UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

7832302027

CO-ORDINATED SCIENCES **0654/02**

Paper 2 (Core) **May/June 2008**

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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7	
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9	
10	
11	
12	
Total	

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

UNIVERSITY *of* CAMBRIDGE International Examinations

[Turn over

1 Fig. 1.1 shows a section through a human eye.

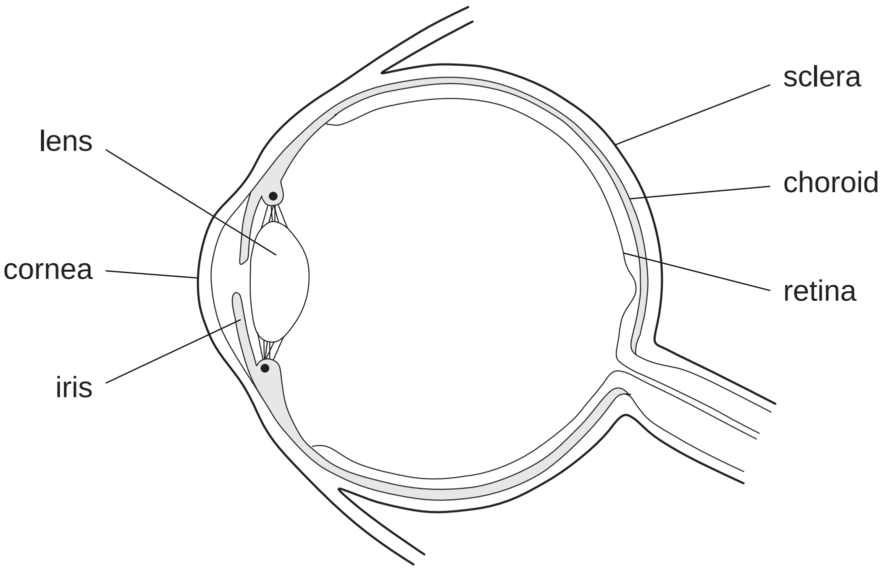

Fig. 1.1

(a) Using the labels on Fig. 1.1, list, in order, the parts of the eye through which light passes to reach the retina.

.... [1]

(b) Describe the function of the following parts of the eye.

(i) the lens

....

....

.... [2]

(ii) the retina

....

....

.... [2]

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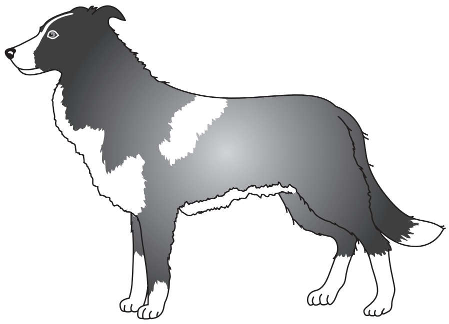
(c) Collies are a breed of dog that have been bred to herd sheep and cattle. A rec allele, **a**, in collies causes the choroid to develop abnormally. This can cause blindn



(i) What is the phenotype of a collie with the genotype **aa**?

.... [1]

Breeders of collies try to make sure that none of the puppies that are born inherit this disease.

A collie breeder mates a male dog with the genotype **AA**, and a female dog with the genotype **Aa**.

(ii) Complete the genetic diagram to explain whether any of their puppies will inherit the choroid disease.

parents	**AA**	**Aa**
gametes	all **A**	.... and ....
offspring genotypes	....	
offspring phenotypes	....	[3]

2 **(a)** The mass of a golf ball is 40 g.

Its volume is 35 cm^3.

Calculate the density of the golf ball.

State the formula that you use and show your working.

formula

working

.... g/cm^3 [2]

(b) A golfer hits the ball.

Calculate the momentum of the golf ball when it has a velocity of 40 m/s.

State the formula that you use and show your working.

formula

working

.... kg m/s [2]

For Examiner's Use

(c) The golfer's bag of clubs has a mass of 6 kg.

(i) Calculate the weight of the bag of clubs.
Assume that the gravitational field strength on Earth is 10 N / kg.

