



UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS  
General Certificate of Education Ordinary Level

CANDIDATE  
NAME

CENTRE  
NUMBER

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**COMBINED SCIENCE**

**5129/02**

Paper 2

**October/November 2009**

**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 20.

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**

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This document consists of **19** printed pages and **1** blank page.



- 1 Fuel (gasoline) is mixed with air and burned in the engine of a car. The waste gas is passed out of the exhaust of the car. This is shown in Fig. 1.1.

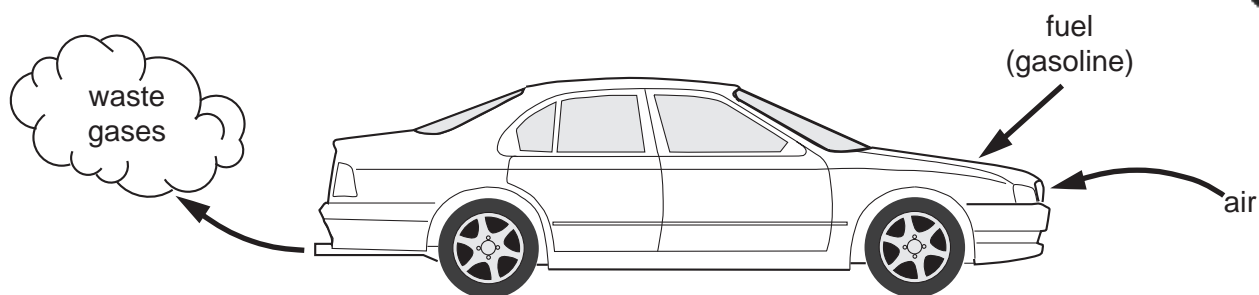


Fig. 1.1

- (a) Gasoline is a mixture of hydrocarbons, mainly alkanes, obtained from petroleum.

Explain the meaning of the term *hydrocarbon*.

.....  
 ..... [2]

- (b) Name the gas in the air used when the fuel is burned.

..... [1]

- (c) (i) Name the gases produced by the **complete** combustion of the fuel used in this car.

..... and ..... [2]

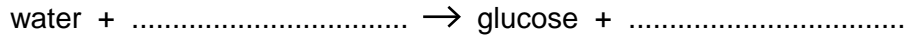
- (ii) Name a gas that is produced during the **incomplete** combustion of this fuel.

..... [1]

- (iii) State **one** other pollutant in the waste gases.

..... [1]

2 (a) Complete the word equation for photosynthesis.



(b) An experiment is carried out to investigate the effect of changing light intensity on the rate of photosynthesis. The apparatus is shown in Fig. 2.1.

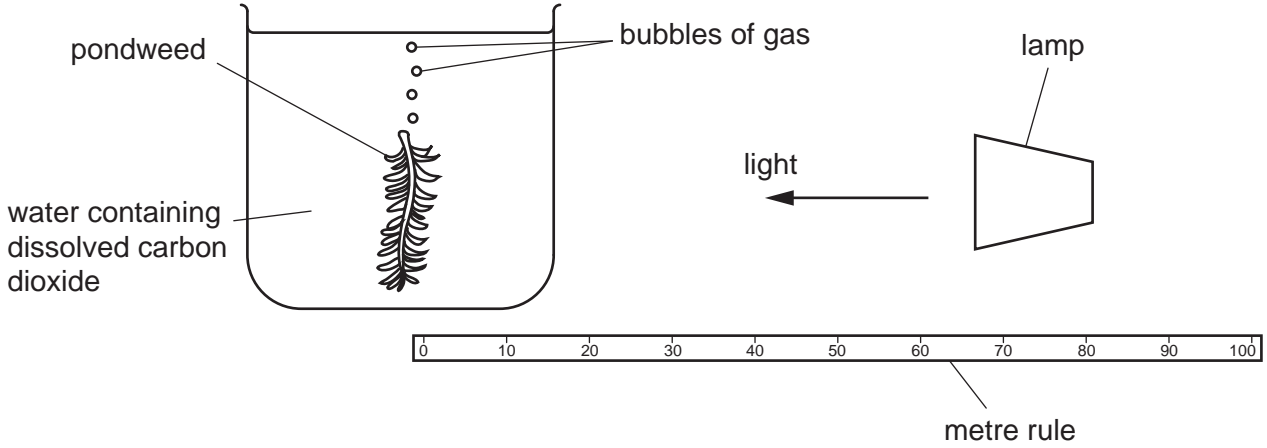


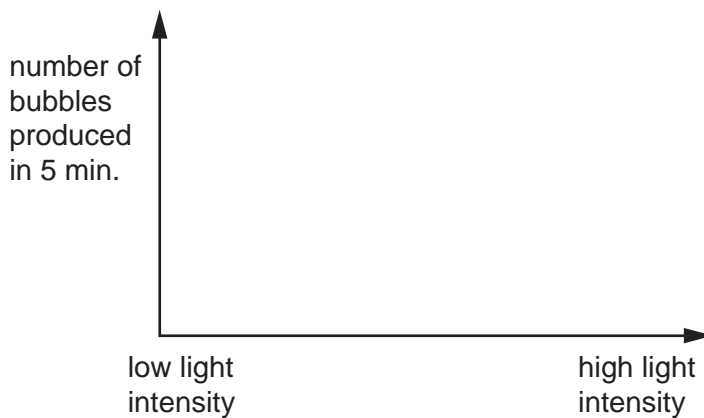
Fig. 2.1

The light intensity at the plant is changed by changing the distance between the lamp and the plant. The rate of photosynthesis is measured by counting the number of bubbles produced by the pondweed in five minutes.

