

## UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS International General Certificate of Secondary Education

_	
Í	
Í	

CANDIDATE NAME					
CENTRE NUMBER			CANDIDATE NUMBER		

## **COMBINED SCIENCE**

0653/03

Paper 3 (Extended)

October/November 2007

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 24.

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				
6				
7				
8				
9				
Total				

This document consists of 21 printed pages and 3 blank pages.



1 Hydrogen peroxide, H<sub>2</sub>O<sub>2</sub>, is a colourless liquid.

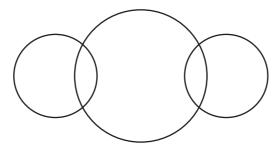
Hydrogen peroxide decomposes according to the equation below.

hydrogen peroxide → oxygen water

www.PapaCambridge.com (a) State the total number of atoms which are bonded in one molecule of hydrogen peroxide.

[1]

- (b) Complete the bonding diagram below to show
  - the chemical symbols of the elements in a molecule of water,
  - the arrangement of the outer electrons of each atom.



[2]

(c) Fig. 1.1 shows apparatus which a student used to measure the rate at which hydrogen peroxide decomposes.

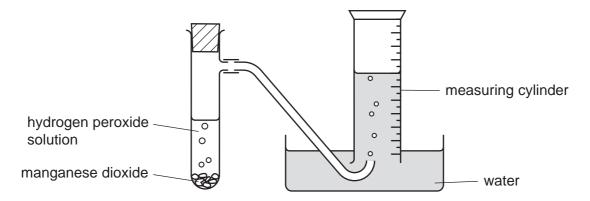


Fig. 1.1

The student measured the time for a known volume of oxygen gas to collect in the measuring cylinder.

able 1.1 shows re	3 sults the student obtained for fo Table 1.1	our experiments, <b>A</b> , <b>B</b> , <b>C</b> and <b>D</b>	For iner's
experiment	volume of oxygen gas collected /cm <sup>3</sup>	time taken for oxygen to collect /seconds	3e.com
Α	40	35	
В	40	15	
С	40	10	
D	40	25	

(i)	State and explain in which experiment, A, B, C or D, the reaction rate was the highest.
	[1]
(ii)	State and explain, in terms of particles, <b>one</b> variable (factor) which the student could have changed in order to obtain the results shown in Table 1.1.
	[3]

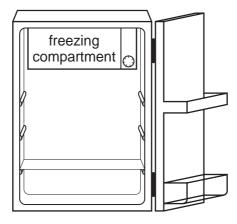


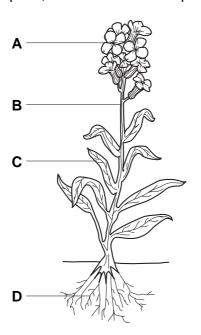
Fig. 2.1

(a)	(i)	Draw arrows on Fig. 2.1 to show what happens to the air cooled by the freezi compartment.	ing [1]
	(ii)	Use the idea of density to explain why this happens.	
			•••••
			[2]
(b)		en the refrigerator is used for 60 minutes, 360 000 joules of electrical energy averted.	are
	(i)	How many joules of energy are converted per second?	
		joules	[1]
	(ii)	What is the power of the refrigerator?	
			[1]

		5 e refrigerator has two lamps inside. The supply voltage is 240 V and the ssing through each lamp is 0.04 A.	
		5	1
(c)		e refrigerator has two lamps inside. The supply voltage is 240 V and the ssing through each lamp is 0.04 A.	aCal.
	(i)	Show that the resistance of one lamp is $6000\Omega$ .	
		State the formula that you use and show your working.	
		formula used	
		working	
			[1]
	(ii)	The lamps are connected together in parallel.	
		Calculate the combined resistance of the two lamps.	
		State the formula that you use and show your working.	
		formula used	
		working	

[3]

**3** Fig. 3.1 shows a plant, and also a cell from part of the plant.



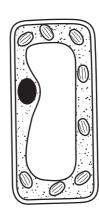


Fig. 3.1

(a)	1 10	I'll which part of the plant, A, B, C of B, does the cell come:				
			[1]			
(b)	On	the diagram of <b>the cell</b> in Fig. 3.1, label the following structures.				
	Use	e label lines and the appropriate letters.				
	Р	a partially permeable membrane				
	Q	the part of the cell that contains DNA				
	R	a part of the cell that contains a substance whose molecules contain magnesia	um [3]			
(c)	Wh	en a leaf is tested for starch, it is first boiled in water and then put into hot alcohol.				
	Exp	plain why these steps are necessary.				
	boiling in water					
	put	ting into hot alcohol				