.... N [1]

(ii) Calculate the work done by the golfer when the bag is lifted 0.5 metres.

State the formula that you use and show your working.

formula

working

.... J [2]

3 Fig. 3.1 shows some natural processes which occur on and under the Earth's surface.

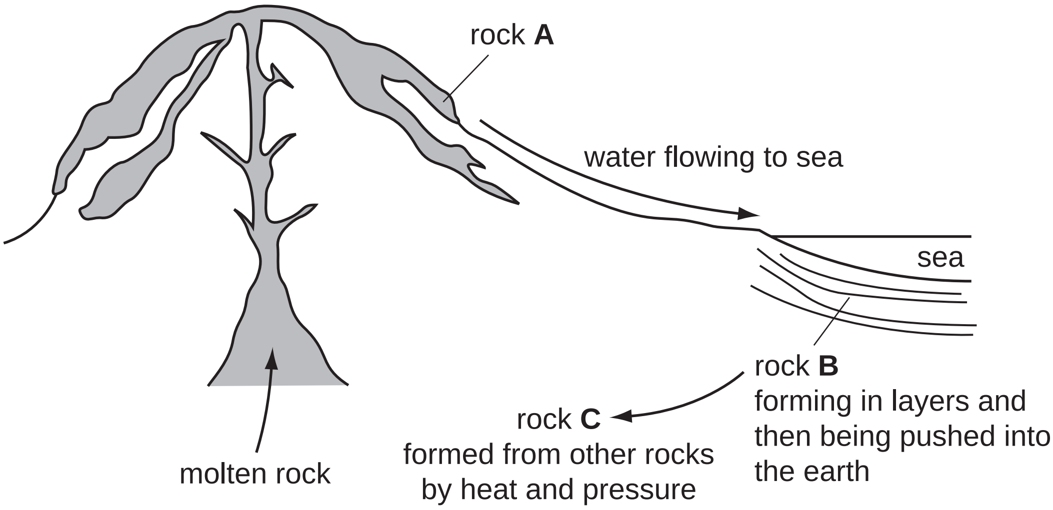


Fig. 3.1

(a) State which rock, **A**, **B** or **C**, was formed when a hot liquid cooled and changed into a solid.

.... [1]

(b) Rock **B** was formed when tiny pieces of solid were washed down into the sea by rivers and compressed. The tiny pieces of solid were produced from rock **A** whose surface had been damaged by weathering.

(i) What general name is given to rocks like rock **B**?

.... [1]

(ii) Describe **one** way in which the surface of rock **A** could have been weathered.

....

....

....

.... [2]

(iii) Underline the word in the list below which correctly names the type of weathering you have described in part **(ii)**.

biological **chemical** **physical**

[1]

(c) A sample of water flowing into the sea, as shown in Fig. 3.1, was taken to a laboratory for testing.

A student observed a drop of the water under a microscope.

Fig. 3.2 shows a labelled diagram of what he saw.

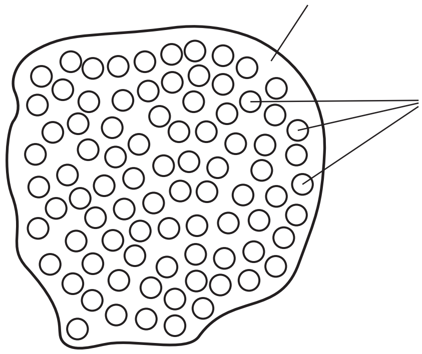


Fig. 3.2

(i) What **general** name is given to a mixture in which one substance is finely dispersed throughout another?

.... [1]

(ii) The student stated that the mixture he was observing was an example of an *emulsion*.

Explain whether or not the student's statement was correct.

....

....

.... [2]

(iii) The student then added a few drops of acidified barium nitrate solution to some of the water. A white precipitate was formed.

What may be concluded about the water sample from this result?

....

