UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER			

COMBINED SCIENCE **0653/33**

Paper 3 (Extended) **October/November 2010**

1 hour 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, tables 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	
1	
2	
3	
4	
5	
6	
7	
8	
9	
Total	

This document consists of **20** printed pages.

1 Fig. 1.1 shows some stages in the formation of a human fetus.

For Examiner's Use

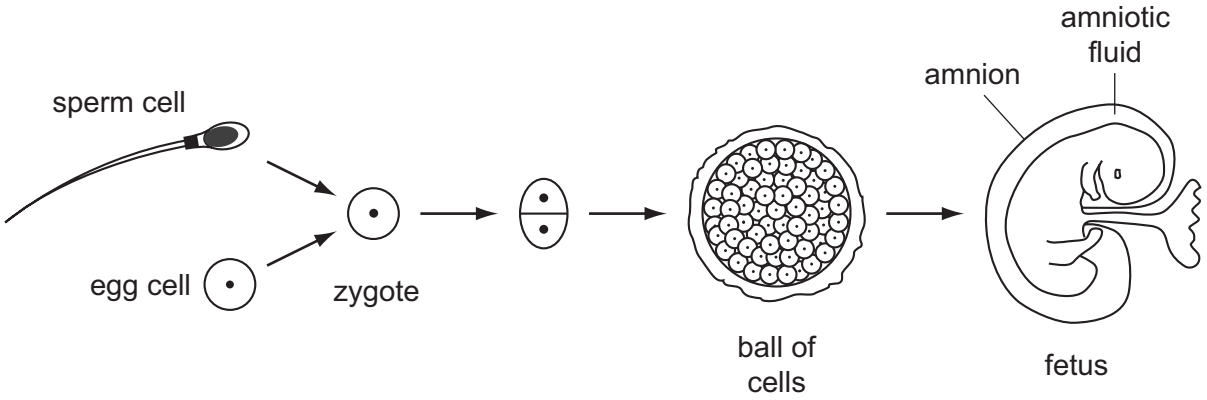


Fig. 1.1

(a) Most human cells contain 46 chromosomes, but egg cells and sperm cells contain only 23 chromosomes each.

Suggest a reason for this.

.....

..... [1]

(b) Name the part of the reproductive system in which each of these events takes place.

(i) Eggs are produced. ..... [1]

(ii) Fertilisation takes place. ..... [1]

(c) Describe the function of the amnion.

.....

.....

..... [2]

For Examiner's Use

(d) A disease called thalassaemia is caused by a person's genes.

The haemoglobin gene has two alleles, **T** and **t**. A person with the alleles **tt** has thalassaemia, but a person with alleles **Tt** does not.

(i) State which allele, **T** or **t**, is dominant. Explain your answer.

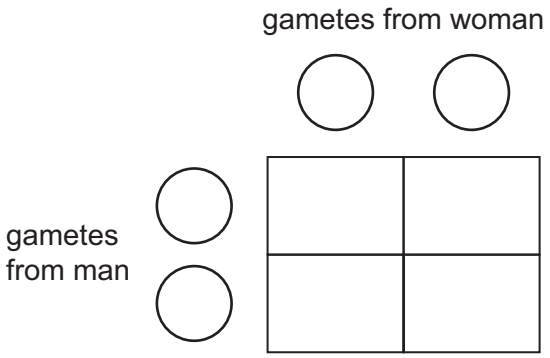
allele .....

explanation .....

..... [1]

(ii) Complete the genetic diagram to show how two parents who do not have thalassaemia could have a child with thalassaemia.

phenotypes of parents	man without thalassaemia	woman without thalassaemia
genotypes of parents	**Tt**	.....
gametes	○ and ○	○ and ○



[4]

(iii) Thalassaemia reduces the amount of normal haemoglobin in a person's blood.

Explain why someone with thalassaemia often does not have the energy to do vigorous exercise.

.....

.....

..... [2]

For Examiner's Use

2 **(a)** Fig. 2.1 shows apparatus used in the electrolysis of copper chloride solution.

