Cambridge
O Level

Cambridge International Examinations
Cambridge Ordinary Level

CANDIDATE NAME	
CENTRE NUMBER	
CANDIDATE NUMBER	

8164049766

COMBINED SCIENCE **5129/22**

Paper 2 **October/November 2018**

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 an HB pencil for any diagrams, graphs or rough working.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
A copy of the Periodic Table is printed on page 24.
Electronic calculators may be used.
You may lose marks if you do not show your working or if you do not use appropriate units.

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 **24** printed pages.

CAMBRIDGE
International Examinations

1 When sodium hydrogencarbonate is heated, it decomposes to produce sodium carbonate, water and carbon dioxide.

The equation for the reaction is

$$2NaHCO_3 \longrightarrow Na_2CO_3 + CO_2 + H_2O.$$

[A_r: H, 1; C, 12; O, 16; Na, 23]

The relative molecular mass of sodium hydrogencarbonate is 84.

(a) (i) Calculate the relative molecular mass of sodium carbonate.

.....[1]

(ii) Complete the following sentences.

84 g of sodium hydrogencarbonate produces ..... g of sodium carbonate and

..... g of water.

4.2 g of sodium hydrogencarbonate produces ..... g of sodium carbonate.

[3]

(b) State a test and the result of the test that show that carbon dioxide is produced.

test .....

result .....

[2]

[Total: 6]

2 **(a)** Muscle cells normally respire aerobically.

During strenuous exercise, muscle cells also respire anaerobically.

Complete Table 2.1 to compare aerobic and anaerobic respiration in muscle cells.

Write a tick (✓) to show a correct statement and a cross (✗) to show a statement that is not correct.

Two rows have been completed for you.

Table 2.1

statement	aerobic respiration	anaerobic respiration
oxygen is used	✓	✗
glucose is used	✓	✓
carbon dioxide is produced		
water is produced		
lactic acid is produced		
a relatively large amount of energy is released		

[4]

(b) Describe how oxygen in atmospheric air reaches muscle cells to be used in aerobic respiration.

.....

.....

.....

.....

.....[3]

[Total: 7]

3 A circuit containing two different resistors connected to a power source is shown in Fig. 3.1.

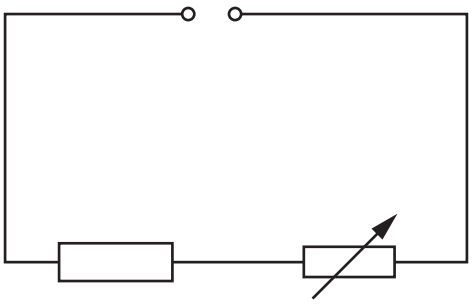

Fig. 3.1

(a) Two types of meters are connected in the circuit so that the resistance of the fixed resistor may be calculated.

State the names of the types of meters that must be used.

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

(b) The meter used to measure the potential difference V_1 across the fixed resistor is shown in Fig. 3.2.

The meter used to measure the potential difference V_2 across the variable resistor is shown in Fig. 3.3.

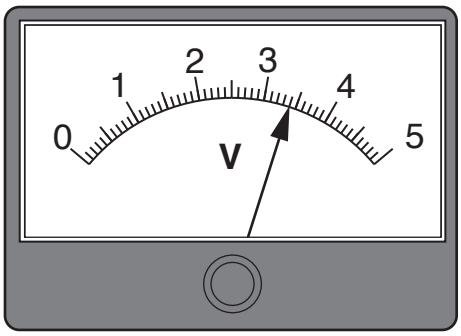

Fig. 3.2

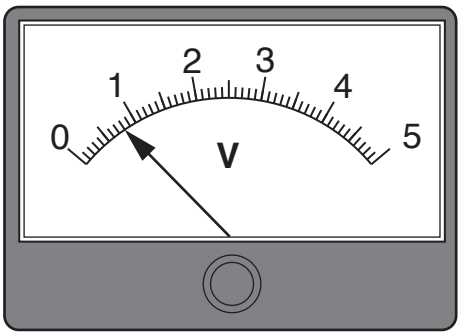

Fig. 3.3

(i) The current in the circuit is 0.08 A.

Calculate the resistance of the fixed resistor. State the unit.

resistance = ... unit ..... [3]

(ii) Determine the total potential difference V supplied by the source.

Show your working.

