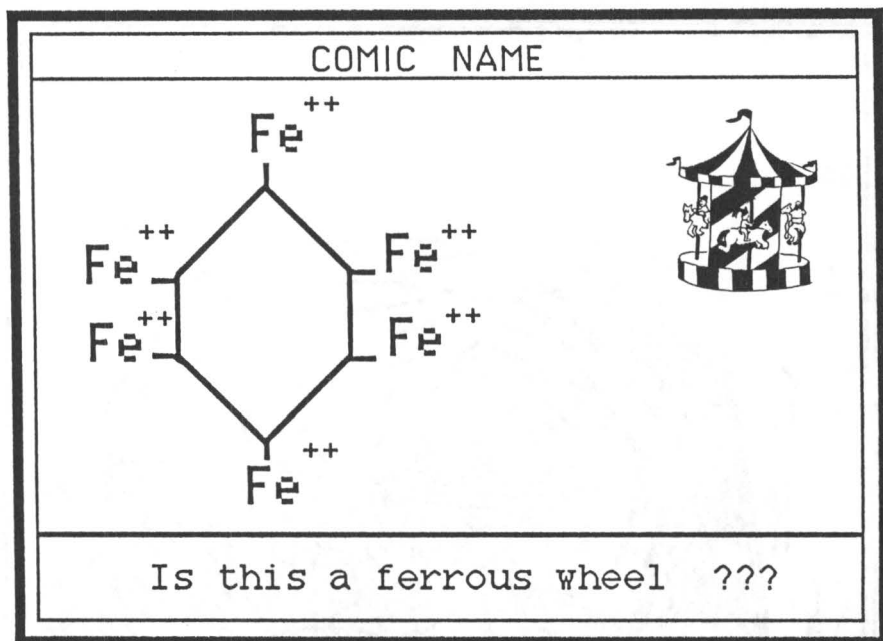
A **respirometer** is often called a Warburg unit.

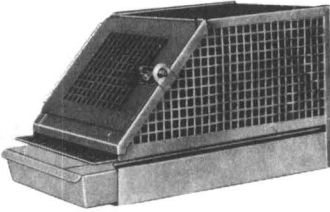
Attach the manometer to the **respirometer**.

T

THE CANARY CAN ALSO MEASURE GAS.

A **respirometer** permits precise measurements of gas evolved or absorbed in cell respiration.





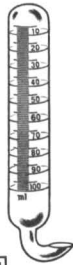
T

ANIMAL CAGE

Place the mouse in the **animal cage**.

Some **animal cages** are made of metal and others are made of plastic.

Be sure the **animal cage** is of the appropriate size for the animal.



T

DRINKING TUBE

Attach the **drinking tube** to the **animal cage**.

Keep the **drinking tube** filled with clean water.

This **drinking tube** is graduated.



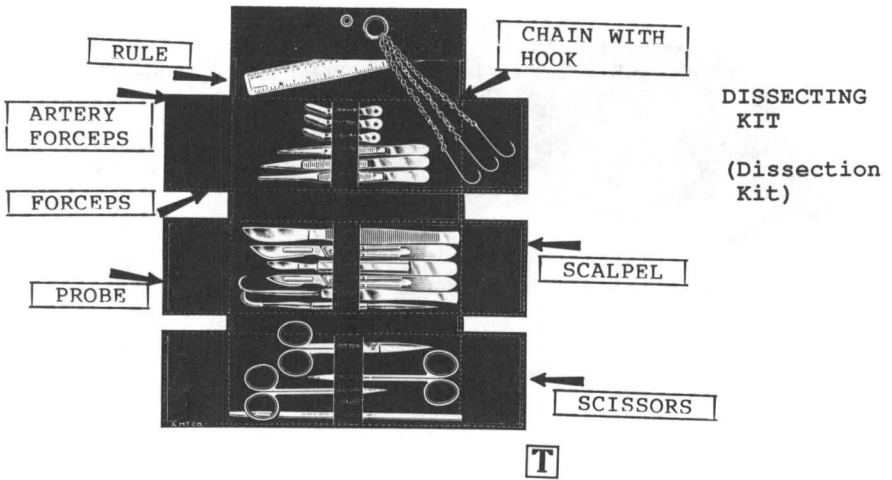
T

FEEDING DISH

Place the animal food in the **feeding dish**.

Clean the **feeding dish** frequently.

The food level in the **feeding dish** should be checked daily.



This **dissecting kit** contains a **rule**, **forceps**, **artery forceps**, **probe**, **scissors**, **scalpels** and a **chain with hooks**.

Use the **dissecting kit** to separate the tissue.

Get the **scalpel** from the **dissecting kit**.



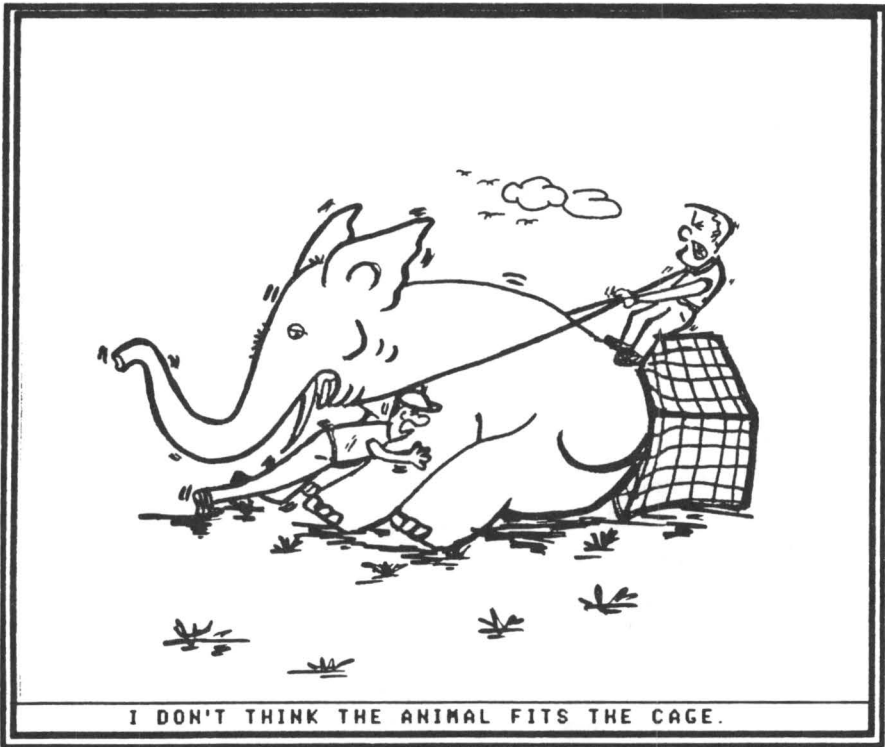
ANIMAL OPERATING TABLE

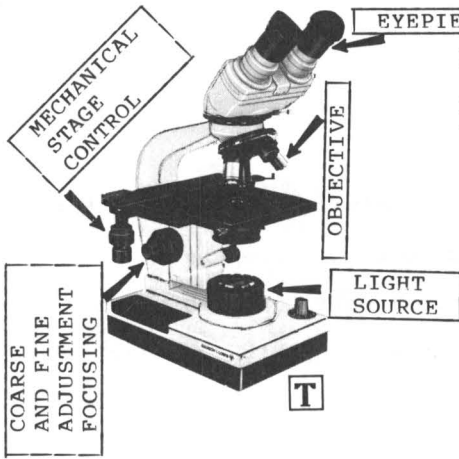
A small **animal operating table** without legs is called an **animal board**.

Perform the surgery on the anesthetised animal after placing it on the **operating table**.

Sanitize the **animal operating table** before the operation.

Place the rabbit in the **animal cage** and fill the **drinking tube** and the **feeding dish**. Prepare for surgery by cleaning the **animal operating table** and checking the **dissecting (dissection) kit**. Be sure that there are sufficient **forceps** and **probes** and that the **scissors** and **scalpels** are sharp.





MICROSCOPE

Examine the slide under the **microscope**.

Check the sample with the oil immersion objective on the **microscope**.

Focus the **microscope** carefully.



SLIDE

Place the microorganisms on the **slide**.

Identify the **slide** on the marking surface.

View the **slide** on the **microscope**.

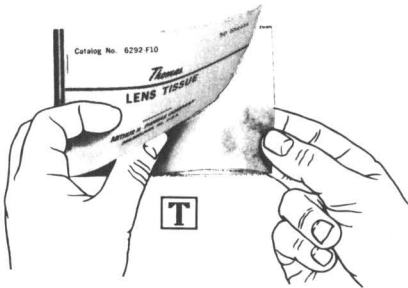


MAGNIFIER

A **magnifier** will change the size 2 to 5 times.

Focus the **magnifier** by moving it in relation to the object being viewed.

Count the bacterial colonies with the **magnifier**.

**LENS TISSUE**

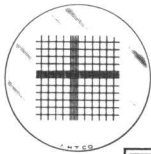
Use only **lens tissue** to clean optical lens.

Clean the objective on the microscope with the **lens tissue**.

A **lens tissue** is soft, free from impurities and does not easily collect dust.

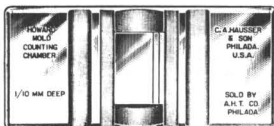
**MICROMETER**

A **micrometer** is used when a measurement with a microscope is needed.



Some **micrometers** are placed on the stage (upper picture) and some are placed in the eyepiece (lower picture).

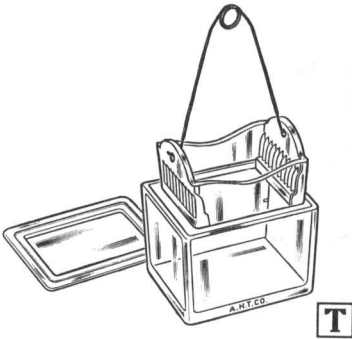
Measure the mold filament length with the **micrometer**.

**COUNTING CHAMBER**

Place the blood in the **counting chamber** to count the cells.

Count the bacteria with the aid of the **counting chamber**.

Check the food for mold mycelia with the **counting chamber**.

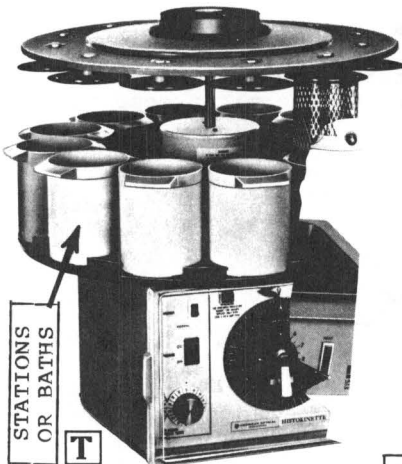
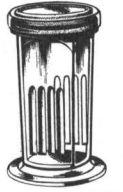


STAINING DISH OR JAR

Stain the tissue on the slides in the **staining dish or jar**.

The **staining dish (or jar)** may be used to aid in identifying the bacteria.

A **staining dish** may be used for staining, differentiation, dehydration and clearing of embedded sections.

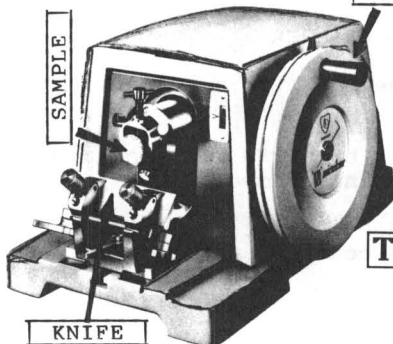


TISSUE PROCESSING UNIT

The **tissue processing unit** is used for automatically fixing, dehydrating, and infiltrating tissue specimens.

The **tissue processing unit** may be programmed through 12 stations.

A paraffin bath is also located in this **tissue processing unit**.



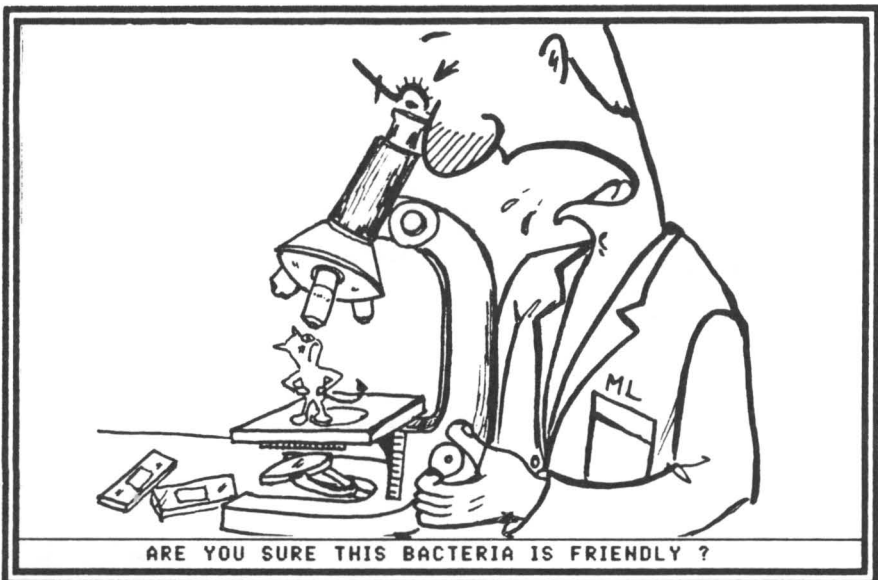
MICROTOME

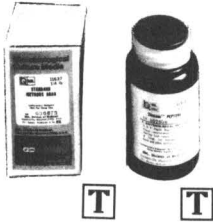
Use the **microtome** to thinly slice the tissue.

The object clamp moves up and down on the **microtome**.

Cutting angle of the knife is adjustable on the **microtome**.

Microscopic examination is often useful in the laboratory. A **microscope** is used when large magnifications are needed and a **magnifier** is used for small magnification. Biological tissues or microorganisms are often mounted on a **slide** for viewing. Optical lens are cleaned with the aid of **lens tissues**. A **micrometer** is used to measure small distances and a **counting chamber** is used to count small objects. Biological tissues or microorganisms are stained in a **staining dish** or **jar** or in a **tissue processing unit**. This tissue is sliced on a **microtome** prior to viewing.

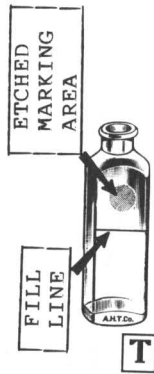


CULTURE MEDIA

Microbiology **culture media** are usually dehydrated.

Some **culture media** are selective and will only permit growth of certain types of microorganisms.

If the **culture media** contain agar, they will gel when cooled.

**DILUTION BOTTLE**

Dilute the microorganisms with the aid of a **dilution bottle**.

The **dilution bottle** usually has a capacity of 160 ml.

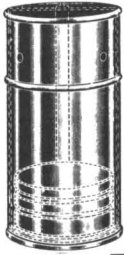
A rubber stopper with an elongated bottom is used to cap the **dilution bottle**.

PETRI DISH

Petri dishes are usually plastic or glass.

Grow the microorganisms in the **petri dish**.

Pour the culture media into the **petri dish**.



