Centre Number	Candidate Number	Name

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CO-ORDINATED SCIENCES **0654/02**

Paper 2

May/June 2004

2 hours

Candidates answer on the Question Paper.
No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen in the spaces provided on the Question Paper.
You may use a soft pencil for any diagrams, graphs, tables or rough working.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Answer **all** questions.
The number of marks is given in brackets [ ] at the end of each question or part question.
A copy of the Periodic Table is printed on page 24.

If you have been given a label, look at the details. If any details are incorrect or missing, please fill in your correct details in the space given at the top of this page.

Stick your personal label here, if provided.

For Examiner's Use	
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Total	

This document consists of **23** printed pages and **1** blank page.

1 **(a)** Fig. 1.1 shows diagrams of particles in five materials **A** to **E**.

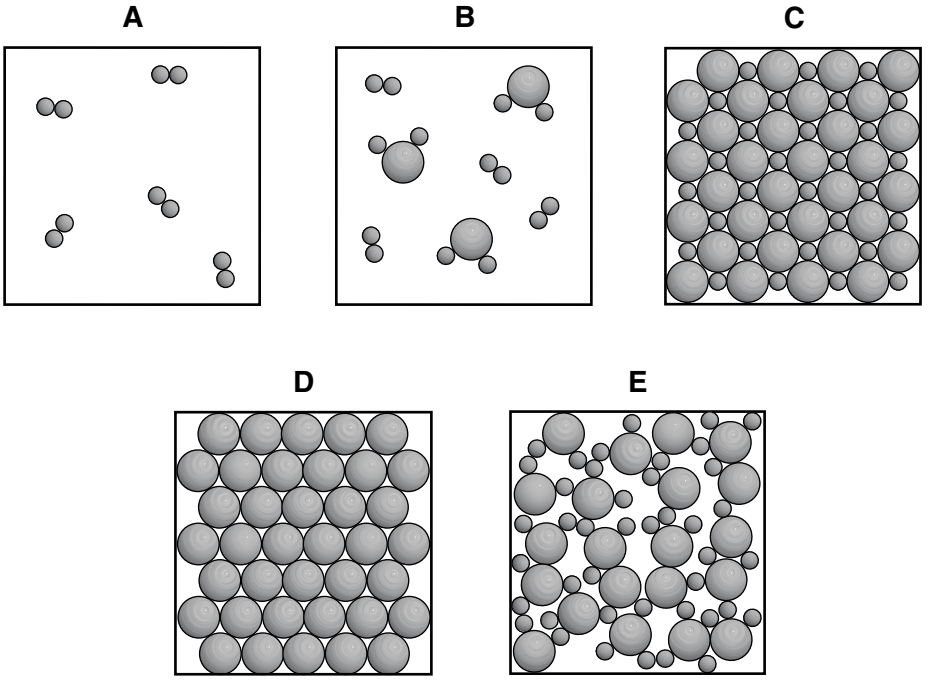


Fig. 1.1

(i) State which diagram, **A B C D** or **E**, represents

a solid compound, ……

a solid element, ……

a gaseous mixture. …… [3]

(ii) State the letters of the particle diagrams in Fig. 1.1 that represent

giant structures, ……

simple molecules. …… [2]

(b) The full chemical symbol of an atom of manganese is

$$^{55}_{25}\mathrm{Mn}$$

(i) State the number of neutrons in the nucleus of this atom. …… [1]

(ii) State the number of electrons in a manganese atom. …… [1]

(iii) Explain why the manganese ion, Mn^{2+}, has very nearly the same mass as a manganese atom.

.....

..... [2]

2 **(a)** **(i)** Explain how friction is reduced between the bones of the arm when the elbow is bent.

.....

.....

.....

..... [3]

(ii) Describe how friction is reduced between the lungs and the rib cage as the lungs inflate and deflate.

.....

..... [1]

(b) In the alimentary canal, friction between the food and the walls of the canal is reduced by slippery mucus.

Describe **one** other function of mucus in the human body.

.....

.....

..... [2]

(c) The inner lining of blood vessels is normally very smooth, so that blood can flow through them easily. However, sometimes deposits of cholesterol can build up on the inner surface of the blood vessels supplying the heart wall. This makes the surface much rougher. When blood platelets come into contact with a rough surface, they tend to form blood clots.

Use this information, and your own knowledge, to explain why a person whose diet contains a lot of animal fat has an increased risk of having a heart attack.

