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.

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.

For Exam	iner's Use
1	
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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.

ke	Эу				
	×	electron			
		nucleus			
	4 5	p n	* * * * * * * * * * * * * * * * * * *	* * (** ** 18p
	I	•	Q		R
			Fig. 1.1		
Whi	ch ato	m, P , Q or R	,		
	has t	ne full chemi	cal symbol ¹⁹ F,		
	is of a	an element ir	Group 2 of the Periodic	Table,	
	gains	one electror	n to form an ion?		[3]
	nixture g if igr		n and oxygen in a test-tu	be explodes v	riolently with a very loud
A m	ixture	of hydrogen	and air in a test-tube expl	odes with a so	ueaky 'pop' if ignited.
(i)	Sugg	est why the r	mixture of hydrogen and a	ir explodes les	s violently.

.....[1]

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

.....[2]

(a)

(b)

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

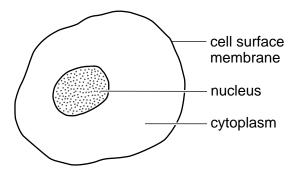


Fig. 2.1

	Describe the function of the nucleus.
(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 <i>renewable</i> 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.

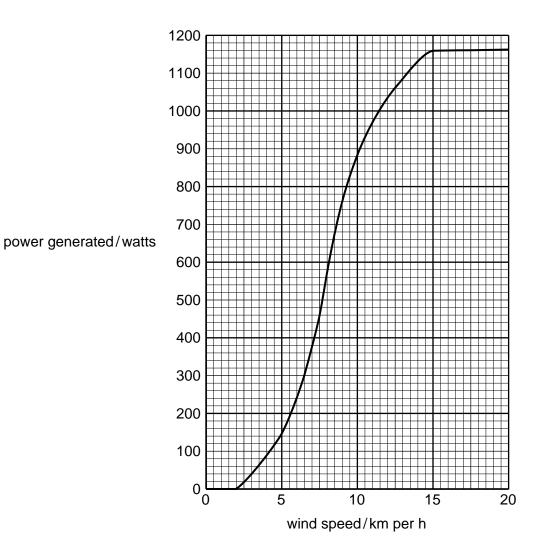


Fig. 3.1

(1)	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]
	mplete the sentence to show the energy transfer taking place in the wind-power lerator.	red
	energy is transferred to energy	[2]

(b)

(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]
(ii	ii)	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.

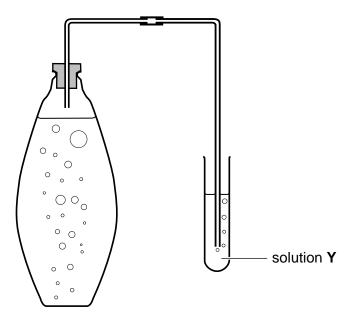


Fig. 4.1

The solution turns cloudy when it reacts with the gas.

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

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

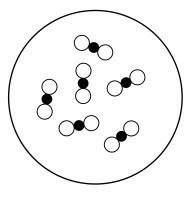


Fig. 4.2

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

- (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.

dilute sulphuric acid	+	sodium carbonate	\rightarrow		+		+	
-----------------------------	---	---------------------	---------------	--	---	--	---	--

[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	1
	J

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

г	41
	IJ

- 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.

10 8 percentage of babies with low 6 birthweight 4 2 0 less than none 15 or more 15 number of cigarettes smoked by a mother per day during pregnancy

Fig. 5.1

(1)	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]

(a)

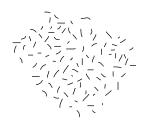
(b)	that carbon monoxide from the cigarette smoke passes into the blood of the fetus.
	Describe where and how the carbon monoxide passes from the mother to the fetus.
	[3]
(c)	Explain how smoking could lead to the development of bronchitis in the mother.
	[2]

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

	gan	nma rays	infra-red	microwaves	radiowaves
	ultr	a-violet	visible light	X-rays	
	Nan	ne one type of ele	ectromagnetic wave the	at	
	(i)	causes ionisation	٦,		[1]
	(ii)	is used to sterilis	e food and medical ed	uipment,	[1]
	(iii)	is used to photog	graph bone structure,		[1]
	(iv)	is used to transm	nit information		[1]
(b)	Mic	owaves are used	for detecting aircraft.	This is called radar.	
	The	speed of all elect	romagnetic radiation i	s 300 000 000 m/s.	
		time between ser raft is 0.00004 s.	nding out a microwave	signal and receiving th	e signal back from an
	(i)	Calculate how fa	r away the aircraft is.		
		Show your worki	ng and state the formu	ıla that you use.	
		formula			
		working			
					m [3]
	(ii)	The signal receive Suggest why this		raft is much weaker tha	n the signal sent out.
					[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	
	[0]

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

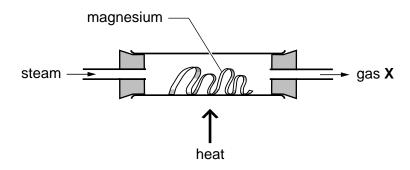


Fig. 7.1

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

(ii) Name gas X and the white solid.