.... [1]

4 Fig. 4.1 shows a transverse section through a leaf.

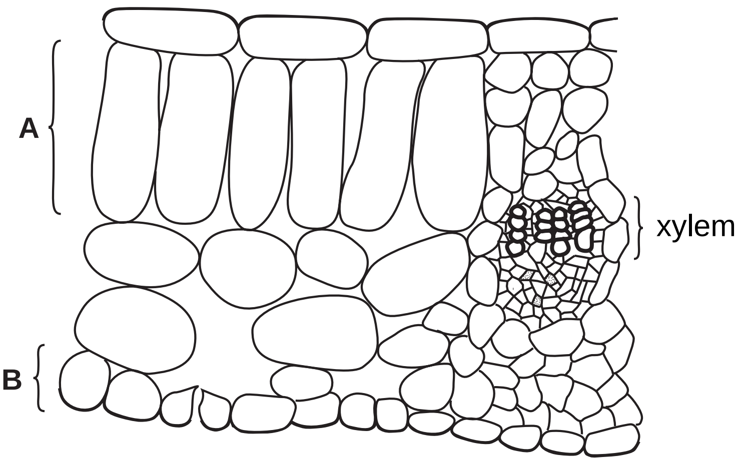


Fig. 4.1

(a) (i) Name the tissues labelled **A** and **B**.

A ....

B .... [2]

(ii) State two ways in which a cell in tissue **A** differs from an animal cell.

1. ....

2. .... [2]

(iii) On Fig. 4.1, draw an arrow to show where carbon dioxide enters the leaf. [1]

(b) State two functions of xylem tissue in a leaf.

1. ....

2. .... [2]

For Examiner's Use

5 **(a)** The graph in Fig. 5.1 shows the motion of a dolphin travelling through water.