(i) Suggest **one** condition that should be kept constant in this experiment.

.....[1]

(ii) On the axes below, sketch a curve to show the results expected from this experiment.



[2]

(c) Explain why **animals** depend on photosynthesis.

.....  
 .....[1]

3 A car maintains a constant speed of 30 m/s for 20 s. During the next 20 s, the car accelerates at a constant rate, reaching a speed of 50 m/s.

(a) (i) On Fig. 3.1, plot a speed-time graph for the car. [2]

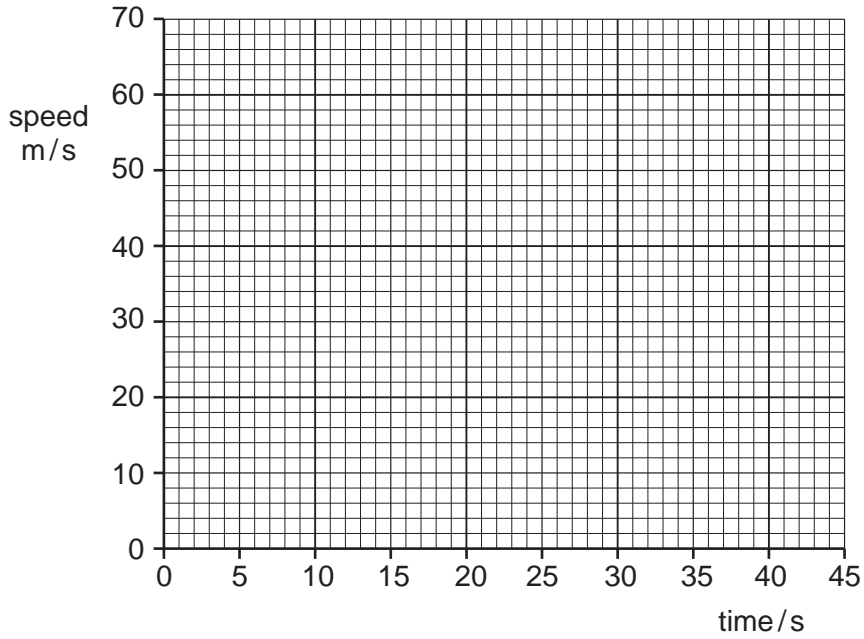


Fig. 3.1

(ii) Although the car has a constant speed for 20 s, its velocity may not be constant.

Explain the difference between velocity and speed.

.....  
 ..... [2]

(b) A second car has a mass of 1 500 kg.

Calculate the acceleration of the car when the accelerating force acting on it is 5 100 N.

acceleration = ..... unit ..... [3]

4 Some properties of five substances are shown in Fig. 4.1.

substance	conducts electricity when solid	conducts electricity when melted	melting point /°C	soluble in water
<b>A</b>	yes	yes	1539	no
<b>B</b>	no	no	-75	yes
<b>C</b>	yes	yes	98	reacts with water
<b>D</b>	no	no	119	no
<b>E</b>	no	yes	772	yes

**Fig. 4.1**

(a) Give the letter, **A**, **B**, **C**, **D** or **E**, of the substance that is **not** a solid at room temperature.

..... [1]

(b) (i) Give the letter, **A**, **B**, **C**, **D** or **E**, of one Group I metal.

..... [1]

(ii) Give a reason for your choice.

.....  
 ..... [1]

(c) Give the letter, **A**, **B**, **C**, **D** or **E**, of one ionic compound.

Explain the reasons for your choice.

compound .....

reasons .....

.....

..... [3]

5 Plant reproduction involves the production of fruits and seeds.

(a) What is a *pericarp*?

.....  
.....[1]

(b) A section through a broad bean seed is shown in Fig. 5.1.