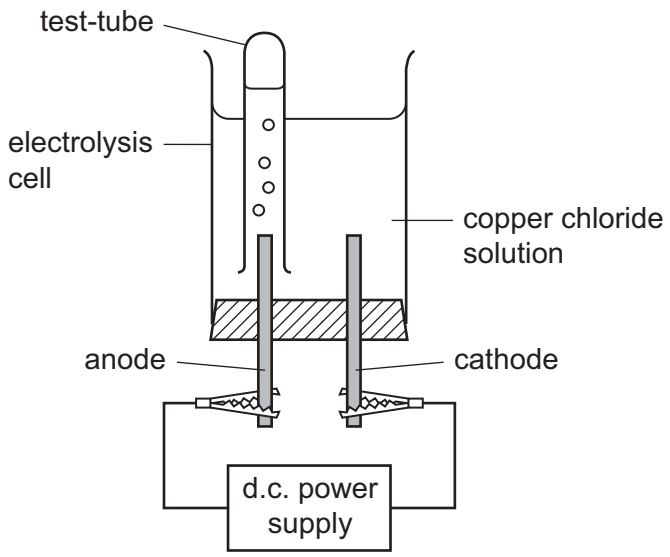


Fig. 2.1

(i) Describe what is observed at the cathode.

.....

[1]

(ii) Chloride ions have a single negative electrical charge, Cl^-.

For every copper ion in the solution, two chloride ions are present.

Deduce the electrical charge of a copper ion.

Show how you obtained your answer.

.....

[2]

For Examiner's Use

(iii) Fig. 2.2 shows diagrams of two particles, **L** and **M**. Each of these particles have 17 protons in their nucleus.

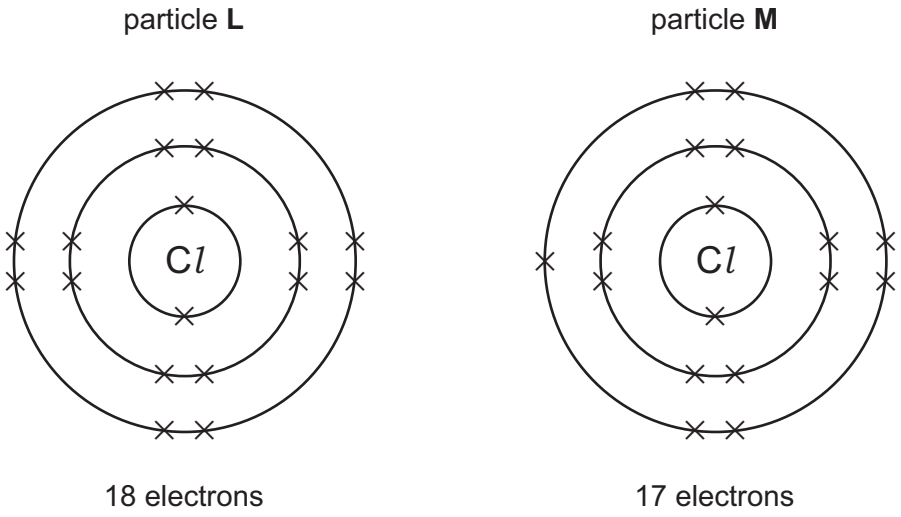


Fig. 2.2

State and explain which one of these particles, **L** or **M**, moves towards the anode during electrolysis.

particle .....

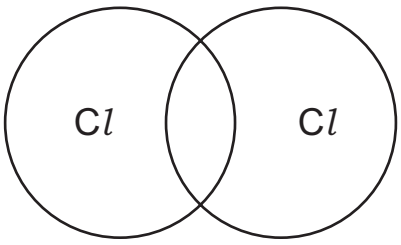
explanation .....

.....

..... [2]

(iv) The bubbles of gas which rise from the anode contain diatomic molecules of chlorine.

Complete the bonding diagram below to show how the outer electrons are arranged in a chlorine molecule.



[2]

For Examiner's Use

(b) The apparatus shown in Fig. 2.3 can be used to react lead oxide, PbO, and carbon.

