UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

5250328429

COMBINED SCIENCE **0653/22**

Paper 2 (Core) **October/November 2013**

1 hour 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 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 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.

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

UNIVERSITY of CAMBRIDGE International Examinations

For Examiner's Use

1 **(a)** Fig. 1.1 shows apparatus that can be used to test the electrical conductivity of the materials contained in the beakers **Q**, **R** and **S**.

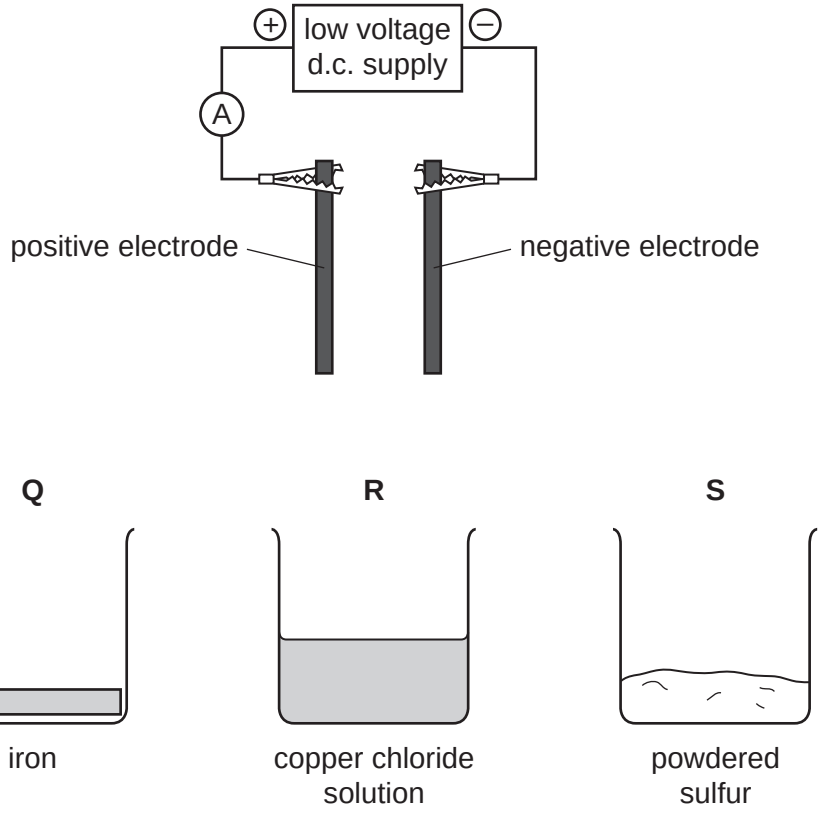


Fig. 1.1

(i) The contents of beakers **Q** and **S** are tested for electrical conductivity by lowering the electrodes into the beakers.

Predict and explain the results.

beaker **Q**

prediction .....

explanation .....

beaker **S**

prediction .....

explanation ..... [3]

For Examiner's Use

(ii) When the electrodes are lowered into the solution in beaker **R**, the following observations are made.

- Bubbles of gas form on the surface of the positive electrode.
- A layer of an orange solid appears on the surface of the negative electrode.

Name the gas that forms and the substance in the orange layer.

gas .....

orange layer ..... [2]

(iii) State the name of the process described in **(ii)**.

..... [1]

(b) Fig. 1.2 shows names and molecular structure diagrams of some compounds containing carbon.

Draw straight lines to match the structures with names. One line has been drawn as an example.

