CAMBRIDGE INTERNATIONAL EXAMINATIONS

General Certificate of Education Ordinary Level

COMBINED SCIENCE   **5129/2**

PAPER 2

OCTOBER/NOVEMBER SESSION 2002

2 hours 15 minutes

Candidates answer on the question paper.
No additional materials are required.

TIME   2 hours 15 minutes

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.

FOR EXAMINER'S USE	
TOTAL	

This question paper consists of 19 printed pages and 1 blank page.

UNIVERSITY *of* CAMBRIDGE
Local Examinations Syndicate

[Turn over

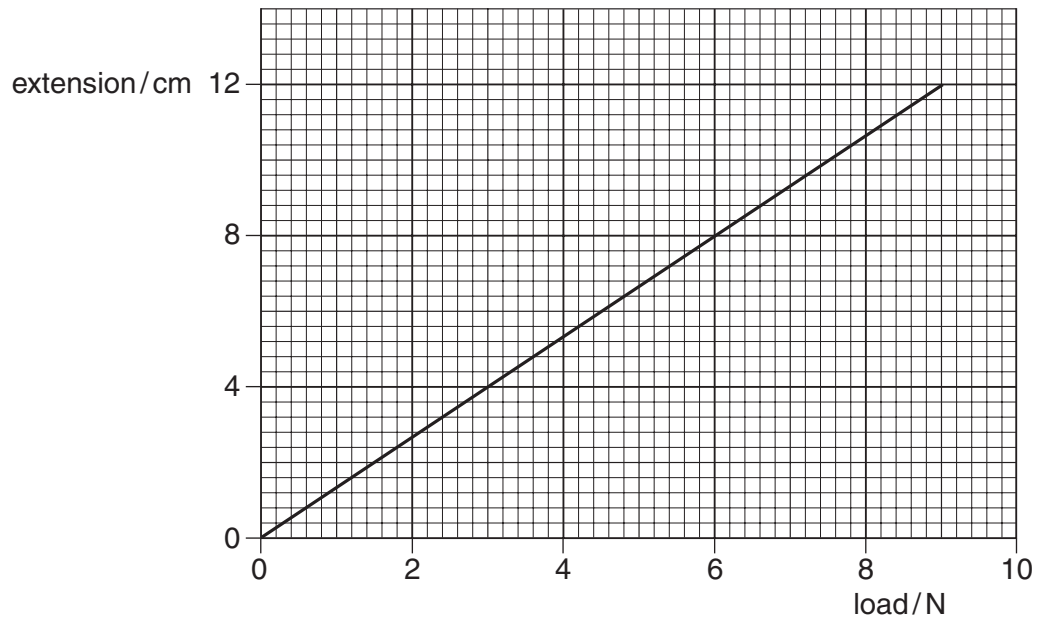**1** **(a)** Fig. 1.1 shows an extension-load graph for a spring.

Fig. 1.1

With no force on the spring, it has a length of 10.0 cm.

What force is acting on the spring when its length is 18.0 cm?

[2]

(b) Fig. 1.2 shows the same spring being used in a device for weighing objects. The spring pulls down on one side of a wooden strip with a force of 8.0 N. The wooden strip is horizontal.

object

6.0 cm   12.0 cm

pivot   wooden strip

stretched
spring
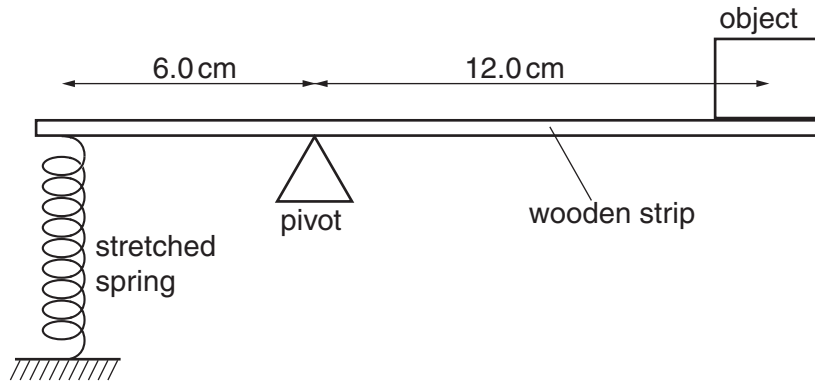
Fig. 1.2

(i) Calculate the anticlockwise moment, about the pivot, of the force in the spring.