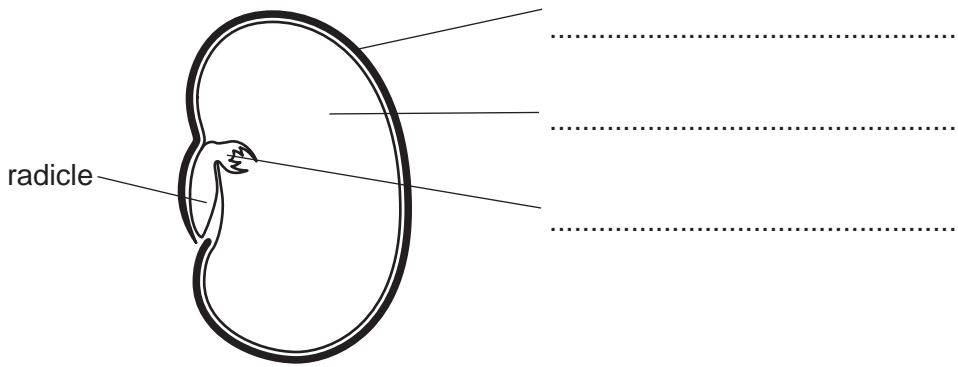


Fig. 5.1

Complete the labels on Fig. 5.1. [3]

(c) Explain the importance of seed dispersal for plants.

.....  
.....  
.....[1]

6 Use words from the following list to complete the sentences below.

- chemical      geothermal      hydroelectric      kinetic**  
**nuclear      potential      solar**

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

There are several ways of generating electricity. In ..... schemes, water falls from a high level to a lower level.

As the water falls it loses ..... energy. When coal burns, ..... energy is converted into thermal energy.

..... cells use the energy from sunlight to produce electricity. [4]

7 Chlorine, bromine and iodine are elements in Group VII of the Periodic Table.

(a) State the name given to the elements in Group VII.

..... [1]

(b) Describe the change of state of the Group VII elements as the group is descended from fluorine to astatine.

..... [1]

(c) When bromine is added to potassium iodide, a brown solution is produced.

Name the products of this reaction.

..... and ..... [2]

(d) State why chlorine is used in the purification of water supplies.

.....  
..... [1]

8 A human heart is shown in Fig. 8.1.

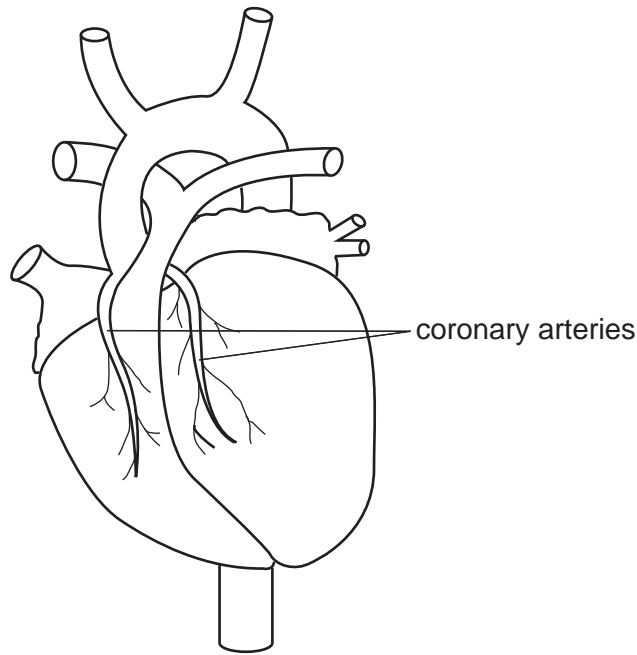


Fig. 8.1

Blood is carried to the heart muscle in the coronary arteries and away from the heart muscle in the coronary veins.

(a) State **two** differences between the blood carried in the coronary arteries and the blood carried in the coronary veins.

- 1. ....  
.....
- 2. ....  
..... [2]

(b) State **two** ways in which the structure of the coronary arteries differs from that of the coronary veins.

- 1. ....  
.....
- 2. ....  
..... [2]

(c) A coronary artery may become blocked. This may cause a heart attack. A heart attack is more likely to happen if a person is a smoker. State **two** other features of a person's lifestyle that may make a heart attack more likely.

- 1. ....



- 9 A wire is moved downwards between the North and South poles of two magnets, as shown in Fig. 9.1.

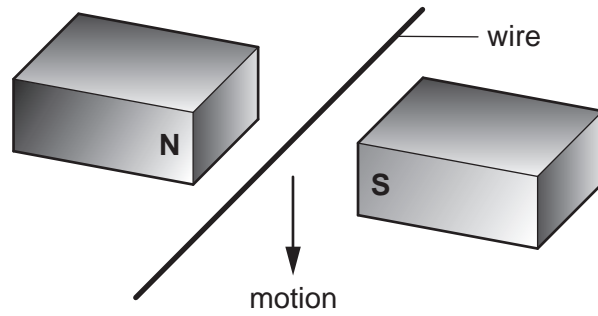


Fig. 9.1

The variation of the induced e.m.f. with time is shown in Fig. 9.2.