T



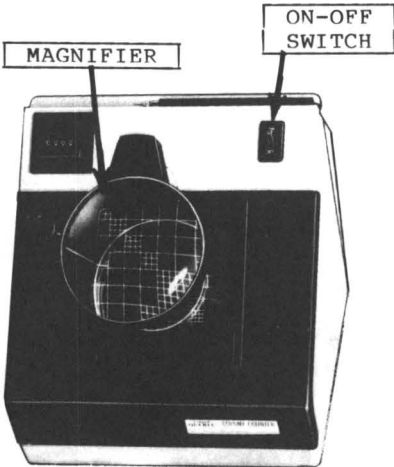
T

PETRI DISH STERILIZING BOX

Place the **petri dish** in the rack and then put the rack in the **sterilizing box**.

Place the **sterilizing box** in the autoclave.

Most **sterilizing boxes** will hold 12 to 15 petri dishes.



MAGNIFIER

ON-OFF SWITCH

T

QUEBEC COLONY COUNTER

Place the **petri dish** on the **Quebec colony counter**.

The **Quebec colony counter** is used to count bacteria colonies on a **petri dish**.

The **Quebec colony counter** illuminates and magnifies the **petri dish**.

COUNTER



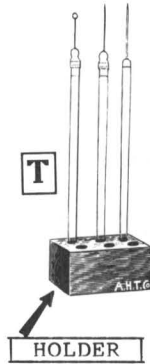
T

ZERO RESET KNOB

Use the **counter** to tally the number of microorganisms.

This is a hand **counter** and there are also table models.

The **counters** contain a zero reset knob.



INOCULATING NEEDLE OR LOOP

Use the **inoculating needle** or **loop** to transfer the microorganisms.

Sterilize the **inoculating needle** (or **loop**) in a flame.

The **inoculating loop** will transfer a specific volume of liquid.

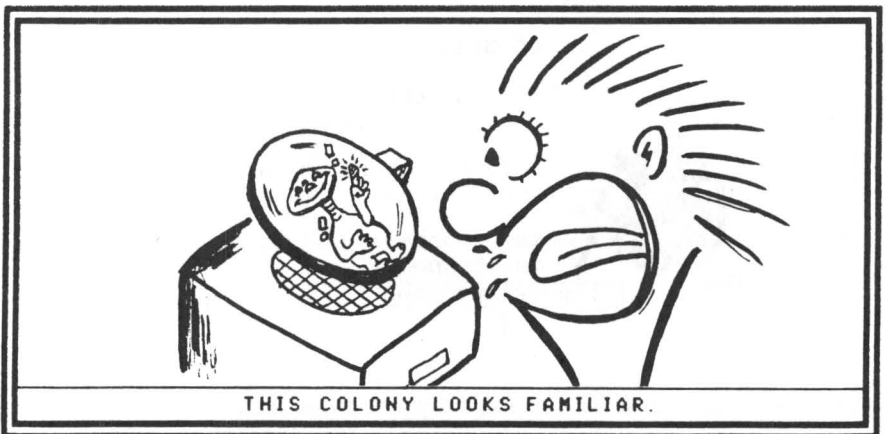


CULTURE TUBE

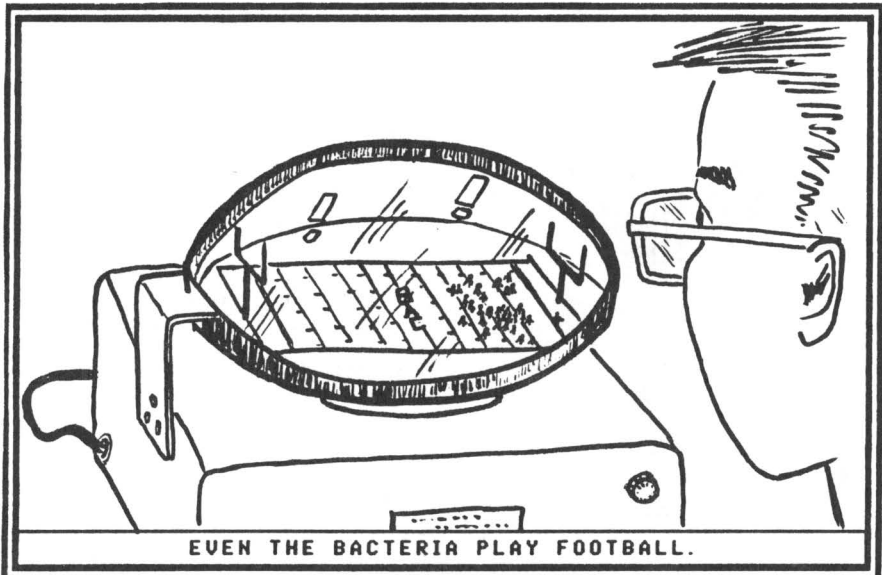
Grow the microorganism in a **culture tube**.

This **culture tube** has a screw cap.

Transfer the microorganisms to the **culture tube** with an **inoculating needle**.



The **microbiology** area is often used in evaluating biological spoilage and disease-producing agents. Microorganisms are diluted with the aid of **dilution bottles** and placed in a **petri dish**. Then, **culture media** is added to the **petri dish**. Prior to placing the microorganisms in the **petri dish**, the **dishes** should be sterilized in a **sterilizing box**. After the microorganisms have grown into colonies, they are counted on a **Quebec colony counter** and tallied on a **hand-counter**. Microorganisms can be transferred with an **inoculating needle** or **loop** and are often added to a **culture tube**.



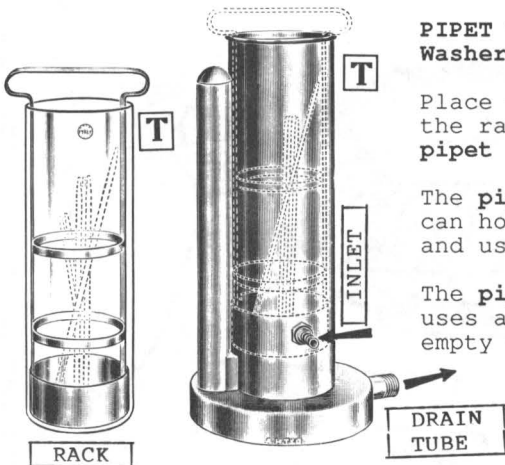


GLASSWARE WASHER

Use the **glassware washer** after the experiment is finished.

Place the beakers and the detergent in the **glassware washer**.

The last rinse cycle in the **glassware washer** uses distilled water.

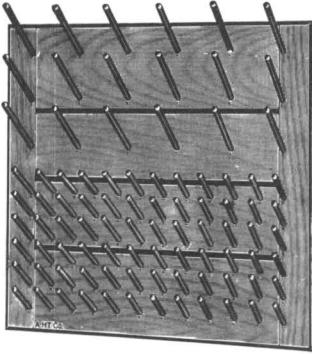


PIPET WASHER (Pipette Washer)

Place the pipet (pipette) in the rack and the rack in the pipet (pipette) washer.

The **pipet (pipette) washer** can hold 200 pipets (pipettes) and uses 3 gallons of water.

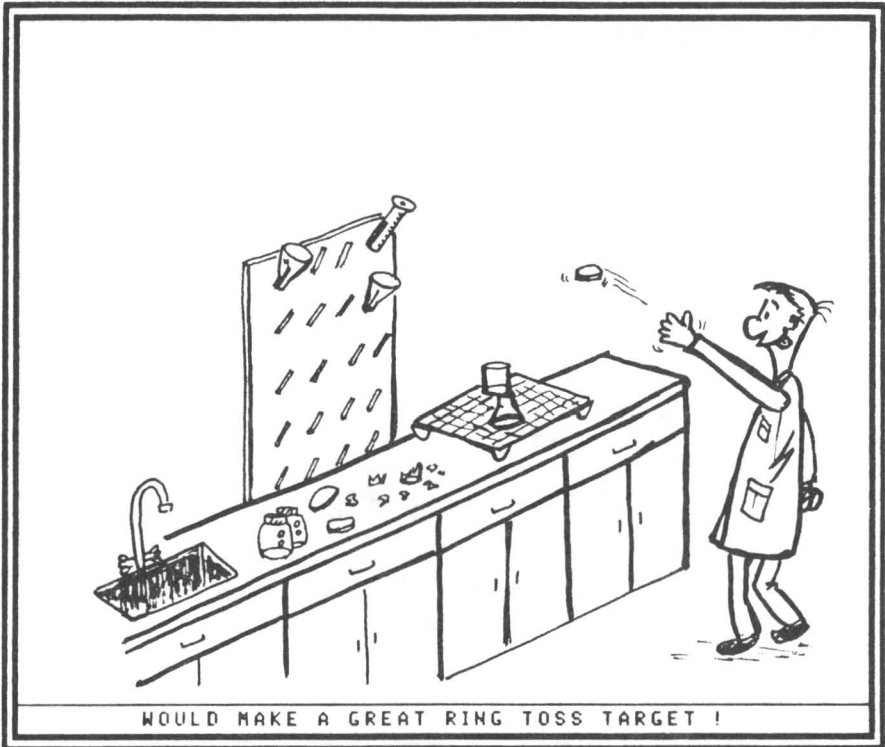
The **pipet (pipette) washer** uses an automatic siphon to empty the washer.

**DRAINING RACK**

Place the glassware on the **draining rack**.

The **draining rack** may be used for drying equipment.

A **draining rack** can hold glassware in an inverted position.

T

Use the **glassware washer** to clean the flasks but place the pipets (pipettes) in the **pipet (pipette) washer**. After washing the beakers in the sink and rinsing them in distilled water, place them on the **draining rack**.



- A -

Acetic Acid	42, 44
Acid	42, 44
ACS	43
Adjustable Wrench	34, 36
Adjusting Knob	34
Air	12, 14, 20, 22
Air Adjustment	77
Air Filter	20
Alcohol	42, 44
Alcohol Lamp	78, 80
Aluminium Foil Dish	99, 103
Aluminum Foil Dish	99, 103
Ammeter	88, 93
Ammonium Hydroxide	42, 44
Ampere Meter	16
Animal Cage	113, 115
Animal Operating Table	114, 115
Apron	27, 32
Artery Forceps	114
Asbestos Gloves	28, 32
Aspirator	21, 22, 101
Atom	45
Autoclave	77, 80
Automatic Sampler	95, 103
Automatic Transfer Pipet	63, 67
Automatic Transfer Pipette	63, 67
Automatic Zero Pipet	65, 67
Automatic Zero Pipette	65, 67
Avoid Contact With Skin	3, 5
AVO-Meter	88, 93

- B -

Babcock Bottle	98, 103
Babcock Centrifuge	98, 103
Back	9
Bag	27, 32
Bail	56
Balance	68, 72, 100, 103
Ball and Socket Joint	51, 55
Ball Point Pen	37, 39
Barometer	88, 93
Base	44
Base Unit	6, 8, 11
Basin	11
Bath	75, 79, 80, 118
Battery	16, 17
Battery Charger	16, 17

Battery Connections	16
Beaker	56, 59, 64, 67
Belt	83, 89
Biohazard	2, 5
Bit	35, 36
Blanket	1, 5
Blender	82, 86
Bomb	89
Bomb Calorimeter	89, 93
Bond	45
Boss Heads	47, 48
Bottle	28, 32, 56, 59, 70, 72, 98, 103, 120, 123
Box	24, 25, 78, 121, 123
Brake	98
Bristle	29
Brush	29, 32
Buchner Filter Funnel	105, 107
Bucket	56, 59
Buffer	87, 93
Bulb	29, 32, 63, 67
Buret	64, 67
Buret Clamp	47, 49
Buret Stand	46
Burette	49, 64, 65, 67
Burette Clamp	47, 49
Burette Stand	46
Burner	77, 80, 108

- C -

Cabinet	6, 7, 8, 96
Cage	113, 115
Calcium Hydroxide	42, 44
Calculator	38, 39
Calibration Ring	66
Calorimeter	89, 93
Ca(OH) ₂	42
Cap	18, 29, 57, 59, 78, 122
Capillary Tubing	50, 55
Carbon Dioxide	23, 24, 25
Carriers	90, 93
Cart	9, 10
Case	7, 8
Catalog Number	43
Caustic	3, 5
Caution	2, 5
Cell	91, 93
Centrifuge	89, 93, 98, 103

Centrifuge Head	90, 93
Centrifuge Rotor	90, 93
Centrifuge Tube	90, 93
Certified	43
Chain	114
Chair	9
Charger	16, 17
Chart	40, 41
CH ₃ CH ₂ OH	42
CH ₃ COOH	42
Checknut	48
Chromatography	96, 103
Chromatography Cabinet	96
Chromatography Column	96, 103
Clamp	18, 19, 47, 48, 49, 51, 55, 60, 61, 83
Clamp Holder	47, 49
Clamp With Holder	48, 49
Cleaning Compound	29, 32
Clip	37, 65
Clock	30, 32
Cold Storage	23, 25
Cold Water	12, 14, 52, 108
Collection Flask	108
Colony Counter	121, 123
Column	96, 103
Concentric Rings	75
Condenser	52, 55, 97, 100, 101, 108
Conical Flask	56, 59
Containers and Closures	56, 59
Cork	58, 59
Cork Borer	58, 59
Corrosive	3, 5
Counter	121, 123
Counting Chamber	117, 119
Coarse Adjustment	116
Crank	89, 118
Crescent Wrench	34, 36
Crown	31
Crucible	75, 80, 105, 107
Crucible Holder	106, 107
Culture Media	120, 123
Culture Tube	122, 123
Cupboard	3, 5, 6, 8
Cutter	37, 54, 55
CW	12
Cylinder	18, 19, 63, 67
Cylinder Coupling	18
Cylinder Gas	18

- D -

Danger	3, 5
Demineralizer	109, 110
Densitometer	94, 103
Desiccator	99, 103
Desk	7, 8
Dewar Flask	24, 25
Dial	2, 68, 76, 80
Dial Thermometer	76, 80
Dialyzer	94, 103
Dilution Bottle	120, 123
Dish	27, 32, 99, 103, 113, 115, 118, 119, 120, 121, 123
Disposable Gloves	28, 32
Dissecting Kit	114, 115
Dissection Kit	114, 115
Distillation	108, 110
Distillation Flask	108, 110
Distilled Water	12, 14
Distilling Flask	108, 110
Distribution Board	15
Distribution Box	15, 17
Divider	98, 103
Door	6, 23
Draining Rack	125, 126
Drain Tube	124
Drawer	6
Drill Bit	35, 36
Drinking Tube	113, 115
Dropping Bottle	29, 32
Dry Ice Bath	100
Dry Ice Box	24, 25
Dry Ice Storage Container	23, 25
Drying Oven	99, 103
DW	12

- E -

Electrical	15, 17
Electrical Outlet	15, 17
Electrical Socket	15, 17
Electrode	87, 93
Electrophoresis	94, 103
Emulsion Homogenizer	84, 86
Erlenmeyer Flask	56, 59
Etched Marking Area	120
Evaporating Dish	27, 32
Evaporator	109, 110
Explosive	2, 5

Extraction Thimble	97, 103
Extraction Tube	97
Extractor	97, 103
Eyepiece	116
Eye Wash	2, 5

