

### UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS International General Certificate of Secondary Education

	CANDIDATE NAME		
	CENTRE NUMBER		CANDIDATE NUMBER
* 3 5	CO-ORDINATE	D SCIENCES	0654/21
° 3	Paper 2 (Core)		October/November 2013
-1 5			2 hours
۵	Candidates ans	wer on the Question Paper.	
8	No Additional M	aterials are required.	
° 📕			
	<b>READ THESE I</b>	NSTRUCTIONS 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 pencil for any diagrams or graphs.

Do not use staples, paper clips, glue or correction fluid.

DO NOT WRITE IN ANY BARCODES.

Answer all questions.

Electronic calculators may be used.

You may lose marks if you do not show your working or if you do not use appropriate units. A copy of the Periodic Table is printed on page 32.

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.

This document consists of **31** printed pages and **1** blank page.



solutions such as sea water. Examiner's (a) (i) Explain why the Earth's crust contains the compound sodium chloride and not the uncombined elements sodium and chlorine. .....[1] (ii) State **one** difference between a compound and an element. ......[1] (iii) Describe how crystals of sodium chloride could be obtained from a salt solution. [2] (b) (i) Explain the following statements in terms of protons and electrons. Atoms do **not** have an overall electrical charge. A potassium ion, K<sup>+</sup>, has a single positive electrical charge. [2] (ii) The chemical formula of the compound calcium nitride is  $Ca_3N_2$ . Explain the meaning of the numbers in this formula. ..... [1]

Sodium chloride is obtained from underground deposits in the Earth's crust or from

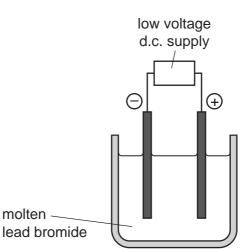
1

For

Use

(c) Fig. 1.1 shows apparatus used to separate the element lead from the compound lead bromide.

For Examiner's Use





- (i) Name the process shown in Fig. 1.1.
- (ii) Explain why an orange-coloured gas is observed rising from the molten lead bromide during the process.

[2]

**2** Fig. 2.1 shows the inside of a refrigerator.

The temperature inside the freezing compartment is -20  $^{\circ}$ C and the temperature in the rest of the refrigerator is +5  $^{\circ}$ C.

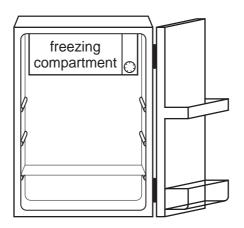


Fig. 2.1

(a) The air in the refrigerator is cooled by convection.

Draw **one** arrow on Fig. 2.1 to show the movement of the air cooled by the freezing compartment. [1]

(b) The volume of air in the refrigerator is  $0.15 \, \text{m}^3$ .

The density of air is  $1.26 \text{ kg/m}^3$ .

Calculate the mass of air in the refrigerator.

State the formula that you use and show your working.

formula

working

..... kg [2]

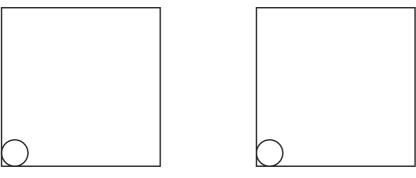
4

(c) (i) Complete the diagrams to show the arrangement of water molecules in solid ice and in liquid water.

5

For Examiner's Use

One molecule has been drawn for you in each box. Each diagram should contain at least twelve water molecules.



solid ice

liquid water

[2]

(ii) Each sentence describes either a solid, a liquid or a gas.

In the right hand column write the letter  ${\bf S}$  for solid,  ${\bf L}$  for liquid or  ${\bf G}$  for gas to match the description.

description	S, L or G
It cannot flow.	
It cannot transfer heat by convection.	
It contains particles which are widely separated.	
It expands the most when heated.	
It fills a closed container.	
It has a fixed volume but not a fixed shape.	

[3]

- **3** The concentration of glucose in the blood does not normally vary much. The hormone adrenaline causes blood glucose concentration to increase.
- For Examiner's Use

(a) (i) Define the term hormone.

[2]

(ii) State **one** effect of adrenaline on the body, other than increasing the concentration of glucose in the blood.

[1]

(b) Researchers investigated how adding fibre to foods affected the concentration of glucose in the blood after eating.