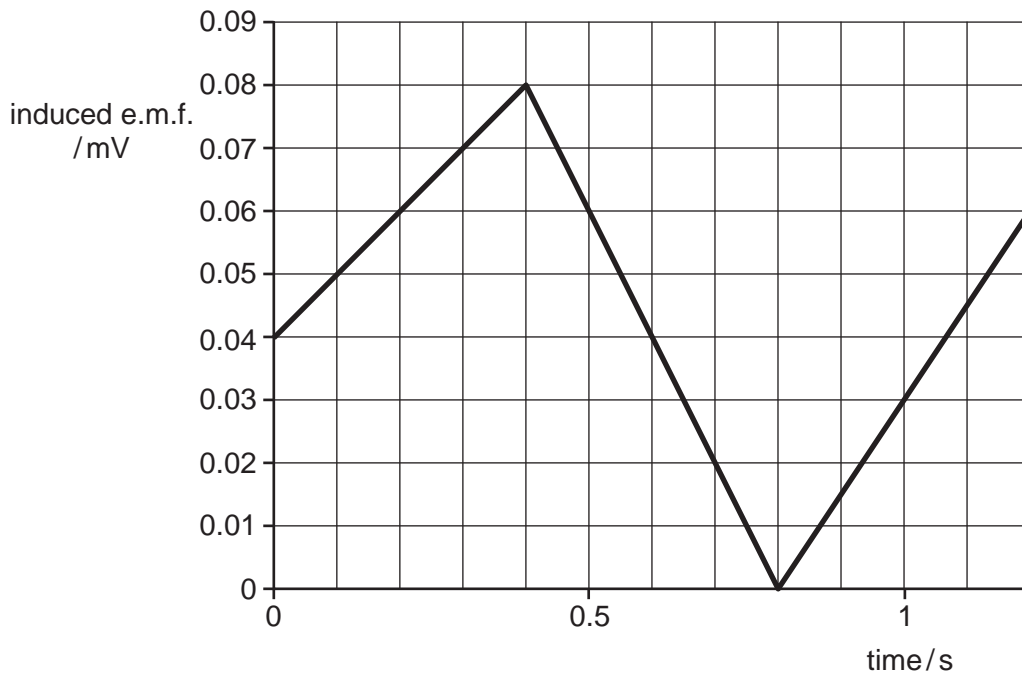
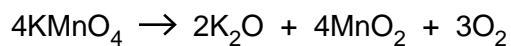


Fig. 9.2

- (a) Use Fig. 9.2 to state at which time
- (i) the induced e.m.f. is at maximum, ..... s
  - (ii) the wire is not moving. .... s [2]
- (b) Name **two** factors affecting the magnitude of the induced e.m.f.
- 1..... [2]
  - 2..... [2]

- 10 When potassium manganate(VII) is heated, it decomposes according to the following equation.



Four students each weigh a test-tube containing some potassium manganate(VII). Each student heats the test-tube, collects the oxygen given off in a gas syringe and then weighs the test-tube again.

The mass and the volume of oxygen given off from each tube are shown in Fig. 10.1.

mass of oxygen / g	volume of oxygen / cm <sup>3</sup>
0.80	600
0.60	450
0.40	300
0.20	150

Fig. 10.1

- (a) On Fig. 10.2, plot a graph of these results.