[2]

(ii) State the clockwise moment of the weight of the object. The weight of the wooden strip can be ignored.

....[1]

(iii) Calculate the weight of the object.

[1]

(c) Identical apparatus is used to weigh the same object on the Moon. The wooden strip is horizontal but the pivot is not in the same position as it is on Earth.

Explain why.

....

....

....[2]

[Turn over

2 When sodium burns in chlorine, sodium chloride is produced. The structure of sodium chloride is illustrated in Fig. 2.1.
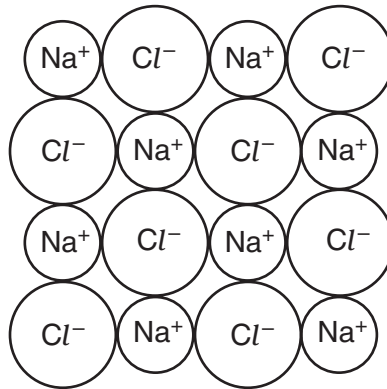
Fig. 2.1

(a) What type of bonding is present in sodium chloride?

....[1]

(b) State the formula of sodium chloride.

....[1]

(c) Explain why solid sodium chloride does not conduct electricity.

....

....[1]

(d) Suggest the names of an acid and an alkali that react together to form sodium chloride.

....

....[2]

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**PLEASE TURN OVER
FOR QUESTION 3**

[Turn over

3 Fig. 3.1 shows the apparatus used to investigate how the rate of photosynthesis varies with light intensity.
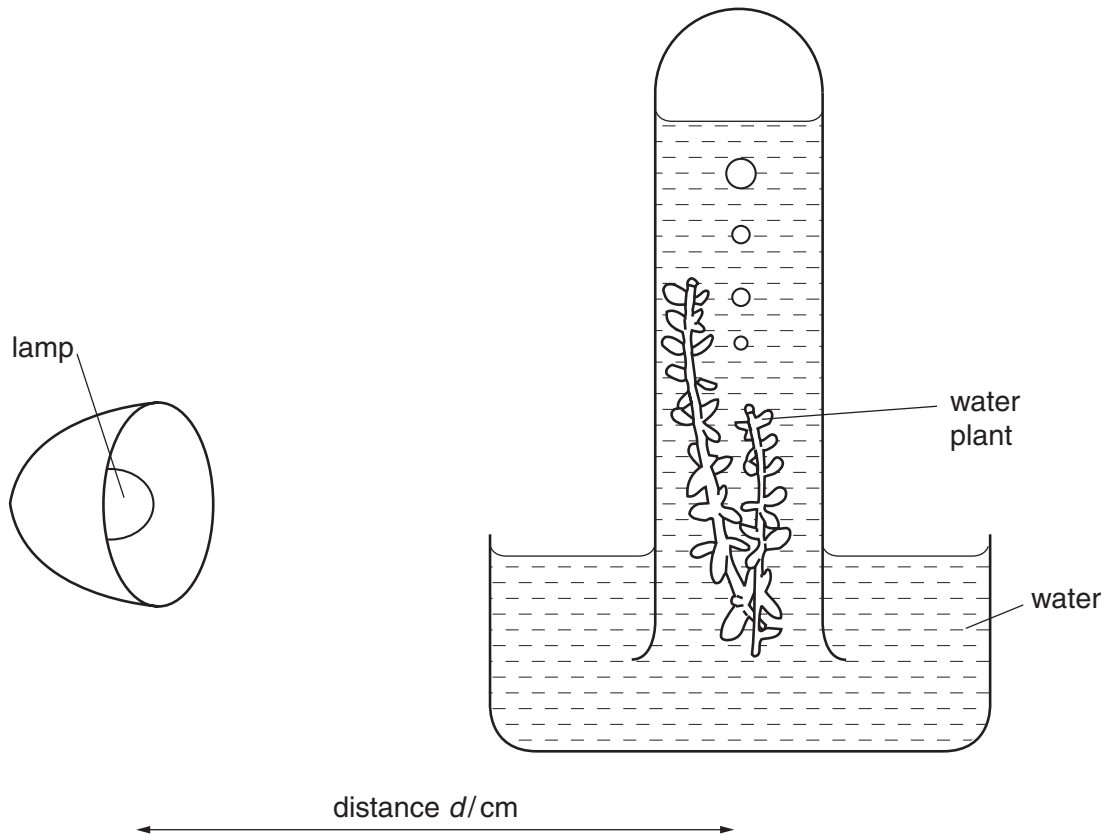
Fig. 3.1

