UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

2524430016

COMBINED SCIENCE **5129/21**

Paper 2 **October/November 2011**

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 a soft pencil for any diagrams, graphs 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

This document consists of **19** printed pages and **1** blank page.

1 Three samples of human blood **A**, **B** and **C**, are mixed with three salt solutions of different concentrations.

The blood samples are then observed under the microscope.

The results are shown in Fig. 1.1

blood sample	observations
A	cells are small and wrinkled
B	cells are normal in size and shape
C	no cells can be seen

Fig. 1.1

(a) What type of blood cell would be seen in the largest numbers in each of the samples **A** and **B**?

.....[1]

(b) Which blood sample is mixed with the most concentrated salt solution?

.....[1]

(c) Explain the observation for blood sample **C**.

.....

.....

.....

.....

.....[2]

2 A cyclist travels along a road.

For Examiner's Use

Fig. 2.1 shows how the speed of the cyclist varies with time.

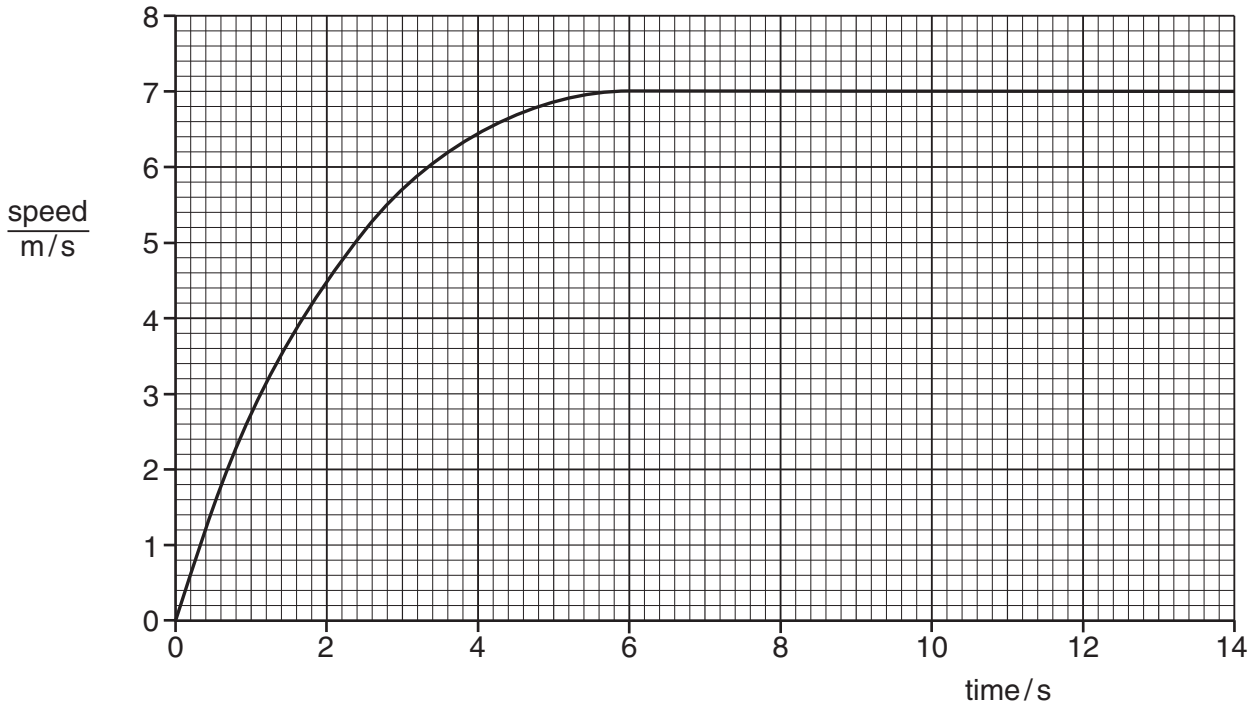


Fig. 2.1

(a) Explain the difference between speed and velocity.

.....[1]

(b) Use Fig. 2.1 for the following.

(i) Complete the following sentence.

The acceleration of the cyclist is zero from

..... seconds to ..... seconds. [1]

(ii) Calculate how far the cyclist travels between the times of 9 seconds and 13 seconds.

distance = ... m [2]

(c) Further along the road, the cyclist stops the bicycle.

Complete the following sentence about energy.

As the cyclist uses the brakes, ... energy is converted

into .....energy. [2]

3 Methane is a hydrocarbon.

(a) State the name of the homologous series to which methane belongs.