(i) State the meaning of the word exothermic.

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.

(d)		minium is a widely used metal and the noble (inert) gases are non-metals that have by 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.

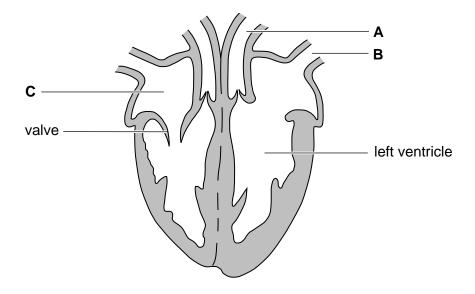


Fig. 8.1

(a)	Name the parts labelled A , B and C .	
	A	
	В	
	C	[3]
(b)	When the ventricles of the heart contract, they push on the blood so that it flows into arteries.	the
	Explain why this will not happen properly in the left hand side of the baby's heart.	
		[2]

;)		ues.
	(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]

Exp	plain 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]
	[-]

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DATA SHEET
The Periodic Table of the Elements

						_	he Perio	he Periodic Table of the Elements	le of the	Elemen	ts						
								Gre	Group								
_	=												ΛI	>		IIN	0
							1 T Hydrogen										4 Te Helium
7 Lithium	9 Be Beryllium							1				11 Boron 5	12 C Carbon	14 N itrogen 7	16 Oxygen	19 Fluorine	20 Neon
23 Na Sodium	24 Mg Magnesium											27 A1 Aluminium 13	28 Si Silicon 14	31 P Phosphorus 15	32 S Sulphur 16	35.5 C1 Chlorine	40 Ar Argon
39 K Potassium 19	40 Ca calcium	Scandium	48 Ti Titanium	51 V Vanadium 23	52 Cr Chromium 24	Manganese	56 Fe Iron 26	59 Co Cobalt 27	59 N ickel 28	64 Cu Copper 29	65 Zn Zinc 30	70 Ga Gallium 31	73 Ge Germanium	75 AS Arsenic	79 Selenium	80 Br Bromine 35	84 Kry pton 36
Rb Rubidium	88 Sr Strontium 38	89 ×	91 Zirconium 40	93 N iobium 41	96 Mo Molybdenum 42	Tc Technetium 43	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	Sb Antimony 51	128 Te Tellurium		131 Xe Xenon Xenon
CS Caesium	137 Ba Barium 56	139 La Lanthanum 57 *	178 Hf Hafnium 72	181 Ta Tananum 73	184 W Tungsten 74	186 Re Rhenium 75	190 OS Osmium 76	192 Ir	195 Pt Platinum 78	197 Au Gold	201 Hg Mercury 80	204 T.1 Thallium	207 Pb Lead 82	209 Bi Bismuth 83	Po Polonium 84	At Astatine 85	Rn Radon 86
Fr Francium	226 Ra Radium 88	227 Act Actinium 89															
71 La 103 /	*58-71 Lanthanoid series †90-103 Actinoid series	d series series		140 Ce Cerium	141 Pr Praseodymium	144 Neodymium	Pm Promethium	150 Sm Samarium	152 Eu Europium	157 Gd Gadolinium	159 Tb Terbium	162 Dy Dysprosium	165 Ho Holmium	167 Er Erbium	169 Tm Thulium	173 Yb Ytterbium	175 Lu Lutetium

	140	141	144		150	152	157	159	162	165			173	175
noid series	S	፵	N	Pm	Sm	Eu	gq	Д	ò	우	ш	Ш	Υb	Ρn
סום אפוופא	Cerium 58	Praseodymium 59	Neodymium 60	Promethium 61	Samarium 62	Europium 63	Gadolinium 64	Terbium 65	Dysprosium 66	Holmium 67	89		Ytterbium 70	Lutetium 71
a = relative atomic mass	232		238											
X = atomic symbol	드	Ра	_	N O	Pu	Am	Cm	BK	ర	Es	Fm	Md	2	ئ
b = proton (atomic) number	Thorium 90	Protactinium 91	Uranium 92		Plutonium 94	Americium 95		Berkelium 97	0)	Einsteinium 99	Fermium 100	Mendelevium 101	Nobelium 102	Lawrencium 103

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

Key