



UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

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CANDIDATE
NAME

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NUMBER

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COMBINED SCIENCE

0653/02

Paper 2 (Core)

May/June 2008

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 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 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

1	
2	
3	
4	
5	
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7	
8	
9	
Total	

This document consists of **20** printed pages.



- 1 The Periodic Table shows all of the chemical elements arranged into groups and periods.

Fig. 1.1 shows part of the Periodic Table. The letters in this table are **not** the normal chemical symbols of the elements.

	I	II										III	IV	V	VI	VII	0
1																	A
2	F																E
3	C											H					
4	G							B								D	

Fig. 1.1

- (a) Complete the statements below using letters, chosen from **A** to **H**, which refer to elements in Fig. 1.1. Letters may be used once, more than once or not at all.

- The element shown as letter is an alkali metal in period 3.
- The element shown as letter is the noble gas with the lowest density.
- The three elements shown as letters, ... and have very similar chemical properties to each other.
- The element shown as letter is sometimes used as a catalyst. [4]

- (b) The elements sodium and sulphur are both oxidised when they burn in air to produce sodium oxide and sulphur dioxide respectively.

- (i) Explain the meaning of the term *oxidised*.

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

- (ii) Sodium oxide reacts with water to form solution **P**.

Sulphur dioxide reacts with water to form solution **Q**.

Predict and explain the colour of Universal Indicator solution when added to **P** and **Q**.

colour in **P**

explanation

.....

colour in **Q**

explanation

..... [4]

- (iii) Name the type of chemical reaction which occurs when solution **P** is added to solution **Q**.

..... [1]

- 2 Fig. 2.1 shows the structure of the human thorax (seen from the front).

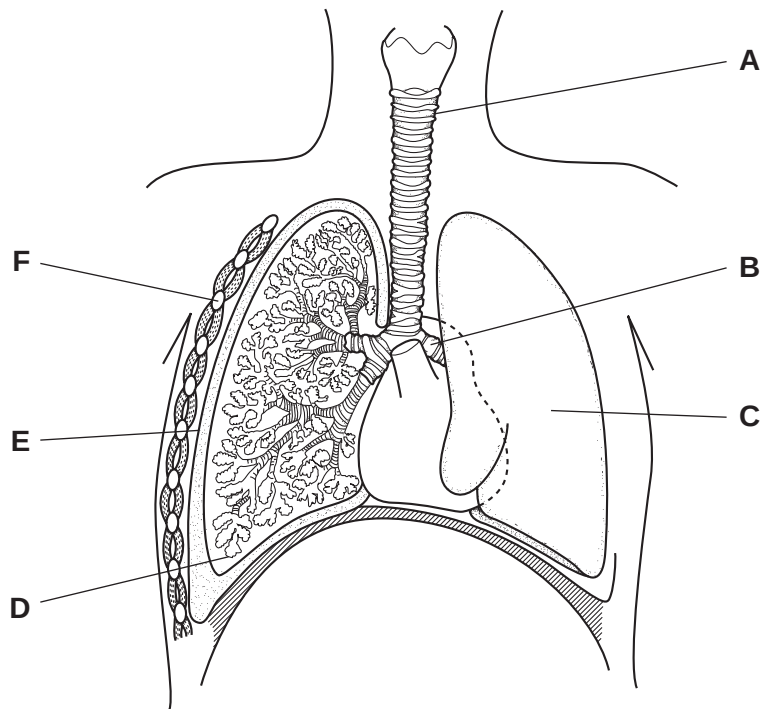


Fig. 2.1

- (a) Give the **letter** of each of the following structures.

- (i) the left bronchus
- (ii) a pleural membrane
- (iii) a place where there are goblet cells and cilia [3]

- (b) Gas exchange takes place in the alveoli. When a person smokes for a number of years, the walls of the alveoli start to break down. This is called emphysema.

- (i) Name the process by which molecules of oxygen pass into the blood from the alveoli.

