Учреждение образования
«Брестский государственный университет имени А.С. Пушкина»

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ИНОСТРАННЫЙ ЯЗЫК (АНГЛИЙСКИЙ)

Учебно-методический комплекс
для магистрантов
(специальности 1-31 80 01 Биология, 1-31 80 06 Химия,
1-31 80 02 География, 1-31 80 03 Математика, 1-31 80 05 Физика)

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Учебно-методический комплекс ориентирован на формирование у магистрантов иноязычной коммуникативной компетенции, позволяющей использовать иностранный язык как средство профессионального и межличностного общения.
Адресован магистрантам неязыковых специальностей.

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ВВЕДЕНИЕ

Предлагаемый учебно-методический комплекс «Иностранный язык (английский)» предназначен для магистрантов специальностей 1-31 80 01 «Биология», 1-31 80 06 «Химия», 1-31 80 02 «География», 1-31 80 03 «Математика», 1-31 80 05 «Физика» и составлен в соответствии с требованиями Типовой программы-минимума кандидатского экзамена по иностранному языку / Постановление Министерства образования Республики Беларусь от 13.08.2012 N 97 и Учебной программы учреждения высшего образования по дисциплине «Иностранный язык (английский)».

Изучение иностранных языков является необходимой и неотъемлемой составной частью общеобразовательной профессиональной подготовки научных и научно-педагогических кадров. Это обусловлено интернационализацией научного общения, развитием сотрудничества специалистов и ученых на глобальном уровне и расширением сферы научного дискурса в современной коммуникации. Знание иностранного языка облегчает доступ к научной информации, использованию ресурсов Интернет, помогает налаживанию международных научных контактов и расширяет возможности повышения профессионального уровня ученого. Это подняло статус иностранного языка как общеобразовательной дисциплины, реально востребованной в практической и интеллектуальной деятельности специалиста.

Иностранный язык воплощает единство процессов общения, познания и становления личности. В этих условиях цели и задачи изучения иностранного языка сближаются с целями и задачами профессиональной подготовки и становления магистранта как исследователя, т.е. иностранный язык постигается одновременно и вместе с наукой как форма, в которую облекается научное знание в соответствии с условиями научного общения. Курс изучения иностранного языка носит, таким образом, профессионально-ориентированный и коммуникативный характер.

Необходимость подготовки специалиста, способного быстро ориентироваться в постоянно изменяющихся условиях современной жизни, усваивать большое количество новой информации, а также широкое развитие международных контактов, тенденции к интернационализации международной жизни, осознание того, что образование в современном мире становится одним из решающих компонентов в ценностных ориентациях людей, повышение требований к подготовке специалистов – все это обусловило необходимость определения основной цели и сопутствующих задач обучения иностранному языку как средству коммуникации в сфере профессиональной деятельности.

Целью изучения дисциплины является овладение иностранным языком как средством межкультурного, межличностного и профессионального общения в различных сферах научной деятельности.

В процессе достижения указанной цели реализуются коммуникативные, когнитивные и развивающие задачи.

Коммуникативные задачи включают обучение следующим практическим умениям и навыкам:

- свободного чтения оригинальной литературы соответствующей отрасли знаний на иностранном языке;
- оформления извлеченной из иностранных источников информации в виде письменного перевода, реферата и устной аннотации;
- устного общения в монологической и диалогической форме по специальности и общественно-политическим вопросам (доклад, сообщение, презентация);
- письменного научного общения на темы, связанные с научной работой магистранта (научная статья, тезисы, доклад, перевод, реферирование и аннотирование);
- различения видов и жанров справочной и научной литературы;
- использования этикетных форм научного общения.

Когнитивные (познавательные) задачи включают приобретение следующих знаний и навыков:

- развития рациональных способов мышления: умения производить различные логические операции (анализ, синтез, установление причинно-следственных связей, аргументирование, обобщение и вывод, комментирование);
- формулирования цели, планирования и достижения результатов в научной деятельности на иностранном языке.

Развивающие задачи включают:

- способность четко и ясно излагать свою точку зрения по проблеме на иностранном языке;
- способность давать оценку другой точке зрения по научной проблеме, готовность к выработке общей позиции в условиях различия взглядов и убеждений;
- готовность к различным формам и видам международного сотрудничества (совместный проект, грант, конференция, семинар и др.), а также к освоению достижений науки в странах изучаемого языка.

В результате изучения дисциплины «Иностранный язык (английский)» магистрант должен **знать:**

- нормы литературного произношения английского языка;

- грамматический строй языка, включая морфологию и синтаксис;
- общеупотребительную, научную и профессиональную лексику английского языка;
- приемы и методы межкультурной коммуникации на английском языке;
- способы построения фразы, предложения;
- этикетные формы межличностного общения.

В результате изучения дисциплины «Иностранный язык (английский) магистрант должен **уметь:**

- использовать английский язык в ситуациях речевого общения, связанных с будущей профессиональной деятельностью специалиста;
- свободно читать оригинальную литературу соответствующей отрасли знаний на иностранном языке;
- излагать содержание извлеченной из иностранных источников информации в форме резюме, аннотации, перевода, реферата;
- составлять тезисы доклада, сообщения по теме исследования;
- составлять заявку на участие в научной конференции;
- вести научную переписку (в том числе через Интернет);
- владеть навыками составления делового письма;
- различать виды и жанры справочной и научной литературы;
- вести устное общение в монологической и диалогической форме по специальности и общественно-политическим вопросам (сообщение, презентация, беседа за круглым столом, дискуссия, подведение итогов и т.п.);
- пользоваться эффективными формами самостоятельной работы в процессе овладения иностранным языком и рациональными приемами поиска и использования иноязычной информации в научно-исследовательской и практической деятельности.

Учебно-методический комплекс ориентирован на формирование у магистрантов иноязычной коммуникативной компетенции будущего специалиста, позволяющей использовать иностранный язык как средство профессионального и межличностного общения. Такие виды речевой деятельности, как чтение, говорение, письмо и перевод используются на протяжении всего курса. Данный подход учитывается в содержательной структуре УМК.

Объем материала является достаточным для достижения сформулированной цели обучения. УМК включает тексты и упражнения для обучения чтению, а также тексты и упражнения, направленные на развитие определенных навыков разговорной речи, письма и перевода.

Аудиторная работа магистранта под руководством преподавателя осуществляется путем групповых занятий различного характера (установочных, практических, контрольно-закрепительных).

В УМК представлены оригинальные материалы общепрофессиональной направленности. В соответствии с учебной программой практический раздел включает 3 части:

1. Higher education. Degrees.
2. Science and Technology.
3. My Scientific Research.

При работе с текстами основное внимание уделяется обучению магистрантов различным видам чтения. Большинство текстов ориентировано на изучающее чтение, а задания к ним включают систему послетекстовых упражнений, способствующих анализу и пониманию содержательной структуры текста. Ряд текстов предназначен для ознакомительного чтения, которое предполагает знакомство с содержанием предлагаемого текстового материала. Проверка понимания осуществляется путем ответов на вопросы. В разделе присутствуют тексты, ориентированные на развитие навыков просмотрового чтения, при котором достаточно получить общее представление о теме и содержании текста.

Каждая из вышеназванных частей включает тексты для аннотирования и письменного перевода, которые направлены не только на развитие соответствующих компетенций магистрантов, но и на обеспечение качественной подготовки к сдаче экзамена по иностранному языку. Тексты информационно насыщенны и могут иметь широкий спектр применения от аудиторных занятий до активизации самостоятельной работы магистрантов.

Дополнительные тексты для чтения и обсуждения соответствуют тематике глав и представляют богатый материал для расширения лексического запаса, развития творческого мышления, навыков свободного говорения и ведения аргументированной дискуссии.

УМК содержит материалы текущей аттестации, которые представлены лексико-грамматическими тестами, предназначенными для итогового контроля усвоения программного материала, а также текстами, направленными на развитие умения составления аннотаций на английском языке. Данные тексты обеспечивают повышение общеобразовательного и профессионального уровня магистрантов.

Промежуточный контроль осуществляется

1) по устным темам – в форме монологического высказывания, диалогов, беседы с преподавателем;

2) по текстам – в форме разработанных комплексных заданий, составления аннотаций и рефератов, выборочного письменного перевода;

3) по лексике и грамматике – в виде выполнения лексических и грамматических упражнений и тестов по изученным темам.

Итоговый контроль знаний, умений и навыков магистрантов осуществляется в форме экзамена в конце всего курса.

УМК включает глоссарий научных терминов, а также перечень учебных изданий и информационно-аналитических материалов, рекомендуемых при изучении данной учебной дисциплины. Перечень учебных изданий и информационно-аналитических материалов включает список рекомендуемой литературы и электронных образовательных ресурсов, который поможет обучающимся ориентироваться в источниках информации по предмету.

Требования к практическому владению видами речевой деятельности

Обучение различным видам речевой деятельности должно осуществляться в их совокупности и взаимной связи с учетом специфики каждого из них. Управление процессом усвоения обеспечивается четкой постановкой цели на каждом конкретном этапе обучения. Определяющим фактором в достижении установленного уровня того или иного вида речевой деятельности является требование профессиональной направленности практического владения иностранным языком.

Чтение

Свободное чтение научного текста предусматривает формирование умений вычленять опорные смысловые блоки в читаемом, определять структурно-семантическое ядро, выделять основные мысли и факты, находить логические связи, исключать избыточную информацию, группировать и объединять выделенные положения по принципу общности, а также формирование навыка обоснованной языковой догадки (на основе контекста, словообразования, интернациональных слов и др.) и навыка прогнозирования поступающей информации.

Обучающийся в магистратуре должен:

• владеть навыками чтения аутентичных текстов научного стиля (монографии, научные журналы, статьи, тезисы);

• владеть всеми видами чтения научной литературы (изучающее, ознакомительное, просмотровое, поисковое), предполагающими различную степень понимания и смысловой компрессии прочитанного;

• уметь варьировать характер чтения в зависимости от целевой установки, сложности и значимости текста.

В качестве контроля понимания прочитанного в зависимости от вида чтения используются ответы на вопросы, подробный или обобщенный пересказ прочитанного, передача его содержания в виде перевода, реферата или аннотации. Все виды чтения должны служить конечной цели – научиться свободно читать и понимать иностранный текст по специальности.

Критерием сформированности навыков чтения на протяжении курса может служить приближение темпа чтения про себя к следующему уровню: для ознакомительного чтения с охватом содержания на 70 % – 500 печатных знаков в минуту; для ускоренного, просмотрового чтения – 1000 печатных знаков в минуту.

Говорение

В целях достижения профессиональной направленности устной речи навыки говорения должны развиваться во взаимодействии с навыками чтения. Обучающийся в магистратуре должен уметь:

- подвергать критической оценке точку зрения автора;
- делать выводы о приемлемости или неприемлемости предлагаемых автором решений;
- сопоставлять содержание разных источников по данному вопросу, делать выводы на основе информации, полученной из разных источников о решении аналогичных задач в иных условиях.

Монологическая речь

В области монологической речи обучающийся должен уметь:

- логично и целостно как в смысловом, так и в структурном отношениях выразить точку зрения по обсуждаемым вопросам;
- составить план и выбрать стратегию сообщения, доклада, презентации проекта по проблеме научного исследования;
- устанавливать и поддерживать речевой контакт с аудиторией с помощью адекватных стилистических средств.

Диалогическая речь

В области диалогической речи обучающийся должен уметь:

• соблюдать правила речевого этикета в ситуациях научного диалогического общения;

• вести диалог проблемного характера с использованием адекватных речевых форм;

• аргументированно выражать свою точку зрения.

Письмо

Магистрант должен уметь:

• логично и аргументированно излагать на письме свои мысли, связанные с тематикой научного исследования;

• соблюдать стилистические особенности научного текста;

• излагать содержание прочитанного в форме резюме, аннотации и реферата.

Перевод

Устный и письменный перевод с иностранного языка на родной используется как одно из средств овладения иностранным языком, как наиболее эффективный способ контроля полноты и точности понимания содержания.

Обучающийся в магистратуре должен:

• владеть необходимым объемом знаний в области теории перевода;

• иметь навыки компенсации потерь при переводе, контекстуальных замен, различать многозначность слов, словарное и контекстуальное значение слова, значения интернациональных слов в родном и иностранном языке и т.д.;

• уметь адекватно передавать смысл научно-технического текста с соблюдением норм родного языка;

• владеть навыками преобразования исходного материала, в том числе реферативного перевода научного текста.

СОДЕРЖАНИЕ УЧЕБНОГО МАТЕРИАЛА

I. Лексико-грамматический курс.

1.1. Parts of Speech. Types of Questions. The Noun. The Category of Case and Number. The Use of Articles.

1.2. The Adjective. Degrees of Comparison. Употребление выражений-клише.

1.3. Different Types of Pronouns. Adverbs. Degrees of Comparison. Фразы-клише для реферирования и аннотирования текстов.

1.4. The Verb. Simple, Continuous, Perfect and Perfect Continuous Tenses. Future Tenses. Passive Voice. Tenses in Passive Voice: Difficulties in Translation.

1.5. Modal Verbs. Modal Verbs and their Equivalents. Употребление фраз-клише для ведения дискуссии.

1.6. Shall/will in Request and Order. Constructions with Participles.

1.7. Gerund. Forms and Functions. Constructions with Gerund.

1.8. The Infinitive. Forms and Functions. Infinitive Cnstructions. Complex Object. Complex Subject. Modal Verbs with the Infinitive: Active and Passive.

1.9. Conditional Type I, II, III. Wish-constructions. To…for…purpose. False Friends of Interpreters. Review of Subjunctive Mood.

II. Работа с текстами общей научной тематики с целью перевода, реферирования, аннотирования.

2.1. Higher Education in Belarus.

2.2. Higher Education and Academic Degrees in Great Britain. The Development of Higher Education in the USA.

2.3. Science. The Importance of Science. The Branches of Science.

2.4. How Scientists Work.

2.5. The History of Science. The Scientific Revolution.

2.6. The Age of Reason. The Future of Science.

2.7. The Development of Science in Belarus. Science in Great Britain.

2.8. Scientific Projects. Scientific Cooperation in Research.

2.9. Nobel Alfred Bernard. Nobel Prizes for Physics and Chemistry.

III. Развитие речи в диалогической и монологической форме по ситуациям научной и общественно-социальной тематики:

3.1. Область науки, в которой работает магистрант и её достижения. Формулировка проблемного поля, в котором выполняется научное исследование магистрантом.

3.2. Формулировка актуальности, новизны и практической значимости научной работы магистранта. Перечисление методов, используемых в научном исследовании.

3.3. Описание эксперимента, практической части исследовательской работы и статистического / математического аппарата работы.

3.4. Личное участие в научных проектах, конференциях, симпозиумах. Международные научные контакты университета, кафедры, ученых. Участие в международных проектах, получение грантов.

3.5. Формулирование гипотезы научного исследования магистранта. Обоснование эффективности исследования.

3.6. Симуляция научной дискуссии в виде дебатов в форме полилога о спорных направлениях в современной науке. Ролевая игра по заранее подготовленному сюжету.

3.7. Выступление с публичной речью (докладом) по своей научной тематике в учебной аудитории. Мультимедийная презентация на английском языке.

3.8. Составление и апробация в аудитории коллег общей информации о себе и своей научной деятельности для её презентации на экзамене.

IV. Работа с текстом научной монографии.

4.1. Контроль индивидуального письменного перевода.
4.2. Коррекция и рецензирование первой части реферата.
4.3. Коррекция и рецензирование второй части реферата.
4.4. Публичная защита текста реферата.

UNIT I

HIGHER EDUCATION. DEGREES

I. Read the text and sum up what it says about

- education and knowledge;
- system of higher education in Belarus;
- institutions of higher education in the Republic of Belarus.

HIGHER EDUCATION IN BELARUS

Knowledge is very important in modern life; it helps young people choose a profession according to their brain and abilities, be active, useful citizens of the country, develop the national economy. Only highly qualified specialists can solve the most complex problems facing our society. "An educated person is one who knows a lot about many things. He is also finding out more about the world around him." Knowledge, science and culture open prospects for the future. Scientific and intellectual potential is the main strategic resource of Belarus. Development and enhancement of the national educational system is the top priority of the public policy.

The republic is reforming its system of education today with the aim of creating an independent national school, corresponding to international standards and ensuring each citizen the right to the high-quality education according to his abilities.

Another important issue is the control over the quality of education. Regardless of the pattern of ownership all educational establishments are subject to accreditation procedure, which takes place every five years. Accreditation is aimed to confirm the adequate quality and contents of education and graduate training, which should meet the requirements of established educational standards.

Institutions of higher education in the Republic of Belarus fall into four major types: *University, Academy, Institute and Higher College*. University carries out fundamental research in a wide range of natural sciences, humanities and other sciences, culture. University is the centre of developing education, science and culture. University trains specialists at all levels of higher education over a wide range of fields of study. Academy trains specialists at all levels in one field of study, carries out applied and fundamental research, mainly in one branch of science or engineering. Institute trains specialists, as a rule, at the first level of higher education in a number of specialties of one field of study. Higher College trains specialists at the first level of one or several specialties.

Altogether there are 55 higher educational establishments, of which 45 are state owned, 10 are private and 2 are run by religious organisations. Every establishment occupies its particular niche in training highly qualified specialists for various branches of national economy. They prepare students in more than 320 specialties and in over 1,200 majors. All higher educational establishments are subordinate to the Ministry of Education of the Republic of Belarus.

The oldest higher educational institutions of the country are the Belarusian Agricultural Academy; the Belarusian, Mogilev and Vitebsk State Universities; the Belarusian Polytechnic Academy; Vitebsk Veterinary Medicine Academy.

Higher educational establishments provide a two level system of higher education. The 1st-level (stage) education is completed by passing the examinations and/or defending a diploma thesis. The students, who successfully completed the education, are issued a diploma and awarded a qualification (a Bachelor’s Degree). A more stringent selection and much more advanced 2nd-stage curriculum (for obtaining the Master’s Degree) allow perfectly educated intellectual elite to be formed. Also after university graduation young specialists have the possibility to get a postgraduate education. Here training of the scientific personnel with highest qualifications is conducted with granting scientific degrees of Candidate of Science (equivalent of PhD) and Doctor of Science. Curricula and programmes take into account both specific features of the national system of higher education and necessity of its integration into the world’s educational space. The curriculum structure includes disciplines of humanitarian, general scientific and general professional type, special disciplines, specialisation disciplines.

High demand for higher education led to high entrance competition regardless of the form of study or specialty. The rules of enrollment to the institutions of higher education provide for unified conditions for admission. In order to obtain free education an applicant has to pass the compulsory centralised testing in two or three admission disciplines. The entrants who passed the entrance exam successfully but did not win the competition (did not get the necessary entrance score) have the opportunity to study on their own account. As regards tuition fee, it does not significantly exceed education costs.

Three forms of learning are available at Belarusian higher educational establishments: full-time, evening and by correspondence. Full-time learning is the most widespread and in the greatest demand with 2/3 of the students. Full-time students with positive grades receive a monthly allowance. Its size depends on a student's academic success. Some groups of students are granted social allowances; the most gifted young people can also apply for scholarships from a special President fund on social support of gifted students. Less than 1 % of students use evening form of learning and over 35 % learn by correspondence. These forms of learning are a good opportunity for persons with financial, age, physical and other limitations.

External studies represent another form of receiving higher education. It is based on the independent study of subjects from regular curriculum. This form is available to persons with secondary education, who cannot study full-time or leave their workplace. Diplomas are granted to external students on a regular basis.

The efficiency of any form of learning is ensured by qualified teaching staff including a large number of candidates and doctors of science, associate professors and professors.

Higher education in Belarus does not only mean lectures, seminars and exams. In addition, Belarusian students participate in international scientific conferences and competitions, student exchange programmes. Belarusian teams take first places at competitions in mathematics, economics and programming. However, organisation of the educational process is not the only concern of the Higher School. Much attention is paid to students' living conditions, providing non-residents with hostel accommodation. University administration renders assistance in conducting leisure activities of students (sports meetings, festivals, tourist programmes).

After graduation budget students are provided with the first workplaces. Belarus has a bilateral agreement on mutual recognition of education certificates with dozens of the world countries. Belarusian specialists are much in demand in the world.

Belarusian education is ranked among the best ones and intellectual resources are the major wealth of the republic. The future of the country in many respects depends upon the quality of education received by its citizens.

1. Answer to the following questions.

1) What is education?
2) What is the role of knowledge in modern life?
3) Why do you think so much attention is given to education in our country?
4) What helps make a person educated?
5) What is the aim of the reforms in the system of education?
6) What types of higher educational establishments does national system of education have? Speak about the chief functions of each type.

7) How many higher educational establishments are there in Belarus?
8) How many years does training take?
9) What are the entrance requirements?
10) What are the main forms of learning?

2. Find words defined by the following:

1) charge or payment for professional advice or services; cost of examination;
2) a person with authority to maintain discipline, the head of a department of studies;
3) a list of all the courses of study offered by a university;
4) the principal field of study of a student at a university;
5) a person who applies, a candidate;
6) permission to enter;
7) a person who has been awarded the first degree from a university.

3. Choose the appropriate word.

1) My friend wants to … in a college in our city.
   a) enroll b) go c) attend
2) My sister has several opportunities to get a university degree, but she wants to talk this … with our parents.
   a) back b) over c) into
3) She received a … to pay university expenses.
   a) scholarship b) loan c) major
4) What is your … at university? Someone told me you were studying economics.
   a) major b) teacher c) class
5) Though it is rather difficult, she is working really hard to … good grades and work part-time.
   a) analyse b) conserve c) maintain

4. Fill in the missing word to complete the sentences below.

1) The Belarusian system of … education includes educational and research institutions that use unified standards in the processes of teaching, management, assessment and research.
   a) higher b) secondary c) post-graduate
2) Those who have successfully completed the 1^{st}-level (stage) education may be given a … degree.
   a) Master's b) Bachelor's c) Doctor's

3) … carries out fundamental research in natural sciences, humanities and other sciences.

a) Academy b) University c) Institute

4) All educational establishments are subordinate to the … of the Republic of Belarus.

a) President b) Ministry of Education c) Government

5) … forms of learning are available at Belarusian higher educational establishments.

a) Three b) Two c) Four

6) … form of learning is for those with secondary education, who cannot leave their workplace.

a) full-time b) evening c) part-time

7) … disciplines constitute a major portion of disciplines in the curriculum structure.

a) specialisation b) general professional c) extra-curricular

8) The Ministry of education adopted the decision of introducing … scale.

a) 5-grade b) 10- grade c) 100-grade

5. Use the following words in the sentences given below.

majoring in	***at the end of the tunnel***	***accomplishment***
tuition	***talk it over***	
realistic	***switch***	

1) My younger sister is … literature.