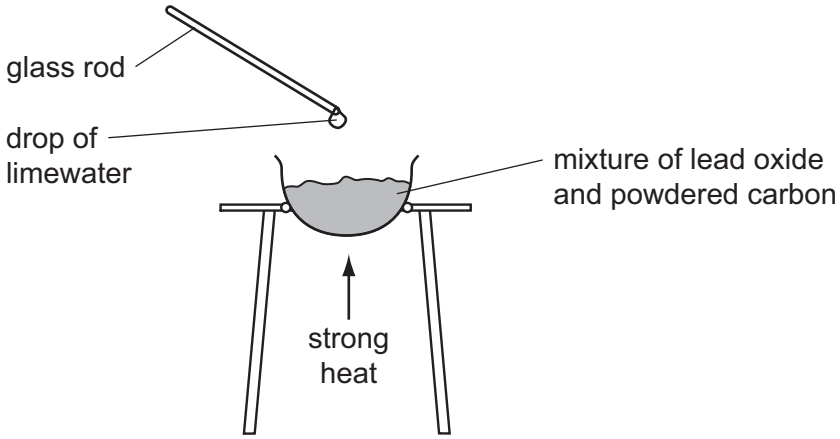


Fig. 2.3

When the mixture is heated, a redox reaction occurs in which lead oxide is reduced.

The drop of limewater suspended on the glass rod turns cloudy.

(i) Name the gas which is produced in this redox reaction.

..... [1]

(ii) Suggest the balanced symbolic equation for the redox reaction between lead oxide and carbon.

..... [2]

For Examiner's Use

3 (a) (i) Complete Table 3.1 to show the properties of alpha, beta and gamma radiations.

Table 3.1

	description	**charge**	**range in air**	**ionising ability**
alpha		positive	5 cm	very strong
beta	electron		50 cm	
gamma	electromagnetic wave		many kilometres	weak

[4]

(ii) Many people have smoke detectors in their houses.

Smoke detectors contain a radioactive source which emits alpha radiation.

Explain why the alpha radiation from the smoke detector is not dangerous to people living in the house.

.....

.....

..... [1]

(b) A scientist uses a Geiger counter to measure the radiation from a radioactive source.

For Examiner's Use

She records the results every hour.

Fig. 3.1 shows the graph of her results.

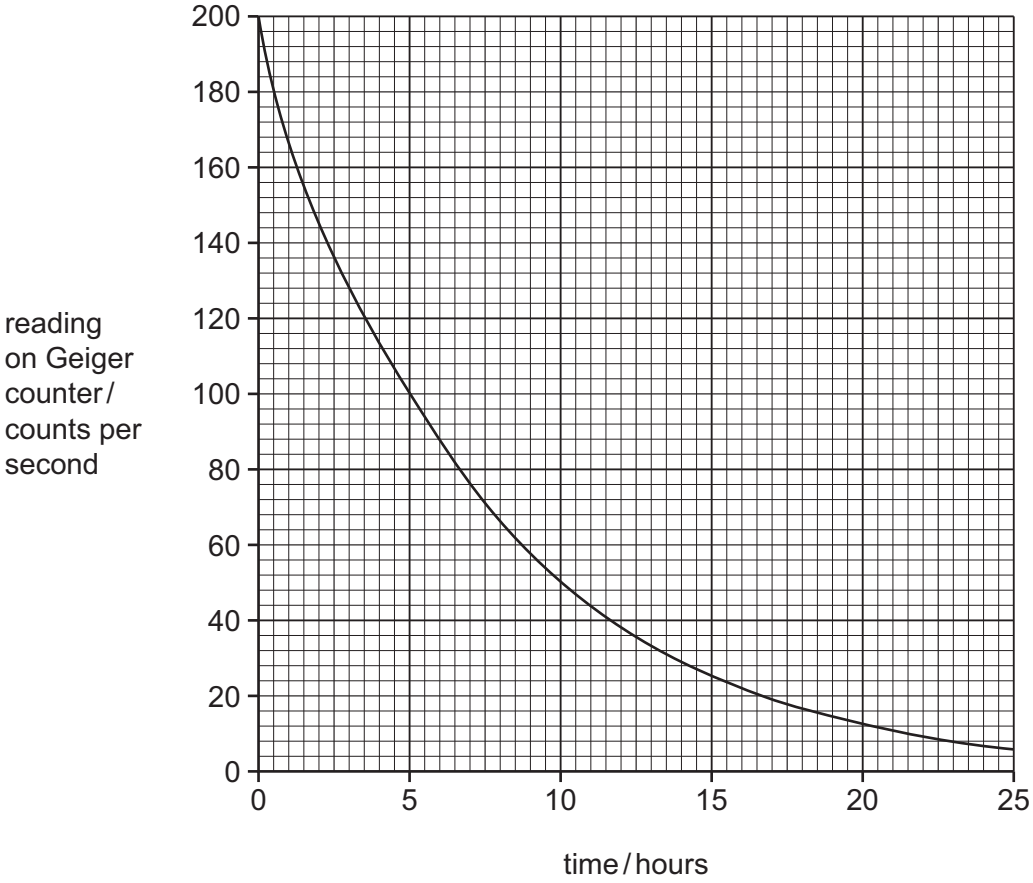


Fig. 3.1

Calculate the half-life of the radioactive source.