- F -

Faucet	11, 14
Feeding Dish	113, 115
Felt Tip Marking Pen	38, 39
File	35, 36
Filing Cabinet	7, 8
Fill Line	120
Filter Flask	105, 107
Filtering	104, 105, 107
Filtering Flask	105, 107
Filter Paper	104, 107
Fine Adjustment	116
Fine Nose Pliers	33
Finger	28
Fire Blanket	1, 5
Fire Extinguisher	1, 5
First Aid Kit	1, 5
Fixtures	11
Flammable	3, 5
Flash Evaporator	109, 110
Flask	24, 25, 56, 57, 59, 66, 67, 97, 101, 103, 105, 107, 108, 110
Float	92
Floor Case	7, 8
Florence Flask	57, 59
Flow Control	13
Flow Meter	92, 93
Fluorometer	92, 93
Fluorimeter	92, 93
Foil	27, 32, 99, 103
Foil Cap	27
Foil Dish	27
Forceps	114
Frame	46, 49
Freeze Drying	100, 103
Freezer	23, 25
Fume Cupboard	6, 8
Fume Hood	6, 8
Funnel	95, 103, 104, 105, 107
Furnace	75, 80

Furniture 6, 9
 Fuse 15

- G -

Gas 13, 14, 18, 19,
 78, 80
 Gas Adjustment 77
 Gas Cylinder 18
 Gas Cylinder Clamp 18, 19
 Gas Lighter 78, 80
 Gas Measurement 111, 112
 Gauge 18, 20, 21, 85
 Gel Column Electrophoresis 94, 103
 Glass 50, 55
 Glass Electrode 87
 Glass Rod 50, 55
 Glass Stopcock 52, 55
 Glass Stopper 57, 59
 Glass Tubing 50, 55
 Glass Tubing Cutter 54, 55
 Glassware Washer 124, 126
 Glass Wool 104, 107
 Gloves 28, 32
 Goggles 3, 4, 5
 Goldfish Extractor 97, 103
 Graduate 64, 67
 Graduated Buret 64, 67
 Graduated Burette 64, 67
 Graduated Cylinder 63, 67
 Graduated Pipet 62, 67
 Graduated Pipette 62, 67
 Grease 65, 67
 Grinder 83, 86

- H -

Hammer 34, 36
 Hand 30, 31
 Hand Grinder 83, 86
 Hand Mincer 83, 86
 Hand Laboratory Equipment 26, 32
 Handle 7, 21, 26, 29,
 34, 56, 83, 85
 Hand Pump 21, 22
 Hand Pump (Floor Model) 21, 22
 Hand Refractometer 71, 72
 HCl 42
 Heater 101
 Heating 73, 80
 Heating Mantle 74, 80
 Heating Tape 74, 80

Hex Wrench Set	34, 36
HNO ₃	42
Holder	122
Hole	57
Homogenizer	84, 86
Hood	3, 5, 6, 8
Hook	114
Hose Connection	18
Hot	3, 5
Hot Plate	73, 80
Hot Plate Height Adjustment	97
Hot Water	12, 14
H ₂ SO ₄	42
HW	12
Hydraulic Press	85, 86
Hydrochloric Acid	42, 44
Hydrometer	70, 72
Hydroxide	42, 44

- I -

Immersion Heater	74, 80
Impinger	106, 107
Incubator	73, 80
Inlet	20
Inlet Tube	64, 65, 124
Inoculating Loop	122, 123
Inoculating Needle	122, 123
Instrument Sterilizer	77, 80
Intake Valve	13
Interval Timer	30, 32

- J -

Jar	118, 119
Joint	51, 55

- K -

Keep In Refrigerator	3, 5
Kjeldahl Digestion Unit	101, 103
Kjeldahl Distilling Unit	101, 103
Kjeldahl Flask	101, 103
Knife	118
KOH	42

- L -

Label	2, 5, 37, 39, 43, 44
Label Maker	37, 39
Laboratory Cart	9, 10
Laboratory Chair	9
Laboratory Furniture	6
Laboratory Hand Tools	33
Laboratory Stool	9, 10
Laboratory Trolley	9, 10
Ladder	9, 10
Lamp	78, 80
Large Size Shaker	82
Leg	7
Lens Tissue	117, 119
Lever	2, 30
Lid Control Handle	77
Lighter	78, 80
Light Source	116
Lip	56
Liquid Volume Measuring Equipment	62
Litmus Paper	88, 93
Lock Release	7
Loop	122, 123
Lot Analysis	43
Lot Number	43

- M -

Magnetic Stirrer	81, 86
Magnifier	116, 119, 121
Mantle	74, 80
Matches	78, 80
McLeod Vacuum Gauge	100
Measurement Equipment	87, 93
Measuring Pipet	62, 67
Measuring Pipette	62, 67
Mechanical Stage Control	116
Media	120, 123
Melting Point Bath	79, 80
Melting Point Tube	79, 80
Metal File	35, 36
Metric	43
Microbiology	120, 123
Micrometer	117, 119
Microscope	116, 119
Microscopic Examination	116, 119
Microtome	118, 119

Mill	83, 86
Mincer	83, 86
Mixer Tap	11, 14
Mixing and Pressing Equipment	81, 86
Mixing Faucet	11, 14
Model	45
Moisture Balance	100, 103
Molecular Models	45
Mortar and Pestle	81, 86
Motor	20, 83, 89
Muffle Furnace	75, 80

- N -

NaOH	42
Needle Nose Pliers	33
Needle Valve	13, 14, 18, 20
NH ₄ OH	42
Nipple	21
NIT	13
Nitric Acid	42, 44
Nitrogen (N ₂)	13, 14
Notebook	26, 32
Nut	52

- O -

Objective	116
Office Hand Tools	37, 39
Ohm	88, 93
Oil Level	20
Oil Trap	20
On-Off Switch	15, 121
Open-End Wrench	34, 36
Operating	114, 115
O-Ring Joint	51, 55
OSHA	43
Outlet	15, 17, 20
Outlet Box	15
Outlet Strip	15, 17
Out of Order	3, 5
Oven	73, 80, 99, 100, 103
Overflow	11, 13
Overflow Cup	64, 65
OXY	13
Oxygen (O ₂)	13, 14

- P -

Pail	56, 59
Pan	68, 69
Pen	37, 39
Periodic Chart	40, 41
Periodic Table	40, 41
Pestle	81, 86
Petri Dish	120, 123
Petri Dish Sterilizing Box	121, 123
pH	87, 88, 93
pH Buffer Solution	87, 93
pH Meter	87, 93
Phone	2
Pilot Light	15
Pinch Clamp	51, 55
Pipet	29, 62, 63, 65, 67, 126
Pipet Filling Attachment or Bulb	63, 67
Pipette	29, 32, 62, 63, 65, 67, 126
Pipette Filling Attachment	63, 67
Pipette Filling Bulb	63, 67
Pipette Washer	124, 126
Pipet Washer	124, 126
Plastic Stopper	57
Plastic Tubing	60, 61
Pliers	33, 36
Plug	15, 16, 52, 65, 74
Plunger	62
Point	37
Poison	3, 5
Polarimeter	71, 72
Policeman	26, 32
Portable Laboratory Furniture	9
Potassium Hydroxide	42, 44
Powerstat	15
Press	85, 86
Pressure Control Valve	18
Pressure Gauge	18, 20, 21
Pressure Indicator	18
Pressure Pump	20, 22
Pressure Regulator	18, 19
Probe	114
Pulley	83, 89
Pump	20, 22, 66, 67
Punch	58
Purity Grade	43
Pycnometer	70, 72

- Q -

Quebec Colony Counter	121, 123
Quickfit	51, 55

- R -

Rack	124, 125, 126
Radiation Hazard	3, 5
Reagent	42, 44
Reagent Label	43, 44
Receptacle	15
Recorder	102, 103
Reference Electrode	87
Refractometer	71, 72
Refrigerator	3, 5, 23, 25
Regulator	18, 19
Respirator	4, 5
Respirometer	111, 112
Retort Stand	46, 47, 49
Ring Stand	46, 47, 49
Rod	50, 55
Rotary Oil Pump	20
Rotor	90, 93
Rubber Bulb	29, 32
Rubber Gloves	28, 32
Rubber Stopper	57
Rubber Tubing	60, 61
Rule	38, 39, 114
Ruler	38, 39

- S -

Safety Data	43
Safety Equipment	1, 5
Safety Goggles	4, 5
Safety Hand Grip	53, 55
Safety Matches	78, 80
Sample Holder	91
Sampler	95, 103
Scale	68, 72
Scalpel	114
Scanning Densitometer	94, 103
Scissors	33, 36, 114
Scoop	26, 32

Screwdriver	34, 36
Screw Locking Device	51
Seal	20
Seat	9
Separating Funnel	95, 103
Separation Equipment	94, 103
Separatory Funnel	95, 103
Shaker	82, 86
Shears	33, 36
Shelf	6, 11
Shower	1, 5
Side Arm	79, 105, 108
Sieve	95, 103
Signs	2, 5
Sink	11, 14
Siphon	13, 14
Size	43
Slide	116, 119
Small Animal Equipment	113
Socket	15, 17
Sodium Hydroxide	42, 44
Soldering Gun	35, 36
Soldering Iron	35
Solid Carbon Dioxide Storage Container	23, 24, 25
Source	43
Soxhlet Extractor	97, 103
Spatula	26, 32
Specific Gravity Balance	69, 72
Specific Gravity Bottle	70, 72
Spectro Cell	91, 93
Spectrophotometer	91, 93
Speed	81, 89
Speed Control	82, 89
Speed Indicator	89
Spout	56
Staining Dish	118, 119
Staining Jar	118, 119
Stand	46, 49
Standard Taper Ground Glass Joint	51, 55
Standard Taper Joint	52, 57
Station	118
Steam	12, 14
Step	9
Steps	9, 10
Sterile	3, 5
Sterilizer	77, 80, 121, 123
Still	108, 110
Stirrer	81, 86
STM	12
Stool	9, 10
Stopcock	12, 14, 52, 55
	65, 67

Stopcock Grease	65, 67
Stopper	57, 59
Stopwatch	31, 32
Storage Cabinet	6, 8
Strap	4, 18
Suction	63
Sulfuric Acid	42, 44
Sulphuric Acid	42, 44
Support	46, 49
Sweep Hand	31
Switch	15
Syringe Pipet	62, 67
Syringe Pipette	62, 67

- T -

Table	7, 8, 114, 115
Tank	18, 19
Tap	11, 14
Tape Dispenser	37, 39
Tappets	30
Telephone	2, 5
Temperature Control Knob	73, 97
Temperature Control Unit	75
Terminal	16
Test Paper	88, 93
Test Tube	27, 52, 53, 55
Test Tube Holder	53, 55
Test Tube Rack	53, 55
Thermometer	76, 80, 89, 99
Thermometer (Electronic)	76, 80
Thermos Flask	24, 25
Thermostat	74
Thimble	97, 103
Thin Layer Chromatography (TLC)	96, 103
Thumb	28
Thumbscrew	47, 48
Time	30
Timer	30, 32
Time Switch	30, 32
Tin Snips	33, 36
Tip	35
Tissue	29, 32, 117, 119
Tissue Grinder	83, 86
Tissue Processing Unit	118, 119
TLC	96, 103
Tongs	26, 32
Top	23, 24
Top-Loading Balance	69, 72
Transfer Pipet	62, 67
Transfer Pipette	62, 67

Transformer	15, 17
Trap	11
Trigger	1, 35
Triple Beam Balance	68, 72
Tripod	47, 49
Tripper	30
Trolley	9, 10, 18, 19
Truck	18
Tube	79, 80, 90, 93, 113, 115, 122, 123
Tubing	50, 54, 55, 60, 61
Tubing Clamp	60, 61
Tweezers	69

- U -

Under High Pressure	3, 5
Under Low Pressure	3, 5
Use In Hood	3, 5
Universal Indicator Paper	88, 93

- V -

VAC	13
Vacuum	13, 14, 20, 21, 22, 106
Vacuum and Air Pumps	20, 22
Vacuum and Pressure Pump	20, 22
Vacuum Gauge	20, 73, 100
Vacuum Inlet	20
Vacuum Oven	100, 103
Vacuum Pump	20, 22, 100
Valve	13, 14, 18, 20, 66
Vane Pump Movement	20
Variable Transformer	15, 17
Variac	15, 17
Vent	63
Vial	57, 59
Vice	35, 36
Viscometer	70, 72
Vise	35, 36
Voltage Control Knob	15
Volt-Ohm-Ammeter	88, 93

Volumetric Flask	66, 67
Volumetric Pipet	62, 67
Volumetric Pipette	62, 67

- W -

Wall Cabinet	6
Wall Clock	30, 32
Warning Labels	2, 5
Warning Signs	2, 5
Wash Bottle	28, 32
Washer	124, 126
Washing	124, 126
Watch Glass	53, 55
Water	1, 12, 14, 52, 108
Water Bath	75, 80
Water Discharge	21
Water Pressure	21
Water Pump	21, 22
Water Still	108, 110
Wavelength Adjustment Knob	91
Wax Pencil	38, 39
Wear Your Goggles	3, 5
Weight and Sample Composition	68
Weight Control Knob	68
Weights	68
Weight Set	69, 72
Wheel	9
Wick	78
Wire Cutter Pliers	33, 36
Work Top	11
Wrench	34, 36

- Z -

Zero Reset Knob	121
---------------------------	-----

中文索引

— A —

- 石棉手套 ····· 28、32
 醋酸；乙酸 ····· 42、44
 酸 ····· 42、44
 A C S (美國化學學會) ····· 43
 可調節扳鉗 ····· 34、36
 調節鈕 ····· 34
 空氣 ····· 12、12、14、20、22
 空氣調節 ····· 77
 空氣過濾器 ····· 20
 酒精 ····· 42、44
 酒精燈 ····· 78、80
 鋁箔盤(皿、碟) ····· 99、103
 鋁箔盤(皿、碟) ····· 99、103
 安培計 ····· 88、93
 氫氧化銨 ····· 42、44
 安培計 ····· 16
 動物籠(檻) ····· 113、115
 動物手術檯 ····· 114、115
 圍裙 ····· 27、32
 動脈鉗(鑷子) ····· 114
 吸引器；吸出器(抽氣泵浦) ····· 21、22、101
 原子 ····· 45
 壓熱器；高壓蒸氣釜、高壓殺菌器 ····· 77、80

- 自動取樣機 ····· 95、103
- 自動傳遞吸管 ····· 63、67
- 自動傳遞吸管 ····· 63、67
- 自動歸零吸管 ····· 65、67
- 自動歸零吸管 ····· 65、67
- 避免和皮膚接觸 ····· 3、5
- 安培—伏特—歐姆 (AVO) 計 ····· 88、93
- B —
- 巴布科克 (貝氏) 瓶 ····· 98、103
- 巴布科克 (貝氏) 遠心分離 ····· 98、103
- 背; 後面 ····· 9
- 袋子 ····· 27、32
- 水斗、汲出、鍋標 ····· 56
- 天平、秤 ····· 68、72、100、103
- 球窩接頭 ····· 51、55
- 原子筆 ····· 37、39
- 氣壓計 ····· 88、93
- 鹼、鹽基、底 ····· 44
- 鹼單位、基本單位 ····· 6、8、11
- 盆、皿 ····· 11
- 浴、浴器 ····· 75、79、80、118
- 電池組 ····· 16、17
- 電池充電器 ····· 16、17
- 電池連接 (接頭) ····· 16
- 燒杯 ····· 56、59、64、67
- 皮帶 ····· 83、89