Bubbles of gas are given off as the plant photosynthesises.
The number of bubbles given off in a time of 20 seconds is counted.
The distance *d*, between the lamp and the plant, is changed and the experiment is repeated.

Fig. 3.2 shows the results of the investigation.

distance *d*/cm	number of bubbles in 20 seconds
5	40
10	25
15	20
20	15
25	10
30	8
35	5
40	2
50	1

Fig. 3.2
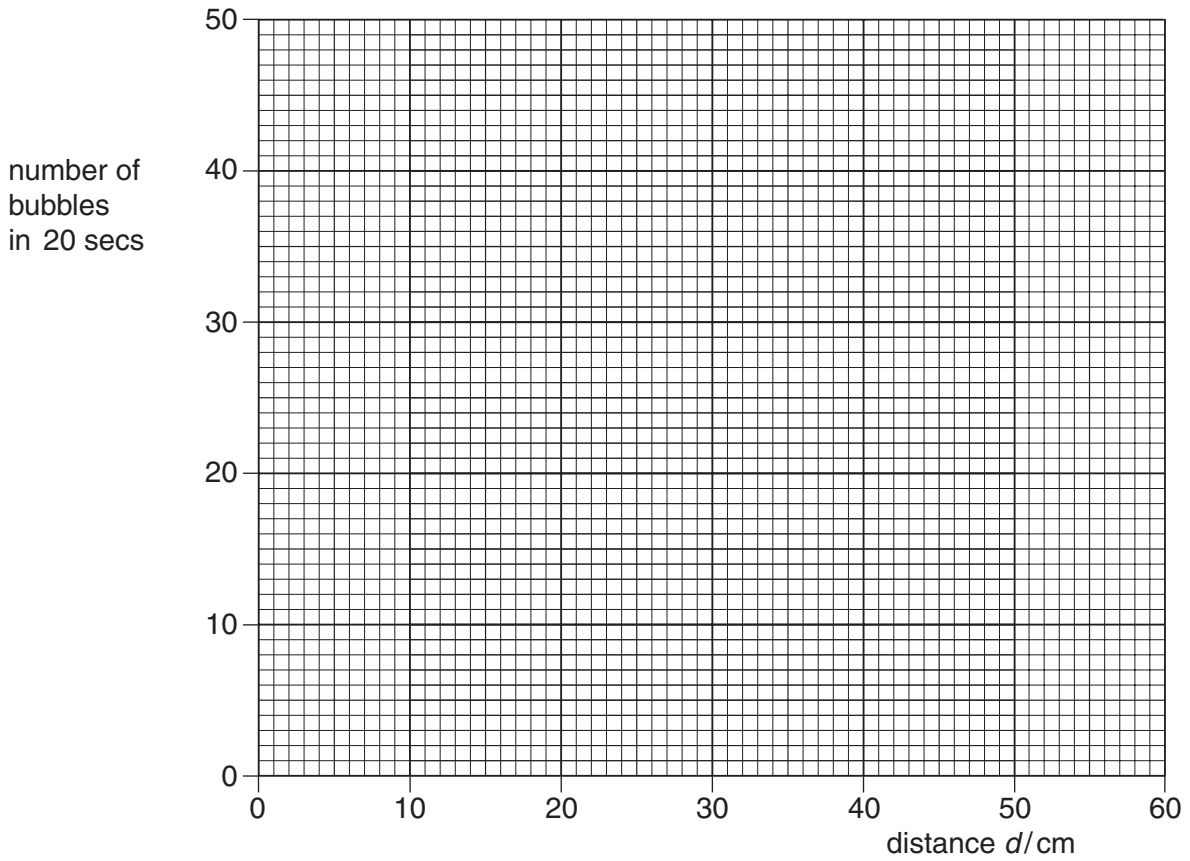
(a) Name the gas in the bubbles.

