



CANDIDATE NAME

CENTRE NUMBER

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

CANDIDATE NUMBER		

**COMBINED SCIENCE** 

0653/21

Paper 2 (Core)

May/June 2013

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 pencil for any diagrams or graphs.

Do not use staples, paper clips, glue or correction fluid.

DO **NOT** WRITE IN ANY BARCODES.

Answer all questions.

Electronic calculators may be used.

You may lose marks if you do not show your working or if you do not use appropriate units.

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.



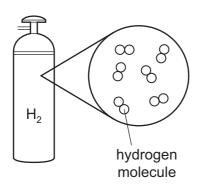
(a) Table 1.1 shows the numbers of protons, neutrons and electrons in four atoms, and D.

Table 1.1

atom protons neutrons electrons
. 1

atom	protons	neutrons	electrons
Α	1	0	1
В	8	8	8
С	1	1	1
D	15	16	15

(i)	Name the central part of an atom that contains protons and neutrons.
	[1]
(ii)	Explain which one of the atoms, <b>A</b> , <b>B</b> , <b>C</b> or <b>D</b> , has a nucleon number (mass number) of 16.
	atom
	explanation
	[2]
(iii)	Use the information in Table 1.1 to explain why atoms do <b>not</b> have an overall electrical charge.
	[2]
	[2]



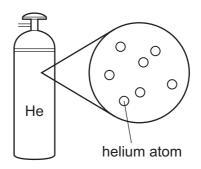


Fig. 1.1

(i) Hydrogen is usually described as a non-meta	l.
---	----

Name the type of chemical bond joining the atoms in a hydrogen molecule.

(ii) Suggest why helium exists as uncombined atoms.

(c) Hydrogen is often included in the reactivity series of metals.

Use the idea of reactivity to explain the observations shown in Fig. 1.2.

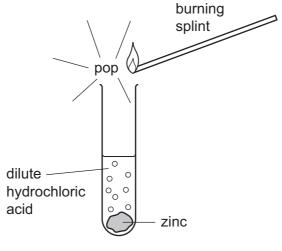


Fig. 1.2

[2]

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2 (a) A fishing boat is floating on the sea.

A fisherman drops a heavy anchor from the boat. The anchor accelerates as it fall through the water.

(i) Name the downward force which makes the anchor accelerate.

Г1	1	
 ι,	1	

(ii) Complete the sentence below to describe the main energy change that happens to the anchor during its fall.

	energy is changed into	
eneray.		[2]

**(b)** Fig. 2.1 shows a diagram of a water wave.

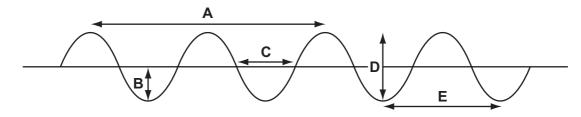


Fig. 2.1

Which measurement A, B, C, D or E is

(i)	the wavelength of the wave?	[1	11
` '	9	 •	-

(ii) the amplitude of the wave? [1]

(c) Water waves are a renewable energy resource.

Fig. 2.2 shows how water waves can be used to produce electricity.

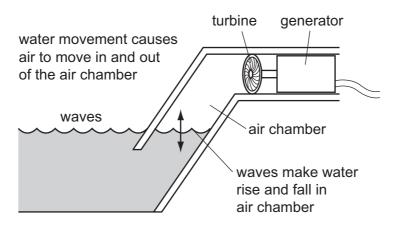


Fig. 2.2

Complete the sentences below to describe how the kinetic energy of the waves is changed into electrical energy.

The kinetic energy of the waves is transferred into the gravitational potential energy of the water.

This causes the air to move and make the	ie	spin.	
Electrical energy is produced in the	·		[2]



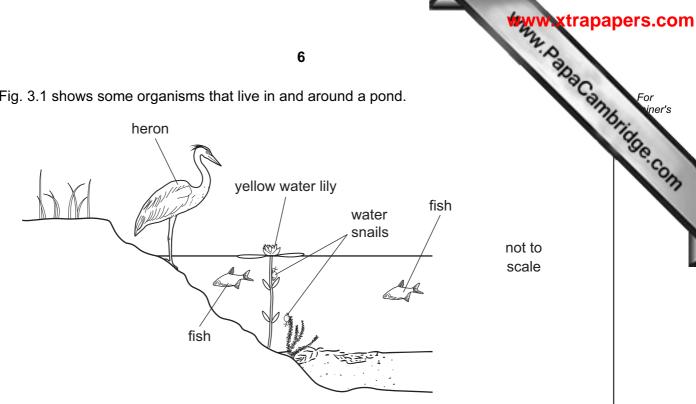


Fig. 3.1

(a) Herons eat fish. Water snails eat water plants, such as yellow water lilies.