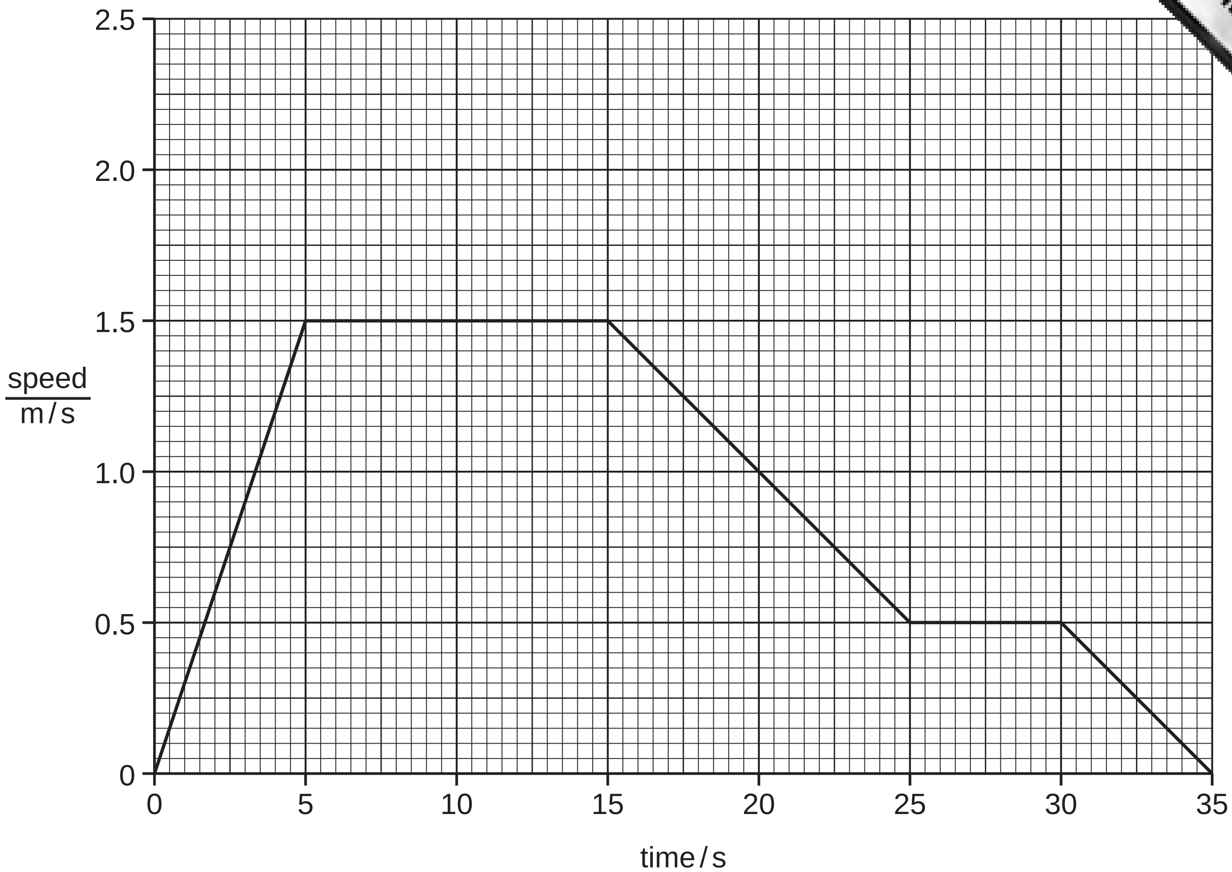


Fig. 5.1

(i) On the graph, label with an **S** a period when the dolphin was moving at a constant speed. [1]

(ii) Describe the motion of the dolphin between 0 s and 5 s.

.... [1]

(b) Table 5.1 shows the maximum and minimum frequencies of sounds heard by do[lphins,] humans and whales.

Table 5.1

animal	maximum frequency / kHz	minimum frequency / Hz
dolphin	110	40
human	20	20
whale	1	2

(i) What is meant by the term *frequency*?

....

.... [1]

Which animal can hear

(ii) the greatest range of frequencies, ... [1]

(iii) the sound with the highest pitch? .... [1]

(c) A dolphin locates an object by emitting a pulse of high frequency sound.

The pulse takes 0.2 s to reach the object and return to the dolphin after reflection. The speed of the sound pulse in water is 1500 m / s.

Calculate the distance between the dolphin and the object.

State the formula that you use and show your working.

formula

working

.... m [3]

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iner's

(d) A man in a boat sees a dolphin under the water. Draw a ray of light on Fig. 5.2 t
how light travels from the dolphin's head to the man's eye.

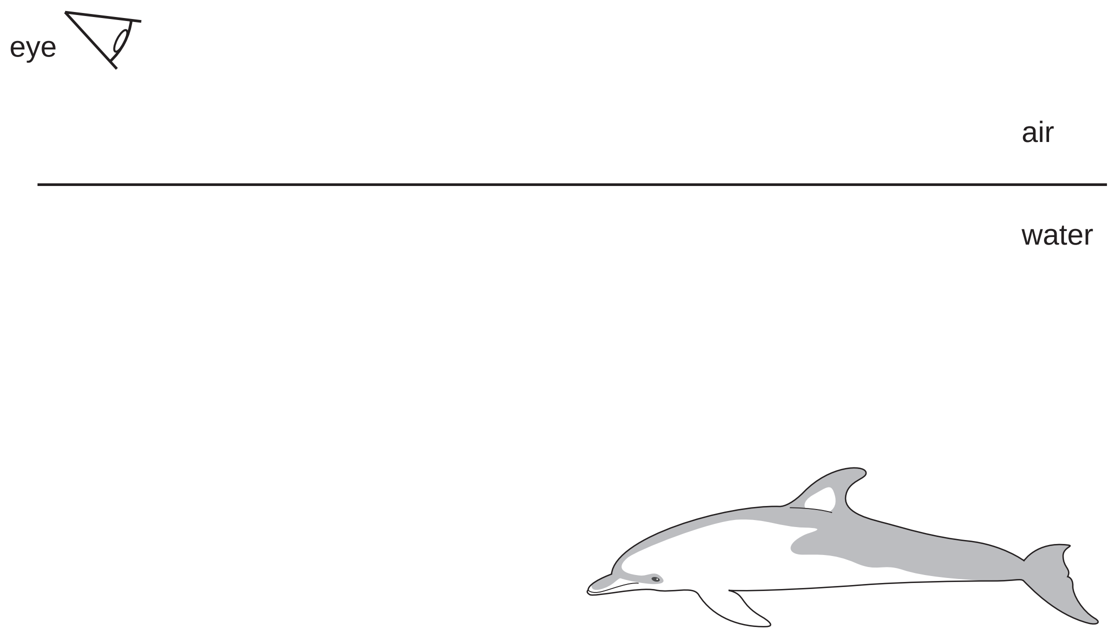

Fig. 5.2

[3]