生物危險性	2、5
鑽頭；鑽孔器	35、36
毛毯；掩蓋	1、5
摻和器；攪拌器	82、86
飾；螺栓聯繫	15
彈；炸彈	89
彈式熱量計	88、93
結合；鍵	45
岩瘤頭	47、47、48
瓶	28、32、56、59、70、72、98、103、120、123
箱；盒	24、25、78、121、123
鞞；制動器	98
繫毛	29
刷子	29、32
瓷過濾漏斗	105、107
斗；桶；吊桶	56、59
緩衝液	87、93
球管；球；燈泡	29、32、63、67
滴定管；量管	64、67
滴定管夾	49、49
滴定管架	46
滴定管	49、64、65、67
滴定管夾	47、49
滴定管架	46
燈頭、爐；燃燒器	77、80、108

- C -

- 櫃；櫥 ······ 6、7、8、96
- 籠；檻 ······ 113、115
- 氫氧化鈣 ······ 42、44
- 計算機 ······ 38、39
- 校準環 ······ 66
- 熱量計；熱量器 ······ 88、93
- 氫氧化鈣 ······ 42
- 蓋；帽 ······ 18、29、57、59、78、122
- 毛細管 ······ 50、55
- 二氧化碳 ······ 23、24、25
- 載體 ······ 90、93
- 三輪車；用車運送 ······ 9、10
- 盒；箱 ······ 7、8
- 目錄號碼 ······ 43
- 苛性的；腐蝕的；焦散的 ······ 3、5
- 謹慎；小心 ······ 2、5
- 小室；電池；細胞 ······ 91、93
- 遠心分離機 ······ 88、93、98、103
- 離心機轉頭 ······ 90、93
- 離心機轉動子（轉座） ······ 90、93
- 離心管 ······ 90、93
- 檢定的；證明的 ······ 43
- 鏈 ······ 114
- 椅子 ······ 9
- 充電器；裝料機 ······ 16、17
- 圖；圖表；表 ······ 40、41
- 酒精；乙醇 ······ 42
- 醋酸；乙酸 ······ 42

抑止螺旋	48
色層分析法	96、103
色層分析櫥	96
色層分析柱	96、103
夾；夾板、壓板	18、19、47、48、49、51、55、60、61、83
持夾把手、持夾器	47、49
附把手夾	48、49
清潔劑	29、32
夾；紙夾	37、65
鐘；計時器	30、32
冷藏	23、25
冷水	12、14、52、108
收集瓶	108
菌落計數器	121、123
柱、塔	96、103
同心環	75
冷凝器；電容器；聚光器	52、55、97、100、101、108
錐形瓶	56、59
容器和密閉器	56、59
軟木塞；軟木；塞	58、59
穿孔器	58、59
腐蝕劑；腐蝕的	3、5
計數器；逆；反	121、123

- 計算室 ····· 117、119
 粗調節螺 ····· 116
 曲柄 ····· 89、118
 新月形扳鉗 ····· 34、36
 燈帽；窯頂 ····· 31
 坩堝；熔鍋 ····· 75、80、105、107
 坩堝座 ····· 106、107
 培養基 ····· 120、123
 培養管 ····· 122、123
 杯櫥 ····· 3、5、6、8
 切刀；切斷機 ····· 37、54、55
 C W (冷水) ····· 12
 圓筒、量筒、氣缸 ····· 18、19、63、67
 圓筒聯合(連結) ····· 18
 氣缸氣體；鋼瓶氣 ····· 18
 — D —
 危險 ····· 3、5
 脫礦物質器(劑) ····· 109、110
 深淺計；光密度計 ····· 94、103
 除濕乾燥器 ····· 97、103
 桌子、實驗檯 ····· 7、8
 真空瓶；杜瓦瓶 ····· 24、25
 刻度盤；標度 ····· 2、68、76、80
 刻度溫度計 ····· 76、80

- 滲析膜；滲析器 ····· 94、103
 稀釋瓶 ····· 120、123
 碟、皿、盤 ····· 27、32、99、103、113、115、118、119、120、121、123
 使用後丟棄手套 ····· 28、32
 解剖用具(組、套) ····· 114、115
 解剖用具組 ····· 114、115
 蒸餾作用 ····· 108、110
 蒸餾瓶 ····· 108、110
 蒸餾水 ····· 12、14
 蒸餾瓶；分餾燒瓶 ····· 108、108、110
 分配板 ····· 15
 分配槽 ····· 15、17
 分規；雙腳規 ····· 98、103
 門 ····· 6、23
 排水架；滴乾架 ····· 12、5、126
 排水管；洩水管 ····· 124
 抽屜、衣櫃 ····· 6
 鑽孔器、螺旋錐 ····· 35、36
 吸水管 ····· 113、115
 滴瓶 ····· 29、32
 乾冰浴槽 ····· 100
 乾冰盒 ····· 24、25
 乾冰貯藏器(容器) ····· 23、25
 乾燥機、烘乾機 ····· 99、103
 DW(蒸餾水) ····· 12

— E —

- 電氣的 ····· 15、17
- 電的出路，電路 ····· 15、17
- 電插頭 ····· 15、17
- 電極 ····· 87、93
- 電泳 ····· 94、103
- 乳濁液均質機(乳化機) ····· 84、86
- Erlenmeyer 瓶(細頸三角瓶) ····· 56、59
- 浸蝕區域標誌 ····· 120
- 蒸發皿 ····· 27、32
- 蒸發器 ····· 109、110
- 爆炸性的 ····· 2、5
- 萃取殼筒 ····· 97、103
- 萃取管 ····· 97
- 萃取器 ····· 97、97、103
- 目鏡 ····· 116
- 洗眼水 ····· 2、5

— F —

- 水龍頭管 ····· 11、14
- 送料皿(碟) ····· 113、115
- 簽字筆(細筆尖) ····· 38、39
- 銼刀 ····· 35、36
- 銼屑櫥 ····· 7、8
- 裝油管線 ····· 120
- 吸濾瓶 ····· 105、107
- 過濾 ····· 104、105、107

吸濾瓶	105、107
濾紙	104、107
細調節螺	116
細鼻鉗	33
手指	28、28、28
防火毯	1、5
滅火器	1、5
急救箱	1、5
裝置品；裝置器	11
可燃的	3、5
急驟蒸發器	109、110
燒瓶；三角瓶 24、25、56、57、59、66、67、97、101、103、105、107、108、110	
浮標；浮筒；浮	92
落地櫥	7、8
平底燒瓶	57、59
流量的控制	13
流速計、流量計	92、93
氟量計；螢光計	92、93
氟量計；螢光計	92、93
箔；薄片、鋁箔片	27、32、99、103
箔片帽(蓋)	27
箔片皿(碟)	27
鑷子	114
框架	46、49
冷凍乾燥	100、103
冷凍機	23、25

- 烟橱 (烟室) 6、8
- 烟橱；通風室、抽油煙機 6、8
- 漏 斗 95、103、104、105、107
- 爐 75、80
- 傢 具 6、9
- 保險絲；引信、導火線 15、15
- G —
- 氣 體 13、14、18、19、78、80
- 空氣調節 77
- 氣體鋼瓶 18
- 氣體鋼瓶夾 (轉栓) 18、19
- 氣體打火器 78、80
- 氣體測定器 111、112
- 表；規、計 18、20、21、85
- 膠體電泳柱 (塔) 94、103
- 玻璃；眼鏡 50、55
- 玻璃電極 87
- 玻璃棒 50、55
- 玻璃塞 52、55
- 玻璃塞 57、59
- 玻璃管 50、55
- 玻璃管切斷器 54、55
- 玻璃器皿洗滌機 124、126
- 玻璃棉；玻璃絨 104、107

- 手 套 28、32
- 眼罩；護目眼鏡 3、4、5
- 金鈞鈞分離器 (Gold Fisch) 97、103
- 量筒；量杯、刻度 64、67
- 刻度滴定管 64、67
- 刻度滴定管 64、67
- 刻度量筒 63、67
- 刻度吸管 62、67
- 刻度吸管 62、67
- 潤滑脂；膏脂 65、67
- 碾磨；碾碎 83、83、86
- H —
- 錘 子 34、36
- 手 30、31
- 手動碾磨器 83、86
- 手動切碎 (切片) 器 83、86
- 實驗室使用設備 26、32
- 手動的；可使用的、柄；把手 7、21、26、29、34、56、83、85
- 手動泵 (唧筒) 21、22
- 手動泵 (地板式) 21、22
- 手提式反射計 71、72
- 氯化氫、塩酸 42
- 加熱器 101、101
- 加 熱 73、80
- 加熱罩 74、80
- 加熱帶 74、80

- 六角形扳鉗 ····· 34、36
- 硝酸 ····· 42
- 座；支架；柄；把持 ····· 122
- 洞；孔；穴 ····· 57
- 均質機；均化器 ····· 84、86
- 通風櫥；蓋、抽油煙機 ····· 3、5、6、8
- 鉤 ····· 114
- 軟管連接 ····· 18
- 熱的 ····· 3、5
- 熱板；電爐 ····· 73、80
- 熱板高度調節螺 ····· 97
- 熱水 ····· 12、14
- 硫酸 ····· 42
- H W (熱水) ····· 12
- 水壓機 ····· 85、86
- 塩酸 ····· 42、44
- 比重計 ····· 70、72
- 氫氧化物 ····· 42、44
- I —
- 浸液加熱器 ····· 74、80
- 衝擊器；震動器 ····· 106、107
- 孵卵器 ····· 73、80
- 入口管；入口 ····· 20
- 入口管 ····· 64、65、124

- 播種環(圈)、接種環、白金耳 ····· 122、123
- 接種針 ····· 122、123
- 消毒(殺菌)器 ····· 77、80
- 進入轉栓(活塞) ····· 13
- 間隔時鐘(計時器) ····· 30、32
- J —
- 缸;瓶 ····· 118、119
- 接頭;接合;關節 ····· 51、55
- K —
- 保存在冷却器內(冷却冷藏) ····· 3、5
- 凱氏分解裝置 ····· 101、103
- 凱氏蒸餾裝置 ····· 101、103
- 凱氏燒瓶 ····· 101、103
- 刀;小刀 ····· 118
- 氫氧化鉀 ····· 42
- L —
- 標識 ····· 2、5、25、37、39、43、44
- 標識號誌 ····· 37、39
- 實驗室推車(吊車) ····· 9、10

實驗室椅子	9
實驗室用具(家具)	6
實驗室使用工具	33
實驗室凳子	9、10
實驗室手推車	9、10
梯子	9、10
燈	78、80
大型搖盪機	82
支架;腿	7
鏡頭擦拭紙	117、119
槓桿;桿	2、30
蓋子控制把	77
發光器;點火器	78、80
光源	116
唇;口緣	56
液體體積測定設備	62
石蕊試紙	88、93
開鎖	7
週線;線、鈎	122、123
整批分析	43
批號	43

— M —

- 磁鐵攪動器 ····· 81、86
- 放大鏡 ····· 116、119、121
- 罩；紗罩 ····· 74、80
- 火柴 ····· 78、80
- McLeod 真空計 ····· 100
- 測量用具 ····· 87、93
- 量液吸管 ····· 62、67
- 量液吸管 ····· 62、67
- 機械分段控制 ····· 116
- 培養基 ····· 120、123
- 熔點浴 ····· 79、80
- 熔點管 ····· 79、80
- 金屬銼刀 ····· 35、36
- 米制的；度量的、公制的 ····· 43
- 微生物學 ····· 120、123
- 測微計 ····· 117、119
- 顯微鏡 ····· 116、119
- 顯微鏡檢查 ····· 116、119
- 切片機 ····· 118、119
- 磨；碾機；壓碎 ····· 83、86
- 絞碎器 ····· 83、83、86
- 混合水龍頭 ····· 11、11、14
- 混合和加壓設備 ····· 81、86
- 混合水龍頭 ····· 11、11、14
- 模式；模型 ····· 45

水分測定計	100、103
分子模型	45
碾鉢和杵	81、86
電動機；馬達	20、83、89
蒙煇爐；隔焰爐；迴熱爐	75、80
— N —	
氫氧化鈉	42
針鼻鉗	33
針狀塞（栓）、針孔閥	13、14、18、20
氫氧化氮	42
螺紋接管	21
NIT（氮氣）	13
硝酸	42、44
氮氣	13、14
筆記簿	26、32
螺母、螺套	52
— O —	
物鏡；目的；目標	116
辦公室使用工具	37、39
歐姆	88、93
油面	20
集油槽；油收集器	20

轉換開關	15、15、121
開口端扳鉗	34、36
操作中；操作的；工作的；外科手術的	114、115
O-環聯接	51、55
OSHA	43
出口管；出口	15、15、17、20
出口箱；出口室	15
出口窄道（配線箱）	15、17
失靈、壞掉	3、5
爐；烘乾箱	73、80、99、100、103
溢出	11、13
溢流杯	64、65
氧氣	13
氧氣(O ₂)	13、14

— P —

提桶；桶	56、59
盤；鍋	68、68、69
筆；檻	37、39
週期表	40、41
週期表	40、41
杆	81、86
培養皿	120、123
培養皿殺菌盒（筐）	121、123

- PH ; 酸鹼度 87、88、93
- 酸鹼緩衝液 87、93
- PH 測定計 87、93
- 電話 2
- 引火燈 15
- 挾夾 ; 捏夾 51、55
- 吸 管 29、62、63、65、67、126
- 附球充填吸管 63、67
- 吸管 ; 吸移管 ; 吸量管 29、32、62、63、65、67、126
- 附充填器吸量管 63、67
- 附球充填吸管 63、67
- 吸管洗滌器 124、126
- 吸管洗滌器 124、126
- 塑膠塞子 57
- 塑膠試管 60、61
- 扁嘴鉗 ; 手鉗 33、36
- 管塞 ; 塞子 ; 插頭 15、16、52、65、74
- 柱 塞 62
- 點 ; 尖端 ; 要點 37
- 毒 ; 毒物 ; 毒藥、中毒 3、5
- 旋光計 ; 偏振計 71、72
- 澱 帚 26、32
- 手提式實驗室用具 9
- 氫氧化鉀 42、44
- 發電廠 ; 動力廠 15
- 壓機 ; 壓力機 ; 壓榨機 85、86
- 壓力控制閥 18
- 壓力計 18、20、21
- 壓力指示器 18
- 壓氣泵 20、22
- 調壓器 18、19

- 試探具；試探電極；探針 ····· 114
- 滑輪；滑車；皮帶輪 ····· 83、89
- 泵浦；唧筒；抽機 ····· 20、22、66、67
- 衝床；沖壓機；穿孔器 ····· 58
- 純度分級 ····· 43
- 比重瓶 ····· 70、72
- Q —
- Quebec 菌落計數器 ····· 121、123
- 快速裝配 ····· 51、55
- R —
- 架；齒條 ····· 124、125、126
- 幅射危險性 ····· 3、5
- 試劑；試藥 ····· 42、44
- 試藥標籤 ····· 43、44
- 收容器；插座 ····· 15
- 記錄器 ····· 102、103
- 參考電極 ····· 87
- 折射計；折光儀 ····· 71、72
- 冷凍器（機）；冷藏箱 ····· 3、5、23、25
- 調節劑；調節器 ····· 18、19
- 面罩；呼吸器；濾毒罐 ····· 4、5
- 呼吸計 ····· 111、112
- 甌架；甌鑷座 ····· 46、47、49
- 環架；鐵環架 ····· 46、47、49
- 棒條；圓條 ····· 50、55
- 旋轉石油泵（幫浦） ····· 20
- 轉子；轉動片、旋度 ····· 90、93