..... [1]

(b) Methane is used as a fuel.

The equation for the combustion of methane is

$$CH_4 + 2O_2 \longrightarrow CO_2 + 2H_2O$$

The relative molecular mass M_r of methane is 16.
[A_r: C, 12; O, 16]

Complete the following sentences.

16 g of methane reacts with ..... g of oxygen and produces ..... g of carbon dioxide.

1.6 g of methane reacts with ..... g of oxygen and produces ..... g of carbon dioxide.

0.4 g of methane produces ..... g of carbon dioxide. [4]

(c) State the test for oxygen.

test .....

result .....

..... [2]

4 Complete Fig. 4.1.

particle	relative mass	relative charge
proton	1	
neutron		
electron	negligible	–1

Fig. 4.1

[3]

5 Fig. 5.1 shows the structure of the heart in section as seen from the front.

For Examiner's Use

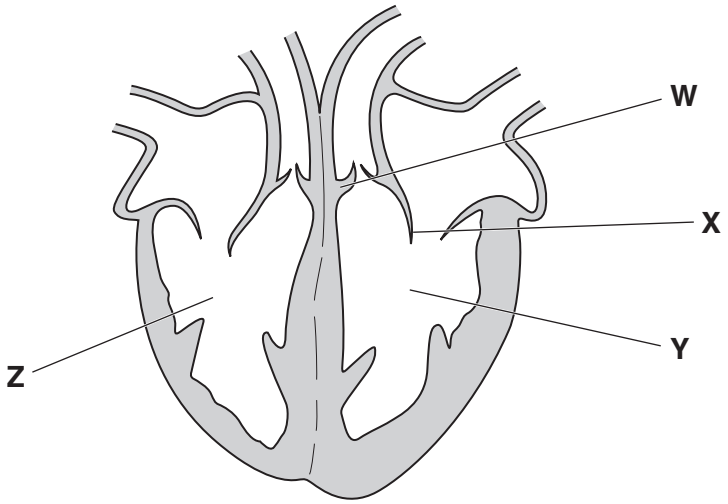


Fig. 5.1

(a) What type of tissue is the heart mainly composed of?

.....[1]

(b) When the chamber labelled **Y** contracts, what happens to

(i) valve **W**, ...[1]

(ii) valve **X**? .....[1]

(c) When chamber **Z** contracts, what effect does this have on the blood in that chamber?

.....

.....

.....

.....[2]

(d) How does the composition of the blood in chamber **Z** differ from that in chamber **Y**?

.....

.....

.....[2]

6 A pupil places a pin in front of a plane mirror so that he can see an image of the pin. Light from the pin is incident on the plane mirror as shown in Fig. 6.1. The position of the image of the pin is also shown.

For Examiner's Use

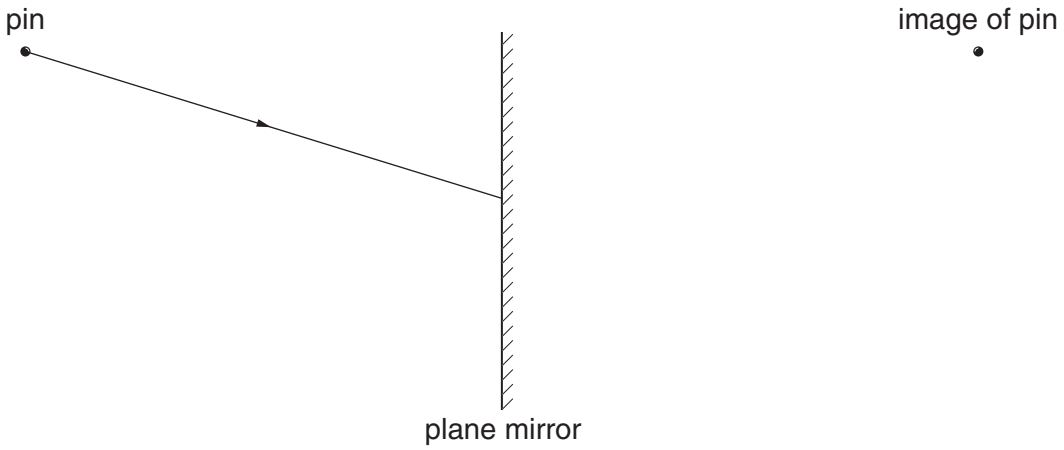


Fig. 6.1

(a) On Fig. 6.1 draw

(i) the normal where the ray is incident on the mirror, [1]

(ii) the reflected ray. [1]

(b) The pin is moved to the right, towards the mirror.