V = ... V [2]

[Total: 7]

4 Some reactions of nitric acid are shown in Fig. 4.1.

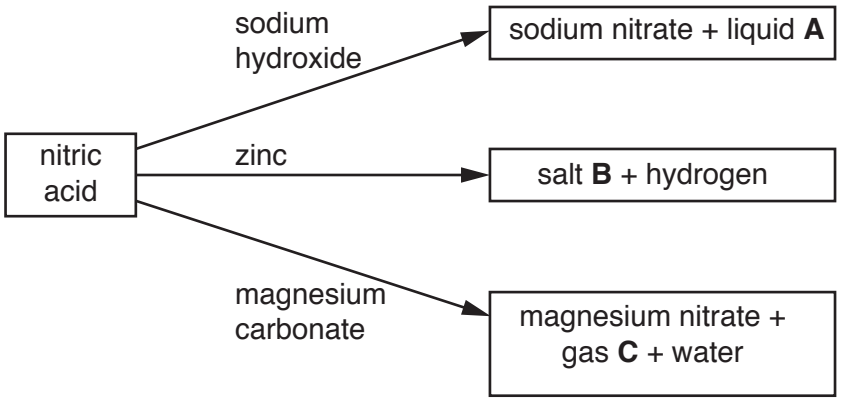

Fig. 4.1

(a) Identify liquid **A**, salt **B** and gas **C**.

liquid **A** .....

salt **B** .....

gas **C** ..... [3]

(b) Nitric acid is titrated with aqueous sodium hydroxide, using Universal Indicator as the indicator.

Complete the sentences about the titration.

The nitric acid is added to the sodium hydroxide using a ..... until

Universal Indicator turns green, which shows that the solution is ..... .

The temperature of the solution increases because the reaction is ..... .
[3]

(c) The formula of a magnesium ion is Mg^{2+} and the formula of a nitrate ion is NO_3^-.

Deduce the formula of magnesium nitrate.

.....[1]

[Total: 7]

Question 5 starts over the page.

5 AAA cells are used in small electrical devices.

Fig. 5.1 shows a ruler, marked with 1 mm divisions, being used to measure the length of a used AAA cell.

A line **P** marks the position of one end of the AAA cell against the scale on the ruler.

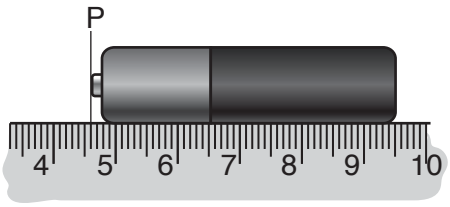

Fig. 5.1

(a) (i) On Fig. 5.1 draw a line, labelled **Q**, to show the position of the other end of the AAA cell against the scale on the ruler. [1]

(ii) Use the scale on the ruler in Fig. 5.1 to determine the length l in mm of the AAA cell.

l = ...mm [1]

(iii) The diameter d of the AAA cell is shown in Fig. 5.2.

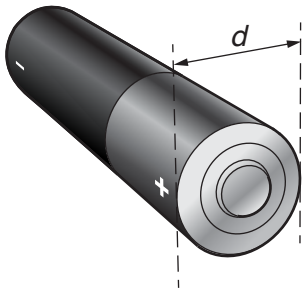

Fig. 5.2 (not to scale)

The ratio of the diameter d of the cell to the length l of the cell is 2 : 9.

Calculate the diameter d of the cell.

d = ...mm [1]

(b) (i) Describe how a measuring cylinder and water are used to determine the volume of a used AAA cell.

.....

.....

.....

.....[1]

(ii) The volume of the AAA cell is 4.40 cm^3.

The density of the cell is 3.16 g/cm^3.

Calculate the mass *m* of the cell.

m = ...g [2]

[Total: 6]

6 **(a)** The word equation for photosynthesis is

carbon dioxide + water ⟶ glucose + oxygen .

This reaction will only take place in the presence of light and chlorophyll.

Explain the role of light and the role of chlorophyll in photosynthesis.

light .....

.....

chlorophyll .....

.....

[2]

(b) In an investigation, a green plant is placed in bright light with a supply of carbon dioxide and water.

The rate of photosynthesis is measured at different temperatures.

The results are shown in Fig. 6.1.