..... [1]

- (ii) Explain why emphysema makes it more difficult for oxygen to get into the blood.

.....

.....

..... [2]

- (c) Oxygen is transported around the body in red blood cells. Fig. 2.2 is a diagram of a group of red blood cells.

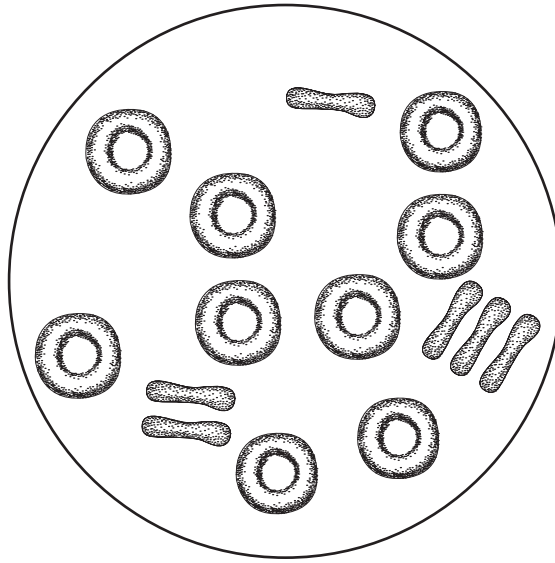


Fig. 2.2

- (i) State **one** difference, apart from their colour, between the appearance of red blood cells and white blood cells.

..... [1]

- (ii) What makes red blood cells look red?

..... [1]

- (d) Explain why body cells need a constant supply of oxygen.

.....

 [2]

- 3 A man drives a golf ball with his club and it flies through the air for nearly 200 metres.

(a) (i) State the form of energy given to the ball by the club when the ball is hit.

.....

[1]

(ii) State the type of energy gained by the ball as it rises into the air after being hit.

.....

[1]

- (b) As the golfer moves around the course in a golf cart, his movement is measured. The measurements are plotted on the graph in Fig. 3.1.

