Centre Number	Candidate Number	Name

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CO-ORDINATED SCIENCES **0654/02**

Paper 2 (Core)

October/November 2006

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.

Answer **all** questions.
A copy of the Periodic Table is printed on page 28.

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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4	
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11	
Total	

This document consists of **25** printed pages and **3** blank pages.

1 Fig. 1.1 shows five birds that live in New Zealand.

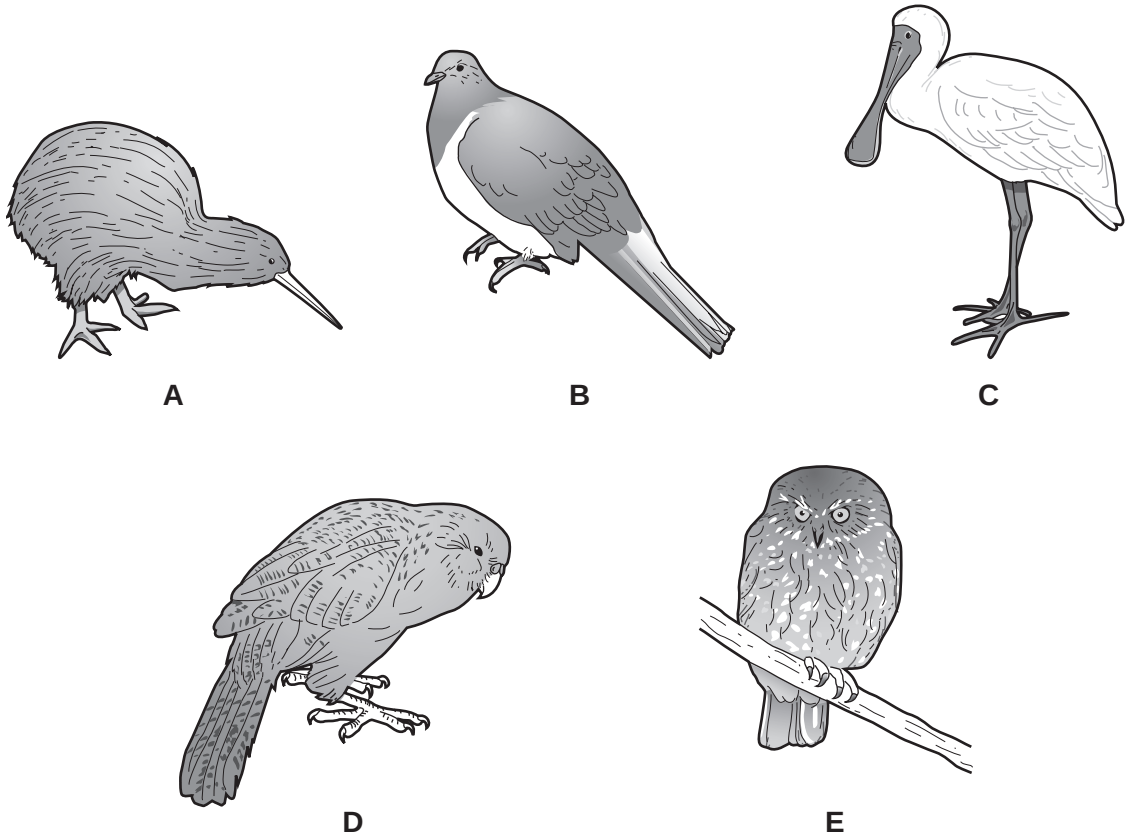

Fig. 1.1

(a) This is a key to these five birds.

1a	has wings	go to 2
b	no wings	*Apteryx mantelli*
2a	tail at least half as long as body	go to 3
b	tail less than half as long as body	go to 4
3a	speckled markings on body	*Strigops habroptilus*
b	large area of white on body	*Hemiphaga novaeseelandiae*
4a	speckled markings on body	*Ninox novaeseelandiae*
b	large area of white on body	*Platalea regia*

Use the key to identify the following birds. Write the **letter** of the bird next to its name.

Strigops habroptilus .....

Hemiphaga novaeseelandiae .....

Ninox novaeseelandiae .....

Platalea regia ..... [4]

(b) Each kind of living organism that is known to exist has been given a binomial. *Apteryx mantelli* is the binomial of the kiwi.

(i) What does a binomial tell you about an organism?

.....

.....

..... [2]

(ii) Give the binomial of **one** organism, other than a bird, that you know.

..... [1]

2 Fig. 2.1 shows an electric circuit.

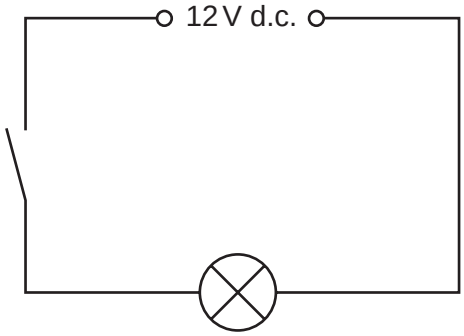

Fig. 2.1

(a) (i) Name an instrument which could measure the electric current in this circuit.