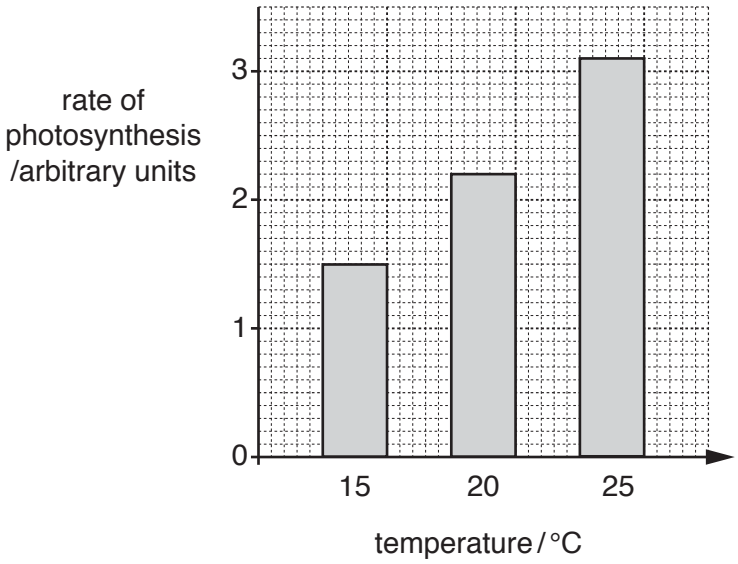

Fig. 6.1

(i) Describe the trend shown in Fig. 6.1.

Suggest an explanation for your answer.

.....

.....

.....

.....[2]

(ii) Predict what happens to the rate of photosynthesis at 45 °C.

Give a reason for your answer.

prediction .....

.....

reason .....

.....

[2]

(c) Explain why all animal life depends on plants carrying out photosynthesis.

.....

.....

.....

.....[2]

[Total: 8]

7 Petroleum is separated into fractions by fractional distillation.

(a) Name the fraction that is used for

making roads, ...

aircraft fuel. .....

[2]

(b) Heptane is a hydrocarbon obtained from petroleum.

State what is meant by the term *hydrocarbon*.

.....

.....

.....[2]

(c) Heptane is broken down into other substances by cracking.

During this process, heptane forms two compounds **X** and **Y** and hydrogen.

The equation for the reaction is

$$C_7H_{16} \longrightarrow 2\mathbf{X} + \mathbf{Y} + H_2$$

Both **X** and **Y** change the colour of bromine water from brown to colourless. A molecule of **X** contains two carbon atoms.

(i) Deduce the molecular formula of **X** and of **Y**.

X .....

Y .....

[2]

(ii) Name the homologous series to which **X** and **Y** belong.

.....[1]

[Total: 7]

8 The inside of an electrical plug is shown in Fig. 8.1.

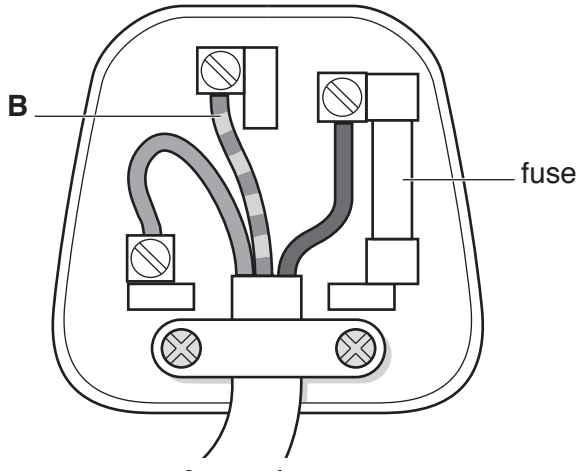

Fig. 8.1

(a) On Fig. 8.1 draw a line to identify the live wire. Label the line **L**. [1]

(b) Wire **B** is the earth wire. Explain the function of the earth wire.

.....

.....

.....[2]

(c) When plugged into a socket, the plug supplies mains electricity at 230 V to a washing machine.

The current in the appliance is 9.6 A.

Calculate the power *P* produced in the washing machine.