2) You should be proud of yourself. Graduating from university is a real … .

3) I'm thinking about majoring in physics, but I need to … with my parents.

4) Studying medicine no longer interested her and she decided to … majors.

5) You have to be … about your chances of getting into that famous university.

6) Having taken University classes for 5 years, she could finally see the light … .

7) My parents gave me some money to pay for … because I can't pay university expenses on my own.

6. Give the English equivalents to the following words and expressions.

Магистрант; аспирант; преподаватель; обучение; учебный план и программа; воспитание; вечернее образование; профессиональное обучение; разностороннее образование; применять знания на практике; учиться в магистратуре (аспирантуре); вести научно-исследовательскую работу; получать степень магистра; изучать экономические науки; кандидат наук; доктор наук; сдать выпускные экзамены; правила приема в вуз.

II. Group work. a. Divide into groups of four. Each group will choose one of the texts about the systems of higher education in Great Britain, the USA, France and Germany and make a summary of their specific features. In 10 minutes each group will represent it to the class.

THE SYSTEM OF HIGHER EDUCATION IN GREAT RITAIN

The autonomy of higher-educational institutions is important in Great Britain. Its universities enjoy almost complete autonomy from national or local government in their administration and the determination of their curricula. However, the schools receive nearly all of their funding from the state. Entrance requirements for British universities are rather difficult. A student must have a General Certificate of Education by taking examinations in different subjects. If they have greater number of “advanced level” passes, in contrast to General Certificate of Secondary Education (“ordinary level”) passes, then the student has better chances of entering the university of his choice. This selective admission to universities, and the close supervision of students by a tutorial system, makes it possible for most British students to complete a degree course in three years instead of the standard four years. Great Britain’s academic programmes are more specialised than the same programmes in other parts of Europe. Great Britain’s model of higher education has been copied to different degrees in Canada, Australia, India, South Africa, New Zealand, and other former British colonial territories in Africa, Southeast Asia, and the Pacific.

THE SYSTEM OF HIGHER EDUCATION IN THE UNITED STATES

The system of higher education in the United States differs from European one in certain ways. In the United States, there is a national idea that students who have completed secondary school should have at least two years of university education. That is why there is a great number of “junior colleges” and “community colleges.” They give two years of undergraduate study. There are traditional universities and colleges, where a majority of students complete four years of study for a degree. Universities that provide four-year study courses can be funded privately or can have state or city foundations that depend heavily on the government for financial support. Private universities and colleges depend on students' payments. The state governments fund the nation's highly developed system of universities, which give qualified higher education.

In the American system, the four-year, or bachelor's degree is ordinarily given to students after collecting course "credits", or hours of classroom study. The quality of work done in these courses is assessed by continuous record of marks and grades during a course. The completion of a certain number (and variety) of courses with passing grades leads to the bachelor's degree. The first two years of a student's studies are generally taken up with obligatory courses in a broad range of subjects, some "elective" courses are also chosen by the student. In the third and fourth years of study, the student specialises in one or perhaps two subject fields. Postgraduate students can continue advanced studies or research in one of the many graduate schools, which are usually specialised institutions. At these schools students work to get a master's degree (which involves one to two years of postgraduate study) or a doctoral degree (which involves two to four years of study and other requirements).

A distinctive feature of American education is the de-emphasis on lecture and examination. Students are evaluated by their performance in individual courses where discussion and written essays are important. The American model of higher learning was adopted by the Philippines and influenced the educational systems of Japan and Taiwan after World War II.

SYSTEMS OF HIGHER EDUCATION IN FRANCE AND GERMANY

Both France and Germany have systems of higher education that are basically administered by state agencies. Entrance requirements for students are also similar in both countries. In France an examination called the *baccalauréat* is given at the end of secondary education. Higher education in France is free and open to all students who have passed this examination. A passing mark admits students to a preparatory first year at a university, which finishes in another, more strict examination. Success in this examination allows students to attend universities for other three or four years until they get the first university degree, called a *licence* in France.

Basic differences, however, distinguish these two countries' systems. French educational districts, called *academies,* are under the direction of a rector, who is appointed by the national government and is in charge of the university. The uniformity of curriculum in the country leaves each university with little to distinguish itself. That is why many students prefer to go to Paris, where there are better accommodations and more entertainment for students. Another difference is the existence in France of higher-educational institutions known as great schools, which give advanced professional and technical training. Different great schools provide scrupulous training in all branches of applied science and technology. Their diplomas have higher value than the ordinary *licence*.

In Germany, a country made up of what were once strong principalities, the regional universities have autonomy in determining their curriculum under the direction of rectors. Students in Germany change universities according to their interests and the strengths of each university. In fact, it is a custom for students to attend two, three, or even four different universities in the course of their studies, and the professors at a particular university may teach in four or five others. This mobility means that schemes of study and examination are free and individual, what is not typical for France.

Each of these countries has influenced higher education in other nations. The French, either through colonial influence or through the work of missionaries, introduced many aspects of their system in North and West Africa, the Caribbean, and the Far East. In the 1870s Japan's growing university system was remodeled along French lines. France's *great schools* have been copied as models of technical schools. German influence has come in philosophical concepts regarding the role of universities. The Germans were the first to stress the importance of universities in the sphere of research. The doctoral degree, or PhD, invented in Germany, has gained popularity in systems around the world.

b. Fill in the table with specific features of different systems of higher education.

Country	***Specific features***
Great Britain	
The USA	
France	
Germany	

III. Read the text about the system of higher education in Russia, find its distinctive features and be ready to speak about them in detail.

HIGHER EDUCATION IN RUSSIA

Higher education plays an important role in the life of any country as it provides the country with highly-qualified specialists for future development and progress. It trains people to become teachers, engineers, doctors and other professional workers. In all industrial countries standards of living are steadily changing; this means that the kind of education, which was good enough thirty years ago, is not necessarily good today.

A new system of education has been introduced in Russia – a distance education system. This computer system of learning helps working professionals continue their education while remaining at their jobs. This system enables people to get knowledge and a good foundation in the sciences basic to his or her field of study. Distance learning has developed over years from satellite video courses to modern videoconferencing through personal computers.

The academic year usually lasts 9 months and is divided into two terms (semesters). The first- and second-year students obtain thorough instructions in the fundamental sciences of mathematics, physics, chemistry and drawing as well as computer engineering and a number of others. The curricula are enriched and broadened by training in such subjects as foreign languages, history and economics.

At the third year students get more advanced knowledge and begin to concentrate on their special interests, so to say, their "major" subject and take many courses in this subject. Specialised study and courses will help students become specialists and prepare them for their future work.

After four years students will get a bachelor's degree. Then the students may go on with their studies and in a year or two of further study and research get a master's degree. After graduating from the university they may go on with their study and research and may get a still higher degree.

About 75 % of students receive state grants and 15 % are sponsored by enterprises. Universities have their own students' hostels and some of them have large and excellent sports centres.

Education is a process through which culture is preserved, knowledge and skills are developed, values are formed, and information is exchanged. Education is the way to success.

Discussion

Why do systems of higher education differ from country to country? What factors influence the development of higher education?

IV. Read the text paying attention to peculiar features of degrees. Make a plan of the text "University Degrees" and get ready to retell it according to the text.

UNIVERSITY DEGREES

A university or college awards a degree to a person who has completed a required course of study. An institution presents the degree in the form of a diploma, a document which certifies the award. The basic kinds of degrees are called bachelor, master, and doctor. An honorary degree may be awarded for an outstanding contribution to a certain field.

Most students wishing to take a degree course seek entrance to a university. In some countries students can take degree courses as external students, through correspondence and television courses.

Most universities require a good pass in the final secondary school examination, and competition is keen for entry into such faculties as medicine and law. If it is possible, a student planning to study in a university should seek information two years before completing a secondary school course. This will permit a choice of subjects appropriate for the intended course.

First degrees. First degrees are generally called bachelor's degrees. They include the Bachelor of Arts (BA) and the Bachelor of Science (BSc). The BA is given for such subjects as history, literature, fine arts, and, in some universities, for science. The BSc is given for science, engineering, and economics. Law students receive the Bachelor of Laws (LIB) in some universities, and the BA in others.

Until the late 1950s, students could take only two main types of the course: a *general,* or *pass,* course, or a *special,* or *honours,* course. Many universities still offer such courses, which last for three years. Students following the general course take three or four related subjects. Those taking the special course generally study one subject. The general courses were designed for students who wished to have general knowledge of a group of related subjects, such as science. The special courses were intended for those who wished to specialise in a specific subject, such as chemistry.

Some newer universities have tried to avoid rather narrow training provided by the special courses. They plan their studies so that all students follow the same broad course in the first year, and then study at least one science and one arts subject for another three years. Students do not specialise until the second year at the earliest. They may also study both scientific and non-scientific subjects, because the division into *families* common in many universities, has been abandoned.

In non-English-speaking countries, there is no standard name for the first degree. In France, the first degree is called the *licencie es lettres.* In Germany, it is called the *staatsexamen.* In Sweden, it is called the *filosofie kandidatexamen* (FK). The Italian *Laurea* takes the place of the first and second degrees in other countries. In Japan, the bachelor's degree is called *gakushi.* It is awarded after four years of study. In the countries of the former Soviet Union, students receive a diploma after studying for four or five years. The Candidate of Science degree is equivalent to a PhD.

When the student has passed a final examination, he or she is qualified to receive a degree. But students cannot use the letters BA, BSc, and so on, until they have been formally admitted to the degree. This process is called *graduation,* and at a university or similar institution it is a dignified ceremony. For many students, the first degree marks the end of their university education.

Higher degrees. In most universities, students must complete one or two years of advanced study beyond the first degree to obtain a second or higher degree. Many universities require a *thesis,* a written report of a special investigation in the student's main subject of study. In most English-speaking universities, second degrees are called *master's degrees.* Such degrees include the *Master of Arts (MA), Master of Arts and Economics (MEcon), and Master of Science (MSc).*

Doctorates. The doctor's degree is the highest earned degree in many countries. There are two distinct types of doctor's degrees. One is a professional degree required to practise in certain professions, such as medicine. The other is a research degree that indicates the candidate has acquired mastery of a broad field of knowledge and the technique of scholarly research. The research doctorate may require at least two or three additional years of study beyond a master's degree. The candidate may be required to complete examinations and present a written thesis or *dissertation.* The doctoral thesis represents an original contribution to knowledge, and is a more detailed study of a research problem than that required for master's degree.

In many English-speaking universities, the *Doctor of Philosophy (PhD)* degree is the most important research doctorate and may include specialisation in almost any academic subject. In some European countries, students of non-professional subjects also take a doctor's degree as the second degree. For example, the German degree *of Doctor of Philosophy (DPhil)* is the equivalent of the MA in English-speaking countries. In Russia and in Belarus, the Doctor of Science degree is awarded by a special commission. To receive this degree post-graduate students must research new and important material. In Japan the doctorate degree is called *nakushil.*

Honorary degrees. Many universities have adopted the custom of awarding honorary degrees to persons for achievement in their chosen fields. Chief among these are the Doctor of Letters (Dlitt) and the Doctor of Laws (LLD). These degrees are often given to prominent authors, scholars, and leaders in professions, business, government, and industry.

V. Read the text without a dictionary and answer the questions that follow it.

TYPES OF DEGREES IN THE USA

Bachelor's degree. The bachelor's degree, usually representing completion of a four-year course of study on a collegiate level, is the oldest and best-known academic degree, particularly under the designation of Bachelor of Arts. Some varieties of bachelor's, or baccalaureate degree are currently offered by about 750 institutions, most of which offer a Bachelor of Arts degree. Next in frequency and availability is the Bachelor of Science, of which the most frequent variety is the Bachelor of Science in Education. Other baccalaureate degrees offered by a large number of institutions are Bachelor of Education, Bachelor of Music, Bachelor of Business Administration, Bachelor of Divinity, and Bachelor of Home Economics. Most institutions offer more than one variety of baccalaureates, but about one tenth report use of the Bachelor of Arts only, regardless of the particular curriculum completed.

Currently about 900,000 baccalaureate degrees are awarded annually, about 46 % to women. It is estimated that more than 12 million degrees have been conferred to date.

Master's Degree. The earned master's degree in general represents one year of work beyond the baccalaureate, but in a few institutions or in a few fields it requires two years of graduate work. The most frequently awarded master's degrees are Master of Arts, Master of Science, Master of Education, Master of Business Administration, Master of Music, and Master of Fine Arts. The Master of Philosophy degree is conferred on those who have completed all requirements for the Doctor of Philosophy degree except the doctoral dissertation. About 45 varieties of Master of Arts and 40 varieties of Master of Science degrees are reported. Currently 317,000 individuals receive the master's degree annually, about 47 % of them women.

Doctor's Degree. The doctor's degree represents the most advanced earned degree conferred by U.S. institutions, or indeed by those of any country. In the academic sense, a doctor is an individual in any faculty or branch of learning who has attained to the highest degree conferred by a university. Doctor's degrees in the United States are of two distinct types – professional or practitioner's degrees, and research degrees.

The former represent advanced training for the practice of various professions, chiefly in medicine and law. The principal ones are Doctor of Medicine, Doctor of Dental science of Dental Surgery, Doctor of Veterinary Medicine, Doctor of Pharmacy, and Doctor of Jurisprudence. These degrees carry on implication of advanced research.

Quite different in character are the research doctorates representing prolonged periods of advanced study, usually at least three years beyond the baccalaureate, accompanied by a dissertation designed to be a substantial contribution to the advancement of knowledge. The most important of these is the Doctor of Philosophy (PhD), which no longer implies knowledge of philosophy, but which represents advanced research in any major field of knowledge. It was first awarded by Yale University in 1861 to three young men. It was modeled on the doctorate conferred by German universities. For more than half a century prior to 1861, young men desiring the most advanced training in scholarship attended the principal German and occasionally other European universities to secure their PhDs.

Second in importance and much more recent as a research degree is the Doctor of Education (EdD) currently offered by 108 institutions. It was first awarded by Harvard in 1920, but was preceded by the equivalent Doctor of Pedagogy first conferred by New York University in 1891. The only other earned doctorates of the research type currently conferred by 10 or more institutions are the Doctor of the Science of Law and the Doctor of Business Administration.

At present doctorates of the research type are earned by about 28,000 individuals annually, of which about 14 percent are women.

1. What do the Bachelor's, Master's and Doctor's degree represent?
2. What is the best-known academic degree?
3. How are Bachelor's and Master's degrees awarded?
4. What are the two types of Doctor's degrees in the United States?

VI. Read the text and answer the question: Where and when was the first degree conferred?

FROM THE HISTORY OF DEGREES

Academic degrees have been in use for about 800 years; the first one recorded was the Doctor of Civil Law conferred by the University of Bologna (Italy) in the middle of the 12^{th} century. This was followed by the Doctor of Canon Law and Doctor of Divinity and, in the 13^{th} century, by doctorates in medicine, grammar, logic, and philosophy. The use of degrees spread from Bologna to the other European universities. Originally the Doctor's and Master's degrees were used interchangeably, each indicating that the holders were qualified to teach, and the titles of Master, Doctor, and Professor were synonymous. On the other hand, the Bachelor's or baccalaureate degree (from Latin baccalaureus, a Bachelor of Arts) was used to indicate the entrance upon a course of study preparatory to the doctorate or mastership, and not achievement. Gradually, however, it came to mean successful completion of one level of study preparatory to a higher degree.

The use of academic degrees spread to British universities from the Continent and was extensively developed, especially at Oxford and Cambridge universities.

VII. Choose the right answer.

1. Modern academic education represents … .

a) 4 stages
b) 3 stages
c) 5 stages

2. An academic degree is a title awarded for … .
   a) reading lectures
   b) practical work in industry
   c) successfully completed a course of study
3. The best known academic degree is … .
   a) Bachelor's degree
   b) Master's degree
   c) Doctor's degree
4. The earned Master's degree represents … .
   a) one year of work
   b) three years of work
   c) four years of work
5. The first academic degree was conferred by … .
   a) the University of Bologna
   b) the University of Cambridge
   c) the University of St. Petersburg

VIII. a. Report on any type of degrees.
b. Present your report on the topic "Postgraduate Education in Belarus".

Discussion

Discuss the problem of determining equivalence of degrees in various countries in groups. Work out and present your own solution.

TEXTS FOR ADDITIONAL READING

THE HISTORY OF UNIVERSITY EDUCATION IN BELARUS

The universities of Europe appeared during the Middle Ages in connection with the growth of cities. In Italy, Spain, France and England first universities were founded between the eleventh and thirteenth centuries. As for Russia's oldest universities, Moscow University was founded in 1755.

Education and science have a very old tradition in Belarus. In the past Belarus was a part of the Grand Duchy of Lithuania. The oldest university in the Soviet Union was the Main School of the Grand Duchy of Lithuania, which dated from the sixteenth century and enrolled about 500 students in the beginning. It was renamed Vilnius University in 1579. During the Middle

Ages the University had a preparatory faculty, the faculty of Arts, that prepared students for entering one of the three faculties – of Law, Medicine and Theology. Later this preparatory faculty was renamed the Philosophy faculty with Latin as the main language of instruction. Students studied seven liberal arts subjects consisting of the trivium of Grammar, Rhetoric and Dialectics, followed by the quadrium of Arithmetic, Geometry, Astronomy and Music. Students became Bachelors of Arts after finishing their trivium course. On completing the quadrium, students were awarded a Master's degree. At each higher faculty a Master's degree and a Doctor's degree were conferred in accordance with the requirements of a faculty.

The University was a leader in many areas. In 1645 Vilnius University became the first university to recognise and adopt the Copernican view of the universe. A Ukrainian graduate of the University, Milenty Smotritsky, published the Old Church Slavonic Grammar. Another outstanding academician and professor of History, Philosophy and Rhetoric, Matsey Kazimezh Sarbevsky, was well known all over Europe for his Latin verses. The first works of Francisk Skaryna were published by the Vilnius University Printing House, and in 1753 an observatory was commissioned which continues to function today.

There were no institutions of higher learning on the territory of Belarus before the October Revolution. Vitebsk Pedagogical Institution and Mogilev Pedagogical Institution were founded in 1918. Vitebsk Architectural Institution functioned from 1918 till 1923. The People's Committee on Education passed a resolution in 1919 to open 15 new Soviet universities but the resolution was never implemented into life because it was the period of foreign intervention. The Belarusian Polytechnic Institution was opened in 1920; Vitebsk Veterinary Institution – in 1924; and the Medical Institution – in 1930.

The Belarusian State University was opened in 1921. The University consisted of the RABFAK (Pre-University Training subdivision for working youth), the Social Sciences Division (which trained lawyers and economists), the Medicine Division, the Agricultural Division and the Physics and Mathematics Division. The Division of Social Sciences opened its doors for the first time to 237 students. Later this division changed its name several times. Starting from 1925, it was called the Law and Economics Division, it had four branches in it, namely: Industry and Administration, Planning and Statistics, Finance and Cooperative Societies. For the first time in many years, the republic got 85 graduates from this university to work in all spheres of industry, finance and credit.

CAMBRIDGE AND OXFORD UNIVERSITIES

Cambridge is one of the two main universities of England which is located at the Cam River. It was founded at the beginning of the 12^{th} century.

The University consists of 24 different colleges including 4 colleges for women. Each college is self-governing.

The head of the University is the chancellor who is elected for life. The teachers are commonly called “dons” and “tutors”. Part of the teaching is by means of lectures organised by the University. Besides lectures, teaching is carried out by tutorial system for which Cambridge University is famous all over the world. This is a system of individual tuition organised by the colleges.

Each student has a tutor who practically guides him through the whole course of studies. The tutor plans the student’s work and once a week the student goes to his tutor to discuss his work with him. The training course lasts 4 years. The academic year is divided into 3 terms. The students study natural and technical sciences, law, history, languages, geography and many other subjects.

After three years of study a student may proceed to a Bachelor’s degree, and later to the degrees of Master and Doctor. Students are required to wear gowns at lectures, in the University library, in the street in the evening, for dinners in the colleges and for official visits. All the students must pay for their education, examinations, books, laboratories, university hostels, the use of libraries, etc. Very few students get grants. Not many children from the working class families are able to get higher education, as the cost is high. The cost of education depends on the college and specialty.

A number of great men, well-known scientists and writers studied at Cambridge. Erasmus, the great Dutch scholar, Bacon, the philosopher, Milton and Byron, the poets, Cromwell, the soldier, Newton and Darwin, the scientists are among them.

Oxford is renowned all over the world. It ranks in importance with Athens, Rome and Paris because of the stream scholars who, for hundreds of years, and particularly in the 20th century, have come to sit at the feet of learned men, and have returned to their own countries, their minds enriched with the distilled learning to be found here, and imbued with an abiding love for the place. They have absorbed the almost indefinable “spirit of Oxford”, and many of them return again and again, so strong is the pull of the place.

So many visitors want to know where the University is. In their home country, the universities are easily identifiable because they are compact, purpose-built places, and probably isolated from the domestic and commercial buildings which form the heart of the city from which they take their name.

Oxford is different. It has a golden heart – an area of less than half a square mile in which the most varied assortment of historic buildings in the world is to be found. But they do not stand in isolation; they are intermingled, in the most delightful way, with houses, shops and offices.

Over the last decade millions of pounds have been spent on restoring and cleaning the stonework of college and university buildings, which became blackened and decayed, and in many cases were in danger of disintegrating. Great care was taken in the restoration, and the result is that the university buildings present the honey-coloured facades which the great architects such as Wren and Hawksmoor created.

Interiors too, have been cleaned and restored – notably those of the Sheldonian Theatre and the Bodleian Library. Oxford is a place of great beauty, but it is not just a shrine to the past. It is a living entity and its historic buildings are the homes of masters and students whose learning, thinking and ideas have a profound influence on culture, education, science and politics, not only in England, but throughout the world.

The University did not come into being all at once. Oxford had existed as a city for at least 300 years before scholars began to resort to it. The end of the 12^{th} century saw the real beginnings of the University. It is known that early in that century distinguished scholars were lecturing in Oxford, but it had no recognition as a place of learning. In about 1184 the University became an accomplished fact as result of the migration of students who brought their own traditions with them.

It is generally assumed that between 1164 and 1169, when Henry II forbade English clerks to go to the University of Paris, which at that time was the foremost in Europe, the scholars had to find somewhere else to continue their studies. Their choice fell on Oxford. The first group of scholars at Oxford may have been joined by others from Paris, and from other parts of Britain.

There is no "university" as such. Each college is practically autonomous, with its own set of rules for its good government. There is a central administration, providing services such as libraries and laboratories.

BLACK STUDENTS GET "FEWER TOP DEGREES"

Black students at the University of Cambridge are much less likely to be awarded first-class degrees than their white counterparts.

