



UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS  
International General Certificate of Secondary Education

CANDIDATE  
NAME

CENTRE  
NUMBER

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CANDIDATE  
NUMBER

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**CO-ORDINATED SCIENCES**

**0654/22**

Paper 2 (Core)

**October/November 2010**

**2 hours**

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 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	
1	
2	
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4	
5	
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7	
8	
9	
10	
<b>Total</b>	

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



1 Fig. 1.1 shows the horizontal forces acting on a moving car.

For  
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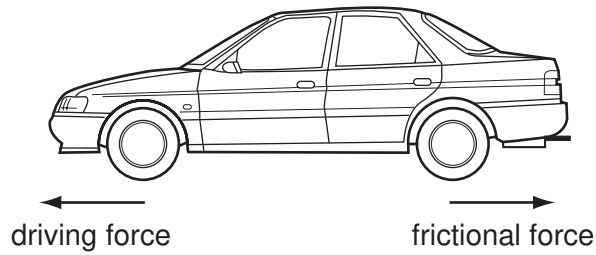


Fig. 1.1

(a) Compare the sizes of the two forces when the car is

(i) decelerating (slowing down),

..... [1]

(ii) travelling at a constant speed.

..... [1]

(b) Fig. 1.2 shows the speed-time graph for the car for the first 24 seconds of a journey.