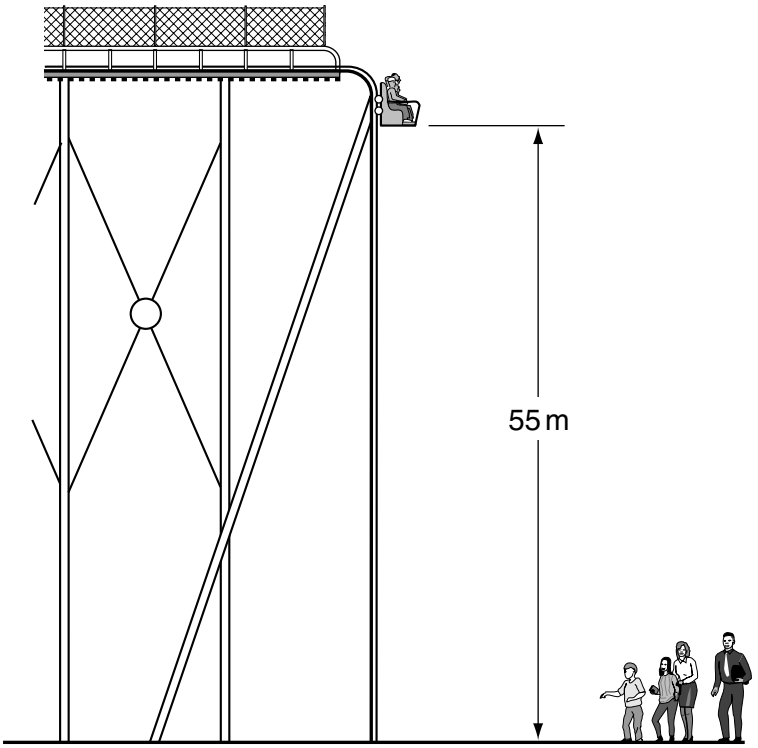
.....

.....

.....

..... [3]

3 A ride at a theme park consists of a car of mass 4800 kg, which holds 20 people and falls a vertical distance of 55 m. Its maximum speed during this fall is 30 m / s.



(a) If the average mass of a passenger is 60 kg, calculate the total mass of the car and 20 passengers.

..... kg [1]

(b) Calculate the maximum kinetic energy of the ride during its fall.

Show your working and state the formula that you use.

formula

working

..... J [2]

(c) Calculate the weight of the car and 20 passengers.

Earth's gravitational force is 10 N / kg.

..... N [1]

(d) Calculate the work done in raising the car and 20 passengers from the bottom to the top of its 55 metre fall.

Show your working and state the formula that you use.

formula

working

..... J [2]

(e) The electric motor which lifts the car and passengers is rated at 100 kW. Calculate the time it would take for the car and passengers to be raised from the bottom to the top of the fall.

Show your working and state the formula that you use.

formula

working

..... s [2]

(f) In practice, the time taken to reach the top of the fall will be longer than your answer to part **(e)**. Explain why.

.....

..... [1]

(g) The passengers in the car scream when the car begins to drop.

(i) Explain how the sound of the screams travels through the air to people watching the ride.

.....

.....

..... [2]

(ii) Sound is an example of a longitudinal wave.

Give **one** example of a transverse wave.

..... [1]

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4 A rock sample, thought to be limestone, is tested in a laboratory.

(a) Fig. 4.1 shows apparatus used for one of the tests applied to the rock sample.

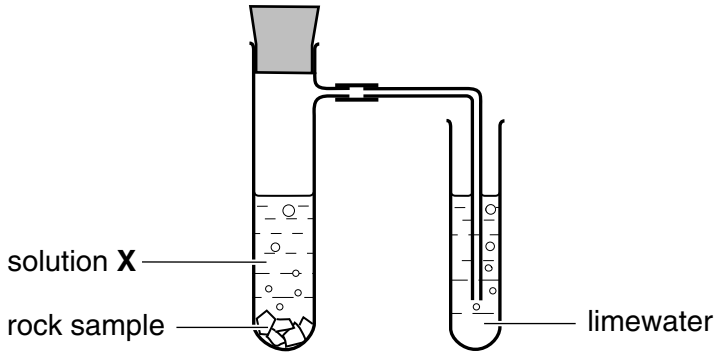


Fig. 4.1

During the test the limewater turns cloudy.

(i) Name the gas produced when solution **X** reacts with the rock sample.

..... [1]

(ii) Suggest the name of solution **X**.

..... [1]

(iii) Explain how this test provides some evidence that the rock may be limestone.

.....

.....

