UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

COMBINED SCIENCE **5129/21**

Paper 2 **October/November 2012**

2 hours 15 minutes

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.
You may use a soft pencil for any diagrams, graphs or rough working.
Do not use staples, paper clips, highlighters, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
A copy of the Periodic Table is printed on page 24.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

For Examiner's Use

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

1 Use words from the list to complete the sentences below.

For Examiner's Use

antibodies **enzymes** **fibrin** **fibrinogen** **hormones**

platelets **plasma** **red** **white** **water**

Each word may be used once, more than once, or not at all.

The liquid part of the blood is called ..... .

This liquid contains several different types of blood cell.

The function of the ..... blood cells is to carry oxygen.

The ..... blood cells carry out phagocytosis and produce

..... .

The platelets help the blood to clot by turning .....

into ..... . [6]

2 Fig. 2.1 shows a paper chromatogram obtained from three coloured dyes and three unknown dyes **W**, **X** and **Y**.

For Examiner's Use

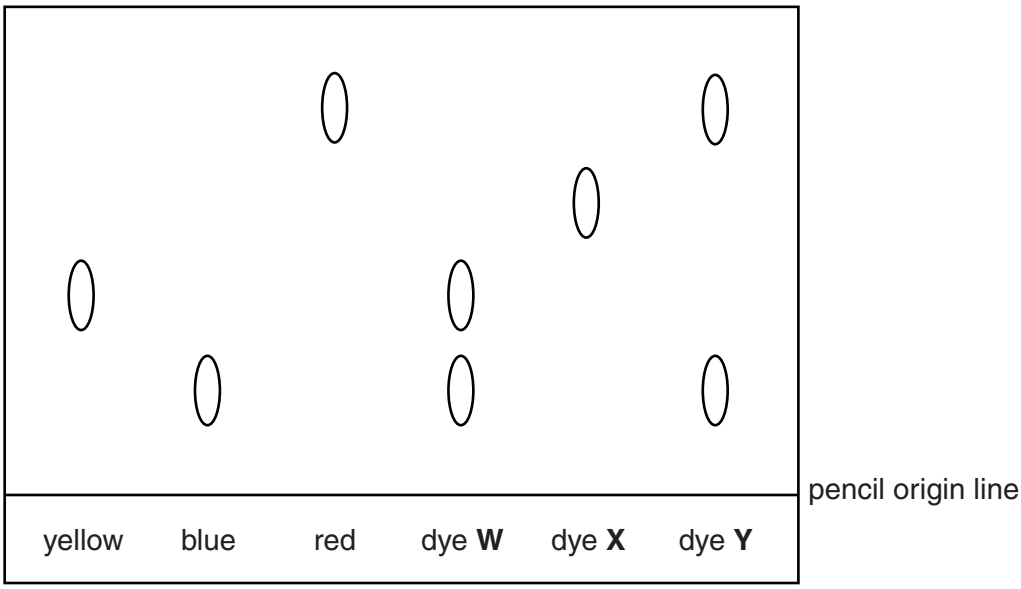

Fig. 2.1

(a) Explain why the origin line on the chromatography paper is drawn using a pencil rather than a pen.

.....

..... [1]

(b) Which coloured dyes are present in dye **W**?

.....

..... [2]

(c) Which of the unknown dyes **W**, **X** or **Y** is a pure substance?

Explain your answer.

.....

..... [2]

3 A student measures the time for 20 complete oscillations of a pendulum.

She repeats the experiment for different lengths of the pendulum.

The results are shown in Fig. 3.1.

For Examiner's Use

length / m	time for 20 oscillations / s	period / s
0.30	22.0	1.10
0.80	35.8	
1.20	44.0	2.20

Fig. 3.1

(a) (i) Complete Fig. 3.1 by calculating the period of the pendulum for a length of 0.80 m.

[1]

(ii) Using the results from Fig. 3.1, state how the period of a pendulum varies with its length.

.....