Show your working.

..... [2]

For Examiner's Use

4 Soya beans are an important crop in many tropical and subtropical countries, because they contain a lot of protein.

(a) A farmer grows soya beans in a field on a steep slope.

Describe **two** things the farmer could do to reduce the risk of soil erosion.

1 .....

.....

2 .....

..... [2]

(b) Soya beans and other crops are often attacked by aphids and other insect pests.

Farmers may use pesticides or biological control to kill the pests.

(i) Describe **one** advantage and **one** disadvantage of using pesticides, rather than biological control, to control pests of crops.

advantage .....

.....

disadvantage .....

..... [2]

(ii) State what is meant by a *systemic pesticide* and explain **one** advantage of using a systemic pesticide rather than a contact pesticide.

meaning .....

.....

advantage .....

..... [2]

For Examiner's Use

5 **(a)** Fig. 5.1 shows a circuit built by a student.

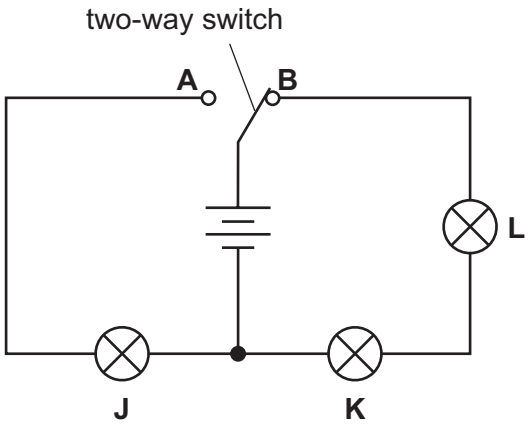


Fig. 5.1

(i) The switch is at position **B**. Which lamps will be lit? ..... [1]

(ii) The switch is then moved to position **A**.

What happens to lamps **J**, **K** and **L**?

lamp **J** .....

lamp **K** .....

lamp **L** ..... [2]

(b) The student has six resistors as shown in Fig. 5.2.

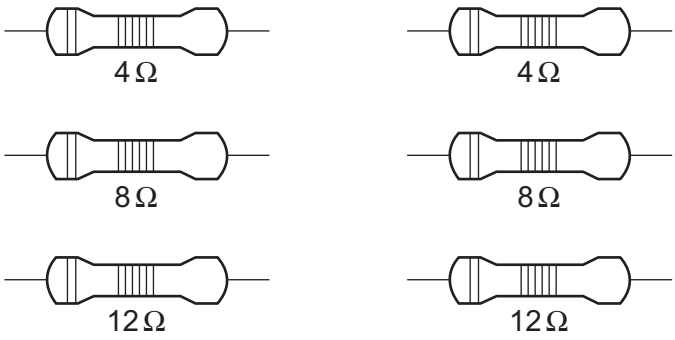


Fig. 5.2

Explain how he can combine **two** of these resistors to get a total resistance of 6 ohms.

.....

.....

.....

..... [3]

(c) Fig. 5.3 shows a simple electrical generator.

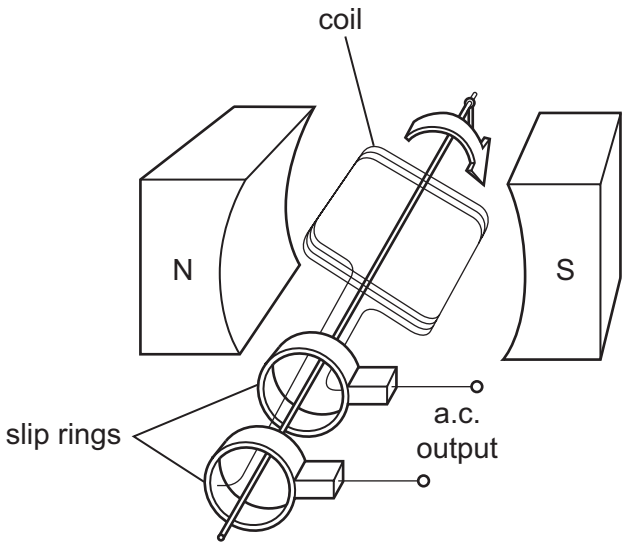


Fig. 5.3

(i) Explain why a voltage is induced in the coil when the coil is turned.