Fig. 3.1 shows the results that they obtained for two different types of cornflakes. Cornflakes contain a lot of starch.

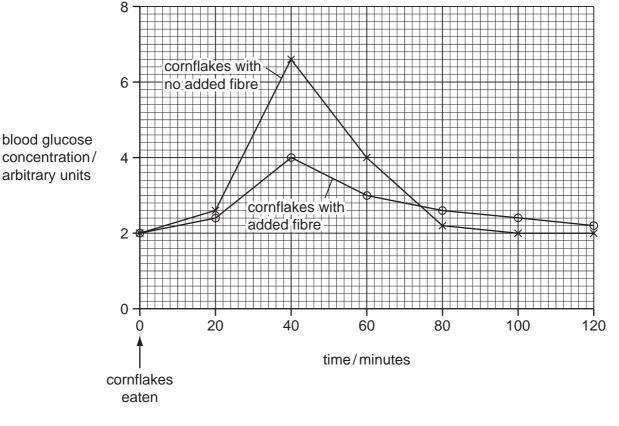


Fig. 3.1

Use the information in Fig. 3.1 to help you to answer the following questions.

(i) Describe how the blood glucose concentration changed after eating cornflakes with no added fibre.

[3] (ii) Suggest explanations for the changes in blood glucose concentration. [3] (iii) Describe how adding fibre to the cornflakes affected the changes in blood glucose concentration after eating. ..... [3] (c) Outline one other way in which fibre in the diet affects health. [1]

**4** Fig. 4.1 shows a period in the Periodic Table. Four elements are represented by letters which are not their usual chemical symbols.

group 1 2 3 4 5 6 7 0 NUMBER W X V V Z



(a) (i) State and explain which of the elements W, X, Y and Z are poor conductors of electricity.

	element(s)
	explanation
	[2]
(ii)	One of the elements shown in Fig. 4.1 is <b>not</b> expected to form a compound with any of the others.
	State and explain which <b>one</b> of the elements this is.
	element
	explanation
	[2]

8

For

Examiner's Use (b) Fig. 4.2 shows the melting points of four metallic elements from the same group of the Periodic Table.

For Examiner's Use

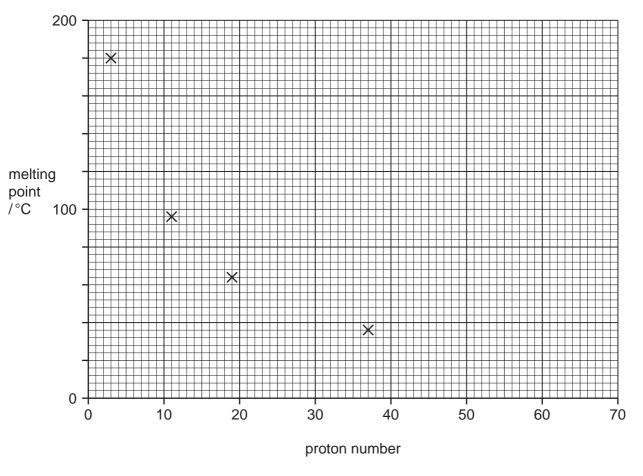


Fig. 4.2

(i) State the number of the group that contains the elements whose melting points are shown in Fig. 4.2.

Explain your answer briefly.

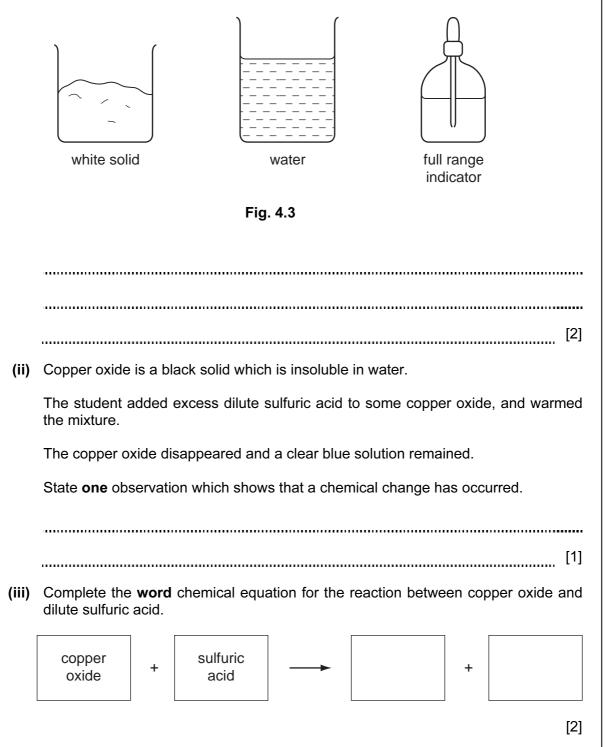
group number \_\_\_\_\_\_explanation \_\_\_\_\_\_[2]

(ii) Use the Periodic Table on page 32 to name the element in Fig. 4.2 that has the lowest melting point.