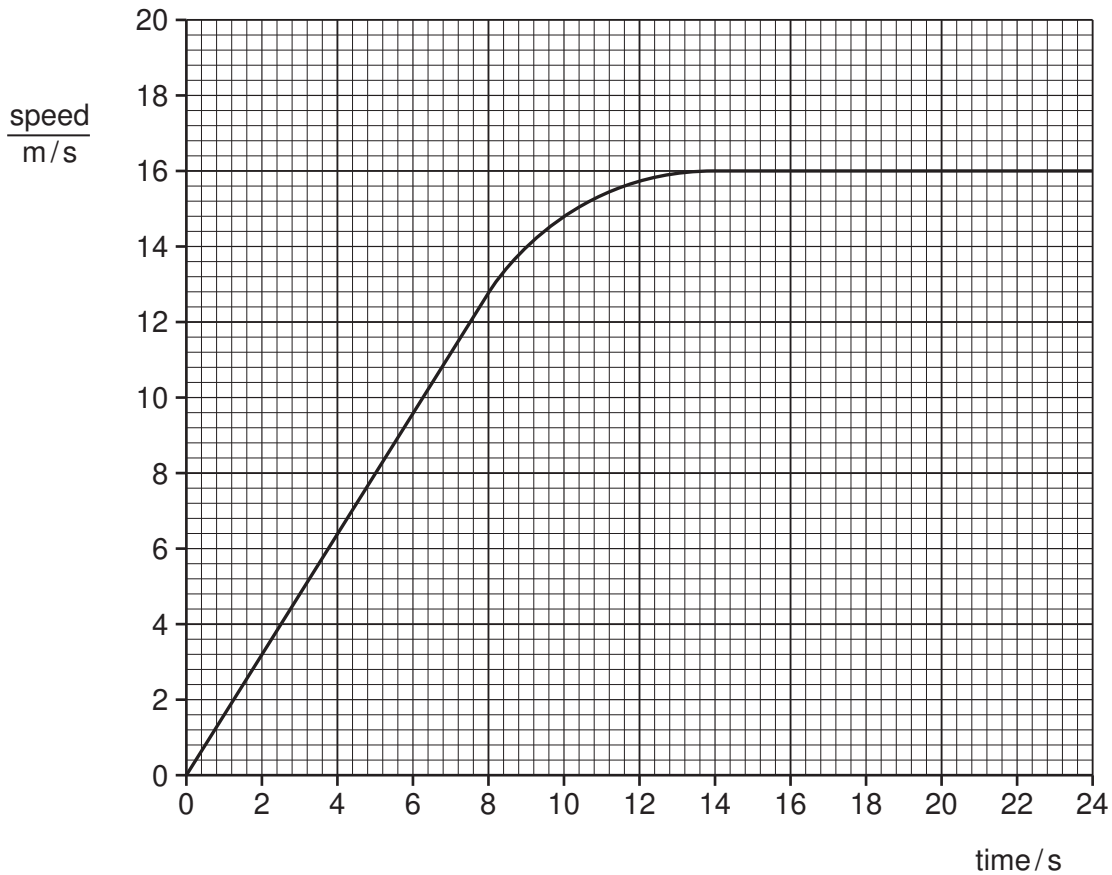


Fig. 1.2

- (i) On the graph, label with an **A**, a section when the car is accelerating. [1]
- (ii) State the maximum speed of the car. .... m/s [1]
- (iii) The mass of the car is 800 kg.

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Use your answer to (ii) to calculate the kinetic energy of the car when travelling at its maximum speed.

State the formula that you use and show your working.

formula used

working

..... J [2]

- (c) A car headlamp has a power rating of 50W.

- (i) State how many joules of energy will be converted every second in the headlamp.

..... J [1]

- (ii) Use the formula

$$\text{power} = \text{voltage} \times \text{current}$$

to calculate the current in the headlamp when the voltage across it is 12V.

Show your working.

..... A [2]

2 (a) Mammals are vertebrates. State **two** characteristic visible features of mammals that distinguish them from all other classes of vertebrates.

1 .....

2 ..... [2]

(b) Mammals are able to maintain a constant internal body temperature and regulate their blood glucose concentration.

(i) State the term used to describe the maintenance of a constant internal environment.

..... [1]

(ii) Name the process that generates heat inside body cells when the internal body temperature falls too low.

..... [1]

(iii) Describe how blood glucose concentration is brought back to normal if it rises too high.

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

(c) Mammals excrete a nitrogenous waste product called urea.

(i) Name the organ in which urea is formed.

..... [1]

(ii) Name the substances from which urea is made.

..... [1]

(iii) Name the organs that excrete urea from the body.

..... [1]

- 3 (a) Fig. 3.1 shows some of the apparatus used in the electrolysis of copper chloride solution.

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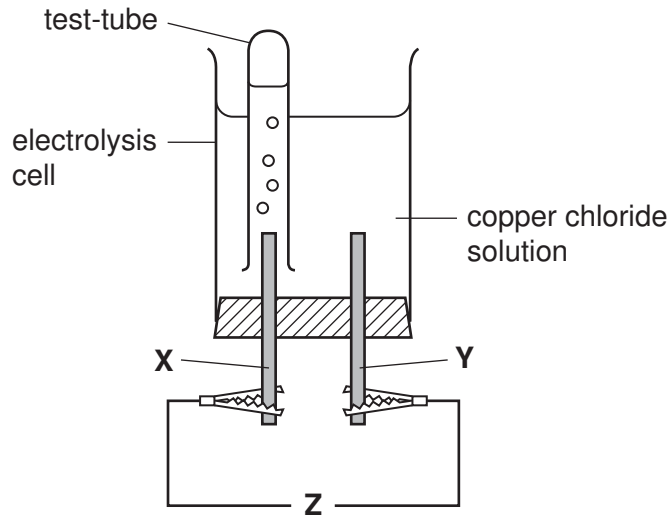


Fig. 3.1

- (i) What is missing from position Z in Fig. 3.1?

..... [1]

- (ii) Name the gas which collects in the test-tube, and explain whether electrode X is the anode or the cathode.

gas .....

Electrode X is the ..... because .....

..... [2]

- (iii) Describe what is observed at electrode Y.

..... [1]

- (b) The apparatus shown in Fig. 3.2 can be used to find out what is formed when lead oxide reacts with carbon.

