2016

6.0.C.1 Hands-on Phase Properties of Gases

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Task 1 Review experimental work from Thursday

A) Assign a Manager, Recorder, Spokesperson, Reflector

Decide so that the person with least experience with that role takes it on.

There is a role reminder sheet at table

Recorder should keep track of important responses starting at C.

If Question arise, write those down on back of Recorder Report.

The Reflector will have a specific task – I will give that to them privately.

B) Once organized:

- Describe what you did for experiments A and B (remember you split that work up)
- Share your results.
- Review your results for expt C (which you all did).

C) Review of class data handouts for all the experiments.

Expt A: volume of syringe vs temperature

1) Review results from all 6 groups on front side of page.
   What data seems to be OK? What data seems not OK? Speculate as to why the problematic data may be problematic.
2) Look on the reverse.
   What did I do to the data? What are the lines I've drawn?
   Is this behavior consistent with:
   a) the simulation results
   b) when you played with liquid nitrogen – what was the liquid nitrogen doing?
3) For your data (or for mine if you data is not shown), calculate what the temperature is when the gas volume goes to zero. When you have a number, Spokesperson should write in on the board.

Expt B: sublimation of dry ice in syringe

1) What does sublimation mean?
2) What is dry ice? Why is it called that?
3) Look at the class data to see whether your results are consistent.
4) Sketch a rough to-scale picture of the size of the dry ice relative to the volume of gas.
5) Convert your picture into a molecular level picture (what would before and after look like if this were a simulation like the PhET)

Expt C: compressibility of substances in syringe

1) What types of substances are compressible?
2) Sketch a molecular level picture of a solid, a liquid, and a gas, such that the picture helps you explain the results.
3) Is what you conclude here consistent with your experimental results in Expt B? How so?
4) In the gas phase, what is in between the particles?

Christopher F. Bauer, Principal Investigator.
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Task 2 Discussion of Readings

You may address these in any order you wish. If Questions occur, please make note of them on the Recorder Report form (use a new one).

a. Hauksbee:

- What was he studying?
- What was his explanation for the behavior he found?
- What alternative explanation can you propose that is related to what we've recently considered?

b. Rumsford

- What was he studying?
- What did he conclude? How related to Hauksbee's model?
- What did he do that makes his conclusion perhaps more compelling?
- What fun facts did you learn about Count Rumsford?

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RECORDER REPORT, Chem 444A "Fire & Ice"

Group Member Name	Role	Date: 10 Feb 2015
Tim Classen	Manager	
Café Frost	Recorder	
Eliza Sneeden	Reflector	
Jon Tampost	Spokesperson	
Samantha		

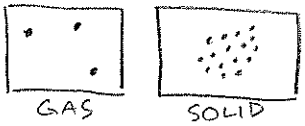
-273.71

Expt. A

C. 1. Everyone's data except ours (Samantha, Eliza, Café) because we did the experiment wrong. Problematic because we didn't depress the syringe + messed up the order of the experiment.

2. Drew a line of best fit + created an equation to show a graphed relationship.
   a. It corresponds w/ the simulation—shows that as temp increases, so does volume.
   b. Liquid nitrogen caused volume of balloon to decrease. Volume increased again when taken out of the liquid nitrogen.
3. Temp. when gas volume goes to zero: -273.31.

Expt. B

1. solid → gas
2. solid carbon dioxide, doesn't come from a liquid like reg. ice
3. yes, consistent
4. O
5. 

Expt. C

1. water, air, TFE (occasionally sand + salt)
2. 

3. Yes. Same/similar results found.
4. air (?), energy (?) heat (?)

RECORDER REPORT, Chem 444A "Fire & Ice"

Group Member Name	Role	Date: 2/10/14
Heather Price	Recorder	
Amanda Jancas	Reflecter	
Taylor Witkiewicz	Spokesperson	
Kaleigh Zukowski	Manager	

C.) Expt A: 1) most graphs seem to reflect an upward slope except one which shows a more constant slope. This could have been due to human error.

2) He figured out the line of best fit and changed the scales to better illustrate the upward slope.

a) Yes, it is consistent with PhET. As temp. increases, volume increases.

b) When we stuck objects into liquid nitrogen, it decreased its temperature, thus decreasing its gas volume (the balloon). It expanded instantly when returned to room temperature.

3) $y = 0.0474x + 18.785$

$0 = 0.0474x + 18.785 \Rightarrow x = -396.308$

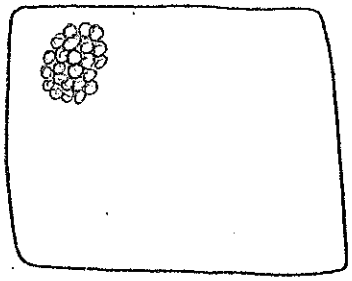
Expt B: 1) Sublimation is when an element goes from solid to gas without going through the liquid phase.