..... [2]

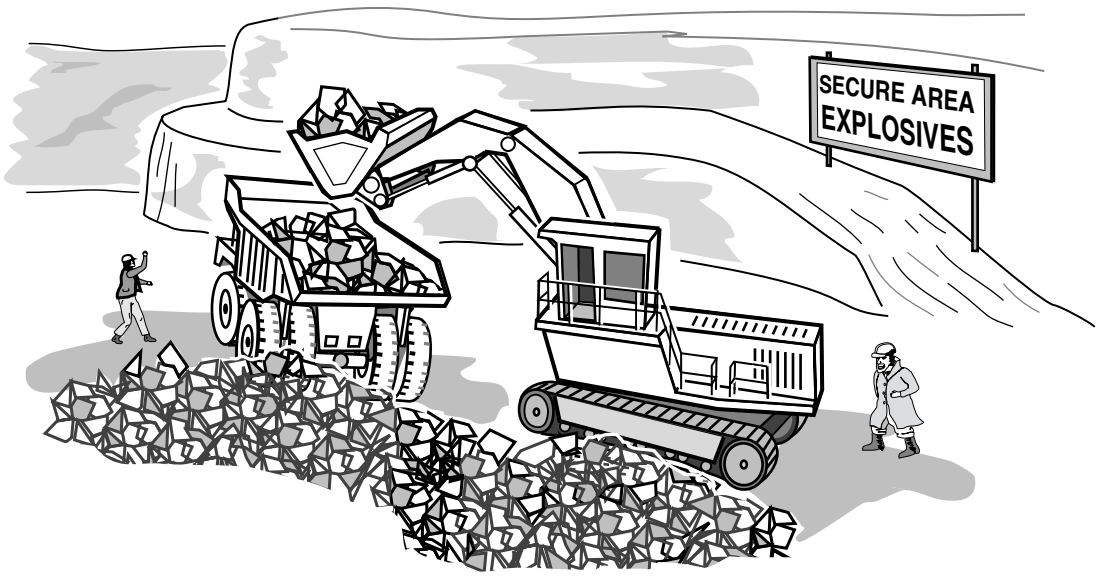
(b) Describe another test which could be applied to the rock sample to find out whether it contained any **calcium** compounds.

.....

.....

..... [2]

(c) Limestone is extracted from the Earth's crust by quarrying. Explosives are used to break up the rocks which are then taken away in large trucks.



Suggest **one** environmental problem caused by the extraction process.

.....

..... [1]