9

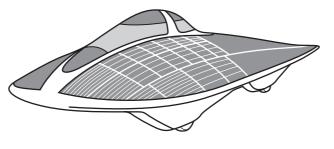
- (c) Many elements combine with oxygen to form oxides.
  - (i) A student is given a soluble white solid which she knows is either an oxide of a metal or an oxide of a non-metal.

Describe how the student can use the apparatus and materials shown in Fig. 4.3 to find out whether the solid is a metal oxide or a non-metal oxide.



Please turn over for Question 5.

**5** Fig. 5.1 shows a solar-powered vehicle which travelled 3000 km in 30 hours.





(a) Calculate the average speed of the vehicle in km/hr.

State any formula that you use and show your working.

formula

working

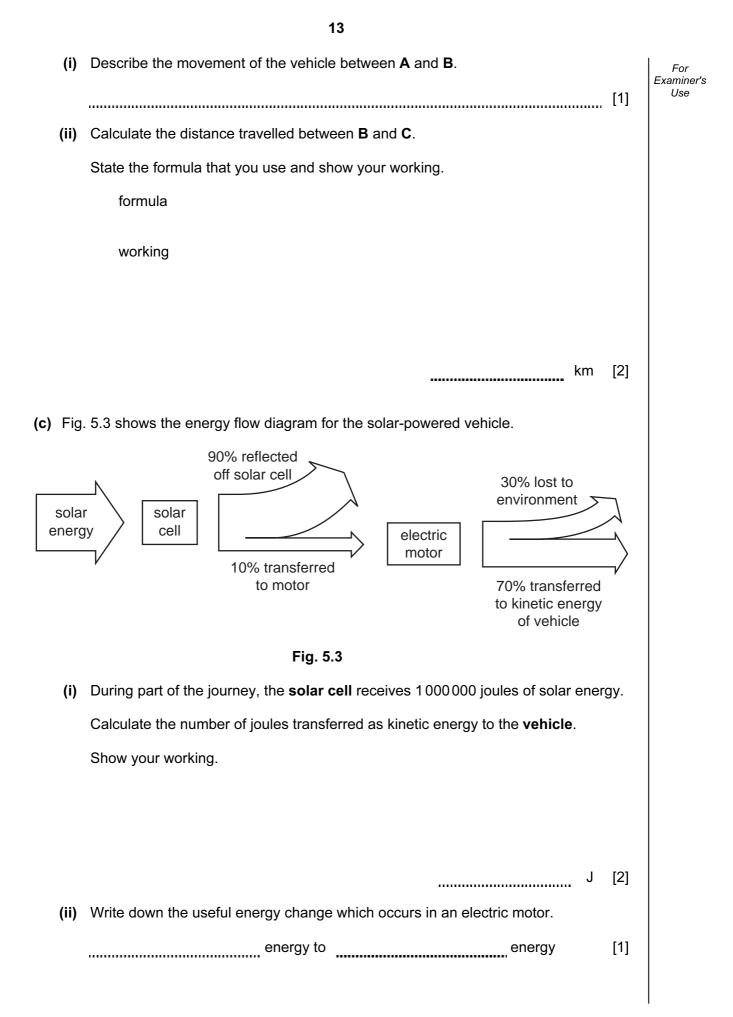


For Examiner's Use

(b) Fig. 5.2 shows a speed/time graph for part of the journey.

160 140 В 120 100 speed/km 80 per hour 60 40 20 0 0 0.5 1.0 1.5 2.0 time/hours





(d) Solar energy is a renewable energy source.
 (i) Name one other renewable energy source.
 [1]
 (ii) Describe one advantage to the environment of using solar energy as a renewable energy source.
 [1]

14

(e) The vehicle has mirrors to help the driver see behind him. The driver sees a car in his mirror as shown on Fig. 5.4.