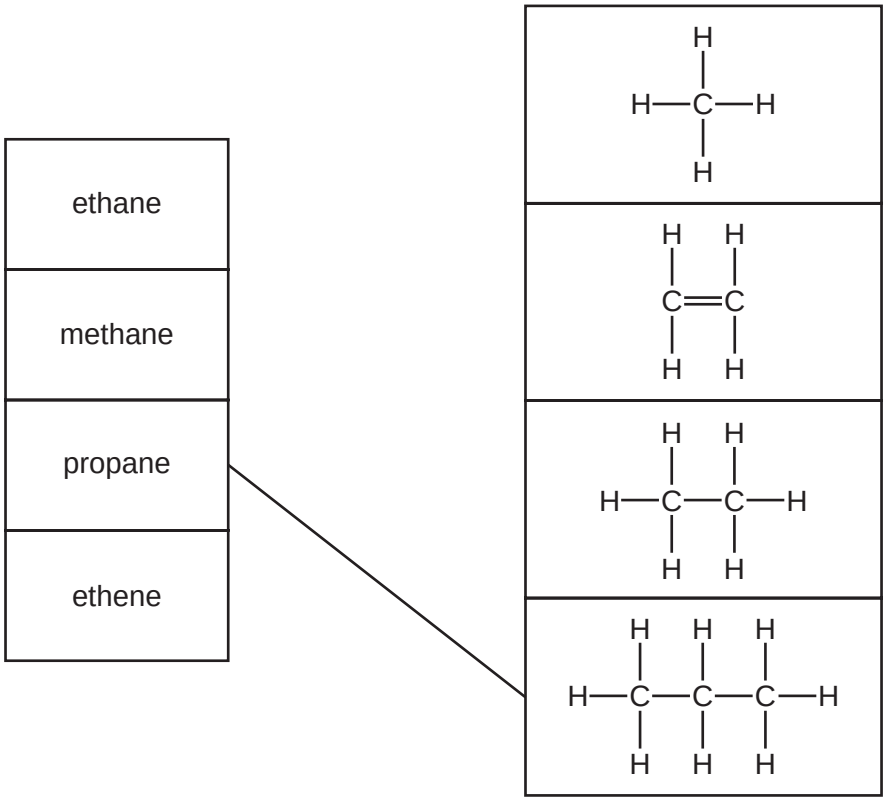


Fig. 1.2

[2]

(c) Fig. 1.3 shows the structure of one molecule of a type of compound called a CFC (chlorofluorocarbon).

For Examiner's Use

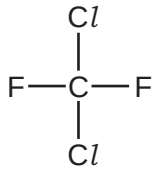


Fig. 1.3

(i) State the chemical formula of the molecule whose structure is shown in Fig. 1.3.

..... [1]

(ii) Explain whether or not the molecule in Fig. 1.3 is an example of a hydrocarbon.

.....

..... [1]

For Examiner's Use

2 **(a)** Use the words or phrases below to complete the sentences.

amplitudes **frequencies** **slows down** **speed** **speeds up**

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

(i) Light ..... when it travels from air to glass.

(ii) In the electromagnetic spectrum, the waves are arranged in order of

..... .

(iii) 20 Hz to 20 000 Hz is the approximate human range of audible

..... .

(iv) The ..... of sound waves determines the loudness of the sounds.

[4]

(b) Fig. 2.1 shows a demonstration of sound transmission using a bell jar.

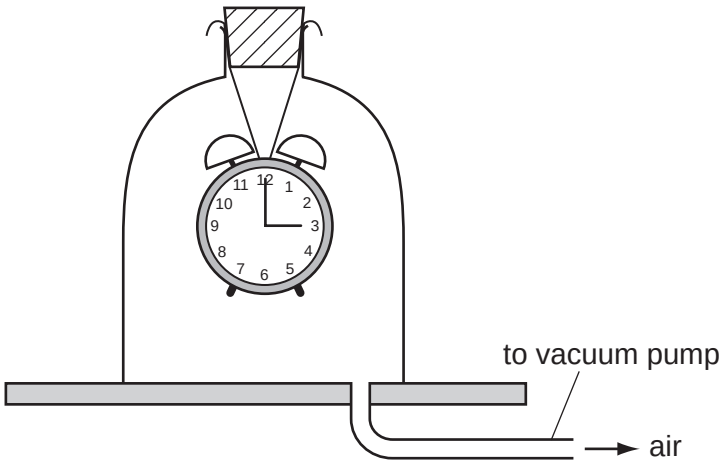


Fig. 2.1

As the air is removed from the bell jar, the ringing sound from inside the bell jar gets quieter. When all the air has been removed, the bell cannot be heard.

Explain these observations.

.....

.....

.....

..... [3]

3 **(a)** Fig. 3.1 shows cross-sections of a root and a stem.