How does the position of the image of the pin move?

.....[1]

(c) Light is an example of a transverse wave.

Name an example of a longitudinal wave.

..... [1]

7 Chlorine is a diatomic gas in Group VII of the Periodic Table.

For Examiner's Use

(a) Complete Fig. 7.1 to show the outer shell electrons in a molecule of chlorine.

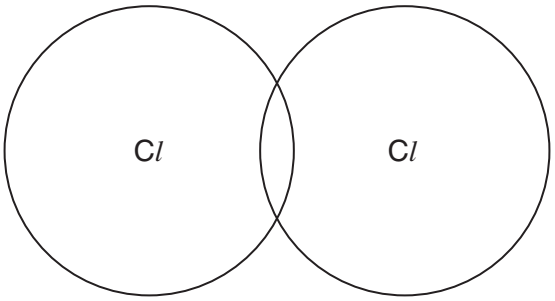


Fig. 7.1

[2]

(b) State how the boiling point of the elements in Group VII changes as the group is descended.

.....[1]

(c) State **one** industrial use of chlorine.

.....[1]

(d) Fig. 7.2 shows chlorine being bubbled into potassium iodide solution.

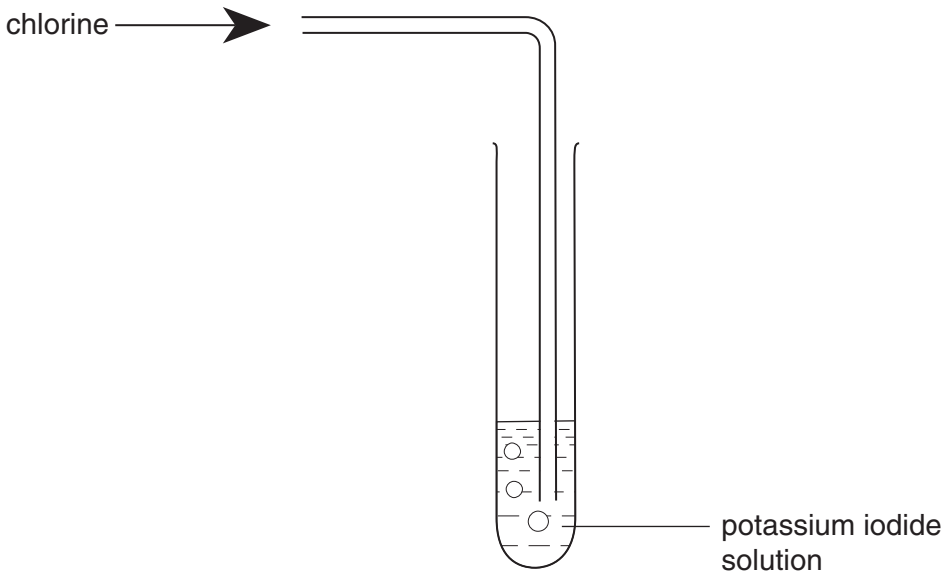


Fig. 7.2

State the names of the **two** products of the reaction between chlorine and potassium iodide.

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

8 **(a)** There are four types of birth control – natural, chemical, mechanical and surgical.

For Examiner's Use

(i) On Fig. 8.1, draw a line to match each birth control method to its type.
One has been done for you.