....[1]

(b) Plot the data in Fig. 3.2 on the grid above. [3]

(c) How does the rate of photosynthesis vary with increasing distance of the lamp?

....

....[1]

(d) Suggest why, in a lake, very few water plants grow at depths greater than 20 m.

....[1]

[Turn over

4 Fig. 4.1 shows water droplets from a nozzle falling on a plant. The nozzle gives each droplet a positive charge.
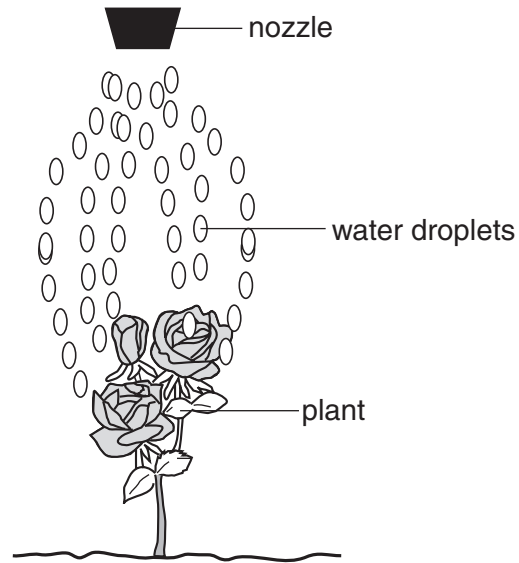
Fig. 4.1

(a) Explain why the droplets spread out as they leave the nozzle.

....

....

....[2]

(b) The plant gains a negative charge. Explain why this makes the water droplets move towards the plant.

....

....[1]

(c) Every 20 seconds, 5.0×10^7 water droplets come out of the nozzle. Each droplet carries a charge of 1.8×10^{-11} C.

Calculate

(i) the charge carried away by the droplets in 20 s,

[1]

(ii) the charge carried away by the droplets in 1.0 s,

[1]

(iii) the electric current from the nozzle.

[1]

[Turn over

5 Fig. 5.1 shows the apparatus used to investigate the composition of air.
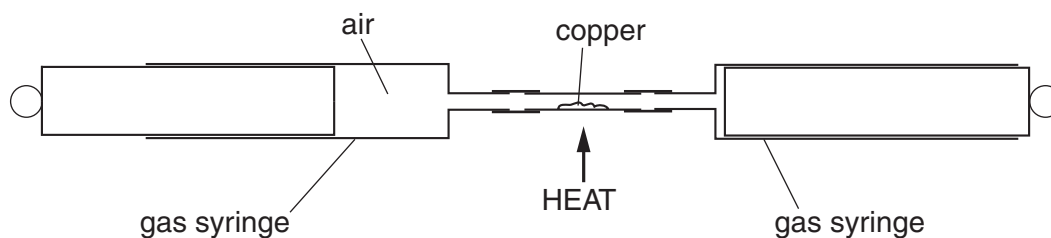
Fig. 5.1

Air is passed over hot copper from one syringe to the other. One of the gases of the air, **X**, reacts with the copper, which changes colour from brown to black.

