Candidate Name Mark Scheme

Centre Number | Candidate Number

International General Certificate of Secondary Education
UNIVERSITY OF CAMBRIDGE LOCAL EXAMINATIONS SYNDICATE

CO-ORDINATED SCIENCES 0654/2

PAPER 2

Thursday 12 NOVEMBER 1998 Afternoon 2 hours

Candidates answer on the question paper.
Additional materials:
Ruler (cm/mm)

Biol ✓
Chem ✓
Phys ✓

TIME 2 hours

INSTRUCTIONS TO CANDIDATES

Write your name, Centre number and candidate number in the spaces at the top of this page.
Answer all questions.
Write your answers in the spaces provided on the question paper.

INFORMATION FOR CANDIDATES

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 20.
You may use a calculator.

| FOR EXAMINER'S USE | |
|---|---|
| 1 | |
| 2 | |
| 3 | |
| 4 | |
| 5 | |
| 6 | |
| 7 | |
| 8 | |
| 9 | |
| 10 | |
| 11 | |
| TOTAL | |

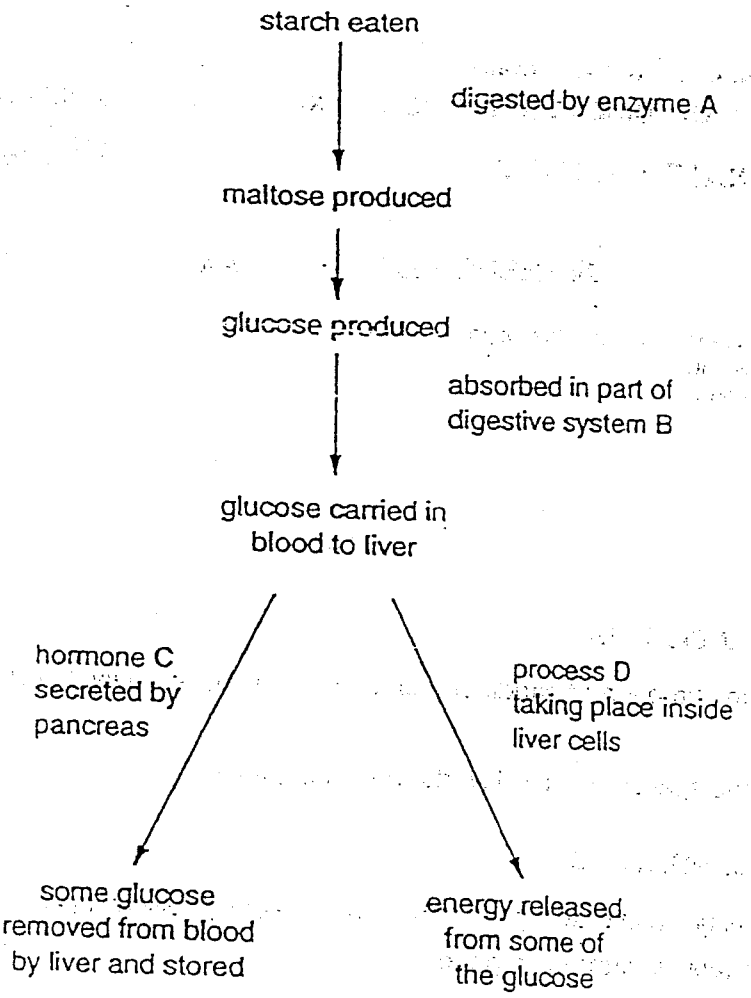
This question paper consists of 20 printed pages.




[Turn over

For Examiner's Use

1 The flow diagram shows what happens after a person eats a meal containing large amounts of starch




(a) (i) Name enzyme A. Amylase [1]

(ii) Name the part of the digestive system B. Small intestine [1]

(iii) Name hormone C. Insulin [1]

(iv) Name process D. Respiration [1]

(b) The starch which was eaten came from bread made from wheat seeds

Describe how the starch was made by the wheat plants.

Sunlight (energy) absorbed by Chlorophyll;
Converted/transferred into Chemical energy;
During photosynthesis;
Produces glucose;
Glucose is converted into starch;

[4]

For Examiner's Use

2 Use the Periodic Table on page 20 to help with this question.

(a) Write down the **symbols** of the following:

the element whose atoms contain 10 protons ..Ne..

the least reactive element in the third period ..Ar..

the most reactive **metal** in the second period ..Li..

the most reactive element in group VII ..F..

the element whose atoms contain no neutrons ..H.. [5]

(b) The table shows some of the properties of four elements W, X, Y and Z.

| *element* | *melting point / °C* | *electrical conductivity* | *colour and state of the oxide* |
|---|---|---|---|
| W | 650 | high | white solid |
| X | 1539 | high | orange solid |
| Y | 98 | high | white solid |
| Z | 96 | low | colourless gas |

(i) Which element, W, X, Y or Z, could be iron? ..X..