..... [1]

(ii) When the switch is closed, a current of 2 A flows through the lamp.
How much charge passes through the lamp every second?

..... coulombs [1]

(iii) Calculate the resistance of the lamp.

Show your working and state the formula that you use.

formula used

working

..... Ω [2]

(iv) A second identical lamp is now connected in series with the first lamp in this circuit.

Complete Fig. 2.2 to show the arrangement of the lamps in the circuit.

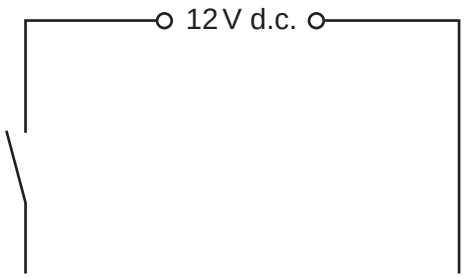

Fig. 2.2 [1]

(v) State the combined resistance of the two lamps.

..... Ω [1]

(b) An electric food mixer has a 3 speed control switch and an on/off switch. This is produced using two identical resistors as shown in Fig. 2.3.

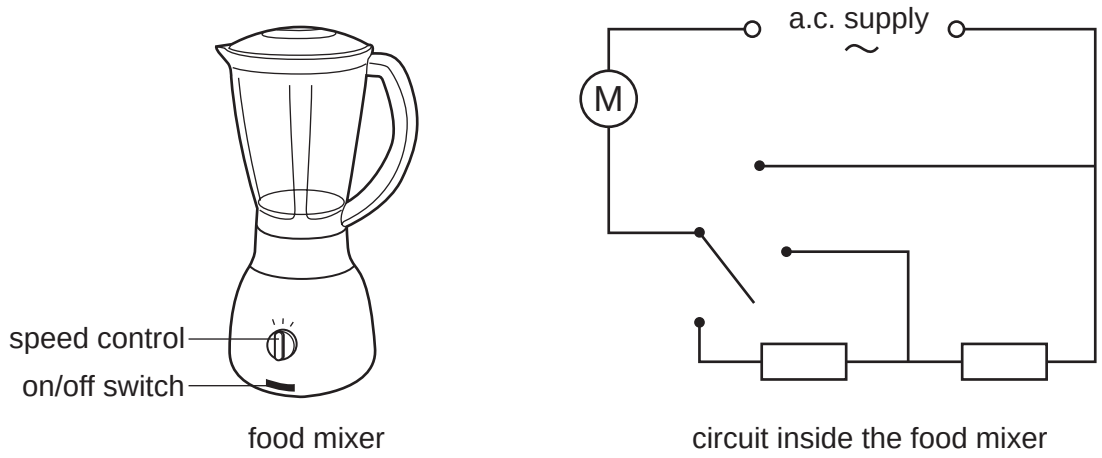

Fig. 2.3

(i) The circuit diagram does not show the on/off switch. On the circuit diagram in Fig. 2.3, write the letter **S** to show where the switch could be. [1]

(ii) The mixer operates at a voltage of 220 V and has a current of 5 A passing through it when it is being used.

Calculate the power input to the mixer.

Show your working and state the formula that you use.

formula used

working

..... W [2]

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3 **(a)** Fig. 3.1 shows an experiment set up by a student to investigate the conditions needed for iron to rust.

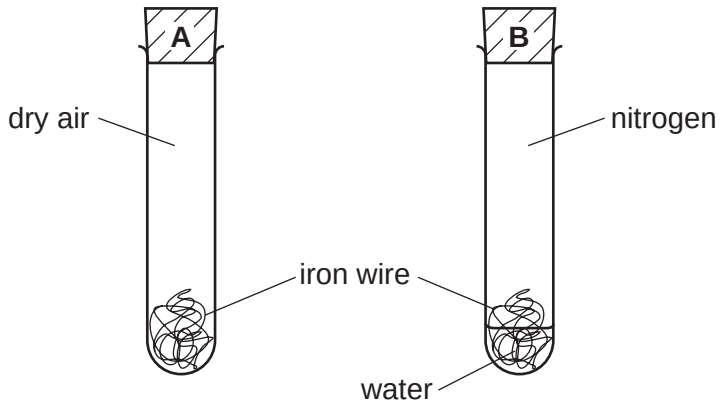


Fig. 3.1

(i) Explain whether or not the iron wire in each of tube **A** and tube **B** is expected to rust.

.....

.....

.....

..... [3]

(ii) Mild steel contains mainly iron. Mild steel can be prevented from rusting by covering it with a layer of paint, a layer of oil or a layer of an unreactive metal such as gold.

