

Centre Number	Candidate Number	Name
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UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

COMBINED SCIENCE

0653/02

Paper 2

May/June 2004

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 in the spaces provided on the Question Paper.
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.
The number of marks is given in brackets [] at the end of each question or part question.
A copy of the Periodic Table is printed on page 20.

For Examiner's Use	
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2	
3	
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If you have been given a label, look at the details. If any details are incorrect or missing, please fill in your correct details in the space given at the top of this page.

Stick your personal label here, if provided.

This document consists of **17** printed pages and **3** blank pages.

1 Fig. 1.1 shows three atoms, **P**, **Q** and **R**. These letters are **not** chemical symbols.

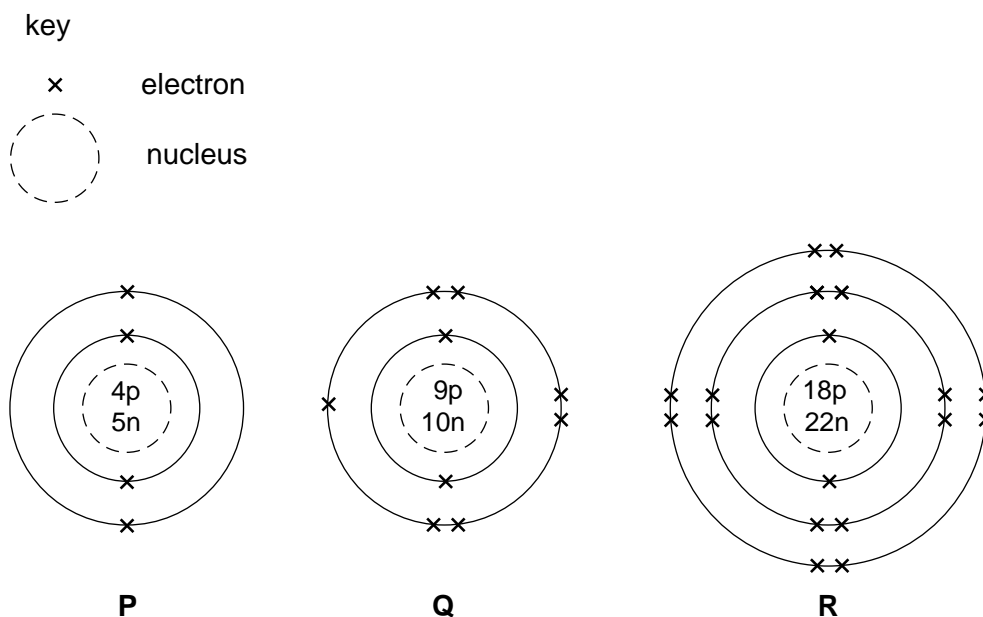


Fig. 1.1

(a) Which atom, **P**, **Q** or **R**,

has the full chemical symbol ${}^{19}_9\text{F}$,

is of an element in Group 2 of the Periodic Table,

gains one electron to form an ion?

[3]

(b) A mixture of hydrogen and oxygen in a test-tube explodes violently with a very loud bang if ignited.

A mixture of hydrogen and air in a test-tube explodes with a squeaky 'pop' if ignited.

(i) Suggest why the mixture of hydrogen and air explodes less violently.

.....

 [2]

(ii) Write a **word** equation for the reaction between hydrogen and oxygen.

..... [1]

2 (a) Fig. 2.1 shows an animal cell.

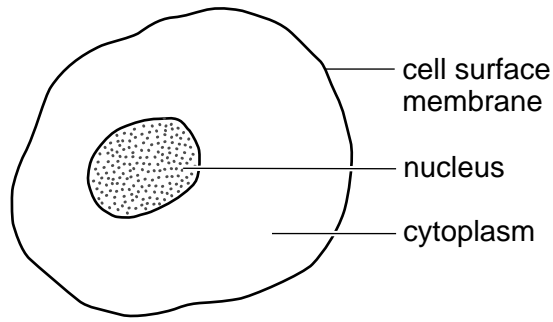


Fig. 2.1

Describe the function of the nucleus.

.....

.....

..... [2]

(b) Make a large, labelled diagram of a plant cell that could carry out photosynthesis.

[4]

(c) In photosynthesis, light energy is converted into chemical energy.

Using this information, and your own knowledge, explain why wood from trees is said to be a *renewable* fuel.

.....

.....

..... [2]

- 3 (a) Fig. 3.1 is a graph to show how much electrical power is generated by a small wind-powered generator, when the wind is blowing.