5 Fig. 5.1 shows part of the nitrogen cycle.

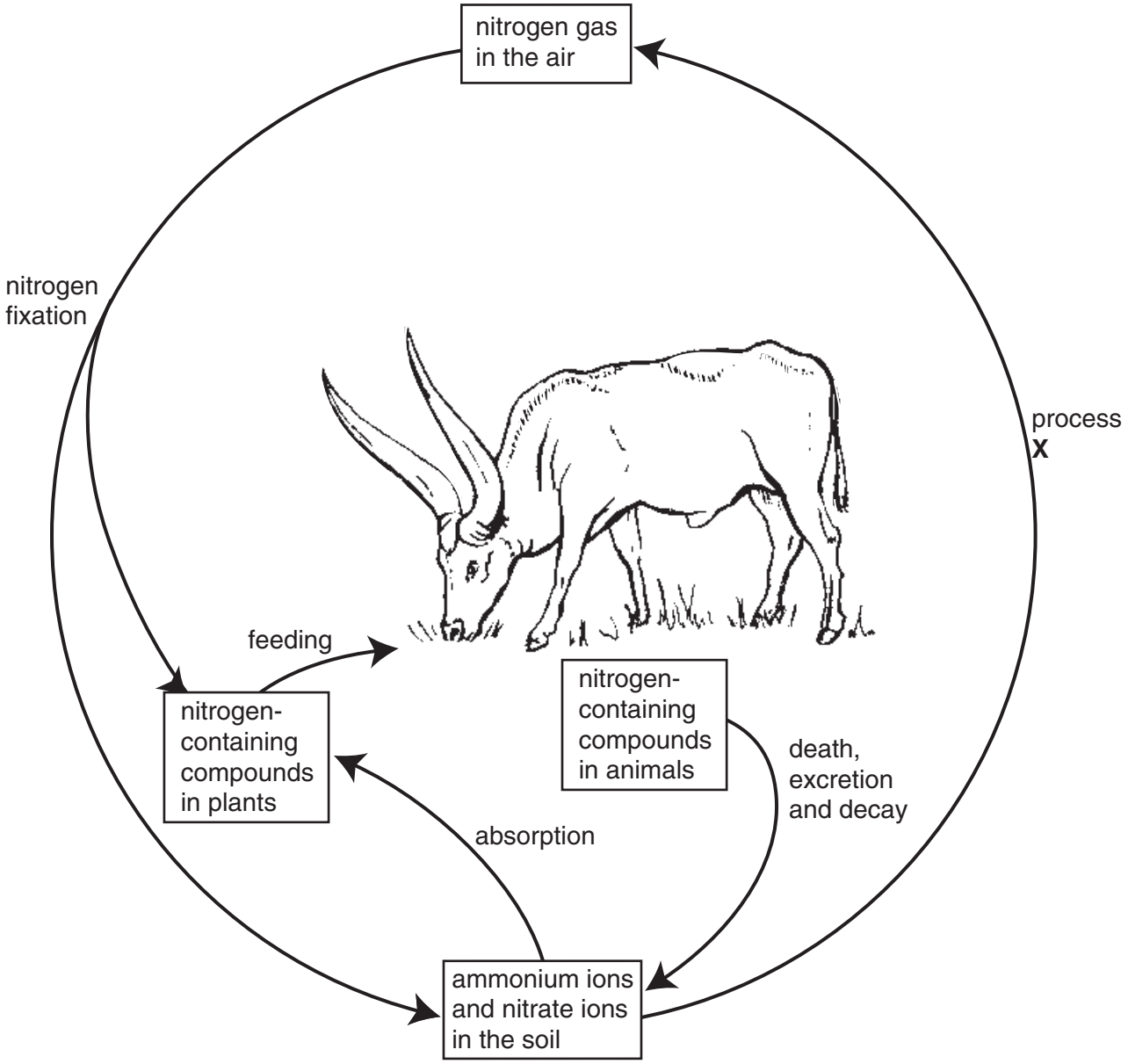


Fig. 5.1

(a) Name **one** type of molecule, found in both animals and plants, which contains nitrogen.

..... [1]

(b) Describe **one** way in which nitrogen fixation can occur.

.....

.....

.....

..... [3]

(c) Name process **X**.

..... [1]

(d) **(i)** Describe how plants take up nitrate ions from the soil.

.....

.....

..... [2]

(ii) Name the tissue in which these ions are transported within the plant.

..... [1]

6 **(a)** A small balloon was charged negatively by rubbing it on a piece of woollen cloth. It was hung from a nylon thread supported by a metal stand. A plastic rod, which had been rubbed on a different cloth, was held near the balloon. The balloon moved away from the plastic rod as shown in Fig. 6.1.

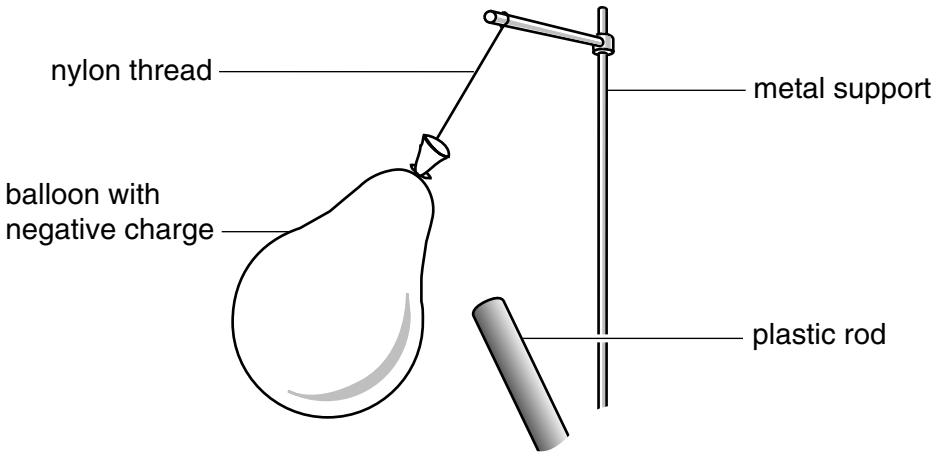


Fig. 6.1

(i) Explain why the balloon became negatively charged.

.....

.....

..... [2]

(ii) Explain why the balloon moved away from the plastic rod.

.....

.....

..... [2]

(iii) Describe and explain what would happen if the nylon thread is replaced with a thin metal wire and the experiment repeated.

.....

.....

..... [2]

(b) Fig. 6.2 shows a large hot air balloon.

Fig. 6.2

(i) Explain why a hot air balloon rises when the air inside the balloon is heated.

.....

.....

..... [2]

(ii) Hot air balloons, which are designed to travel long distances, are often painted a silver colour.

Suggest a reason for this.

.....