Explain which one of the substances mentioned above would normally be used to prevent the rusting of car body panels made from mild steel.

.....

.....

.....

..... [2]

(b) When the mineral chromite, $FeCr_2O_4$, is heated with carbon, an alloy of iron and chromium called ferrochrome is formed. The balanced equation for this reaction is shown below.

$$FeCr_2O_4 + 4C \longrightarrow \underbrace{Fe + 2Cr}_{\text{ferrochrome}} + 4CO$$

(i) State the number of different elements in chromite.

.....

[1]

(ii) The reaction shown above involves oxidation and reduction. Explain which substance is oxidised and which is reduced.

.....

.....

.....

[2]

[Turn over

4 Fig. 4.1 shows the bones and muscles associated with the elbow joint.

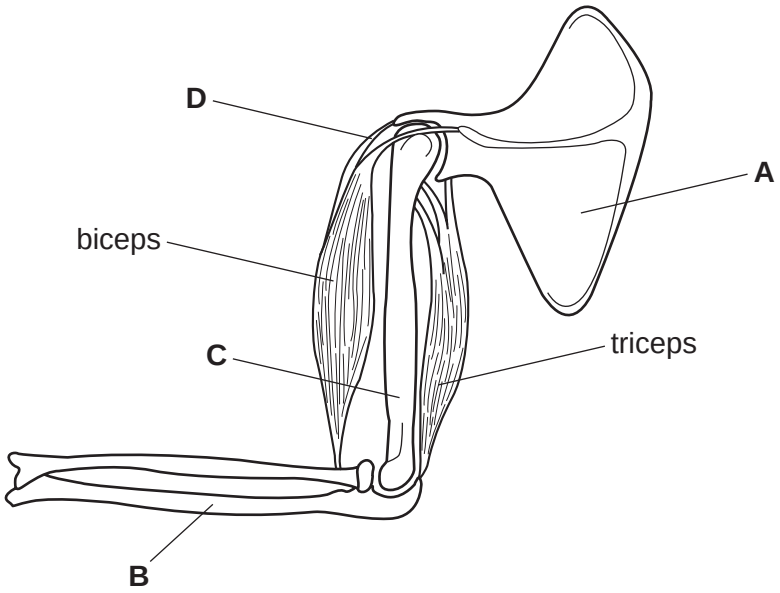


Fig. 4.1

(a) (i) Name structures **A** to **D**, choosing from this list.

humerus **patella** **radius** **scapula** **tendon** **ulna**

A .....

B .....

C .....

D ..... [4]

(ii) On Fig. 4.1, draw an accurate labelling line to show where synovial fluid is present, and label it **F**. [1]

(iii) State the function of synovial fluid.

.....

..... [1]

(b) A girl touches a very hot object with her arm. Her biceps muscle quickly contracts, bending her arm and lifting up her hand.

(i) What is the stimulus for this action?

..... [1]

(ii) What is the effector in this action?

..... [1]

(iii) Describe how the information to contract was carried to the biceps muscle.

.....

..... [2]

(iv) Describe what happens to the triceps muscle during this action.

.....

..... [1]

5 Fig. 5.1 shows the apparatus used to test the thickness of some paper at a paper making factory.

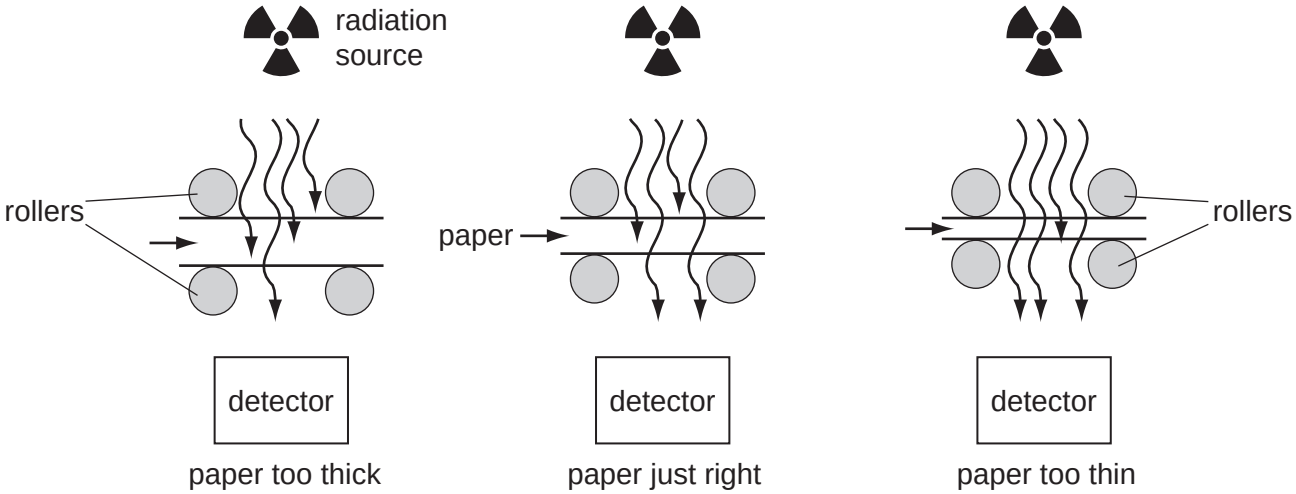


Fig. 5.1

The radioactive source gives out beta radiation. The source is placed above the moving sheet of paper and the detector below it.