.....

..... [1]

(ii) Explain why this generator produces an alternating current.

.....

..... [1]

[Turn over

For Examiner's Use

6 A solution of sodium chloride is produced when sodium hydroxide solution, an alkali, is neutralised by dilute hydrochloric acid. Fig. 6.1 shows apparatus which can be used to carry out this neutralisation.

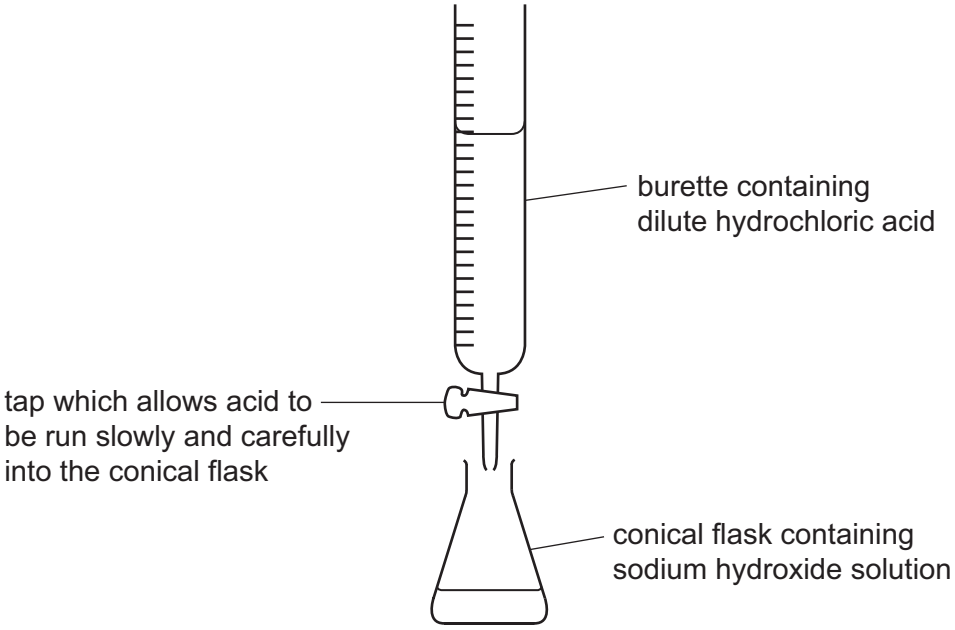


Fig. 6.1

(a) Complete the balanced symbolic equation, involving ions and molecules, for the neutralisation reaction between an aqueous acid and an aqueous alkali.

H^+ + ... → ..... [2]

(b) A student adds a few drops of litmus solution, an indicator, to the sodium hydroxide solution.

Suggest what the student should then do in order to produce a **neutral** solution of sodium chloride, using only the apparatus shown in Fig. 6.1.

.....

.....

..... [2]

(c) Suggest how the student could use information gained from the experiment in **(b)** to obtain a sample of dry, **colourless** sodium chloride crystals which do not contain any litmus.

.....

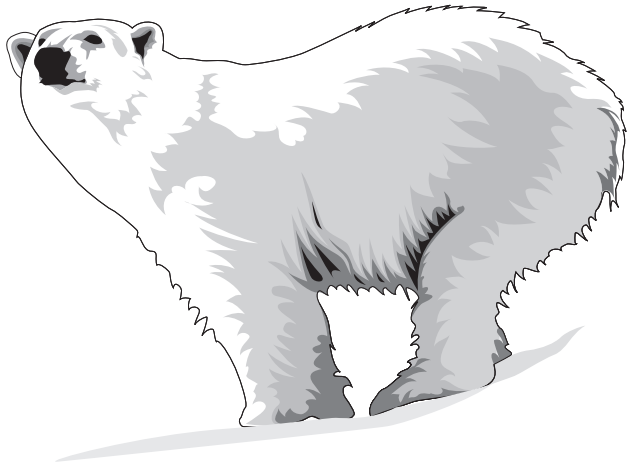
.....