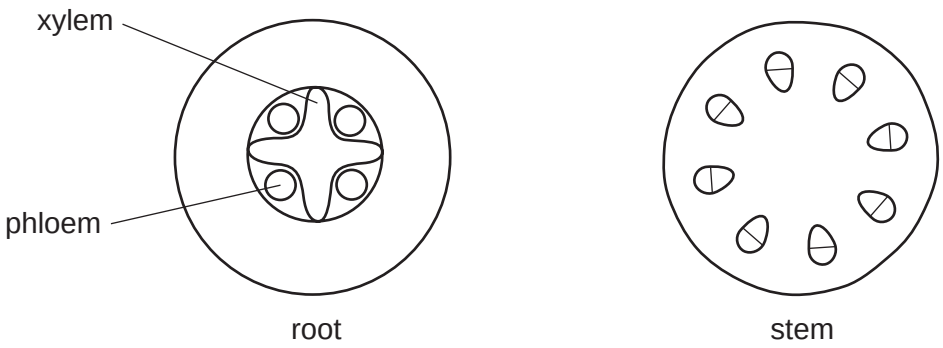


Fig. 3.1

(i) On Fig. 3.1, use label lines to indicate the positions of the xylem and phloem on the diagram of the stem. [2]

(ii) Describe the functions of xylem and phloem.

xylem .....

.....

.....

phloem .....

.....

.....

[4]

(b) The roots of most plants have root hairs near their tips.

Researchers grew two types of plants, **A** and **B**, in soil with different concentrations of phosphate ions. They measured the mean number of root hairs in a small area of the roots, and also the mean length of the root hairs.

Table 3.1 shows their results.

Table 3.1

type of plant	phosphate concentration	mean number of root hairs per unit area	mean length of root hairs / micrometres
A	low	1.26	175
	high	1.70	149
B	low	1.41	225
	high	1.85	52

(i) Describe **two** ways in which the addition of phosphate ions to the soil affects the root hairs in type **A** plants.

1 .....

.....

2 .....

..... [2]

(ii) Compare the effect of adding phosphate ions to the soil for type **A** plants and for type **B** plants.

.....

.....

..... [2]

(iii) Explain why a reduction in the length of its root hairs could reduce the rate of growth of a plant.

.....

.....

.....

.....

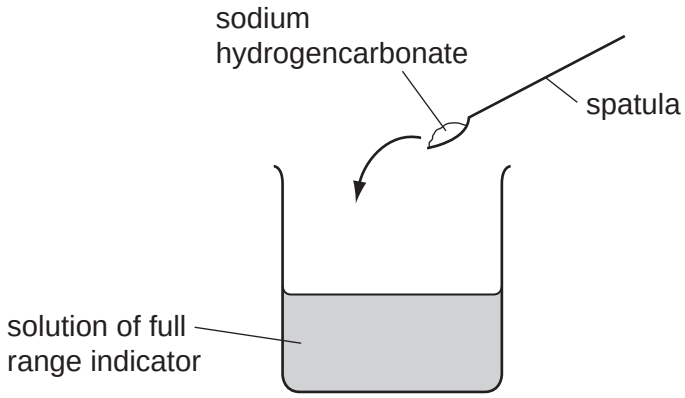
..... [3]

[Turn over

For Examiner's Use

4 Sodium hydrogencarbonate, $NaHCO_3$, is a white solid compound which is soluble in water.

(a) A student adds some sodium hydrogencarbonate to a beaker which containes an aqueous solution of full range indicator (Universal Indicator).



When the sodium hydrogencarbonate dissolves, the solution changes colour from green to blue.

(i) State and explain briefly how the pH of the mixture changes when the sodium hydrogencarbonate dissolves.

.....

..... [2]

(ii) The student then adds excess dilute hydrochloric acid to the blue solution.

Apart from an increase in volume, state **two** observations that are made when the acid is added.

1 .....

.....

2 .....

..... [2]

(b) Fig. 4.1 shows apparatus a teacher uses to demonstrate the heating of sodium hydrogencarbonate.