(a) Why are alpha radiation and gamma radiation both unsuitable for this test?

alpha radiation is unsuitable because .....

.....

gamma radiation is unsuitable because .....

..... [2]

(b) The readings on the detector over a period of eight seconds are given in Table 5.2.

Table 5.2

time in seconds	0	1	2	3	4	5	6	7	8
total count	0	80	160	240	330	420	530	660	810
count in 1 second interval	0	80	80	80	90	90			

(i) Complete Table 5.2. [1]

(ii) Use the data in Table 5.2 to describe what is happening to the thickness of the paper.
Give a reason for your answer.

.....

.....

..... [2]

(c) A technician working on this process has a small packet containing photographic film attached to the outside of his clothing.

(i) Explain the purpose of the photographic film.

.....

..... [2]

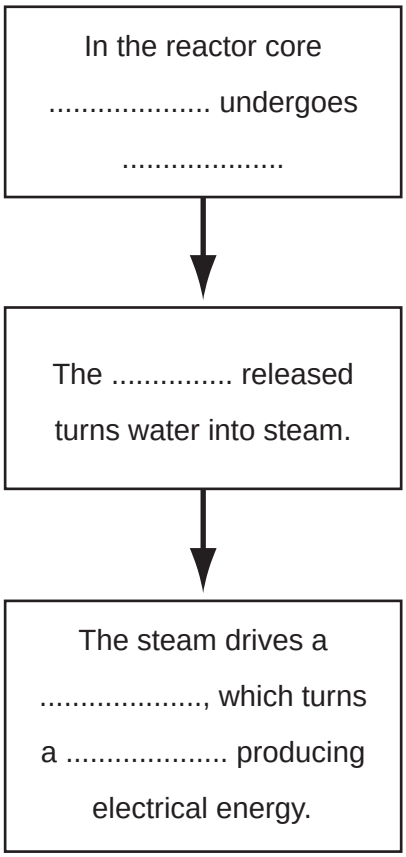
(ii) Why does the technician **not** keep the packet in his pocket?

..... [1]

(d) Using words from the list below, complete the flow chart to show the stages of generating electrical energy in a nuclear power station.

Use each word once.

fission **generator** **heat** **turbine** **uranium**



[3]

(e) Nuclear fuel is an alternative to using fossil fuels in a power station.

Why is it necessary to find alternatives to fossil fuels?

..... [1]

6 Fig. 6.1 shows an experiment similar to one carried out in the middle of the last century.

A mixture of the gases methane, CH_4, ammonia, NH_3, and water vapour was placed in the flask. Electrical sparks provided energy that caused chemical reactions to occur.

The mixture of products can be analysed using paper chromatography.