..... [2]

(c) A small object falls from the balloon.

Choose the best words or phrases from the list to complete the sentences below.

accelerates	**air pressure**	**falls at a steady speed**
friction	**gravity**	**slows down**

The weight of an object is the force of gravity acting on it.

When an object is dropped, it initially …… .

The faster it falls the bigger the force of …… acting on it.

Eventually the object …… . [3]

7 Sugars, starch and proteins from plants provide food for other organisms. Starch and proteins are natural polymer molecules.

(a) (i) Describe briefly **one** major difference between a polymer molecule and a molecule such as carbon dioxide.

.....

..... [1]

(ii) Name the monomer molecules which have reacted to form the polymer molecules in starch.

..... [1]

(b) A student extracted the coloured material from some green leaves. She ground up the leaves to break the cell walls so that the green substance could form a solution in ethanol.

She then carried out paper chromatography using the solution and obtained the chromatogram shown in Fig. 7.1.

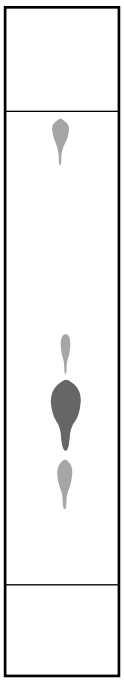


Fig. 7.1

(i) Suggest why the solution used in the experiment was made by using ethanol and not water.

.....

..... [1]

(ii) Describe briefly what the student had to do to obtain the chromatogram shown in Fig. 7.1.

.....

.....

.....

.....

..... [3]

(iii) From the chromatogram, what conclusion can the student draw about the coloured material she extracted from the leaves?

.....

..... [1]

8 Scientists have predicted that by 2010 more people will be dying because of illness caused by obesity (being very overweight) than from most other causes. People become obese when they take in much more energy in food than their bodies use each day.

(a) (i) Name the **three** types of nutrient that contain energy which our bodies can use.

..... [1]

(ii) State how any extra energy taken in as food is stored in the body.

..... [1]

(b) One of the illnesses that often develops as a result of obesity is diabetes. In this illness, the body is not able to control the level of glucose in the blood.

(i) Name the hormone that is secreted when the blood glucose level goes too high, and which helps to bring the level down to normal.

..... [1]

(ii) Name the organ that secretes this hormone.

..... [1]

(iii) Using your knowledge of osmosis, suggest why it is dangerous for the body if blood glucose levels become much higher than normal.

.....

.....

..... [2]

(c) Energy in food is converted by respiration into a form that the body can use. Fig. 8.1 shows a group of respiring cells and a blood capillary.

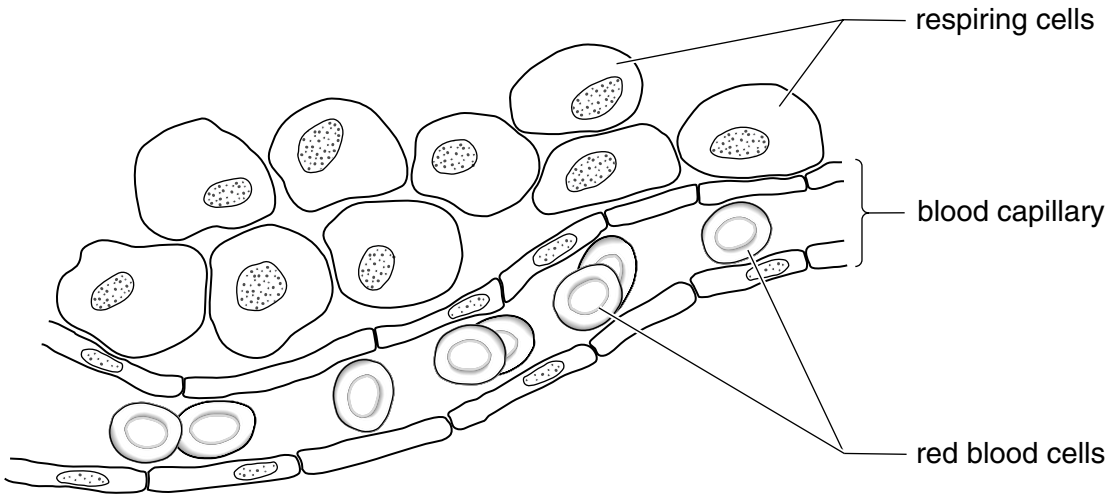


Fig. 8.1

(i) Describe how oxygen passes from the blood into the respiring cells.

.....

.....

..... [2]

(ii) Describe what happens in respiring muscle cells if the blood capillary does not deliver as much oxygen as they need.