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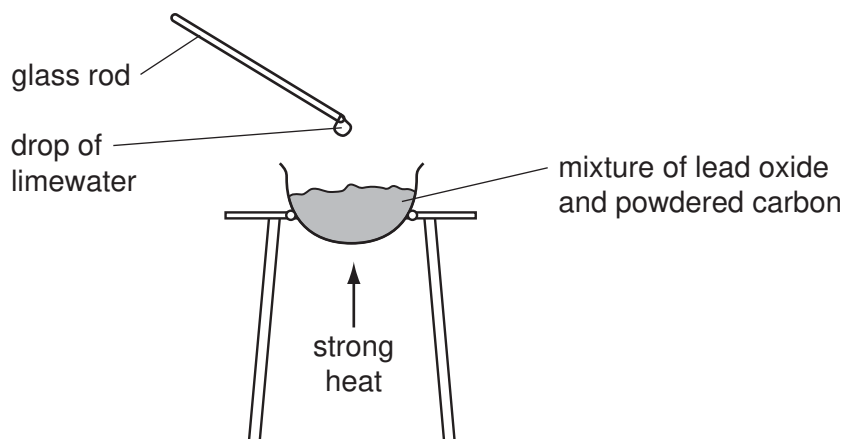


Fig. 3.2

When the mixture is heated, molten metal is formed in the container and a gas is given off which turns the drop of limewater cloudy.

- (i) Complete the **word** equation for the reaction between lead oxide and carbon.



[2]

- (ii) State **one** substance, shown in the equation in (i), which is a compound.

Explain why this substance is described as a compound and **not** as an element.

substance .....

.....

.....

..... [3]

- (c) (i) The main chemical compound in most types of glass is obtained from sand.

Name this compound. ....

[1]

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- (ii) Name and explain briefly which of the metal oxides below would need to be mixed with sand in order to obtain coloured glass.

**copper oxide**

**lead oxide**

**sodium oxide**

name .....

explanation .....

..... [2]

- 4 (a) Alpha, beta and gamma radiations have different properties.

Draw **one** line from each type of radiation below to link it to its correct property.

**radiation**

**properties**

alpha

partly stopped by 2 cm lead  
no charge

beta

stopped by 2 cm of lead  
negative charge

gamma

stopped by 5 cm of air  
positive charge

[2]

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

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(i) State **one** safety precaution she should take when doing this experiment.

..... [1]

Fig. 4.1 shows the graph of her results.