Research into the achievements of black students has found that a significant number "clearly do not thrive in the Cambridge context".

The four-year study, carried out by researchers at the university, emphasised that the majority of black students at the university were successful.

But it also found that a "significant minority" of black students were underachieving, which was reflected in their relative lack of success at achieving the highest degree scores.

While 21 % of white students were awarded first class degrees, only 3.1 % of black students were awarded firsts. This compares with 23.7 % Indian students and 17.9 % Chinese students who scored firsts.

"Although the numbers in non-white ethnic groups are small, and particularly so for black students, the difference between black students and other students is marked enough to give cause for concern," say researchers.

Dr Joan Whitehead, from the university's Faculty of Education, said that the findings were not evidence of discrimination.

"I don't think the university is institutionally racist. I don't think a university that does its best to attract and fund overseas students from all ethnic backgrounds can be institutionally racist," said Dr Whitehead.

"This is a problem common throughout the whole of the education system. It isn't that they are all having difficulties, it just appears that more of them are having difficulties than other students."

The findings emerged from research which had been examining whether female students at Cambridge faced discrimination in the awarding of first-class degrees.

UNIVERSITY AIMS TO BE LESS ELITIST

Edinburgh University is taking radical steps to break down its exclusive image and bring in more students from poorer areas. The university will consider every student's family background as well as their exam results. Plans involve a number of initiatives to bring in more students from disadvantaged areas. The university is battling an elitist image and is failing to meet targets for widening participation.

Because of this it is planning to overhaul its admissions process to take into account more than just exam results. A new scoring system will mark students on such factors as the school they attended, their parents' jobs and whether anyone in their family has been to university. It will be the first time any Scottish university has systematically assessed all of its applicants this way. And the university said it is the first step in a much wider programme to break down its exclusive image. The institution has over 20,000 students.

The university's Principal, Professor Timothy O'Shea, said that he was "uncomfortable" with Edinburgh ranking alongside Oxford, Cambridge and St Andrews as one of the most elitist institutions in the country. He said massive demand for places at the university had resulted in its increasing the entry grades required. "As we know, the Higher and A-level entry grades are not particularly good indicators of university performance", he said.

What the University of Edinburgh has now decided to do is go for a minimum threshold rather than continuing to ratchet up grades.

University principal Professor Timothy O'Shea said the minimum grades – 4Bs at Higher or 3Bs at A-level – would still be quite high by UK standards. He said other factors that would be considered were: evidence of motivation; personal qualities; suitability and resourcefulness. Extra credit would be given if no one in the applicant's family had been to university, Professor O'Shea added.

There will also be extra credits given to disabled people and those whose schooling has been disrupted by family tragedy or some other traumatic event.

U.S. STUDENTS KNOW WHAT, BUT NOT WHY

The first-ever use of interactive computer tasks on a national science assessment suggests that most U.S. students struggle with the reasoning skills needed to investigate multiple variables, make strategic decisions, and explain experimental results.

Paper-and-pencil exams measure how well students can critique and analyse studies. But interactive tasks also require students to design investigations and test assumptions by conducting an experiment, analysing results, and making tweaks for a new experiment. Those real-world skills were measured for the first time on the science component of the National Assessment of Educational Progress (NAEP) that was given in 2009 to a representative sample of students in grades four, eight, and 12.

"Before this, we've never been able to know if students really could do this or not," says Alan Friedman, a member of National Assessment Governing Board, which sets policy for NAEP. The overall scores on the 2009 science test were released in January 2011, and today's announcement focuses on the results from the portion of the test involving interactive computer tasks.

What the vast majority of students can do, the data show, is to make straightforward analyses. More than three-quarters of fourth grade students, for example, could determine which plants were sun-loving and which preferred the shade when using a simulated greenhouse to determine the ideal amount of sunlight for the growth of mystery plants. When asked about the ideal fertilizer levels for plant growth, however, only one-third of the students were able to perform the required experiment, which featured nine possible fertilizer levels and only six trays. Fewer than half the students were able to use supporting evidence to write an accurate explanation of the results. Similar patterns emerged for students in grades 8 and 12.

"We've got our work cut out for us," says Friedman, who is also a consultant in museum development and science communication.

The computer simulations offer NAEP a much better way to measure skills used by real scientists than do multiple-choice questions, says Chris Dede, a professor at Harvard Graduate School of Education. "Scientists don't see the right answer. They see confusing situations and use methods like inquiry to get meaning from complexity. Science is a domain where paper and pencil is a poor match."

The more the test matches the domain, Dede adds, the less problematic teaching to the test becomes. Interactive computer tasks also allow examiners to speed up processes and eliminate safety concerns raised by having students perform actual hands-on tasks.

Computer simulations will continue to evolve at NAEP, which likes to call itself the nation's report card. Friedman says that so-called embedded assessments – which can provide the ability to track when students make a mistake and what they do to correct it – would be "dynamite information" to have. Keystroke data, for instance, have the potential to provide insight about the reasoning skills that students use to solve problems.

"It may give us a way to reward students who don't necessarily jump to the answer right away but show a deliberate process to get to the answer," says Friedman. It could also identify those students who have learned material without really understanding it. "There is no way to memorise for this test," says Friedman. "You really have to think on your feet."

UNIVERSITIES JOIN FORCES IN BRUSSELS

Sharing the excellence of the main technical universities in Europe and beyond, working together to find solutions to the challenges of our society, providing cross-border study programmes – these are the goals of the EuroTech Universities Alliance, which brings together four elite technical universities in Switzerland, the Netherlands, Denmark and Germany. Today, they are opening their joint office in Brussels.

The Ecole Polytechnique Fédérale de Lausanne (EPFL), the Eindhoven University of Technology (TU/e), the Technical University of Denmark (DTU) and the Technische Universität München (TUM) – these institutions are all leading centres of technical education. Together they form the EuroTech Universities Alliance, whose shared mission is to develop technically sound solutions to the major challenges of our society: energy, food, health, communication and mobility.

The partners have a shared vision. They want to join forces to create, in the fields of engineering and technology, the strongest and most innovative research and teaching programmes in Europe. Together, the EuroTech Universities will initiate large-scale, long-term projects that will generate new cross-border capacities. At the same time, they will offer transnational study programmes at all levels, from Bachelor to Master to PhD, along with summer courses as well as student and scholar exchange programmes. In order to implement the results of research in the form of manufacturing processes and marketable products, each university has strong partnerships with leading industrial and business organisations.

The EuroTech Universities bring together research, education and technology transfer for the first time under one roof, in a cross-border approach that is quite unique in Europe. The first project they will undertake this year is the "GreenTech initiative" in which each partner will invest one million euros for the development of environmentally friendly technologies.

By being built upon significant, "bottom-up" cooperative actions and programmes, established through existing relations between the researchers across the Alliance, the Brussels office will have a uniquely legitimate and informed basis in helping to shape EU research and innovation policies. Also the EuroTech Universities will be promoting dialogue between different sectors of society. In addition, they aim to encourage and enhance the professionalisation of science management.

The office of the EuroTech Universities Alliance will play a key role in this regard. Each partner university will have a representative at the office to serve as a contact person for his or her institution. The joint interests of the EuroTech Universities in relation to the European Union will be represented by Dr. Andrew Sors, a British materials scientist who has many years of experience in European research and technology policy. He has held several positions within the European Commission, including Head of a DG Research and Innovation Unit as well as the Commission's science counselor in India. He has also served as Rector of the Collegium Budapest Institute for Advanced Study.

UNIT II

SCIENCE AND TECHNOLOGY

I. Read the text and get ready to do the tasks that follow it.

SCIENCE

For many thousands of years the Earth was inhabited by creatures who lived and died without passing on their experiences to following generations. These early fish, reptiles, birds and mammals could only “talk” to each other through the roars, calls and screams of the jungle. Yet, somehow, from these prehistoric beings a more intelligent animal evolved with a brain able to form the controlled sounds of speech.

This human being began to use rocks and trees to fashion weapons to help him hunt for food. Stones and spears were probably the first tools used by humans as extensions of their own bodies – the spear could travel faster in flight than man could run – and this ability to invent tools and pass on knowledge gave man a growing control of his surroundings. His search for new ways to survive and to improve his way of life continued through the ages thus the story of man’s world of science and invention was shaped.

Writing is known to contribute much to man’s experience accumulation, books printing being his greatest brainchild. As knowledge grew and the art of writing developed, parts of the story were recorded – some in one book, some in another. No man could remember all there was to know and writers found it useful to classify their knowledge under separate headings – much like a library arranges its books in sections so that the reader will know where to look for each subject. Science became separated into various branches. But its progress began only when man started to search for natural laws and principles, and produced theories, applying to scientific methods, such as: observation, analysis, synthesis, induction, deduction, hypothesis and experimentation.

Science (from Latin scientia, meaning “knowledge”) is an enterprise that builds and organises knowledge in the form of testable explanations and predictions about the world. An older and closely related meaning still in use today is that of Aristotle for whom scientific knowledge was a body of reliable knowledge that can be logically and rationally explained. Since classical antiquity science as a type of knowledge was closely linked to philosophy. In the early modern era the words "science" and "philosophy" were sometimes used interchangeably in the English language. By the 17^{th} century, natural philosophy (which is today called "natural science") had begun to be considered separate from "philosophy" in general, while, "science" continued to be used in a broad sense denoting reliable knowledge about a topic, in the same way it is still used in modern terms such as library science.

However, in modern use, "science" is still mainly treated as synonymous with 'natural and physical science', and thus restricted to those branches of study that relate to the phenomena of the material universe and their laws, sometimes with implied exclusion of pure mathematics. This is now the dominant sense in ordinary use. The word "science" became increasingly associated with the disciplined study of physics, chemistry, geology and biology. This sometimes left the study of human thought and society in a linguistic limbo, which was resolved by classifying these areas of academic study as social science. In its turn the term "humanities" or "arts" refers to the subjects of study that are concerned with the way people think and behave, for example literature, language, history and philosophy (as it is understood nowadays).

Science is often distinguished from other domains of human culture by its progressive nature: in contrast to art, religion, philosophy, morality, and politics, there exist clear standards or normative criteria for identifying improvements and advances in science. For example, the historian of science George Sarton argued that "the acquisition and systematisation of positive knowledge are the only human activities which are truly cumulative and progressive," and "progress has no definite and unquestionable meaning in other fields than the field of science". However, the traditional cumulative view of scientific knowledge was effectively challenged by many philosophers of science in the 1960s and the 1970s, and thereby the notion of progress was also questioned in the field of science.

Debates on the normative concept of progress are at the same time concerned with axiological questions about the aims and goals of science. The task of philosophical analysis is to consider alternative answers to the question: What is meant by progress in science? This conceptual question can then be complemented by the methodological question: How can we recognise progressive developments in science? Relative to a definition of progress and an account of its best indicators, one may then study the factual question: to what extent, and in which respects, is science progressive?

1. Say if the following statements are true of false. Correct the false statements to make them true.

1) The word "knowledge" is derived from the negation "no", meaning the path leading from ignorance to understanding the world.

2) The term "science" is applied only to natural science.

3) Natural and physical sciences deal with testable explanations and predictions.

4) Aristotle studied the body of a human being and gained a reliable knowledge in this sphere.

5) There was a time when "science" and "philosophy" meant the same.

6) The word "science" and the word combination "natural and physical science" are looked upon as synonymous.

7) Pure mathematics is included into the notion "natural and physical science".

8) Biological science naturally belongs to humanities.

2. Match the terms and their right definitions.

observation	***synthesis***
experiment	***analysis***
theory	***induction***
hypothesis	***deduction***

1) the process of using information or finding the answer to the problem;

2) a formal set of ideas that is intended to explain why smth happens or exists;

3) an idea or explanation of smth that is based on a few known facts but has not yet been proved to be true or correct;

4) a method of discovering general rules and principles from particular facts and examples;

5) the detailed study or examination of smth in order to understand more about it;

6) the act of watch smth carefully for a period of time, esp. to learn smth.;

7) a scientific test that is done in order to study what happens and to gain new knowledge;

8) the act of combining separate ideas, beliefs, styles; a mixture or combination of them.

II. Read the text to find out about the difference between pure and applied science. Be ready to explain the notion of mathematisation of natural sciences.

PURE AND APPLIED SCIENCE

As students of science you are probably sometimes puzzled by the terms "pure" and "applied" science. Are these two totally different activities, having little or no interconnection? Let us begin by examining what is done by each.

Pure science is primarily concerned with the development of theories (or, as they are frequently called, models) establishing relationships between the phenomena of the universe. When sufficiently validated these theories (hypotheses, models) become the working laws or principles of science. In carrying out this work, the pure scientist usually disregards its application to practical affairs, confining his attention to explanations of how and why events occur.

Exact science in its generally accepted sense can be referred to as a family of specialised natural sciences, each of them providing evidence and information about different aspects of nature by somewhat different working methods. It follows that mathematics in its pure sense does not enter into this frame, its object of study being not nature itself. Being independent of all observations of the outside world, it attempts to build logical systems based on axioms. In other words, it concentrates on formulating the language of mathematical symbols and equations which may be applied to the functional relations found in nature.

This "mathematisation", in the opinion of most specialists, is witnessed first in physics which deals with general laws of matter and energy on subatomic, atomic and molecular levels. Further application of these mathematical laws and studies is made by chemistry and results in structural bonds between the elements of matter being established.

1. Translate the following words and word combinations.

Pure and applied science, totally different activities, interconnection, to establish relationships, phenomena, the working laws of science, to carry out work, practical affairs, to confine attention to explanation, events, exact science, specialised natural science, to provide evidence, pure sense, functional relations, logical systems based on axioms, observations, general laws of matter, subatomic level, structural bonds.

2. Choose the correct word to complete the sentences.

1) You are sometimes … by the terms "pure" and "applied" science.
a) impressed b) puzzled c) inspired
2) Let us begin by … what is done by each.
a) operating b) confining c) examining
3) Pure science is primarily … the development of theories establishing relationships.
a) concerned with b) explained by c) connected to

4) When sufficiently … these theories become the working laws of science.

a) established b) validated c) completed

5) The pure scientist usually … its application to practical affairs.

a) deals with b) works out c) disregards

6) Exact science can be referred to as a family of … .

a) applied sciences c) specialised natural sciences
b) pure sciences

7) The object of study in mathematics is … .

a) not nature itself b) nature itself c) matter itself

8) Mathematics concentrates on formulating the language of … .

a) functional relations
b) different working methods
c) mathematical symbols and equations

9) Physics deals with general laws of … .

a) matter and energy
b) structural bonds between elements
c) logical systems

10) Further application of these studies results in … .

a) different aspects of nature
b) structural bonds between the elements of matter
c) general laws of matter

3. Answer the following questions.

1) What definition of "pure science" does the author give?
2) When does a hypothesis become a principle of science?
3) What problems does the pure scientist deal with?
4) What is your own explanation of "pure science"?
5) What is considered to be "exact science"?
6) How does the author describe "specialised natural sciences"?
7) What is the object of study in mathematics?
8) What laws does physics deal with?
9) What does the application of mathematical laws in chemistry result in?

Discussion

1. What can you tell about pure and applied science? Do these two activities really have little or no interconnection?
2. When do different theories become working laws of science?
3. Do you understand the term "pure" scientist? Try to define it.

III. Translate the text into Russian in writing using a dictionary.

WHAT IS SCIENCE

The word "scientist" was introduced only in 1840 by a Cambridge professor of philosophy who wrote: "We need a name for describing a cultivator of science in general. I should be inclined to call him a scientist". "The cultivators of science" before that time were known as natural philosophers". They were curious, often eccentric, persons who poked inquiring fingers at nature. In the process of doing so they started a technique of inquiry which is now referred to as the "scientific method".

Briefly, the following steps can be distinguished in this method. First comes the thought that initiated the inquiry. It is known, for example, that in 1896 physicist Henri Becquerel, in his communication to the French Academy of Sciences, reported that he had discovered rays of an unknown nature emitted spontaneously by uranium salts. His discovery excited Marie Curie, and together with her husband Pierre Curie she tried to obtain more knowledge about the radiation. What was it exactly? Where did it come from?

Second comes collecting of facts: the techniques of doing this will differ according to the problem which is to be solved. But it is based on the experiment in which anything may be used to gather the essential data – from a test-tube to an earth-satellite. It is known that the Curies encountered great difficulties in gathering their facts, as they investigated the mysterious uranium rays.

This leads to step three: organising the facts and studying the relationships that emerge. It was already noted that the above rays were different from anything known. How to explain this? Did this radiation come from the atom itself? It might be expected that other materials also have the property of emitting radiation. Some investigations made by Marie Curie proved that this was so. The discovery was followed by further experiments with "active" radioelements only.

Step four consists of stating a hypothesis or theory: that is, framing a general truth that has emerged, and that may be modified as new facts emerge. In July 1898, the Curies announced the probable presence in pitchblende ores of a new element possessing powerful radioactivity. This was the beginning of the discovery of radium.

Then the clearer statement of the theory follows. In December 1898, the Curies reported to the Academy of Sciences: "The various reasons enumerated lead us to believe that the new radioactive substance contains a new element to which we propose to give the name of Radium. The new radioactive substance certainly contains a great amount of barium, and still its radioactivity is considerable. It can be suggested therefore that the radioactivity of radium must be enormous”.

And the final step is the practical test of the theory, i. e. the prediction of new facts. This is essential, because from this flows the possibility of control by man of the forces of nature that are newly revealed.

Note should be taken of how Marie Curie used deductive reasoning in order to proceed with her research, this kind of “detective work” being basic to the methodology of science. It should be stressed further that she dealt with probability – and not with certainty – in her investigation. Also, although the Curies were doing the basic research work at great expense to themselves in hard physical toil, they knew they were part of an international group of people all concerned with their search for truth. Their reports were published and immediately examined by scientists all over the world. Any defects in their arguments would be pointed out to them immediately.

IV. Read the text without consulting a dictionary and get ready to do the tasks that follow it.

FUNDAMENTAL, APPLIED, AND PUBLIC RESEARCH

People are always talking about fundamental research, implying thereby the existence of a nameless opposite. A good definition of fundamental research will certainly be welcomed: let us see whether we can invent one. We have to begin, of course, by defining research. Unfortunately the concept of research contains a negative element. Research is searching without knowing what you are going to find: if you know what you are going to find you have already found it, and your activity is not research. Now, since the outcome of your research is unknown, how can you know whether it will be fundamental or not?

We may say for instance that fundamental research is that which you undertake without caring whether the results will be of practical value or not. It may not be reasonable to go further and say that fundamental research is that which will be abandoned as soon as it shows a sign of leading to results of practical value. By saying this you may limit your own achievement. It will be better to say that fundamental research is that which may have no immediate practical value, but can be counted upon as leading to practical value sooner or later. The extension of knowledge and understanding of the world around us will always be profitable in the long run, if not in the short.

This is a very powerful argument for fundamental research and it is a completely unassailable one, and yet there are people who will not like it. Let us seek a definition that will give fundamental research a value of its own, not dependent upon other uses appearing soon or late. We say for instance that fundamental research is that which extends the theory. Now we have to theorise upon theory. There have been several viewpoints about theory. One is that theory discerns the underlying simplicity of the universe. The nontheorist sees a confused mass of phenomena; when he becomes a theorist they fuse into a simple and dignified structure. But some contemporary theories are so intricate that an increasing number of people prefer dealing with the confusion of the phenomena than with the confusion of theory.

A different idea suggests that theory enables one to calculate the result of an experiment in a shorter time than it takes to perform the experiment. We do not think that the definition is very pleasing to the theorists, for some problems are obviously solved more quickly by experimenters than by theorists. Another viewpoint is that theory serves to suggest new experiments. This is sound, but it makes the theorist the handyman of the experimenter, and he may not like this auxiliary role. Still another viewpoint is that theory serves to discourage the waste of time on making useless experiments.

Let us try to flatter theory by giving it a definition that shall not describe it as a mere handmaid of experiment or a mere device for saving time. We suggest that theory is an intellectual instrument granting a deep and indescribable contentment to its designer and to its users. This instrument is made up of units which can be compared, for instance, to different branches of physics: solid state physics, relativity, acoustics, elementary particles and others, which sometimes have only a remote relation with one another and may not even be interconnected at all. The rest of our talk will be devoted to a different question which is: how are we going to communicate to the layman some of our passion for our science? This is a very important question, for everyone is a layman until he becomes a scientist. If we can solve the problem of interesting the layman we may succeed in attracting the potential Slaters, Lands and Fletchers of future into the field of physics. Nothing could be more desirable.

A frequent technique is that of surprise. The trouble with this is that one cannot be surprised if one is not accustomed to the situation which is nullified by the surprise. Imagine, for example, a physicist trying to surprise an audience of laymen by telling them that there are a dozen elementary particles instead of two or three, or that the newest cyclotron imparts an energy of 500 mev to protons. It simply will not work, because the listeners will have no background to compare this information with. It is also a mistake to think that we can excite an audience by solving a mystery for them. The trouble here is that practically no one is interested in the answer to a question which he never thought of asking.

Relativity had a wonderful build-up in the decade before 1905, for the physicists of that era were acquainted with the sequence of experiments which were designed to show that the earth moves relatively to the ether and which obstinately showed the opposite. Each stage in the unfolding of quantum mechanics was exciting to the physicists who knew the earlier stages, because they knew the problems which were left unsolved. The writer of a detective story creates the mystery before he solves it; but the mystery usually begins with the discovery of a murdered man, and this is considerably more exciting than a murdered theory. The corresponding technique in physics consists in trying to create a particular state of out-of-datedness in the mind of the public, in the expectation of bringing them up-to-date at the end of the lecture or paper. There is too much risk of leaving the audience in the out-of-date condition, and this technique cannot be recommended. Another mistake is that of stressing a paradox.

Try telling an audience that if you know the exact position of a particle you cannot know its momentum, and vice versa – the effect is unpredictable but obviously not what you wanted. Still another mistake is that of springing an isolated fact upon the audience. An isolated fact is not science and it is not interesting. Facts are of interest only as parts of a system. And we must strive to interest the layman in the system.

1. Give English equivalents to the following phrases.

Желательно иметь хорошее определение; предпринять, не задумываясь; ограничить возможные результаты своей деятельности; расширение знаний приносит пользу; образуют простую, но строгую систему; теории имеют настолько сложный и запутанный характер; вспомогательная функция; предотвращать потерю времени; приносящий удовлетворение.

2. Give Russian equivalents to the following phrases.

Of a nameless opposite; searching; outcome of your research; immediate practical value; research can be counted upon as leading; in the long run, if not in the short; a very powerful argument for; the underlying simplicity; the handyman of the experimenter; a device for saving time; a remote relation.

