



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.

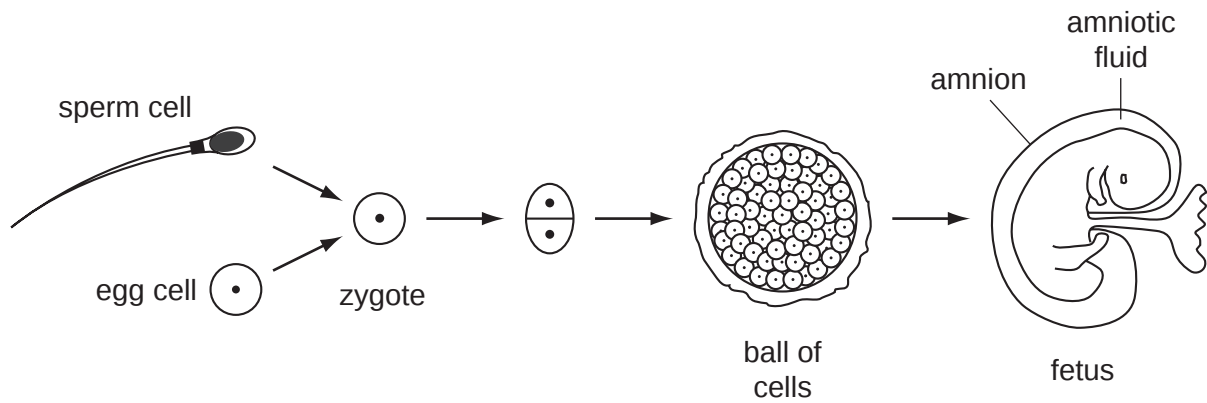


Fig. 1.1

- (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]

- (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

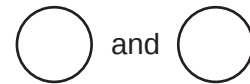
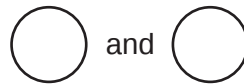
woman without
thalassaemia

genotypes of parents

Tt

.....

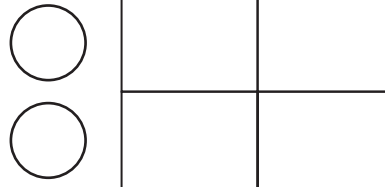
gametes



gametes from woman



gametes
from man



[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]

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

For
Examiner's
Use

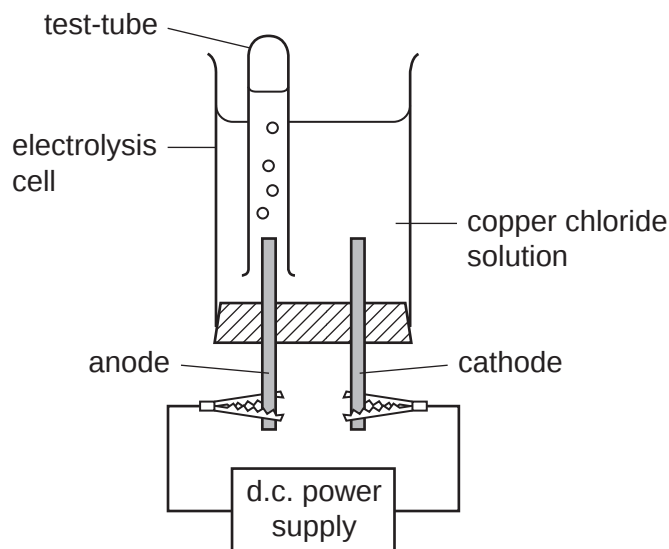


Fig. 2.1

- (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]