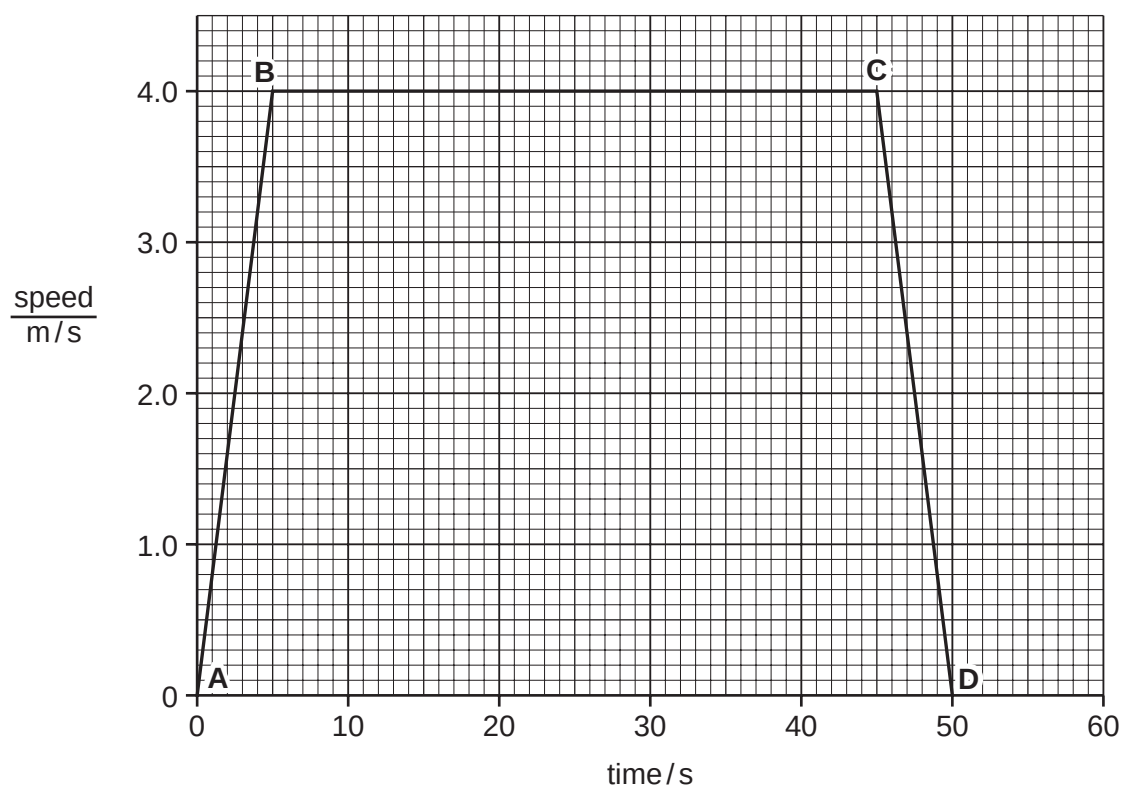


Fig. 3.1

- (i) Describe what is happening between

A – B

.....

B – C

.....

C – D

.....

[3]

- (ii) What is the speed of the cart after 3 seconds?

..... m/s

[1]

- (c) The golfer hits the ball along the ground. It travels 6 m in 3 s.

Calculate the average speed of the ball.

State the formula that you use and show your working.

formula

working

..... m/s [2]

- (d) 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 m.

State the formula that you use and show your working.

formula

working

..... J [2]

- 4 Kerosene is a mixture of hydrocarbons used as a fuel for aircraft and for lighting for cooking.

(a) Kerosene is obtained from petroleum (crude oil) and is a liquid which boils in the range $150^{\circ}\text{C} - 200^{\circ}\text{C}$.

(i) Name the process used to separate kerosene from petroleum.

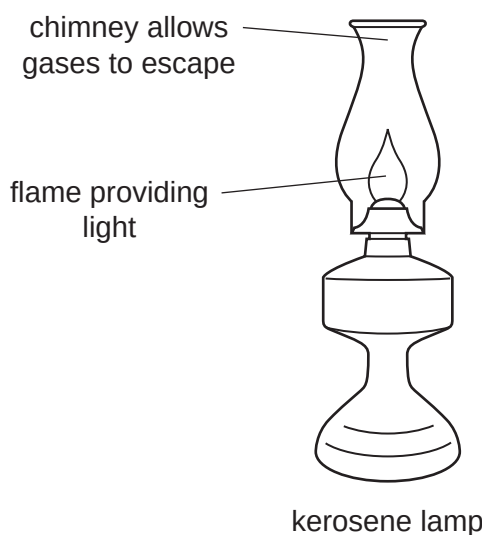
..... [1]

(ii) State the important difference between the various compounds in petroleum which enables them to be separated by the process you have named in (i).

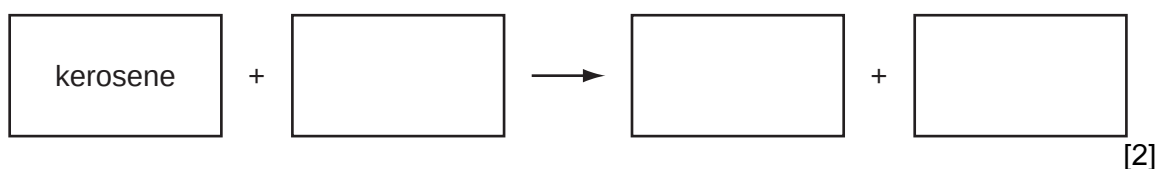
..... [1]

(b) The light from a kerosene lamp is provided by the flame produced when kerosene burns in air.

The lamp must be carefully designed and operated to ensure that most of the kerosene undergoes complete combustion.



(i) Complete the **word** chemical equation for the complete combustion of kerosene.