2) It's called dry ice because we don't see it in the liquid phase. It's doesn't melt into a puddle. It is solid CO_2.

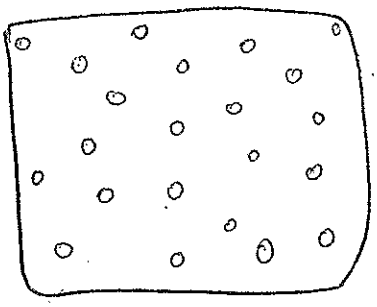
3) our data is very close the average, but nowhere near the theory.

4)

5) Before

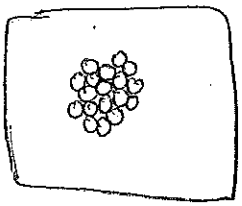


After

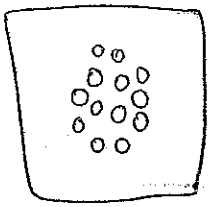


Expt. C: 1) ~~[illegible]~~ Water, TFE, and air were compressible.

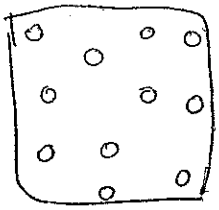
2) Solid



Liquid



Gas



when the molecules are close together, it's more difficult to compress because there's less space ~~between~~ for them to move.

3) Our diagrams are the same in terms of space between the molecules.

4) Molecules move freely in the gas phase because there is space between them.

Questions:

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RECORDER REPORT, Chem 444A "Fire & Ice"

Group Member Name	Role	Date: 1/10/14
Emma	Manager	
Jake	Recorder	
Marisa	Spokesperson	
Miriam	Reflector	

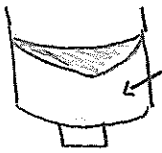
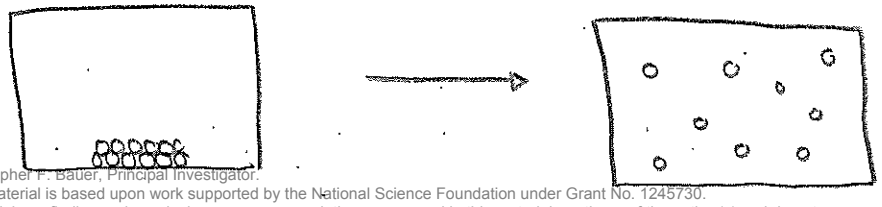
Expt A:

1. All data but one showed a positive relationship between volume and temperature. The one inconsistent group may have just not closed the valve, causing pressure to not remain constant.
2. On the reverse, CB took the last three data points and created a line of best fit for them. The relationship is consistent with simulation play when pressure is kept constant. It is also consistent with the deflation of a balloon upon contact with freezing liquid nitrogen.
3. $y = 0.0453x + 15.289$

   $(0) = 0.0453x + 15.285$

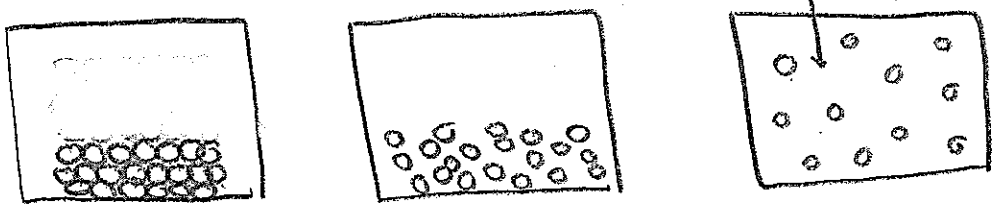
   $x = \boxed{-337.4\,^{\circ}C}$

Expt B:

1. Sublimation is when something goes directly from solid to gas
2. Dry ice is solid carbon dioxide. It's "dry" because though it looks like ice, it doesn't melt into a liquid but rather sublimates.
3. Yes they are all consistent.
4. 0 ← dry ice used =  gas produced
5. 

Expt C : 1. gasses were most compressable

2.



solid liquid gas

3. Yes. Gaseous molecules take up more space than solid molecules

4. Empty space

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RECORDER REPORT, Chem 444A "Fire & Ice"

Group Member Name	Role	Date: 2/10/15
Emily D	Reflector	
Charles C	Recorder	
Kylie R	Manager	
Mandy G	Spokesperson	

XPT A

C1) There seems to be an upward trend, with the exception to graph 3 - Samantha and Eliza. Perhaps the plunger was not closed.