State and explain **one** piece of evidence from the table which supports your choice.

high melting point (1539°C) - transition metals tend to have high melting points

or orange solid — $Fe_2O_3$ Iron(III) oxide is orange/brown

..... [2]

(ii) Which element, W, X, Y or Z, forms an oxide which might dissolve to form an acidic solution? ..Z..

State and explain one piece of evidence from the table which supports your choice.

low conductivity indicates a non-metal — non metal oxides often form acidic solutions

..... [2]

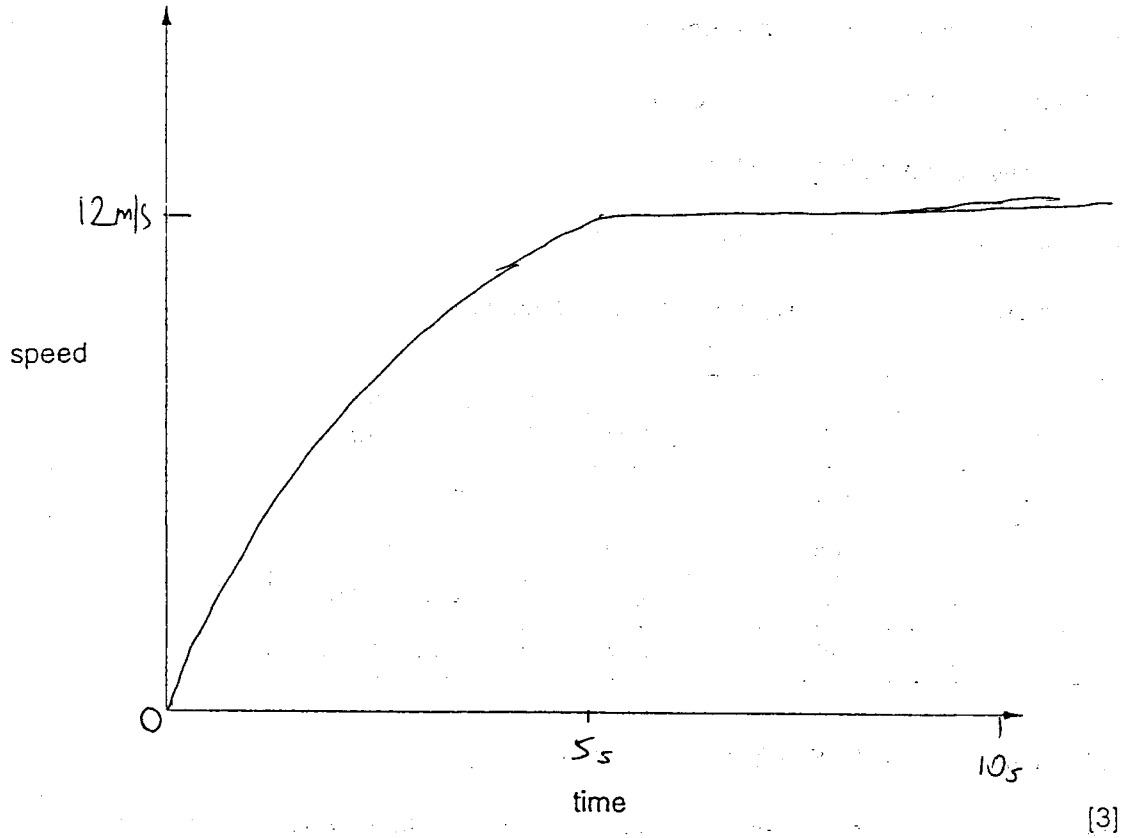


[Turn over

For Examiner's Use

3 In a 100 m race, an athlete, with a mass of 100 kg, reached a maximum speed of 12 m/s at 5 seconds. He continued at this speed and crossed the finish line at 10 seconds.

(a) Using the axes below, sketch a speed/time graph to show this.




[3]

(b) Calculate the athlete's average speed over the whole race.

Show your working and state any formula which you use.