P = ... W [2]

[Total: 5]

9 Fig. 9.1 shows some words associated with food webs and the definitions of those words.

Draw one line from each word to its definition.

words	definitions
producer	shows the transfer of energy from one organism to the next
consumer	an organism that gets its energy from eating other organisms
food chain	an organism that makes its own organic nutrients
decomposer	an animal that gets its energy from eating plants
carnivore	an organism that gets its energy from dead or waste organic material
herbivore	an animal that gets its energy from eating other animals

Fig. 9.1

[6]

[Total: 6]

10 Table 10.1 shows the arrangement of electrons in atoms of five different elements **A**, **B**, **C**, **D** and **E**.

The letters are **not** the chemical symbols of the elements.

Table 10.1

element	**A**	**B**	**C**	**D**	**E**
electronic structure	2,1	2,8,5	2,6	2,8,7	2,8,2

Use the letters in Table 10.1 to complete the following sentences.

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

(a) The element with the proton number 15 is ..... . [1]

(b) The element with the nucleon number 35 which has an isotope containing 18 neutrons is

..... . [1]

(c) The two non-metallic elements in the same period of the Periodic Table are

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

(d) An element that forms an ionic compound with fluorine is ..... . [1]

(e) The element that gains two electrons to form an ion is ..... . [1]

[Total: 5]

[Turn over

11 Fig. 11.1 shows a lens **A** and plane mirror **B**.

A ray of light **R** is incident on lens **A**.

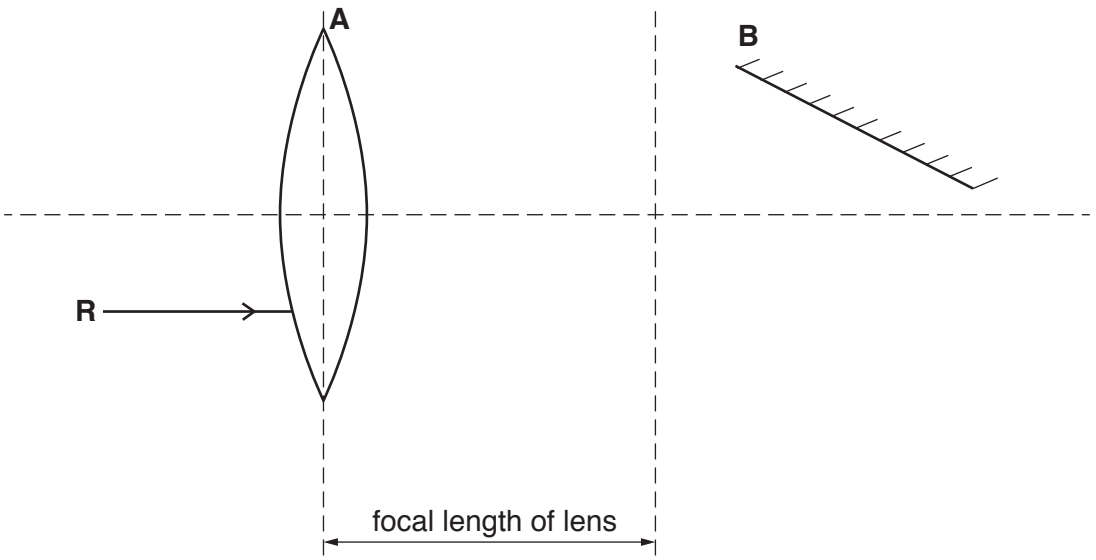

Fig. 11.1

(a) Ray **R** passes through the lens and is reflected from the mirror.

On Fig. 11.1, draw the path of ray **R**. [3]

(b) Fig. 11.2 is a simplified diagram showing the range of wavelengths for some colours in the visible spectrum.

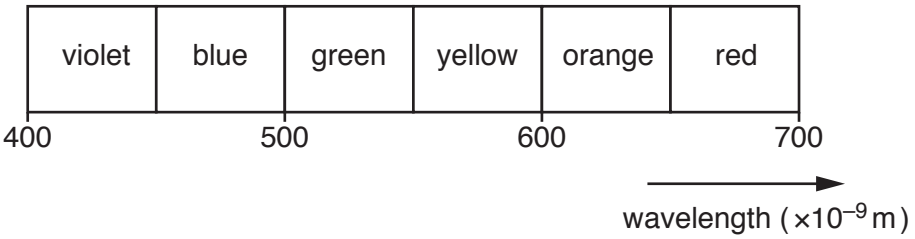

Fig. 11.2

(i) Estimate the range of wavelengths of orange light.

.....[1]

(ii) State the speed of light in a vacuum.