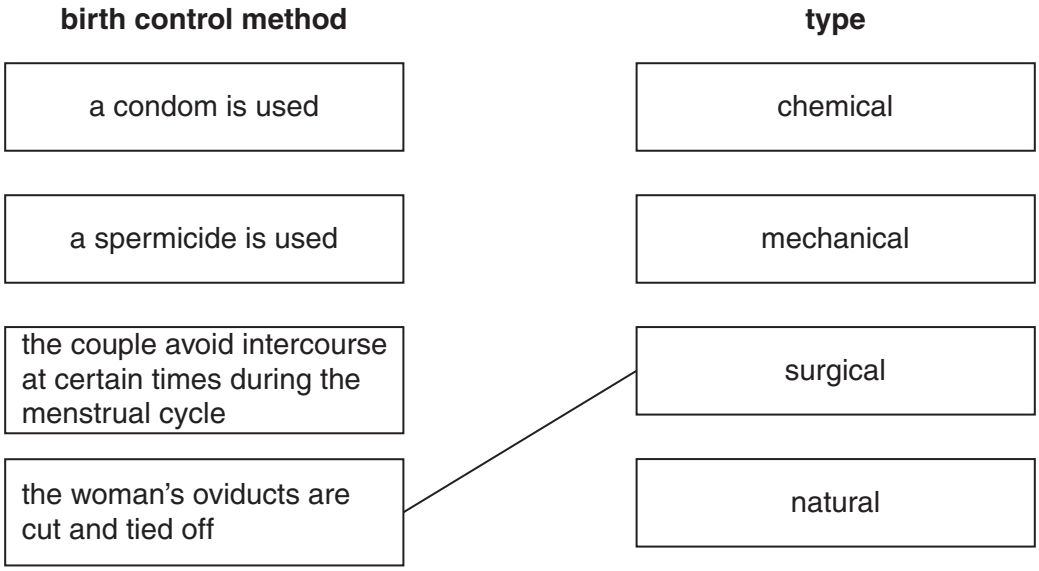


Fig. 8.1

[3]

(ii) Name a birth control method that depends on the use of hormones.

.....[1]

(iii) Which method of birth control helps to protect against HIV infection?
Explain how.

method .....

explanation .....

.....

[2]

(b) Describe **two** advantages for the baby of breast-feeding instead of bottle-feeding.

1. .....

.....

2. .....

.....

[2]

9 A circuit contains a cell, a lamp, an ammeter and a variable resistor all connected in series.

For Examiner's Use

(a) In the space below, draw a diagram of this circuit.

[3]

(b) When the current in the lamp is 0.2 A, the potential difference across the lamp is 1.8 V.

Calculate

(i) the resistance of the lamp,

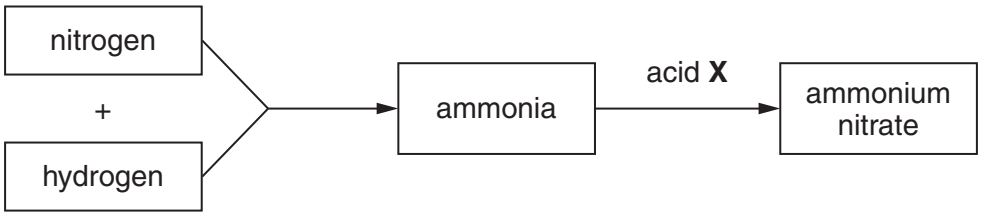
resistance = ... unit ..... [3]

(ii) the power of the lamp.

power = ... W [2]

10 Study the following reaction scheme.

For Examiner's Use



(a) (i) Name the catalyst used to speed up the reaction between nitrogen and hydrogen in the manufacture of ammonia.

..... [1]

(ii) Balance the equation for the formation of ammonia.

N_2 + ... H_2 ⟶ ..... NH_3 [1]

(iii) Ammonia solution turns Universal Indicator blue.
Suggest the pH of the solution.

..... [1]

(b) Name acid **X** and state the type of reaction that occurs between acid **X** and ammonia.

acid **X** .....[1]

type of reaction .....[1]

11 **(a)** Define an *enzyme*.

For Examiner's Use

.....

.....

.....[2]

(b) Fig. 11.1 shows the effect of pH on the activity of the enzyme amylase at two different temperatures.