$V = \frac{d}{t} = \frac{100}{10} = 10 \text{ m/s}$

10 m/s [2]

(c) Calculate the athlete's average acceleration over the first five seconds.

Show your working and state any formula which you use.

$a = \frac{V-u}{t} = \frac{12}{5} = 2.4$

2.4 m/s$^2$ [2]

For Examiner's Use

(d) Calculate the athlete's kinetic energy as he crossed the finish line.

Show your working and state any formula which you use.

$KE = \frac{1}{2}mv^2 = \frac{1}{2} \times 100 \times 12^2 = 7200$

7200 J [2]

(e) State three forces which are acting on the athlete during the race.

1. Gravity
2. Drag
3. Thrust (Normal reaction) [3]

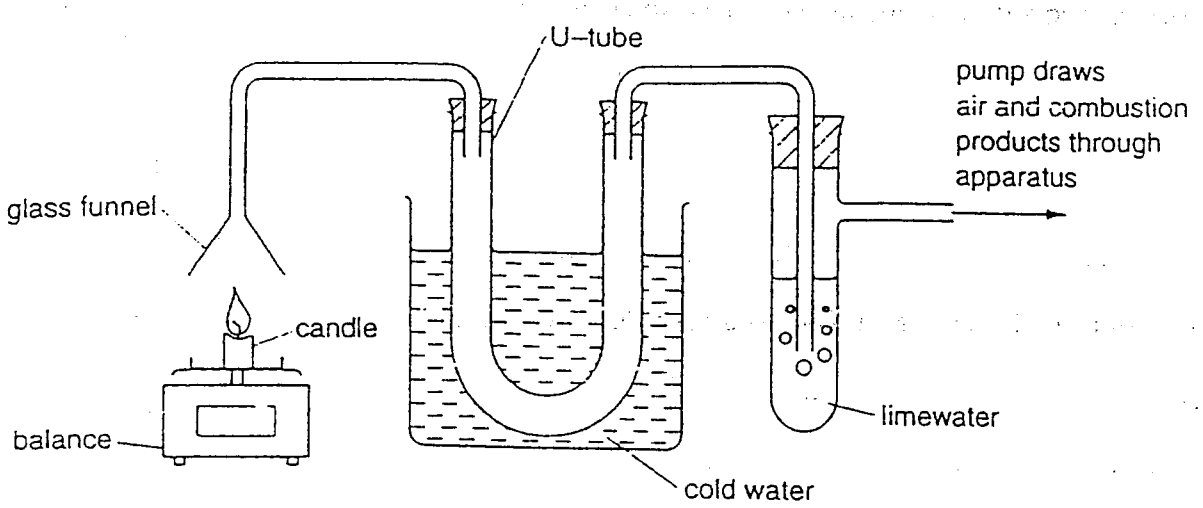
(f) A race timekeeper, standing at the finish line, starts his stopwatch when he hears the sound of the starting pistol, rather than when he sees the pistol fired. Explain whether the time he measures for the race will be too long or too short.

- Too short
- Some time will elapse while the sound reaches the timekeeper.

[2]

For Examiner's Use

4 The apparatus shown in the diagram can be used to investigate what happens when a candle burns in air. The wax used to make the candle is a mixture of solid hydrocarbons.




(a) Explain the following observations.

(i) The limewater becomes cloudy.

Carbon dioxide is produced from the combustion of hydrocarbons – carbon dioxide turns limewater cloudy

[2]

(ii) A colourless liquid condenses inside the U-tube.

water is produced from the combustion of hydrocarbons – water is a colourless liquid

[2]

(iii) The balance reading decreases. (carbon + hydrogen oxidation)

Since mass is lost during burning, the mass of the candle decreases

[2]

(b) Underline two words only, in the list below, which describe the chemical reaction involved when a candle burns.

endothermic exothermic neutralisation oxidation precipitation

[2]

For Examiner Use

(c) (i) A typical hydrocarbon molecule in the candle wax has the chemical formula $C_{20}H_{42}$.

State the total number of atoms which are joined in this molecule.

62 [1]

(ii) Explain briefly why a hydrocarbon is called a compound and not an element.

a combination of 2 elements

or molecules are made up from 2 types of atom [2]

5 Both plants and animals have receptors which are sensitive to light. They are able to sense light intensity and direction, and they can respond to this by movement or by growth. An animal such as an earthworm may respond to light by moving away from it. A plant may respond to light by growing towards it.

(a) Suggest why each of these responses is useful to the organism.