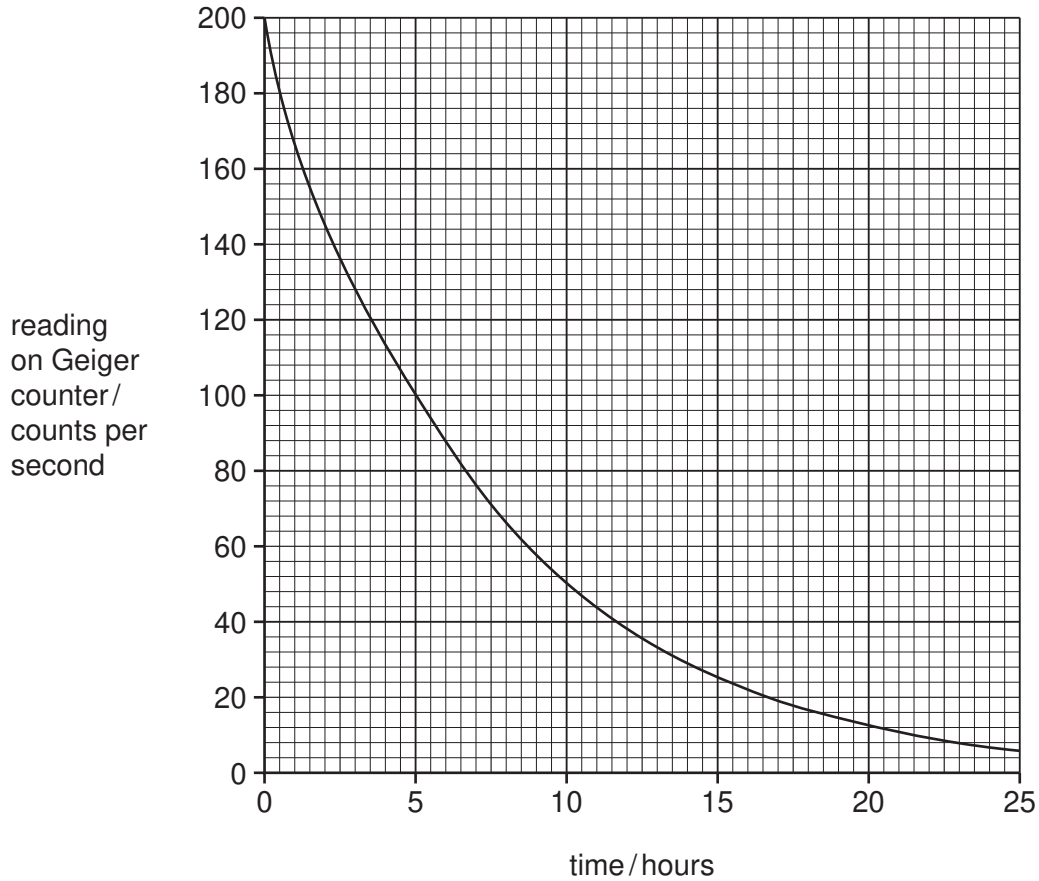


Fig. 4.1

(ii) State the reading on the Geiger counter,

at the start of the experiment, ..... counts per second

after 5 hours. .... counts per second

[1]

(iii) State the half-life of the radioactive source. .... hours [1]

(c) Alpha radiation is a form of ionising radiation.

(i) Explain the meaning of the term *ionising radiation*.

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

(ii) An alpha radiation source is **less** harmful to humans than a gamma radiation source if it is **outside** the body.

An alpha radiation source is **more** harmful to humans than a gamma radiation source if it is **inside** the body.

Explain why.

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

(d) Nuclear fission and nuclear fusion are both sources of energy.

Describe how these processes differ.

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

Please turn over for Question 5.

5 Fig. 5.1 shows some stages in the formation of a human fetus.

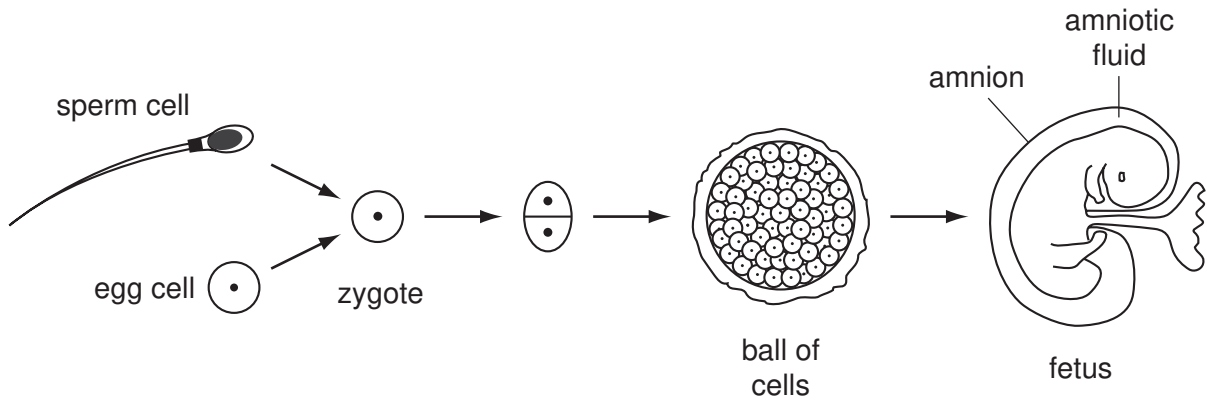


Fig. 5.1

For  
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(a) Most human cells contain 46 chromosomes.

(i) State the number of chromosomes in a sperm cell. .... [1]

(ii) State the number of chromosomes in a zygote. .... [1]

(iii) Name the part of the cell in which chromosomes are found. .... [1]

(b) Describe how fertilisation takes place in the oviduct of a mammal.

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

(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

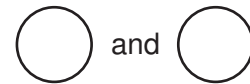
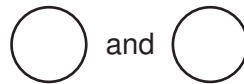
woman without  
thalassaemia

genotypes of parents

**Tt**

.....