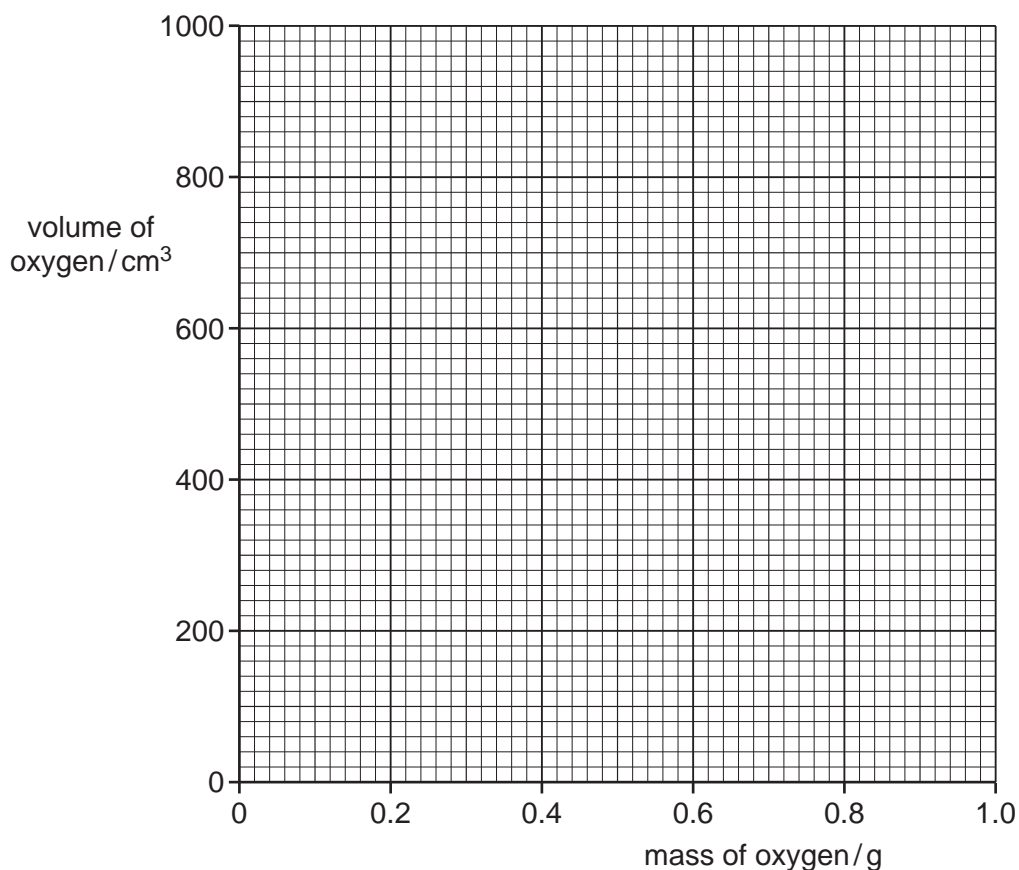


Fig. 10.2

[3]

- (b) (i) Use the graph to find the volume of 1.0 g of oxygen .....
- (ii) The relative molecular mass,  $M_r$ , of oxygen is 32.  
Using your answer to (b)(i), calculate the volume of 32 g of oxygen.

volume of oxygen = .....  $\text{cm}^3$  [1]

- (c) State a test to show that the gas given off is oxygen.

test .....

result ..... [2]

- 11 (a) Use the words from the following list to complete the sentences below.

**alveoli**      **carbon dioxide**      **chest**  
**diffusion**      **osmosis**      **oxygen**

The words may be used once, more than once, or not at all.

In the lungs, ..... moves into the blood across the walls of the .....

This occurs by .....

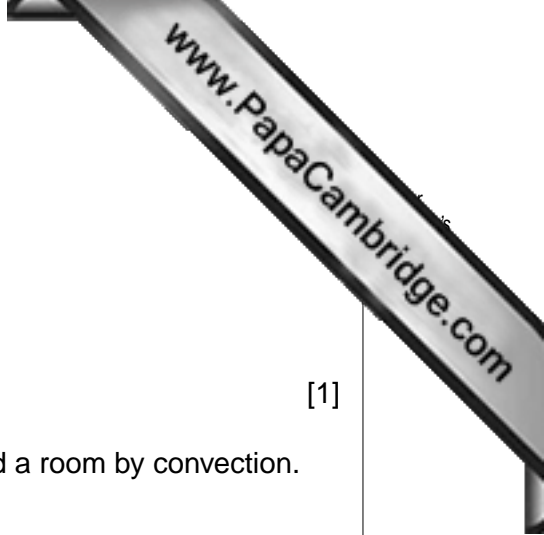
At the same time, ..... moves from the blood into the air. [4]

- (b) State **three** ways in which expired air differs from inspired air.

1. ....

2. ....

3. .... [3]



12 The following questions are about the transfer of thermal energy.

(a) The handle of a saucepan must not get hot.

Name a suitable material for the handle.

..... [1]

(b) Explain fully how thermal energy from a radiator travels round a room by convection.

.....  
.....  
.....  
.....  
..... [3]

(c) Infra-red radiation is incident on two similar objects. The temperature of both rises. One is painted black and the other is white.

State why the temperature of the black object rises more quickly.

..... [1]

- 13 A student wants to find which coloured dyes have been mixed together to make dye X. She separates a sample of dye X and samples of coloured dyes using paper chromatography. Her results are shown in Fig. 13.1.