Use Fig. 5.4 to describe **two** characteristics of an image seen in this mirror that are similar to the characteristics of an image seen in a plane mirror.

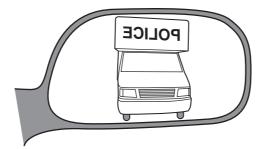


Fig. 5.4

1 \_\_\_\_\_ 2 \_\_\_\_\_ [2] (f) Sunlight can be focused onto smaller areas of a solar panel to improve its efficiency.

Fig. 5.5 shows two parallel rays of sunlight being focused by a lens. The lens has a focal length of 5 cm.

Complete the diagram to show the rays of sunlight being focused by the lens.

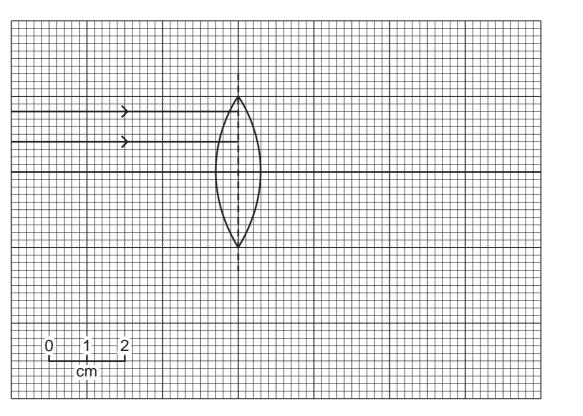
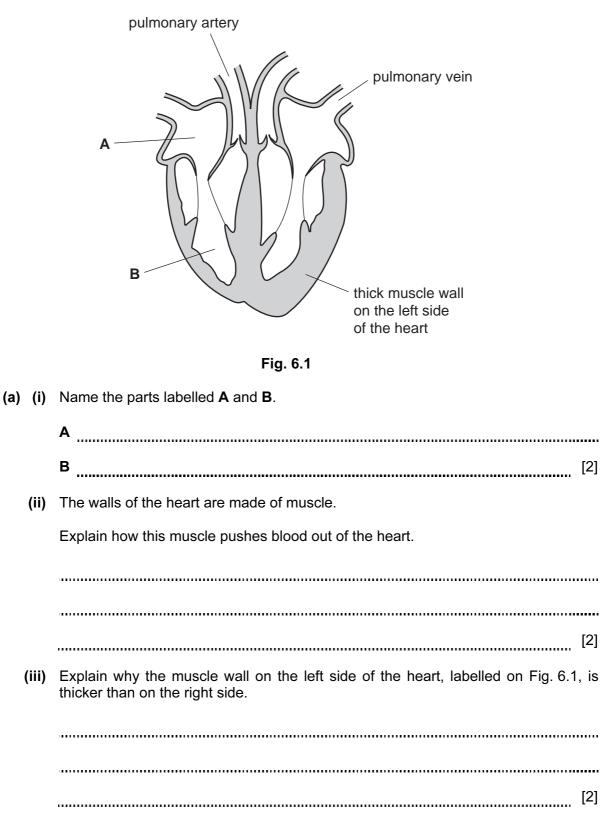


Fig. 5.5

[2]

**6** Fig. 6.1 shows a section through the heart.



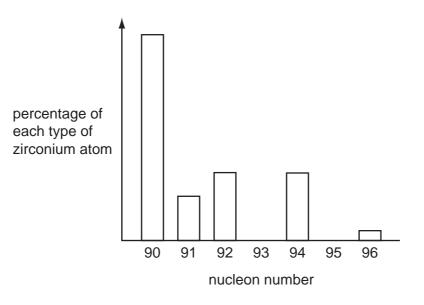
(b)	(i)	Describe <b>two</b> differences between the contents of a pulmonary artery and a pulmonary vein.	For Examiner's Use
		1	
		2	
		[2]	
	(ii)	Describe <b>two</b> differences between the structure of the wall of a pulmonary artery and the wall of a pulmonary vein.	
		1	
		2	
		[2]	

# [Turn over www.theallpapers.com

Zirc	coniu	im is a metallic element found in Period 5 of the Periodic Table.	For Examiner's					
(a)	) Zirconium metal is made into several different types of alloy.							
	State the meaning of the term alloy.							
		[1]						
(b)		arge piece of zirconium does not burn in air but zirconium powder burns rapidly, ning zirconium oxide.						
	(i)	Suggest the <b>word</b> chemical equation for the reaction that occurs when zirconium burns in air.						
		[1]						
	(ii)	The mass of zirconium oxide formed is greater than the mass of zirconium burned.						
		Explain this in terms of atoms.						
		[2]						
	(iii)	Suggest why zirconium powder burns rapidly but a large piece of zirconium does not.						
		[2]						

7

(c) Fig. 7.1 shows information about five different types of zirconium atoms.