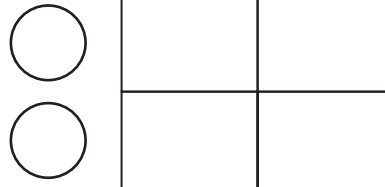
gametes



gametes from woman



gametes  
from man



[4]

(iii) Thalassaemia reduces the amount of normal haemoglobin in the blood. Explain why someone with thalassaemia often does not have the energy to do vigorous exercise.

.....

.....

..... [2]

- 6 Fig. 6.1 shows how the current in a circuit containing a resistor varies with voltage.

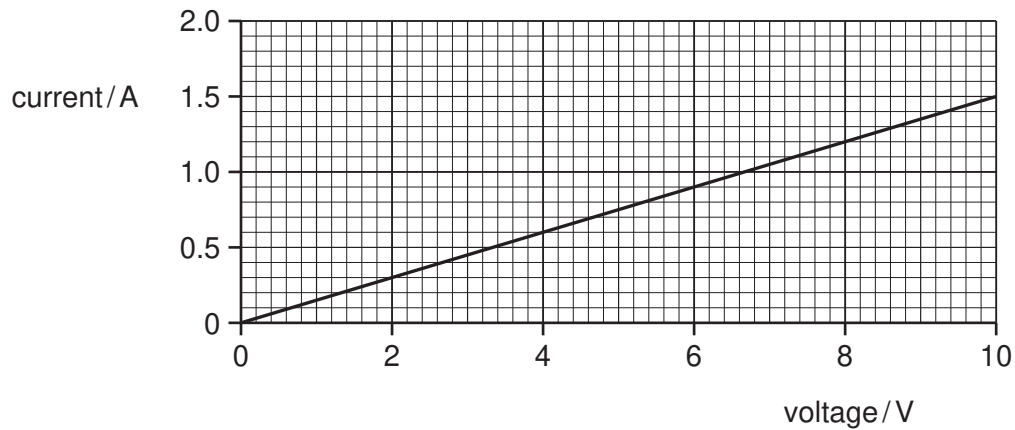


Fig. 6.1

- (a) In the space below draw a circuit diagram for the circuit you would use to obtain the results shown in Fig. 6.1.

Your circuit should include:-

- ammeter**
- connecting wires**
- power supply**
- resistor**
- voltmeter**

[4]

(b) (i) Predict the value of the current in the circuit at 20V.

Explain your answer.

prediction ..... A

explanation .....

..... [2]

(ii) State the number of coulombs of charge flowing per second when the current in the circuit is 0.5A.

..... C [1]

(iii) Name the particle responsible for carrying this charge around the circuit.

..... [1]

7 In many countries, river water is collected and treated to make it safe for humans to drink.

(a) (i) Suggest **one** way in which a river could become polluted because it flows through land which is used for agriculture (farming).

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

(ii) Describe how water in rivers and lakes could become polluted if sulfur compounds are **not** removed from fossil fuels before they are burned.

.....  
.....  
..... [4]

(iii) Explain which **one** of the treatments shown below might **not** remove all the harmful bacteria from water which is to be used for drinking.

adding chlorine      distillation      filtration

treatment .....

explanation .....

..... [1]



- (b) In an experiment to compare the hardness of three water samples, **A**, **B** and **C**, equal volumes of water were shaken with the same volume of soap solution.

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Use

Fig. 7.1 shows the appearance of each mixture after shaking.

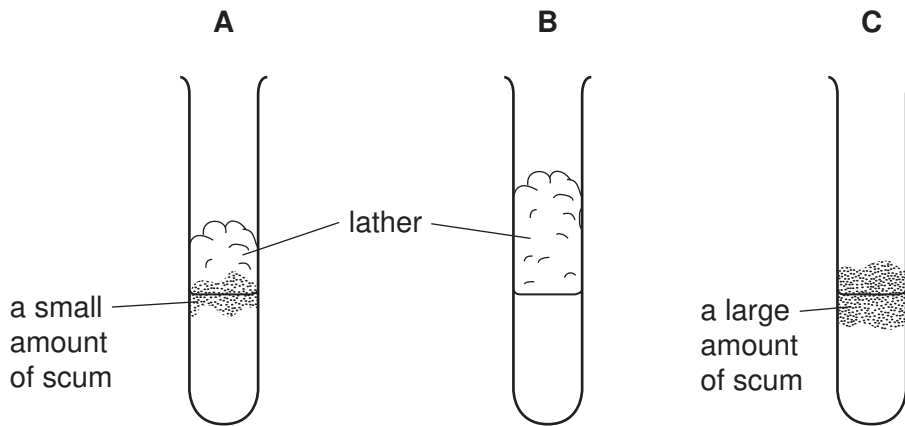


Fig. 7.1

- (i) Suggest a substance, present in water samples **A** and **C**, which has reacted with soap to form scum.