(i) An earthworm moves away from light.

Earthworm can move into the soil/underground;
away from predators; [2]

(ii) A plant grows towards light.

Plant gets more light;
light is needed for photosynthesis; [2]

(b) Humans have four different types of light receptors. Type A responds to all wavelengths of light. Types B, C and D each respond to a different range of wavelengths of light.

(i) Describe the position of the light receptors in the human body.

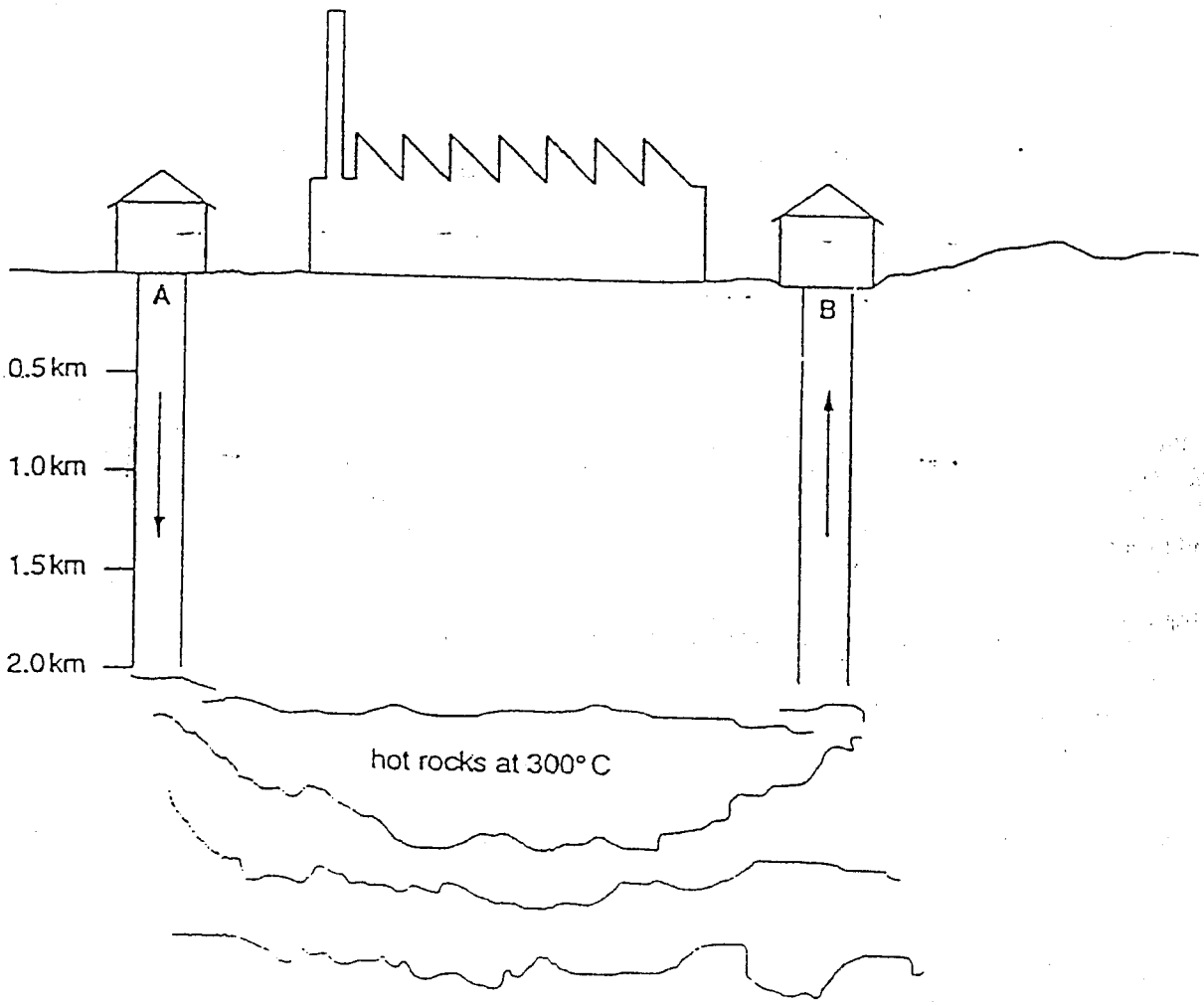
Retina;
Back of the eye [2]

(ii) Which type or types of light receptors would allow you to see in colour? Explain your answer.