Tick **all** the boxes that correctly describe each organism.

	producer	consumer	carnivore	herbivore
heron				
water snail				
yellow water lily				

[3]

- (b) The addition of a harmful substance to the environment is called pollution. Two examples of pollution caused by human activities are
  - untreated sewage entering a pond,
  - the release of methane into the atmosphere.

(i)	Explain why untreated sewage entering a pond may cause fish to die.		
	(3)		

iner's

(ii)	Methane is produced by bacteria and other decomposers breaking down of waste material in rubbish dumps.
	Describe how air pollution by methane can harm the environment.
	[2]

- 4 Petroleum (crude oil) and rock salt occur naturally in the Earth's crust.
  - (a) Petroleum is a mixture that contains thousands of different compounds. Many of the compounds are alkanes.
    - (i) Complete the diagram of the alkane molecule that contains two carbon atoms.

[2]

(ii) Fig. 4.1 shows a simple pie chart of the composition of natural gas.

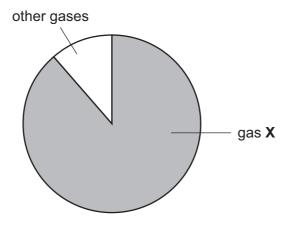


Fig. 4.1

Name gas **X**. [1]

**(b)** When petroleum is refined, it is separated into fractions.

Fig. 4.2 shows a simplified diagram of apparatus that is used to refine petroleum.

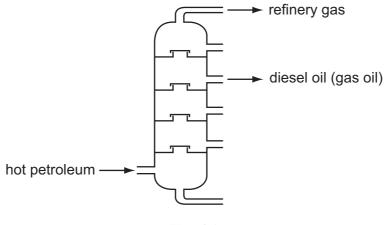


Fig. 4.2

(i)	State the full name of the process shown in Fig. 4.2.	
		[1]
(ii)	Refinery gas and diesel oil are used as fuels.	
	Name the <b>two</b> compounds that are formed when alkanes in these fuels undergomblete compustion	go

and

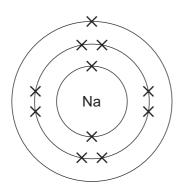
- (c) Rock salt contains mainly sodium chloride which is a compound of the alkali metal, sodium, and the halogen, chlorine.
  - Earth's crust.

(i) Explain why the uncombined elements sodium and chlorine are not found in the

[1]

(ii) Fig. 4.3 shows diagrams of a sodium atom and a chlorine atom.

10



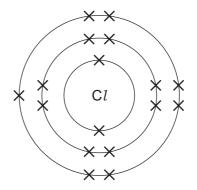


Fig. 4.3

When sodium reacts with chlorine, the atoms shown in Fig. 4.3 first change into electrically charged atoms known as ions.

Describe briefly what happens when sodium atoms and chlorine atoms are

	[2]
	•••••
changed into ions.	

5 Milk is a liquid produced by cows and other mammals, on which they feed their young

Table 5.1 shows the mass of some of the substances in 100g samples of milk from two mammals.

Table 5.1

substance	cow's milk	water-buffalo's milk
protein/g	3.2	4.5
fat/g	3.9	8.0
carbohydrate/g	4.8	4.9
calcium/mg	120	195

(a)	Which substance shown in Table 5.1 is present in the samples of milk in the smallest quantity?
	[1]
(b)	Suggest which substance, <b>not</b> shown in Table 5.1, is present in the samples of milk in the largest quantity.
	[1]
(c)	Explain why both cow's milk and water-buffalo's milk produce a violet colour when tested with biuret solution.
	[1]
(d)	Predict the colour you would see if you added iodine solution to cow's milk.
	Explain your answer.
	colour
	explanation [2]
(e)	List the components of milk, shown in Table 5.1, that provide energy.
	[1]
(f)	Explain <b>one</b> way in which drinking water-buffalo's milk might be better for a person's health than drinking cow's milk.
	[2]

**6 (a)** In a store, two workers are lifting 5 kg bags of flour onto the shelves. There a shelves, 0.5 m apart. The lowest shelf is 0.5 m from the floor.

Fig. 6.1 shows the two workers.

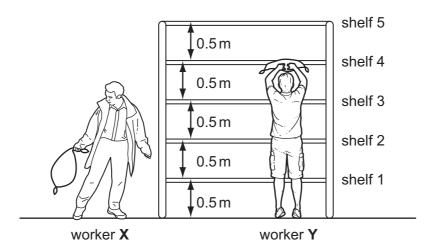


Fig. 6.1

(i)	Worker <b>X</b> lifts a bag of flour onto shelf 2. Worker <b>Y</b> lifts a bag of flour onto shelf 4	ŧ.
	Which worker has done more work?	
	Explain your answer.	
	worker because	
		[1]
(ii)	State the unit in which work and energy are measured.	[1]
iii)	State the mass of each 5 kg bag of flour in grams.	[1]
iv)	Each 5 kg bag of flour has a volume of 5500 cm <sup>3</sup> .	
	Calculate the average density of the bag of flour. State your answer in g/cm <sup>3</sup> .	
	State the formula that you use and show your working.	
	formula	

g/cm<sup>3</sup> [2]

working

(b) Three boys, A, B and C, walk together from their school to a store. They stay store for a few minutes and then return to school.