The results obtained from the experiment are as follows:
initial volume of air in the syringe = 75.0 cm^3
final volume of gas in the syringe = 60.0 cm^3

(a) Name the gas **X**.

....[1]

(b) (i) What is the volume of gas **X** in the sample of air?

.... cm^3 [1]

(ii) Calculate the percentage by volume of gas **X** in the air.

....

....[2]

(c) Air contains about 1% of argon.

(i) In which group of the Periodic Table is argon?

....

(ii) Suggest why argon does not react with the copper.

....[2]

6 **(a)** State the function of red blood cells.

....[1]

(b) **(i)** State two structural adaptations of human red blood cells that help them to carry out their function.

1 ....

2 ....[2]

(ii) Explain how **one** of the adaptations you stated in **(b)(i)** helps the cell to function.

....

....[1]

(c) Fig. 6.1 below shows a blood smear seen under a microscope.
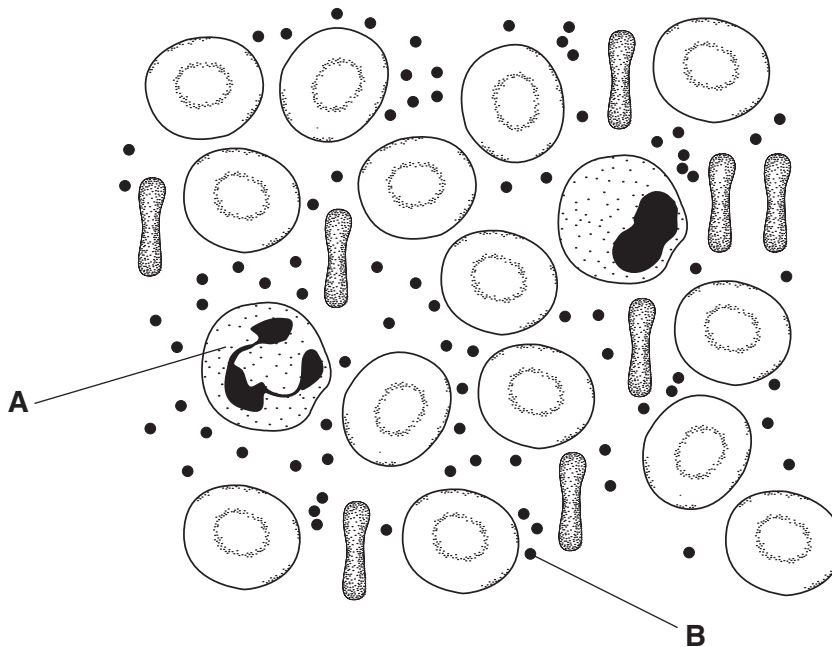
Fig. 6.1

(i) Name **A** and **B**.

A ....

B ....[2]

(ii) State the functions of **A** and **B**.

A ....

B ....[2]

[Turn over

7 **(a)** Complete the following sentences about energy changes in a hydroelectric power station.

In a hydroelectric power station, water flows downhill. As it falls, the ....

energy of the water is changed into .... energy. In the generators,

.... energy is changed into .... energy. Friction causes

some energy to be wasted as ....   [3]

(b) One generator produces 72 000 000 J of energy in 12 minutes.

(i) State an equation for calculating power.

....[1]

(ii) Calculate the power of the generator.