B, C + D;
Different coloured objects will reflect different wavelengths of light; [2]

For Examiner's Use

6 The diagram shows how energy can be extracted from hot rocks in the ground. Two holes are drilled into the Earth's crust. Water at 20 °C is pumped down hole A. The water returns up hole B.




(a) Describe what happens to the water at the bottom.

• It will boil

• Because 300°C is above the b.p.

[2]

(b) This process can be used to generate steam. Describe how steam can be used to generate electricity.

• K.E of moving steam

• Can be used to drive turbines and generators

[2]

For Examiner's Use

(c) Suggest and explain **one** advantage of using energy from hot rocks to generate electricity rather than burning a fossil fuel.

- It is renewable
- It wont run out, unlike fossil fuels.

[2]

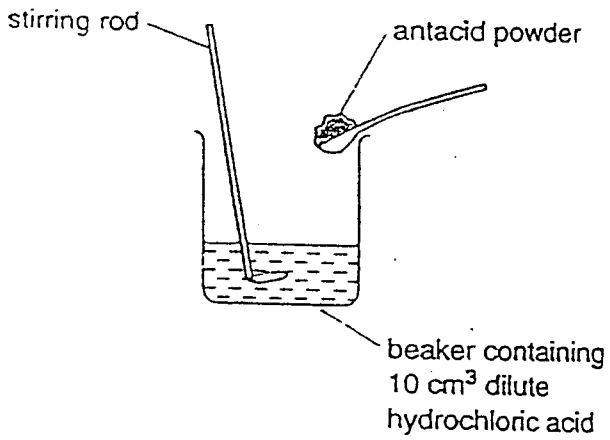
(d) Explain why the electrical energy is transmitted over long distances at a high voltage.

- To reduce the current
- To reduce heat loss in the cables
- To increase efficiency

[3]

For Examiner's Use

7 A student is investigating four different types of antacid tablet. She powders the tablets and then carefully adds each powder separately to 10.0 $cm^3$ of dilute hydrochloric acid as shown below.




Her results are shown in the table.

| *antacid* | *mass of powder needed to neutralise the acid /g* |
|---|---|
| A | 0.8 |
| B | 0.6 |
| C | 1.0 |
| D | 1.3 |

(a) State what happens to the pH of an acidic solution when it is neutralised.

goes up [1]

(b) Explain why the student concluded that tablet B is the most effective in neutralising dilute hydrochloric acid.

least powder required to carry out the neutralisation [2]

For Examiner Use

(c) The student wishes to neutralise 20.0 $cm^3$ of the same dilute hydrochloric acid, using tablets of antacid A. Each tablet has a mass of 0.3 g.

Calculate the minimum number of whole tablets of antacid A which the student must use to be sure that all the acid has reacted.

Show your working.

10 $cm^3$ requires 0.8 g

$\Rightarrow$ 20 $cm^3$ " 1.6 g

$\frac{1.6}{0.3} = 5.33$

$\Rightarrow$ 6 tablets needed

[3]

(d) Antacid C gives off carbon dioxide when it reacts with dilute hydrochloric acid.

Suggest a type of compound which is present in antacid C.

a carbonate (or hydrogen carbonate) [1]

(e) The following label appears on a bottle of antacid tablets.

*For faster relief from acid indigestion*

*tablets should be chewed before swallowing.*

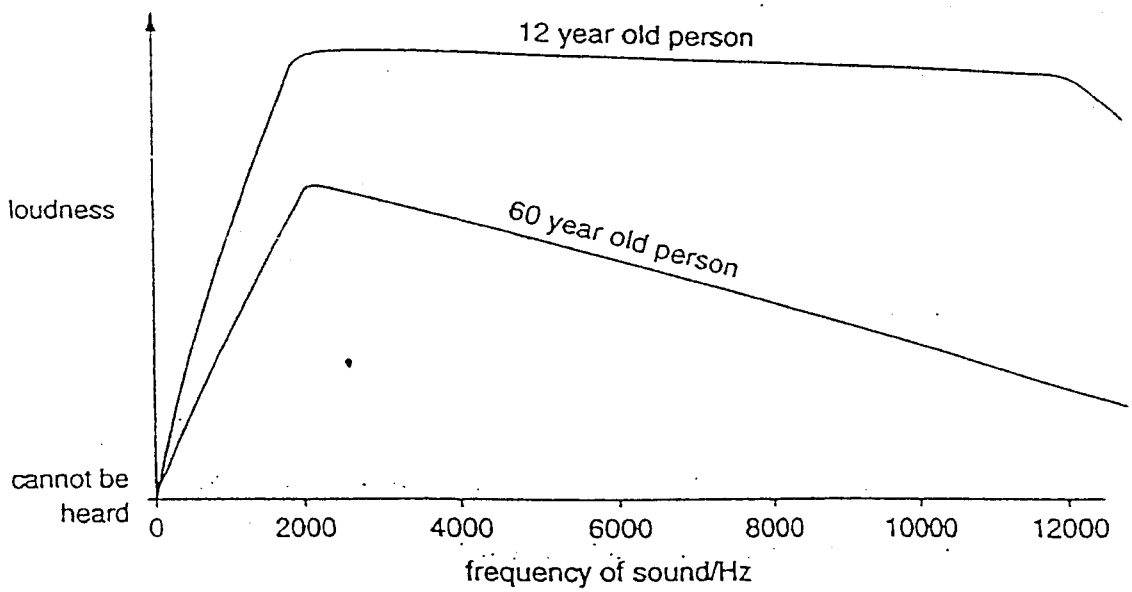
Explain why chewing the antacid tablets will bring faster relief from acid indigestion.