..... [1]

(b) Three different positions of a swinging pendulum are shown in Fig. 3.2.

For Examiner's Use

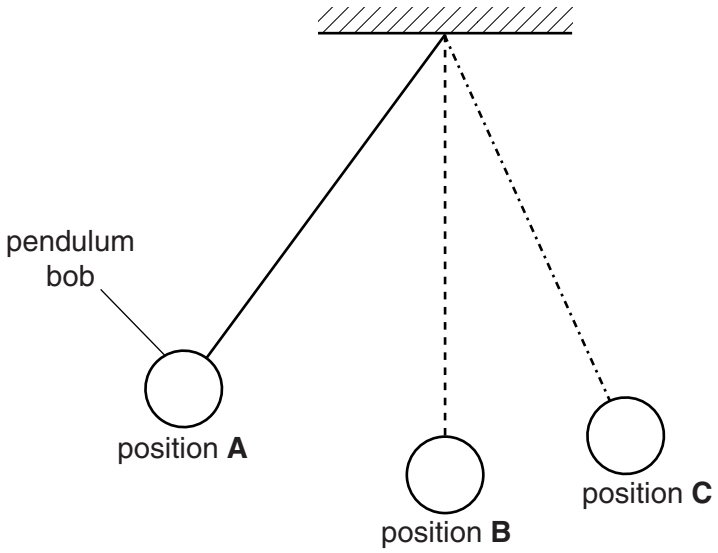

Fig. 3.2

(i) State the letter of the position or positions where the pendulum has most kinetic energy.

..... [1]

(ii) State the energy changes that take place as the pendulum swings from position **A** to position **B**.

from ..... to ..... [1]

4 Information about the height and mass of humans is given in Fig. 4.1.

For Examiner's Use

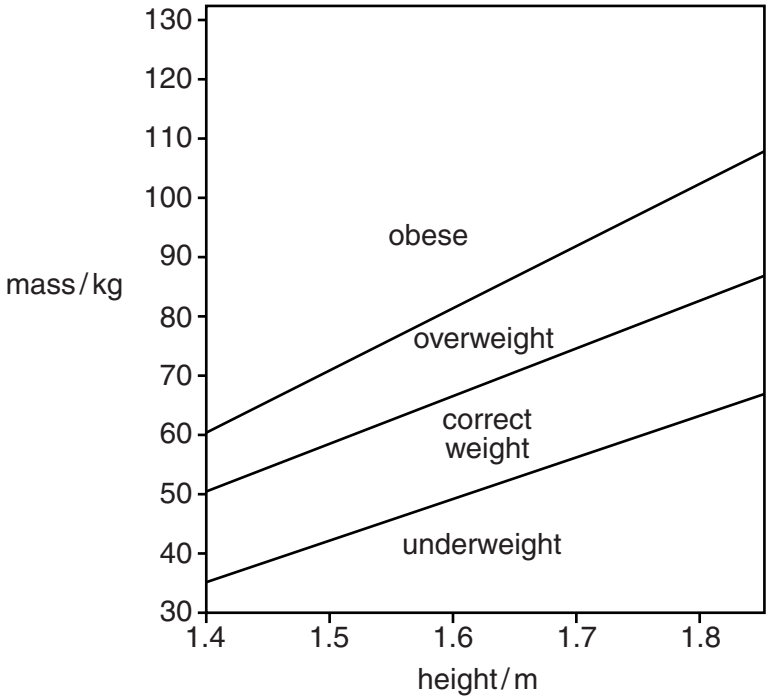

Fig. 4.1

The heights and masses of four students are:

student A	1.75 m and 88 kg
student B	1.65 m and 65 kg
student C	1.82 m and 58 kg
student D	1.45 m and 70 kg

(a) State which student is obese and which student has the correct weight.

obese student .....

student with correct weight .....

[2]

(b) Table 4.1 gives information about the energy and nutrients provided by 1.0 kg of six types of food.