- (ii) Describe **one** observation which shows that the reaction occurring in the kerosene lamp is exothermic.

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

- (c) The full chemical symbol for carbon is shown below.



Draw a diagram of a carbon atom. Label the nucleus and show the full electron configuration.

[2]

- 5 Fig. 5.1 shows the quantity of carbon dioxide that was emitted to the atmosphere by industrial company, between 2000 and 2005.

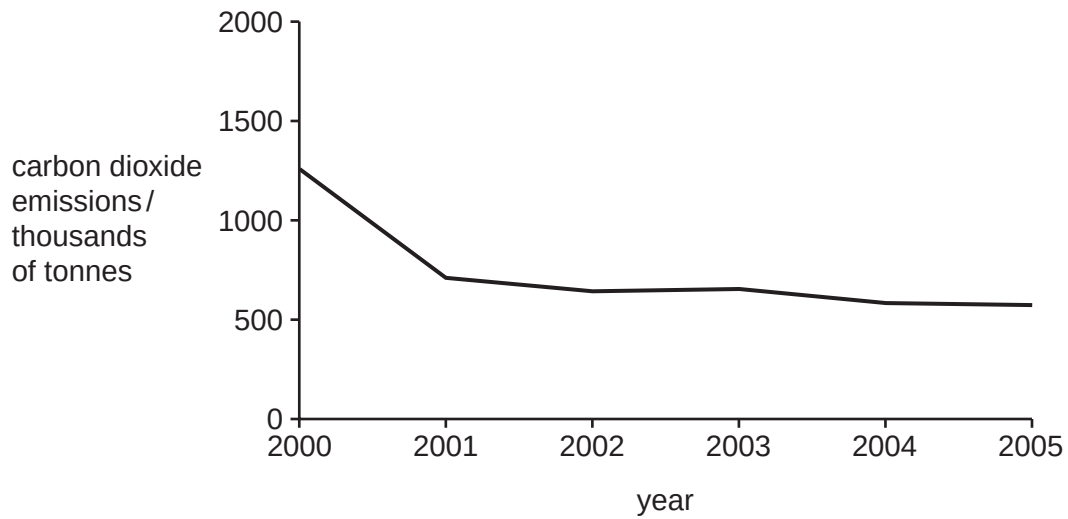


Fig. 5.1

- (a) Describe how the company's carbon dioxide emissions changed between 2000 and 2005.

.....

 [2]

- (b) The company stated that these carbon dioxide emissions included those relating to the electricity that it used.

Explain how using electricity can be responsible for emissions of carbon dioxide.

.....

 [2]

- (c) Apart from using less electricity, suggest **one** other way that the company could reduce its carbon dioxide emissions.

.....
 [1]

- (d) In 1997, at a meeting in the city of Kyoto in Japan, many countries in the world reached an agreement to reduce their emissions of carbon dioxide. The agreement came into force in 2005.

Explain why we need to reduce emissions of carbon dioxide.

.....

.....

..... [2]

- (e) Tropical rainforests can help to combat rising levels of carbon dioxide, because they take it from the air and use it in photosynthesis.

Describe **one** other reason why we should try to conserve tropical rainforests.

.....

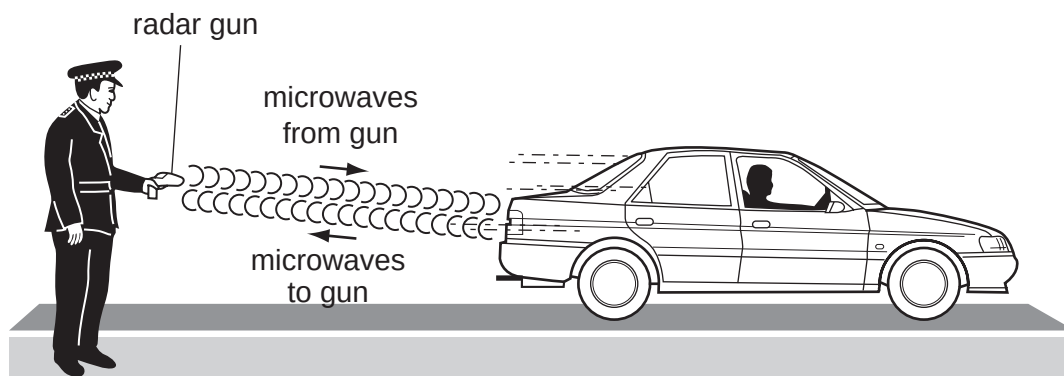
.....