.....

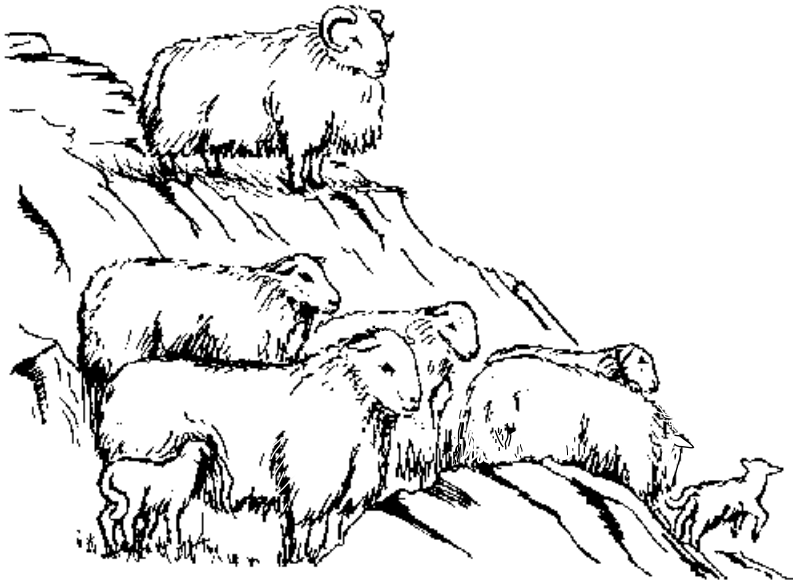
.....

..... [2]

9 Read the passage and then answer the questions which follow.

Some power stations generate electricity using nuclear fission. In 1986, an accident occurred in a power station at Chernobyl in Ukraine. This released many radioactive isotopes into the atmosphere. Wind and rain caused these materials to contaminate grass all over Europe.

One of the most important radioactive isotopes is caesium-137 because it remains in the environment for a long time. After sheep had been eating contaminated grass for five weeks, their bodies contained this isotope. Young lambs feeding on their mother's milk were found to have a very high concentration of caesium-137 in their tissues.



(a) Explain what happens to an atom when nuclear fission occurs.

.....

..... [2]

(b) Explain the meaning of the term *isotope*.

.....

..... [1]

(c) Suggest why young lambs became very contaminated as a result of their diet.

..... [1]

(d) A scientist suggested that it was safer to walk on the radioactive grass than to eat meat from a sheep a few weeks after the accident.

Explain why this was correct.

.....

.....

..... [2]

(e) The accident increased the background radiation present in the environment. Give **one** natural cause of background radiation.

..... [1]

(f) State **one** advantage of nuclear power as a method of generating electricity compared to the burning of fossil fuels.

.....

..... [1]

10 A student investigates the rate of reaction between dilute sulphuric acid and magnesium ribbon. The apparatus he uses is shown in Fig. 10.1. When the conical flask is gently shaken, the container of sulphuric acid tips over, allowing the reaction to start.

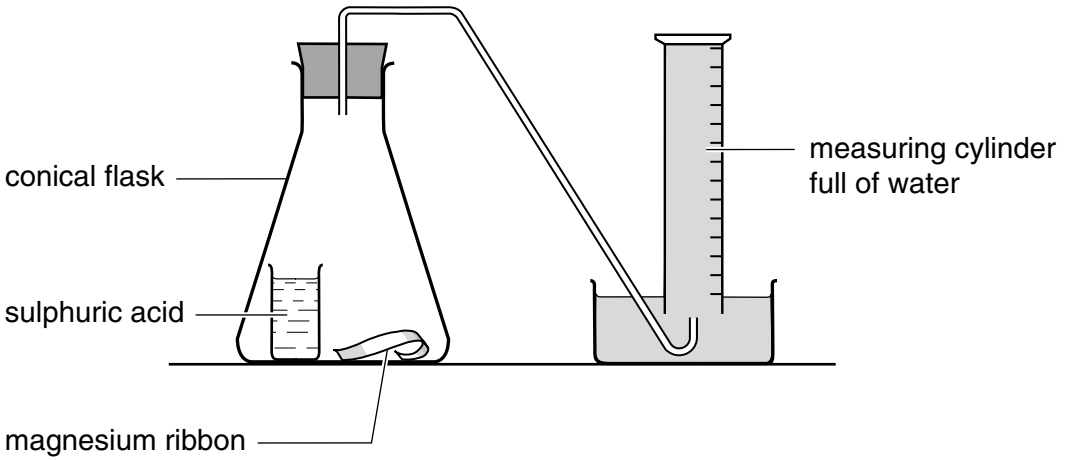


Fig. 10.1

In this reaction hydrogen gas is formed and it bubbles into the measuring cylinder.