(	$(\mathbf{d})$	Part A	of the	plant in	Fia.	3.1	is a	flower
١				P. C	,-	• • •		

	The state of the s
	The A of the plant in Fig. 3.1 is a flower.  Is this an insect-pollinated or a wind-pollinated flower?  Explain your answer.  type of pollination
Par	rt <b>A</b> of the plant in Fig. 3.1 is a flower.
(i)	Is this an insect-pollinated or a wind-pollinated flower?
	Explain your answer.
	type of pollination
	explanation
	[1]
(ii)	Some pollen from one of the flowers on this plant is transferred onto the stigma of another flower on the same plant. The male gamete in the pollen fertilises a female gamete in the flower.
	Is this asexual reproduction or sexual reproduction?
	Explain your answer.
	type of reproduction
	explanation
	[1]
(iii)	Explain why a plant breeder may prefer to use an asexual method of propagation of his plants, rather than a sexual method.
	[2]

potassiu For iner's

4 The apparatus in Fig. 4.1 can be used to study the reaction between potassible oxygen.

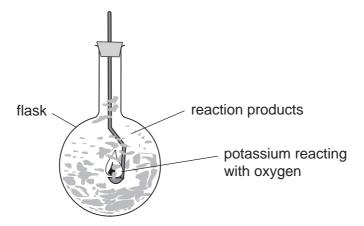


Fig. 4.1

(a)	Suggest why the flask becomes warm during the reaction.					
				[1]		
(b)	One of the compounds for		·			
	The electron configuration below.	ons of a po	otassium <b>atom</b> and ar	n oxygen <b>atom</b> are shown		
		К	2.8.8.1			
		0	2.6			
Use this information to explain the bonding in potassium oxide. In your answ should describe any changes in the electron configurations of these atoms, and the chemical formula of potassium oxide.						
				เยเ		

- www.PapaCambridge.com (c) Another compound formed in the reaction in Fig. 4.1 is potassium peroxide, When potassium peroxide is added to water the products are potassium hydroxide oxygen gas.
  - (i) A student attempted to work out the balanced equation for this reaction. His attempt is shown below.

$$2K_2O_2 + 2H_2O \longrightarrow 2KOH + O_2$$

	His teacher said this attempt was incorrect. Explain why this attempt is incorred and write down the correct equation.	ect,
		[2]
(ii)	Describe how the student should test the gas given off to confirm that it is oxyge	n.
		 [1]
iii)	The student found that the pH of the final mixture was 13.	
	Write the formula and charge of the ion present in the mixture which is respons for this pH value.	ible
		[1]

- 5 A space rocket is launched to the Moon.
- www.PapaCambridge.com (a) After launch, the empty fuel tanks are released and fall back to Earth. As a tank fall two forces act on it as shown in Fig. 5.1.

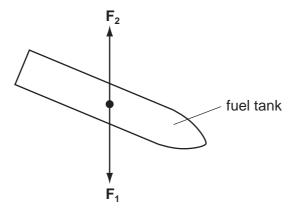


Fig. 5.1

	•	
(i)	Name forces F <sub>1</sub> and F <sub>2</sub> .	
	F <sub>1</sub>	
	F <sub>2</sub>	[2]
(ii)	As it falls, the tank accelerates because $\mathbf{F_1}$ is greater than $\mathbf{F_2}$ .	
	What will happen to the size of force F <sub>2</sub> as the tank goes faster?	
		[1]
(iii)	Eventually the two forces will balance each other.	
	How will this affect the speed of the falling tank?	
	Explain your answer.	
		[2]

		a rocket travels 400 000 km to the Moon in 80 hours.  culate the average speed of the rocket.  te the formula that you use and show your working.  formula used	
		11	
(b)	The	e rocket travels 400 000 km to the Moon in 80 hours.	Sh.
	Cal	culate the average speed of the rocket.	3
	Sta	te the formula that you use and show your working.	7
		formula used	
		working	
		[2	<u>']</u>
(c)		e of the astronauts on the rocket has a mass of 90 kg. The gravitational field ength of the Moon is about one-sixth that of the Earth.	t
	Sta	te the differences, if any, between	
	(i)	the mass of the astronaut on the Earth and on the Moon,	
		[1	]
	(ii)	the weight of the astronaut on the Earth and on the Moon.	
		[1	]