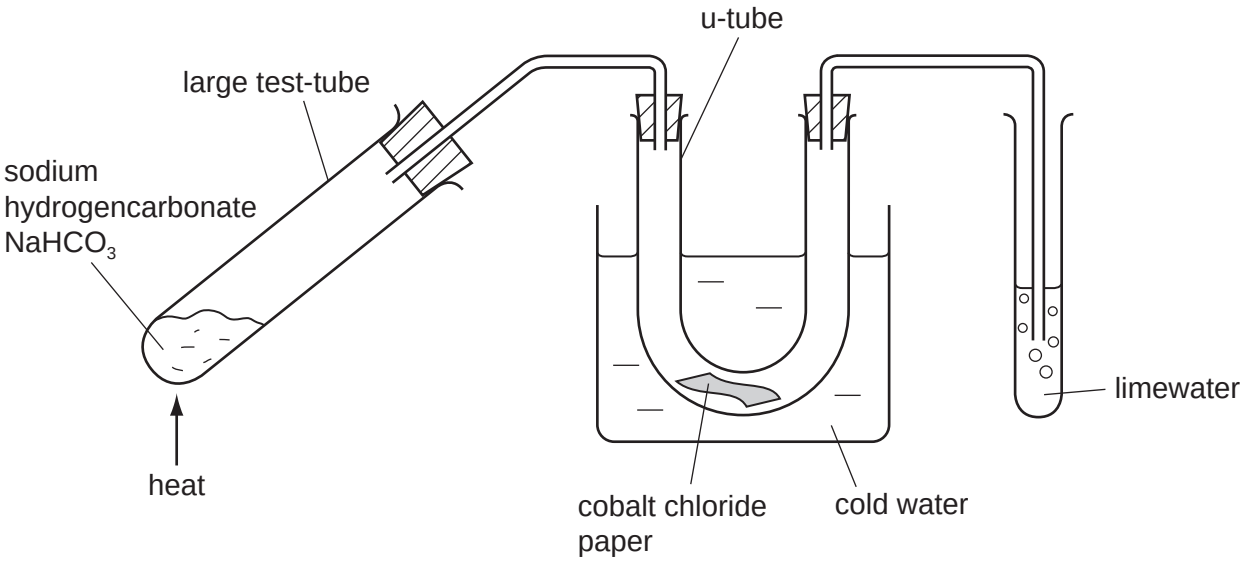


Fig. 4.1

The solid is heated strongly for a few minutes.

- The cobalt chloride paper changes colour from blue to pink.
- A gas bubbles out through the limewater, turning it cloudy.

After the reaction, a white solid, sodium carbonate, remains in the large test-tube.

(i) Explain how the observations show that both water and carbon dioxide are produced.

.....

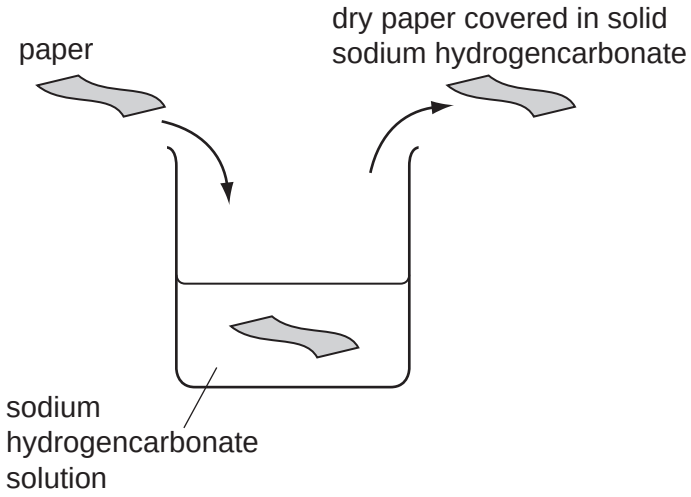
.....

..... [2]

For Examiner's Use

(ii) A student places a piece of paper into a solution of sodium hydrogencarbonate.

She removes the paper and allows it to dry. She notices that crystals of solid sodium hydrogencarbonate are left on the paper.



The student found that it is now difficult to set fire to the paper.

Use the results of the experiment in Fig. 4.1 to suggest why the student finds it difficult to get the paper to burn.

.....

.....

.....

..... [2]

5 **(a)** Fig. 5.1 shows a bicycle with two lights **A** and **B** at the front.

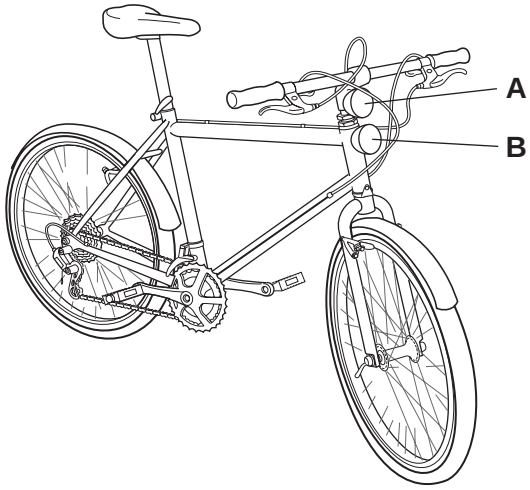


Fig. 5.1

Fig. 5.2 shows the circuit used to power the two lights.