.....

..... [3]

For Examiner's Use

7 **(a)** Polar bears live in the cold, arctic region. They have thick, white fur.



(i) Describe how fur keeps a polar bear warm.

.....

.....

..... [2]

(ii) Explain why white fur will keep a polar bear warmer than black fur.

.....

.....

..... [2]

For Examiner's Use

(b) An elephant can communicate with other elephants using infra-sound. This is a very low frequency vibration, which is usually impossible for a human to hear.

(i) Suggest a possible frequency for this vibration and explain how you chose your answer.

frequency ..... Hz

explanation .....

..... [1]

(ii) State the meaning of the term *frequency*.

.....

..... [1]

(iii) Fig. 7.1 shows an oscilloscope trace for a low frequency sound which the human ear can just hear.

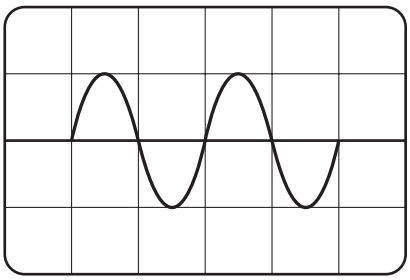
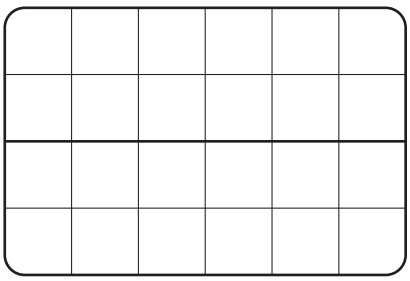


Fig. 7.1

On Fig. 7.2 draw the trace of an infra-sound wave of the same amplitude.



[2]

Fig. 7.2

(c) Fig. 7.3 shows a magnifying glass being used to look at a caterpillar.

For Examiner's Use

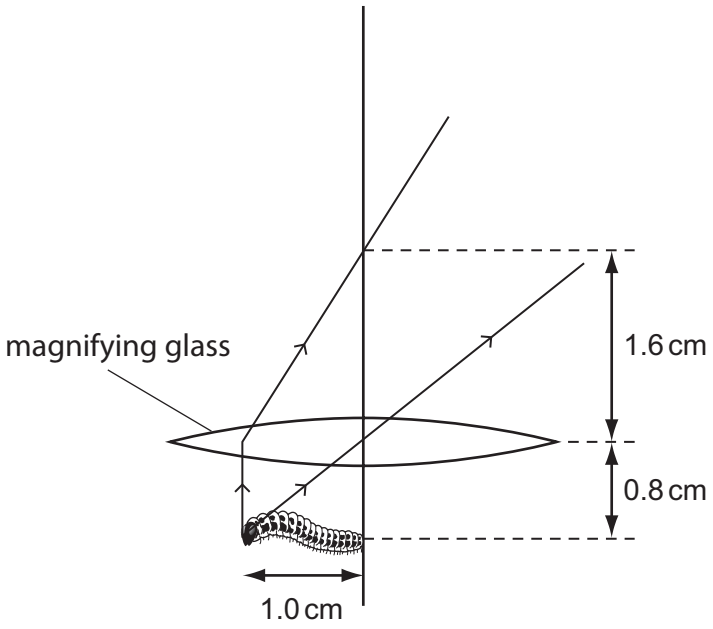


Fig. 7.3

(i) State the focal length of the lens. ..... [1]

(ii) Complete the ray diagram to show how the eye sees an enlarged image of the caterpillar. [2]

(iii) This image is called a virtual image.

Explain the meaning of the term *virtual image*.

.....

..... [1]

For Examiner's Use

8 Carbon and hydrogen combine to form hydrocarbons.

Ethene, C_2H_4, is a gaseous, unsaturated hydrocarbon, which is of industrial importance.

(a) Complete the displayed formula of the ethene molecule which has been started below.

[2]

(b) Unsaturated hydrocarbons are made in industry from fractions obtained by the fractional distillation of oil (petroleum).

Name the process which is used to make unsaturated hydrocarbons, and describe briefly how it is done.

name of process .....

description .....

.....

.....