6

(ii) phagocytosis

Tuberculosis (TB) is an infectious disease caused by a bacterium. HIV/AIDS is cause virus.	For iner's
(a) Name the cells in the body that help to destroy harmful bacteria and viruses by	Tage
(i) producing antibodies,	COM
	[1]

[1]

**(b)** Table 6.1 shows the percentage of people with TB and HIV/AIDS in four parts of the world in 2005.

Table 6.1

part of the world	percentage of people with TB	percentage of people with HIV/AIDS
sub-Saharan Africa	0.51	7.2
Southeast Asia	0.35	1.1
Americas	0.07	0.7
Europe	0.06	0.5

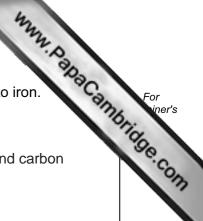
(i)	Describe any pattern that seems to link the percentages of people with TB and with HIV/AIDS.
	[1]
(ii)	The virus that causes AIDS infects white blood cells.
	Explain how this could be responsible for the pattern that you have described in (i).
	[2]

(c)	In many countries, young people are vaccinated against TB. They are given injection of weakened TB bacteria.  Explain how this vaccination could make a person immune to TB.	For iner's
		COM

Aluminium, iron, sodium and chlorine are important elements produced by the ch

ind	ustry.
(a)	State which of the elements above
	(i) has atoms which are converted into ions by <b>gaining</b> an electron,
	[1]
	(ii) has atoms which contain 3 electrons in their outer shells.
	[1]
(b)	When chlorine gas is bubbled into a colourless solution of sodium bromide, the solution turns orange.
	Explain this observation.
	[2]

For iner's (c) Fig. 7.1 shows a blast furnace which is used to convert iron(III) oxide into iron.



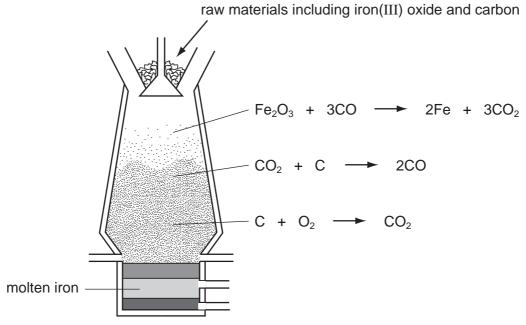


Fig. 7.1

The balanced equations of the three main chemical reactions in the blast furnace are shown in Fig. 7.1. Each reaction is a redox reaction.

(i)	State <b>two</b> substances, shown in Fig. 7.1, which are reduced.	
	Explain your answer briefly.	
		[3]
(ii)	Use the relative atomic masses shown on the Periodic Table to calculate relative formula mass of iron( ${ m III}$ ) oxide.	the
	Show your working.	
		[1]

- 8 A student is having a medical examination.
  - (a) A dentist checks the student's teeth using a dental mirror. This is shown in Fig. 8.1.

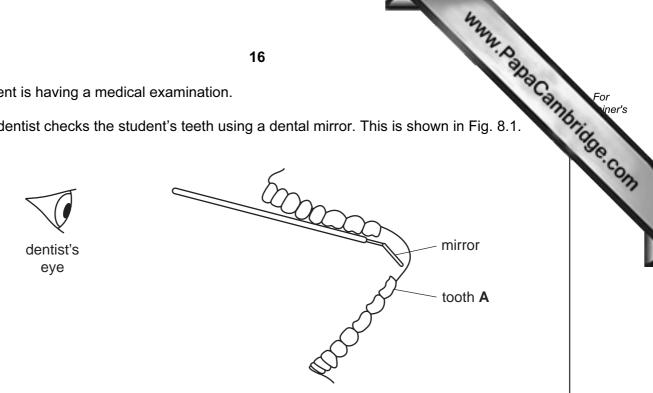


Fig. 8.1

(i) Draw a ray of light from the back of tooth A to the dentist's eye to show how the dentist is able to see the back of the tooth.

On the ray, draw arrows showing the direction in which light travels. [3]

(ii) Describe how the dentist could find the density of an irregular object such as an extracted tooth.

www.PapaCambridge.com (b) The doctor wants to use a small torch to look down the student's throat. When the student's throat was a small torch to look down the student's throat. switches the torch on, it does not work.