(i) Use the Periodic Table on page 32 to find the proton number of zirconium.

proton number of zirconium = [1]

(ii) Complete Table 7.1 showing the numbers of protons and neutrons in two of the zirconium atoms in Fig. 7.1.

|--|

atom	number of protons	number of neutrons
Zr-90		
Zr-96		

[2]

For Examiner's Use

(iii) State the scientific word that is used to refer to atoms of the same element that have different numbers of neutrons.

[1]

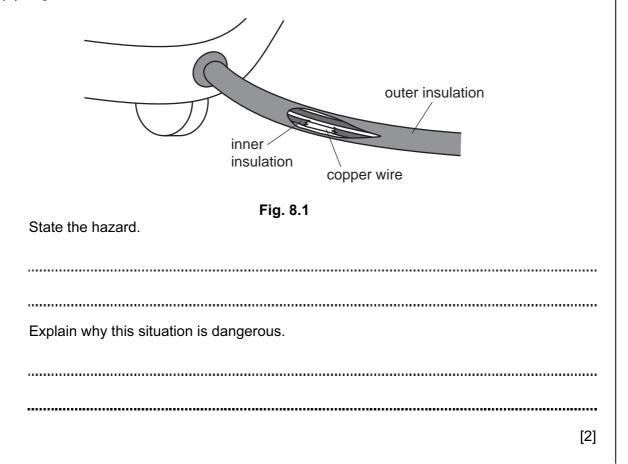
8 (a) Complete Table 8.1 below by drawing the circuit symbol for each electrical component.

name of component	circuit symbol
open switch	
resistor	
voltmeter	
fuse	

Tal		0 1
l a	bie	8.1

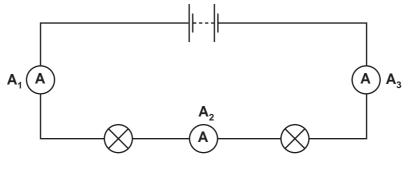
[2]

(b) Fig. 8.1 shows an electrical hazard.

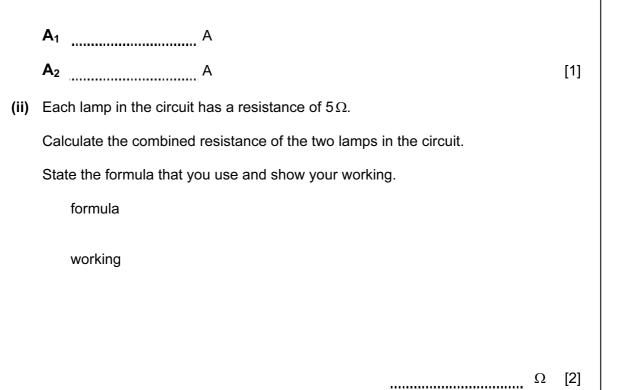


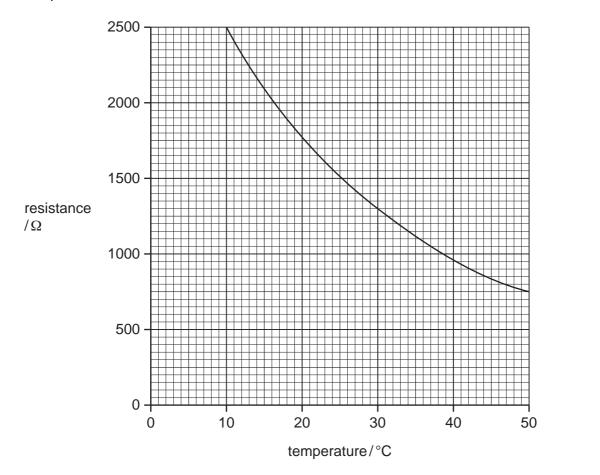
### www.theallpapers.com

- (c) In the circuit shown in Fig. 8.2 the reading on ammeter  $A_3$  is 0.5 A.
  - (i) State the current readings on ammeters  $A_1$  and  $A_2$ .