..... [1]

- (ii) Explain the difference in appearance between the mixtures in Fig. 7.1.

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

- 8 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. 8.1.

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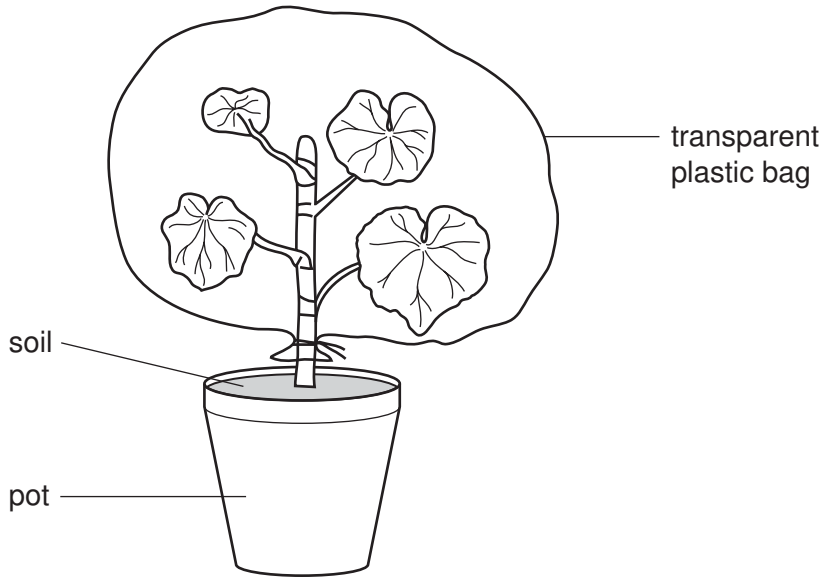


Fig. 8.1

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

(i) Explain where the water came from.

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

(ii) Explain why the water formed droplets of liquid on the plastic bag.

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

- (b) The plastic bag was then removed from the plant. The plant lost a lot of water and wilted. Fig. 8.2 shows the wilted plant.

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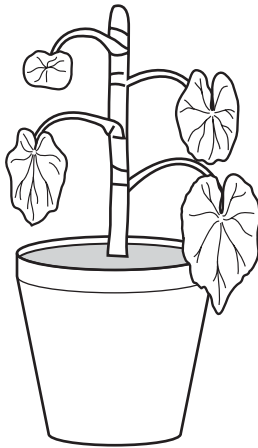


Fig. 8.2

Explain why the main stem of the plant remained upright when the rest of the plant wilted.

.....

..... [2]

(c) Fig. 8.3 shows a cell from the plant leaf before and after it wilted.

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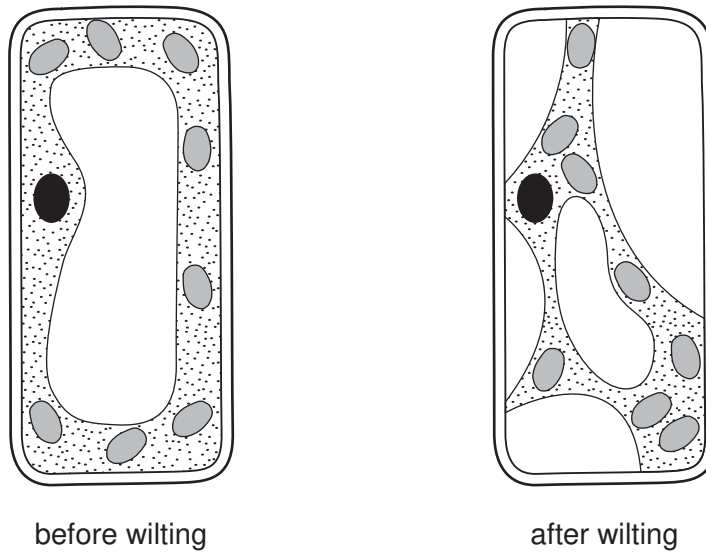