..... [2]

- 6 (a) A policeman is using a radar gun to measure the speed of a car.

The radar gun emits microwaves which hit the moving car and bounce back to receiver in the radar gun.

A computer in the radar gun calculates the speed of the car.



- (i) What type of waves are microwaves?

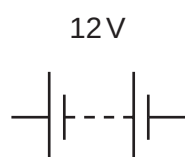
..... [1]

- (ii) The waves bounce off the car back towards the radar gun. What is this process called?

..... [1]

- (b) A car has two headlamps and two rear lamps. All four lamps are connected in parallel with each other across a 12V battery.

- (i) Complete the circuit diagram below to show how the four lamps are connected to the battery. Include one switch in your circuit which will control all four lamps.



[2]

- (ii) If the filament in one lamp breaks, the other three stay lit. Explain what happens.

.....
 [1]

- (c) Fig. 6.1 shows a spring. The spring is 10 cm long. A metal nut is hung on the spring and the length is now 13 cm.

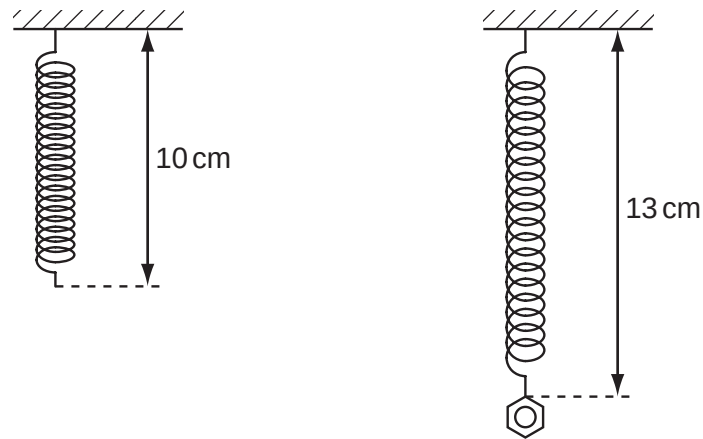


Fig. 6.1

Calculate the length of the spring if 3 **more** identical nuts are hung on the spring.

Show your working.

.....cm [2]

- 7 (a) Draw lines to link each term to its definition.

term	definition
cell membrane	a green pigment found in some plant cells, which absorbs energy from sunlight
chlorophyll	a partially permeable layer surrounding a cell
cell wall	a fully permeable layer surrounding a plant cell
chloroplast	an organelle found in some plant cells, where photosynthesis takes place

[3]

- (b) Plant leaves often contain starch, which is produced during photosynthesis.

Describe how the starch is produced.

.....

.....

.....

.....

[2]

- (c) Fig. 7.1 shows one of the ways in which a plant called *Bryophyllum* reproduces. It grows new plantlets from its leaves.



Fig. 7.1

- (i) Name the type of reproduction that is taking place.

..... [1]

- (ii) The new plants that are produced are clones of the parent plant.

Explain what is meant by the term *clone*.

.....

 [2]

- 8 (a) A student wrote down some properties of alpha, beta and gamma radiations.

Draw a line from each property to the correct radiation.

stopped by paper	alpha
contains negatively charged particles	
passes through several centimetres of lead	beta
passes through paper but stopped by a few millimetres of aluminium	
has no mass	gamma

[3]

- (b) (i) Gamma radiation can be used to sterilise surgical instruments. What property of gamma radiation makes it suitable for this purpose?