When they leave the store,

- one boy walks back to school at a steady pace,
- one boy walks back to school at a slower steady pace,
- one boy slows down gradually as he walks back to school.

The graph in Fig. 6.2 shows how their speeds vary with time during the whole journey to the store and back again.

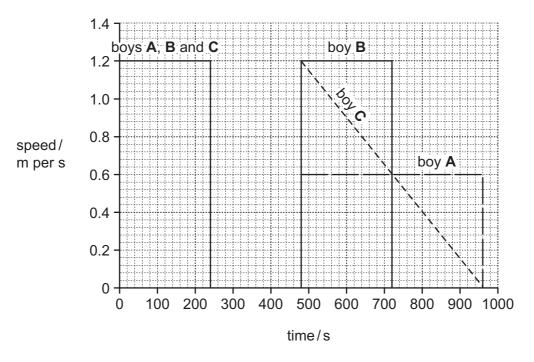


Fig. 6.2

(i) Calculate the distance of the store from the school.Show your working.

		 m	[2]
(ii)	For how many seconds do the boys stay in the store?		
		 s	[1]
(iii)	Which boy slowed down on his way back to school?		
	State a reason for your answer.		
	boybecause	 	

7 (a) Sodium hydrogencarbonate, NaHCO<sub>3</sub>, is a white solid compound.

State the number of different elements that are shown combined in the formula NaHCO<sub>3</sub>.

Γ1	1	
 г.	1	

**(b)** Fig. 7.1 shows apparatus a student used to investigate the reaction between sodium hydrogencarbonate and dilute hydrochloric acid.

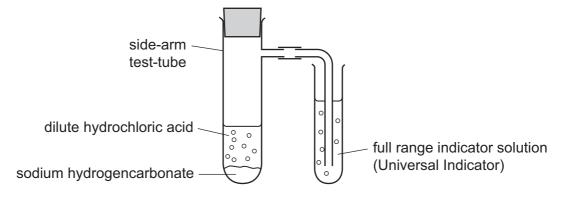


Fig. 7.1

The student observed that the indicator changed colour from green to orange.

	[2
Explain this observation.	

(c) The student investigated the temperature change when sodium hydrogencal was added to excess dilute hydrochloric acid.

Fig. 7.2 shows the apparatus she used.

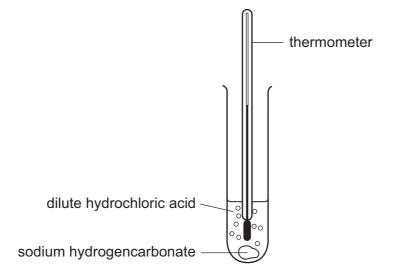


Fig. 7.2

Table 7.1 shows the temperature measurements the student made.

Table 7.1

temperature of the acid before the reaction/°C	19.0
temperature of the reaction mixture after reaction/°C	12.0

(i)	Calculate the temperature change that occurred during the reaction.	
	°C [2	<u>'</u> ]
(ii)	State the term that is used to describe chemical reactions that cause this <b>type</b> of temperature change.	)f
	[1	]
	,	d
Len	mon juice contains a relatively low concentration of acid.	
Sta	ate the effect on the rate of reaction of	
	using a relatively low acid concentration,	
	using egg shells in the form of a fine powder.	
	(ii) A s	(ii) State the term that is used to describe chemical reactions that cause this <b>type</b> of temperature change.  [1]  A soluble calcium compound can be made by reacting lemon juice with finely powdered egg shells, which are made mainly of calcium carbonate.  Lemon juice contains a relatively low concentration of acid.  State the effect on the rate of reaction of using a relatively low acid concentration,

8 Fig. 8.1 shows the human gas exchange system.

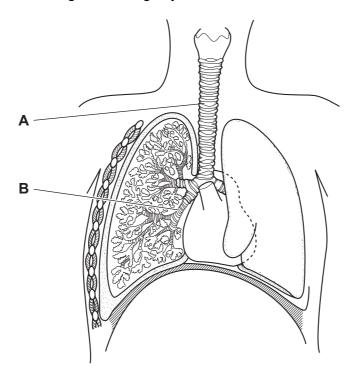


Fig. 8.1

(a)	Name struc	ctures A	and <b>B</b>
-----	------------	----------	--------------

Α	
_	[0]

(b) Table 8.1 shows the differences in the composition of inspired and expired air.