..... m/s [1]

(iii) Calculate the highest **frequency** of orange light.

frequency = ... Hz [3]

[Total: 8]

12 A list of words about blood is shown below.

antibodies **blood clotting** **fibrinogen**

hormones **oxygen** **phagocytosis**

photosynthesis **plasma** **water**

Use words from the list to complete the sentences about blood.

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

White blood cells protect the body from infection by producing ..... .

White blood cells also carry out the process of ..... .

Platelets in the blood are responsible for ..... .

The liquid part of the blood is called ..... .

One of the functions of the liquid part of the blood is to transport .....

to target organs.

[5]

[Total: 5]

13 Lithium, sodium and potassium are elements in Group I of the Periodic Table.

Group I elements are called the alkali metals.

(a) State how the melting points of the elements change as the group is descended.

.....[1]

(b) Suggest why the Group I elements are called the alkali metals.

.....[1]

(c) **(i)** Each of the elements in Group I reacts with chlorine to form an ionic metal chloride.

Write a balanced symbol equation for the reaction of chlorine with potassium.

.....[1]

(ii) State how the reactivity of lithium differs from that of potassium.

.....[1]

(iii) State **one** way in which the properties of potassium chloride differ from the properties of a covalent compound.

.....

.....[1]

[Total: 5]

Question 14 starts over the page.

14 A thin strip of metal **X** is firmly fixed to a thin strip of metal **Y**. This is called a bimetallic strip.

Fig. 14.1 shows the effect of heat on the bimetallic strip.

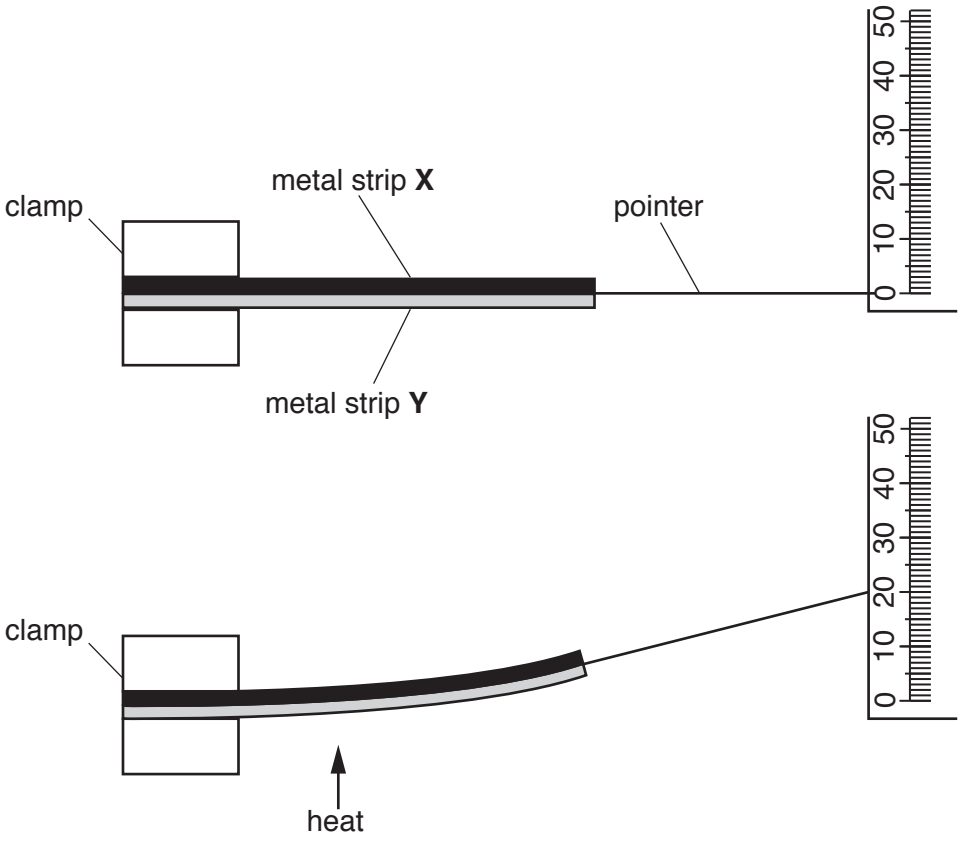

Fig. 14.1

The bimetallic strip is heated and the pointer moves along a millimetre scale.