[2]

8 Fig. 8.1 shows the solubility of ammonia in water at different temperatures.

temperature / °C	0	10	20	30	40	50
<u>solubility of ammonia</u> g per 100 g water	90	69	53	41	31	24

Fig. 8.1

(a) On the grid below, plot a graph of solubility against temperature.

solubility in
g per 100 g water

temperature / °C

[2]
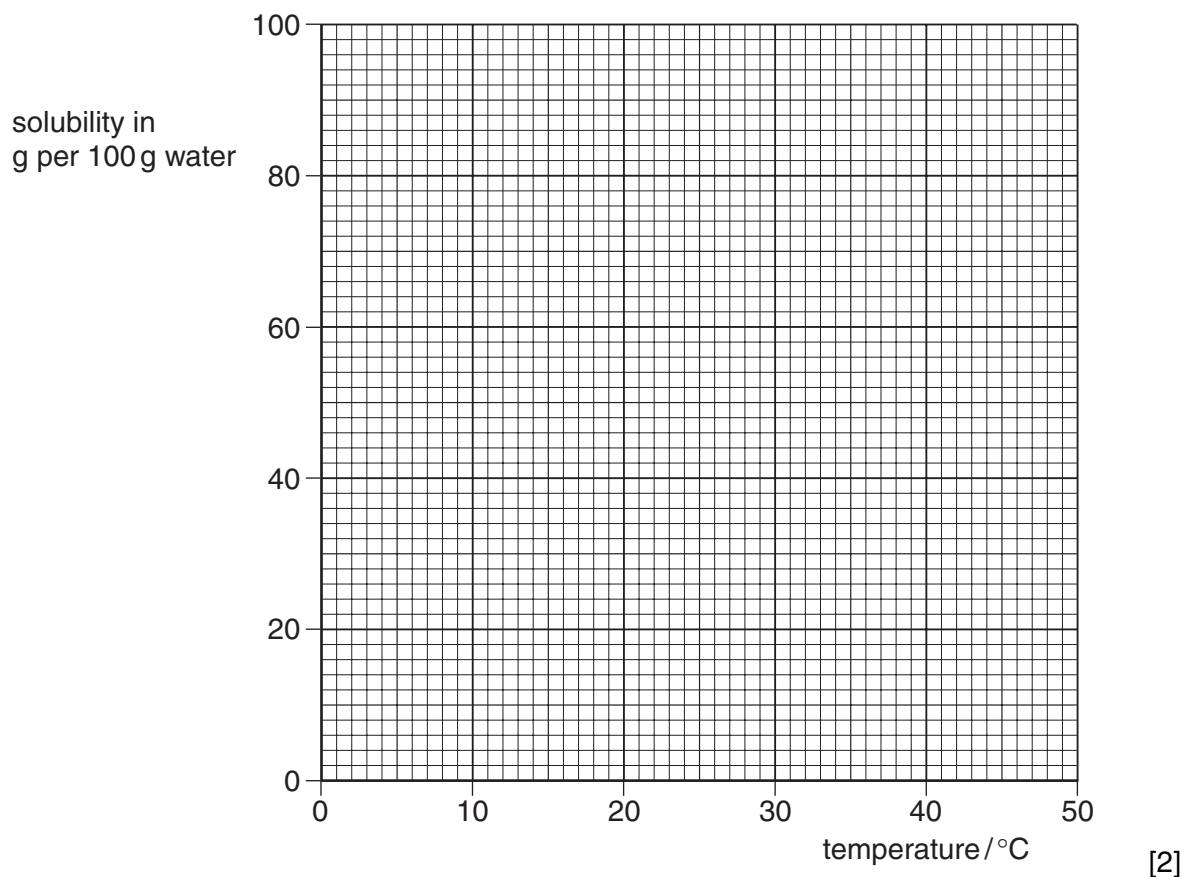
(b) Use the graph to find the solubility of ammonia at 25 °C.

.... g per 100 g water. [1]

(c) When ammonia solution is heated, ammonia gas is given off.

   (i) What is the maximum mass of ammonia that can be dissolved in 100 g of water at 20 °C?

   .... g [1]

   (ii) If this solution is heated to 40 °C, what mass of ammonia gas will be given off?