C2) He made a linear regression and also eliminated graph 3 as stated above. He came up with an equation for each line. This behavior is consistent with the simulation results. The liquid nitrogen was becoming a gas, hissing, beading up when it came into contact with surfaces like the table. Left off the negative temperature data.

C3) For EmilyD and AmandaG's graph, the temperature when the gas volume goes to zero is -154.42 °C.

EXPT B

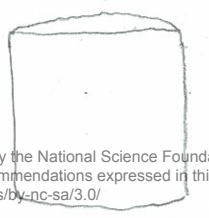
1) Sublimation is when a solid goes directly to a gas

2) Dry ice is solid CO_2. Since it goes through sublimation, it is "dry", whereas ice would melt and then evaporate.

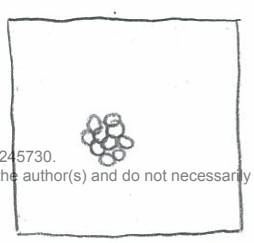
3) Our results, KR CC, are fairly consistent with the class data. However, they are pretty low. That could be a result of the size of the peice and the amount it sublimated before weighing, a loose syringe, or the time the gas level was read.

4) DRY ICE

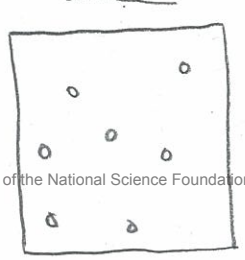
VOLUME



5) BEFORE



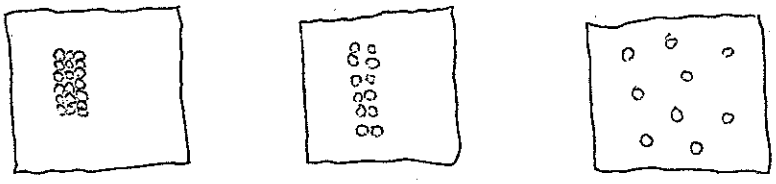
AFTER



EXPT C

1) Gases

2) SOLID LIQUID GAS



3) Yes, the solid and gas pictures show a similar idea in both experiments. Denser states have compact molecules, while gaseous spreads out.

4) Empty Space...

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RECORDER REPORT, Chem 444A "Fire & Ice"

Group Member Name	Role	Date: 2/10/15
Nick	manager	
Becky	recorder	
Emily	spokesperson	
Sean	reflector	

Experiment 5

1.) ① The graphs that show an upward or positive curve seem to look accurate. Samantha and Eliza's graph does not look accurate, as it does not show the same upward slope. The inaccuracy could be due to temperature differences, the order of steps for each experiment, the variation in how procedure was performed.

② The professor took the datapoints + graphed them. He also threw out the outliers, having only 3 points per graph. He also included the equation at the top of each graph. The line he has drawn represents a line of best fit, reflecting the average of the volume of gas + relationship with temperature. The (A) behavior is consistent with simulation results because we found that as gas volume ↑ temp ↑ which is what is depicted in the graph. ⑤ The liquid nitrogen experiment is consistent with our experiment results. For example, when the balloon was exposed to liquid nitrogen, the balloon shrunk + got cooler, indicating a ↓ in gas is correlated to ↓ in temp.

③ temp -440.5°C when gas volume goes to 0.

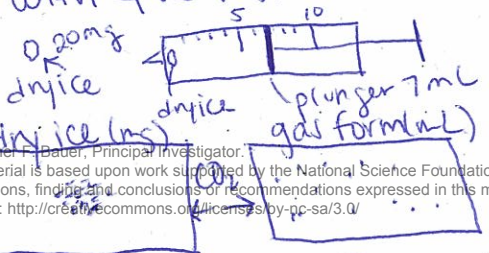
Experiment 6

① going from a solid to a gas

② dry ice is CO_2. it is called dry ice because it is cold like ice, but it never goes to liquid phase, it goes straight to gas.

③ It appears that our results seem to be relatively consistent with the rest of the classes.

④



⑤ dry ice (mg)

exhibit (1) gases, [illegible]

↳ but it was still compressible, it just went back to original mL after you release plunger.

(2) 

This shows the change in the spacing of the molecules.

(3) We feel that our results are ~~consisting~~ consistant with the solids + gas. However, ~~because~~ we could ~~not actually~~ compress the water due to the air bubble.

(4) our results are not what we discovered today since the liquid went back to the original mL.

Empty space?

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