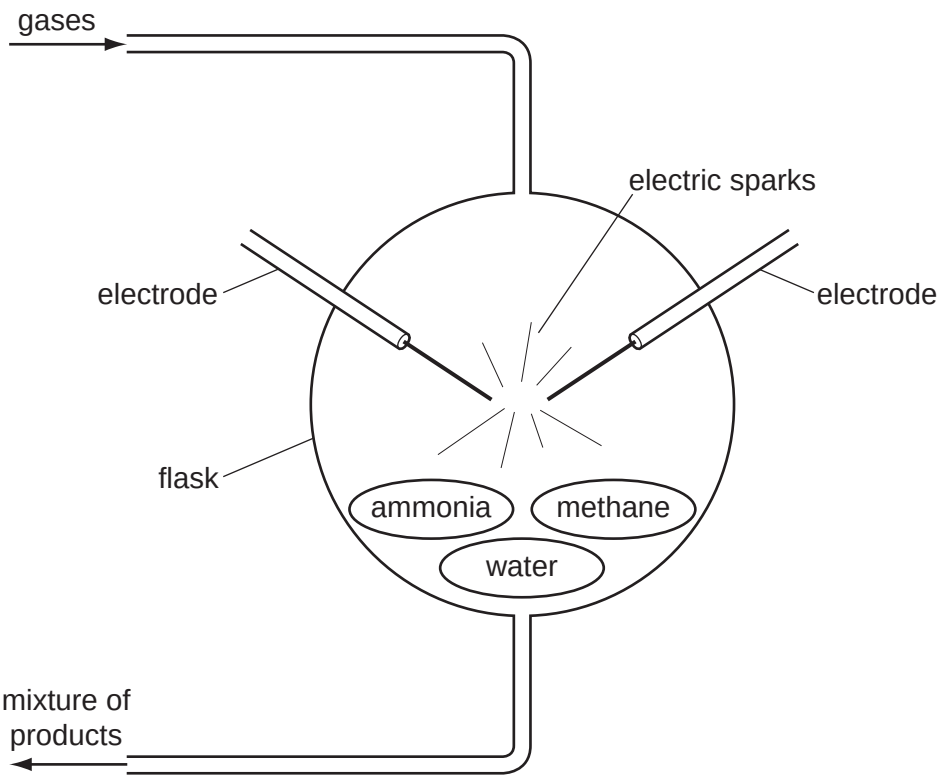


Fig. 6.1

(a) (i) Each of the substances present at the start of the experiment is a compound made of small molecules.

Explain the meaning of the word *molecule*.

.....

.....

..... [2]

(ii) Name the element which is combined in all three of the compounds present at the start of the experiment.

..... [1]

(b) (i) A student carried out paper chromatography to identify some of the products from the experiment in Fig. 6.1.

Four known compounds, glycine, alanine, cysteine and lactic acid, were used for comparison.

His results are shown in Fig. 6.2.

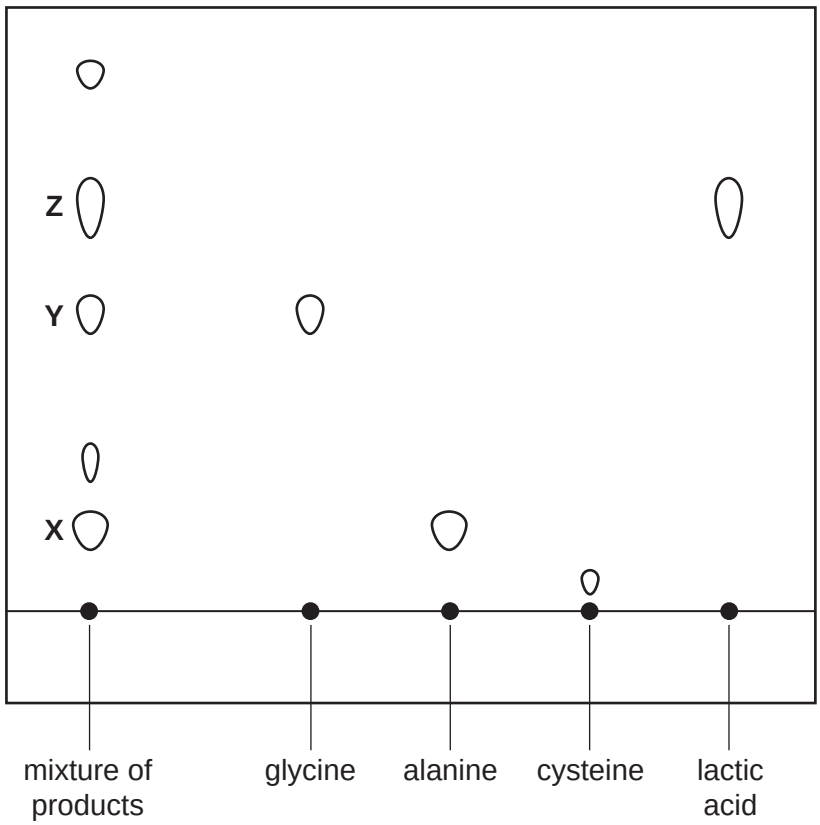


Fig. 6.2

Use the results in Fig. 6.2 to name compounds **X**, **Y** and **Z**, which were present in the mixture of products.

X is .....

Y is .....

Z is .....

Explain how you identified **X**, **Y** and **Z**.

.....

.....

..... [2]

(ii) The student was able to identify the formulae of compounds **X**, **Y** and **Z**.

compound **X** $C_2H_5NO_2$

compound **Y** $C_3H_7NO_2$

compound **Z** $C_3H_6O_3$.

He said, "Because I've found these compounds in the flask at the end, I know chemical reactions have taken place."

Explain how the student knew this.

.....

..... [1]

(iii) Name the important biological polymers which are formed from amino acids.

..... [1]

(iv) Describe **one** difference between a polymer and a small molecule such as an amino acid.

.....

.....

..... [1]

7 Fig. 7.1 shows a yeast cell. Yeast is a kind of fungus. Yeast cells have a cell wall like plant cells, but the cell wall is not made of cellulose.