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

For
Examiner's
Use

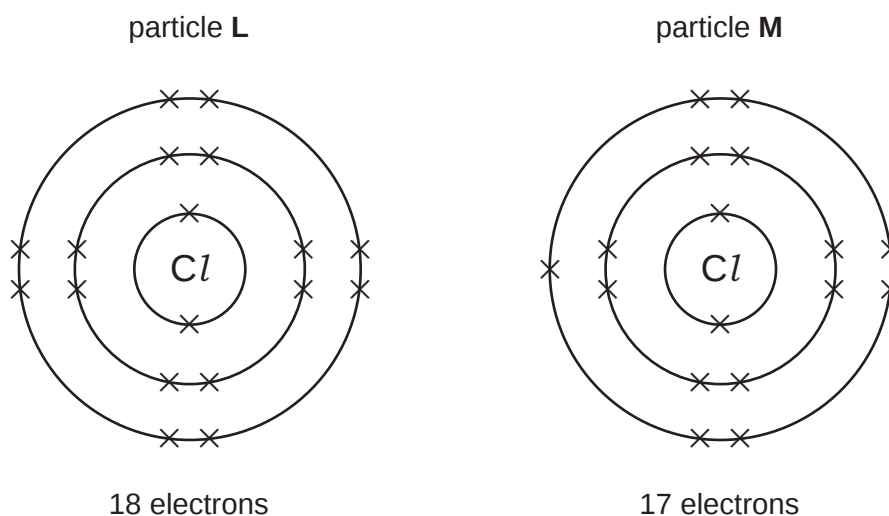


Fig. 2.2

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

particle

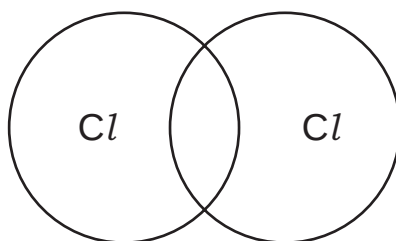
explanation

.....

..... [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]

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

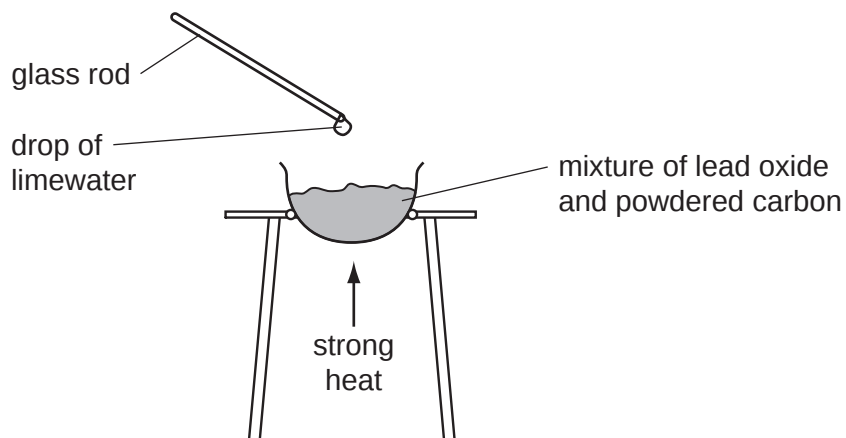


Fig. 2.3

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]

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

For
Examiner's
Use

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.

She records the results every hour.

Fig. 3.1 shows the graph of her results.