(d) Fig. 8.3 shows how the resistance of an electrical component in a circuit changes with temperature.



Fig. 8.3

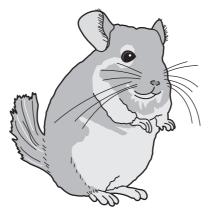
- (i) Write down the equation that shows how resistance is related to potential difference and current.
   [1]
   (ii) State the resistance of the component at 30 °C.
   Ω [1]
- (iii) Calculate the current that passes through the component at 30 °C when it is connected to a 12 V power supply.

Show your working.

..... A [2]

Please turn over for Question 9.

9 Chinchillas are mammals with thick grey fur. Chinchillas are often kept as pets.



People try to breed chinchillas with unusual fur.

(a) A rare allele of the gene that determines fur colour, **A**, is dominant to the normal allele, **a**. Table 9.1 shows the possible fur colours arising from these two alleles.

genotype	colour			
AA	zygote does not develop			
Aa	white			
aa	normal grey			

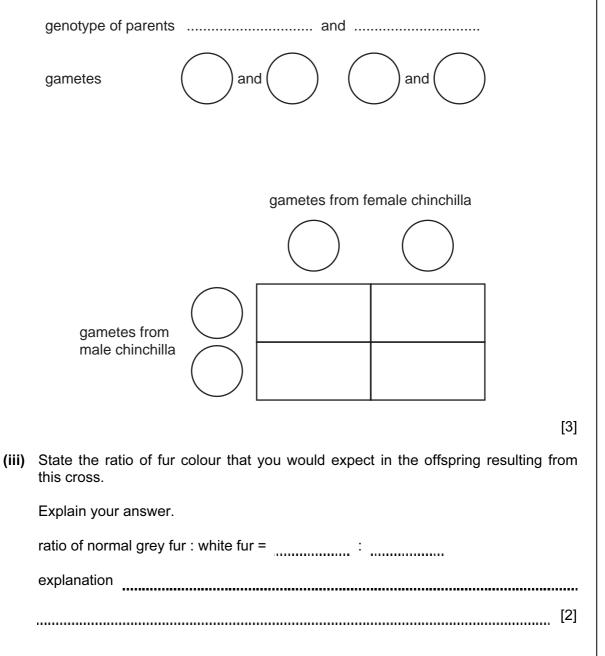
Table 9.1

(i) State the biological term for the observed effect produced by the genotype.

......[1]

(ii) A breeder has two white chinchillas.

Complete the genetic diagram to show the genotypes of the offspring that would be produced when these two chinchillas are bred together.



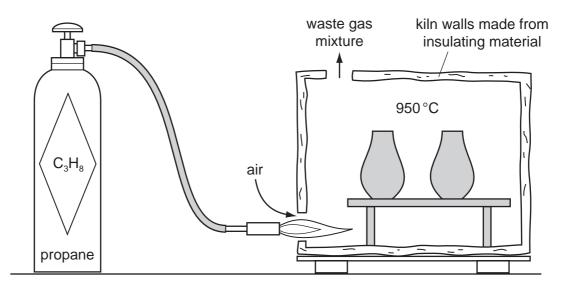
(b) Wild chinchillas live in rocky places in the Andes mountains, where it gets cold at night.
 (i) Suggest how the chinchilla's fur can help it to maintain a constant body temperature.
 [2]
 (ii) Suggest why almost all the chinchillas found in the wild have normal grey fur colour rather than white fur.

**10** Ethene, C<sub>2</sub>H<sub>4</sub>, is a gaseous, unsaturated hydrocarbon. For Examiner's Use (a) Explain the meanings of both words in the term *unsaturated hydrocarbon*. ..... ..... [2] (b) A sample of ethene was bubbled through bromine solution. bromine solution Fig. 10.1 Describe the colour change that is observed when ethene reacts with bromine. from \_\_\_\_\_\_ to \_\_\_\_\_[1]

(c) Propane,  $C_3H_8$ , is a gaseous hydrocarbon used as a fuel.

Fig. 10.2 shows a cross-section through a small furnace (kiln) in which items of pottery are being heated by a propane burner. The temperature inside the kiln is 950 °C.