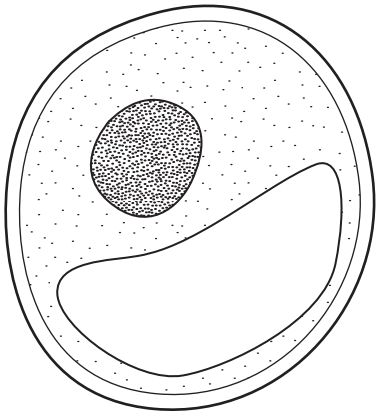


Fig. 7.1

(a) (i) On Fig. 7.1, draw a labelling line to the cell wall and label it **C**. [1]

(ii) How does Fig. 7.1 suggest that yeast cells cannot photosynthesise?

.....

..... [1]

(b) Some yeast cells were added to a solution of glucose in a conical flask. The yeast cells used the glucose to provide energy so that they could grow and reproduce.

While the yeast population was growing in the flask, bubbles of gas were produced from the solution. The gas was thought to be carbon dioxide.

(i) Describe how you could test the gas to confirm that it was carbon dioxide.

.....

.....

..... [2]

(ii) Explain why carbon dioxide was produced.

.....

.....

..... [2]

[Turn over

8 A man is sitting inside a tent.

(a) The tent fabric absorbs red light, one of the three primary colours of light.

(i) Name the other **two** primary colours.

..... [1]

(ii) The light coming through the fabric into the tent contains only these two primary colours.

What colour of light will the man see coming through the fabric?

..... [1]

(iii) The two primary colours of light coming through the fabric are much dimmer than they are in the light shining on the tent.

What has happened to the rest of the light energy of these two primary colours?

..... [1]

(b) A small tent has a mass of 4 kg and packs tightly into a bag of volume 16 dm^3.

(i) Calculate the density of the packed tent.

Show your working and state the formula that you use.

formula used

working

..... kg / dm^3 [2]

(ii) If the gravitational field strength of the Earth is 10N / kg, state the weight of the tent.

..... [1]

(c) The tent of mass 4 kg is carried a vertical distance of 1000 m up a mountain.

Calculate the work done on the tent.

Show your working and state the formula that you use.

formula used

working

..... J [2]

(d) After it rained, the outside of the tent became wet.

Describe in terms of particles how this water can evaporate.

.....

.....

.....

.....

..... [3]

(e) The tent is made from nylon.

Suggest two properties of nylon that make it suitable for a tent fabric.

1. .....

2. ..... [2]

[Turn over

9 Chemical reactions are useful sources of energy. Heat is produced when fuels are burnt, and electrical energy is provided by chemical reactions in batteries.

(a) Underline the **two** fossil fuels in the list below.

animal faeces (dung)	**coal**	**hydrogen**
methane	**uranium**	**wood**

[1]

(b) The combustion of gasoline provides energy for cars.

Name the two compounds which are formed when gasoline undergoes complete combustion.

1. .....

2. ..... [2]

(c) Some car manufacturers have developed engines which use hydrogen as an alternative to gasoline. The energy is provided by the following reaction.

hydrogen + oxygen ⟶ water

Predict and explain briefly **one** advantage of using hydrogen instead of gasoline in cars.

.....

.....

..... [2]

(d) Fig. 9.1 shows an arrangement of apparatus and materials which provides electrical energy.

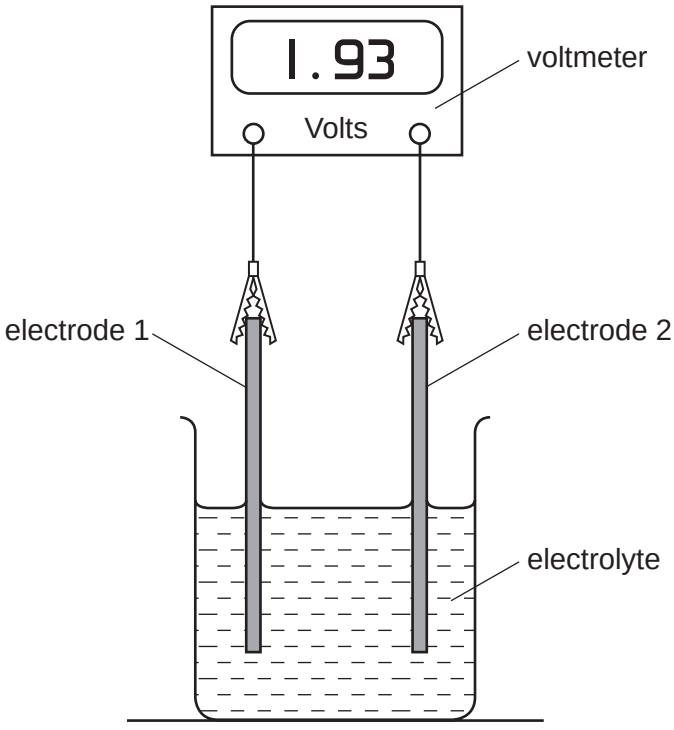


Fig. 9.1

(i) Explain which one of the following compounds produces an electrolyte when dissolved in water.

glucose $C_6H_{12}O_6$

magnesium sulphate $MgSO_4$

.....