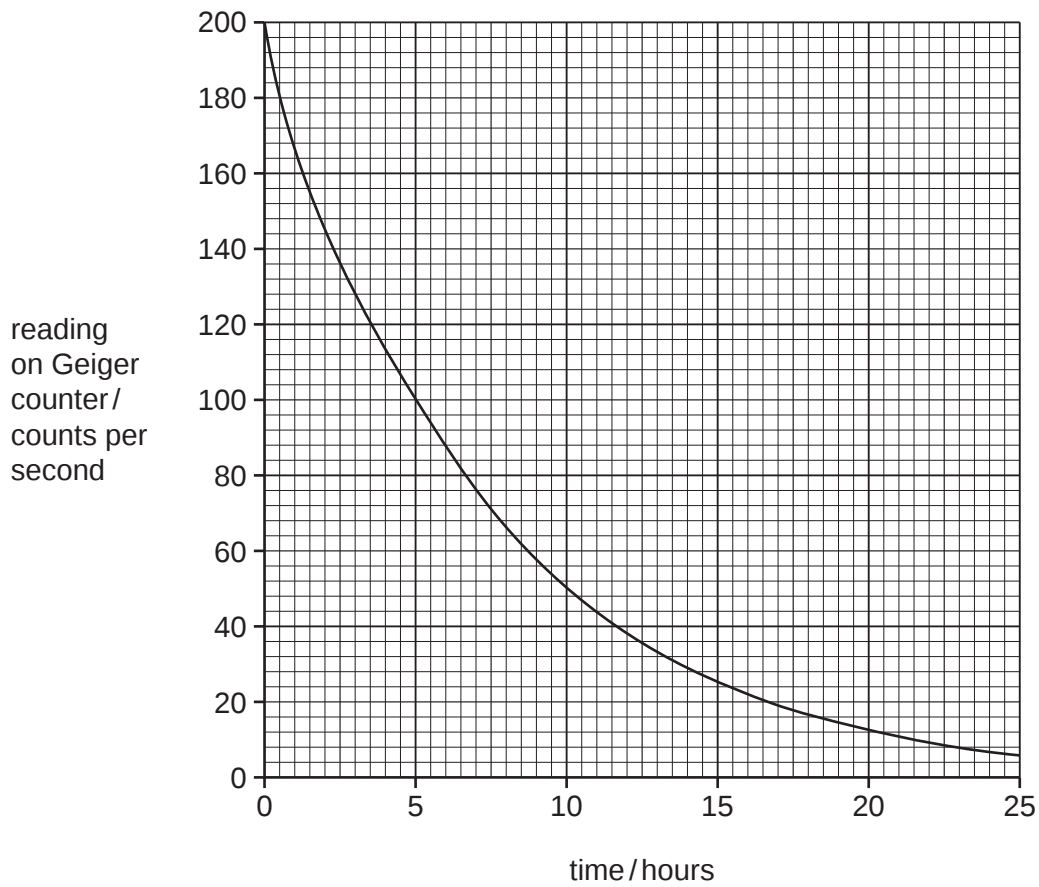


Fig. 3.1

Calculate the half-life of the radioactive source.

Show your working.

[2]

- 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]

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

For
Examiner's
Use

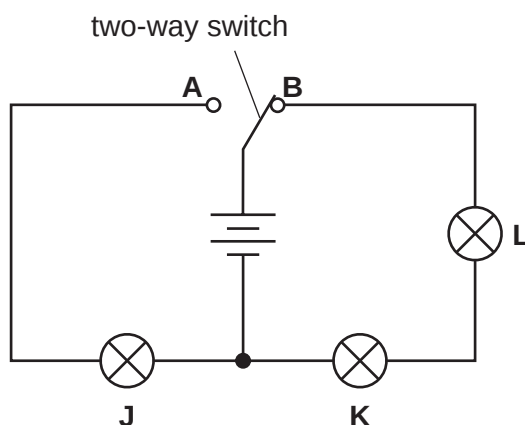


Fig. 5.1

- (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.

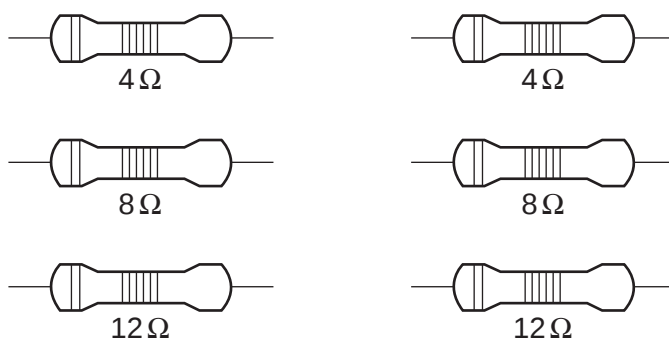


Fig. 5.2

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.

For
Examiner's
Use

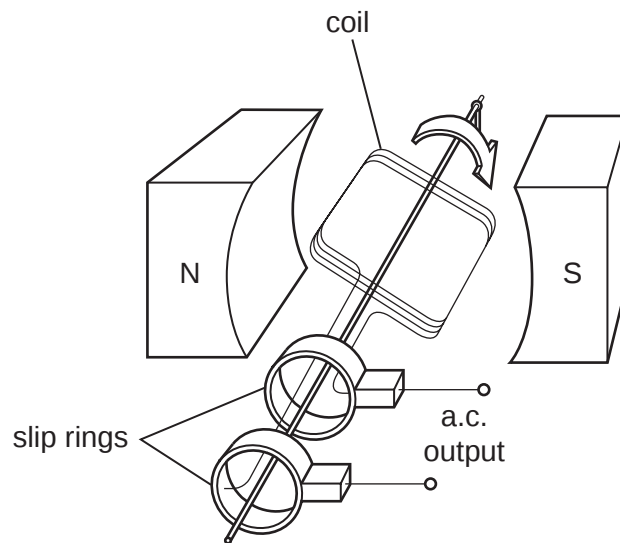


Fig. 5.3

- (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]

- 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.