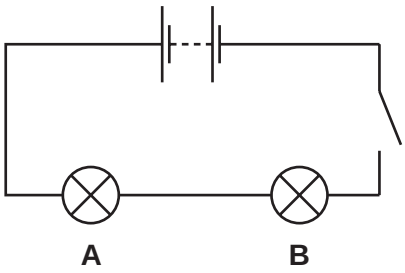


Fig. 5.2

(i) State the name given to this type of circuit arrangement.

.....[1]

(ii) To calculate the resistance of light **A**, the current flowing through it and the voltage across it must be measured.

On Fig. 5.2, using the correct symbols, draw an ammeter and a voltmeter correctly connected to make these measurements. [4]

For Examiner's Use

(iii) The resistance of light **A** in the circuit is 5 Ω and the resistance of light **B** is 10 Ω.

Calculate the combined resistance of the two lights.

State the formula that you use and show your working.

formula

working

..... Ω [2]

(b) The bicycle was made from a block of aluminium alloy of mass 9000 g and volume 3000 cm^3.

Calculate the density of aluminium in g/cm^3.

State the formula that you use and show your working.

formula

working

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

(c) The bicycle is ridden by a cyclist. The cyclist is cooled by sweating.

Explain, in terms of particles, how sweating cools his body.

.....

.....

..... [1]

6 Fig. 6.1 shows the male reproductive system.

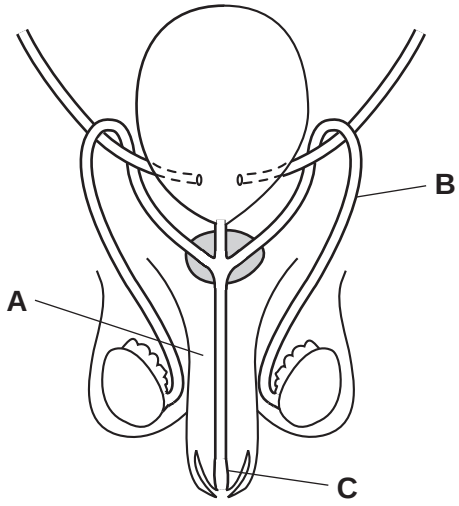


Fig. 6.1

(a) Name the parts labelled **A**, **B** and **C**.

A .....

B .....

C ..... [3]

(b) An infection may block the tube labelled **B**. If the tube on the other side is also blocked, the man may be unable to have children.

Explain why.

.....

.....

..... [2]

(c) HIV / AIDS is a disease that can be passed on by sexual intercourse.

(i) What does HIV stand for?

..... [1]

(ii) State **one** way in which a man with HIV / AIDS can avoid passing it to another person.

..... [1]

For Examiner's Use

7 **(a)** The elements chlorine, bromine and iodine are found in Group 7 of the Periodic Table.

(i) Complete Table 7.1 by writing the physical state (solid, liquid or gas) at room temperature (20 °C) of the elements.

Table 7.1

element	physical state
bromine	
iodine	

[1]

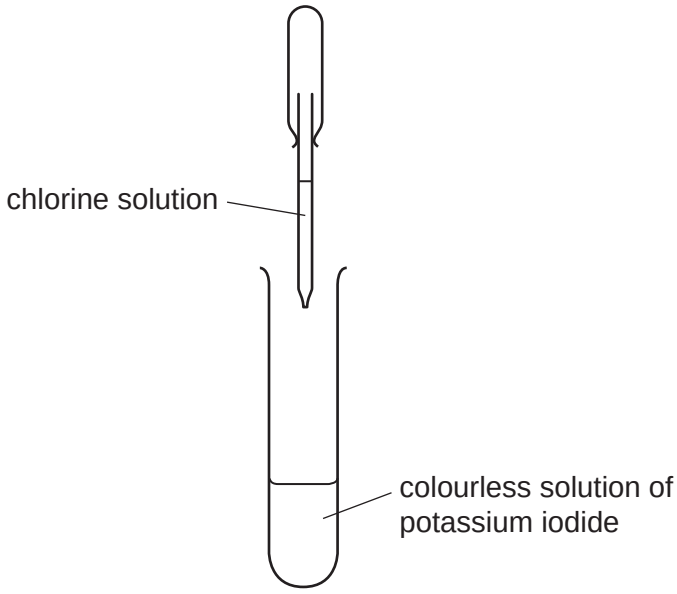
(ii) Explain why an iodine atom is larger and heavier than a bromine atom.