3. Divide the text into three parts and suggest a title for each one. Make up a short retelling of the text using your plan.

V. Read the text about research universities, do the tasks that follow it and be ready to speak about research universities.

Research universities are postsecondary institutions that devote a large portion of their mission, resources, and focus to graduate education and research. Currently, there are more than 250 of these institutions in the United States. Research universities such as Harvard, Stanford, Berkeley, and Michigan are often mentioned in the media due to their size, resources, status, and athletic teams. These are among the best-known, but there are many different kinds of research universities.

Research universities in the United States vary according to size, control, focus, selectivity, and the number of degree programmes offered. They include public universities, such as the universities of Michigan and Virginia, and private universities, such as Duke University and MIT (Massachusetts Institute of Technology). They range in size from very large universities such as the University of Minnesota, which has almost 60,000 students enrolled at three campuses, to small universities such as Rice University in Houston, which has fewer than 4,500 students. A few research universities are focused on mission and offer degree programmes in specialised areas. Some research universities embrace open admissions policies, while others are very selective and admit less than 20 percent of those students that apply.

What all research universities have in common – and what makes them research universities – is an emphasis on graduate education and research. All research universities offer advanced degrees, up to and including the doctorate. Most research universities also enroll a sizeable number of undergraduates in a comprehensive set of bachelor's degree programmes.

Faculty members at research universities are expected to devote a larger amount of their time to research than are faculty members at liberal arts colleges and comprehensive universities, where the faculty's primary role is that of teacher rather than researcher. At research universities, faculty members are sometimes researchers first and teachers second, and are expected to publish articles and books and secure research grants from external sources.

While these qualities have provoked some criticism of research universities, they remain a very popular option for postsecondary students. Research universities enroll more than one out of every five students attending a college or university in the United States. Research universities also attract a large percentage of the best and brightest students. Annually, research universities enroll the largest numbers of National Merit Scholars. These students are attracted to research universities because of their high-profile faculty members, the prestige associated with these institutions, and their resources, including state-of-the-art labs and technology.

The U.S. research university is much more than academics, however. The research university is a far-flung and complex organisation with multiple campuses, extension centres, research centres and institutes, student services and programming for diverse student groups, and often high-profile athletics teams. It is not unusual for research universities to establish their own research parks where the university and private companies are engaged in technology transfer and spin off new businesses. In the early twenty-first century, it is difficult to think of something in which research universities are not involved.

1. Fill in the blanks with the correct prepositions.

1) Research universities devote a large portion of their mission, resources … graduate education and research.
2) Research universities in the United States vary … size, control, focus, selectivity.
3) They range … size from very large universities … small universities.
4) These universities are known throughout the world … … their contributions to the economy.
5) Research universities enrolled more than one … … every five students attending a college or university in the United States.
6) What all research universities have … common – and what makes them research universities – is an emphasis … graduate education and research.

2. Say if the following statements are true of false. Correct the false statements to make them true.

1) Research universities are postsecondary institutions that devote a large portion of their mission, resources, and focus to postgraduate education.
2) Research universities such as Harvard, Stanford, Berkeley, and Michigan are often mentioned in the media due to their size, resources, status, and athletic teams.
3) A lot of research universities are focused on mission and offer degree programmes in specialised areas.
4) All research universities offer advanced degrees, up to and including the doctorate.
5) At research universities, faculty members are sometimes teachers first and researchers second.
6) National Merit Scholars are attracted to research universities because of their high-profile faculty members, the prestige associated with these institutions, and their resources, including state-of-the-art labs and science.
7) The research university is a complex organisation with multiple campuses, extension centres, research centres and institutes, student services and programming for diverse student groups.

3. Answer the questions.

1) What are the reference points for being identified as a research university?

2) What attracts students in research universities?

4. Name some of the research universities mentioned in the text. Using the information you have found out from the text and your own knowledge, prepare a short report about research universities.

VI. Read the text and answer the questions.

1) What are the two motive forces behind synthetic and analytic research?
2) What problems are scientists faced with?
3) Does the pace of scientific development depend on the rate of building new research facilities? Prove your point of view.

SCIENCE AND TECHNOLOGY

Science problems can be roughly classified as analytic and synthetic. In analytic problems we seek the principles of the most profound natural processes, the scientist working always at the edge of the unknown. This is the situation today, for instance, within the two extremes of research in physics – elementary particle physics and astrophysics – both concerned with the properties of matter, one on the smallest, the other on the grandest scale. Research objectives in these fields are determined by the internal logic of the development of the field itself. Revolutionary shocks to the foundations of scientific ideas can be anticipated from these very areas.

As to synthetic problems, they are more often studied because of the possibilities which they hold for practical applications, immediate and distant, than because their solution is called for by the logic of science. This kind of motivation strongly influences the nature of scientific thinking and the methods employed in solving problems. Instead of the traditional scientific question: "How is this to be explained?" the question behind the research becomes "How is this to be done?" The doing involves the production of a new substance or a new process with certain predetermined characteristics. In many areas of science, the division between science and technology is being erased and the chain of research gradually becomes the sequence of technological and engineering stages involved in working out a problem.

In this sense, science is a Janus-headed figure. On the one hand, it is pure science, striving to reach the essence of the laws of the material world. On the other hand, it is the basis of a new technology, the workshop of bold technical ideas, and the driving force behind continuous technical progress.

In popular books and journals we often read that science is making greater strides every year, that in various fields of science discovery is followed by discovery in as steady stream of increasing significance and that one daring theory opens the way to the next. Such may be the impression with research becoming a collective doing and scientific data exchange a much faster process. Every new idea should immediately be taken up and developed further, forming the initial point of an avalanche-like process.

Things are, in fact, much more complex than that. Every year scientists are faced with the problems of working through thicker and tougher material, phenomena at or near the surface having long been explored, researched, and understood. The new relations that we study say, in the world of elementary particles at dimensions of the order of 10-13 cm or in the world of superstellar objects at distances of billions of light years from us, demand extremely intense efforts on the part of physicists and astrophysicists, the continuous modernisation of laboratories with experimental facilities becoming more and more grandiose and costing enormous sums. Moreover, it should be stressed that scientific equipment rapidly becomes obsolete. Consequently, the pace of scientific development in the areas of greatest theoretical significance is drastically limited by the rate of building new research facilities, the latter depending on a number of economic and technological factors not directly linked to the aims of the research.

Discussion

1. Can our country afford to spend millions of dollars on research that may have no practical benefit?
2. Should educational institutions concentrate on basic research, or should they be allowed to concentrate on research programmes that might be more profitable in the end?
3. Should governments be allowed to tell the universities and other research-funding organisations what types of scientific research should be supported?
4. Does industry bear responsibility to support basic research, since its technological and medical advances are often the result of someone else’s basic work?

VII. Read the text and get ready to do the tasks that follow it.

THE QUEST FOR IMMORTALITY

Scientific breakthroughs mean that life expectancy continues to rise every year. But the medical advances which now make it possible to contemplate living to a very great age – if not forever – also raise profound practical and ethical issues.

Over the past century, life expectancy in developed countries has risen at an astonishing rate. In Britain, for example, the average male lifespan went up from 48 in 1901 to 75 in 2000. (During the same time, the female lifespan rose from 49 to 80.) Scientists have always imagined that this rise would tail off, but that does not seem to be happening. Since 1840, people born in any year have, on average, lived three months longer than those born the previous year – a consistent increase that still holds true today. A paper published in *Science* magazine has warned that, at the current rate, female life expectancy in developed countries could be as high as 101 by 2070.

We are lasting so much longer mainly because of better nutrition, better housing, vaccination programmes and a dramatic reduction in infant mortality due to advances in both pre-natal and post-natal care. Since there is only limited potential for further advances in these areas, some scientists think we have almost reached the limit of human longevity. Dr Jay Olshansky, of the University of Chicago, for example, believes that the only way of adding to life expectancy now is to make old people live longer – a painstaking process that will be measured in weeks or months, not years. The real challenge now facing biologists is to learn how to delay the ageing process.

So immortality is a realistic prospect not for the foreseeable future. The gerontologist, Professor Tom Kirkwood firmly quashed the notion that genetic engineering might result in some kind of "fountain of youth". Considering how frustratingly slow the battles against cancer, heart disease and strokes have been, he said it is fanciful to imagine that we could conquer death. On the other hand, scientists do now understand more about why we age, and what can be done to slow the process. "Our ancestral genes placed limited priority on long-term maintenance and repair," says Kirkwood. "Ageing comes about through the gradual build-up of unprepared faults in the cells and tissues of our bodies, not as the result of some active mechanism for death and destruction." The trick, then, is to help the body repair the damage done by wear and tear.

That can be done in many different ways, some of which are already pretty commonplace. Organ transplants from pigs and monkeys are now old news – the American politician Jess Helms has just had a ten-year-old pig valve in his heart replaced. Laser eye surgery has become so commonplace that Americans can now get it in shopping malls. Doctors have succeeded in wiring computerised implants directly to nerve fibres, allowing the deaf to hear, and there is hope that electrodes planted in the brain may soon offer hope for the blind to see. But the real potential at the moment lies in the field of stem cells – special cells that allow lizards to grow new tails and humans to grow new skin over minor cuts. If scientists can learn how to control these cells, they could be used to regenerate parts of the body that are failing.

1. Translate the collocations.

Life expectancy, the rise would tail off, to reach the limit, human longevity, the only way, genetic engineering, we could conquer death, to slow the process, limited priority, long-term maintenance.

2. Say if the sentences are true or false. Correct the false sentences to make them true.

1) People in the UK are living much longer than they used to.
2) It will be common for women to live to over 100 in the year 2070.
3) Infant mortality will continue to fall sharply.
4) Life expectancy will not carry on rising as dramatically as in the past.
5) One day we may be able to live forever.
6) Scientists understand much more about the ageing process nowadays.
7) Replacing body parts is now a common operation.
8) There will be a cure for blindness in the future.

3. Give your viewpoint on the following topic.
Is immortality a realistic prospect?

VIII. Before reading the text, discuss the following questions.

1) What do you use your mobile phone for?
2) How often do you use it?
3) Is it an important part of everyday life?

HOW THE MOBILE PHONE CHANGED THE WORLD

The number of global phone users had doubled in two years to pass the 1 billion mark, China had just overtaken America as the world's largest market and across Africa subscriptions were doubling.

In Europe, the market may have stagnated but across the world the mobile has leapt from obscurity towards ubiquity. The tool, once considered a toy for the elite, has today crossed social and geographical boundaries to find its way into the hands of the young, the old, the rich and the poor, even in communities largely untouched by the technologies.

It was amazed to see how fast, how far and with what diversity the mobile phone has spread. Because it extends a most basic human quality – the ability to communicate – there are few aspects of life that it fails to touch.

Students in Beijing explained the importance of maintaining contact with families in which they are the only children. Go-go dancers in Bangkok said that mobiles had given them a new chance to arrange dates free of a middleman. Somali traders explained how their mobiles allowed them to keep up with the movements of goods between Mogadishu and the Middle East. In Birmingham, teenage girls convinced that because mobile phones "make it cool to talk", even their most taciturn male friends are becoming more communicative.

Teenagers have become the conduits through which mobile phones have found their way into the wider society. For the young throughout the world the sense of freedom of movement and the privacy afforded by the mobile are highly valued. In spite of the high incidence of phone theft in the UK, they value the security of knowing that assistance – often a lift home – is only a call away.

In Japan, the teenage generation has become known as *oya yubi sedai*. The thumb tribe, on account of the dexterity with which they text, unaccountable to an older generation.

Mobile phones encourage and respond to the mobility. In China, which is witnessing vast movements of people, the mobile has become a crucial part of migrant life: a way to keep in touch with families back home and also a means of establishing oneself in a new social environment. In Thailand, many students said that they could move south to Bangkok only when their parents were assured that they could keep in touch by mobile phone.

Connecting people rather than locations, the mobile phone alters people's expectations about what is possible and desirable and changes the parameters of their social lives. It affects their perceptions of themselves, their boundaries and capacities: it is ridiculous to compare a mobile to a prosthetic organ but carried on the person, often all the time, it is something to which people grow attached. It alters the experience of solitude, providing a stream of ways to fill dead time and constant reminders – not always welcome – that one is never quite alone.

Mobiles have changed the parameters of public space, too, blurring the edges of the private world. Visible and audible to all, their usage has rewritten many social rules about where, when and what one should communicate.

It is in developing countries that the mobile phone's impact has been the most immediate. Bangladesh is one of several countries in which mobiles are used as public village telephones, sometimes powered by solar energy, and often offering access to the latest digital services. The mobile has become a political tool, too. Gossip, jokes and trivia first spread text messaging across the Philippines; but during the fall of the government last year, vital news and information moved around the networks.

1. Answer the following questions.

1) What happened to the number of mobile phone users in the last decade?
2) What basic human quality is explained by the mobile phone?
3) Which section of society is mainly responsible for the spread of mobile phones?
4) How has the mobile phone altered "our experience of solitude"?
5) Where are mobile phone subscriptions doubling?
6) How are mobile phones used by the following: students in Beijing; Somali traders in Dubai; teenage girls in Birmingham; the migrant population in China; villages in Bangladesh; political activists in the Philippines?
7) Why are teenagers in Japan called "the Thumb Tribe"?
8) Why is the mobile phone compared to a "prosthetic organ"?

Discussion

1. Do you agree that the mobile phone has had a major impact on our lives? Has it become indispensable or would life be better without it?
2. Can you think of any examples of how the mobile phone has changed our expectations or social lives?
3. Are there any 'social' rules about mobile phone usage in our country?

IX. Read the text about a brief history of distance learning and write down the facts you have not known before.

FROM A DISTANCE

Distance learning is a method of study that involves using electronic means (computers, the Internet, etc.) to receive and send work rather than going to a school or university. "Knowledge", according to the proverb "is power". And nowadays more and more of our information is gained not in the classroom, but via media such as the Internet, CD-ROM and cable TV all of which are playing a key part in the distance learning revolution. Here are three figures in this key educational change which is transforming our lives in the 21st century.

Those who think that distance learning is a relatively new idea might be surprised to learn that English educator, Sir Isaac Pitman, had the same idea – only then they were called correspondence courses – more than 150 years ago. Taking advantage of the development of a reliable postal system in 1840, Pitman began teaching shorthand (a system for writing down what people are saying using special signs to represent letters, words and phrases) by mail to thousands of students who did not have time to attend school. "Lessons" consisted of copying short passages of the Bible in shorthand, and posting them to Mr. Pitman to be corrected. His brother, Benn Pitman, introduces the idea to the United States, and the Pitman shorthand system – which has been adapted to fifteen other languages – is still one of the most widely used shorthand systems in the world.

The Open University. When it was established in 1969, the Open University offered courses via mail, with the back-up of regular TV and radio programmes shown outside normal broadcast times. Each student was assigned a tutor who discussed the course work over the phone, and in group sessions in the evenings or at weekends. Thirty years on, the Open University has expanded to include the Internet, videoconferencing, satellite broadcast and e-mail. There are no entry qualifications or admission interviews, and anyone over the age of 18 can follow one of their courses. It is now Britain's largest single teaching institution, with more than 200,000 people studying its courses every year, with another 16,000 in other countries around the world.

John Hendricks and the Discovery Channel. After a successful career in university education, John Hendricks entered the TV business and launched the Discovery Channel – the first cable TV channel exclusively devoted to documentaries and nature programmes – in June 1985. Today the company's programmes reach over 150 million subscribers in more than a hundred countries. In an age where competition for TV audience has never been tougher, the Discovery Channel's high-quality, educational approach continues to defy those who believe that TV is only about mindless entertainment. The BBC programme *Walking with Dinosaurs* became the most-watched documentary in TV history when it was shown on the Discovery Channel in 2000.

1. Answer the following questions.

1) Who was the first to get the idea of teaching by correspondence?
2) Who took the idea of correspondence courses to the United States?
3) What three methods were originally used for course work by the Open University?
4) What entry qualifications are required to do a course at the Open University?
5) What types of programmes are shown on the Discovery Channel?
6) What programme attracted the most viewers for a TV documentary?

2. Find some more information about distance learning and prepare a 5-minute report on it.

X. Read the text and do the tasks that follow it.

MACHINE TRANSLATION

Part 1

The field of machine translation (MT) was the pioneer research area in computational linguistics during the 1950s and 1960s. When it began, the assumed goal was the automatic translation of all kinds of documents at a quality equaling that of the best human translators. It became apparent very soon that this goal was impossible in the foreseeable future. Human revision of MT output was essential if the results were to be published in any form. At the same time, however, it was found that for many purposes the crude (unedited) MT output could be useful to those who wanted to get a general idea of the content of a text in an unknown language as quickly as possible. For many years, however, this latter use of MT (i.e. as a tool of assimilation, for information gathering and monitoring) was largely ignored. It was assumed that MT should be devoted only to the production of human-quality translations (for dissemination). Many large organisations have large volumes of technical and administrative documentation that have to be translated into many languages. For many years, MT with human assistance has been a cost-effective option for multinational corporations and other multilingual bodies (e.g. the European Union). MT systems produce rough translations which are then revised (post-edited) by translators. But post-editing to an acceptable quality can be expensive, and many organisations reduce costs and improve MT output by the use of 'controlled' languages, i.e. by reducing (or even eliminating) lexical ambiguity and simplifying complex sentence structures – which may itself enhance the comprehensibility of the original texts. In this way, translation processes are closely linked to technical writing and integrated in the whole documentation workflow, making possible further savings in time and costs. At the same time as organisations have made effective use of MT systems, human translators have been greatly assisted by computer-based translation support tools, e.g. for terminology management, for creating in-house dictionaries and glossaries, for indexing and concordances, for post-editing facilities, and above all (since the end of the 1980s) for storing and searching databases of previously translated texts ('translation memories'). Most commonly these tools are combined in translator workstations – which often incorporate full MT systems as well. Indeed, the converse is now true: MT systems designed for large organisations are including translation memories and other translation tools. As far as systems for dissemination (publishable translations) are concerned the old distinctions between human-assisted MT and computer-aided translation are being blurred, and in the near future may be irrelevant. It is widely agreed that where translation has to be of publishable quality, both human translation and MT have their roles. Machine translation is demonstrably cost-effective for large scale and/or rapid translation of technical documentation and software localisation materials. In these and many other situations, the costs of MT plus essential human preparation and revision or the costs of using computerised translation tools (workstations, translation memories, etc.) are significantly less than those of traditional human translation with no computer aids. By contrast, the human translator is (and will remain) unrivalled for non-repetitive linguistically sophisticated texts (e.g. in literature and law), and even for one-off texts in highly specialised technical subjects. However, translation does not have to be always of publishable quality. Speed and accessibility may be more important. From the beginnings of MT, unrevised translations from MT systems have been found useful for low-circulation technical reports, administrative memoranda, intelligence activities, personal correspondence, indeed whenever a document is to be read by just one or two people interested only in the essential message and unconcerned about stylistic quality or even exact terminology. The range of options has expanded significantly since the early 1990s, with the increasing use and rapid development of personal computers and the Internet.

1. Find synonyms for the following adjectives.

Equal, useful, general, quick, rough, expensive, complex, significant, powerful, real.

2. Complete the phrases with *say* or *tell* as appropriate.

… a story; …the time; …as far as I can …; …yes or no; …somebody to do something; …somebody what to do; … hello; …a lie; …what you mean; …something under your breath

3. Write down all collocations with *machine translation* from the text and translate them.

4. Divide the text into logical parts. Find the main idea of each part.

MACHINE TRANSLATION

Part 2

More powerful PCs have encouraged the marketing of translation software for the general public. As general-purpose systems, the quality is inevitably poor. Input texts often contain high proportions of non-technical, colloquial language of the kind which MT systems have always found most problematic.

Quality is usually not good enough for professional translators (although some use the output for drafts), but it is found adequate for individual ‘occasional’ users, e.g. for gist of foreign texts in their own language, for communicating with others in unknown languages, and for translating Web pages and electronic mail. It is the coming of online translation on the Internet, however, that has brought the most significant changes, with potentially far-reaching implications for the future. Exposure to information in many languages has created a rapidly growing demand, and this may well be MT’s niche market: the real-time online supply of rough translations to support personal communication and information needs. The quality of the translations can be (and frequently is) ridiculed, but there is no doubt that the output is useful, particularly if the source language is not known at all and if the subject and context are familiar to some extent. The situation is unlikely to improve much (at least in the near future), but some quality improvements may come with specialisation, i.e. by the development of systems designed for specific subject areas (as in the large-organisation systems), or for specific document types (e.g. patents, letters), or even for specific language registers (e.g. email and text messaging). There are already stand-alone PC systems for medical translation and for patent documents, but the Internet would be the obvious home for such specialised MT systems. They will probably not be free (as many online translation services are now), but users will surely accept charges for better quality.

On the other hand, the ready availability of low-quality MT from Internet services and from commercial stand-alone software could well increase the demand for higher-quality human translation, particularly from those with no previous experience of translation. Some suppliers of online translation are already providing add-on human translation services (e.g. post-editing or full translation). Currently they are used mainly by organisations without their own translation services, but wider use may be expected in the future.

For Internet users, a desirable development would be integration with other language applications. What users are seeking is information, in whatever language it may have been written or stored – translation is just a means to that end. Many would welcome the seamless integration of translation with summarisation, database mining, document retrieval, information extraction, etc. There is already research on cross-lingual information retrieval, multilingual summarisation, multilingual text generation from databases, and so forth, and before many years there may well be systems available on the market and on the Internet. Perhaps most desired of all are systems capable of translating spoken language – not just for trained speakers in restricted domains (e.g. hotel booking and business negotiations, as in current research projects in Japan, the USA and Germany), but for all speakers in all situations.

Users will want reliable and accurate results – poor quality text can be re-read and puzzled over, spoken output must be understood immediately. Automatic speech translation of open-ended communication will not come in the near future, and may never be possible, but in the medium term we may expect to have systems capable of translating the utterances of most speakers in well defined situations (banks, theatres, airports, rail stations, etc.)

At a more mundane level, the language coverage of all MT systems needs to be wider. Currently, most concentrate on the major commercial languages (English, French, German, Spanish, Japanese, Chinese, Korean); and many languages spoken by large populations in developing countries have been ignored by software companies and even by research groups. Equally, there is a real need for systems to deal with the kind of colloquial (often ill formed and badly spelled) language found in emails and chatrooms.

The traditional rule-based approaches found in current systems are probably not equal to these tasks on their own. In MT research, there is much interest in exploring new techniques in neural networks, parallel processing, and particularly in corpus-based approaches: statistical text analysis (alignment, etc.), example-based machine translation, hybrid systems combining traditional linguistic rules and statistical methods, and so forth. Above all, the crucial problem of lexicon acquisition (always a bottleneck for MT) is receiving major attention by many research groups, in particular by exploiting the large lexical and text resources now available (e.g. from LDC, ELRA, and the Internet itself). These developments promise faster system development times, and wider deeper language coverage.