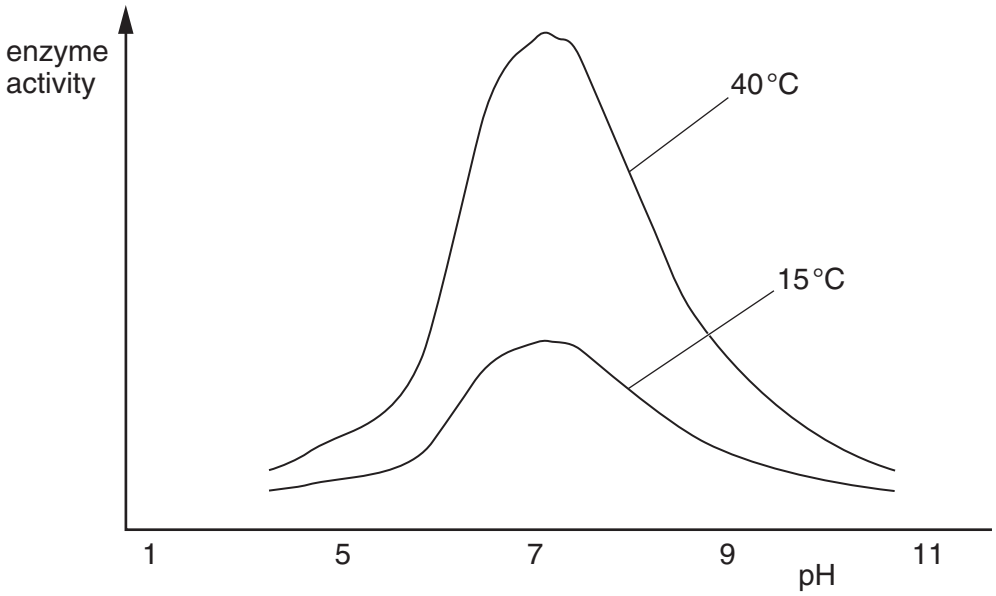


Fig. 11.1

Use Fig. 11.1 to describe how this enzyme's activity is affected by

(i) temperature, ...

.....

.....

(ii) pH. .....

.....

.....
[2]

(c) On Fig. 11.1, draw a line to show the effect of pH on the activity of the enzyme at 100 °C. [1]

12 A copper saucepan containing cold water is heated as shown in Fig. 12.1.

For Examiner's Use

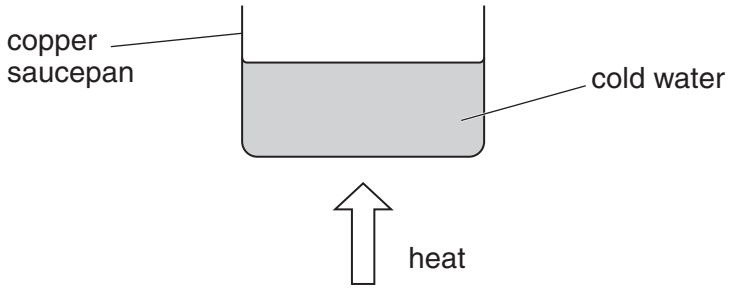


Fig. 12.1

(a) Name the process by which heat is transferred through the copper.

..... [1]

(b) The water at the bottom of the saucepan is heated.

Explain how the rest of the water becomes hot.

.....

.....

.....

.....[3]

(c) The hot water is placed in a container that is then sealed with a cork.
The water is required to stay warm for as long as possible.

State the advantage of

(i) using a plastic container rather than a metal container,

.....[1]

(ii) using a white, rather than black, outer surface for the container.

.....[1]

13 The following is a list of apparatus.

For Examiner's Use

balance	**measuring cylinder**	**condenser**	
filter funnel	**burette**	**pipette**	**thermometer**

(a) From the list, name one piece of apparatus which **must** be used when each of the following experiments is carried out.

Each piece of apparatus may be used once, more than once or not at all.

(i) distilling a mixture of ethanol and water .....[1]

(ii) separating mud from muddy water .....[1]

(iii) finding the volume of a liquid .....[1]

(b) From the list, complete the following sentence.

During a titration experiment, an alkali is measured into a conical flask using a ..... and an acid is added to the alkali using a ..... . [2]

14 Fig. 14.1 shows an alveolus in the lungs.

For Examiner's Use

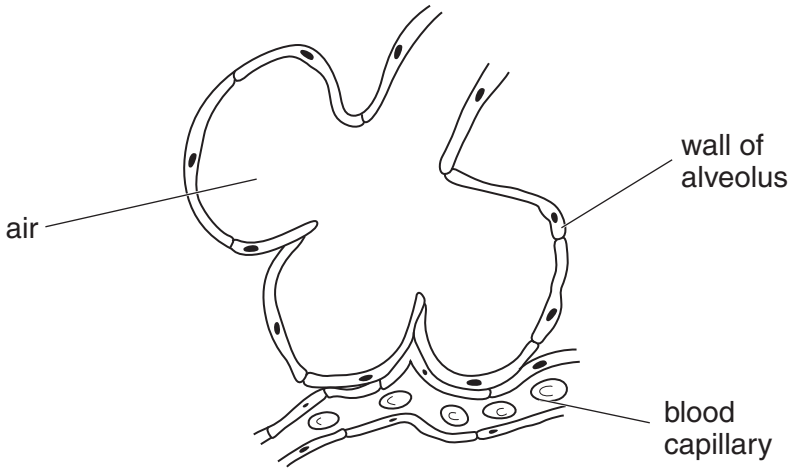


Fig. 14.1

(a) State **two** ways in which the structure of alveoli allows the efficient exchange of gases between blood and air.