chewing creates smaller pieces with larger surface area, therefore faster reaction with acid

[2]

For Examiner's Use

8 Smoke alarms produce a sound signal when smoke is detected. The graph shows how well two people can hear a range of sound frequencies.




(a) (i) State the meaning of *frequency*.

Number of waves per second

[1]

(ii) Using the graph, suggest the best frequency for a smoke alarm to produce. Give a reason for your answer.

- 2000 Hz
- Both people hear this frequency best

[2]

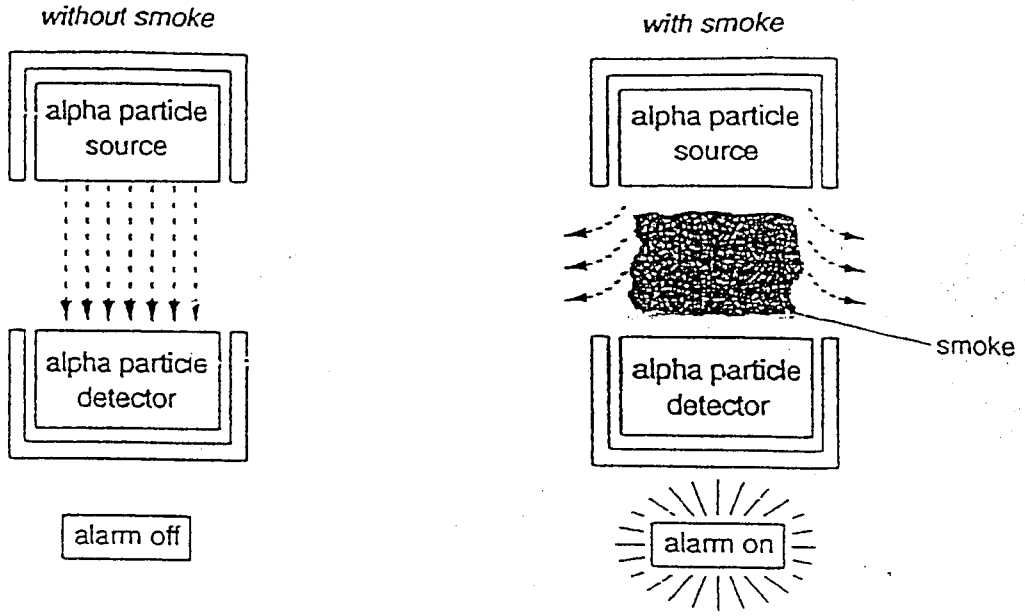
(b) Smoke alarms give out a sound signal rather than a light signal.

State two advantages of using a sound signal rather than a light signal.