(a) (i) The reaction is exothermic.

State the observation which would show that the reaction is exothermic.

..... [1]

(ii) Write the **word** equation for the reaction.

..... [1]

(iii) Describe the test for hydrogen.

.....

..... [2]

(b) Fig. 10.2 shows a graph of the results obtained by the student.

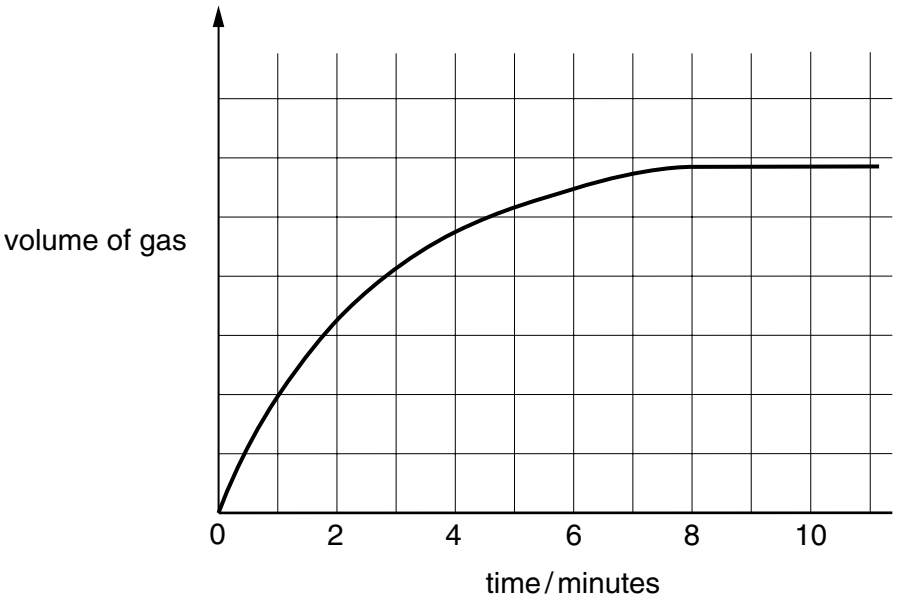


Fig. 10.2

(i) For what length of time did the reactants produce gas?

..... [1]

(ii) The student repeats the experiment using the **same amount** of the acid and the **same mass** of magnesium. This time, however, he uses magnesium powder instead of magnesium ribbon.

On Fig. 10.2, sketch a curve which shows the results of the experiment using magnesium powder. [2]

(iii) Explain your answer to **(ii)**.

.....

.....

.....

..... [3]

11 Fig. 11.1 shows the structure of a seed.

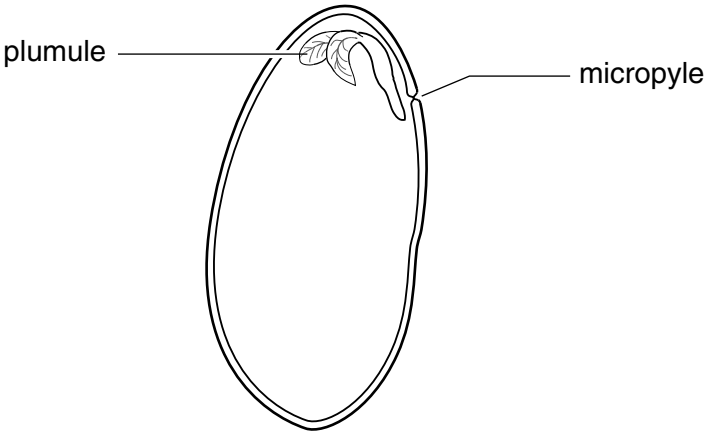


Fig. 11.1

(a) On the diagram, draw label lines to each of the following parts, and label them:

- the testa
- a cotyledon
- the radicle [3]

(b) State **one** substance, other than water, that seeds need for germination.

..... [1]

(c) Twenty seeds were placed on wet cotton wool and allowed to germinate. Ten were kept in a light place, while the other ten were kept inside boxes with a hole in one side.

Fig. 11.2 shows the appearance of one seedling from each group.