1. .....

.....

2. .....

.....
[2]

(b) Name a substance that is excreted through the alveoli.

.....[1]

(c) Explain why air pollution by smoke or soot causes the alveoli to be less efficient for gas exchange.

.....

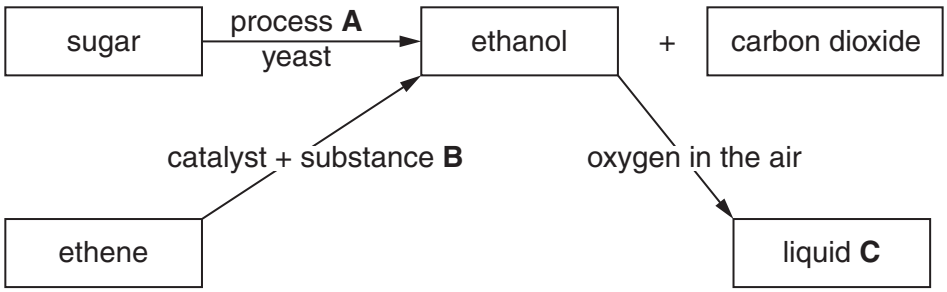
.....

.....

.....[2]

15 Study the following reaction scheme.

For Examiner's Use



(a) Name

(i) process **A**, ... [1]

(ii) substance **B**, ... [1]

(iii) liquid **C**. ..... [1]

(b) State the name of the substances, present in yeast, which cause process **A** to occur.

.....[1]

(c) Complete the following sentences.

Ethene is made into poly(ethene) by a process known as .....

polymerisation.

The ethene molecules are known as the ..... units. [2]

16 **(a)** State a test to show the difference between magnetic and non-magnetic materials.

For Examiner's Use

.....

.....[1]

(b) Iron and steel are both magnetic materials.

Describe a difference between the magnetic properties of iron and steel.

.....

.....[1]

17 A spacecraft has a mass of 50 000 kg and the accelerating force is 225 000 N.

(a) Calculate the acceleration of the spacecraft.

acceleration = ... units ..... [3]

(b) The spacecraft is ejecting exhaust gases. The accelerating force does not change but the acceleration increases.

Explain why the acceleration increases.

.....

.....[1]

18 Fig. 18.1 shows a food chain.

For Examiner's Use

grass → wildebeest → cheetah

Fig. 18.1

(a) A food chain shows the energy flow in an ecosystem.

In this food chain, how does the amount of energy in the cheetahs compare with the amount of energy in the grass?

.....

.....[1]

(b) There are fewer cheetahs than wildebeest.

Use ideas of energy flow in food chains to explain why.

.....

.....

.....

.....[2]

(c) What type of organisms, important in the ecosystem, are not shown in this food chain?

.....[1]

19 Fig. 19.1 shows the arrangement of the electrons in the atoms of six different elements, **R**–**W**.

The letters are not the chemical symbols of the elements.

For Examiner's Use

atom	**R**	**S**	**T**	**U**	**V**	**W**
electron arrangement	2,8,6	2,8,4	2,6	2,8,8	2,7	2,2

Fig. 19.1

Use the letters in Fig. 19.1 to answer the following questions.

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

(a) Which element has an atomic number 14? ..... [1]

(b) Which element has a nucleon number 16 and has an isotope that contains 8 neutrons?

..... [1]

(c) Which **two** elements are in the same group of the Periodic Table?

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

(d) Which element does **not** form an acidic oxide? .....[1]

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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 Sulfur 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	209 Po Polonium 84	210 At Astatine 85	222 Rn Radon 86
223 Fr Francium 87	226 Ra Radium 88	227 Ac Actinium 89 †															

140 Ce Cerium 58	141 Pr Praseodymium 59	144 Nd Neodymium 60	147 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	231 Pa Protactinium 91	238 U Uranium 92	237 Np Neptunium 93	244 Pu Plutonium 94	243 Am Americium 95	247 Cm Curium 96	247 Bk Berkelium 97	251 Cf Californium 98	252 Es Einsteinium 99	257 Fm Fermium 100	258 Md Mendelevium 101	259 No Nobelium 102	260 Lr Lawrencium 103

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

Key

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

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