In time there will be fewer ‘pure’ MT systems (commercial, online, or otherwise) and more computer-based tools and applications where automatic translation is just one component – this will be the case particularly with specialised systems for specific users and specific domains. Integrated translation software will be the norm, available and accessible for anyone from their own computer (desktop, laptop, network-based, etc.) and from other equipment linked to networks (televisions, mobile telephones, hand-held devices, etc.). Most probably, software will no longer be bought for stand-alone computers (whether PCs or client-servers) but accessed from the Internet as and when required. Automatic translation will become an everyday and essential part of the global information society.

1. Divide the whole text into logical parts. Entitle these parts.
2. Write down main sentences from each part.
3. Prepare short retelling of the text according to your plan.

Discussion

Is MT useful? Have you ever used MT? What is the main application of MT?

TEXTS FOR ADDITIONAL READING

PUBLIC INTEREST IN SCIENCE

At the time when the U.S. society has embarked on more technological adventures than ever before, Americans apparently understand less about science and technology than citizens of other western countries. But understanding alone is not the issue; rather, it is the complex relationship among public understanding, public confidence in science and technology, and the public interest. From the turn of the century through World War II, American technology and science came into its own. New inventions for the benefit of consumers were talked about everywhere from the Sears and Montgomery Ward catalogs to popular magazines; stories about the new invention, the telephone, were plentiful; and even if not everyone understood the new technology, they had confidence in it.

Military technology, given its lasting impact on everyone's lives during wartime, seemed easier to fathom "back then." Soldiers understood how a gun worked; stories abound about how American GI's were able to fix things on the spot, using whatever spare parts they could lay their hands on. People thought they understood the technology that surrounded them and that it was essentially beneficial. With the development of the atomic bomb (necessarily shrouded in secrecy) came the end of innocence. The shattering of Hiroshima and Nagasaki was accompanied, for many, by a shattering of faith in science and technology as forever benign and helpful. In ways that we have only now begun to understand, the image of destruction associated with the atom bomb has affected all technology, certainly all technology associated with nuclear power and nuclear waste, With Three Mile Island, Bhopal, the Challenger accident, and Chernobyl, this image of destruction has become the paradigm, for many, of all science and technology. The discovery of restriction enzymes that slice strands of DNA into separate pieces, and that DNA pieces from different species will connect with each other, has given rise to the great hope of understanding and curing genetic diseases. Yet it also has raised fears of somehow disturbing the natural universe, changing things that ought not to be tinkered with. To know more sometimes is to fear more: ‘‘unintended consequences" is today a familiar refrain; even good intentions have side effects.

The very advance of biological and medical knowledge itself leads to frustrations and contradictions, further undermining confidence in science. If we can perform the miracle of organ transplants, why can we not cure multiple sclerosis? If we can cure childhood leukemia, why not lung cancer? *Science* editor Daniel E. Koshland writes: "Basic (fundamental or pure) research is driven by a scientist's curiosity or interest in a scientific question. The main motivation is to expand man's knowledge, not to create or invent something." There is no obvious commercial value to the discoveries that result from basic research.

For example, basic science investigations probe for answers to questions such as:

How did the universe begin?

What are protons, neutrons, and electrons composed of?

How do slime molds reproduce?

What is the specific genetic code of the fruit fly?

Most scientists believe that a basic, fundamental understanding of all branches of science is needed in order for progress to take place. In other words, basic research lays down the foundation for the applied science that follows. If basic work is done first, then applied spin-offs often eventually result from this research. As Dr. George Smoot of LBNL says, "People cannot foresee the future well enough to predict what's going to develop from basic research. If we only did applied research, we would still be making better spears."

Applied research is designed to solve practical problems of the modern world, rather than to acquire knowledge for knowledge's sake. One might say that the goal of the applied scientist is to improve the human condition.

For example, applied researchers may investigate ways to improve agricultural crop production; treat or cure a specific disease; improve the energy efficiency of homes, offices, or modes of transportation.

Some scientists feel that the time has come for a shift in emphasis away from purely basic research and toward applied science. This trend, they feel, is necessitated by the problems resulting from global overpopulation, pollution, and the overuse of the earth's natural resources.

There has been a noticeable shift in philosophy regarding the types of research receiving federal funding in recent years. Universities get much of their money from the National Science Foundation (NSF). Research at the Berkeley National Laboratory is funded primarily by the Department of Energy (DOE) and the National Institutes of Health (NIH).

Congress has a strong influence on what types of research get funded, because it allocates money to these various federal agencies. Some members of Congress want to see less money given to basic research projects that probably will not lead to applied work for quite some time.

This shift in national priorities has greatly concerned many scientists. In fact, a group of 60 Nobel-prize winning researchers co-signed a letter that was sent to the President and every member of Congress. As a result not all large-scale projects involving basic research have been cut.

Industry does little basic research today. Due to the competitive nature of the business world, commercial research tends to emphasise projects requiring less than 10 years to develop a new product or process. Businesses simply cannot afford to engage in long-term research projects. As a result, universities and government laboratories are left with the responsibility to carry out basic research and long-term applied research.

Mankind has become a dominant force in the shaping and manipulation of our global environment. Many scientists are greatly concerned that, in the next 40 years, the population of our planet will increase so dramatically that the earth will no longer be able to support our current standard of living. As more and more countries become industrialised, the problems associated with this lifestyle – overuse of raw materials, energy consumption, pollution – will also increase. Scientists are worried that the planet will reach an unsustainable level of use.

Science research may be able to help solve these problems. This would require funding for long-term applied research – research geared not toward creating products to help us compete with other industrialised nations, but rather research focused on sustainable use of our planet's resources.

ALFRED NOBEL

Alfred Nobel was born in Stockholm on October 21, 1833. His father Immanuel Nobel was an engineer and inventor who built bridges and buildings in Stockholm. In connection with his construction work Immanuel Nobel also experimented with different techniques for blasting rocks.

Alfred's mother, born Andriette Ahlsell, came from a wealthy family. Due to misfortunes in his construction work caused by the loss of some barges of building material, Immanuel Nobel was forced into bankruptcy. The same year Alfred Nobel was born. In 1837 Immanuel Nobel left Stockholm and his family to start a new career in Finland and in Russia. To support the family, Andriette Nobel started a grocery store which provided a modest income. Meanwhile Immanuel Nobel was successful in his new enterprise in St. Petersburg, Russia. He started a mechanical workshop which provided equipment for the Russian army and he also convinced the Tsar and his generals that naval mines could be used to block enemy naval ships from threatening the city.

The naval mines designed by Immanuel Nobel were simple devices consisting of submerged wooden casks filled with gunpowder. Anchored below the surface of the Gulf of Finland, they effectively deterred the British Royal Navy from moving into firing range of St. Petersburg during the Crimean war (1853-1856). Immanuel Nobel was also a pioneer in arms manufacture and in designing steam engines.

Successful in his industrial and business ventures, Immanuel Nobel was able, in 1842, to bring his family to St. Petersburg. There, his sons were given a first class education by private teachers. The training included natural sciences, languages and literature. By the age of 17 Alfred Nobel was fluent in Swedish, Russian, French, English and German. His primary interests were in English literature and poetry as well as in chemistry and physics. Alfred's father sent him abroad for further training in chemical engineering to widen Alfred's horizons.

During a two-year period Alfred Nobel visited Sweden, Germany, France and the United States. In Paris, the city he came to like best, he worked in the private laboratory of Professor T.J. Pelouze, a famous chemist. There he met the young Italian chemist Ascanio Sobrero who, three years earlier, had invented nitroglycerine, a highly explosive liquid. Alfred Nobel became very interested in nitroglycerine and how it could be put to practical use in construction work. He also realised that the safety problems had to be solved and a method had to be developed for the controlled detonation of nitroglycerine. Together with his father he performed experiments to develop nitroglycerine as a commercially and technically useful explosive.

He found that mixing nitroglycerine with *kieselguhr* would turn the liquid into a paste which could be shaped into rods of a size and form suitable for insertion into drilling holes. In 1867 he patented this material under the name of dynamite. To be able to detonate the dynamite rods he also invented a detonator (blasting cap) which could be ignited by lighting a fuse.

The market for dynamite and detonating caps grew very rapidly and Alfred Nobel also proved himself to be a very skillful entrepreneur and businessman. By 1865 his factory in Krümmel near Hamburg, Germany, was exporting nitroglycerine explosives to other countries in Europe, America and Australia. Over the years he founded factories and laboratories in some 90 different places in more than 20 countries.

Intensive work and travel did not leave much time for a private life. At the age of 43 he was feeling like an old man. At this time he advertised in a newspaper "Wealthy, highly-educated elderly gentleman seeks lady of mature age, versed in languages, as secretary and supervisor of household." The most qualified applicant turned out to be an Austrian woman, Countess Bertha Kinsky. After working a very short time for Nobel she decided to return to Austria to marry Count Arthur von Suttner. In spite of this Alfred Nobel and Bertha von Suttner remained friends and kept writing letters to each other for decades. Over the years Bertha von Suttner became increasingly critical of the arms race. She wrote a famous book, *Lay Down Your Arms* and became a prominent figure in the peace movement. No doubt this influenced Alfred Nobel when he wrote his final will which was to include a Prize for persons or organisations who promoted peace.

Alfred Nobel's greatness lay in his ability to combine the penetrating mind of the scientist and inventor with the forward-looking dynamism of the industrialist. Nobel was very interested in social and peace-related issues and held what were considered radical views in his era. He had a great interest in literature and wrote his own poetry and dramatic works. The Nobel Prizes became an extension and a fulfillment of his lifetime interests.

Alfred Nobel died in San Remo, Italy, on December 10, 1896. When his will was opened it came as a surprise that his fortune was to be used for Prizes in Physics, Chemistry, Physiology or Medicine, Literature and Peace. The executors of his will were two young engineers, Ragnar Sohlman and Rudolf Lilljequist. They set about forming the Nobel Foundation as an organisation to take care of the financial assets left by Nobel for this purpose and to coordinate the work of the entrepreneur – Awarding Institutions.

GENETIC VARIANTS BUILD A SMARTER BRAIN

Researchers have yet to understand how genes influence intelligence, but a new study takes a step in that direction. An international team of scientists has identified a network of genes that may boost performance on IQ tests by building and insulating connections in the brain.

Intelligence runs in families, but although scientists have identified about 20 genetic variants associated with intelligence, each accounts for just 1 % of the variation in IQ scores. Because the effects of these genes on the brain are so subtle, neurologist Paul Thompson of the University of California, Los Angeles, devised a new large-scale strategy for tackling the problem. In 2009, he co-founded the ENIGMA Network, an international consortium of researchers who combine brain scanning and genetic data to study brain structure and function.

Earlier this year, Thompson and his colleagues reported that they had identified genetic variants associated with head size and the volume of the hippocampus, a brain structure that is crucial for learning and memory. One of these variants was also weakly associated with intelligence. Those carrying it scored on average 1.29 points better on IQ tests than others, making it one of the strongest candidate intelligence genes so far.

The researchers have now used the same strategy to identify more genetic variants associated with brain structure and IQ. In the new study, they analysed brain images and whole-genome data from 472 Australians, including 85 pairs of identical twins, 100 pairs of nonidentical twins, and their nontwin siblings. They identified 24 genetic variations within six different genes, all of which were linked to differences in the structural integrity of major brain pathways. "We measured the insulation of the neural pathways," says Thompson. "This affects how fast nervous impulses are routed around the brain. If the pathways are insulted poorly, the brain functions less efficiently and is less resistant to disease."

Many of the genes were already known, but "most haven't been linked to brain integrity before," says Thompson. He adds that the genes "help to make cell membranes and connections" in pathways that are involved in spatial abilities and working memory, which allows us to store information for short periods of time while performing mental tasks.

The researchers also found that some of the variants are associated with intelligence, in that individuals carrying them performed several points better on standardised IQ tests than others. The variants seem to amplify each other's effects, so that possessing more than one provided a synergistic IQ boost, the team reports online today in the Journal of Neuroscience. "We found a whole range of genetic variants that affect the impact of other variants," says Thompson, "and we are beginning to understand the guiding principles of these gene networks."

The researchers used a "highly sophisticated method" that simplifies the statistics involved by identifying gene networks rather than individual variants, says human geneticist Silvia Paracchini of the University of St. Andrews in the United Kingdom, who was not involved in the study.

She questions how robustly the experiments were designed, however, and says that the number of participants was relatively small for a study of this kind. "I would like to see the findings replicated, with further evidence from larger samples."

Epidemiologist Sarah Medland of the Queensland Institute of Medical Research in Australia adds another note of caution: Most large-scale genetic studies replicate their findings using preexisting sets of data, Medland says, but "There was no replication here." But that may be because there are no other appropriate data sets. Medland says she knows of only one other study that collected both IQ scores and the same kind of brain imaging data, and that "the data probably aren't comparable."

DO CELL PHONES CAUSE CANCER? AN EXPLOSIVE 'MAYBE'

Whether or not cell phones cause brain cancer is a question that's been debated (but not answered) for years, and today the World Health Organisation (WHO) stepped into the fray. A WHO committee that evaluates various potential cancer-causing agents concluded that radiofrequency electromagnetic fields, including cell phones, are "possibly carcinogenic" to people. The announcement was seized upon and published in dozens of news outlets within minutes.

The International Agency for Research on Cancer (IARC) arrived at the conclusion of possible carcinogenicity after an 8-day review of the literature by 31 experts, in Lyon, France. The classification falls in the middle of IARC's hierarchy of risk, joining a group of more than 250 potential carcinogens that also includes lead, engine exhaust, and occupational exposure to dry cleaning. In a sign of how tough it is to determine that something doesn't cause cancer, just one of the 900 or so agents that IARC has evaluated, caprolactam, a component of fibers and plastics, falls in the "probably not carcinogenic" category.

When it comes to cell phones, "we found some threads of evidence telling us how cancer might occur, but I think there are acknowledged gaps and uncertainties," said Jonathan Samet, chairperson of the IARC Working Group and a physician and public health expert at the University of Southern California in Los Angeles, during a press conference. The working group was particularly influenced by an international study called Interphone that's examining whether exposure to radiofrequency electromagnetic fields from cell phones causes cancer. Last year, the Interphone study group wrote in the International Journal of Epidemiology that it saw "no increase in risk of glioma or meningioma." It continued: "There were suggestions of an increased risk of glioma at the highest exposure level, but biases and errors" make it tough to show that the phones were the cause. "The possible effects of long-term heavy use of mobile phones require further profound investigation," they concluded.

IARC would like more research as well. Samet noted that at this point there are almost 5 billion cell phone subscriptions worldwide, and "we anticipate an ever larger population that is exposed for longer and longer." That said, shifting cell phones from the "possible" category to a more definitive one won't be easy. Epidemiologic studies like Interphone tend to match healthy people with those who have brain cancer and ask both to recall their cell phone use. "We know that is inherently imperfect," said Samet. And because all these studies take time to conduct, they inevitably examine older technology. Animal studies looking at the risk from radiofrequency electromagnetic fields have been mixed, both in whether they see a danger and in why that might be.

Whether IARC re-evaluates cell phone hazards, the committee says, will depend on what new research comes out.

HISTORY OF FIBER OPTIC TECHNOLOGY AND FIBER OPTIC SYSTEMS

People have used light to transmit information for hundreds of years. However, it was not until the 1960s, with the invention of the laser that widespread interest in optical (light) systems for data communication began. The invention of the laser prompted researchers to study the potential of fiber optics for data communications, sensing, and other applications. Laser system could send a much larger amount of data than telephone, microwave, and other electrical systems. The first experiment with the laser involved letting the laser beam transmit freely through the air. Researches also conducted experiments letting the laser beam transmit through different types of waveguides.

Glass fibers soon became the preferred medium for fiber optic research. Initially, the very large losses in the optical fibers prevented coaxial cables from being replaced. Loss is the decrease in the amount of light reaching the end of fiber. Early fibers had losses around 1,000 dB/km making them impractical for communications use. In 1969, several scientists concluded that impurities in the fiber material caused the signal loss in optical fibers. The basic fiber material did not prevent the light signal from reaching the end of the fiber. These researchers believed it was possible to reduce the losses in optical fibers removing the impurities. By removing the impurities, construction of low-loss optical fibers was possible.

There are two basic types of optical fibers, multimode fibers and single mode fibers. In 1970, Corning Glass Works made a multimode fiber with losses under 20 dB/km. This same company, in 1972, made a high silica-core multimode optical fiber with 4 dB/km minimum attenuation (loss). Currently, multimode fibers can have losses as low as 0.5 dB/km at wavelengths around 1300 nm. Single mode fibers available with losses lower than 0.25 dB/km at wavelengths around 1500 nm.

Developments in semiconductor technology, which provided the necessary light sources and detectors, furthered the development of fiber optics. Conventional light optics, such as lamps and lasers, were not easily used in fiber optic systems. These light sources tended to be too large and required lens systems to launch light into the fiber. In 1971, Bell Laboratories developed a small area light-emitting diode (LED). This light source was suitable for low-loss coupling to optical fibers. Researchers could then perform source-to-fiber jointing easily and repeatedly. Early semiconductor sources had operating lifetimes of only a few hours. However, by 1973, projected lifetimes of lasers advanced from a few hours to greater than 1,000 hours. By 1977, projected lifetimes of lasers advanced to greater than 7,000 hours. By 1979, these devices were available with projected lifetimes of more than 100,000 hours.

In addition, researchers also continued to develop new fiber optic parts. The types of new parts developed included low-loss fibers and fiber cables, splices, and connectors. These parts permitted demonstration and research on complete fiber optic systems. Advances in fiber optics have permitted the introduction of fiber optics into present applications.

These applications are mostly in the telephone long-haul systems, but are growing to include cable television, computer networks, video systems, and data links. Research should increase system performance and provide solutions to existing problems in conventional applications. The impressive results from early research show there are many advantages offered by fiber optic systems.

UNIT III

MY SCIENTIFIC RESEARCH

I. Read the text and give your arguments for choosing postgraduate studies.

WHY DO WE CHOOSE POSTGRADUATE STUDIES?

What does choosing the postgraduate course mean for a person? It is going up the level higher than the first degree. What are the reasons for taking postgraduate studies? The first one is the stimulus of the intellectual challenge: working with concepts, approaches, methods and ideas, developing skills of analysis and research among the researchers and academics.

The second reason is the personal challenge. What is the difference between the undergraduate and the postgraduate level? Undergraduate level develops study skills and the ability of independent studies, and the postgraduate course specifies skills perfection, responsibility, independence in one's own learning, ability to work with complex ideas and concepts and developing them.

Next, there is the serious problem of career prospects, more interesting and highly paid jobs. PhD degree or degree of Doctor of Science can be an obligatory requirement for entering the career, the researcher career or securing promotion to higher levels. In some professional fields the joint programmes of universities and employers are undertaken both at undergraduate and postgraduate level and these programmes are defined as the first stage of learning for the trainees.

For a number of postgraduates entering academic career as the university teacher and researcher is important. Besides, with rapid extension of higher education in some countries high-status academic position is available only with the Doctorate. It means the increase of the demand for people educated to Doctorate level.

II. Read the text about types of postgraduate programmes and speak on your research programme.

TYPES OF POSTGRADUATE PROGRAMMES

Actually, there are two main types of postgraduate programmes: taught and research. What is the difference? How can one define the programme type? In taught programmes training is mainly carried out through classroom lectures and practice, seminars, computing and laboratory, coursework and exams. The work in a research programme is knowledge development. It is usually part of the educational institution research. The entry criteria and the description are of a great help.

All Master's programmes contain the research elements, and there are some combined programmes with taught and research elements, for example, the Doctor of Engineering (DEng). Funded integrated programmes are of special interest. The designation '3+1' means an academic year in the master's studies and three-year PhD. The conversion courses are intended to change the students' research direction according to the new career. That is why these courses are intense and deep in the new research subject. Programme coordinators help everybody choose the programme.

In fact, stand-alone taught postgraduate programmes are the first stage in postgraduate education before obtaining a research degree. In the United Kingdom of Great Britain and Northern Ireland there are three levels in taught programme: postgraduate certificate (PGCert), postgraduate diploma (PGDip) or Master's (in science − MSc). They are less than a year and can be either a part of continuing professional development (CPD) or preparation for the full time taught programme.

Sometimes diplomas (MScDiplomas) are awarded to students following the Master's (full time programme during a year, part time programme for two years) without completing the dissertation (20, 000 words). Engineering programmes can be achieved both as an extended period of undergraduate study during a year – M (Eng) or stand-alone one-year programmes for thorough learning the specific area of the discipline − MSc.

In research programmes the master's level for two years is called Master of Research (MRes) or Master of Philosophy (MPhil). All these programmes teach mainly the research skills. PhD is the highest research degree, three years or more. It is much longer, from 7, 000 to 10, 000 words. With PhD one becomes a leading expert in a certain specialisation.

III. Insert the prepositions.

1) A highly-qualified adviser is very important … each postgraduate student and candidate … Master's degree.

2) Associate professors carry … the scientific work of their own and guide postgraduate studies and their scientific research.

3) My brother will become the Doctor of Science after defense … doctorate thesis.

4) Next year I am going to enter magistracy and become the candidate for degree … master.

5) After studies … magistracy the candidate can get the Master's degree.

6) Studies at magistracy are the stage … taking postgraduate course.

7) The magistracy offers a wide range both … part time and full time programmes.

8) Getting postgraduate courses certificates is an obligation necessity … continuing one's operational procedures.

IV. Match the parts of the sentences.

1. Every postgraduate has to write	a. the graduate enters magistracy.
2. The adviser has to manage	b. after four years of university studies and graduation.
3. The associate professor position is higher	c. abstract of thesis before the thesis.
4. Candidates for Master's degree take the course of studies	d. than that of the assistant professor.
5. Continuing professional development courses gives	e. after postgraduate studies and defence of thesis.
6. To become Doctor of Science one has	f. carrying out a lot of scientific research.
7. In magistracy postgraduate students	g. the process of the research and defence.

8. To become a Master	h. new job competences.
9. All the students, candidates for master's degree, postgraduates, and teachers	i. get the degree of Master and then take postgraduate studies.
10. Being postgraduate means	j. write research papers.
11. PhD degree is given	k. to take the course of doctorate.