..... [1]

- (ii) State **one** other use for radiation from a radioactive source.

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

- (c) In an experiment a radiation detector was set up and used to measure background radiation. The background radiation in the laboratory was found to be 40 counts per minute.

- (i) What is *background radiation*?

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

- (ii) State **one** source of background radiation.

..... [1]

- (iii) A radioactive source was placed near the detector and a reading of 1200 counts per minute was recorded. What was the count rate of the radioactive source?

..... counts per minute [1]

- 9 Fig. 9.1 shows apparatus which can be used to reduce copper oxide to copper.

Copper oxide is a black powder and during the reaction metallic copper forms inside the reaction tube.

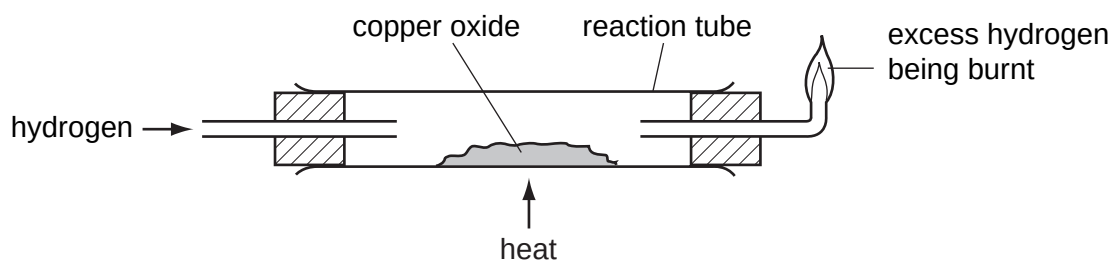


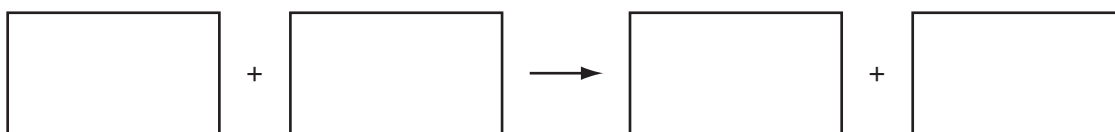
Fig. 9.1

- (a) (i) Select from the list of substances below to complete the word equation for the reaction in Fig. 9.1.

air
hydrogen

copper
oxygen

copper oxide
water



[1]

- (ii) Describe **one** piece of evidence which would show that copper had been formed in this reaction.

.....

..... [1]

- (b) When a student carried out the reaction in Fig. 9.1 she realised the material left in the reaction tube was a mixture of metallic copper and unreacted copper oxide.

In order to separate the metallic copper, she stirred the material from the reaction tube with warm dilute sulphuric acid for several minutes. She then filtered the mixture as shown in Fig. 9.2.

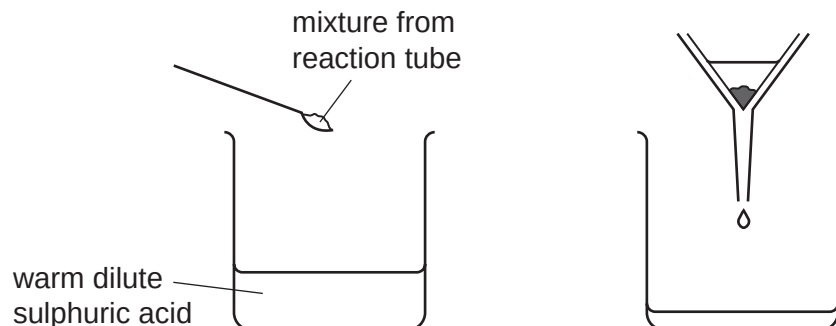


Fig. 9.2

- (i) Name the copper compound formed when sulphuric acid reacts with copper oxide.