.....

..... [2]

(ii) A student sets up apparatus similar to that in Fig. 9.1. She has electrodes made of magnesium, copper and zinc from which to choose.

Table 9.2 shows six possible combinations, **A** to **F**, of metal electrodes that she could use.

Table 9.2

	electrode 1	electrode 2
A	magnesium	magnesium
B	copper	copper
C	magnesium	copper
D	magnesium	zinc
E	copper	zinc
F	zinc	zinc

Explain which combinations of metal electrodes, **A** to **F**, she should use to provide electrical energy.

.....

.....

..... [2]

10 Fig. 10.1 shows some plants growing and reproducing.

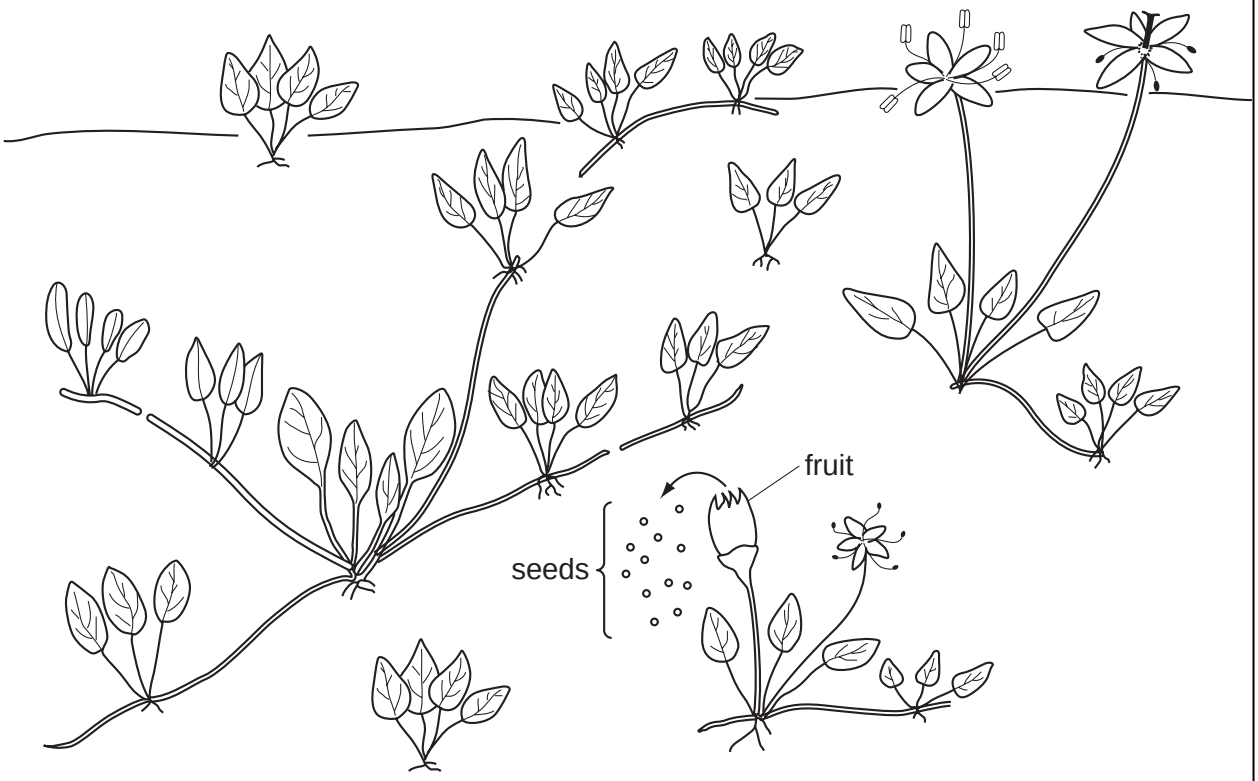


Fig. 10.1

(a) The plants are reproducing sexually and asexually.

(i) On Fig. 10.1, draw a **circle** around an example of sexual reproduction. [1]

(ii) On Fig. 10.1, draw a **square** around an example of asexual reproduction. [1]

(b) The seeds of these plants are shaken out from the dry fruits when the wind blows. Some of them fall a long way from the parent plant.

(i) Name the part of the flower from which a fruit develops.

..... [1]

(ii) Explain why it is useful for seeds to be dispersed away from the parent plant.

.....

.....

..... [2]

(iii) List three conditions that most seeds need before they will germinate.

1. .....

2. .....

3. ..... [3]

11 In many parts of the world, safe drinking water is produced from sea water.

(a) Distillation is a method which can be used to obtain safe drinking water from sea water. Fig. 11.1 shows laboratory apparatus which is used for distillation.