V. Match the terms and their definitions.

1. Abstract	a. A particular procedure or set of procedures. These may include the methods, techniques and instruments used in a research experiment.
2. Bibliography	b. A statement that explains or interprets the data produced in an experiment.
3. Conclusions	c. The organised investigation of questions raised by scientific theories and hypotheses.
4. Data Book	d. A sequence of steps followed in investigating natural phenomena.
5. Demonstration Project	e. A proposed explanation for a phenomenon.
6. Hypothesis (Research Question)	f. A project that retests an experiment already conducted by someone else. It can also show how something works.
7. Graph	g. An organised review of books, articles and published research on a specific topic.
8. Literature Search	h. A diagram that illustrates a relationship, typically between two variables. Each variable is measured along one of two axes.

9. Methodology	i. A brief summary of how the results of an experiment support or contradict a hypothesis.
10. Results	j. A brief summary of a research project and its findings.
11. Scientific Method	k. A documentation of the work done during an experiment. It includes the findings, called data, collected during an experiment, etc.
12. Scientific Research	l. A list of the books referred to in a research project. It usually appears at the end, or as a separate section, known as an appendix.

VI. Translate the sentences into Russian.

1) After passing candidate exams, postgraduates get postgraduate certificates or postgraduate diplomas.
2) Getting postgraduate diploma is a new stage towards the thesis. Postgraduate diploma comprises the name of the postgraduate course, the place of studies and the final results of studies during postgraduate training.
3) Postgraduate level is higher than the one of the magistracy. Postgraduate level ensures the career promotion.
4) I will take a postgraduate course after magistracy. I am going to take my postgraduate training in Mathematics.
5) I have been conducting research for two years under the adviser's supervision. The results of my research are both published and presented in the electronic form.
6) Getting a research degree is the final and main purpose of postgraduate studies. A research degree opens the way to research broadening and achieving better results in science.
7) Research prosecution is very important both in theoretical and practical research. Research prosecution is an integral part of the methodological base of studies.
8) My advisor has devoted all his life to science. Science is the main thing for the scientist.
9) He is a distinguished scientist in the field of computer science. I admire his activity.
10) The results of scientific work are published in scientific journals or in abstracts of thesis, in books, articles and reports. There are catalogues of scientific publications in traditional and electronic libraries.

VII. Answer the following questions.

1) Why did you decide to take a Master's degree course?
2) What is your field? What are you specialising in?
3) What is the title / the headline of your thesis? What is the theme / the subject of your thesis?
4) Is your current research connected with your graduation paper?
5) Have you already begun working at your thesis?
6) Who is your scientific advisor / supervisor?
7) What does your supervisor do? Where does he / she work?
8) In what way does your supervisor help you (with your research)? How often do you consult your scientific advisor?
9) Do you prefer to work on your own or in a team?
10) Have you ever taken part in scientific conferences?
11) Is your research theoretical or practical?
12) What machines (equipment / materials / technologies / processes) used in your field do you know? Which of them do you use in your own research?
13) What is the goal of your research? What problem(s) would you like to solve by your research?
14) Do you know any Belarusian or foreign researchers/investigators working in your field?
15) Is your field important for the national economy?
16) Do you know any English journals in your field?
17) Are the materials you have read in English useful for your research? Will you use the materials you have read in your thesis?

VIII. Get ready to speak on the topic "My Master Degree Research". Use the following phrases.

First, let me introduce myself. My name is …
I am a Master degree student at the department of …
My scientific supervisor is Prof …
I work under the guidance of professor …
My tutor is ...
I work in the field of ...
My major interest is in the field of ...
I am currently doing my master's degree in … studies.
I major (specialise) in the field of …
The title of my future thesis is ...
The subject of my research is …
The object of my research is the operation (behaviour / processes) of ...
Let me now go into some details regarding the subject I have mentioned.

I began with the study of literature on the subject including some basic works written by …
I have used many different sources of information, such as ...
These problems … are widely discussed (treated) in literature.
There are many papers discussing the state of the art in the development of …
The theory of ... was constructed and developed by ...
The immediate aim (goal / purpose) is to examine the function (behaviour / dynamics) of …
The main purpose/goal/aim of it is ... to find out / to define / to characterise / explore / to investigate / to analyse / to gain / ...
It is aimed at ...
A current study in our laboratory is addressing the question of ...
The focus of my research is on the relationship between ... and … .
It is very important and interesting to examine (analyse / evaluate / describe) the complex interaction between … and … .
I set myself a task / objective to / of ...
The tasks that face us / that we are faced with / are as follows ...
Its objectives are the following: …
The methods and techniques we apply in this research include experiments (observations, laboratory tests, field and pilot plant study …).
The experimental part of my research will mostly consist of tests to be conducted on …
It is therefore quite encouraging that these methods may be used to solve a number of problems in this instance and get an insight in …
This work is devoted to an important problem into which too few scientists have researched until now.
The most challenging problems I have faced are ...
My study deals with the problems of ... / is devoted to the investigation of ...
It touches upon the problems of ...
Earlier studies of this subject show that the problem has not been yet properly explored.
I consider my work to be relevant nowadays because ...
Some of most recent results of the research in … make use of the …. and the theory of….
The results may be constructed into a theoretic framework that I am going to describe by systemising the data obtained in the experiments (observations).
I think they will be of considerable practical significance, because …
I expect to obtain the following results ...
In the future I'm going to continue my studies and take a postgraduate course.
In conclusion I would like to say that ...

IX. Do you take part in scientific conferences? Read the text about the importance of scientific exchanges and discussions.

ATTENDING A CONFERENCE

Science knows no boundaries and its development becomes faster due to international cooperation. Scientific exchanges and discussions are always useful because they contribute to general scientific advance. Scientific conferences and symposia give sufficient food for thoughts. A conference is an important event in a researcher's life. You can get the information about the coming conference from scientific magazines or from special circulars that are often sent to universities and other scientific organisations.

If you want to be invited to the conference you should send a short abstract of your report (200 words) to the Organising Committee. If your abstract is accepted and you are invited to the conference you will have to submit your paper some weeks before the conference and make a hotel reservation.

The World Conference on Computers in Education took place in Switzerland some years ago. It brought together more than 500 people concerned with the development and use of computers in primary, secondary and university education, as well as in vocational training. The Conference was organised by the Swiss Federation of Automatic Control, on behalf of the International Federation for Information Processing, and had the backing of UNESCO.

The atmosphere of the conference was very friendly. The delegates talked mostly about science and discussed their research. There you could see prominent scholars.

The chairman declared the conference open. He welcomed the guests and the participants of the conference and wished them success. He also introduced honorary guests.

After the conference was opened, the chairman read the agenda and explained the work to be done. Everyone who wanted to take the floor had to ask the chairman in advance. The chairman required every speaker to keep to the point.

The chairman said that the conference would follow a new practice introduced for scientific gatherings with numerous participants: the papers were divided between sections and generalised by a principle speaker for each section with the discussion following afterwards.

In addition to the Congress a youth world programming tournament was being held in different countries. The national winners were invited to present their entry at the Conference. At the same time an exhibition was set up to present educational material and a range of hardware and software, going from the smallest personal computer to the largest distributed information technology network, a concrete illustration of the multiple resources of these techniques applied to teaching and education.

The Conference put the accent on the relations between information technology and the teaching of other disciplines (computers in the teaching of physics, humanities, engineering, economics and social sciences) and on the impact of new technologies. Moreover, the social impact of information technology on teachers and students, as well as on leisure were discussed during the conference.

Other contributions presented reviews of national policies and models of computer education; a special emphasis was put on the identification of the needs of developing countries and on the definition of the means to meet them.

To sum up, at a scientific conference you can:

1. demonstrate the results of your research to your colleagues;
2. get acquainted with the latest achievements in the branch of science you are engaged in;
3. probably find investors for your further investigation;
4. have a good opportunity to master your language skills.

1. Answer the following questions.

1) Is it important to take part in an international scientific conference?
2) Where can you get information about the conferences?
3) How long should an abstract of your report be?
4) What should you do if you are invited to the conference?
5) When do you have to submit your paper to the conference?
6) What are the duties of the chairman of the conference?
7) What is the difference between plenary and section meetings?
8) Do all participants of the conference have an opportunity to exchange opinions and discuss scientific problems?

2. Speak about the scientific conference you have recently attended. Was it really useful for you and why? Use the words and expressions from the text above.

X. Read the text and write down useful tips.

WRITING SUMMARIES

A summary (an annotation) is a brief characteristic of the contents of the original or the manuscript. The main purpose of such a simplification is to highlight the major points from the original (much longer) subject, e.g. a text, a film or an event. The target is to help the audience to get the main idea in a short period of time. We will take into consideration a summary on the content of scientific literature. There are different types of summaries. They are classified according to their aims of usage and their essence. The first type is a *reference summary.* Such summaries report the theme of the original, give some facts of it and don’t express any opinion of the original work. The second type is a *summary of recommendation.* These summaries estimate the original and define a suitable class of readers.

There is another classification of summaries according to the quantity of the original contents. The first kind is a *general summary.* They give some general characteristics of the original document. These summaries are written to a wide circle of readers. The second one is a *specialised summary.* They show some special aspects of the original. They are written to specialists in a variety of sciences. Summaries usually have a clearly arranged structure and they are written in a logical, chronological and traceable manner. In contrast to a résumé or a review, a summary contains neither interpretation nor rating. Only the opinion of the original writer is reflected – paraphrased with new words without quotations from the text. Unlike a retelling, a summary has no dramatic structure and is written in present tense or historic present. Because summaries should be significantly shorter than the original, minor facts have to be left out. However all major conclusions should remain. In summaries only indirect speech is used and depictions are avoided. Summaries of books or dissertations present the major facts in common scientific language and should be about from a half up to one page long.

A person has to do the following things to write s summary:

- to read the text attentively;
- to formulate the main statement;
- to reread the text and underline important ideas and arguments according to the main statement;
- to introduce the author and title of the work in the opening sentence;
- to mention the important facts in chronological order.

If a person is going to write a summary he has to know some requirements concerning writing them:

1) the volume of a summary is from 500 to 2000 symbols;
2) a logical structure should be kept.

It is also necessary to take the language peculiarities into consideration:

- to give the main ideas and facts of the original simply and in brief;
- to avoid repetitions;
- not to repeat the title of the original;
- to use the same terms as in the original;
- to use the accepted abbreviations and shortenings;

- to avoid using adjectives, adverbs, introductive words a lot;
- to use word combinations helping to organise structure of summaries;
- to use key-patterns.

Each summary has a certain structure. It consists of several parts:

1. The introduction. It is the stage where a reader faces the problem.
2. The body. It expresses the main facts and problems of the original document.
3. The ending. It gives recommendations for a definite group of readers.

Usually a person begins to write a summary from the compression of information stated in the original. It's a difficult process which consists of three main steps:

1) It's necessary to express the main facts using the minimum of the original paper.
2) It's necessary to follow the main ideas of the original.
3) It's necessary to find some extra information about this problem.

The compression can be done in two ways.

The first one is a process of diminishing the quantity of the original information. The second one is a process of keeping information completely.

The first type of compression is divided into two variants:

1) omission of details;
2) generalisation of the rest.

The second type of compression is divided into two types as well. The first one is a combination.

A combination is a way of organising the text when two or more sentences are combined in one short construction where the same components are used once.

E.g. 1. It takes only one number to describe a scalar quantity. It takes several numbers to describe a scalar quantity. It takes several numbers to describe a vector quantity. It takes only one number to describe a scalar quantity and several – a vector one.

The second one is a substitution.

A substitution is a way of organising the text when a part of the text is substituted by shorter one keeping the minimum of information of the original.

E.g. 1. He made up his mind to start the construction of another device. He decided to start…

2. The methods of multiplication of fractions in algebra are identical with those in arithmetic.

Compression of the original text is the first step of writing summaries.

The next one is making a logical plan of the text. A person looks through the text and finds the most important sentences. It's also necessary to pay attention to the language of writing summaries. A mention should be made about key-patterns usually used while writing them. They perform different functions. The key-patterns or speech models make process of communication simpler, help not to waste time and to organise the ideas better.

There is a classification of key-patterns according to their tasks. It's built on the basis of notions. Usually there is a general notion and a lot of notions connected to them.

Key-patterns for writing summaries:

The article deals with . . .
As the title implies… the article describes … .
The paper is concerned with … .
It is known that … .
It should be noted that … .
The fact that … is stressed.
A mention should be made … .
It is spoken in detail about … .
It is reported that … .
The text gives valuable information on … .
Much attention is given to … .
It is shown that … .
The following conclusions are drawn … .
The paper looks at recent research dealing with … .
The main idea of the article is … .
It gives a detailed analysis of … .
It draws our attention to … .
It is stressed that … .

XI. Read the text and write a summary of it following the tips you have written down.

ARTIFICIAL INTELLIGENCE AT EDINBURGH UNIVERSITY: A PERSPECTIVE

Artificial Intelligence (AI) is an experimental science whose goal is to understand the nature of intelligent thought and action. This goal is shared with a number of longer established subjects such as Philosophy, Psychology and Neuroscience. The essential difference is that AI scientists are committed to computational modelling as a methodology for explicating the interpretative processes which underlie intelligent behaviour, that relate sensing of the environment to action in it. Early workers in the field saw the digital computer as the best device available to support the many cycles of hypothesizing, modelling, simulating and testing involved in research into these interpretative processes. They set about the task of developing a programming technology that would enable the use of digital computers as an experimental tool. Over the first four decades of AI’s life, a considerable amount of time and effort was given over to the design and development of new special purpose list programming languages, tools and techniques. While the symbolic programming approach dominated at the outset, other approaches such as non-symbolic neural nets and genetic algorithms have featured strongly, reflecting the fact that computing is merely a means to an end, an experimental tool, albeit a vital one.

The popular view of intelligence is that it is associated with high level problem solving, i.e. people who can play chess, solve mathematical problems, make complex financial decisions, and so on, are regarded as intelligent. What we know now is that intelligence is like an iceberg. A small amount of processing activity relates to high level problem solving, that is the part that we can reason about and introspect, but much of it is devoted to our interaction with the physical environment. Here we are dealing with information from a range of senses, visual, auditory and tactile, and coupling sensing to action, including the use of language, in an appropriate reactive fashion which is not accessible to reasoning and introspection. Using the terms symbolic and sub-symbolic to distinguish these different processing regimes, in the early decades of our work in Edinburgh we subscribed heavily to the view that to make progress towards our goal we would need to understand the nature of the processing at both levels and the relationships between them. For example, some of our work was focused primarily on symbolic level tasks, in particular, on automated reasoning, expert systems and planning and scheduling systems, some aspects of our work were focused on natural language processing, machine vision, such as object recognition, whereas other work dealt primarily with tasks at the sub-symbolic level, including automated assembly of objects from parts, mobile robots, and machine vision for navigation.

Much of AI’s accumulating know-how resulted from work at the symbolic level, modelling mechanisms for performing complex cognitive tasks in restricted domains, for example, diagnosing faults, extracting meaning from utterances, recognising objects in cluttered scenes. But this know-how had value beyond its contribution to the achievement of AI’s scientific goal. It could be packaged and made available for use in the work place. This became apparent in the late 1970s and led to an upsurge of interest in applied AI. In the UK, the term Knowledge Based Systems (KBS) was coined for work which integrated AI know-how, methods and techniques with know-how, methods and techniques from other disciplines such as Computer Science and Engineering. This led to the construction of practical applications that replicated expert level decision making or human problem solving, making it more readily available to technical and professional staff in organisations. Today, AI/KBS technology has migrated into a plethora of products of industry and commerce, mostly unknown to the users.

TEXTS FOR ADDITIONAL READING

U.S. STUDENTS FLOCK TO GRADUATE SCIENCE PROGRAMMES

The data are strangely absent from most discussions about the inadequacies of science education in the United States. But a new report from the National Science Foundation (NSF) finds that the number of Americans pursuing advanced degrees in science and engineering has risen sharply over the past decade and stands at an all-time high.

U.S. politicians are constantly complaining that the nation's system of higher education isn't producing the high-tech workforce needed to keep the country's economy competitive. And one big reason, they say, is a lack of student interest in the so-called STEM (science, technology, engineering, and mathematics) fields. But the numbers, at least for graduate education, tell a different story.

An NSF analysis released today shows that graduate enrollment in science and engineering programmes at U.S. institutions increased 35 % from 2000 to 2010, to a record 556,532. What experts regard as an even more sensitive barometer of student interest has shot up even faster, with first-time, full-time graduate enrollment in STEM programmes registering a 50 % increase over the decade.

A closer analysis of the numbers, which come from NSF's annual Survey of Graduate Students and Postdoctorates in Science and Engineering, offers still more encouraging demographic news. Although foreign students make up 30 % of the total enrollment in U.S. graduate science and engineering programmes, and while they constitute a majority in several fields, their slice of the overall pie has not grown in the past decade. Rather, the pools of U.S. citizens and those with temporary visas each grew by 35 %.

Individuals and organisations trying to attract more women and minorities into careers in science and engineering also have cause for celebration. The number of female graduate students in STEM fields grew by 40 % over the decade, outpacing the 30 % growth rate for men. Likewise, the growth of Hispanic and African-American STEM graduate students rose by 65 % and 50 %, respectively, outpacing the 35 % growth for the overall population.

The author of the report, NSF's Kelly Kang, points out that the increasing interest in STEM degrees among U.S. students is not a new phenomenon. She says her analysis simply provides additional evidence of a decade-long trend.

That is certainly true. On the other hand, it can take a long time for politicians to abandon arguments based on outdated numbers and to embrace new data that make the opposite case. The latest information from NSF has the potential to change minds and, in turn, influence the debate about preparing the next generation of U.S. scientists and engineers.

GLOBAL SCIENCE RESEARCH AND THE VALUE OF INTERNATIONAL COLLABORATION

Science research spending around the globe has increased by 45 percent to more than $1,000 billion (one trillion) U.S. dollars since 2002. In 2008, 218 countries generated more than 1.5 million research papers, with contributions ranging from Tuvalu's one paper to the U.S.' 320,000 papers. The U.S. leads the world's production of science research, accounting for 21 percent of publications and nearly $ 400 billion worth of public and private science R&D. BRIC and other developing countries, including China, India, Brazil and South Korea, account for much of the increase in scientific publications.

A study by the U.K. Royal Society points out that the BRIC countries, along with South Korea, "are often cited as rising powers in science." From 2002 to 2007, the China, India and Brazil more than doubled their spending on science research, bringing their collective share of global spending up from 17 to 24 percent.

Engineering is a common focus of science research in China, India and Russia. Scientific fields in which China has developed a leading position include nanotechnology and rare earths. Agriculture and biosciences are two important fields of emphasis in Brazil, which is a leader in biofuels research.

In keeping with their rapid economic development and massive populations, China and India, the world's first and second most populous countries, produce large and growing numbers of science and engineering graduates each year. In 2006, about 2.5 million students in India and 1.5 million students in China graduated with degrees in science and engineering.

INTERNATIONAL COLLABORATION

Today, over 35 percent of science research articles are the result of international collaborations among researchers from different countries, a 40 percent increase from 15 years ago. The number of internationally co-authored papers has more than doubled since 1990.

The US, UK, France and Germany continue to be key hubs of international collaboration in science research. Researchers in other developed and developing countries actively collaborate with scientists from these countries. According to the Royal Society report, "while links between the BRIC countries

(Brazil, Russia, India and China) have been growing in recent years, they pale in comparison to the volume of collaboration between these individual countries and their partners in the G7."

International science research often takes the form of regional collaboration. Regional political institutions, including the European Union (EU), African Union (AU) and the Association of Southeast Asian Nations (ASEAN), each have their own research strategies that foster and facilitate regional collaboration in science research.

"South-South Collaboration" between developing countries is a growing form of international science research. The International Centre for South-South Cooperation in Science, Technology and Innovation was inaugurated in Kuala Lumpur, Malaysia in 2008 under the auspices of UNESCO. An initiative of India, Brazil and South Africa promotes South-South cooperation in several arenas, including science and research collaboration in fields such as nanotechnology, oceanography and Antarctic research.

There are a number of important benefits, motivations and enabling factors that help explain the growth of international collaboration in science research, including: 1) greater impact; 2) scientific discovery; 3) scale of research projects; 4) scope and complexity of research topics and international issues; 5) capacity-building; and 6) advances in technology and communications.

Fourteen countries experienced more than a three-fold increase in their standard domestic publication impact by collaborating with one or more of 22 partner countries. Each additional international author leads to an increase in a paper's impact, up to a tipping point of about ten authors. By collaborating with one another, scientists can access complementary skills and knowledge and stimulate new ideas.

The scale of some major science research projects is too large for most countries to undertake on their own. In such cases, international collaboration is necessary to meet extensive requirements for human, financial and other resources. The scope and complexity of certain science research topics and objectives can also drive international collaboration.

Many of the world's most pressing social problems are international issues that call for collaboration and cooperation. Climate change, food security, public health (e.g., AIDS/HIV, malaria and tuberculosis) and sustainability are just a few of the global issues that require international collaboration and solutions.

Collaboration allows scientists in one country to build their capacity to conduct significant science research by leveraging the resources of partners in other countries. Collaboration can be particularly beneficial to partners from developing and developed countries.

Advances in technology have contributed greatly to the feasibility and appeal of international collaboration. For researchers in developing and developed countries alike, improvements in communication technologies and services have made international collaboration simpler, faster and cheaper than ever before.