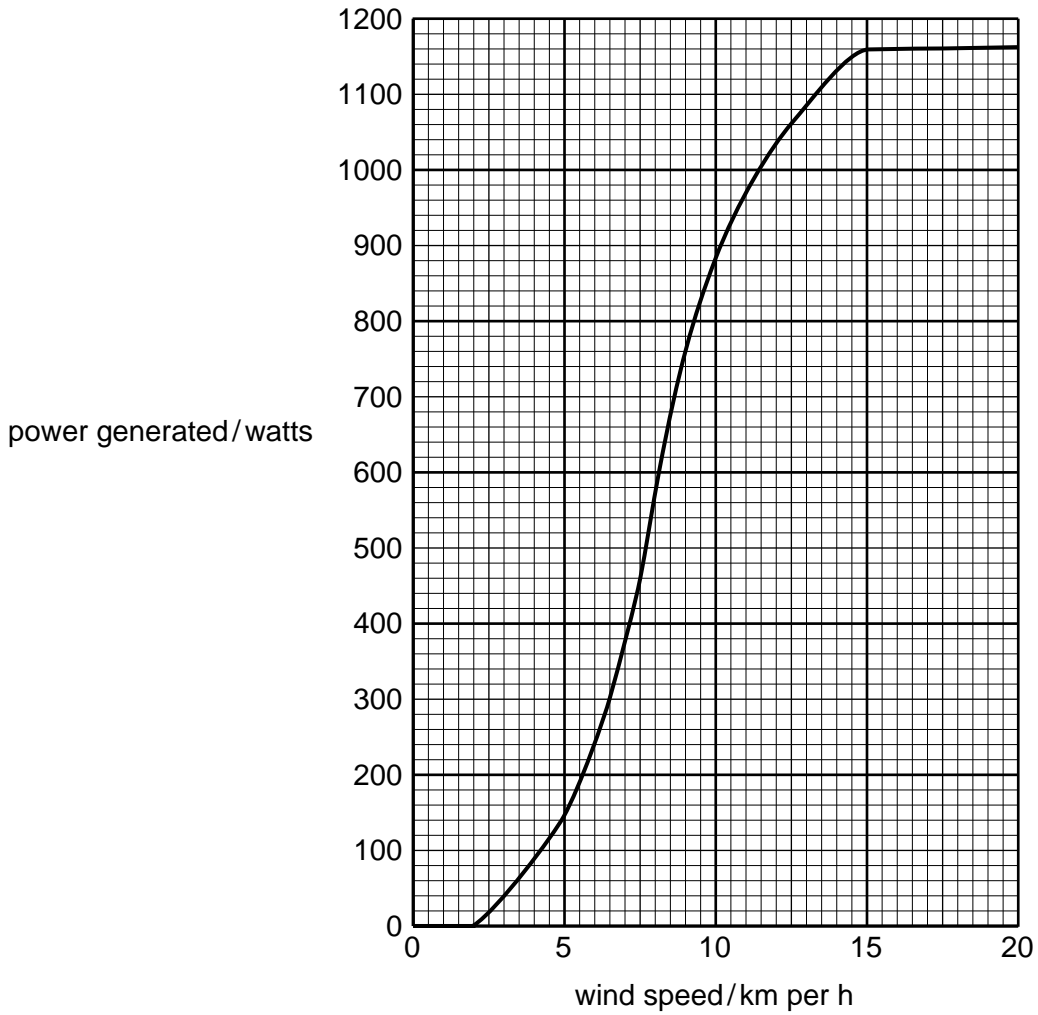


Fig. 3.1

- (i) What is the lowest speed needed to generate any electrical power at all?
 km/h [1]
- (ii) What is the lowest speed needed to generate the maximum power?
 km/h [1]
- (b) Complete the sentence to show the energy transfer taking place in the wind-powered generator.
 energy is transferred to energy. [2]

- (c) (i) One disadvantage of wind turbines is the high cost of manufacture and installation. State **one** other disadvantage of using wind turbines to generate electricity.

..... [1]

- (ii) Name **one** other fossil fuel, apart from coal, that can be burned in a power station.

..... [1]

- (iii) Name the chemical element present in **all** fossil fuels.

..... [1]

- 4 Some types of bottled water contain a dissolved gas. When the cap is removed, the gas bubbles out of the water.

Fig. 4.1 shows this gas being bubbled through solution Y.