Fig. 8.2 shows the circuit diagram for the torch.

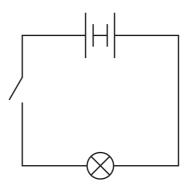


Fig. 8.2

(i)	Explain what is wrong with the torch.	
		••••
		[1

(ii) Draw the correct circuit diagram.

]

**BLANK PAGE** 

Fig. 9.1 shows part of the carbon cycle. 9

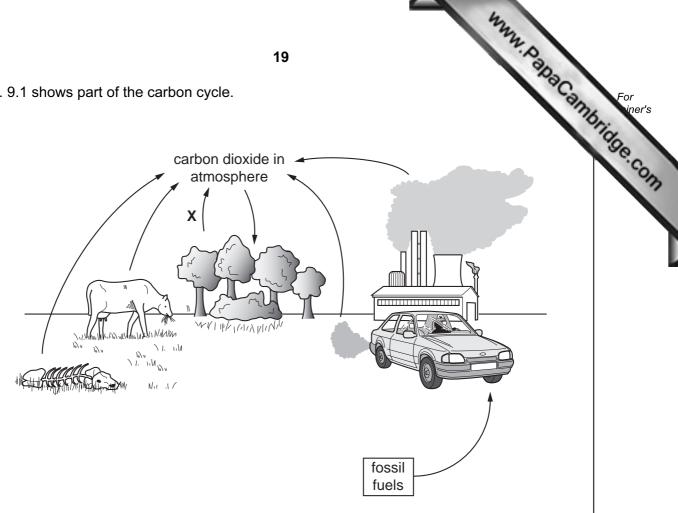


Fig. 9.1

(a)	Name the process labelled <b>X</b> on Fig. 9.1.	
		[1]
(b)	Explain how carbon dioxide is returned to the air from the bodies of dead organisms.	
		[4]

2	2		
	ACS"	For iner'	
`	13	iner	S
 		190	
	`	i.c.	

13
[2]

(d) Fossil fuels are burned in cars, trucks and other vehicles.

(c) Describe how fossil fuels are formed.

Fig. 9.2 shows the quantity of sulphur dioxide and nitrogen oxides emitted from vehicles in a European country between 1990 and 2003. Over this period, the country brought in measures to try to decrease the emissions of these gases.

The number of vehicles using the roads increased over this time period.

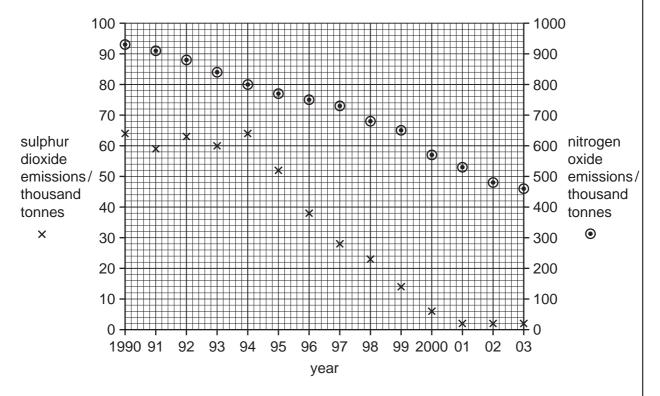


Fig. 9.2

(i)	Suggest a reason for the trend in sulphur dioxide emissions between 1982003.  [1]	For
	[1]	S.C.
(ii)	Catalytic converters were introduced into this country in 1993. They are fitted onto car exhaust systems, and they contain catalysts that cause nitrogen oxide to be reduced to nitrogen.	
	Suggest two reasons why nitrogen oxides had not been completely eliminated from car exhaust gases by 2003.	
	1	
	2.	
	[2]	
iii)	Explain how emissions of sulphur dioxide and nitrogen oxides can harm living organisms.	
	[3]	