..... [3]

(c) Describe, in terms of changes to chemical bonds, what happens when ethene molecules react to form molecules of poly(ethene).

.....

.....

..... [2]

(d) Calculate the relative formula mass of ethene.

Show your working.

For Examiner's Use

..... [2]

For Examiner's Use

9 A healthy plant growing in a pot was watered and placed in a sunny window. A transparent plastic bag was placed over the plant, as shown in Fig. 9.1.

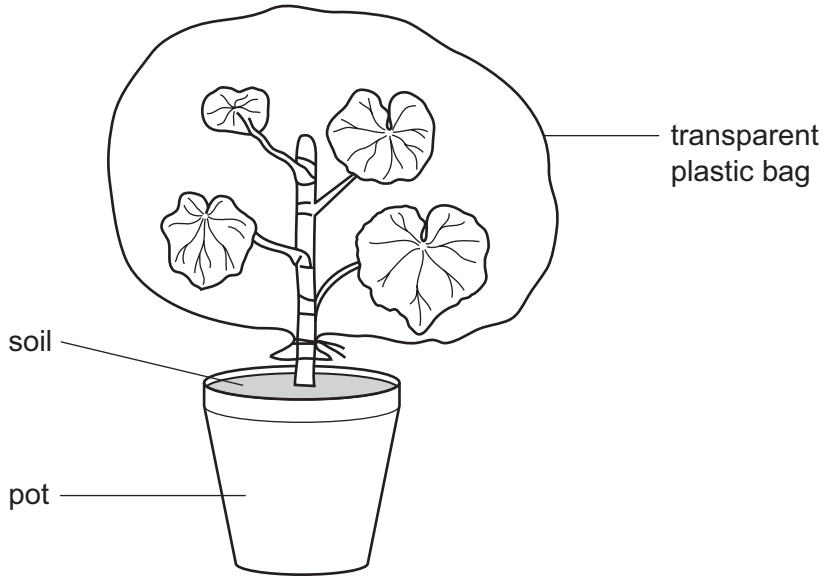


Fig. 9.1

(a) The temperature near the window fell overnight. The next morning, small droplets of water were visible on the inside of the plastic bag.

Explain why the droplets of water appeared on the inside of the plastic bag.

.....

.....

.....

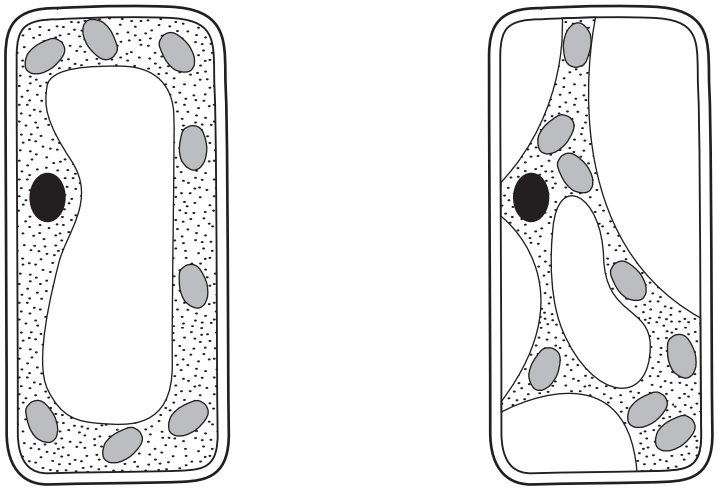
.....

..... [4]

For Examiner's Use

(b) The plastic bag was then removed from the plant. The next day was warm and sunny, and by the end of the day the plant had lost so much water that it wilted.

Fig. 9.2 shows a cell from a leaf before and after the plant wilted.



before wilting after wilting

Fig. 9.2

(i) On the diagram of the cell before wilting in Fig. 9.2, label and name **two** structures that would **not** be present in an animal cell. [2]

(ii) Using your knowledge of osmosis, explain what happened to the plant cell to cause its appearance after the plant wilted.

.....

.....

.....

.....

..... [3]

DATA SHEET
The Periodic Table of the Elements

Group																	
I	II									III	IV	V	VI	VII	0
															4 **He** Helium 2
					1 **H** Hydrogen 1										
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	**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	a = relative atomic mass
X	**X** = atomic symbol
b	b = proton (atomic) number

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