1. People need to be looking at the light to see it (not so sound)
2. Sound can wake people who are sleeping

[2]

(c) The diagram shows how a smoke alarm detects smoke.




the alpha particles reach the detector so the alarm stays off

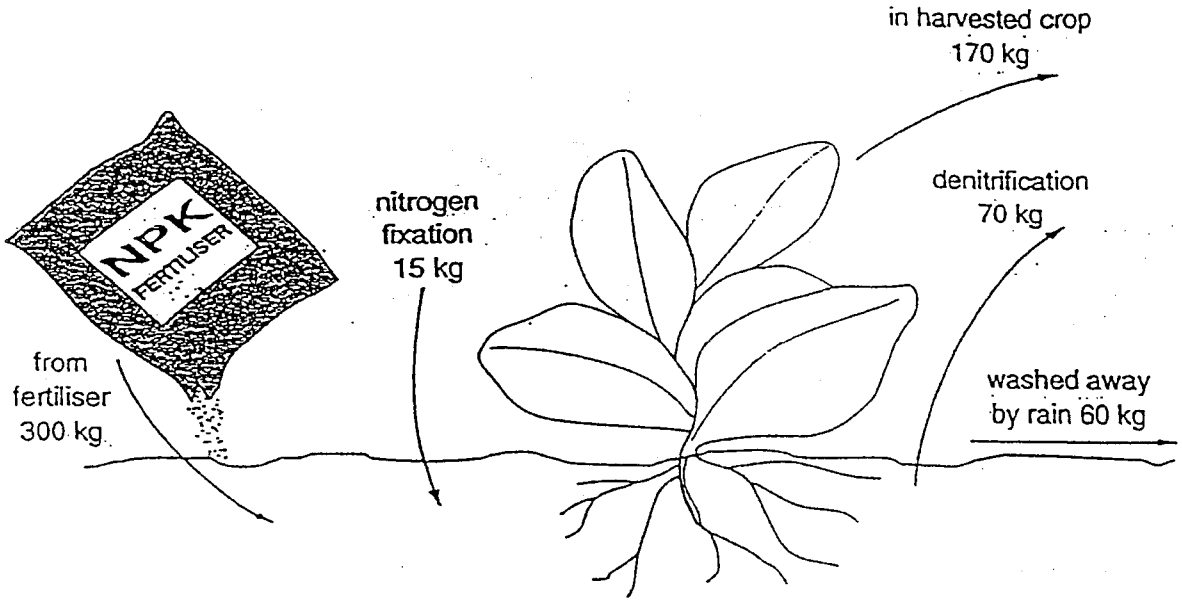
the alpha particles do not reach the detector so the alarm sounds

Explain why an alpha particle source is used rather than sources of beta or gamma radiation.

• Alpha has low penetration

• Only alpha would be stopped by smoke. [2]

9 The diagram shows the mass of nitrogen added to, and lost from, a field in which a leafy crop was growing. The masses of nitrogen gained or lost per hectare in one year are shown.




(a) (i) Calculate how much nitrogen was added to the soil in one year.

315

(300 + 15) − (170 + 70 + 60) = 15 kg per hectare [1]

(ii) Calculate how much more nitrogen was present in the field at the end of the year, compared with the beginning of the year. Show your working.

315 − (170 + 70 + 60) kg per hectare [2]

(b) (i) Suggest one ion likely to be present in the fertiliser, which would add nitrogen to the soil in a form which the plants could use.

$NO_3^-$ or $NH_4^+$ [1]

(ii) Name two elements other than nitrogen which are present in the fertiliser, according to the label on the bag.

1 Potassium

2 Phosphorus [2]

For Examiner's Use

(c) Name two processes, shown on the diagram, which involve bacteria.

1. Nitrogen Fixation

2. Denitrification [2]

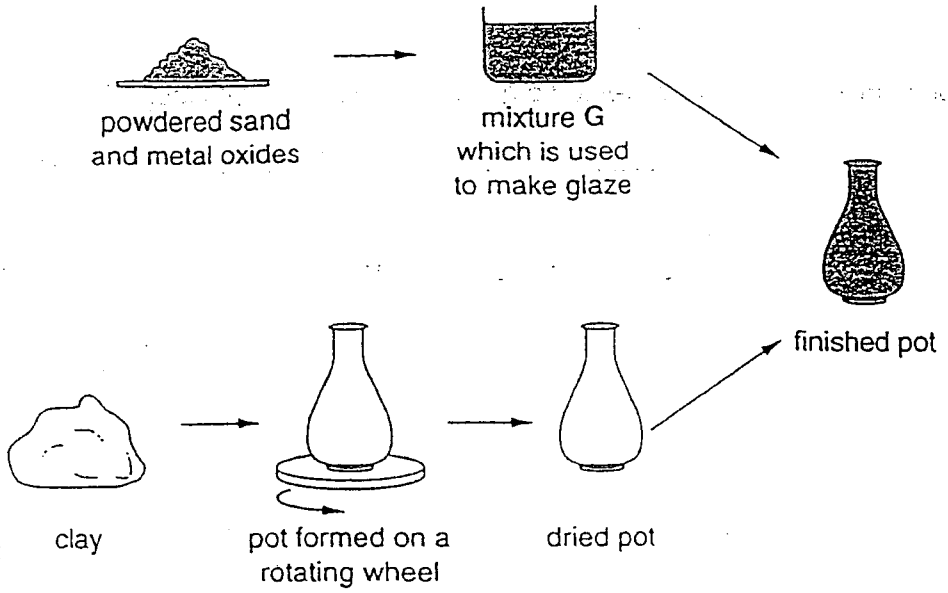
(d) Suggest one type of molecule in the harvested crop which would contain nitrogen.