For
Examiner's
Use

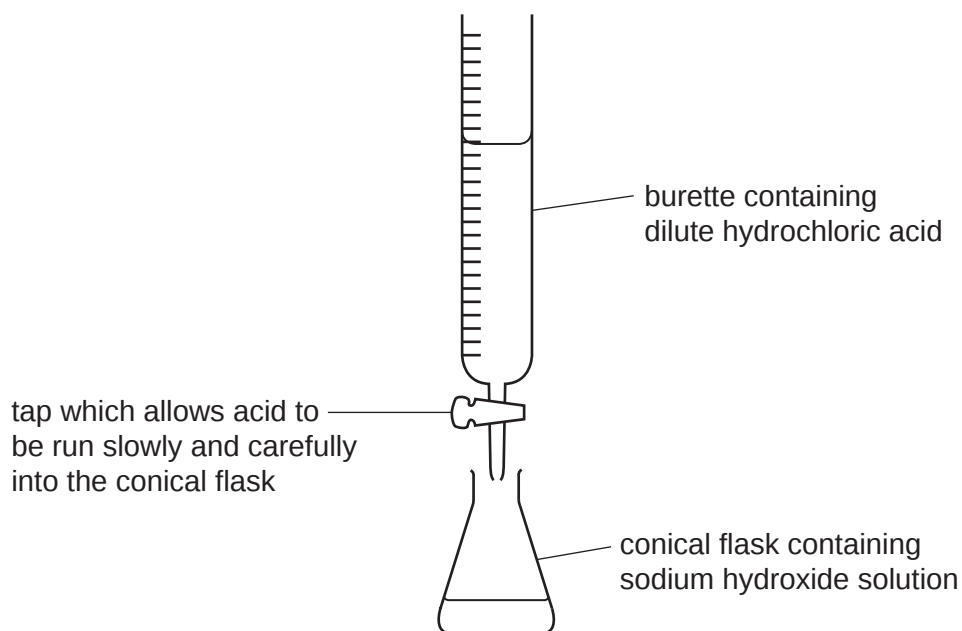


Fig. 6.1

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



- (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.

.....

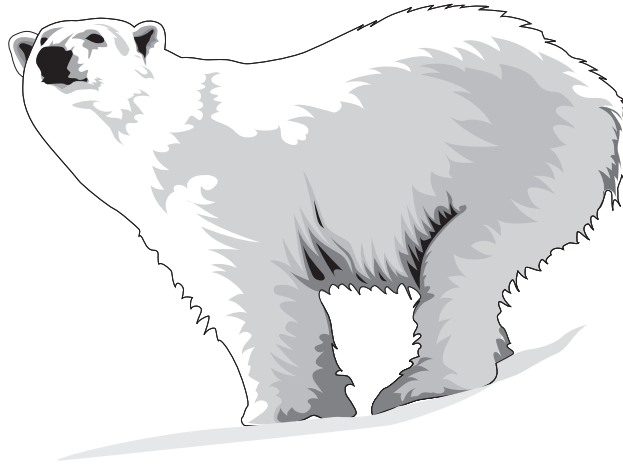
 [2]

- (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]

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



For
Examiner's
Use

- (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]

(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.

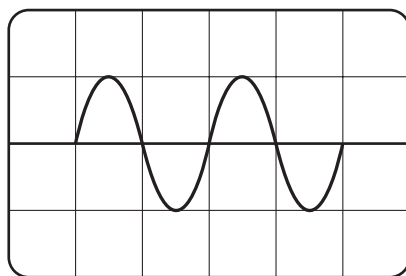


Fig. 7.1

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

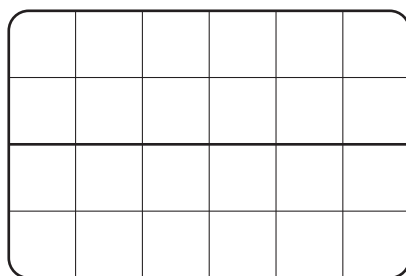


Fig. 7.2

[2]