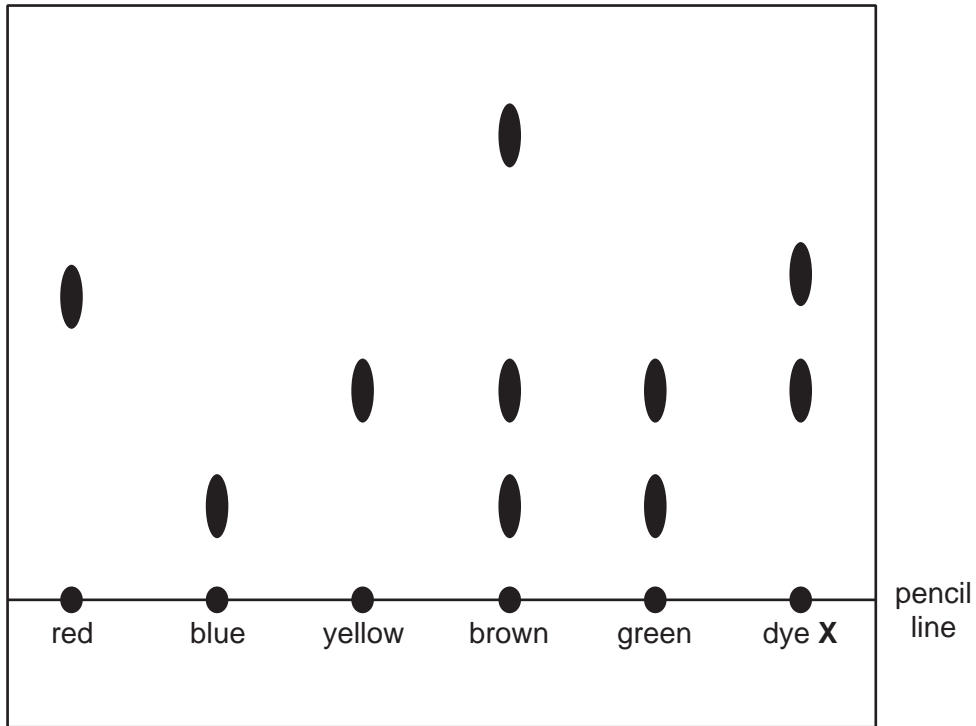


Fig. 13.1

- (a) Explain why the line is drawn in pencil and not in ink.  
 .....[1]
- (b) Which colours are present in dye X?  
 .....[2]
- (c) Which coloured dye contains a substance **not** present in any of the other coloured dyes?  
 .....[1]

14 To investigate the action of amylase, four test-tubes are set up as shown in Fig. 14.1. Each test-tube contains starch solution and amylase.

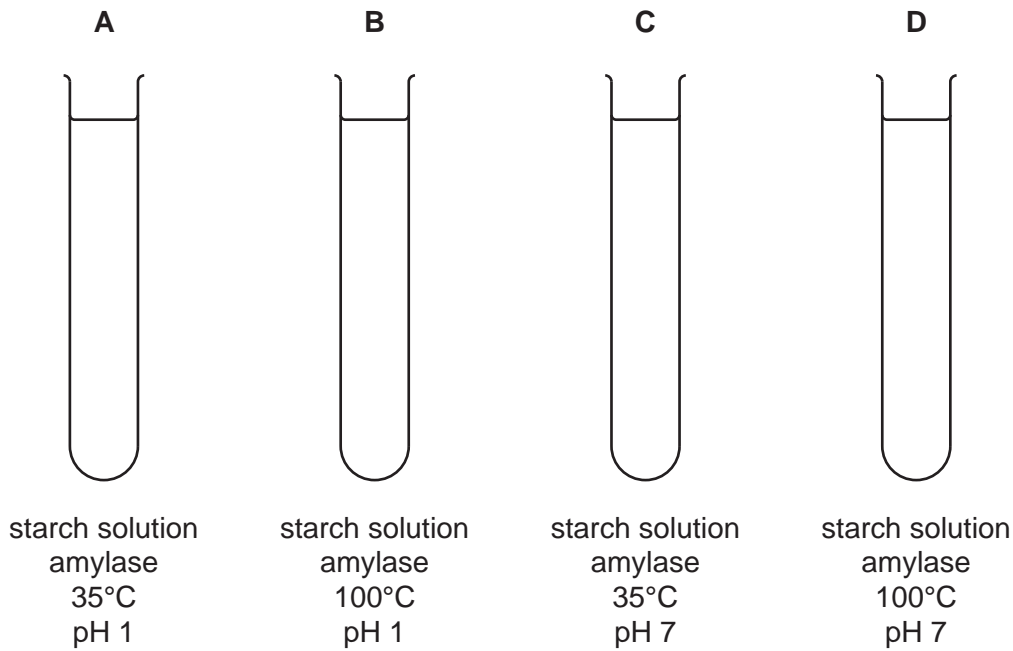


Fig. 14.1

(a) At one-minute intervals, a sample from each tube is tested for sugar.

State and explain in which tube you would expect sugar to be produced most quickly.

.....

.....

.....

..... [2]

(b) For this reaction, name

- (i) the enzyme,  
.....
- (ii) the substrate,  
.....
- (iii) the product.  
.....

[3]

15 Parallel rays of light are incident on a thin convex lens as shown in Fig. 15.1.

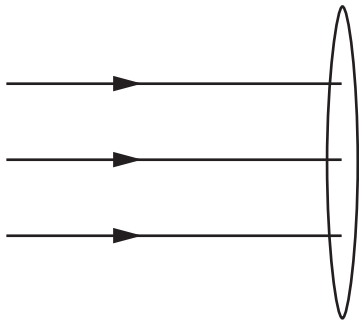


Fig. 15.1

(a) Complete Fig. 15.1 to show what happens to the rays after they pass through the lens. [2]

(b) A ray of light is incident on a glass block as shown in Fig. 15.2.

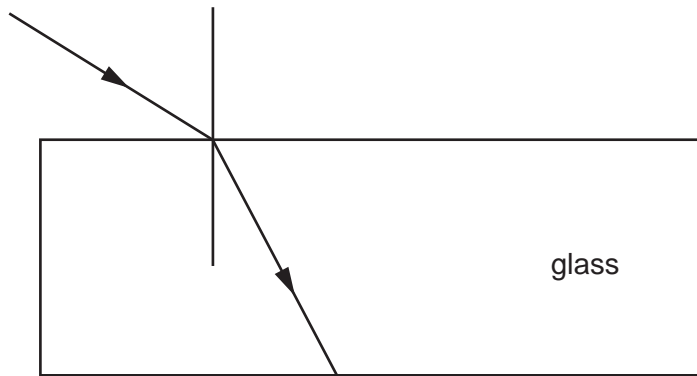


Fig. 15.2

(i) On Fig. 15.2, mark the angle of incidence with the letter *i* and the angle of refraction with the letter *r*. [2]

(ii) The angle of incidence *i* and the angle of refraction *r* are related by the equation

$$\frac{\sin i}{\sin r} = n.$$

State the name given to the constant *n*.