6 Fig. 6.1 shows diagrams of some atoms of elements in Group I of the Periodic Table.

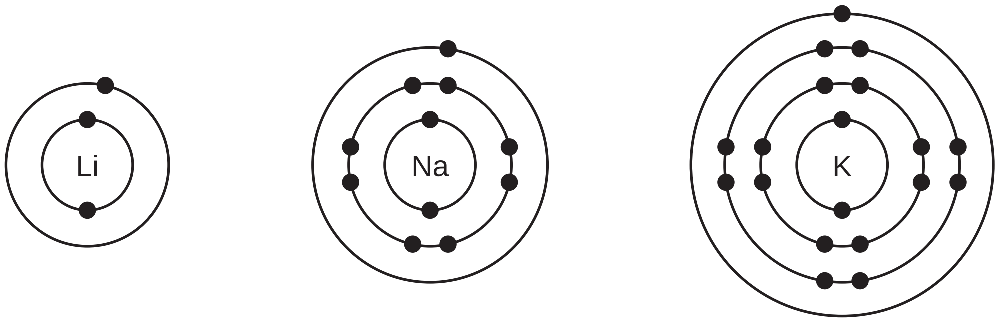

Fig. 6.1

(a) **(i)** Describe briefly two differences in the properties of lithium and potassium.

1. ....

....

2. ....

.... [2]

(ii) When sodium reacts with water, sodium atoms change into sodium ions. Draw a diagram of a sodium ion showing how all the electrons are arranged.

[1]

(iii) Rubidium is another metal in Group I. Explain why a rubidium ion has a single positive electrical charge.

....

.... [1]

(b) Fig. 6.2 shows apparatus a student used to investigate electrochemical cells.

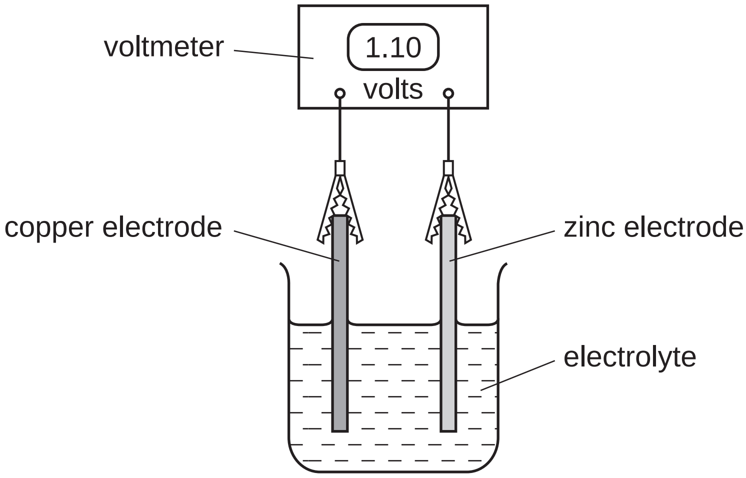

Fig. 6.2

Table 6.1 shows some properties of substances which the student thought might be suitable to produce the electrolyte.

Table 6.1

substance	type of bonding	solubility in water
calcium carbonate	ionic	insoluble
glucose	covalent	soluble
magnesium sulphate	ionic	soluble
silicon dioxide	covalent	insoluble

(i) State and explain which **one** of the substances in Table 6.1 is suitable for making the electrolyte.

....

....

.... [2]

(ii) Describe briefly what change the student could make to the apparatus in Fig. 6.2 in order to obtain a different value of the cell voltage.

....

.... [1]

7 A farmer has grown corn (maize) in the same field for several years.

He measured the concentration of nitrate in the soil in 2001 and in 2003.