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

For
Examiner's
Use

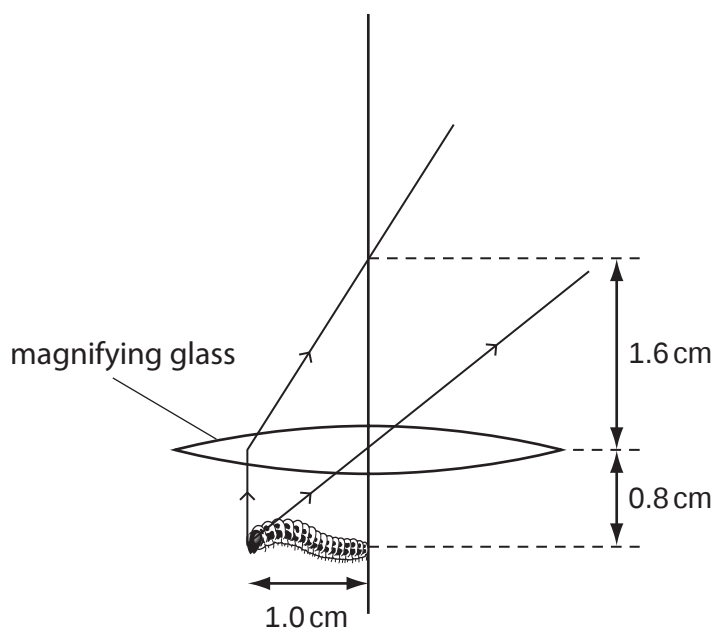


Fig. 7.3

- (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]

.....

- 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]

For
Examiner's
Use

(d) Calculate the relative formula mass of ethene.

Show your working.

*For
Examiner's
Use*

..... [2]

- 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.

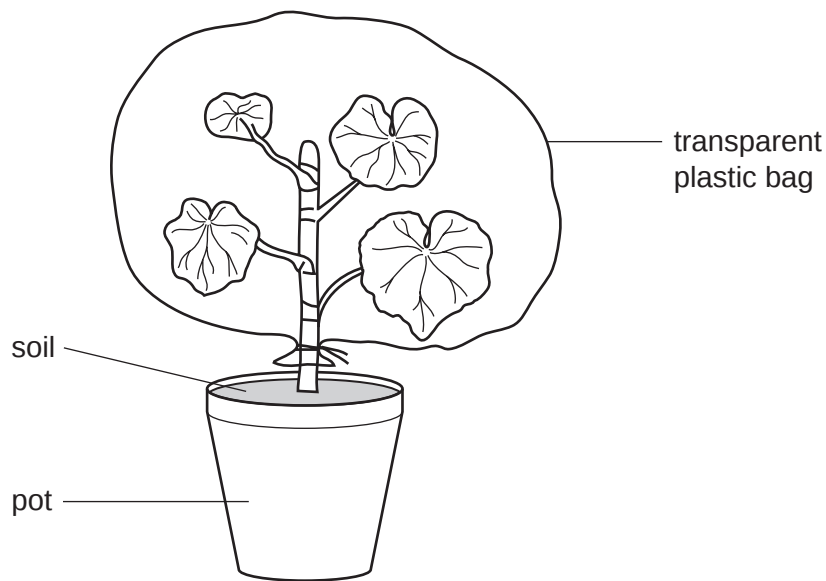


Fig. 9.1

- (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]

- (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.

For
Examiner's
Use

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

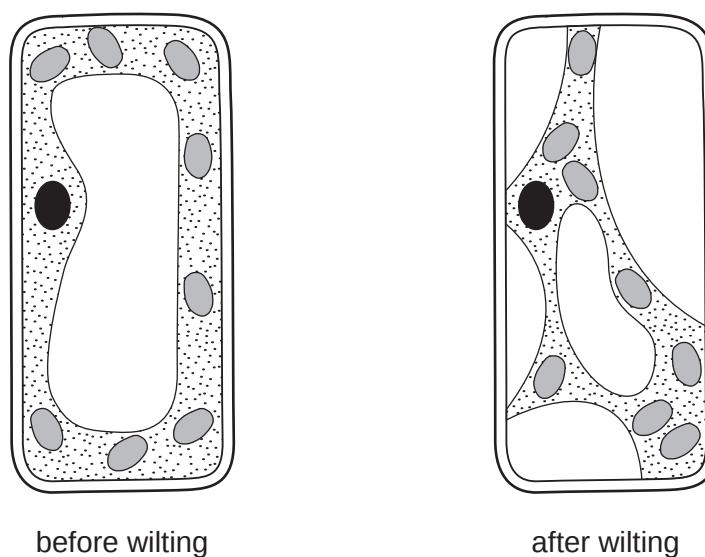


Fig. 9.2

- (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												
												1 H Hydrogen 1																	
7 Li Lithium 3	9 Be Beryllium 4																												
23 Na Sodium 11	24 Mg Magnesium 12																												
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	101 Ru Ruthenium 44	101 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	127 Te Tellurium 52	128 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	210 Po Polonium 84	210 At Astatine 85	222 Rn Radon 86												
Fr Francium 87	88 Ra Radium	89 Ac Actinium																											
58-71 Lanthanoid series										72-103 Actinoid series																			

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

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

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

University of Cambridge International Examinations is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.