For Examiner's Use

Table 4.1

food	energy /kJ	protein /g	fat /g	carbohydrate /g
oily fish	9700	170	190	0
eggs	6700	120	120	0
cheese	16000	250	310	0
milk	2900	31	39	50
beef	13000	150	280	0
leafy vegetables	1100	27	0	38

(i) An obese student wishes to reach a correct body mass.

Name two foods in Table 4.1 that he should avoid.

1 .....

2 ..... [2]

(ii) Suggest **another** way, other than eating different foods, by which this student could reduce his body mass.

.....

..... [1]

(c) Leafy vegetables provide fibre in the diet.

Explain

(i) what is meant by fibre,

.....

..... [1]

(ii) why it is important to include fibre in the diet.

.....

.....

..... [2]

[Turn over

5 Fig. 5.1 shows the structure of an atom of carbon.

For Examiner's Use

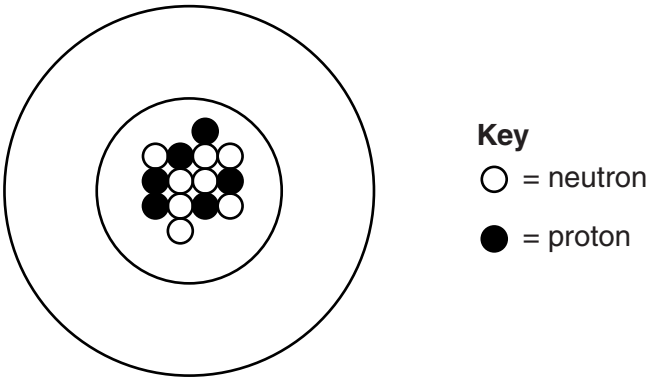

Fig. 5.1

(a) For this atom, state

(i) the nucleon number, ...

(ii) the proton number. ..... [2]

(b) Complete Fig. 5.1 to show the electronic structure of an atom of carbon. [1]

(c) Carbon combines with hydrogen to form methane, CH_4.

State the type of bonding present in methane and explain fully how the bonds are formed.

type of bonding .....

explanation .....

.....

.....

[3]

6 Two lamps are connected in parallel, as shown in Fig. 6.1.

For Examiner's Use

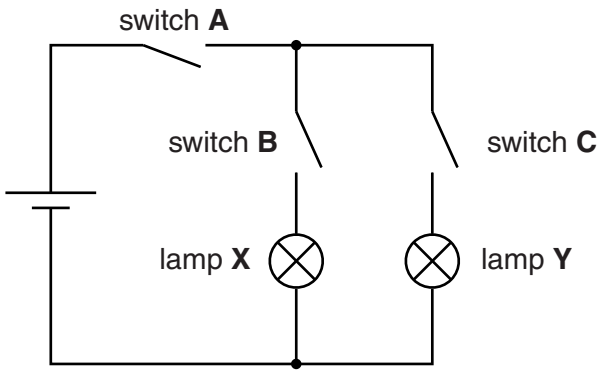

Fig. 6.1

(a) There are three switches **A**, **B** and **C** in the circuit.

State which switch, or switches, are closed to light lamp **Y only**.

..... [1]

(b) With all the switches closed, the current in lamp **X** is 0.2 A.

(i) The current from the cell is 0.5 A.

Calculate the current in lamp **Y**.

current = ... A [1]

(ii) The potential difference across lamp **X** is 1.5 V.

Calculate the resistance of lamp **X**.

resistance = ... unit ..... [3]

[Turn over

7 The boxes on the left state processes carried out in the body.

The boxes on the right represent organs in the body.

Draw **one** line from each process to the organ where the process takes place.

For Examiner's Use

process	**organ**
breaks down alcohol	
destroys hormones	kidney
excretes carbon dioxide	liver
excretes urea	lung
forms urea	

[5]

8 The formula of sulfuric acid is H_2SO_4.

The formula of sodium hydroxide is NaOH.

For Examiner's Use

(a) (i) Name the ion that causes acidity.