Fig. 7.1 shows the results.

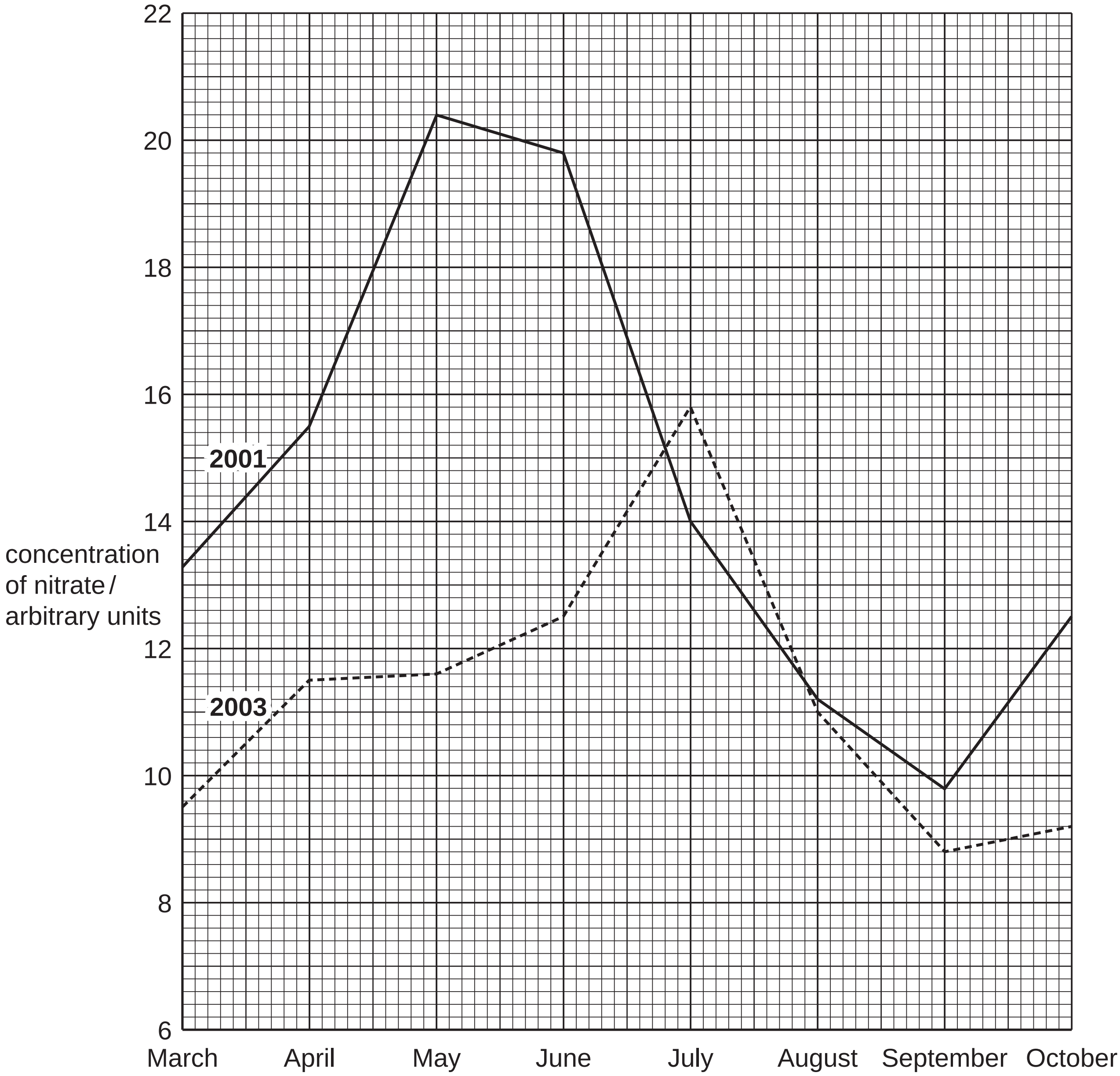

Fig. 7.1

(a) **(i)** In **2001**, in which month was the concentration of nitrate in the soil the highest?