GRAMMAR TESTS

THE ARTICLE

1. This book is about ... Central Africa.
   a) the c) a
   b) – d) an
2. ... Volga is the longest river in Europe.
   a) A c) The
   b) An d) –
3. ... Elbrus is the highest mountain in Russia.
   a) – c) the
   b) an d) a
4. Is ... Malta in ... Mediterranean?
   a) a, a c) –, –
   b) the, the d) –, the
5. ... Big Ben is a symbol of London.
   a) – c) The
   b) An d) A
6. ... Tate Gallery is the main modern art museum in London.
   a) An c) A
   b) The d) –
7. He was in ... Northern Ireland last year.
   a) – c) the
   b) a d) an
8. The USA is washed by ... Atlantic Ocean.

a) an c) the
b) – d) a

9. Rembrandt, a famous painter, was born in ... Netherlands.
a) a c) –
b) an d) the

10. ... Morocco is in ... North Africa.
a) –, the c) –, –
b) The, the d) The, –

ADJECTIVES AND ADVERBS
DEGREES OF COMPARISON

1. It was … music I have ever heard.
a) more beautiful c) less beautiful
b) the most beautiful d) beautiful

2. I have … time than he does.
a) least c) larger
b) most d) less

3. Your English is much … now. You've made … mistakes this time.
a) best, few c) better, less
b) the best, less d) better, fewer

4. Please, tell me something … than this old joke.
a) interesting c) less interesting
b) more interesting d) the most interesting

5. It is much … to speak English than to understand.
a) the most difficult c) more difficult
b) difficult d) most difficult

6. He is … among his groupmates.
a) old c) taller
b) the youngest d) short

7. I make … mistakes now than last year.
a) few c) fewer
b) – d) the fewest

8. It is … and … to live here than there.
a) warm, most pleasant c) warmer, pleasant
b) warmest, pleasanter d) warmer, more pleasant

9. Which is … country in the UK?
a) industrial c) the most industrial
b) more industrial d) most industrial

10. The … you start, the … you'll finish.

a) soon, more quickly
b) sooner, quickly
c) sooner, more quickly
d) soon, quickly

QUESTIONS

1. … could you know that was bad?
   a) Why
   b) When
   c) How
   d) What
2. … were you doing last Monday at 6 o'clock?
   a) What
   b) When
   c) Why
   d) Who
3. … was my dog in the evening? … is he so muddy?
   a) When, What
   b) Whom, When
   c) Where, Why
   d) Who, Where
4. … do you go for a trip? – Twice a year.
   a) How much
   b) How often
   c) How long
   d) How
5. … mansion is it? – It's mine.
   a) Who
   b) How
   c) Whom
   d) Whose
6. … of you should I reprimand (делать выговор)? … is to blame?
   a) What, Whose
   b) What, Whose
   c) Which, Who
   d) When, Who
7. For … are you going to purchase it? – For my little son.
   a) whose
   b) which
   c) whom
   d) what
8. … do you aim at? – I aim at money and power.
   a) Why
   b) What
   c) Which
   d) Who
9. How … do you earn? … is your salary?
   a) many, Which
   b) much, Why
   c) much, What
   d) many, Whose
10. … doctor do you like most of all? Dr. Christina or Dr. Juliet?
    a) Which
    b) Why
    c) When
    d) Whom

QUESTION TAGS

1. You will come along with us, … you?
   a) will
   b) are
   c) won't
   d) aren't

2. Linda knows five languages, … she?
   a) does   c) doesn’t
   b) do   d) is
3. He can jump for 60 minutes without a break, … he?
   a) can   c) is
   b) isn’t   d) can’t
4. We haven’t got a chair, … we?
   a) have   c) haven’t
   b) have not   d) are
5. I didn’t send a letter, … I?
   a) didn’t   c) do
   b) am   d) did
6. We are happy together, … we?
   a) are   c) do
   b) does   d) aren’t
7. She isn’t nice and amiable, … she?
   a) is   c) does
   b) do   d) isn’t
8. I’m tall and pretty, … I?
   a) are   c) am
   b) am not   d) aren’t
9. Let’s change the subject, … we?
   a) should   c) shall
   b) are   d) do
10. Nobody answered me, …they?
   a) did   c) do
   b) didn’t   d) are

TENSES IN ACTIVE AND PASSIVE VOICE

1. He … some new shoes last month.
   a) bought   c) buying
   b) buy   d) buys
2. A: … did she … a job?
   B: In the car factory.
   a) When, get   c) Where, got
   b) Who, get   d) Where, get
3. Max didn’t … yesterday afternoon; he … at home.
   a) go out, stayed   c) go out, stay
   b) went out, stayed   d) went out, stay

4. A: … you … Jane last month?
B: No, I … .
a) _, saw, didn't c) Did, see, didn't
b) Did, saw, didn't d) Did, see, did
5. Geoffrey … French before, but he … at university now.
a) study didn't, studies c) didn't study, study
b) did not study, studies d) didn't studied, studies
6. I … a friend while I … the shopping.
a) was meeting, did c) met, was doing
b) meet, do d) met, did
7. I … for my things when I … someone call my name.
a) paid, was hearing c) pay, heard
b) was paying, hear d) was paying, heard
8. While we … a drink, a waiter … a pile of plates.
a) had, was dropping c) have, dropped
b) have, drop d) were having, dropped
9. While the waiter … up the broken plates, he … his finger.
a) picked, was cutting c) was picking, cut
b) pick, cut d) picks, cut
10. While I … this morning, I … my money. I don't know how.
a) shopped, lose c) was shopping, lost
b) shopped, was losing d) shop, lose
11. What … at 20 years old, that's to say five years ago? … anywhere or were you jobless?
a) did you do, did you work
b) were you working, did you work
c) had you worked, were you working
d) were you working, did you work
12. The other day we … her at the shop. She was busy putting on a red scarf.
a) were meeting c) met
b) meet d) had met
13. My mother … supper by 7. When I … she was still preparing it.
a) did not cook, was returning c) had cooked, return
b) wasn't cooking, returned d) had not cooked, returned
14. Last summer our kids … in the competition. They won first place.
a) took part c) was taking part
b) were taking part d) had taken part
15. It … his first voyage that day. He …to New York many times.
a) were not, was already c) was, been already
b) wasn't, had already been d) was not, was already

16. ….I started talking … they interrupted me.
    a) hardly have, when   c) hardly, if
    b) hardly had, when   d) hardly had, than
17. Once upon a time there … a witch with her husband and stepdaughter.
    a) were living   c) living
    b) had lived   d) lived
18. We went home after it … snowing.
    a) had stopped   c) have stopped
    b) stopped   d) was stopping
19. … your bother … off the table before I turned up?
    a) have, felled   c) did, fell
    b) had, fallen   d) did, fall
20. She … school in 2000, then she … a job and then she … married in 2005.
    a) finished, found, got   c) was finishing, find, get
    b) had finished, had found, had got   d) finished, find, get
21. Is it the second time you … Britain? No, I … Britain four or five times.
    a) have been to, have been to   c) had been to, was in
    b) were in, was in   d) was going to, was to

22. Tom and I … friends since childhood.
    a) has been   c) were
    b) have been   d) was
23. We … a kitten 2 months ago.
    a) bought   c) have bought
    b) were buying   d) buy
24. He ... his work yet.
    a) didn't finish   c) haven't finished
    b) hasn't finished   d) hadn't finished
25. Last night my neighbour … you in a perfumer's shop.
    a) seen   c) seed
    b) have seen   d) saw
26. We … to throw a party three days ago but mother … no.
    a) have decided, have said   c) decided, said
    b) has decided, said   d) were deciding, say
27. … you … my letter from the USA yet? I … it to you a week ago.
    a) have, receiving, was sending   c) did, receive, sent
    b) have, received, sent   d) are, received, sent
28. Why … you … my breakfast before I came back? Were you so hungry?
    a) have, eaten   c) has, eaten
    b) had, eaten   d) did, ate

29. When John made his mind to sign up for English course, Tom …already …it.
    a) had, done   c) have, done
    b) did, do   d) has, done
30. She …a member of our organisation for more than 10 years.
    a) has be   c) have been
    b) was   d) has been
31. You are the most beautiful woman I … ever …. Why are you single then?
    a) have, seen   c) had, seen
    b) has, seen   d) was, seen
32. She … only for half a year before she was fired.
    a) has worked   c) had worked
    b) worked   d) was working
33. Can you tell me where Kate is at the moment? – I don't know, she … just …
    a) have, leave   c) have, left
    b) has, leave   d) has, left
34. … your mother … the table by the time you were back from Canada?
    a) has, laid   c) had, lad
    b) had, laid   d) had, lying

35. I'm sorry. I can't help you at the moment. I … dinner.
    a) will cook   c) am cooking
    b) cook   d) cooked
36. I … to miss classes when I went to school.
    a) used   c) use
    b) using   d) was using
37. Listen! Somebody … to break into our house! Call the police immediately.
    a) is trying   c) are trying
    b) tries   d) tried
38. More and more animals … extinct. We need to take care of nature.
    a) is becoming   c) are becoming
    b) become   d) will become
39. She's always … at me when she's in a bad mood.
    a) nag   c) nagged
    b) nagging   d) nags
39. My nephew … for another job these days. He wants to work at night.
    a) are looking   c) look
    b) looking   d) is looking
40. Look at her hands! They are dirty! She … fruits for 2 hours.
    a) has been picking   c) have been picking
    b) was picking   d) picked

41. ... you still ... ... at six o'clock?
    a) Will, working be
    b) Be, will working
    c) Working, will be
    d) Will, be working
42. He ... ... at midnight.
    a) be will sleep
    b) will be sleeping
    c) be will sleeping
    d) will be sleep
43. We ... ... our flat in May.
    a) will be renovating
    b) will being renovate
    c) will be renovate
    d) be will renovating
44. Do you have a credit card? If no, we can give it to you for free – No, I … cash.
    a) will be paying
    b) am paying
    c) will have paid
    d) will pay
45. We expect he … soon, otherwise we'll be frozen. Then I'm sure we … cold.
    a) will come, will catch
    b) will come, would
    c) would be would catch
    d) comes, catch
46. The sports competitions which … on Sunday … by a lot of people.
    a) are held, will be visited
    b) have been held, have visited
    c) will held, will visit
    d) will be held, will be visited

47. The business letter … just … .
    a) is, written
    b) was, written
    c) has, been written
    d) were, written
48. All the business letters … yesterday. They … to the post office immediately.
    a) answered, take
    b) are answered, were taken
    c) were answered, were taken
    d) answered, took
49. I … that I … at the station at 5.
    a) was told, should be met
    b) tells, am met
    c) told, is being met
    d) am told, was met
50. By the time we came to the bookshop all books ….
    a) are sold
    b) had been sold
    c) were sold
    d) are being sold
51. New schools … in our city every year.
    a) is built
    b) will build
    c) are to be built
    d) are built
52. This year a very beautiful theatre … in our city.
    a) built
    b) has been built
    c) was built
    d) had been built
53. This school … next year.
    a) will close
    b) will be closed
    c) is closed
    d) was closed

54. It is winter. Everything … with snow.

a) is covered
b) were covered
c) covered
d) will cover

55. The report …. by 6 o’clock.

a) is finished
b) will have been finished
c) will finish
d) will be finishing

REPORTED SPEECH

1. He says, “You are right.”

a) He says that I am right.
b) He says which I right.
c) He says I was right.
d) He said I are right.

2. She says to him, “I have a right to know.”

a) She tells him that she would have a right to know.
b) She tells him she have a right to know.
c) She says him she has a right to know.
d) She tells him that she has a right to know.

3. We said to them, “We have no money.”

a) We told them that we have no money.
b) We told them that we had no money.
c) We told them we have no money.
d) We told to them that we had no money.

4. He said, “I have changed my opinion.”

a) He said that he had changed his opinion.
b) He said that he have changed his opinion.
c) He said that he would have changed his opinion.
d) He said that he changed his opinion.

5. He said, “I will bring you a book tomorrow”.

a) He said that he would bring me a book the next day.
b) He said that he will bring me a book the next day.
c) He said that he brings me a book tomorrow.
d) He said that he would bring me a book tomorrow.

6. They said, “We were in the USA the day before yesterday”.

a) They said that they had been in the USA two days after.
b) They said that they had been in the USA the days before yesterday.
c) They said that they have been in the USA two days before.
d) They said that they had been in the USA two days before.

7. He asked her, “Do you speak English?”

a) He asked her if she has spoken English.
b) He asked her if she speaks English.
c) He asked her if she had spoken English.
d) He asked her if she spoke English.

8. I asked them, "Have you been to Africa?"
   a) I asked them whether they had been to Africa.
   b) I asked them whether they have been to Africa.
   c) I asked them whether they were to Africa.
   d) I asked them whether they would be to Africa.
9. He asked us, "What are your names?"
   a) He asked us our names what were.
   b) He asked what our names have been.
   c) He asked us what our names are.
   d) He asked us what our names were.
10. She said to me, "Don't talk to me".
   a) She told me not to talk to her.
   b) She told me to not talk to her.
   c) She told me not to talk to me.
   d) She told me do not to talk to her.

INFINITIVE AND GERUND

1. He agreed … the job as soon as possible.
   a) start c) starting
   b) to start d) starts
2. I stopped … my book and went to bed.
   a) to read c) read
   b) will read d) reading
3. My teachers always expected me … well in exams.
   a) did c) doing
   b) do d) to do
4. Let me … for the meal. You paid last time.
   a) pay c) to pay
   b) paid d) paying
5. The dentist told me … more careful when I brush my teeth.
   a) will be c) being
   b) to be d) be
6. I never liked … to church when I was a child.
   a) going c) to do
   b) went d) go
7. You can't … your car outside the hospital.
   a) parks c) to park
   b) park d) parking

8. David always enjoyed … football at school.
   a) to be played c) playing
   b) to play d) play
9. My family is trying … where to go on holiday.
   a) decided c) decide
   b) to decide d) deciding
10. I'd like … somewhere different for a change.
   a) went c) to go
   b) go d) going
11. They prefer … in a swimming pool all day.
   a) playing c) plays
   b) to play d) to laying
12. They refuse … out on trips if it's too hot.
   a) to going c) to go
   b) going d) go
13. Last year we managed … a holiday that suited everyone.
   a) found c) to find
   b) find d) finding

14. We decided … a house with a swimming pool.
   a) renting c) rent
   b) to renting d) to rent
15. We began … about next year's holiday two months ago.
   a) talked c) talking
   b) talks d) talk
16. Jim said the switch was dangerous and warned me ... touch it.
   a) do not c) not
   b) not to d) no
17. She said the letter was personal and didn't let me ... it.
   a) reading c) read
   b) to read d) read to
18. She didn't want ... to go.
   a) they c) I
   b) his d) me
19. I know him ... a good student.
   a) is c) has been
   b) to be d) was
20. Carol's parents always encouraged her ... hard at school.
   a) to study c) studied
   b) studying d) studies
21. When did you ... him to check the timetable?

a) asked c) to ask
b) ask d) ask to

22. He saw two girls ... on the stage.
a) to dance c) dancing
b) dances d) are dancing

23. She made her brother ... into the water.
a) to jump c) jump
b) jumps d) jump to

24. She didn't want her child .... to hospital.
a) to take c) take
b) to taken d) to be taken

25. Do you like … football on TV?
a) watch c) watched
b) watches d) watching

26. Thank you for … me.
a) helping c) help
b) to help d) helped

27. I'm afraid of … mistakes.
a) to make c) made
b) make d) making

28. It is important ….
a) to win c) winning
b) win d) won

29.A: This problem is too difficult. I can't solve it.
B: Is it really too difficult for you …?
a) solving c) solve
b) to solve d) solved

30. Have you got anything … ?
a) reading c) to read
b) read d) reads

MODAL VERBS

1. … you help me with my homework?
a) Are c) May
b) Can d) Need

2. You … enter without a tie.
a) aren't c) can't
b) ought not d) weren't

3. We … leave now or we'll be late.
   a) has to c) must
   b) can d) will
4. If you had video, you … record it yourself tonight.
   a) could c) can
   b) must d) may
5. A: My car has been stolen.
   B: … .
   a) You should ring the police. c) Will you phone the police?
   b) Could you ring the police? d) You are phoning the police.
6. A: She can't sing.
   B: Neither … .
   a) do I c) could I
   b) am I d) can I
7. If you don't feel better you … go to bed.
   a) ought c) should
   b) don't have to d) needn't

8. You … get the 8.45 train. It doesn't stop at Yorkshire.
   a) had better c) mustn't
   b) should d) don't have to
9. His illness got worse and worse. In the end he … go into hospital for an operation.
   a) will have to c) must
   b) had to d) ought to have
10. You … any more aspirins; you've had four already.
   a) mustn't take c) needn't have taken
   b) shouldn't have taken d) had better not take
11. You … spanked her. She didn't deserve it.
   a) shouldn't have c) needn't have
   b) mustn't have d) couldn't have
12. A: I wonder who took my alarm clock.
   B: It … Julia. She … supposed to get up early.
   a) might be, is c) could be, is
   b) had to be, was d) must have been, was
13. In a hundred years' time we … out of water to drink.
   a) must have run c) might have been run
   b) should have run d) may have run
14. A: Did you enjoy the concert?
   B: It was OK, but I … to the theatre.

a) needn't have gone c) must have gone
b) had better go d) would rather have gone

15. When I was a child, I … a flashlight to bed with me so that I … read comic books without my parents' knowing them.

a) used to take, could c) was used to taking, could
b) would take, can d) would have taken, was able to

PREPOSITIONS

1. Mozart was born in Salzburg ... 1756.

a) on c) at
b) in d) during

2. It has been raining ... two days without stopping.

a) on c) for
b) during d) at

3. Many interesting suggestions were made ... the meeting.

a) into c) onto
b) for d) during

4. My English courses begin ... 7 January and end ... 10 March.

a) on, in c) at, at
b) in, in d) on, on

5. I'm just going out to do some shopping. I'll be back ... half an hour.

a) at c) for
b) while d) in

6. Kate works hard during the week, so she likes to relax ... the weekends.

a) in c) at
b) for d) with

7. Our family always gets together ... Christmas Day.

a) at c) in
b) on d) while

8. I haven't seen Ann ... a few days. I last saw her ... Tuesday.

a) during, on c) during, at
b) for, on d) for, at

9. We met a lot of people ... we were on holiday. ... that time, we also visited a lot of museums and galleries.

a) while, During c) during, While
b) for, At d) at, For

10. Tom doesn't see his parents very often – usually only ... the New Year and sometimes ... the summer for a few days.

a) on, in
b) at, in
c) on, at
d) at, on

TEXTS FOR ANNOTATING

THE NEW FRONTIERS

Throughout history, the unknown has attracted explorers lo the earth's farthest and most isolated places. Today, this same urge continues to draw daring men and women toward the newest frontiers of exploration – the ocean floors and outer space.

The first expedition to explore the depth and life of the oceans was organised in 1872. That year, the Royal Society of London, a British scientific association, helped equip the ship *The Challenger* with instruments to collect information about the world's deep seas. Charles Wyville Thomson, a Scottish naturalist, headed the voyage. *The Challenger* spent more than three years at sea and traveled nearly 70,000 miles (110,000 kilometers). This remarkable expedition led to the development of oceanography, the scientific study of the sea.

During the early 1900s, the Norwegian explorer Fridtjof Nansen developed instruments for sampling sea-water from any depth and measuring its temperature. In 1934, William Beebe, an American naturalist descended half a mile (0.8 kilometer) into the waters off Bermuda in a diving vehicle called a bathysphere.

The Swiss physicist Auguste Piccard made a major contribution to ocean exploration during the 1940s. He invented a diving vehicle known as a bathyscaph, which could descend farther than any craft of its day. In I960, Placard's son Jacques and Lieutenant Don Walsh of the U.S. Navy dived the bathyscaph *Trieste* into the Mariana Trench, a valley in the Pacific Ocean floor off Guam that is the lowest known place in the world. They reached a depth of 35,800 feet (10,910 metres), about 400 feet (120 metres) from the bottom.

During the 1970s, diving vehicles carried explorers to many other areas and produced startling information. Scientists learned that the lands beneath the oceans include mountains, plains, and valleys similar to those on dry land. Oceanographers also discovered many fish and other kinds of sea life that had been unknown.

Today, some explorers are searching the ocean floor for important minerals, such as oil and natural gas. Others are seeking plants or animals that could become major sources of food. Still others hope to find clues that would help explain how the Earth was formed.

ANCIENT AND MEDIEVAL EXPLORATION

The first known explorers were really traders from such places as Babylonia and Egypt. Babylonia was an ancient civilization centered in what is now southeastern Iraq. Its traders learned much about distant lands during their travels. Beginning about 2500 BC, Babylonian trading expeditions traveled as far south as the Indian Ocean and as far west as the Mediterranean Sea. Also about 2500 BC, the Egyptians sent an expedition down the Red Sea to an area on Africa's east coast then known as Punt. Scholars believe Punt was in or near what is now Somalia. In 1500 BC, Egypt's Queen Hatshepsut sent traders to Punt in ships powered by both sails and oars.

The Phoenicians became the leading sea explorers of ancient times. These people lived at the eastern end of the Mediterranean, in the coastal areas of what are now Israel, Lebanon, and Syria. Phoenician explorers became the first to sail the length of the Mediterranean Sea, perhaps as early as 1100 BC. About 750 BC, they established Carthage near present-day Tunis as a trade and shipping post. Later, they went through the Strait of Gibraltar at the Mediterranean Sea's western end, and set up colonies on the Atlantic shores of North Africa.

During the 400s BC, the Phoenicians in Carthage sent out a fleet of 60 ships to explore the Atlantic coast of Africa and establish settlements there. Hanno, a Carthaginian navigator, commanded the fleet. He probably explored as far south as present-day Senegal before he began to run out of supplies and had to return.

The ancient Greeks learned more about world geography than did any people before them. Ancient Greece reached the height of its power in the 400s BC. During this period, Greek sailors explored the Mediterranean coasts of Europe and Africa looking for places to set up colonies. The two men who did the most to expand this civilization's knowledge of the world lived about 100 years later and ranged far beyond the Mediterranean area. These men were Pytheas, who was an astronomer and a mathematician, and Alexander the Great, who was a king, general, and conqueror.

Pytheas lived in Massalia, a Greek colony located at what is now Marseille, France. He had a plan to study the tides of the Atlantic Ocean in various places. About 300 BC, Pytheas sailed from Massalia through the Strait of Gibraltar. He explored the Atlantic coasts of what are now Portugal, Spain, and France. Pytheas sailed past the present-day British Isles and continued northward until ice blocked his way and forced him to turn back. Pytheas later spoke of a land called *Ultima Thule* that supposedly lay near the northernmost point of his journey. Scholars believe this land was Iceland or Norway.

POPULATION TRENDS

Earth's population, or the number of people living on the planet, constantly increases. Population figures are always approximations. No one can know exactly how many people there are in the world because birth and death records are not always well kept, especially in developing countries. In general it is considered that the total population of the world is exceeding 7.5 billion people.

The population growth rate has not always been as high as it is today. Scientists, who study population trends, have found that population growth rates differ in different parts of the world and vary with the levels of a country's economic development. As a nation develops, it moves through four stages of population growth. In the first stage of population growth the number of people increases slowly. The birth rate, or the number of children born per 1,000 people, is high. But the death rate, the number of people who die per 1,000 people, also is high. Few children live to be adults. Sickness, malnutrition, and starvation kill large numbers of people every year. Life expectancy – the average number of years a person is expected to live – is only about 30. This means that the rate of natural increase, or the difference between the birth rate and the death rate, remains low.

In the second stage of population growth technological advances in farming, nutrition, medicine, and sanitation result in increased supplies and improvements in health care. So people live longer and many more children than before live to become adults. The death rate drops rapidly and the population begins to grow rapidly.

In the third stage most children live to be adults. In order to raise their standard of living many adults begin limiting the size of their families, thus lowering the birth rate. The population still grows, but at a lower rate than before.

Finally, in the fourth stage both the birth rate and the death rate are very low. At this stage, the population growth rate slows dramatically and may even approach zero population growth, or a point at which the birth rate and the death rate are about equal. In stage four the rate of natural increase is almost as slow as it was in stage one.