..... [1]

(ii) Name the ion that causes alkalinity.

..... [1]

(b) When sulfuric acid is added to sodium hydroxide the solution becomes neutral.

(i) What is the pH of the solution when it is exactly neutral? ..... [1]

(ii) What is the colour of Universal Indicator in the neutral solution?

..... [1]

(iii) Balance the equation for the reaction between sulfuric acid and sodium hydroxide.

$$H_2SO_4 + \text{.....}\ NaOH \longrightarrow Na_2SO_4 + \text{.....}\ H_2O$$ [1]

(iv) Construct the ionic equation for the reaction between an acid and an alkali.

..... [1]

[Turn over

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9 Fig. 9.1 shows a ray of light incident on the surface of a glass block. The glass block is in air.

For Examiner's Use

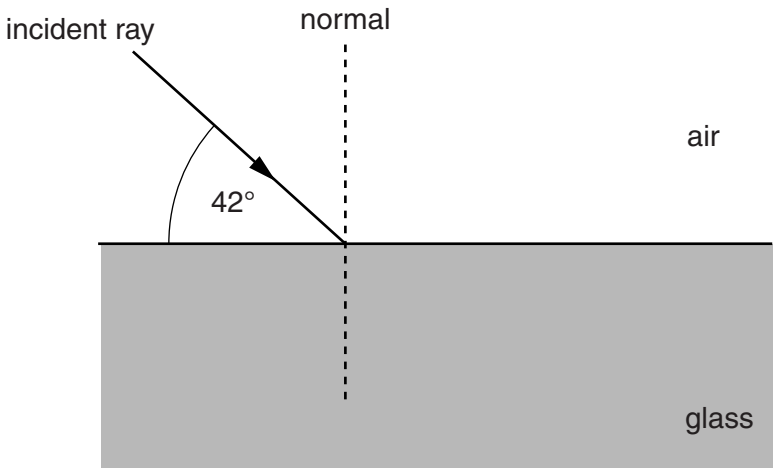

Fig. 9.1

(a) (i) Some of the incident light is reflected.

On Fig. 9.1, draw the reflected ray. [1]

(ii) Calculate the angle of reflection.

angle of reflection = ...° [1]

(b) Some of the incident light is refracted.

On Fig. 9.1, draw the refracted ray. [1]

[Turn over

10 Fig. 10.1 shows the male reproductive system.

For Examiner's Use

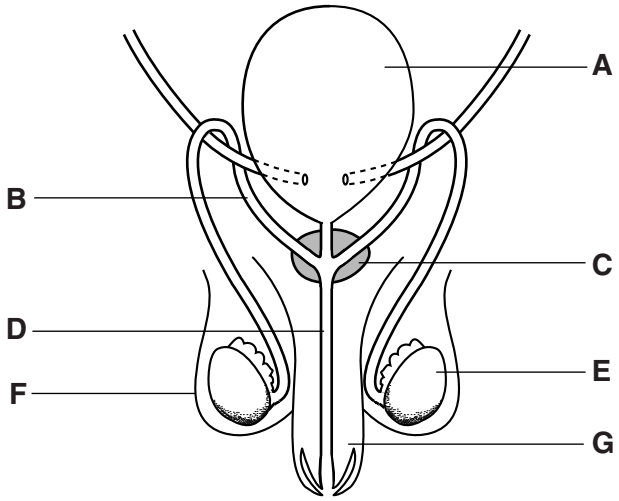

Fig. 10.1

(a) (i) Use the letters on Fig. 10.1 to identify the

prostate gland .....

testis .....

urethra .....

[3]

(ii) State a reproductive function of each of the following structures.

prostate gland .....

.....

testis .....

.....

urethra .....

.....

[3]

(iii) Explain the importance of the scrotum for the production of healthy sperm.

For Examiner's Use

.....

.....

.....

..... [2]

(b) One method of male birth control involves a surgical procedure.