..... [1]

(c) Visible light and infra-red light are both components of the electromagnetic spectrum.

Name **two** other components of the electromagnetic spectrum.

..... and ..... [2]

16 (a) Use the words from the following list to complete the sentences below.

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

**electrons**      **element**      **gained**      **ions**  
**isotopes**      **lost**      **neutrons**      **protons**

The nuclei of atoms are made up of ..... and .....

When atoms form positive ions, ..... are .....

Atoms of the same ..... but with different numbers of neutrons are called .....

In a neutral atom, there are the same number of ..... and ..... [4]

(b) An atom of radon is represented by  ${}_{86}^{222}\text{Rn}$ .

Calculate the number of neutrons in this atom of radon.

number of neutrons = ..... [1]



17 The female reproductive system is shown in Fig. 17.1.

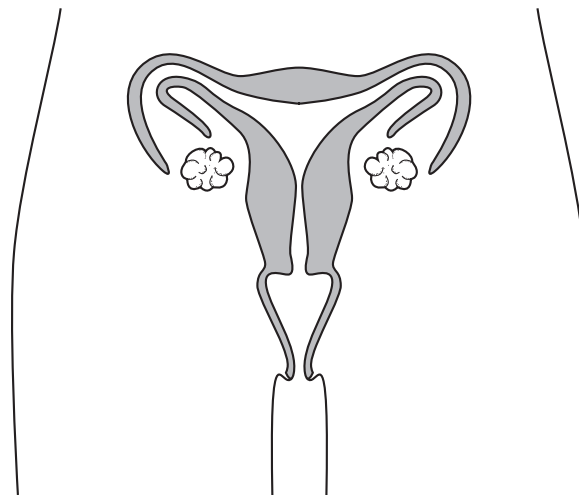


Fig. 17.1

(a) On Fig. 17.1, mark the cervix with the letter **X**. [1]

(b) In which part of the reproductive system does each of these processes occur?

(i) ovulation

.....

(ii) fertilisation

.....

(iii) implantation

.....

[3]

(c) Explain what is meant by *fertilisation*.

.....

.....

..... [1]

- 18 A metre rule rests on a table. A book is placed on one end of the metre rule and a student pushes down on the other end, as shown in Fig. 18.1

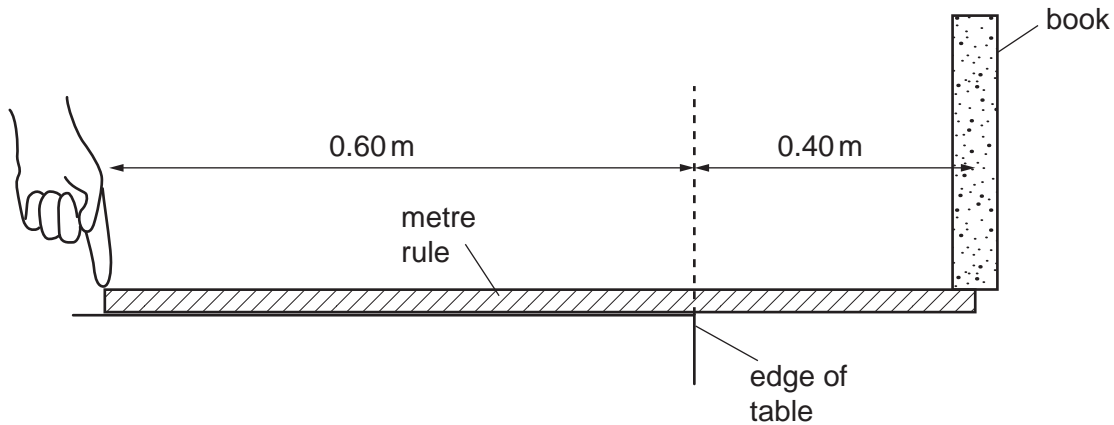


Fig. 18.1

The weight of the metre rule can be ignored.

- (a) On Fig. 18.1, draw an arrow to show the direction of the gravitational force acting on the book. [1]
- (b) The book weighs 6.0 N.

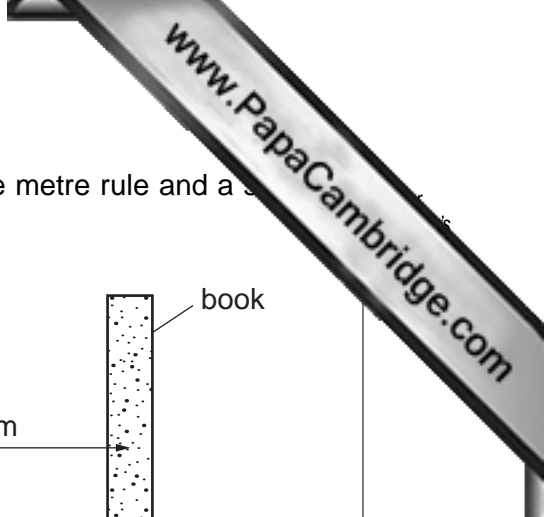
Calculate the moment of the weight of the book about the edge of the table.

moment = ..... unit ..... [2]

- (c) The boy just manages to stop the metre rule tipping clockwise.