Fig. 8.3

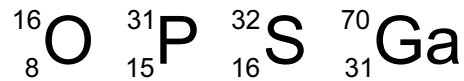
- (i) On the diagram of the cell **before** wilting in Fig. 8.3, label and name **two** structures that would **not** be present in an animal cell. [2]
- (ii) Using your knowledge of osmosis, explain what happened to the plant cell to cause its appearance after wilting.

.....

.....

..... [2]

- 9 The chemical symbols for the atoms shown below include proton (atomic) numbers and nucleon (mass) numbers.



- (i) State which of these symbols represent atoms of elements in the same **group** of the Periodic Table.

..... [1]

- (ii) Complete Table 9.1 which shows the names and the numbers of protons and neutrons in two of the atoms shown above.

Table 9.1

element name	protons	neutrons
oxygen		
	15	16

[2]

- (b) Fig. 9.1 shows a diagram of a water molecule,  $\text{H}_2\text{O}$ .

Choose words or phrases from the following list to complete the labelling of the diagram.

covalent bond      hydrogen atom      ionic bond  
nucleus              oxygen atom              proton

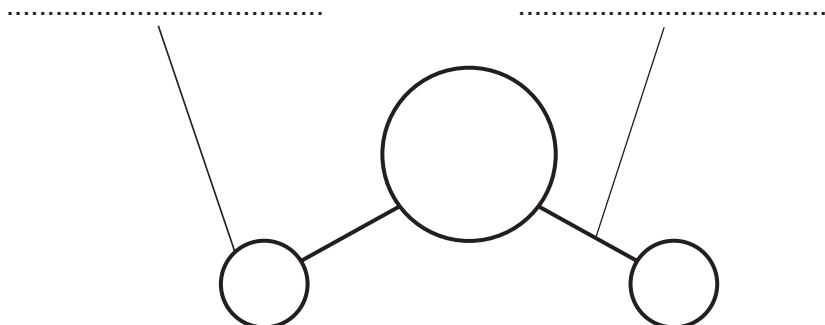


Fig. 9.1

[2]

- (c) Carbon and hydrogen combine to form a very large number of different compounds. Ethene is a gaseous, unsaturated compound of carbon and hydrogen.

Fig. 9.2 shows two different chemical reactions, **1** and **2**, involving ethene.

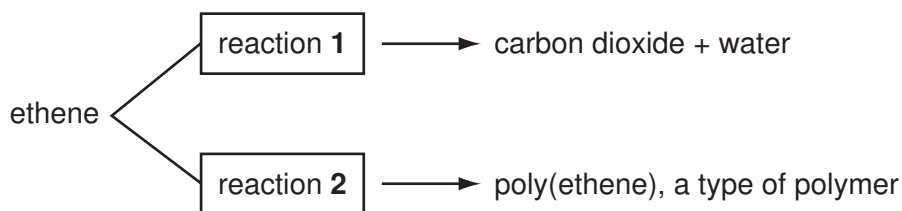


Fig. 9.2

- (i) What general name is given to all compounds which contain only carbon and hydrogen?

..... [1]

- (ii) Explain the meaning of the term *unsaturated* when used to describe ethene.

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

- (iii) For reaction **1** above, deduce the type of chemical reaction which occurs and name the substance which has reacted with ethene.

type of reaction .....

substance which has reacted with ethene ..... [2]

- (iv) For reaction **2** above, deduce the type of chemical reaction which occurs and describe briefly what happens to the molecules of ethene during the reaction.

type of reaction .....

what happens to ethene molecules .....

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

10 (a) Below is a list of some types of waves.