- 橡皮吸球 ······ 29、32
 橡皮手套 ······ 28、32
 橡皮塞子(栓) ······ 57
 橡皮(膠)管 ······ 60、61
 尺、定則、法則 ······ 38、39、114
 尺；米達尺 ······ 38、39
 — S —
 安全數據 ······ 43
 安全裝備 ······ 1、5
 安全護目鏡 ······ 4、5
 安全把手 ······ 53、55
 安全火柴 ······ 78、80
 樣品固定器(試管架) ······ 91
 採樣器 ······ 95、103
 秤 ······ 68、72
 外科用小刀 ······ 114
 微調光密度計 ······ 94、103
 剪刀 ······ 33、36、114
 勺；杓 ······ 26、32
 螺絲起子 ······ 34、36
 螺絲之深陷螺紋 ······ 51
 密封 ······ 20
 座；坐位 ······ 9

- 分液漏斗 95、103
- 分離設備 94、103
- 分液漏斗 95、103
- 搖動器、振盪器 82、86
- 切斷裝置 33、36
- 架子 6、11
- 淋浴器 1、5
- 側臂 79、105、108
- 篩子 95、103
- 符號；標示；簽字 2、5
- 水槽；污水槽 11、11、14
- 虹吸管；虹吸 13、14
- 大小；尺度 43
- 玻片 116、119
- 小動物用器具 113
- 插座 15、17
- 氫氧化鈉 42、44
- 焊接槍；電焊槍 35、36
- 固態二氧化碳貯存器 23、24、25
- 來源；製造商 43
- Soxhlet (索格利特) 萃取器 97、103
- 刮勺；刮鏟 26、32
- 比重天平 69、72
- 比重瓶 70、72
- 光譜室 91、93
- 分光光度計 91、93

- 速率；速度 81、89
- 速度控制（調節） 82、89
- 速率計；速度計；速度指示計 89
- 嘴；唇 56
- 染色皿 118、119
- 染色缸 118、119
- 架；臺 46、49
- 標準錐削玻璃聯結 51、55
- 標準錐削聯結 52、57
- 浸漬槽 118
- 蒸氣；水蒸氣 12、14
- 梯 階 9
- 梯 階 9、10
- 無菌的 3、5
- 殺菌器；消毒器 77、80、121、123
- 蒸餾釜（鍋）；蒸餾 108、110
- 攪拌器；攪動器 81、86
- STM（蒸氣） 12
- 活栓脂膏、潤滑膏 65、67
- 凳子、椅子 9、10
- 活栓；轉門；活塞 12、14、52、55、65、67
- 塞 子 57、59
- 碼錶；計時錶 31、32
- 儲存櫥 6、8
- 帶 子 4、18

- 空吸；吸取；吸力 63
 硫酸 42、44
 硫酸 42、44
 架；支座 46、49
 長針（可歸零） 31
 電閘；開關 15
 注射管 62、67
 注射管 62、67
 — T —
 表；桌子 7、8、114、115
 桶；罐；槽 18、19
 水龍頭 11、14
 膠帶固定座（捲尺） 37、39
 放液（水）管 30
 電話；電話機 2、5
 溫度控制開關 73、97
 溫度控制裝置 75
 端；末端；終點 16、16
 試紙 88、93
 試管 27、52、53、55
 試管夾 53、55
 試管架 53、55
 溫度計 76、80、89、89
 電子溫度計 76、80
 保溫瓶 24、25
 恆溫器 74
 殼筒；套管 97、103
 薄層色層分析（TLC） 96、103
 拇指 28、28、28
 拇指螺絲（螺旋） 47、47、48

時 間	30
自動定時儀	30、32
定時開關	30、32
錫剪；錫鉗子	33、36
管尖；尖	35
擦拭紙	29、32、117、119
組織碾磨器	83、86
組織處理器位	118、119
TLC (薄層液體色析法)	96、103
鉗	26、32
頂；上面；蓋頂	23、24
上皿天平	69、72
移量吸管	62、67
移量吸管	62、67
變壓器	15、17
阱；汽水閥	11
引發物；扳機	1、35
三標天平；三標平	68、72
三腳架	47、49
傾料器	30
空中吊運車	9、10、18、19
貨車；卡車	18
管；筒	79、80、90、93、113、115、122、123
管；製管	50、54、55、60、61
試管夾	60、61
鏟 子	69

- 在高壓情況下 3、5
- 在低壓情況下 3、5
- 在通風室內使用 3、5
- 萬用 (通用) 試紙 88、93
- V —
- VAC (真空) 13
- 真空 13、14、20、21、22、106
- 真空和空氣泵 (幫浦) 20、22
- 真空和壓力泵 (幫浦) 20、22
- 真空計 20、73、100、100
- 真空入口、抽真空口 20
- 真空烘乾箱 (器) 100、103
- 真空泵 (幫浦) 20、22、100
- 活栓、閥; 活塞 13、14、18、20、66
- 移動式葉輪泵 20
- 可變變壓器 15、17
- 可變變壓器 15、17
- 孔; 通氣口 63、63
- 管; 瓶 57、59
- 軋 鉗 35、36
- 黏度計 70、72
- 老虎鉗; 虎頭鉗 35、36
- 電壓控制鈕 15
- 伏特—歐姆—安培計 88、93
- 量 瓶 66、67
- 容量吸管 62、67
- 容量吸管 62、67

壁 櫥	6
壁 鐘	30、32
警告標誌	2、5
警告信號	2、5
洗瓶；沖洗瓶	28、32
洗滌器；洗滌機	124、126
洗 滌	124、126
鍍玻璃	53、55
水	1、12、14、52、108
水 浴	75、80
排水；排水架	21
水 壓	21
水 泵	21、22
蒸餾水製造器	108、110
波長調節鈕	91
蠟 筆	38、39
帶上你的護目鏡	3、5
重量和樣品組成	68
重量調節(控制)鈕	68
法 碼	68
法碼組	69、72
輪子	9
渦轉式混合器	82
蕊；燈心	78
剪鐵絲鉗	33、36
工作臺	11
扳 鉗	34、36

- A -

Acide acétique	42
Acide hydrochlorique	42
Acide nitrique	42
Acide sulfurique	42
Affiches	2
Agitateur	26, 81
Agitateur magnétique	81
Aiguille d'inoculation	122
Air	12
Alambic	108
Alambic à eau	108
Alcool	42
Alumettes	78
Aluminium, assiette en papier	99
Aluminium, papier	27
Ampoule en caoutchouc	29
Appareil de papier collant	37
Appareil respiratoire	111
Aspirateur (pompe à eau)	21
Assiette	113
Assiette d'évaporation	27
Autoclave ou stérilisateur	77

- B -

Baguette de verre	50
Bain à eau	75
Bain à point de fusion	79
Balance	68
Balance à densité spécifique	69
Balance à trois fléaux	68
Balance électronique	69
Ballon filtre	105
Baromètre	88
Basse pression, sous	3
Batterie, chargeable et non-rechargeable	16
Bécher	56, 64
Boîte de stérilisation du plat de Petri	121
Bouchon	58
Bouchon d'arrêt	12, 65
Bouchon d'arrêt en caoutchouc ou plastique	57
Bouchon d'arrêt en verre	57
Bouteille	56
Bouteille à densité spécifique	70
Bouteille à gaz	18
Bouteille de Babcock	98
Bouteille de dilution	120
Briquet à gaz	78
Brosse	29
Broyeur à main	83

Broyeur de tissus	83
Brûleur	77
Bureau	7
Burette graduée	64

- C -

Cabinet au sol	7
Cage	113
Calculatrice	38
Calorimètre	89
Canne de verre	50
Carnet	26
Cartouche de Soxhlet	97
Cartouche d'extraction	97
Caustique	3
Centrifugeuse	89
Centrifugeuse de Babcock	98
Centrifugeuse, tête de	90
Centrifugeuse, tube de	90
Charnière	51
Charriot de laboratoire	9
Chaud	3
Chauffage d'immersion	74
Chromatographie à couche mince	96
Chromatographie, cabinet de	96
Chromatographie, colonne de	96
Chronomètre	31
Clé anglaise	34
Clé anglaise à bout ouvert	34
Clés anglaises, trousseau de	34
Compteur	121
Compteur de la colonie de Québec	121
Condensateur	52
Congélateur	23
Corrosif	3
Couteau à canne de verre	54
Couvercle	57
Couverture anti-feu	1
Crayon à cire	38
Crayon-feutre	38
Creuset	75, 105
Cuillère	26
Cuve de comptage	117
Cylindre gradué	63

- D -

Danger	2, 3
Débitmètre	92
Degré moyen d'humidité	100

Déminéralisateur	109
Densitomètre d'analyse	94
Dessicateur	99
Dialyse	94
Diapositive	116
Disjoncteur	15
Dissection, trousse de	114
Diviseur	98
Douche	1

- E -

Eau chaude	12
Eau distillée	12
Eau froide	12
Echantillonneur automatique	95
Echelle	68
Egoutteur	125
Electrode	87
Electrophorèse à colonne de gel	94
En panne	3
Entonnoir	104
Entonnoir filtre de Buchner	105
Eprouvette-test	52
Epurateur	106
Escabeau	9
Etiquettes	37
Etiquettes et affiches	2
Etuve	73, 99
Etuve à vide	100
Evaporateur instantané	109
Eviter le contact avec la peau	3
Explosif	2
Extincteur	1
Extracteur de Goldfish	97

- F -

Filtre de séparation	95
Fiole	57
Flacon conique d'Erlenmeyer	56
Flacon de compte-gouttes	29
Flacon de distillation	108
Flacon de Florence	57
Flacon laveur	28
Flacon ou plat de coloration	118
Flacon volumétrique	66
Fluoromètre	92
Four à moufle	75

- G -

Gants à jeter	28
Gants de caoutchouc	28
Gants en amiante	28
Gaz	13
Glace sèche, boîte	24
Glace sèche, cuve de stockage de	23
Graisse de bouchon d'arrêt	65

- H -

Haute pression, sous	3
Homogénéiseur	84
Homogénéiseur à emulsion	84
Horloge murale	30
Hotte de ventilation	6
Hotte, utiliser sous	3
Hydromètre	70
Hydroxyde d'ammonium	42
Hydroxyde de calcium	42
Hydroxyde de potasse	42
Hydroxyde de sodium	42

- I -

Incubateur	73
Indicateur	102
Inflammable	3
Installations	11
Interrupteur automatique	30

- K -

Kjeldahl, flacon de	101
Kjeldahl, unité de digestion de	101
Kjeldahl, unité de distillation de	101

- L -

Laine de verre	104
Lampe à alcool	78
Lave-oeil	2
Laveur de pipettes	124
Laveur de verres	124
Limeuse en métal	35

Loupe	116
Lunettes de sécurité	4
Lunettes, mettez vos	3

- N -

Nitrogène (N ₂)	13
Nettoyer, produit à	29

- O -

Oxygène (O ₂)	13
-------------------------------------	----

- P -

Papier filtre	104
Papier indicateur	88
Papier-mouchoir	29
Perceuse	35
pH, appareil de mesure du	87
pH, solution tampon	87
Pilon et mortier	81
Pince	47
Pince avec support	48
Pince de burette	47
Pince de Mohr	51
Pince de tuyau	60
Pinces	26
Pipette au zéro automatique	65
Pipette en seringue	62
Pipette graduée	62
Pipette volumétrique	62
Placard de rangement	6
Plaque chauffante	73
Plat de Petri	120
Poids	69
Poignée de sécurité	53
Poison	3
Polarimètre	71
Pompe	66
Pompe à main	21
Pompe à main, modèle au sol	21
Pompe à vide	20
Pompe à vide et à pression	20
Pompe à vide, mouvement de	20
Presse hydraulique	85
Prise électrique	15

- R -

Raccord et douille	51
Radiations, danger de	3
Réactif	42
Réactif, désignation de	43
Rechargeur de piles	16
Récipient gradué	64
Réfractomètre	71
Réfractomètre à main	71
Réfrigérateur-congélateur	23
Réfrigérateur, garder au	3
Règle	38
Régulateur de pression	18
Risque biologique	2
Robinet	11
Robinet d'arrêt en verre	52
Robinet-mélangeur d'eau	11
Rodage normalisé	51

- S -

Sac en papier	27
Sciseaux	33
Sciseaux pour aluminium	33
Seau	56
Séchage par évaporation de glace	100
Secours, trousse de premier	1
Securité, matériel de	1
Siphon	13
Socle	6
Soudeuse	35
Soupape en aiguille	13
Spatule	26
Spectrophomètre	91
Spectrophomètre, cellule de	91
Stérile	3
Stérilisateur	77
Stérilisateur d'instruments	77
Style à bille	37
Support à tubes d'essais	53
Support d'anneaux	46
Support de bouteille à gaz	18
Support de burette	46
Support de creuset	106
Support de pinces	47
Support d'éprouvette test	53
Support ou cadre	46
Supports	46

- T -

Table	7
Tableau ou carte périodique	40
Table d'opération pour animaux	114
Tablier	27
Tabouret de laboratoire	9
Tamis	95
Téléphone	2
Tenailles	33
Tenailles aux pinces en aiguilles	33
Tenailles coupe-fer	33
Thermique, cordon	74
Thermique, manchon	74
Thermomètre	76
Thermomètre à cadran	76
Thermomètre électronique	76
Thermos, bouteille	24
Tire-bouchon	58
Tissu de lentille	117
Tourne-vis	34
Transformateur variable	15
Trépied	47
Tube à point de fusion	79
Tube capillaire	50
Tube d'alimentation en eau	113
Tube de culture	122
Tuyauterie	60
Tuyauterie en caoutchouc	60
Tuyauterie en plastique	60

- U -

Unité de traitement des tissus	118
--	-----

- V -

Vapeur	12
Verre de montre	53
Verres	50
Vide	13
Viscosimètre	70
Vis d'établis	35
Volgamètre Ohm	88

- A -

Absaugeflasche	105
Abdampfschale	27
Abspeerhahn	12, 65
Abspeerhahnschmiere	65
Abtastdenitometer	94
Abzug	6
Aktenschrank	7
Alkohol	42
Ammoniumhydroxid	42
Ampulle	57
Analytische Waage	68
Anschluß	15
Anschlußkasten	15
Asbesthandschuhe	28
Aspirator (Wasserpumpe)	21
Atemgerät	4
Aufklebezetzel	37
Aufspannblock	35
Augenspülwasser	2
Automatische Nullpipette	65
Automatische Vollpipette	63
Automatische Waage	69
Automatischer Probennehmer	95

- B -

Babcock-Flasche	98
Babcock-Zentrifuge	98
Barometer	88
Batterie; Aufladenbar und Hichtaufladenbar	16
Becher	56, 64
Behälter aus Aluminiumfolie	99
Berührung der Haut vermeiden	3
Beschriftungsgerät	37
Bewegung des Pumpenrotors	20
Bohrens Spitze	35
Bombenkalorimeter	89
Brenner	77
Brutapparat	73
Büchner-Filtertrichter	105
Bürettengestell	46
Bürettenklammer	47
Bürste	29