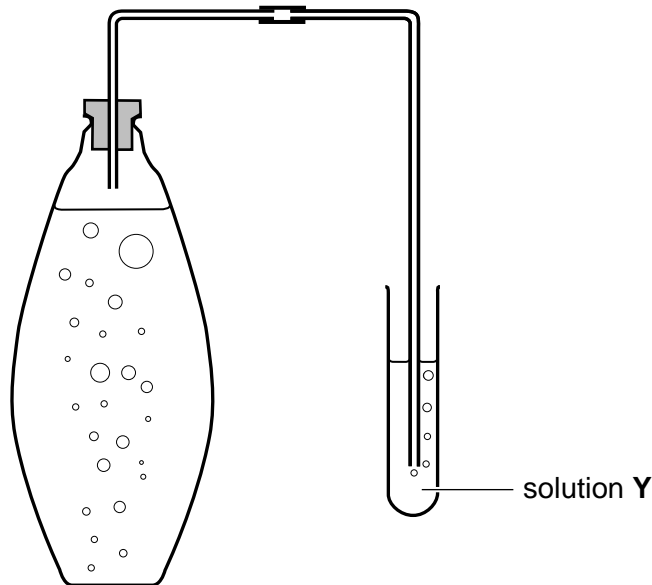


Fig. 4.1

The solution turns cloudy when it reacts with the gas.

- (a) Suggest the name of the gas and of solution Y.

gas

solution Y

[2]

- (b) Fig. 4.2 shows some of the particles in the gas.

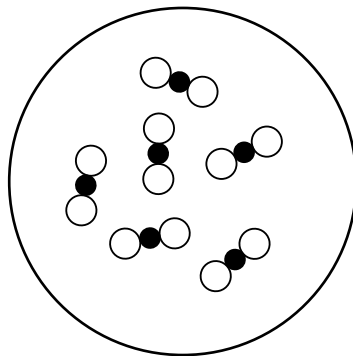


Fig. 4.2

Explain why the gas is a compound and not an element.

.....

.....

.....

[2]

(c) A student spills some dilute sulphuric acid onto the floor. He sprinkles sodium carbonate crystals onto the acid in order to neutralise it.

(i) State the chemical formula of sulphuric acid [1]

(ii) Complete the **word** equation for the reaction between sodium carbonate and dilute sulphuric acid.



[3]

(iii) Suggest an observation, other than using an indicator, which would show the student that he had added enough sodium carbonate to neutralise all of the acid.

.....

..... [1]

(iv) Sodium metal reacts with dilute sulphuric acid. Explain why the student should **not** attempt to use sodium to neutralise the spilled acid.

.....

..... [1]

- 5 Babies that are well below the average weight when they are born are said to have a low birthweight. Babies with a low birthweight are more likely than other babies to have health problems when they are older.

Fig. 5.1 shows the relationship between having a baby with low birthweight and smoking during pregnancy.

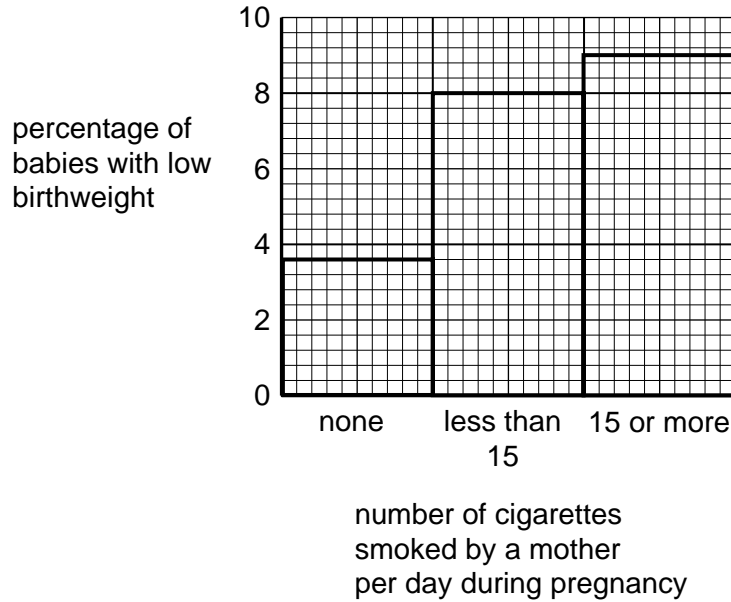


Fig. 5.1

- (a) (i) What conclusions can you draw from the trend shown in the graph?

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

- (ii) Do the results shown in the graph prove that smoking causes an increase in the chance of having a baby with low birthweight? Explain your answer.