   .... g [1]

   (iii) If 17 g of ammonia has a volume of 24 dm³, what is the volume of the gas given off in **(c)(ii)**?

   ....

   ....[1]

[Turn over

9 **(a)** Explain what is meant by *excretion*.

....

....

....[2]

(b) (i) Name the organ through which carbon dioxide is excreted.

....[1]

(ii) Name the process that produces this carbon dioxide.

....[1]

(iii) Where in the body does the process in **(b)(ii)** take place?

....[1]

(c) Fig. 9.1 is a diagram of a kidney and its blood vessels.
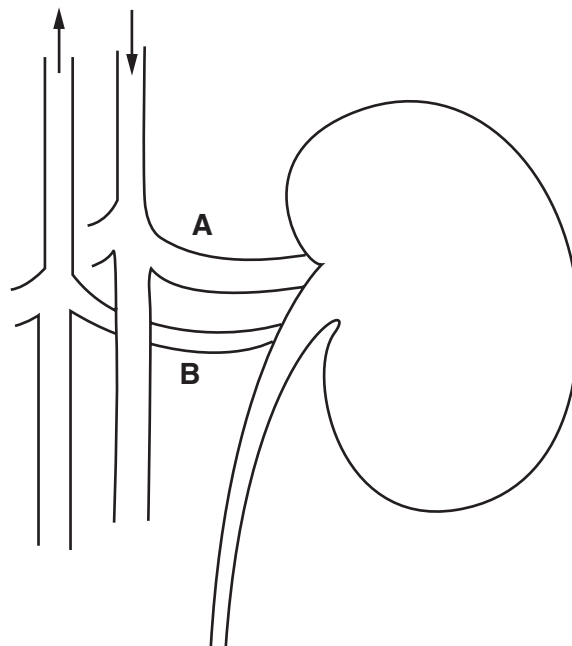
Fig. 9.1

Suggest three differences between the blood in artery **A** and the blood in vein **B**.

1 ....

....

2 ....

....

3 ....

....[3]

[Turn over

10 Fig. 10.1 shows a ray of light, **A**, passing through a glass block and a ray **B** arriving at point **X**.
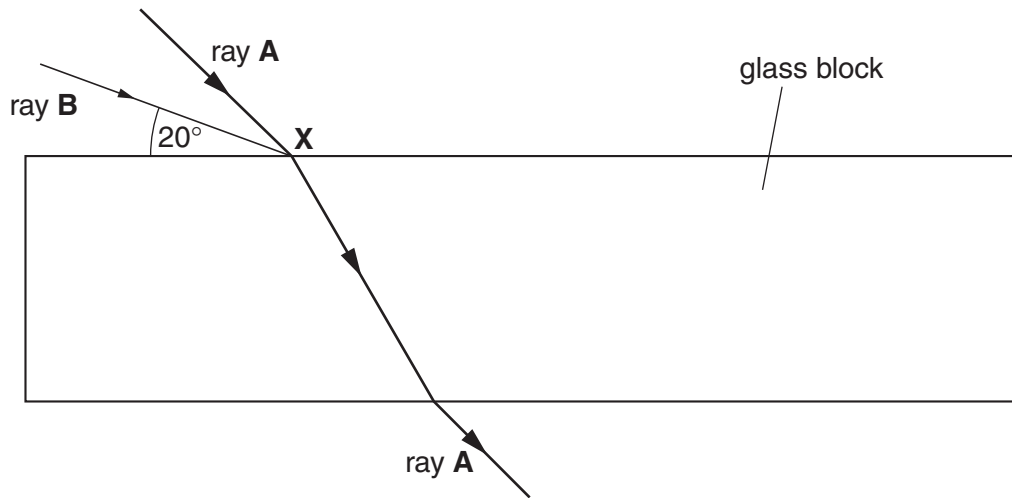
Fig. 10.1

(a) On Fig. 10.1, draw ray **B** passing through and out of the block.   [3]

(b) What is the angle of incidence of ray **B** at point **X**?