- |                   |                    |                      |              |
|-------------------|--------------------|----------------------|--------------|
| <b>gamma</b>      | <b>infra-red</b>   | <b>microwave</b>     | <b>sound</b> |
| <b>ultrasound</b> | <b>ultraviolet</b> | <b>visible light</b> |              |

State **one** wave from the list that is

- (i) a longitudinal wave, ..... [1]
- (ii) a transverse wave, ..... [1]
- (iii) emitted by hot objects but cannot be seen by the human eye,  
..... [1]
- (iv) used to send mobile phone (cell phone) messages from phone to phone.  
..... [1]

(b) Green light and red light are two of the three primary colours for light.

- (i) Name the third primary colour for light. .... [1]
- (ii) Name **one** secondary colour for light. .... [1]

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

		Group																																																																		
I	II	III	IV	V	VI	VII	0																																																													
7 <b>Li</b> Lithium 3	9 <b>Be</b> Beryllium 4	1 <b>H</b> Hydrogen 1	11 <b>B</b> Boron 5	12 <b>C</b> Carbon 6	14 <b>N</b> Nitrogen 7	16 <b>O</b> Oxygen 8	19 <b>F</b> Fluorine 9	20 <b>Ne</b> Neon 10	23 <b>Na</b> Sodium 11	24 <b>Mg</b> Magnesium 12	27 <b>Al</b> Aluminium 13	28 <b>Si</b> Silicon 14	31 <b>P</b> Phosphorus 15	32 <b>S</b> Sulfur 16	35.5 <b>Cl</b> Chlorine 17	40 <b>Ar</b> Argon 18	39 <b>K</b> Potassium 19	40 <b>Ca</b> Calcium 20	45 <b>Sc</b> Scandium 21	48 <b>Ti</b> Titanium 22	51 <b>V</b> Vanadium 23	55 <b>Mn</b> Manganese 25	56 <b>Fe</b> Iron 26	59 <b>Co</b> Cobalt 27	59 <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	89 <b>Y</b> Yttrium 39	91 <b>Zr</b> Zirconium 40	93 <b>Nb</b> Niobium 41	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	128 <b>Te</b> Tellurium 52	127 <b>I</b> Iodine 53	131 <b>Xe</b> Xenon 54	133 <b>Cs</b> Caesium 55	137 <b>Ba</b> Barium 56	139 <b>La</b> Lanthanum 57	178 <b>Hf</b> Hafnium 72	181 <b>Ta</b> Tantalum 73	184 <b>W</b> Tungsten 74	190 <b>Os</b> Osmium 76	192 <b>Ir</b> Iridium 77	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>Po</b> Polonium 84	210 <b>At</b> Astatine 85	210 <b>Rn</b> Radon 86	226 <b>Ra</b> Radium 88	227 <b>Ac</b> Actinium 89	87 <b>Fr</b> Francium
												140 <b>Ce</b> Cerium 58	141 <b>Pr</b> Praseodymium 59	144 <b>Nd</b> Neodymium 60	150 <b>Sm</b> Samarium 62	152 <b>Eu</b> Europium 63	157 <b>Gd</b> Gadolinium 64	159 <b>Tb</b> Terbium 65	162 <b>Dy</b> Dysprosium 66	165 <b>Ho</b> Holmium 67	167 <b>Er</b> Erbium 68	169 <b>Tm</b> Thulium 69	173 <b>Yb</b> Ytterbium 70	175 <b>Lu</b> Lutetium 71	232 <b>Th</b> Thorium 90	238 <b>U</b> Uranium 92	238 <b>Pa</b> Protactinium 91	238 <b>Np</b> Neptunium 93	238 <b>Pu</b> Plutonium 94	238 <b>Am</b> Americium 95	238 <b>Cm</b> Curium 96	238 <b>Bk</b> Berkelium 97	238 <b>Cf</b> Californium 98	238 <b>Es</b> Einsteinium 99	238 <b>Fm</b> Fermium 100	238 <b>Md</b> Mendelevium 101	238 <b>No</b> Nobelium 102	238 <b>Lr</b> Lawrencium 103																														

\*58-71 Lanthanoid series  
†90-103 Actinoid series

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

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

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