On Fig. 10.1, mark with an **X** one of the tubes a surgeon would cut when carrying out this procedure. [1]

11 Study the reaction scheme in Fig. 11.1.

For Examiner's Use

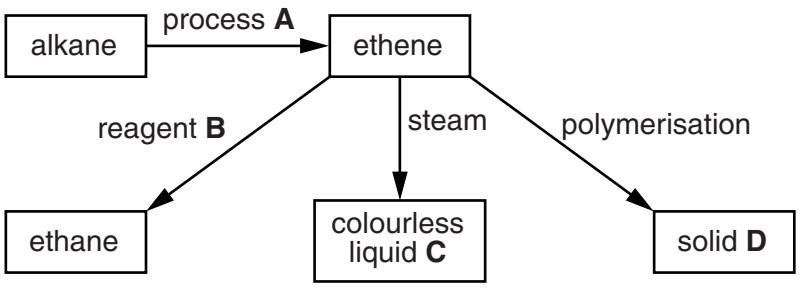

Fig. 11.1

(a) **(i)** Identify the process **A**. ..... [1]

(ii) Identify substances **B**, **C** and **D**.

reagent **B** .....

colourless liquid **C** .....

solid **D** ..... [3]

(b) Bromine water is used to show that ethene is an unsaturated hydrocarbon.

(i) What is meant by the term *unsaturated*?

.....

..... [1]

(ii) How does the colour of the bromine water change when it is added to ethene?

..... [1]

12 A simple a.c. generator consists of a coil rotating in a uniform magnetic field.

For Examiner's Use

(a) Complete Fig. 12.1 to show how the voltage output of the generator varies with time during one rotation of the coil. [2]

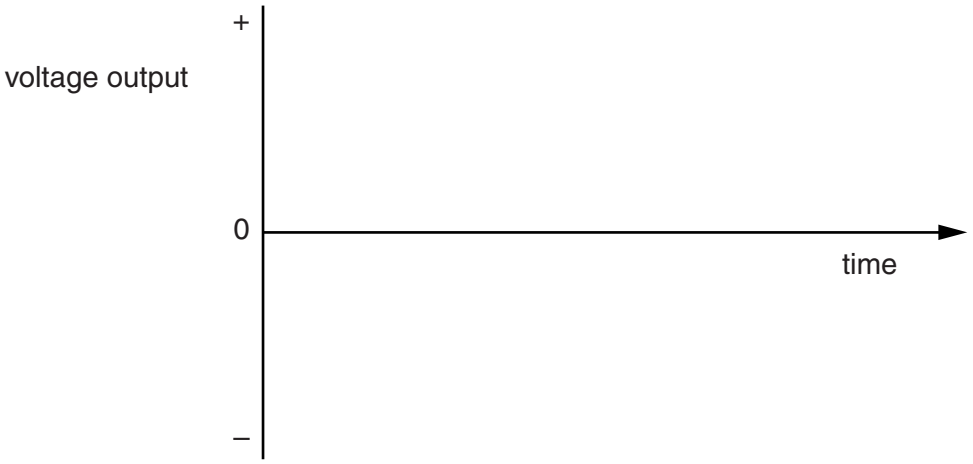

Fig. 12.1

(b) State two factors affecting the size of the maximum voltage output of the generator.

1. .....

2. .....

[2]

(c) The generator has an average power output of 200 W.

Calculate the electrical energy produced in 5 minutes.

energy = ... J [2]

13 **(a)** Describe the intake of water by plants.

For Examiner's Use

.....

.....

..... [2]

(b) Fig. 13.1 shows the appearance of a healthy plant at 07.00 hours.

Fig. 13.2 shows the appearance of the same plant 14 hours later.