..... [1]

- (ii) The copper compound you have named in (i) is soluble.

Explain why the method shown in Fig. 9.2 is successful in separating metallic copper from the original mixture of copper and copper oxide.

.....

 [2]

- (c) Copper oxide is a compound of a metal and a non-metal.

- (i) Name the type of chemical bonding in copper oxide.

..... [1]

- (ii) Explain why there is a strong force of attraction between the copper and oxide particles in copper oxide.

.....

 [2]

(d) Metallic copper can also be obtained by electrolysis.

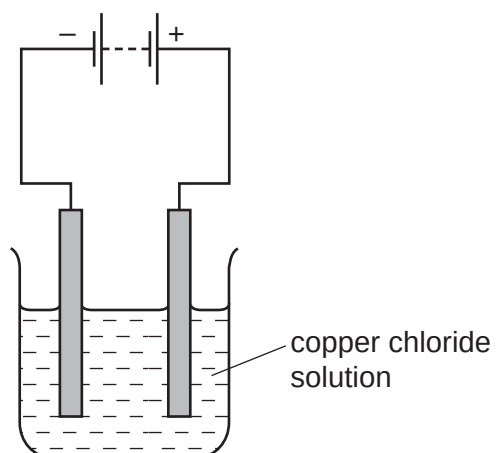


Fig. 9.3

Describe what would be seen at each of the electrodes when the electrolysis shown in Fig. 9.3 is carried out.

at the positive electrode

.....

at the negative electrode

.....

[2]