**BLANK PAGE** 

**BLANK PAGE** 

The Periodic Table of the Elements DATA SHEET

								Gre	Group								
_	=											≡	ΛΙ	>	IΛ	IIΛ	0
							T Hydrogen										4 <b>He</b> Helium
7 Lithium	Beryllium											11 Boron 5	12 <b>C</b> Carbon 6	14 <b>X</b> Nitrogen 7	16 Oxygen	19 <b>F</b> luorine	20 Neon 10
23 <b>Na</b> Sodium	24 Mg Magnesium	I										27 <b>A1</b> Auminium	28 <b>Si</b> Silicon	31 <b>P</b> Phosphorus 15	32 <b>S</b> Sulphur 16	35.5 <b>C1</b> Chlorine	40 <b>Ar</b> Argon
39 K	40 <b>Caa</b> Calcium	Scandium	48 <b>T</b> Titanium 22	51 V Vanadium 23	Chromium 24	Mn Manganese 25	56 <b>Fe</b> Iron 26	59 <b>Co</b> Cobalt	59 Nickel	64 Copper 29	65 <b>Zn</b> Zinc 30	70 <b>Ga</b> Gallium 31	73 <b>Ge</b> Germanium	AS Arsenic	Selenium	80 <b>Br</b> Bromine 35	84 <b>Kry</b> Krypton
Rb Rubidium	Strontium	89 <b>×</b>	91 <b>Zr</b> Zirconium 40	93 <b>N</b> iobium 41	96 <b>Mo</b> Molybdenum 42	Tc Technetium	Ruthenium 44	103 <b>Rh</b> Rhodium 45	106 <b>Pd</b> Palladium 46	108 <b>Ag</b> Silver 47	Cd Cadmium 48	115 <b>In</b> Indium 49	119 <b>Sn</b> Tin	Sb Antimony 51	128 <b>Te</b> Tellurium	127 <b>I</b> lodine	Xe Xenon
Caesium 55	137 <b>Ba</b> Barium 56	139 <b>La</b> Lanthanum 57 *	178 <b>Hf</b> Hafnium 72	181 <b>Ta</b> Tantalum	184 <b>W</b> Tungsten 74	186 <b>Re</b> Rhenium 75	190 <b>Os</b> Osmium 76	192 <b>Ir</b> Indium	195 <b>Pt</b> Platinum 78	197 <b>Au</b> Gold	201 <b>Hg</b> Mercury 80	204 <b>T 1</b> Thallium 81	207 <b>Pb</b> Lead 82	209 <b>Bi</b> Bismuth	Po Polonium 84	At Astatine 85	Radon 86
<b>Fr</b> Francium 87	226 <b>Ra</b> Radium 88	227 <b>Ac</b> Actinium 89															
*58-71 L 190-103	*58-71 Lanthanoid series 190-103 Actinoid series	d series series		140 <b>Ce</b>	141  Pr	Neodymium	<b>Pm</b> Promethium	Samarium	152 <b>Eu</b> Europium	157 <b>Gd</b> Gadolinium	159 <b>Tb</b>	162  Dy  Dysprosium	165 <b>Ho</b> Holmium	167 <b>Er</b> Erbium	169 <b>Tm</b> Thulium	Yb Ytterbium	175 <b>Lu</b> Lutetium

500															
ooi oo oo oo	140	141	144		150	152	157	159	162	165	167	169	173	175	
iold series	ပီ	፵	Nd	Pm	Sm	Eu	gq	<u>P</u>	٥	운	ш	۳	Υb	Ľ	
משושמ חו	Cerium 58	Praseodymium 59	Neodymium 60	Promethium 61	Samarium 62	Europium 63	Gadolinium 64	Terbium 65	Dysprosium 66	Holmium 67	Erbium 68	Thulium 69	Ytterbium 70	Lutetium 71	
a = relative atomic mass	232		238												
X = atomic symbol	ᄕ	Ра	<b>-</b>	o N	Pu	Am	Cm	益	ర	Es	Fm	Md	8	ئ	2
b = proton (atomic) number	Thorium 90	Protactinium 91	Uranium 92	Neptunium 93	Plutonium 94	Americium 95	Curium 96	Berkelium 97	Californium 98	Einsteinium 99	Fermium 100	Mendelevium 101	Nobelium 102	Lawrencium 103	n
	Ī	-	-												00.
	The v	The volume of one mole of any gas is 24 dm <sup>3</sup> at room temperature and pressure (r.t.p.).	one mole	of any ga	ıs is 24 dr	ກ³ at roor	n tempera	ature and	pressure	(r.t.p.).					000
													•	Co	1
													1	M	
													3	STI	nios
													Se.	1	
													CO		
												2	1		
												ļ			

Key

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.