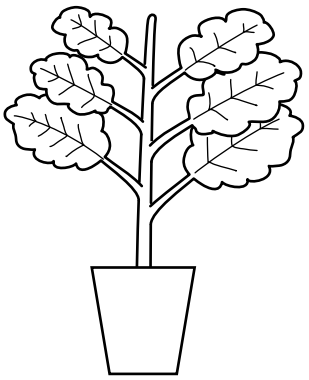

Fig. 13.1

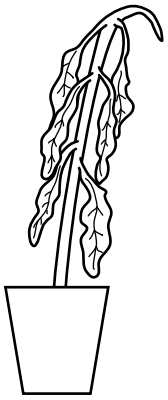

Fig. 13.2

(i) State what has happened to this plant.

..... [1]

(ii) Explain what has caused this change.

.....

.....

.....

.....

.....

.....

.....

..... [2]

14 **(a)** Define *relative molecular mass*.

For Examiner's Use

.....

..... [2]

(b) When it is heated, sodium hydrogen carbonate decomposes to form sodium carbonate, carbon dioxide and water.

The equation for the reaction is

$$2NaHCO_3 \longrightarrow Na_2CO_3 + CO_2 + H_2O$$

The relative molecular mass, M_r, of sodium hydrogen carbonate is 84.
(A_r: Na, 23; O, 16; C, 12; H, 1)

Complete the following sentences.

168 g of sodium hydrogen carbonate produces .....g of sodium carbonate and .....g of carbon dioxide.

16.8 g of sodium hydrogen carbonate produces .....g of sodium carbonate and .....g of carbon dioxide.

4.2 g of sodium hydrogen carbonate produces .....g of sodium carbonate. [4]

[Turn over

15 A measuring cylinder contains 32 cm^3 of water.

A stone is added to the measuring cylinder, as shown in Fig. 15.1.

For Examiner's Use

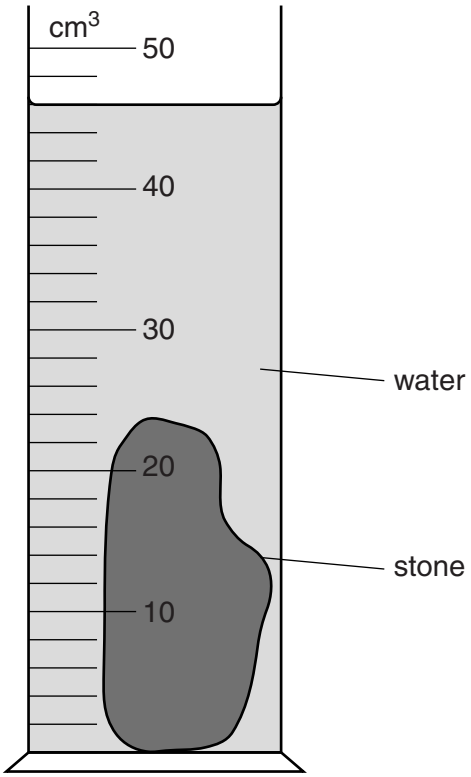

Fig. 15.1

(a) Use Fig. 15.1 to calculate the volume of the stone.

volume = ... cm^3 [1]

(b) The density of the stone is 3.0 g/cm^3.

Calculate the mass of the stone.

mass = ... g [2]

16 A metal can is filled with hot water and placed on a metal table, as shown in Fig. 16.1.

For Examiner's Use

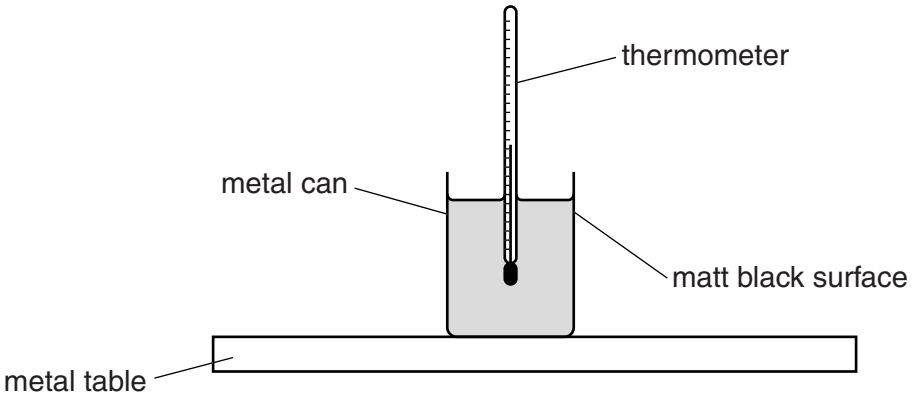

Fig. 16.1

The surface of the metal can is matt black.