(a) Draw a circle around the physical property of the metal strips that changes to cause the movement of the pointer when the bimetallic strip is heated.

colour e.m.f. mass resistance volume

[1]

(b) On Fig. 14.2, sketch a graph to show the relationship between the temperature of the bimetallic strip and the position of the pointer on the scale.

Label the axes of the graph and state the unit for each axis.

Fig. 14.2

[3]

(c) In a second experiment a load of 3.0 N is fixed to the end of the pointer.

The heating of the metal strips is repeated and the load rises 0.02 m in 18.0 s.

Calculate the work done W by the metal strips on the load. State the unit.

W = ... unit ..... [3]

[Total: 7]

15 Fig. 15.1 shows the number of deaths from alcohol-related diseases in a city between 1994 and 2012.

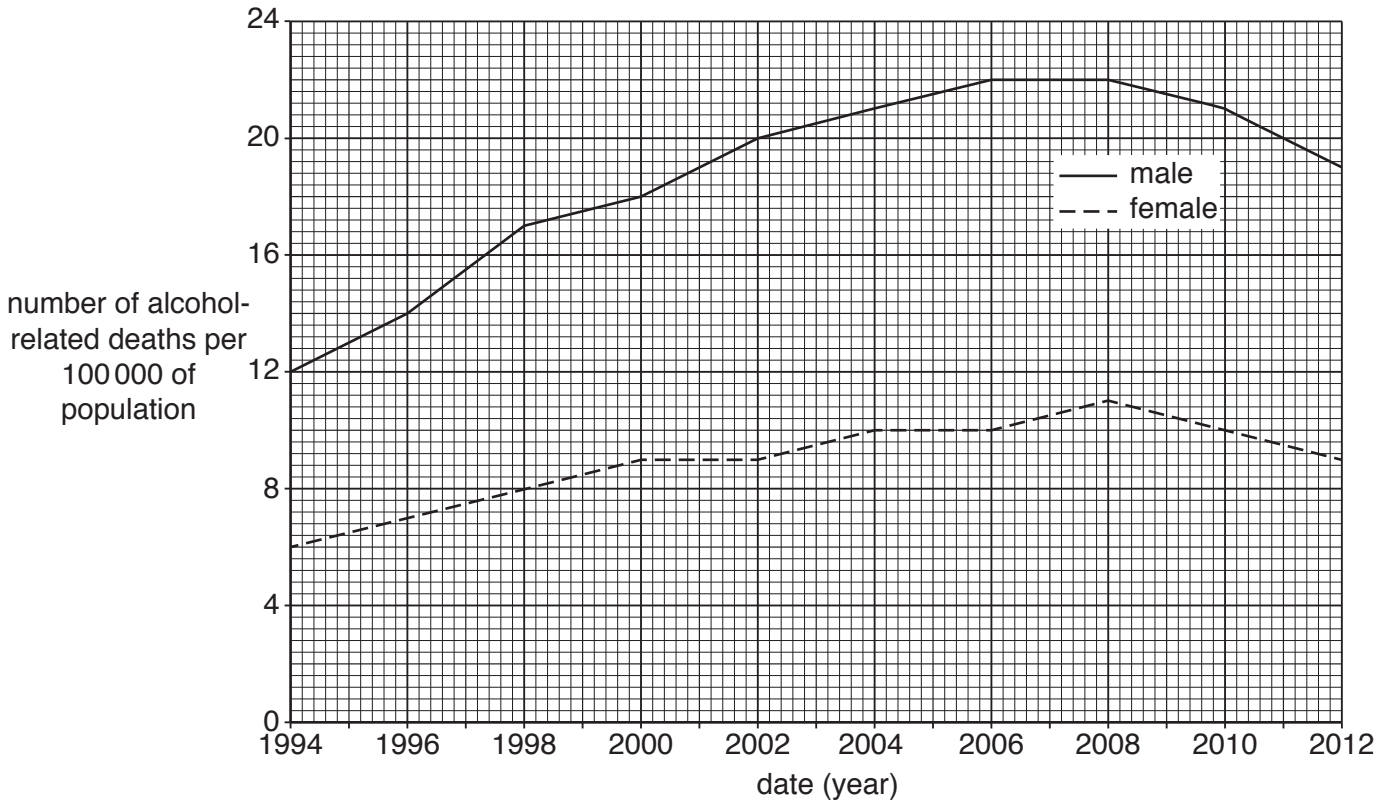

Fig. 15.1

(a) **(i)** State the number of males who died from alcohol-related diseases in 1994.