.... [1]

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(ii) Describe two ways in which the nitrate concentration in the soil in 2003 was different from the concentration in 2001.

1. ....

2. .... [2]

(b) The farmer was worried that the nitrate concentration in the field might be too low. He decided to try to increase it.

(i) Explain why increasing the nitrate concentration in the field might help the farmer.

....

....

.... [2]

(ii) Suggest how he could increase the nitrate concentration in the field.

.... [1]

(c) The farmer feeds the maize to cattle. He sells meat from the cattle for people to eat.

(i) Draw a food chain to show this information.

[1]

(ii) What do the arrows in your food chain represent?

.... [1]

(d) When the maize plants are harvested, their roots are left in the soil.

Describe how the carbon compounds in the roots will be turned into carbon dioxide and released into the air.

....

....

.... [2]

8 The bodywork of a car is usually made from steel.

(a) If part of the bodywork goes very rusty it is usually removed and replaced with plastic filler, before being painted.

A car mechanic can use a magnet to find out if parts of the bodywork of a car have been filled with plastic filler.

He tests three areas of a car by placing a magnet near the surface as shown in Fig. 8.1.

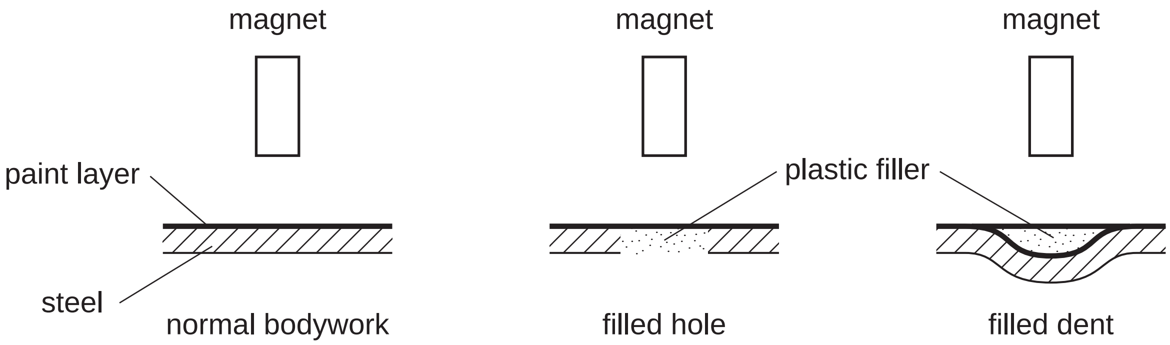

Fig. 8.1

(i) Complete the table.

area	effect on a magnet
normal bodywork	
filled hole	
filled dent	weakly attracted

[2]

(ii) What assumption have you made about the properties of plastic filler?

.... [1]

(iii) Would this method work if the bodywork was made of aluminium?

Explain your answer.

.... [1]

(iv) Suggest why the bodywork of some cars is made from aluminium rather than steel.

.... [1]

(b) Exhaust gases from a car engine leave the car through a solid steel exhaust pipe.

Complete the sentences below about solids and gases.
Use **only** the words **solid** or **gas**.

In a .... , the particles are closer together than in a ....

The forces of attraction between particles are stronger in a .... than in a ....

When a .... is heated it will eventually turn into a liquid.

In a .... , the particles can only vibrate and not move.

Heat energy will travel through a .... by conduction.

Heat energy will **not** travel through a .... by convection. [4]

9 Heat energy is obtained when hydrocarbon fuels are burned. Natural gas, methane, is an important hydrocarbon fuel. Natural gas is extracted from the Earth's crust.

(a) State why natural gas is called a *fossil fuel*.

....

.... [1]

(b) Explain why the burning of hydrocarbon fuels is thought to be causing significant changes to our environment.

....

....

.... [2]

(c) Biogas is an alternative source of methane made from biodegradable materials. Biogas may be obtained from landfill sites and reaction vessels called digesters.

Some information about two sources of biogas are shown in Table 9.1.