....[1]

(c) (i) State an equation for calculating refractive index.

....[1]

(ii) When the angle of incidence is 54°, the angle of refraction is 35°.

Calculate the refractive index of the glass.

[2]

11 Ethanol is made by the fermentation of glucose.

(a) Describe the essential conditions for the fermentation of glucose to form ethanol.

....

....

....

....[4]

(b) Balance the equation for the fermentation of glucose.

$$C_6H_{12}O_6 \longrightarrow .... \; C_2H_5OH \; + \; .... \; CO_2$$ [1]
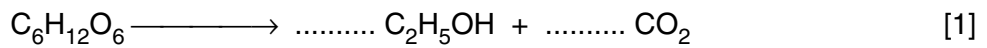
(c) State **one** industrial use of ethanol.

....[1]

12 Breathing in smoke from burning coal, oil, wood or cigarettes can damage the lungs.

Name two air pollutants, other than carbon monoxide, that are harmful to the lungs.

For each one, explain the way in which the lungs are affected.

1 pollutant ....[1]

   effect ....

   ....[1]

2 pollutant ....[1]

   effect ....

   ....[1]

[Turn over

13 Wires in a mains cable are different colours.

(a) State the colour or colours of

(i) the live wire, ...

(ii) the neutral wire, ...

(iii) the earth wire. ....
[3]

(b) Which wire should be connected to the fuse? ....[1]

(c) A plug is connected to a kettle. The element of the kettle is rated at 2.0 kW, 230 V

(i) Calculate the current in the element of the kettle.

[2]

(ii) Three fuse ratings are available. These are 5 A, 10 A and 15 A.

State which fuse rating is most suitable for the plug of the kettle.

....[1]

14 Butane is a fuel obtained from petroleum (crude oil). It is used as a fuel because it burns in air giving a large amount of energy.

(a) Name the process used to obtain butane from petroleum.

....[1]

(b) Butane belongs to a homologous series of hydrocarbons.

(i) Name this homologous series. ....[1]

(ii) State **two** characteristics of a homologous series.

....

....

....[2]

(c) What type of bonding is present in a molecule of butane?

....[1]

15 (a) A woman starts to menstruate on November 1st.

    (i) On which day does she expect to ovulate?

    ....[1]

    (ii) She does not become pregnant.

    On which day does she expect to begin menstruation again?

    ....[1]

    (iii) The days of the following month, December, are listed

    1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

    ....

    write the word *fertile* under the days when an egg is most likely to be fertilised. [1]

(b) Complete the following sentence by choosing words from the list below.

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

      fetus   **ovary**   **sperm**   **uterus**   **zygote**

An egg fuses with a .... to form a .... which develops into

a ball of cells that implants in the wall of the .... , where it grows into a

....   [4]

16 The following is a list of substances.

      ammonium sulphate   **calcium carbonate**   **chlorine**

      copper   **nitric acid**   **sulphur dioxide**

Use the list to answer the questions. Each substance may be used **once**, **more than once** or **not at all**.

Name the substance that

(a) reacts with ammonia to produce a fertiliser, ...[1]

(b) reacts with dilute sulphuric acid to produce a colourless gas, ...[1]

(c) is used to control the acidity of soil, ...[1]

(d) forms a covalent compound when reacted with hydrogen, ...[1]

(e) forms an alloy when mixed with zinc. ....[1]

DATA SHEET
The Periodic Table of the Elements

Group

I	II		III	IV	V	VI	VII	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		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		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		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							

Transition elements:

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
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
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
227 **Ac** Actinium 89 †									

1
H
Hydrogen
1

*58-71 Lanthanoid series

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

†90-103 Actinoid series

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

Key

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

a
X
b

The volume of one mole of any gas is 24 dm³ at room temperature and pressure (r.t.p.).