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

(b) It is thought that one reason for the harmful effects of smoking on a developing fetus is that carbon monoxide from the cigarette smoke passes into the blood of the fetus.

Describe where and how the carbon monoxide passes from the mother to the fetus.

.....
.....
.....
..... [3]

(c) Explain how smoking could lead to the development of bronchitis in the mother.

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

6 (a) Below is a list of electromagnetic waves.

- | | | | |
|---------------------|----------------------|-------------------|-------------------|
| gamma rays | infra-red | microwaves | radiowaves |
| ultra-violet | visible light | X-rays | |

Name **one** type of electromagnetic wave that

- (i) causes ionisation, [1]
- (ii) is used to sterilise food and medical equipment, [1]
- (iii) is used to photograph bone structure, [1]
- (iv) is used to transmit information. [1]

(b) Microwaves are used for detecting aircraft. This is called radar.

The speed of all electromagnetic radiation is 300 000 000 m / s.

The time between sending out a microwave signal and receiving the signal back from an aircraft is 0.00004 s.

(i) Calculate how far away the aircraft is.

Show your working and state the formula that you use.

formula

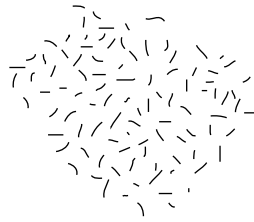
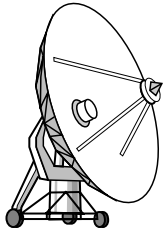
working

..... m [3]

(ii) The signal received back from the aircraft is much weaker than the signal sent out. Suggest why this is so.

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

- (iii) Aircraft flying in war zones sometimes drop strips of aluminium foil to confuse the enemy radar.



Explain how this works.

.....

.....

..... [1]

- (c) A wave is shown in Fig. 6.1.

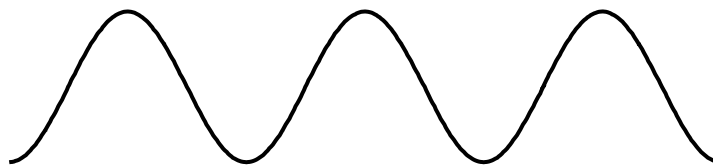


Fig. 6.1

- (i) Show clearly on the diagram the wavelength of the wave. Label it **W**. [1]
- (ii) Show clearly on the diagram the amplitude of the wave. Label it **A**. [1]
- (iii) This wave has a *frequency* of 10 Hz.

Explain what this means.

.....

..... [1]

7 The two main types of element in the Periodic Table are metals and non-metals.

(a) State two physical properties of most metals that are different from those of most non-metals.

- 1
-
- 2
- [2]

(b) Fig. 7.1 shows an apparatus being used to investigate the reaction between magnesium and steam.

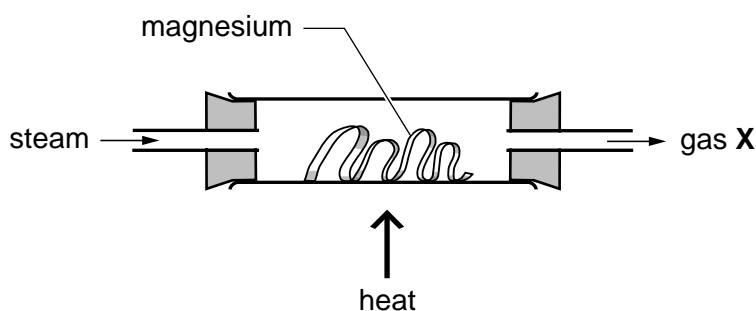


Fig. 7.1

There is an exothermic reaction between the magnesium and the steam and a white solid is produced in the reaction tube.

(i) State the meaning of the word *exothermic*.

..... [1]

(ii) Name gas X and the white solid.

gas X

white solid [2]

(c) The white solid from the reaction in Fig. 7.1 contains a metallic element joined to a non-metallic element. Steam contains two non-metallic elements joined together.

Name the type of chemical bonding present in the white solid and in steam.

type of bonding in the white solid

type of bonding in steam [2]

(d) Aluminium is a widely used metal and the noble (inert) gases are non-metals that have many important uses.

(i) State and explain **one** property of aluminium that makes it a particularly suitable metal for the manufacture of food containers.

.....