28





(i) State which information from Fig. 10.2 shows that the combustion of propane is exothermic.

Explain your answer.

(ii) Explain why the waste gas mixture contains high concentrations of carbon dioxide and water vapour.
[1]
(iii) The waste gases may also contain some carbon monoxide.
Suggest a reason for this.
[1]
(iv) Explain why it is much safer to use a kiln like the one in Fig. 10.2 outside in the open air.
[1]

**11** X-rays and  $\gamma$ (gamma)–rays are both forms of electromagnetic radiation. They are also both forms of ionising radiation and are used in the treatment of cancer. (a) State the meaning of the term *ionising radiation*. ..... .....[1] (b) Name the radiation that comes between X-rays and visible light in the electromagnetic spectrum. Give one use for this radiation. radiation use [2] (c) (i) Electromagnetic waves are transverse waves. Water waves are also transverse. Draw a diagram of a transverse wave on the axes below. Label the amplitude and wavelength on your diagram. [3] (ii) Sound waves are **not** transverse waves. State the type of wave motion demonstrated by sound waves. [1] 

#### [Turn over www.theallpapers.com

12 (a) Fig. 12.1 shows a plant cell. For Examiner's Use chloroplast cellulose cell wall vacuole membrane nucleus cell membrane large permanent vacuole cytoplasm Fig. 12.1 (i) Name the tissue in the leaf in which this type of cell is found. .....[1] ..... (ii) Describe how photosynthesis is carried out in this cell. [3] (b) About one tenth of the Earth's surface is covered by forests in which much photosynthesis takes place. Explain how extensive deforestation could harm the environment. ..... . . . . . . . . . . . . . . . [3] 

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	0	4 <b>He</b> lium	2 20 Neon 40 <b>Ar</b>	Argon 18	84 Krypton 36	131 Xenon 54	Rn <sup>Radon</sup>		175 Lutetium 71	Lr Lawrencium 103
	NII		19 9 35.5 <b>C1</b>	Chlorine 17	80 Bromine 35	127   lodine 53	At Astatine 85		173 Yb Vtterbium 70	Nobelium 102
	>		8 <sup>0</sup> <sup>0</sup> 0 9	Sulfur 16	79 Selenium 34	128 <b>Te</b> Tellurium	PO Polonium 84		169 Thulium 69	Mendelevium 101
	>		<b>7</b> Nitrogen 31 33	Phosphorus 15	75 <b>AS</b> Arsenic 33	122 <b>Sb</b> Antimony 51	209 <b>Bi</b> Bismuth		167 <b>Er</b> Erbium 68	100 Fermium
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					59 <b>Co</b> 27	103 <b>Rh</b> Rhodium 45	192 <b>                                     </b>		150 <b>Sam</b> arium 62	
		Hydrogen	-		56 Fe	101 <b>Ru</b> Ruthenium 44	190 <b>OS</b> <sup>Osmium</sup> 76	-	Promethium 61	Neptunium 93
			_		55 Manganese 25	Tc Technetium 43	186 <b>Re</b> Rhenium 75		144 Neodymium 60	238 Uranium 92
					52 <b>Cr</b> Chromium 24	96 <b>Mo</b> lybdenum 42	184 <b>V</b> Tungsten 74	-	141 <b>Pr</b> Praseodymium 59	Protactinium 91
					51 Vanadium 23	93 <b>Niob</b> ium 41	181 <b>Ta</b> Tantalum 73		140 Cerium 58	232 Thorium 90
					48 Titanium 22	91 Zr Zirconium 40	178 Hafhium 72			nic mass ool ic) number
					45 SC Scandium 21	89 Yttrium 39	139 Lathanum 57 *	227 Actinium 89 †	series eries	a = relative atomic mass X = atomic symbol b = proton (atomic) number
	=		9 Be <sup>4</sup> 24 <b>Mg</b>	Magnesium 12	40 <b>Ca</b> Calcium 20	88 <b>Sr</b> Strontium 38	137 <b>Ba</b> Barium 56	226 <b>Ra</b> Radium 88	*58-71 Lanthanoid series 190-103 Actinoid series	a <b>X</b> a a a a
	1		7 Lithium 23 <b>Na</b>	Sodium	39 Potassium 19	85 <b>Rb</b> <sup>Rubidium</sup>	133 CS Caesium	Francium	1L6 03 A	٩

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