The four stages of population growth may not always apply to every country of the world but the understanding of the demographic tendencies helps put the world's population growth into perspective.

HISTORY OF CENSUS

The term "census" (Latin *censere*, "to assess") is primarily referring to the official and periodical counting of the people of a country or section of a country; it also means the printed record of such a counting. In actual usage the term is applied to the collection of information on the size and characteristics of population, as well as on the number and characteristics of dwelling units, various business enterprises, and governmental agencies.

The earliest known census enumerations were conducted for purposes of levying (demanding) taxes or for military conscription. Clay tablet fragments from ancient Babylon indicate that a census was taken there as early as 3800 BC to estimate forthcoming tax revenues. The ancient Chinese, Hebrews, Egyptians, and Greeks also are known to have conducted censuses. Not until the Romans began a count of their empire's inhabitants, however, did enumerations take place at regular intervals. The Roman censuses, designed for both taxation and military conscription, were the responsibility of local censors. In addition to registering the population and collecting taxes, the censor was also in charge of maintaining public morals.

With the dominance of the feudal system in the Middle Ages, information on taxation and personnel for military conscription became unnecessary. Not until the 17th century did a nation again attempt an accurate count of its population. Sweden has been cited as the forerunner in the collection of information on its inhabitants. Its churches were required by law to keep continuous records of births, deaths, and marriages occurring among all people residing within the parish boundaries. Such vital statistics registrations are still maintained in Scandinavia, Finland, the Netherlands, and Belgium.

The first true census in modern times, however, was taken in the colony of New France (France's North American empire), where the enumeration of individuals began in 1665. The rise of democratic governments resulted in a new feature of the census process: the 1790 census of the United States was the first to be made public after gathered information was tabulated.

During the 19th century and the first half of the 20th century, the practice of census spread throughout the world. International organisations, such as the United Nations, have encouraged all countries to adopt uniform standards in taking their censuses. Decennial censuses are now taken by many countries throughout the world.

INTERNATIONAL TRADE

In the very early days people produced everything they needed themselves. They made their own clothes, produced their own food and built their own shelters. At a later stage in human history people began to specialise in doing particular kinds of work, so they no longer produced all of their needs. This meant that they had to get some of the things which they needed from other people, and had to supply these people with something else in return. At first this was done by bartering (simply exchanging one thing for another). Trade by barter is still to a limited extent practiced in some parts of the world. In most areas, however, money is now the main medium of exchange.

The buying and selling or exchanging things is known as trade. Trading involves the buying and selling of both goods and services. Trade can be divided into two broad types: domestic and external. Domestic trade or internal trade involves the buying and selling entirely within one country. The trading of goods may take place in market places or in shops or it may involve people selling goods from door to door or on the street.

External trade or international trade or foreign trade involves the transfer of goods and services between different countries. Basically countries trade with each other because they are better at producing certain things than others. Climatic variations among countries offer different possibilities for agriculture. For example, in the Caribbean it is possible to grow successfully a whole range of tropical crops such as bananas, cocoa, coconuts, cotton, sugar cane and so on. None of these crops can be grown in colder countries such as those of Western Europe. On the other hand, wheat cannot be grown successfully in the Caribbean, but grows well in colder countries such as Canada. As a result, the Caribbean depends upon colder countries to provide it with wheat or wheat flour and they in turn purchase tropical crops from the Caribbean.

It is easy to understand why nations import goods they cannot produce. If people want to eat bananas, bananas must be imported from the countries where they are grown. But why are clothing, toys, and automobiles imported if they are also made in the country? There are two answers: quality and price.

A country that specialises in making a certain product may produce goods of such quality that buyers abroad prefer them to goods made in their own countries. The Swiss, for example, have long specialised in making watches and scientific instruments, which they export to countries that make these products, too. American companies specialise in making office machines and computers, which they export to other countries.

Lower prices are probably connected with the success of imports.

THE BATTLE OF THE BICYCLE

In Denmark, and in particular Copenhagen, the cycling culture is so strong that most car drivers are terrified of the cyclists, much in the same way Hindu driver may fear wandering cows in the streets of Bombay.

Every morning a third of the Danes pick up their bicycle clip and the other third their car keys, while the final third watch from the windows of public buses and trains. To be honest the future of the car looks rather grim. There are already more cyclists here than in any other European city. As soon as the first wave of commuting cyclists decreases around 9.30 a.m., the streets come alive with a new species of cyclist. Dressed in black lycra leggings and bright yellow and green jackets, with rucksacks on their backs, crowds of bicycle couriers move from office to office. The first bicycle couriers started up in Copenhagen in 1989 when it became clear that bicycles were quicker than taxis within central city areas with traffic jams and one-way streets. Today many bicycle courier firms operate around the city with each courier peddling up to 100 km a day, some even going into Sweden.

So why is cycling in Copenhagen so popular? One of the answers is the flatness of the terrain and a relatively small size of the city. Distances are short and at night two-thirds of Copenhageners make their way home to the suburbs. However, the answers to the question are not only geographical but political and philosophical. In 1905 Europe’s first Cyclist Federation was founded in Denmark with the aim of improving cycling conditions. Since then numerous cycle paths have been built around the city, and different cycling schemes have been introduced.

One of these schemes is a government initiative to replace the company car with the company bicycle. Many inner-city firms have been offered bicycles to encourage staff to take a bicycle rather than take a taxi to their local meetings. If all goes well, windswept, rosy-cheeked businessmen with the company annual report in the front basket may soon become the style. This is not such a great change to business philosophy. Economically speaking the bicycle is certainly the cheapest form of transport, and within central Copenhagen it is usually the quickest. One can often see people with mobile phone in one hand and handle bar in the other, speeding past the lakes on their way into the city.

THE GYPSIES

Brightly painted wagons, colourful costumes, and wild violin music are part of a culture unique in the world. The culture belongs to bands of nomads who owe allegiance to no government. This is the culture of the Gypsies, also called Romanies. Although Gypsies live on every continent except Antarctica, they remain concentrated in the nations of Eastern Europe. Population geographers have had a difficult time taking a census of the Gypsies.

Gypsy origins remain shrouded in mystery. The Gypsies language, Romany, is an offshoot of Sanskrit, the ancient language of India. Because of this link, scholars have theorised that Gypsies trace their descent to people who originally lived in India. For unknown reasons the Gypsies began migrating to Europe thousands of years ago. By the 1600s Gypsies lived in Europe and North America, and even in the Americas.

Gypsies usually live in bands of from 10 to several hundred families. A chief, elected for life, heads each band and governs with the help of a council of elders. The entire band shares the responsibility of raising the group's children. Such an upbringing gives the children a sense of loyalty to the band and helps explain why Gypsies seldom leave the band into which they were born. Gypsies depend on cooperation among band members. Taking advantage of another Gypsy is considered dishonorable.

As have many Nomads, the Gypsies have suffered discrimination from people through whose domains they pass. They have been accused of bringing bad luck; being the source of disease, and of lying and cheating. Persecution reached its height during World War II when German Nazis imprisoned and executed more than 500,000 Gypsies.

Although some Gypsies have given up their nomadic life style and settled in various countries, many still follow traditional ways. As they travel through the countryside they earn their living as migrant agricultural workers and performers, fortune-tellers, or entertainers.

However, the traditional life style of the Gypsies is rapidly disappearing. Increasing urbanisation, political tensions, and the policies adopted by many national governments are forcing Gypsies to give up their nomadic life style and find permanent jobs.

EL NIÑO

The Peru Current, which flows northward along the western coast of South America, sometimes behaves in ways that scientists do not fully understand. Because this usually occurs soon after Christmas, it is called *El Niño,* Spanish for "The [Christ] Child".

Upwelling – a climatic condition brought on by winds that persistently drive water away from the coast – is of great biological importance to the west coast of South America. When upwelling occurs, the cold subsurface water of the Peru Current rises to replace the usually warm water. The rising, cooler water is rich in nutrients for phytoplankton – microscopic ocean plants. Tiny marine animals called zooplankton feed on the trillions of phytoplankton. At the upper end of the food chain, fish thrive on the abundance of food. This process makes the coasts of Ecuador, Peru, and Chile among the world's most productive fishing areas.

Occasionally northerly winds replace the prevailing southerly winds and the cold Peru Current moves westward. In its place comes a warm current – El Niño. The warm waters of El Niño stop the upwelling and completely break down the normal ecological system. Most of the marine life moves in search of plankton-rich cooler waters and the fishing fleets follow.

In 1972 El Niño appeared quite suddenly. Warm water herded fish into a narrow band of cool water along the coast of Peru. Several thousand fishing vessels closed in. Together they caught as much as 180,000 tons of fish in a day.

When El Niño stopped, upwelling resumed. But most of the fish were gone. Without fish to consume the plankton, they overmultiplied and exhausted their food sources. Billions died and decomposed on the ocean floor. Decomposition used large quantities of the water's oxygen, making the ocean off Peru unable to support fish until balance was restored.

Scientists now recognise that El Niño's influences reach far beyond the west coast of South America. Indeed, it is now known that El Niño interacts with worldwide weather patterns. Rainfall shifts from the normally wet western Pacific toward the drier eastern Pacific. The Philippines and Indonesia experience drought. Intense heat and drought sweep Australia. Ecuador and Peru receive heavy rain and floods take heavy tolls in human lives and property losses. Record-breaking snowfalls paralyse the east coast of North America, while western Canada and Alaska experience unusually mild winters. All result from a still-unexplained change in the weather.

CORAL REEFS

In the warm waters of tropical oceans throughout the world lie wondrous coral reefs that teem with marine life. These reefs make up an important element in the landscapes of coastal locations in the tropics. Reefs are found in the South Pacific, around the coastlines of South and Southeast Asia, and around the huge island of Madagascar off the southeastern coast of Africa. Reefs also lie along the coast of tropical Brazil, throughout the Caribbean, and along the coasts of Florida and Bermuda.

Tiny marine creatures called polyps create corals. Polyps can survive only in clear ocean water that remains warmer than 18° C throughout the year. Because polyps also require light, they grow close to the surface. They grow in many different sizes, shapes, and colours. Each polyp extracts calcium from ocean water and secretes a skeleton around the lower half of its body.

The formations that we know as coral reefs are the groups of many thousands of individual polyps that have attached themselves to one another with both living tissue and their external skeletons. They continue to build over time on dead polyp skeletons on the ocean floor, on rock, around the cones of undersea volcanoes, and on such ocean debris as sunken ships. Coral reefs, then, are a living, self-repairing colony of polyps and rank among the earth's most amazing physical phenomena.

Just off the northeast coast of Australia lies a maritime habitat of coral reefs, sandbars, coral islands, and sheltered seas. This habitat makes up the Great Barrier Reef – the largest coral reef in the world. The reef stretches north and south for more than 2000 kilometres. The reef received the name "barrier red" because it forms a barrier between the water of the open ocean and the water near the shore.

Australia's Great Barrier Reef is actually an enormously complex structure composed of many individual reefs. Along the eastern face of the reefs the Pacific Ocean forms an almost continuous line of surf.

Hundreds of coral islands rise above the water near the Great Barrier Reef. These islands originally came into being as reefs, perhaps partially exposed to low tide, but covered by water twice each day. Day after day, year after year, sand and coral debris washed over them and coral grew on than until finally the reef emerged permanently from the ocean. Once above the ocean's surface, plants produced from seeds carried by wind, waves, and birds grew on the islands.

THE MYSTERY OF WALES

The story of the Welsh people is one of determined resistance to invaders – the Romans, the Saxons, the Vikings, the Normans and finally the English. After the fall of the Roman Empire in 410 AD, barbarian Angles and Saxons invaded Britain. Legendary kings and princes, like King Arthur, won important victories against the Saxons but gradually these original 'Britons' were pushed west into the hills and mountains of Wales. Welsh princes fought hard against the English but Wales was finally conquered. In 1301 Edward I gave his son the title of Prince of Wales and in 1536 Wales was united with England.

Despite the conquest, this small nation of three million people has maintained its unique culture and strong national identity, particularly through its language. Welsh, a Celtic language very different from English, is one of the oldest languages in Europe. However, in the nineteenth century and first half of the twentieth century, the Welsh language declined. The British government made English the official language and English was the only language allowed in schools. The number of Welsh speakers went down from 80 % to under 20 % of the population. Since the 1960s, though, there has been a revival. Welsh, along with English, is an official language and is spoken by half a million people. It is taught in schools, it is spoken in the Welsh Assembly, Wales' own regional 'parliament' and there is a Welsh TV channel.

A tradition of storytelling, poetry and singing began in the castles of the Welsh princes in the Middle Ages and continues today. Every year, *eisteddfods* are held around the country. An *eisteddfod* is a meeting of poets and singers who take part in competitions. As well as literature in the Welsh language, Wales has produced poets in English such as Dylan Thomas and R.S. Thomas. Famous actors include Richard Burton, Anthony Hopkins and Catherine Zeta-Jones. Wales is a musical nation and choirs are important. Nowadays, when the national rugby team plays in the capital, Cardiff, 80,000 voices can be heard singing the Welsh hymn, 'Bread of Heaven'.

The flag of Wales, with its red dragon, is one of the oldest in the world. It was brought to Britain by the Romans. The patron saint of Wales is St David who converted Wales to Christianity and established the Welsh church. The leek, a vegetable, is another national symbol. St David ordered his soldiers to wear them on their helmets before the Welsh went into battle against the Saxons.

CHEMICALS IN OUR FOOD – TWO SIDES OF AN ARGUMENT

Much of the food that leaves a farmer's field undergoes several processing steps before it reaches our tables. Grain is ground into flour or meal, often enriched with vitamins and minerals lost in processing, and then turned into cereal or bakery products. Meat is smoked, pickled, or otherwise treated to keep it from spoiling. Salt, pepper, garlic, other herbs and spices, and flavourings improve the taste of food. Dyes injected into fruit or added to other foods make them more eye-appealing. Vitamins, minerals, smoke, dyes, stabilizers, thickeners, salt, and other flavour enhancers, substances with chemical-sounding names – all these things are food additives.

In the past, most – if not all – food additives came from nature. Today technology has made it possible for many natural additives to be replaced with manufactured ones – additives made by putting chemicals together.

Some people say we should be just as concerned with the effects these manufactured additives have on our bodies as we are with the effects of chemicals on the land, in the water, and in the air. These people fear we are polluting our bodies with too many chemicals. They think these chemicals may cause diseases such as cancer.

Food processors try to justify their use of manufactured additives. They point out that every living and non-living thing on earth is made up of chemicals or combinations of them. Even when eating "natural" foods, people are eating chemicals. Processors argue that manufactured additives do all the things that natural additives do, but they do them with less cost to the consumer. They also point out that manufactured additives do some things that natural ones cannot do. For example, they enrich milk, flour, and other foods with vitamins and minerals lost in processing. Or they make foods tastier for people who cannot eat salt or sugar.

Food companies admit that large doses of some manufactured additives can cause diseases. At present, the use of some of them is banned. Words of caution on the packaging of some products are added.

HISTORY OF NATIONAL PARKS

The concept of creating national parks and nature reserves developed in the early 19th century in response to increasing industrialisation which had begun to cause large scale damage or destruction to natural environments in western Europe and North America. Many heavily populated countries already had urban parks and public gardens, while some rural areas had long been reserved as hunting grounds or private estates by monarchs and nobles. In most parts of the world, however, human activity had little impact on enormous areas which were sparsely inhabited or untouched wildernesses, such as the Great Plains of North America, the Amazon Basin, the forests of sub-Saharan Africa, or the Australian bush. These did not seem to need special protection, since most of them were still inaccessible or hostile to human beings.

The modern idea of deliberately conserving special areas of the countryside and opening them to the general public rather than reserving them for the wealthy and privileged, originated in the 19th century. For example, in 1832 the American artist George Catlin called for the protection of wildernesses in the western United Stated in order to preserve the landscapes which he had painted; and in 1835 the English poet William Wordsworth suggested in a guidebook to his native region, the Lake District, that it should become “a sort of national property” (although, unlike most later campaigners for national parks, he was against large numbers of people being allowed to visit it).

Yellowstone National Park, covering parts of Montana, Wyoming, and Idaho, is regarded as the first national park in the world. It was designated by the United States Congress in 1872. The term “national park”, however, was first used for the Royal National Park established in New South Wales, Australia, in 1879. The concept of national parks then spread to Canada and New Zealand during the 1880s and several more parks had been established in all four countries by 1909, when the first national park in Europe was designated in Sweden. Similar parks were created in Japan, Mexico, the former Soviet Union, and several British colonies during the 1930s, and in Britain, France, and elsewhere in Europe during the 1950s. Some of these incorporate former royal hunting grounds.

GLOSSARY OF SCIENTIFIC TERMS

A

accept
To take as the best explanation based on the evidence. In the scientific community, an idea is generally accepted when it is supported by many lines of evidence and meets other criteria.
analyse
The skill of recognising the underlying details of important facts or patterns that are not always readily visible.
anomaly
In science, an observation that differs from the expectations generated by an established scientific idea.
applied science
Research undertaken with the explicit goal of solving a problem or developing a technology.
assumption
In science, an auxiliary hypothesis that is taken as true for the purposes of interpreting a particular test.

B

bibliography
A list of the books referred to in a research project. It usually appears at the end, or as a separate section, known as an appendix.

C

citation
In science publishing, a reference to another published scientific work that provides the information necessary to locate that work.
cite
In science publishing, to give credit to the previous work of other scientists – usually through a list of references, or citations, at the end of a scientific article.
conclusions
A brief summary of how the results of an experiment support or contradict a hypothesis.
control
A duplicate setup, sample or observation treated identically to the rest of an experiment except for the variable being tested.
control group
In scientific testing, a group of individuals or cases matched to an experimental group and treated in the same way as that group, but which is not exposed to the experimental treatment or factor that the experimental group is.
controlled experiment
An experiment that uses a control group.
controlled variable
In scientific testing, a variable that is kept constant so that the impact of another factor can be better understood.
correlation
A relationship between two variables, such that the value of one variable can be used to generate an expectation about the value of the other.

D

data
Information gleaned from observations – usually observations that are made in a standardised way.
Data Book (also Logbook)
A documentation of the work done during an experiment. It includes the findings, called data, collected during an experiment, as well as any observed responses, reactions and results.

double-blind experiment
An experiment designed such that neither the participants nor the researchers observing them know which participants are in the experimental and control groups until after the observations are complete.

E

error
In reference to statistics, the difference between a computed or measured value and the true value.
evidence
Test results and/or observations that may either help support or help refute a scientific idea.
expectation
In science, a potential outcome of a scientific test that is arrived at by logical reasoning about a particular scientific idea (i.e., what we would logically expect to observe if a given hypothesis or theory were true or false).
experiment
A scientific test that involves manipulating some factor or factors in a system in order to see how those changes affect the outcome of the system. Experiments are important in science, but they are not the only way to test scientific ideas.
experimental group
In scientific testing, a group of individuals or cases that receive the experimental treatment or factor.

F

fact
Statement that is known to be true through direct observation.
false balance
A perceived or real media bias, in which opposing viewpoints are given similar weight though the evidence more strongly supports one viewpoint.
falsify
To perform a test showing that a particular claim or scientific idea is false.

H

hypothesis
A proposed explanation for a fairly narrow set of phenomena, usually based on prior experience, scientific background knowledge, preliminary observations,

and logic.

I

inductive reasoning
Making a generalisation based on many individual observations.
infer
To figure out through logical reasoning. Inferences are often based on established knowledge and/or assumptions.
investigate
Scientific methodology that systematically employs many inquiry skills.

L

law
In science, the term law usually refers to a generalisation about data and is a compact way of describing what we'd expect to happen in a particular situation.
line of evidence
Evidence drawn from one sort of test result that bears on the accuracy of an idea.

M

measure
To compare the characteristics of something (such as mass, length, volume) with a standard (such as grams, metres, etc).
methods
An ordered series of steps followed to help answer a question.
methodology (or research methods)
A particular procedure or set of procedures. These may include the methods, techniques and instruments used in a research experiment.
model
In science, the term model can mean several different things (e.g., an idea about how something works or a physical model of a system that can be used for testing or demonstrative purposes). However, as a research method, modeling often means creating a mathematical model.

N

natural experiment
A scientific test that mimics the design of an experiment, but that involves phenomena not controllable by the investigator (e.g., planetary movement, tecton-

ic action).

natural world

All the components of the physical universe – atoms, plants, ecosystems, people, societies, galaxies, etc., as well as the natural forces at work on those things.

null hypothesis

Usually a statement asserting that there is no difference or no association between variables.

O

objective

Not influenced by biases, opinions, and/or emotions.

observe

To note, record, or attend to a result, occurrence, or phenomenon.

observation

(1) Noticing objects or events using the five senses. (2) The data collected by using the five senses to learn about objects and events.

P

parsimony

Principle suggesting that when two explanations fit the observations equally well, a simpler explanation should be preferred over a more complex one.

peer review

A method of vetting articles. Articles submitted to a peer-reviewed publication are sent out to several scientists who work in the same field as the author.

philosophy of science

The study of what science is and how science works.

prediction

In science, a possible outcome of a scientific test based on logical reasoning about a particular scientific idea (i.e., what we would logically expect to observe if a particular idea were true or false).

pure science

Research undertaken to build knowledge and understanding, regardless of its potential applications.

R

replicate

In reference to the process of science, to repeat a study using methods equivalent to the original's and obtain similar results.

S

sample
In science, to collect information from part of an entity, with the aim of learning about the entity as a whole (e.g., to collect information on a subset of the members of a population or on cores of ice from the Antarctic).
science
Our knowledge of the natural world and the process through which that knowledge is built.
scientific argument
A logical description of a scientific idea and the evidence for or against it.
scientific conference
An event, usually organised by a scientific society or a group of researchers, at which scientists give short presentations describing their research.
scientific journal
Publication that contains firsthand reports of scientific research, often reviewed by experts.

scientific literature
The body of scientific publications that contain firsthand reports of research, often reviewed by experts.
scientific misconduct
Actions that violate the expectations and norms of the scientific community and that undermine the aims of science and the success of the scientific enterprise.
subjective
Influenced by biases, opinions, and/or emotions.
systems
An organised group of related objects or components that form a whole.

T

technology
Designed innovations that serve some practical function.
test
In science, an observation or experiment that could provide evidence regarding the accuracy of a scientific idea.
testable
Capable of being tested scientifically.
theory

In science, a broad, natural explanation for a wide range of phenomena. Theories are concise, coherent, systematic, predictive, and broadly applicable, often integrating and generalising many hypotheses.

U

uncertainty
In reference to statistics, the range of values within which the true value is likely to fall.

V

variable
Something that can affect a system being examined, and is therefore a factor that may change in an experiment.
variation
Slight differences among objects, organisms or events that are all of the same basic type.

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