Table 9.1

	% of substances in the biogas mixture	
	biogas from a digester	biogas from landfill
methane	60 – 70	45 – 55
carbon dioxide	30 – 40	30 – 40
nitrogen	less than 1	5 – 15

(i) Describe a chemical test which would show that biogas contains carbon dioxide.

....

....

.... [2]

(ii) Use the information in Table 9.1 to suggest why 1.0 kg of biogas from a digester produces more heat energy when burned than 1.0 kg of biogas from a landfill site.

....

....

.... [2]

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10 Enzymes are proteins that act as catalysts.

(a) Explain the meaning of the term *catalyst*.

....

....

.... [2]

(b) Amylase, protease and lipase are enzymes that digest food in the alimentary canal.

Draw lines to link each enzyme with the food type that it digests, and the molecules that digestion produces.

food digested	enzyme	molecules produced
fats	amylase	amino acids
proteins	protease	fatty acids and glycerol
starch	lipase	maltose (sugar)

[3]

(c) A good diet contains fibre. Fibre cannot be digested.

(i) Describe what happens to fibre that is eaten.

....

....

.... [2]

(ii) Explain why fibre is an important part of a healthy diet.

....

.... [1]

(iii) Name **one** food that is a good source of fibre.

.... [1]

11 Starch, cellulose and proteins are compounds found in plants.

(a) (i) State the **chemical symbols** of the three elements which are combined together in starch.

.... [1]

(ii) The chemical bonds in starch are formed by atoms sharing pairs of electrons.

Name this type of chemical bonding.

.... [1]

(b) Plants contain proteins, which are compounds containing nitrogen atoms. These atoms have been obtained from gaseous nitrogen in the air by nitrogen fixation.

(i) Explain the meaning of the term *nitrogen fixation*.

....

....

.... [2]

(ii) When some types of protein are heated in sodium hydroxide solution, a gas is produced which turns damp red litmus paper blue.

Name this gas.

.... [1]

(iii) A nitrogen atom has a *nucleon number* of 14.

Explain this statement.

....

.... [2]

(c) State two important types of compound, other than those used for food, which may be extracted from plants.

1. ....

2. .... [2]

12 (a) The circuit in Fig. 12.1 was set up and the current measured by meters M_1, M_2,
and M_5.

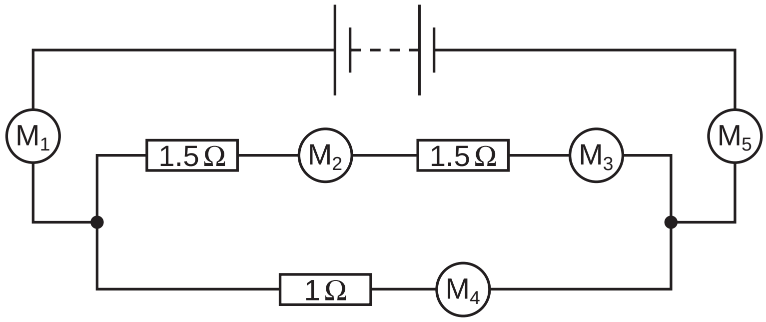

Fig. 12.1

(i) What type of meter is M_1?

.... [1]

(ii) The readings on M_1, M_3, M_4, and M_5 are shown in Table 12.1.

Complete the table for M_2.

Table 12.1

M_1 = 4A
M_2 =
M_3 = 1A
M_4 = 3A
M_5 = 4A

[1]

(iii) Calculate the total resistance of the 1.5 Ω and 1.5 Ω resistors in series.

.... [1]

(iv) The voltage across the 1 Ω resistor is 3 V.

Use the formula

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

to calculate the power consumed in the 1 Ω resistor.

Show your working.

.... W [1]

(b) The current flows through M_1 for one minute.

Calculate the charge which has passed.

State the formula that you use and show your working.

formula

working

.... C [2]

DATA SHEET
The Periodic Table of the Elements

Group

I	II											III	IV	V	VI	VII	0
							1 **H** Hydrogen 1										4 **He** Helium 2
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** Sulphur 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 †															

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

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

Key

a **X** b

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

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