- C -

Calciumhydroxid	42
Chromatographiekammer	96

- D -

Destillierkolben	108
Dampf	12
Destilliertes Wasser	12
Dewargefäß	24
Dialysator	94
Drahtschneidende Zange	33
Dreibein	47
Druckregulator	18
Durchflußmesser	92
Dusche	1
Dünnschichtchromatographie	96

- E -

Elektrode	87
Elektronisches Thermometer	76
Emulsionshomogenisiersapparat	84
Entsaltyngsvorrichtung	109
Erlenmeyerkolben	56
Erste Hilfe Tasche	1
Essigsäure	42
Exsikkator	99
Extraktionshülse	97

- F -

Färbetopf	118
Federwaage	68
Fettstift	38
Feuchtheitswaage	100
Feuerdecke	1
Feuerlöscher	1
Filterpapier	104
Filzstift	38
Flachbodenkolben	57
Flasche	56
Flachschlüsselgarnitur	34
Fluorometer	92
Folie	27
Füttererschale	113

- G -

Gas	13
Gasanzünder	78

Gasflasche oder Gasbehälter	18
Gefahr	3
Gefahr der biologischen Verseuchung	2
Gefahr der radioaktiven Verstrahlung	3
Gefrier-trocknung	100
Gel-Säuleelektrophorese	94
Gewebsschleifmaschine	83
Gewebebearbeitungseinheit	118
Gewichtssatz	69
Gift	3
Glasshahn	52
Glassrohr	50
Glassrohrfräser	54
Glasstab	50
Glasstöpsel	57
Glasswolle	104
Glühtiegel	105
Goldfisch-Extraktor	97
Grosse Schüttelvorrichtung	82
Gummibirne	29
Gummihandschuhe	28
Gummischlauch	60

- H -

Haarrörchen	50
Hahn	11
Hammer	34
Handpumpe	21
Handrefraktometer	71
Handschleifmaschine	83
Handschuhe zum einmaligen Gebrauch	28
Handschutz	53
Hebelwaage	68
Heiß	3
Heißes Wasser	12
Heizband	74
Heizpilz	74
Heizplatte	73
Homogenisierapparat	84
Hydraulische Presse	85
Hydrometer	70

- I -

Im Kühlschrank aufbewahren	3
Impfnadel oder Schlinge	122
Intervallstoppuhr	30

- K -

Käfig	113
Kaliumhydroxid	42
Kaltes Wasser	12
Kappe	57
Kaputt	3
Kaustisch	3
Kjeldahl-Destilliereinheit	101
Kjeldahl-Digestioneinheit	101
Kjeldahl-Kolben	101
Klammer	47
Klammer der Gasflasche	18
Klammerhalter	47
Klammer mit Halter	48
Klebebandverteiler	37
Korkbohrer	58
Korken	58
Kübel oder Eimer	56
Kugelgelenk	51
Kugelschreiber	37
Kühler	52
Kühlschrank-Tiefkühltruhe	23
Kulturböden	120
Kulturröhrchen	122

- L -

Laborschrank mit Arbeitsbrett	6
Laborstuhl	9
Laborwagen	9
Lackmuspapier	88
Ladegrät	14
Lagerschrank	6
Leicht anzündbar	3
Leiter	9
Linial	38
Linsentuch	117
Lötpistole	35
Luft	12
Lüftung nötig	3
Lupe	116

- M -

Magnetischer Rührer	81
Messbürette	64
Messglass	64
Messkolben	66
Messpipette	62

Messzylinder	63
Metalfeile	35
Metalschneidende Schere	33
Mikrometer	117
Mikroskop	116
Mikrotom	118
Mixer	82
Molekulmodelle	45
Mörser und Mörserkeule	81
Muffelofen	75
Mühle	83

- N -

Nadelförmige Zange	33
Nadelventil	13
Natriumhydroxid	42
Notizheft	26

- O -

Ofen	73
Operationstisch für Tiere	114
O-Ringelenk	51

- P -

Papiertücher	29
Periodensystem oder Tabelle	40
Petrischale	120
pH-Meter	87
pH-Pufferlösung	87
Pipettenbirne	63
Plastikschlauch	60
Polarimeter	71
Präpariersatz	114
Pumpe	66
Putzmittel	29
Pyknometer	70

- Q -

Quebec-Kolonienzähler	121
Quetschhahn	51

- R -

Reagenspapier	43
Reagenzglass	52
Reagenzglassgestell	53
Reagenzglasshalter	53
Rechner	38
Refraktometer	71
Reinigungsflasche	28
Registrierapparat	102
Respiratometer	111
Retorte	108
Retortengestell	46
Rührer	26, 81

- S -

Salpetersäure	42
Salzsäure	42
Sauerstoff (O ₂)	13
Scheidetrichter	95
Schere	33
Schieber	116
Schlauchhahn	60
Schmelzpunktbestimmungsapparat	79
Schmelzpunkttröichen	79
Schmelztiegel	75
Schrank	7
Schraubenschlüssel (einstellbar)	34
Schraubenzieher	34
Schaufel	26
Schreibtisch	7
Schürze	27
Schüttelvorrichtung	82
Schutzbrille	4
Schwefelsäure	42
Setz die Schutzbrille auf	3
Sieb	95
Siphon	13
Soxhlet-Extraktor	97
Spachtel	26
Spektralphotometer	91
Spektralzelle	91
Spirituslampe	78
Sprengstoff	2
Spritzpipette	62
Spühlbecken	11
Standard Verjüngtes Glasschliff	51
Stativ	46
Staubprobensammler	106
Stechzirkel	98
Steril	3
Sterilisationskasten für Petrischale	121

Sterilisator	77
Sterilisator der Instrumente	77
Stickstoff (N ₂)	13
Stoppuhr	31
Stöpsel	57
Stoßverdampfer	109
Streichhölzer	78
Stützbare Handpumpe	21

- T -

Tauchsieder	74
Telefon	2
Tiegelhalter	106
Tisch	7
Thermometer	76
Thermometer mit Zifferblatt	76
Träger	90
Tränkröhr	113
Transformator ("Variac")	15
Trennsäule	96
Trichter	104
Trockeneisbehälter (Kohlendioxidsehneebehälter)	23
Trockeneiskasten (zur Lagerung und Transport)	24
Trockner	99
Trockner für Glass	125
Tropfflasche	29
Tüten	27

- U -

Uhrglass	53
Unter hohem Druck	3
Unter niedrigem Druck	3

- V -

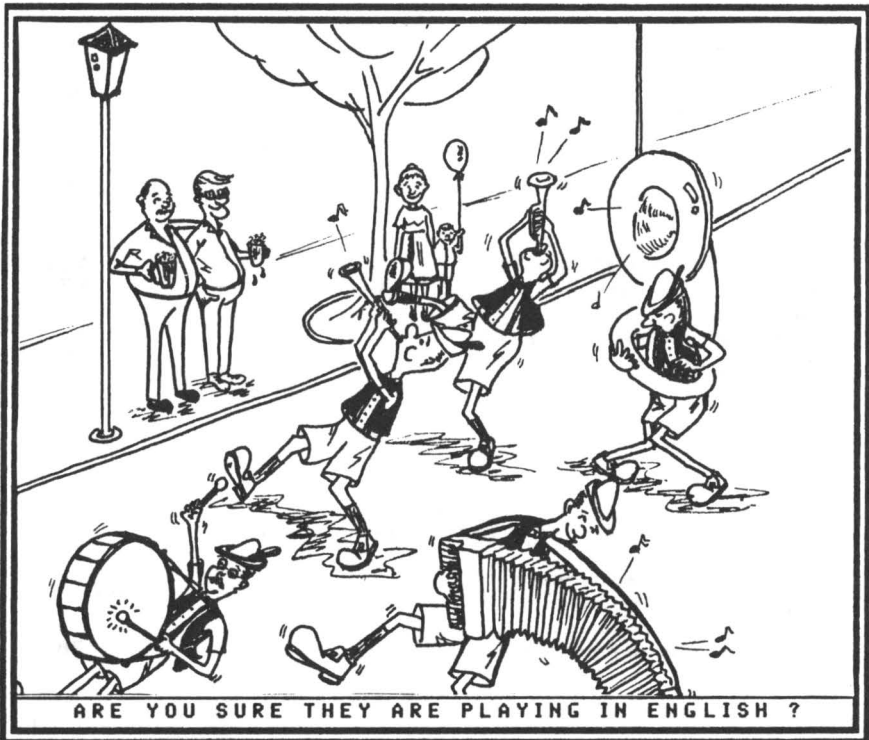
Vakuum	13
Vakuumofen	100
Vakuumpumpe (Drehkolbenölpumpe)	20
Vakuum- und Druckpumpe	20
Verdünnungsflasche	120
Viscosimeter	70
Vollpipette	62
Volt-Ohm-Amperemeter	88
Vorsicht	2

- W -

Wanduhr	30
Warm und Kalt Wasserhahn	11
Warntafeln, Warnzeichen	2
Waschvorrichtung für Glass	124
Waschvorrichtung für Pipetten	124
Wasserbad	75
Wasserdestillierappart	108
Wichtewaage	69

- Z -

Zählkammer	117
Zähler	121
Zange	26, 33
Zeitschalter	30
Zentrifuge	89
Zentrifugenglass	90
Zentrifugenkopf (Rotor)	90
Zerfressend	3



- A -

alkohol	42
aparat destylacyjny	108
aparat destylacyjny stosowany w metodzie Kjeldahla	101
aparat do oznaczania zawartości wody	100
aparat do przygotowywania preparatów histologicznych	118
aparat do spalania próbek stosowany w metodzie Kjeldahla	101
aparat Goldfische	97
aparat Soxhleta	97
aparatura pomiarowa	87
aparatura rozdzielcza	94
aparat Warburga	111
areometr	70
autoklaw	77
automat do rotacyjnego przesuwania próbek	95
azot (N ₂)	13

- B -

badania mikroskopowe	116
badanie przemian gazowych	111
bagietka szklana	50
barometr	88
bateria	16
bibuła filtracyjna	104
bibułka do czyszczenia	29, 117
biureta wielomiarowa	64
biurko	7
bomba kalorymetryczna	89
bufory wzorcowe	87
butelka	56
butelka do rozcieńczen	120
butla gazowa	18

- C -

chłodnica	52
chromatografia cienkowarstwowa	96
cieplarka	73
ciężar i skład próbki	68
cylinder miarowy	63
cyrkiel pomiarowy	98
czasomierz, minutnik	30

- D -

demineralizator	109
desintometr skaningowy	94
destylacja	108
destylarka	108
dializator	94
długopis	37
dozownik	63
drabinka	9

- E -

Eksykator	99
Elektrody	87
elektroforeza kolumnowa na żelu	94
etykiety na odczytnikach	43
eza	122

- F -

fartuch ochronny	27
fiolka	57
filtracja	104
fleometr	92
fluorymetr	92
folia	27

- G -

gaśnica	1
gaz	13
gaz w butlach	18
gilza ekstrakcyjna	97
gilzy do próbek wirówkowych	90
głowica wirówki	90
gniazdko elektryczne	15
gruszka gumowa	29
grzejnik zanurzeniowy	74

- H -

homogenizator	84
homogenizator emulsyjny	84
homogenizator szklany do miękkich tkanek	83

- I -

imadło 35

- K -

kalkulator 38
karmidełko 113
klamra zaciskowa 51
klatka dla zwierząt 113
klucz francuski 34
klucz płaski do nakrętek 34
koc przeciwpożarowy 1
kolba destylacyjna 108
kolba Kjeldahla 101
kolba miarowa 66
kolba płaskodenna 57
kolba ssawkowa 105
kolba stożkowa 56
kolumna chromatograficzna 96
komora chromatograficzna 96
komora do liczenia krwinek i drobnoustrojów 117
konieczna odpowiednia wentylacja 3
korek 57
korek szklany 57
korek z kory drzewa 58
korek z otworem do wprowadzania lejka 106
korkobór 58
kran wodociągowy 11
kran wodociągowy z zimną i ciepłą wodą 11
kroplomierz 29
krzesło laboratoryjne 9
kurek 12, 65
kurek szklany 52
kuweta 91
kwas azotowy 42
kwas octowy 42
kwas siarkowy 42
kwas solny 42

- L -

lampka spirytusowa 78
lejek 104
lejek Büchnera 105
lejek rozdzielczy 95
licznik 121
licznik kolonii 121
linijka 38
lodówka z zamrażalnikiem 23
lupa 116
lutownica 35

- Ł -

Łapa statywu	47
Łapa statywu z łącznikiem	48
Łaźnia wodna	75
Łącznik	47
Łącznik pierścieniowy	51

- M -

materiał wybuchowy	2
meble laboratoryjne	6
menzurka	64
miernik uniwersalny	88
mieszadło	26, 81
mieszadło magnetyczne	81
mikrobiologia	120
mikrometr	117
mikroskop	116
mikrotom	118
mikser	82
młotek	34
młynek	83
modele molekularne	45
moździerz i pistol	81

- N -

naczynia i ich zamknięcia	56
naczynie do batwienia	118
naczynko z folii aluminiowej	99
nalepka	37
napisy i znaki ostrzegające	2
niebezpieczeństwo	3
niebezpieczeństwo skażenia biologicznego	2
notatnik	26
nożyce do cięcia blachy	33
nożyczki	33

- O -

ochraniacz dłoni	53
odczynniki chemiczne	42
ogrzewanie	73
okulary ochronne	4
ołówek woskowy, dermatograf	38
ostrożnie	2

- P -

palnik	77
papierki wskaźnikowe	88
para wodna	12
parownica	27
pH-metr	87
piec muflowy	75
piknometr	70
pilnik	35
pipeta automatyczna jednomiarowa	65
pipeta miarowa	62
pipeta napełniana gruszką gumową	63
pipeta strzykawkowa	62
pipeta wielomiarowa	62
pisak, flamaster	38
płaszcz grzejny	74
płuczka	106
płuczka do pipet	124
płytki Petriego	120
podgrzewacz	73
podłoża	120
pod niskim ciśnieniem	3
podręczne narzędzia laboratoryjne	33
podręczny sprzęt laboratoryjny	26
pod wysokim ciśnieniem	3
poidełko	113
pojemnik do przechowywania suchego lodu	23
pojemnik do sterylizacji płytek Petriego	121
polarymetr	71
połączenie na standardowy szlif stożkowy	51
połączenie na szlif kulisty	51
pompa próżniowa	20
pompa próżniowo-ciśnieniowa	20
pompka	66
pompka ręczna	21
pompka ręczna (opierana o podłogę)	21
pompka wodna	21
pompy próżniowe i powietrzne	20
powietrze	12
prasa hydrauliczna	85
próbówka	52
próbówka bakteriologiczna	122
próbówka do oznaczania temperatury topnienia	79
próbówka wirówkowa	90
próżnia	13
prysznic	1
przechowywać w lodówce	3
przechowywanie w niskich temperaturach	23
przenośne meble laboratoryjne	9
przybory biurowe	37
przyrząd do oznaczania temperatury topnienia	79
przyrząd do rozwijania i cięcia taśmy klejącej	37
przyrząd do tłoczenia napisów na plastikowych nalepkach	37
pudło do transportu i przechowywania suchego lodu	24