DATA SHEET
The Periodic Table of the Elements

Group																							
I	II											III	IV	V	VI	VII	0						
												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 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	101 Ru Ruthenium 44	101 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	127 Te Tellurium 52	131 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			210 Rn Radon 86						
Fr Francium 87	226 Ra Radium 88	227 Ac Actinium 89																					
58-71 Lanthanoid series																							
90-103 Actinoid series																							
175 Lu Lutetium 71																							
173 Yb Ytterbium 70																							
169 Tm Thulium 69																							
167 Er Erbium 68																							
165 Ho Holmium 67																							
162 Dy Dysprosium 66																							
159 Tb Terbium 65																							
157 Gd Gadolinium 64																							
152 Eu Europium 63																							
150 Sm Samarium 62																							
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141 Pr Praseodymium 59																							
140 Ce Cerium 58																							
238 U Uranium 92																							
236 Pu Plutonium 94																							
234 Th Thorium 90																							
232 Pa Protactinium 91																							
230 Ac Actinium 89																							
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209 Bi Bismuth 83																							
208 Pb Lead 82																							
207 Tl Thallium 81																							
206 Hg Mercury 80																							
201 Au Gold 79																							
198 Pt Platinum 78																							
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193 Rh Rhodium 45																							
191 Pd Palladium 46																							
188 Ag Silver 47																							
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160 Ar Argon 18																							
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157 P Phosphorus 15																							
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150 O Oxygen 8																							
149 N Nitrogen 7																							
148 C Carbon 6																							
147 B Boron 5																							
146 He Helium 2																							
145 H Hydrogen 1																							
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125 Pu Plutonium 94																							
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123 Cm Curium 96																							
122 Bk Berkelium 97																							
121 Cf Californium 98																							
120 Es Einsteinium 99																							
119 Fm Fermium 100																							
118 Md Mendelevium 101																							
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98 Mo Molybdenum 42																							
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-55 Ra Radium 88																							
-56 Ac Actinium 89																							
-57 Th Thorium 90																							
-58 Pa Protactinium 91																							
-59 U Uranium 92																							
-60 Np Neptunium 93																							
-61 Pu Plutonium 94																							
-62 Am Americium 95																							
-63 Cm Curium 96																							
-64 Bk Berkelium 97																							
-65 Cf Californium 98																							
-66 Es Einsteinium 99																							
-67 Fm Fermium 100																							
-68 Md Mendelevium 101																							
-69 No Nobelium 102																							
-70 Lr Lawrencium 103																							
-71 Lu Lutetium 71																							
-72 Yb Ytterbium 70																							
-73 Tm Thulium 69																							
-74 Er Erbium 68																							
-75 Ho Holmium 67																							
-76 Dy Dysprosium 66																							
-77 Tb Terbium 65																							
-78 Gd Gadolinium 64																							
-79 Eu Europium 63																							
-80 Sm Samarium 62																							
-81 Nd Neodymium 60																							
-82 Pr Praseodymium 59																							
-83 Ce Cerium 58																							
-84 La Lanthanum 57																							
-85 Y Yttrium 39																							
-86 Zr Zirconium 40																							
-87 Nb Niobium 41																							
-88 Mo Molybdenum 42																							
-89 Tc Technetium 43																							
-90 Ru Ruthenium 44																							
-91 Rh Rhodium 45																							
-92 Pd Palladium 46																							
-93 Ag Silver 47																							
-94 Cd Cadmium 48																							
-95 In Indium 49																							
-96 Sn Tin 50																							
-97 Sb Antimony 51																							
-98 Te Tellurium 52																							
-99 I Iodine 53																							
-100 Xe Xenon 54																							
-101 Kr Krypton 36																							
-102 Br Bromine 35																							
-103 Se Selenium 34																							
-104 As Arsenic 33																							
-105 Ge Germanium 32																							
-106 Ga Gallium 31																							
-107 Zn Zinc 30																							
-108 Cu Copper 29																							
-109 Ni Nickel 28																							
-110 Co Cobalt 27																							
-111 Fe Iron 26																							
-112 Mn Manganese 25																							
-113 Cr Chromium 24																							
-114 V Vanadium 23																							
-115 Ti Titanium 22																							
-116 Sc Scandium 21																							
-117 Ca Calcium 20																							
-118 K Potassium 19																							
-119 Ar Argon 18																							
-120 Cl Chlorine 17																							
-121 S Sulphur 16																							
-122 P Phosphorus 15																							
-123 Si Silicon 14																							
-124 Al Aluminium 13																							
-125 Mg Magnesium 12																							
-126 Na Sodium 11																							
-127 Ne Neon 10																							
-128 F Fluorine 9																							
-129 O Oxygen 8																							
-130 N Nitrogen 7																							
-131 C Carbon 6																							
-132 B Boron 5																							
-133 He Helium 2																							
-134 H Hydrogen 1																							
-135 Li Lithium 3																							
-136 Be Beryllium 4																							
-137 B Boron 5																							
-138 C Carbon 6																							
-139 N Nitrogen 7																							
-140 O Oxygen 8																							
-141 F Fluorine 9																							
-142 Ne Neon 10																							
-143 Ar Argon 18																							
-144 Kr Krypton 36																							
-145 Xe Xenon 54																							
-146 Rn Radon 86																							
-147 Fr Francium 87																							
-148 Ra Radium 88																							
-149 Ac Actinium 89																							
-150 Th Thorium 90																							
-151 Pa Protactinium 91																							
-152 U Uranium 92																							
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-174 Nd 																							

159
Tb
Terbium

160
Dy
Dysprosium

161
Ho
Holmium

162
Er
Erbium

163
Tm
Thulium

164
Yb
Ytterbium

165
Lu
Lutetium

232
Th
Thorium

233
Pa
Protactinium

234
U
Uranium

235
Np
Neptunium

236
Pu
Plutonium

237
Am
Americium

238
Cm
Curium

239
Bk
Berkelium

240
Cf
Californium

241
Es
Einsteinium

242
Fm
Fermium

243
Md
Mendelevium

244
No
Nobelium

245
Lr
Lawrencium

Key

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

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

The volume of one mole of any gas is 24 dm³ at room temperature and pressure (r.t.p.).