The temperature is seen to fall quickly.

(a) Explain why the temperature falls more slowly when

(i) the can is placed on a wooden table,

.....

..... [1]

(ii) the surface of the can is shiny white instead of matt black.

.....

..... [1]

(b) Air above the can becomes heated and rises.

Explain why hot air rises.

.....

..... [1]

(c) A laboratory liquid-in-glass thermometer is used to measure the temperature of the water.

Explain two differences between a laboratory liquid-in-glass thermometer and a clinical liquid-in-glass thermometer.

1. .....

.....

2. .....

.....

[2]

17 Fig. 17.1 shows some properties of five elements, **A**, **B**, **C**, **D** and **E**.

The letters are not the symbols of the elements.

For Examiner's Use

element	melting point /°C	boiling point /°C	electronic structure
A	–248	–246	2,8,8
B	–7	59	2,8,18,7
C	63	766	2,8,1
D	119	444	2,8,6
E	659	2447	2,8,3

Fig. 17.1

Use the letters **A**–**E** to answer the questions.

(a) Which element is a liquid at room temperature? ..... [1]

(b) Which element is in Group 3 of the Periodic Table? ..... [1]

(c) Which element is a **solid** non-metal at room temperature?

Explain why you have chosen this element.

element .....

explanation .....

.....

[3]

18 **(a)** State the sign of the charge on the nucleus of an atom.

..... [1]

(b) Explain why an electron is attracted to the nucleus of an atom.

.....

..... [1]

(c) Some nuclei are unstable and emit gamma-rays.

State the speed of gamma-rays in a vacuum. .....m/s [1]

19 Fig. 19.1 shows a mains plug.

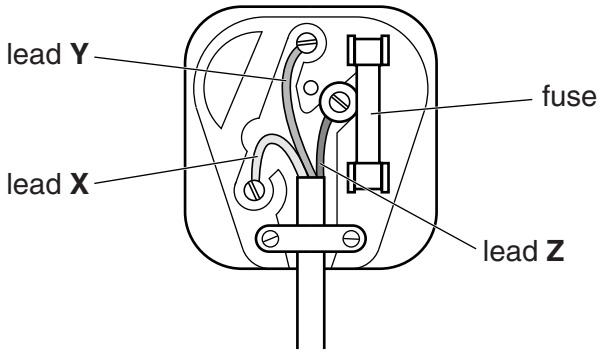

Fig. 19.1

(a) Identify the leads **X**, **Y** and **Z**.

X .....

Y .....

Z ..... [2]

(b) The fuse has a rating of 10 A.

Explain what is meant by a fuse *rating*.

.....

..... [2]

DATA SHEET
The Periodic Table of the Elements

Group I	Group II						Group III	Group IV	Group V	Group VI	Group VII	Group 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 Sulfur 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	55 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	209 Po Polonium 84	210 At Astatine 85	222 Rn Radon 86
223 Fr Francium 87	226 Ra Radium 88	227 Ac Actinium 89 †															

140 Ce Cerium 58	141 Pr Praseodymium 59	144 Nd Neodymium 60	147 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	231 Pa Protactinium 91	238 U Uranium 92	237 Np Neptunium 93	244 Pu Plutonium 94	243 Am Americium 95	247 Cm Curium 96	247 Bk Berkelium 97	251 Cf Californium 98	252 Es Einsteinium 99	257 Fm Fermium 100	258 Md Mendelevium 101	259 No Nobelium 102	260 Lr Lawrencium 103

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

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

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