- R -

refraktometr	71
refraktometr ręczny	71
regulator ciśnienia	18
rejestrator	102
ręczna maszynka do mielenia	83
rękawice azbestowe	28
rękawice gumowe	28
rękawice jednorazowe	28
rozdzielacz, kontakt przenośny	15
ruch wirnika pompy	20
ruchomy stolik laboratoryjny	9
rurka gumowa	60
rurka kapilarna	50
rurka plastikowa	60
rurka przelewowa	13
rurka szklana	50
rurki	60

- S -

Sito	95
Smar do uszczelniania kurków	65
spektrofotometr	91
sprzęt do badań z użyciem małych zwierząt	113
sprzęt do mierzenia objętości cieczy	62
sprzęt do mieszania i zgniatania	81
statyw do biuret	46
statyw do próbek	53
statyw laboratoryjny	46
statyw ramowy	46
statywy	46
sterylizator do narzędzi	77
sterylne	3
stoper	31
stół	7
stół operacyjny dla zwierząt	114
substancja korozyjna	3
suszarka	73, 99
suszarka próżniowa	100
suszenie sublimacyjne	100
syfon	13
szafka laboratoryjna z blatem roboczym	6
szafka z szufladami do przechowywania dokumentów	7
szczotka	29
szcypce	26, 33
szcypce do cięcia drutu	33
szcypce do wyginania i cięcia drutu	33
szkiełko podstawowe	116
szkiełko zegarkowe	53
szkło laboratoryjne	50
szpachelka	26
szufelka	26

- Ś -

środek zmywający	29
śróbokręt	34

- T -

tabela układu okresowego pierwiastków	40
taśma grzejna	74
telefon	2
termometr	76
termometr elektroniczny	76
termometr tarczowy	76
termos	24
tlen (O ₂)	13
tłuszczomierz Babcocka	98
torebka	27
transformator	15
trójnóg	47
trucizna	3
tryskawka	28
tygiel	75, 105

- U -

uchwyt do biuret	47
uchwyt do mocowania butli gazowej	18
uchwyt do próbek	53
uniknąć kontaktu ze skórą	3
urządzenia elektryczne	15
urządzenie do cięcia szklanych rurek	54
urządzenie do ładowania baterii	16
uszkodzone	3

- W -

waga analityczna	68
waga automatyczna jednoszalkowa	69
waga do określania ciężaru właściwego	69
waga sprężynowa	68
waga trójramienna z przesuwными odważnikami	68
wata szklana	104
wiadro	56
wieczko, nakrętka	57
wiertło	35
wieszak do suszenia szkła laboratoryjnego	125
wirówka	89
wirówka Babcocka	98
wiskozymetr	70
woda destylowana	12
woda do płukania oczu	2

woda gorąca	12
woda zimna	12
wodorotlenek amonowy	42
wodorotlenek potasowy	42
wodorotlenek sodowy	42
wodorotlenek wapniowy	42
wstrząscarka	82
wyciąg	6
wyłącznik zegarowy	30
wyparka	109
wyposażenie	11
wyposażenie związane z bezpieczeństwem pracy	1
wysoka szafka laboratoryjna	6
wysoka szafka laboratoryjna z przesuwanymi drzwiami	7
wysoka temperatura	3
wziewnik	4

- Z -

zaciskacz do rurek	60
zagrożenie pożarowe	3
zagrożenie promieniowaniem	3
załóż okulary ochronne	3
zapalacz do gazu	78
zapałki	78
zasada żrąca	3
zawór iglicowy	13
zegar ścienny	30
zestaw kluczy wpustowych sześciokątnych	34
zestaw odważników	69
zestaw pierwszej pomocy medycznej	1
zestaw sekcyjny	114
zlew	11
zlewka	56, 64
zmywanie	124
zmywarka do szkła laboratoryjnego	124

- A -

Acido Acético	42
Acido Clorhídrico	42
Acido Nítrico	42
Acido Sulfúrico	42
Agitador	81
Agitador magnético	81
Agitador-Vibrador	82
Agua caliente	12
Agua destilada	12
Agua fría	12
Aire	12
Alcohol	42
Alicates	33
Alicates de punta fina	33
Archivador	7
Arcón para hielo seco	23
Areómetro	70
Armario	6
Asa de platino	122
Autoclave	77

- B -

Balanza analítica	68
Balanza digital	69
Balanza para densidades	69
Balanza para humedad	100
Baño maría	75
Baño para punto de fusión	79
Barómetro	88
Báscula	68
Batería	16
Batidora	82
Bebedero	113
Bolígrafo	37
Bolsa	27
Bomba	66
Bomba calorimétrica	88
Bomba de vacío	20
Bomba de vacío de Agua	21
Bomba de vacío y compresor	20
Bomba manual	21
Bomba Peristáltica	20
Botella	56
Botiquín	1
Broca	35
Bureta	64

- C -

Cabezal de centrifuga	90
Cabezal múltiple de centrifuga	90
Caja de conexiones electricas	15
Calculadora	38
Caliente	3
Cámara cromatográfica	96
Cámara cuentaglóbulos	117
Cápsula	27
Cargador de baterías	16
Cartucho de extracción	97
Cáustico	3
Centrifuga	88
Centrifuga de Babcock	98
Cilindro de gas	18
Cilindros para esterilizar placas	121
Cinta Adhesiva	37
Cinta calefactora	74
Columna cromatográfica	96
Comedero	113
Compás de puntas	98
Condensador	52
Contador	121
Copa graduada	64
Corcho	58
Corrosivo	3
Cortadora de tubos de vidrio	54
Criba	95
Crisol	75
Crisol de Gooch	105
Cromatografía en capa fina	96
Cronómetro	31
Cubeta de tinción	118
Cubeta para espectrofotometría	91
Cubo con asa	56
Cuchara de agitación	26
Cucharón	26
Cuenta colonias	121

- D -

Delantal	27
Densitómetro	94
Desecador	99
Desmineralizador	109
Destilación, aparato para	108
Destilación, matraz de	108
Destilador de agua	108
Destornillador	34
Diálisis, equipo de	94
Disección, equipo de	114
Ducha	1

- E -

Electrodo	87
Electroforesis en gel, equipo para	94
Embudo	104
Embudo de Buchner	105
Embudos Buchner, conos de goma para	106
Embudo de separación	95
Emulsificador	84
Encendedor	78
Enchufe	15
Equipo de inclusión	118
Equipo de muestreo automático	95
Equipo de seguridad	1
Escalera	9
Escobillón	29
Escurridor	125
Espátula	26
Espectrofluorímetro	92
Espectrofotómetro	91
Estantería	7
Estéril	3
Esterilizador de instrumentos	77
Estufa	73
Estufa de desecación	99
Estufa de vacío	100
Etiqueta	37
Etiquetado de Reactivos	43
Etiquetador	37
Etiquetas y señales	2
Evaporador	109
Explosivo	2
Extintor de incendios	1
Extractor de Goldfisch	97
Extractor de Soxhlet	97

- F -

Flotámetro	92
Fósforos de seguridad	78
Frasco cuentagotas	29
Frasco de dilución	120
Frasco lavador	28
Frasco lavador de gases	106
Fregadero	11
Frigorífico-Congelador	23
Funciona, no	3

- G -

Gafas protectoras	4
Gafas, use	3
Gas	13
Goma, tubo de	60
Gradilla	53
Granatario	68
Grasa para buretas	65
Grifo	11, 12
Grifo combinado	11
Guantes de amianto	28
Guantes de goma	28
Guantes desechables	28

- H -

Hidróxido Amónico	42
Hidróxido Cálxico	42
Hidróxido Potásico	42
Hidróxido Sódico	42
Hoja de aluminio	27
Homogeneizador	84
Homogeneizador de vidrio	83
Horno	73
Horno de mufla	75

- I -

Inflamable	3
----------------------	---

- J -

Jaula	113
Jeringuilla micrométrica	62
Juego de pesas	69

- K -

Kjeldahl, equipo de destilación	101
Kjeldahl, equipo de digestión	101
Kjeldahl, matraz de	101

- L -

Laboratorio, carro de	9
Lámpara de alcohol	78
Lana de vidrio	104
Lapiz de cera	38
Lavadora	124
Lavador de pipetas	124
Lavaojos	2
Libro de notas	26
Lima	35
Limpiador	29
Liofilizador	100
Lupa	116

- LL -

Llave Ajustable	34
Llave de dos bocas	34
Llave de paso de vidrio	52
Llave de vidrio	65
Llaves para tuercas hexagonales	34

- M -

Mango de seguridad	53
Manta calefactora	74
Manta contra incendios	1
Mantener en refrigeración	3
Martillo	34
Mascarilla	4
Matraz de Babcock	98
Matraz de fondo plano	57
Matraz erlenmeyer	56
Matraz Kitasato	105
Matraz volumétrico	66
Mechero	77
Medio de cultivo	120
Mesa	7
Mesa de despacho	7
Mesa de operaciones	114
Micrómetro	117
Microscopio	116
Microtomo	118
Modelos moleculares	45
Molino	83
Mortero y mano	81

- N -

Nitrógeno	13
Nuez	47

- O -

Oxígeno	13
-------------------	----

- P -

Pañuelo	29
Papel de filtro	104
Papel indicador	88
Papel limpiantes	117
Peligro	3
Pera	63
Pera de goma	29
pH-Metro	87
Picadora manual	83
Picnómetro	70
Piel, evite el contacto con la	3
Pinza	47
Pinza con nuez	48
Pinza de mohr	60
Pinza de sujeción para cilindros de gas	18
Pinza para buretas	47
Pinzas para crisoles	26
Pinza para esmerilados de rótula	51
Pinzas para tubos de ensayo	53
Pipeta aforada	62
Pipeta automática	63, 65
Pipeta graduada	62
Placa calentadora	73
Placa de Petri	120
Platillo de hoja de aluminio	99
Polarímetro	71
Portaobjetos	116
Precaución	2
Prensa hidráulica	85
Presión elevada	3
Presión reducida	3
Presión, regulador de	18
Probeta	63

- R -

Recipiente para hielo seco	24
Refractómetro	71
Refractómetro manual	71
Registrador	102
Regla	38
Reloj avisador	30
Reloj de pared	30
Respirómetro	111
Riesgo Biológico	2
Riesgo Radiactivo	3
Rotulador	38

- S -

Sifón	13
Silla o taburete de laboratorio	9
Soldador	35
Solución tampón	87
Soporte de aro	46
Soporte o Emparrillado	46
Soporte para buretas	46
Sustentacion, módulo de	6

- T -

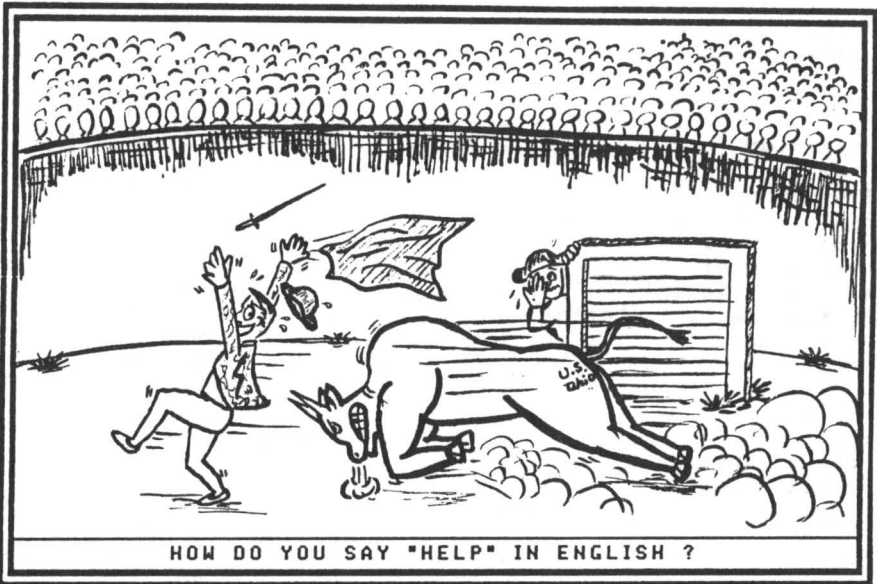
Taladratapones	58
Tapa	57
Tapón	57
Tapón de vidrio	57
Teléfono	2
Tenazas	33
Termo	24
Termómetro	76
Termómetro electrónico	76
Termómetro industrial	76
Termostato	74
Tijeras	33
Tornillo de banco	35
Transformador	15
Tripode	47
Tubo capilar	50
Tubo de centrifuga	90
Tubo de cultivo	122
Tubo de ensayo	52
Tubo de plástico	60
Tubo de vidrio	50
Tubo para punto de fusión	79

- U -

Unión cónica esmerilada	51
Unión de rótula	51
Unión plana	51

- V -

Vacío	13
Válvula de aguja	13
Vapor	12
Varilla de vidrio	50
Vaso de precipitado	56, 65
Veneno	3
Vial	57
Vidrio de reloj	53
Viscosímetro	70
Vitrina de gases	6
Vitrina de gases, usar en la	3
Voltímetro-Amperímetro	88



ACS	43
Açma kapama düğmesi	1, 121
Ağırlıklar	68
Ağırlık kontrol düğmesi	68
Ağırlık seti	69, 72
Ağız	56, 63
Akış kontrolü	13
Akrep ve yelkovan	30, 31
Alçak basınç	3, 5
Alevlenebilir	3, 5
Aliminyum foil	27, 32, 99, 103
Aliminyum foil kapak	27
Aliminyum kuru madde kabı	27, 99, 103
Alkol	42, 44
Alkol veya gazyağı lambası	78, 80
Ameliyat	114, 115
Ameliyat takımı	114, 115
Ameliyat masası	114, 115
Amonyum hidroksit	42, 44
Ampermetre	16, 88, 93
Anahtar	34, 36
Anahtar takımı	34, 36
Araba	9, 10, 18
Arka	9
Artery forceps	114
Aşındırıcı (corrosive)	3, 5
Asbest eldiven	28, 32
Asetik asit	42, 44
Asit	42, 44
Aspiratör	21, 22, 101
Atom	45
AVO-metre	88, 93
Ayak	7
Ayak pompası	21
Ayar düğmesi	34
Ayarlama çizgisi	66
Ayırma alet ve cihazları	94, 103
Ayırma hunisi	95, 103
Azot (N ₂)	13, 14

- B -

Babkok santrifüjü	98, 103
Babkok şişesi	98, 103
Bağ	45
Bağlantı	51, 55
Banyo	75, 78, 80, 118
Barometre	88
Basınç ayarlayıcısı	18, 19
Basınç göstergesi	18, 20, 21
Basınç kontrol vanası	18

Başparmak	28
Battaniye	15
Baz	44
Beherglas	56, 59, 64, 67
Besiyeri	120, 123
Bıçak	118
Bilezikli dayama ayağı	46, 47, 49
Bir çeşit süzgeç	105
Bir çeşit elcek (cam çubuk için)	53, 55
Biyolojik tehlike	2, 5
Blender	82, 86
Bomb	89
Bomb kalorimetresi	89, 93
Boncuk	9
Boru veya hortum	50, 54, 55, 60 61
Boyama malzemesi	118, 119
Bozuk	3, 5
Buffer çözeltisi	87, 93
Buhar	12, 14
Bulaşık eldiveni	28, 32
Bulaşık makinası	124, 126
Bulb	29, 32, 63, 67
Bunzen	77, 80, 108
Bühner süzgeci	105, 107
Büret	64, 67
Büret ayaklığı	46
Büret kısıkaçı	47, 49
Büro malzemesi	37, 39
Büro tipi dosya dolabı	7, 8
Büyüteç	116, 119, 121
Buzdolabı	3, 5, 23, 25
Buzdolabı ve derin dondurucu	23
Buzdolabında muhafaza et	3, 5