..... [1]

(ii) Name a noble gas and describe briefly **one** important use of this gas.

name

use

..... [2]

8 A baby girl was born with a missing heart valve. Fig. 8.1 shows the structure of her heart.

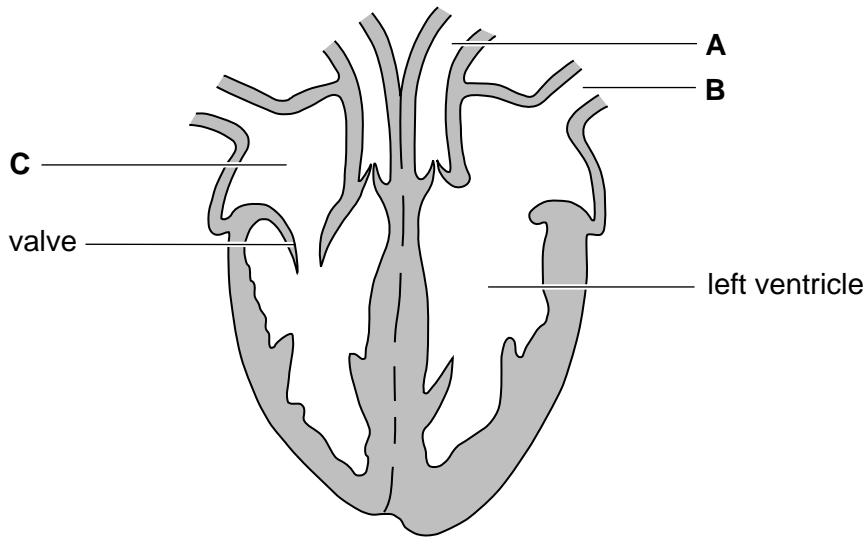


Fig. 8.1

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

A

B

C

[3]

(b) When the ventricles of the heart contract, they push on the blood so that it flows into the arteries.

Explain why this will not happen properly in the left hand side of the baby's heart.

.....

.....

..... [2]

(c) The missing heart valve means that less oxygenated blood is carried to the body tissues.

(i) Describe where and how the blood becomes oxygenated.

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

(ii) Explain why a lack of oxygen in the blood makes it difficult to do vigorous exercise.

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

9 Explain each of the following statements.

(a) Weight is not the same as mass.

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

(b) Electricity is transmitted through power lines at high voltages, rather than at low voltages.

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

(c) Sound waves can travel through water but not through a vacuum.

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

(d) Beta radiation can be used to measure the thickness of sheets of metal.

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

DATA SHEET
The Periodic Table of the Elements

Group									
I	II	III	IV	V	VI	VII	VIII	IX	X
7 Li Lithium 3	9 Be Beryllium 4	1 H Hydrogen 1	11 B Boron 5	12 C Carbon 6	14 N Nitrogen 7	16 O Oxygen 8	19 F Fluorine 9	20 Ne Neon 10	4 He Helium 2
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
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	103 Rh Rhodium 45	106 Pd Palladium 46	108 Ag Silver 47
133 Cs Caesium 55	137 Ba Barium 56	139 La Lanthanum 57	178 Hf Hafnium 72	181 Ta Tantalum 73	184 W Tungsten 74	190 Os Osmium 76	192 Ir Iridium 77	195 Pt Platinum 78	197 Au Gold 79
226 Ra Radium 88	227 Ac Actinium 89								
140 Ce Cerium 58	141 Pr Praseodymium 59	144 Nd Neodymium 60	144 Pm Promethium 61	150 Sm Samarium 62	152 Eu Europium 63	157 Gd Gadolinium 64	162 Dy Dysprosium 66	165 Ho Holmium 67	167 Er Erbium 68
232 Th Thorium 90	238 U Uranium 92	238 Pa Protactinium 91	238 Np Neptunium 93	238 Pu Plutonium 94	238 Am Americium 95	238 Cm Curium 96	238 Bk Berkelium 97	238 Cf Californium 98	238 Es Einsteinium 99
175 Lu Lutetium 71	173 Yb Ytterbium 70	169 Tm Thulium 69	167 Fm Fermium 100	167 Er Erbium 68	165 Ho Holmium 67	162 Dy Dysprosium 66	159 Tb Terbium 65	157 Gd Gadolinium 64	152 Eu Europium 63
103 Lr Lawrencium 103	102 No Nobelium 102	101 Md Mendelevium 101	86 Rn Radon 86	83 Bi Bismuth 83	82 Po Polonium 84	81 Tl Thallium 81	80 Hg Mercury 80	79 Pb Lead 82	209 Po Polonium 84

*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 dm³ at room temperature and pressure (r.t.p.).