(i) Use the symbols shown in the key in Fig. 11.1 to show which particles are present, and how they are arranged in each of the stages **2** and **3.**

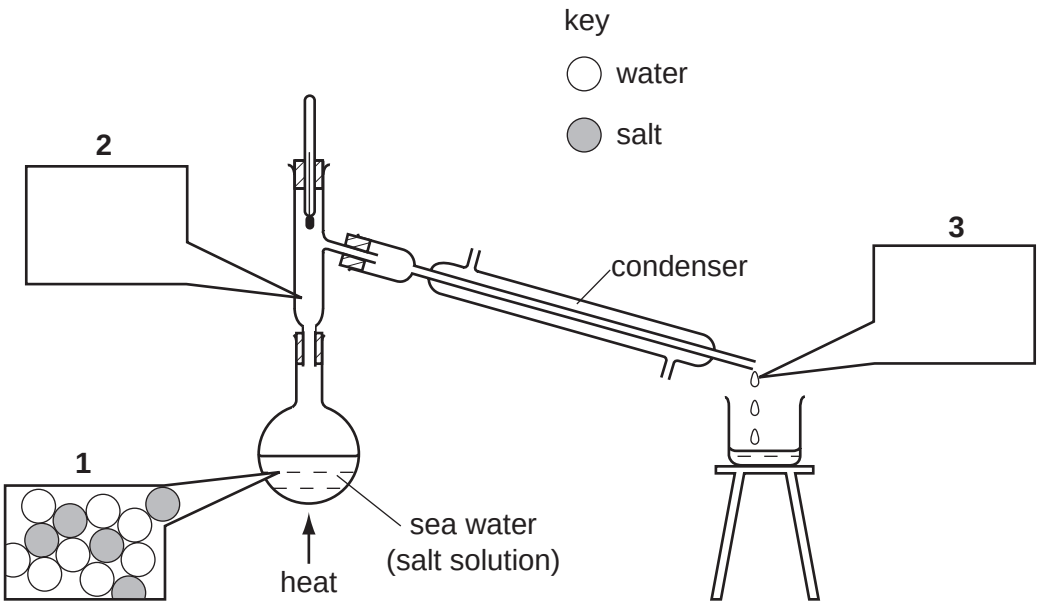


Fig. 11.1

[3]

(ii) Describe a chemical test which could be used to show whether the water coming out of the condenser contains chloride ions.

.....

.....

..... [2]

(b) Fig. 11.2 shows a flow diagram of another method used in some countries to produce safe drinking water from sea water. In this method, water molecules are able to pass through the partially permeable membrane, but salt particles cannot.

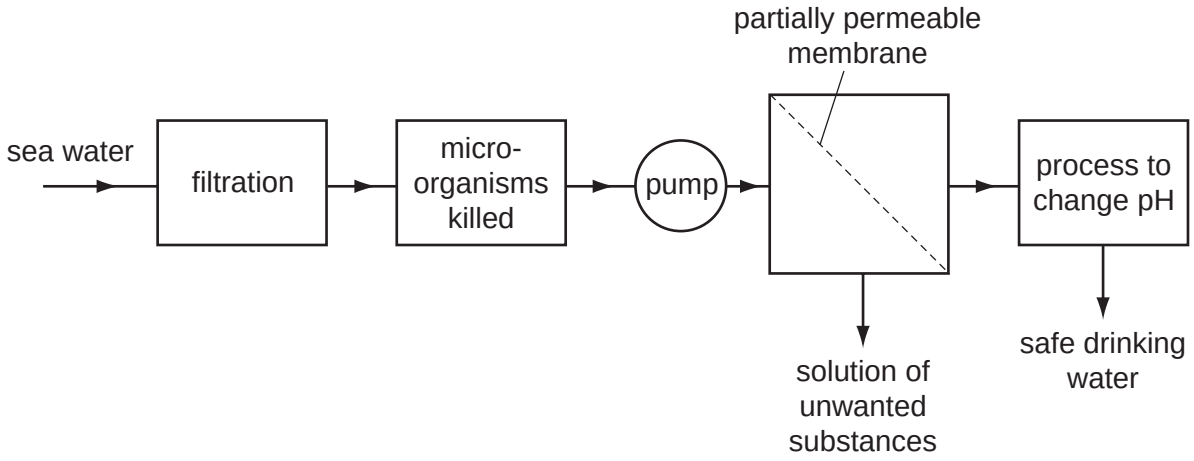


Fig. 11.2

(i) Suggest the purpose of the filtration process in this method.

.....[1]

(ii) Name **one** substance which could be used to kill micro-organisms in this process.

.....[1]

(iii) When water first passes through the partially permeable membrane it is not suitable for drinking because its pH is less than 5.

Suggest a compound which could be used to neutralise the water.
Explain your answer.

.....

.....

.....[2]

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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 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 Radius 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 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.).