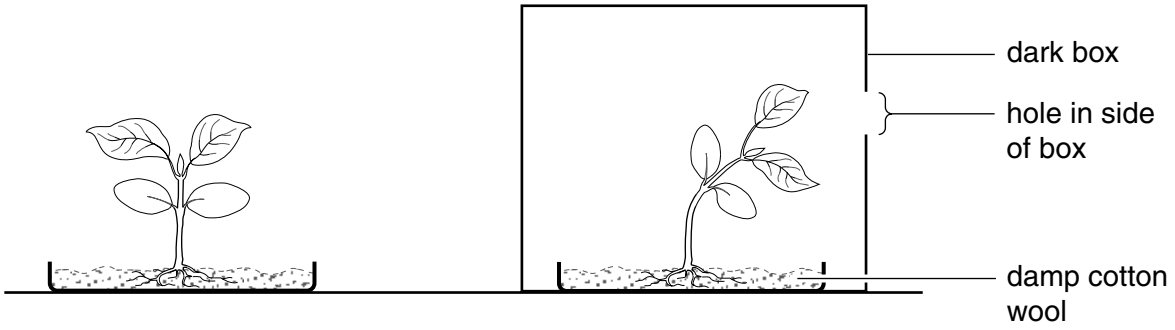


Fig. 11.2

(i) Name the stimulus to which the seedling in the box has responded.

..... [1]

(ii) Explain how this response of the seedling in the box may increase the chance of its survival.

.....

.....

..... [2]

DATA SHEET
The Periodic Table of the Elements

Group																
I	II										III	IV	V	VI	VII	0
							1 H Hydrogen 1									4 He Helium 2
7 Li Lithium 3	9 Be Beryllium 4										11 B Boron 5	12 C Carbon 6	14 N Nitrogen 7	16 O Oxygen 8	19 F Fluorine 9	20 Ne Neon 10
23 Na Sodium 11	24 Mg Magnesium 12										27 Al Aluminium 13	28 Si Silicon 14	31 P Phosphorus 15	32 S Sulphur 16	35.5 Cl Chlorine 17	40 Ar Argon 18
39 K Potassium 19	40 Ca Calcium 20	45 Sc Scandium 21	48 Ti Titanium 22	51 V Vanadium 23	52 Cr Chromium 24	55 Mn Manganese 25	56 Fe Iron 26	59 Co Cobalt 27	59 Ni Nickel 28	64 Cu Copper 29	65 Zn Zinc 30	70 Ga Gallium 31	73 Ge Germanium 32	75 As Arsenic 33	79 Se Selenium 34	80 Br Bromine 35	84 Kr Krypton 36
85 Rb Rubidium 37	88 Sr Strontium 38	89 Y Yttrium 39	91 Zr Zirconium 40	93 Nb Niobium 41	96 Mo Molybdenum 42	Tc Technetium 43	101 Ru Ruthenium 44	103 Rh Rhodium 45	106 Pd Palladium 46	108 Ag Silver 47	112 Cd Cadmium 48	115 In Indium 49	119 Sn Tin 50	122 Sb Antimony 51	128 Te Tellurium 52	127 I Iodine 53	131 Xe Xenon 54
133 Cs Caesium 55	137 Ba Barium 56	139 La Lanthanum 57 *	178 Hf Hafnium 72	181 Ta Tantalum 73	184 W Tungsten 74	186 Re Rhenium 75	190 Os Osmium 76	192 Ir Iridium 77	195 Pt Platinum 78	197 Au Gold 79	201 Hg Mercury 80	204 Tl Thallium 81	207 Pb Lead 82	209 Bi Bismuth 83	Po Polonium 84	At Astatine 85	Rn Radon 86
Fr Francium 87	226 Ra Radium 88	227 Ac Actinium 89 †														

140 Ce Cerium 58	141 Pr Praseodymium 59	144 Nd Neodymium 60	Pm Promethium 61	150 Sm Samarium 62	152 Eu Europium 63	157 Gd Gadolinium 64	159 Tb Terbium 65	162 Dy Dysprosium 66	165 Ho Holmium 67	167 Er Erbium 68	169 Tm Thulium 69	173 Yb Ytterbium 70	175 Lu Lutetium 71
232 Th Thorium 90	Pa Protactinium 91	238 U Uranium 92	Np Neptunium 93	Pu Plutonium 94	Am Americium 95	Cm Curium 96	Bk Berkelium 97	Cf Californium 98	Es Einsteinium 99	Fm Fermium 100	Md Mendelevium 101	No Nobelium 102	Lr Lawrencium 103

*58-71 Lanthanoid series
†90-103 Actinoid series

Key: a = relative atomic mass; X = atomic symbol; b = proton (atomic) number

The volume of one mole of any gas is 24 dm^3 at room temperature and pressure (r.t.p.).