- C -

Cam	50, 55
Cama yazar kalem	38, 39
Cam balon	57, 59
Cam boru	50, 55
Cam boru kesicisi	54, 55
Cam çubuk	50, 55
Cam elektrot	87
Cam musluğu	65, 67
Cam şişe	56
Cam tıpa	57, 59
Cam vana	52, 55
Cam yünü	104, 107
Ca(OH) ₂	42
Cerrah mili	114
Cetvel	38, 39, 114

CH ₃ CH ₂ OH	42
CH ₃ COOH	42
Checknut	48
Cımbız	69, 114
Clip	37, 65
Concentric rings	75
Contalı ekleme	51, 55
CW	12
- Ç -	
Çakmak	78, 80
Çalışma ünitesi	6, 8, 11
Çalkalayıcı	82, 86
Çeker ocak	3, 5, 6, 8
Çeker ocagı kullan	3, 5
Çekiç	34, 36
Çekmece	6
Çerçeve	46, 49
Çevirme kolu (krank)	89, 118
Çıkış	15, 17, 20
Çıkış borusu	21
Çoklu priz	15, 17
Çubuk	50, 55
- D -	
Dalga boyu ayar düğmesi	91
Damlalık	29, 32
Dayama (destek)	46, 49
Dayama çerçevesi	46
Değirmen	83, 86
Delik	57
Deney hayvanları için özel aletler	113
Deney tüpü maşası	53, 55
Deney tüpü	27, 52, 53, 5!
Densitometre	94, 103
Dereceli beherglas	64
Dereceli pipet	62, 67
Deri temasından sakın	3, 5
Desikatör	99, 103
Desikatör yağı (gres).	65, 67
Dial (gösterge)	2, 68, 76, 80
Distilasyon	108, 110
Distilasyon balonu	108, 110
Dilüsyon şişesi.	120, 123
Dişli musluk	12
Distile su	12, 14
Diyaliz cihazı	94, 103
Doku işleme ünitesi	118, 119
Doku öğütücüsü	83, 86

Dolap	3, 5, 6, 7 8, 96
Dolum çizgisi	120
Dondurarak kurutma	100, 103
Dondurucu	23, 25
Duş için çeşme	1, 5
Duvar saati	30, 32
Düğme	15
DW	12

- E -

Eğе	35, 36
Ekstraktör	97, 103
Ekstraksiyon tüpü	97, 103
Elcek	7, 21, 26, 29 34, 53, 55, 56 83, 85
Eldiven	28, 32
Elek	95, 103
Elektrik	15, 17
Elektrikli havya	35, 36
Elektroforez	94, 103
Elektronik termometre	76, 80
Elektrot	87, 93
El değirmeni	83, 86
El pompası	21, 22
El refraktometresi	71, 72
Emme	63
Emniyet alet ve ekipmanları	1, 5
Emniyet bilgileri	43
Emniyet gözlüğü	3, 4, 5
Emülsiyon homojenizatörü	84, 86
Erime noktası tayini için banyo	79, 80
Erime noktası tayin tüpü	79, 80
Erlenmayer	56, 59
Eter ekstraksiyon cihazı	97, 103
Etiket	2, 5, 37, 39 43, 44
Etiket yazıcısı	37, 39
Etiket yeri	120
Evaporatör	109, 110
Ezme, parçalama ve karıştırma aletleri	81

- F -

Fırın	73, 80, 99, 100 103
Fırça	29, 32
Fiş	15, 16, 74
Fitil	78
Flaş evaporatör	109, 110

Florometre	92, 93
Flowmetre	92, 93
Fren	98

- G -

Garantili	43
Gaz	13, 14, 18, 19 78, 80
Gaz ayarı	77
Gaz ölçümü	111, 112
Gaz tüpü	18
Gaz tüpü emniyet kemeri	18, 19
Giriş	20
Giriş borusu	13, 64, 65, 124
Gösterge	18, 20, 21, 85
Göstergeli termometre	76, 80
Göz yıkamak için çeşme	2, 5

- H -

Hacim pipeti	62, 67
Hacimli balon	66, 67
Hassas terazi	68, 72, 100, 103
Hava	12, 14, 20, 22
Hava ayarı	77
Hava filtresi	20
Havagazı	13
Havan ve tokmak	81, 86
Hazne	118
HCl	42
Hesap makinası	38, 39
Hidroklorik asit	42, 44
Hız	81, 89
Hız kontrolü	82, 89
Hız göstergesi	89
Hidrolik pres	85, 86
Hidroksit	42, 44
Hidrometre	70, 72
HNO ₃	42
Homojenizatör	84, 86
Hortum bağlantısı	18
Hot plate	73, 80
Hot plate yükseklik ayarı	97
H ₂ SO ₄	42
Hüni	95, 103, 104 105, 107
Hücre	91, 93
HW	12

Isı kuşağı	74, 80
Isı mantosu	74, 80
Isıtıcı	101
Isıtma	73, 80
Işık kaynağı	116

- İ -

İçecek tüpü	113, 115
İlk yardım kutusu	1, 5
İmbik (damıtıcı)	108, 110
İmpinger	106, 107
İnce ayar	116
İnce tabaka kromotografisi	96, 103
İnkübatör	73, 80
İşaret	2, 5

- J -

Jel elektroforezi	94, 103
-----------------------------	---------

- K -

Kaba ayar	116
Kaba dereceli silindir	64, 67
Kafes	113, 115
Kağıt mendil	29, 32
Kalem	37, 38, 39
Kalın uçlu kalem	37, 39
Kalsiyum hidrokisit	42, 44
Kanca	114
Kap	27, 32, 99, 103 113, 115, 118, 119 120, 121, 123
Kap tipi malzemeler	56, 59
Kapak	18, 29, 57, 59 78, 122
Kapak ayar kolu	77
Kapaklı deney tüpü	122, 123
Kapı	6, 23
Kapillar cam boru	50, 55
Karbondioksit	23, 24, 25
Karga burnu	33
Karıştırıcı	81, 86
Kasnak	83, 89
Katalog numarası	43
Kavanoz	118, 119
Kayış	4, 18, 83, 89
Kaynatıcı	77, 80
Kazıyıcı (spatula)	26, 32
Kefe	68, 69
Keldal balonu	101, 103

Keldal distilasyon ünitesi	101, 103
Keldal yakma ünitesi	101, 103
Kelebek vida	47, 48
Kepçe	26, 32
Kesici	37, 54, 55
Kilit manivelası	7
Kimyasal madde	42, 44
Kimyasal madde etiketi	43, 44
Kiprit	78, 80
Kıskaç	18, 19, 47, 48 49, 51, 55, 60 61, 83
Kıskaç tutucu	47, 49
Kıskaçlı büret tutucu	48, 49
KOH	42
Kolon	96, 103
Koloni sayıcısı	121, 123
Konik cam kap	56, 59
Kontrol lambası	15
Koruyucu gözlüğünü tak	3, 5
Kostik	3, 5
Kova	56, 59
Kromotografi	96, 103
Kromotografi kabineti	96
Kromotografi kolonu	96, 103
Kronometre	31, 32
Kulp	56
Kül kabı (crucible)	75, 80, 105, 107
Kullanılıp atılabilen eldiven	28, 32
Kurbağacık	34, 36
Kuru buz banyosu	100
Kuru buz (CO ₂) dolabı	23, 25
Kuru buz kutusu	24, 25
Kurutma dolabı	99, 103
Kurutma fırını	73
Kurutma kabı	27, 32
Kurutma rafı	125, 126
Kutu	24, 25, 78, 121 123
Kutup	16

- L -

Laboratuvar donanımı	6, 9
Laboratuvar el aletleri	26, 32, 33
Laboratuvar tipi el arabası	9, 10, 18, 19
Laboratuvar tipi sandalye	9, 10
Laboratuvar tipi saat	30, 32
Lam	116, 119
Lamba	78, 80
Lastik boru kıskacı	60, 61
Lastik bulb	29, 32

Lastik hortum	60, 61
Lastik tıpa	57
Lavoba	11, 14
Lens mendili	117, 119

- M -

Magnetik karıştırıcı	81, 86
Makas	33, 36, 114
Malzeme dolabı	6, 7, 8
Manivela kolu	2, 30
Mantar tıpa	58, 59
Mantar delici	58, 59
Masa	7, 8, 114, 115
Maşa	26, 32
Maşalı kılkaç	51, 55
Matkap (kalem) seti	35, 36
McLead vakum ölçer	100
Mendil	29, 32, 117, 119
Mengene	35, 36
Merdiven	9, 10
Metrik	43
Mikrobiyoloji	120, 123
Mikrometre	117, 119
Mikroskop	116, 119
Mikrotom (kesit alma cihazı)	118, 119
Miktar	43
Mineral uzaklaştırıcı	109, 110
Model	45
Molekül modelleri	45
Motor	20, 83, 89
Musluk	11, 12, 14

- N -

NaOH	42
Naylon torba	27, 32
Nem ölçme terazisi	100, 103
Neşter	114
NH ₄ OH	42
NİT	13
Nitrik asit	42, 44
Not defteri	26, 32

- O -

Objektif	116
Ofis tipi çalışma masası	7
Ohm	88, 93
Oksijen (O ₂)	13, 14
Oküler	116
OSHA	43

Otoklav	77, 80, 121, 123
Otomatik bret	65, 67
Otomatik rnek alıcı	95, 103
Otomatik pipet	63, 67
Oksi	13

-  -

lu alet ve cihazları	87, 93
lu silindiri	63, 67
nlk	27, 32
rnek alıcı	95, 103
rnek koyma yeri	98
ze ve ine	122, 123
zgl aırlık terazisi	69, 72

- P -

Parmak	28
Patlayıcı (explosive)	2, 5
Pense	33, 36
Pergel	98, 103
Periyodik cetvel	40, 41
Petri kutusu	120, 123
Petri kutusu sterilizasyon kabı	121, 123
PH	87, 88, 93
pH metre	87, 93
Piknometre	70, 72
Pil (arz olabilir veya olamaz tip)	16, 17
Pil arjer (arz aleti)	16, 17
Pipet	29, 32, 62, 63
	65, 67, 126
Pipet emicisi (zararlı sıvılar iin)	63, 67
Pipetlik (yıkama iin)	124, 126
Plastik hortum	60, 61
Plastik su iesi	28, 32
Polarimetre	71, 72
Pompa	20, 22, 66, 67
Pompa hareket vanası	20
Porselen kap	27
Potasyum hidroksit	42, 44
Priz	15, 17
Punch	58

- R -

Rack	124, 125, 126
Radyasyon tehlikesi	3, 5
Raf	6
Referans elektrot	87
Refraktometre	71, 72

Regülatör	18, 19
Respirometre	111, 112

- 8 -

S (es) boru	11
Saat	30, 32
Saat camı	53, 55
Saat kolu	31
Sabit donanım	11
Safiyet tablosu	43
Saf su cihazı	108
Sandalye	9
Santrifüj	89, 93, 98, 103
Santrifüj başı (rotoru)	90, 93
Santrifüj tüpü	90, 93
Sayaç	121, 123
Sayım haznesi	117
Scanning densitometre	94, 103
Seloteyp (bant)	37, 39
Seri numarası	43
Sıfırlama düğmesi	121
Sıvı hacim ölçme malzemeleri	62
Sıcak	3, 5
Sıcaklık kontrol düğmesi	73, 97
Sıcaklık kontrol ünitesi	75
Sıcak soğuk karıştırma musluğu	11, 14
Sıcak su	12, 14
Sifon	13, 14
Silindir	18, 19, 63, 67
Silindir coupling	18
Sodyum hidroksit	42, 44
Soğuk depolama	23, 25
Soğuk su	12, 14, 52, 108
Soğutucu	52
Soksilet cihazı	97, 103
Spatula	26, 32
Spektrofotometre	91, 93
Spektrofotometre tüpü	91, 93
Standart traşlı cam	51
Standart traşlı cam ekleme	51, 55
Steril	3, 5
STM	12
Su	1, 12, 14, 52 108
Su banyosu	75, 80
Su basıncı	21
Su çıkışı	21
Su ısıtıcısı	74, 80
Su trompu	21, 22
Sülfürik asit	42, 44
Süzgeç destegi	106, 107

Süzgeç kağıdı	104, 107
Süzme	104, 105, 107
Süzme erleni	105, 107
- Ş -	
Şarz aleti	16, 17
Şırınga tipi pipet	62, 67
Şişe	28, 32, 56, 59 70, 72, 98, 103 120, 123
- T -	
Tahliye borusu	124
Tapa	52
Tappet (tripper)	30
Tartım ve örnek kompozisyonu	68
Taşıma	11, 13
Taşıma kabı	64, 65
Taşınabilir laboratuvar donanımı	9
Taşıyıcı	90, 93
Tedbirli ol	2, 5
Tehlike etiket ve işaretleri	2, 5
Tehlike	3, 5
Tekerlek	9
Tel keser (pense)	33, 36
Telefona	2, 5
Temizlik malzemesi (sabun vb)	29, 32
Teneffüs cihazı	4, 5
Teneke makası	33, 36
Terazi	68, 72
Termometre	76, 80, 89, 99
Termostat	74
Termus	24, 25
Tetik veya zemberek	1, 35
Tıpa	57, 59
TLC	96, 103
Top ve yuva şeklinde ek (cam malzelerde)	51, 55
Toplama kabı	108
Tornavida	34, 36
Tornavida tipi anahtar takımı	34, 36
Transformotor	15, 17
Tulumba	62
Tüp	79, 80, 90, 93 113, 115, 122, 123
Tüp (gaz)	18, 19
Tüp sehpası	53, 55, 122
Turnusol kağıdı	88, 93
- U -	
Uç	35, 37

Ufak şişe 57, 59

- ü -

Üç ayak (11 ızgara) 47, 49
 Üç kollu terazi 68, 72
 Üst 23, 24
 Üstten kefeli hassas terazi 69, 72

- v -

VAC 13
 Vakum 13, 14, 20, 21
 22, 106
 Vakum girişi 20
 Vakum göstergesi 20, 73, 100
 Vakum kurutma dolabı 100, 103
 Vakum pompası 20, 22, 100
 Vakum ve basınç pompası 20, 22
 Vana 13, 14, 18, 20
 52, 55, 65, 66
 67
 Viskoizimetre 70, 72
 Voltaj ayar düğmesi 15
 Volt metre 88, 93

- y -

Yağ haznesi 20
 Yağ seviyesi 20
 Yakma fırını 75, 80
 Yangın örtüsü (battaniye) 1, 5
 Yangın söndürücü 1, 5
 Yan kol 79, 105, 108
 Yazıcı 102, 103
 Yelkovan 31
 Yeri (kaynağı) 43
 Yıkama 124, 126
 Yiyecek kabı 113, 115
 Yogunlaştırıcı 52, 55, 97, 100
 101, 108
 Yüksek basınç 3, 5

- z -

Zaman 30
 Zamanlayıcı 30, 32
 Zehir 3, 5
 Zincir 114