.....

.....

..... [2]

(iii) An aqueous solution containing chlorine is added to a colourless solution of potassium iodide.



Describe and explain briefly what is observed in this reaction.

observation .....

explanation .....

..... [2]

(b) Explain why a dilute solution of chlorine is usually added to drinking water before it is supplied to homes.

For Examiner's Use

.....

.....

..... [2]

(c) Helium is a gas found in Group 0 of the Periodic Table.

Some helium is added to a flask containing chlorine and left for a few days.

Predict and explain whether the flask now contains a mixture of the two elements or a compound.

.....

.....

..... [2]

For Examiner's Use

8 **(a)** Fig. 8.1 shows a car moving along a road.

(i) Draw and label arrows on Fig. 8.1 to show the directions of the driving and friction forces acting on the car. [1]

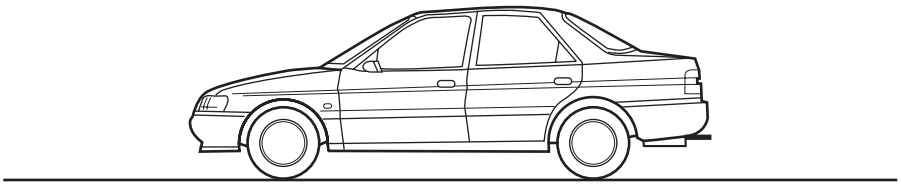


Fig. 8.1

(ii) State **one** source of friction on the moving car.

..... [1]

(iii) The driving and friction forces are balanced.

Explain what is meant by the phrase *forces are balanced*.

.....

..... [1]

(iv) Describe the movement of the car when these forces are balanced.

.....

..... [1]

(v) Apart from the driving and friction forces there are other forces acting on the car.

Name **one** of these forces.

..... [1]

(b) **(i)** The car travels a distance of 400 m down a hill in 25 seconds.

Calculate the average speed of the car.

State the formula that you use and show your working.

formula

working

..... m / s [2]

(ii) The car is going faster at the bottom of the hill than it was at the top.

State the type of energy which the car has gained. ..... [1]

(iii) State the type of energy which the car will have lost as it travels down the hill.

..... [1]

[Turn over

For Examiner's Use

9 **(a)** Fig. 9.1 shows a food web in the Antarctic Ocean.

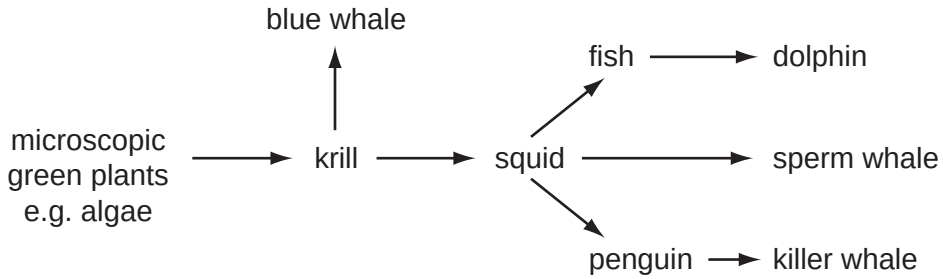


Fig. 9.1

(i) State the term used for organisms such as the microscopic green plants that make their own organic nutrients.

..... [1]

(ii) Name **one** organic nutrient that is made by the green plants.

..... [1]

(iii) State what is shown by the arrows in the food web.

..... [1]

(b) Fishing boats catch large quantities of krill in the Antarctic Ocean.

Suggest how this could affect the numbers of the organisms in the food web in Fig. 9.1.

.....

.....

.....

..... [2]

(c) There is concern that global warming will damage the environment in the Antarctic Ocean.

Name **two** gases that contribute to global warming.

1 .....

2 ..... [2]

BLANK PAGE

DATA SHEET
The Periodic Table of the Elements

	Group																	
	I	II									III	IV	V	VI	VII	0
																4 He Helium 2
	1 H Hydrogen 1															
	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	Po Polonium 84	At Astatine 85	Rn Radon 86
	Fr Francium 87	226 Ra Radium 88	227 Ac Actinium 89 †															

*	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

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

Key

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

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