..... per 100 000 population [1]

(ii) State the number of females who died from alcohol-related diseases in 2010.

..... per 100 000 population [1]

(b) Describe **two** trends shown in Fig. 15.1.

1 .....

.....

2 .....

.....

[2]

(c) Name the organ in the body that breaks down alcohol.

.....[1]

(d) State **two** ways, other than death, in which long term excessive use of alcohol affects the body.

1 .....

.....

2 .....

.....
[2]

[Total: 7]

16 Complete the following sentences about atoms.

Atoms are the smallest parts of ..... .

When two atoms of the same type combine chemically, a diatomic ..... is formed.

When two different non-metal atoms combine chemically, a .....
compound is formed.

When atoms of two different metals are mixed together, an ..... is formed.
[4]

[Total: 4]

The Periodic Table of Elements

Group																	
I	II											III	IV	V	VI	VII	VIII
							1 H hydrogen 1										2 He helium 4
3 Li lithium 7	4 Be beryllium 9											5 B boron 11	6 C carbon 12	7 N nitrogen 14	8 O oxygen 16	9 F fluorine 19	10 Ne neon 20
11 Na sodium 23	12 Mg magnesium 24											13 Al aluminium 27	14 Si silicon 28	15 P phosphorus 31	16 S sulfur 32	17 Cl chlorine 35.5	18 Ar argon 40
19 K potassium 39	20 Ca calcium 40	21 Sc scandium 45	22 Ti titanium 48	23 V vanadium 51	24 Cr chromium 52	25 Mn manganese 55	26 Fe iron 56	27 Co cobalt 59	28 Ni nickel 59	29 Cu copper 64	30 Zn zinc 65	31 Ga gallium 70	32 Ge germanium 73	33 As arsenic 75	34 Se selenium 79	35 Br bromine 80	36 Kr krypton 84
37 Rb rubidium 85	38 Sr strontium 88	39 Y yttrium 89	40 Zr zirconium 91	41 Nb niobium 93	42 Mo molybdenum 96	43 Tc technetium –	44 Ru ruthenium 101	45 Rh rhodium 103	46 Pd palladium 106	47 Ag silver 108	48 Cd cadmium 112	49 In indium 115	50 Sn tin 119	51 Sb antimony 122	52 Te tellurium 128	53 I iodine 127	54 Xe xenon 131
55 Cs caesium 133	56 Ba barium 137	57–71 lanthanoids	72 Hf hafnium 178	73 Ta tantalum 181	74 W tungsten 184	75 Re rhenium 186	76 Os osmium 190	77 Ir iridium 192	78 Pt platinum 195	79 Au gold 197	80 Hg mercury 201	81 Tl thallium 204	82 Pb lead 207	83 Bi bismuth 209	84 Po polonium –	85 At astatine –	86 Rn radon –
87 Fr francium –	88 Ra radium –	89–103 actinoids	104 Rf rutherfordium –	105 Db dubnium –	106 Sg seaborgium –	107 Bh bohrium –	108 Hs hassium –	109 Mt meitnerium –	110 Ds darmstadtium –	111 Rg roentgenium –	112 Cn copernicium –		114 Fl flerovium –		116 Lv livermorium –		

Key

atomic number
atomic symbol
name
relative atomic mass

lanthanoids	57 La lanthanum 139	58 Ce cerium 140	59 Pr praseodymium 141	60 Nd neodymium 144	61 Pm promethium –	62 Sm samarium 150	63 Eu europium 152	64 Gd gadolinium 157	65 Tb terbium 159	66 Dy dysprosium 163	67 Ho holmium 165	68 Er erbium 167	69 Tm thulium 169	70 Yb ytterbium 173	71 Lu lutetium 175
actinoids	89 Ac actinium –	90 Th thorium 232	91 Pa protactinium 231	92 U uranium 238	93 Np neptunium –	94 Pu plutonium –	95 Am americium –	96 Cm curium –	97 Bk berkelium –	98 Cf californium –	99 Es einsteinium –	100 Fm fermium –	101 Md mendelevium –	102 No nobelium –	103 Lr lawrencium –

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