Calculate the minimum force with which the student pushes on the metre rule.

force = ..... N [2]





**DATA SHEET**  
**The Periodic Table of the Elements**

		Group																																					
		I	II	III	IV	V	VI	VII	VIII	IX	X																												
		<table border="1" style="margin: auto; border-collapse: collapse;"> <tr> <td style="padding: 2px;">1 <b>H</b> Hydrogen 1</td> </tr> </table>										1 <b>H</b> Hydrogen 1																											
1 <b>H</b> Hydrogen 1																																							
7 <b>Li</b> Lithium 3	9 <b>Be</b> Beryllium 4											4 <b>He</b> Helium 2																											
23 <b>Na</b> Sodium 11	24 <b>Mg</b> Magnesium 12											20 <b>Ne</b> Neon 10																											
39 <b>K</b> Potassium 19	40 <b>Ca</b> Calcium 20	51 <b>V</b> Vanadium 23	48 <b>Ti</b> Titanium 22	52 <b>Cr</b> Chromium 24	55 <b>Mn</b> Manganese 25	56 <b>Fe</b> Iron 26	59 <b>Co</b> Cobalt 27	58 <b>Ni</b> Nickel 28	64 <b>Cu</b> Copper 29	65 <b>Zn</b> Zinc 30	70 <b>Ga</b> Gallium 31	73 <b>Ge</b> Germanium 32	75 <b>As</b> Arsenic 33	79 <b>Se</b> Selenium 34	80 <b>Br</b> Bromine 35	84 <b>Kr</b> Krypton 36																							
85 <b>Rb</b> Rubidium 37	88 <b>Sr</b> Strontium 38	91 <b>Zr</b> Zirconium 40	93 <b>Nb</b> Niobium 41	96 <b>Mo</b> Molybdenum 42	101 <b>Ru</b> Ruthenium 44	106 <b>Pd</b> Palladium 46	108 <b>Ag</b> Silver 47	112 <b>Cd</b> Cadmium 48	115 <b>In</b> Indium 49	119 <b>Sn</b> Tin 50	122 <b>Sb</b> Antimony 51	127 <b>I</b> Iodine 53	128 <b>Te</b> Tellurium 52	131 <b>Xe</b> Xenon 54	222 <b>Rn</b> Radon 86																								
133 <b>Cs</b> Caesium 55	137 <b>Ba</b> Barium 56	178 <b>Hf</b> Hafnium 72	181 <b>Ta</b> Tantalum 73	184 <b>W</b> Tungsten 74	190 <b>Os</b> Osmium 76	195 <b>Pt</b> Platinum 78	197 <b>Au</b> Gold 79	201 <b>Hg</b> Mercury 80	204 <b>Tl</b> Thallium 81	207 <b>Pb</b> Lead 82	209 <b>Bi</b> Bismuth 83	210 <b>At</b> Astatine 85	209 <b>Po</b> Polonium 84	222 <b>Rn</b> Radon 86	222 <b>Rn</b> Radon 86																								
223 <b>Fr</b> Francium 87	226 <b>Ra</b> Radium 88											227 <b>Ac</b> Actinium 89																											
												175 <b>Lu</b> Lutetium 71	173 <b>Yb</b> Ytterbium 70	169 <b>Tm</b> Thulium 69	167 <b>Er</b> Erbium 68	165 <b>Ho</b> Holmium 67	162 <b>Dy</b> Dysprosium 66	159 <b>Tb</b> Terbium 65	157 <b>Gd</b> Gadolinium 64	152 <b>Eu</b> Europium 63	150 <b>Sm</b> Samarium 62	147 <b>Pm</b> Promethium 61	144 <b>Nd</b> Neodymium 60	141 <b>Pr</b> Praseodymium 59	140 <b>Ce</b> Cerium 58	260 <b>Lr</b> Lawrencium 103	259 <b>No</b> Nobelium 102	258 <b>Md</b> Mendelevium 101	257 <b>Fm</b> Fermium 100	252 <b>Es</b> Einsteinium 99	251 <b>Cf</b> Californium 98	247 <b>Bk</b> Berkelium 97	247 <b>Cm</b> Curium 96	243 <b>Am</b> Americium 95	244 <b>Pu</b> Plutonium 94	237 <b>Np</b> Neptunium 93	238 <b>U</b> Uranium 92	231 <b>Pa</b> Protactinium 91	232 <b>Th</b> Thorium 90

58–71 Lanthanoid series  
90–103 Actinoid series

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

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