Amino acid [1]

~~Fat~~ Protein

DNA

10 The diagrams show some of the stages involved in making a ceramic pot which is covered by a layer of glaze. Glaze is very similar to glass.




(a) State the chemical name of the compound which is the main raw material used to make glass.

Silicon dioxide ..... [1]

(b) The mixture G consists of powdered sand and metal oxides dispersed in water to form a colloid.

(i) Name the type of colloid formed when solids are dispersed in a liquid.

Sol ..... [1]

(ii) Explain briefly why the mixture G is not transparent.

Solid particles scatter light in all directions preventing light from passing through

..... [2]

(iii) When the dried pot is dipped into mixture G, the water soaks into the pot leaving the solid materials as a thin layer on the surface. This happens because the dried pot is porous.

Explain the meaning of the word *porous*.

allows liquids or gases to penetrate ..... [1]

For Examiner's Use

(c) (i) State what must be done to the dried, glazed pot in order to produce the finished pot.

fired (heated to high temperatures) [1]

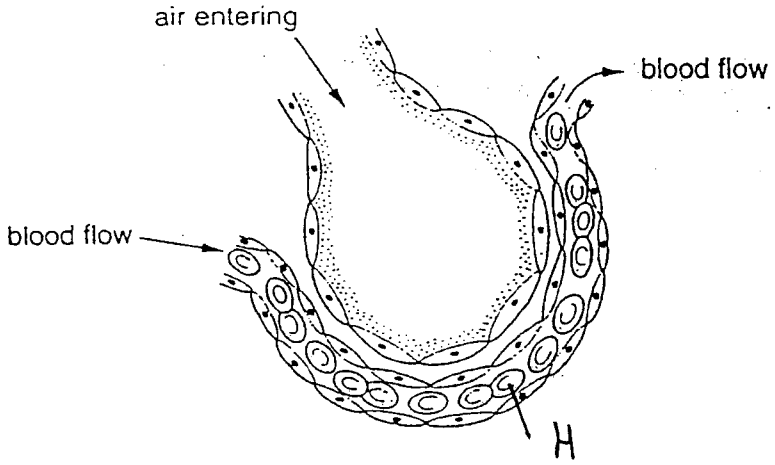
(ii) The finished pot is to be used as a water container. State **two** properties of the finished pot, other than cost, which make it suitable for this use.

1. non-porous

2. will not dissolve [2]

For Examiner's Use

11 The diagram shows an alveolus and blood capillary from a human lung. Gas exchange takes place between the air in the alveolus and the blood in the capillary.




(a) Describe two features of the human gas exchange system which help gas exchange to take place efficiently.

1. Thin Walls of Alveolus; Thin Walls of Capillary;
2. Large Surface area; Moisture on the inside of alveoli Walls; Good Blood Supply; [2]

(b) Oxygen is transported by haemoglobin. On the diagram, draw a labelling line to a place where haemoglobin is present, and label it H. [1]

(c) Some people have an inherited disease called thalassaemia. They have faulty haemoglobin which does not carry oxygen properly. This is caused by a recessive allele t of the gene for haemoglobin. The normal allele of the gene is T.

A man with thalassaemia and a woman with the genotype Tt had five children. Three of them inherited the disease, and two did not.

Complete the genetic diagram to explain how this could happen.

| *parents* | man with thalassaemia | normal woman |
|---|---|---|
| *genotypes* | tt | Tt |
| *gametes* | t | T and t |
| *childrens' genotypes* | Tt | tt |
| *childrens' phenotypes* | Normal | Thala. |

[5]

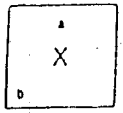
# DATA SHEET
## The Periodic Table of the Elements

| Group I | Group II | | | | | | | | | | | Group III | Group IV | Group V | Group VI | Group VII | Group 0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | 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.)