Table 8.1

gas	percentage in inspired air	percentage in expired air
nitrogen	78	
oxygen	21	17
carbon dioxide	0.04	4
noble gases	1	

	(ii)	Name <b>one</b> noble gas that is present in air.	- 4 -
(ii) Namo <b>ano</b> noble gas that is present in air	(11)	Name one hobie gas that is present in all.	[1]
	(ii)	Name <b>one</b> noble gas that is present in air.	

(iii)	Explain why the air that we breathe out (expired air) contains less oxygemore carbon dioxide than the air we breathe in.
	[2]
(iv)	Describe how you could show that expired air contains more carbon dioxide than inspired air. You can use a diagram if it helps your answer.
	ro1

(c) An athlete exercised on a treadmill. The treadmill measured her power output, in The faster she ran, the greater her power output.





(i)	Explain why the athlete's power output was greater when she ran faster.
	[2]

(ii) The athlete was connected to a machine that measured the rate and depth breathing.

Fig. 8.2 shows how her depth of breathing changed when she ran with different power outputs.



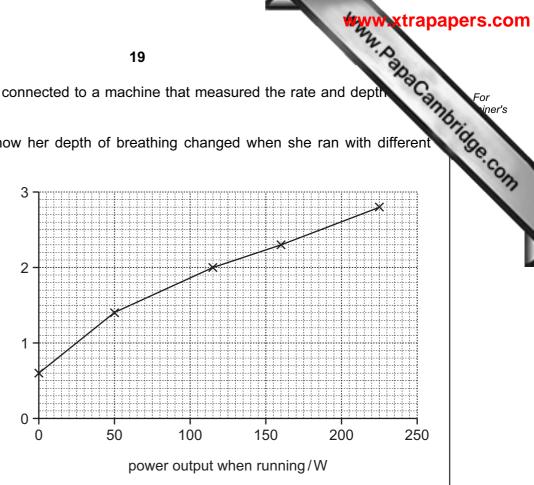


Fig. 8.2

	Describe greater po			depth	of	breathing	changed	when	she	ran	with	а
		 				•••••			•••••	•••••		
		 									[3	2]
(iii)	State one greater po		•	ch her	bre	eathing wo	uld chang	e wher	n she	ran	with	а
											[	1]

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9 (a) Complete the following sentences choosing from the terms below.

				www.xtrapa
		20	`	12.0
Complete the follow	wing sentences cho	osing from the	terms below.	abacar
Each term may be	used once, more th	nan once or not	at all.	Sang
cur	rent parall	el pote	ential difference	
	resistance	series	watt	
A flow of electric cl	harge is called a		·	
An ammeter is use	ed to measure		······································	[2]

(b) A student investigated how a change in potential difference across a lamp affect current flowing through the lamp.

She used wires to connect the components shown in Fig. 9.1 to make a circuit.

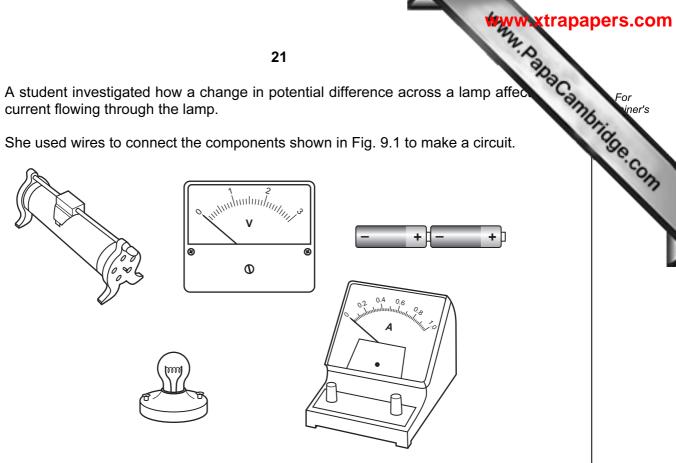


Fig. 9.1

Using the correct circuit symbols, draw a diagram to show the circuit she used.

[4]

rom pylon For iner's (c) Electricity is often transmitted through overhead power cables hung from pyrthese cables are put up on a hot summer day, they are hung loosely from the pylone. shown in Fig. 9.2.

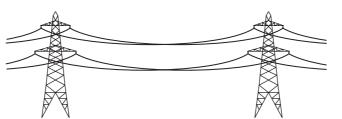


Fig. 9.2

Suggest why the cables are hung loosely.	
	[2]

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The Periodic Table of the Elements DATA SHEET

								-	1	WWW.	Axtrapapers.com
					2	4					Papa
-	0	Helium	20 <b>Ne</b> on 10	40 <b>Ar</b> Argon	84 <b>Kr</b> Krypton 36	131 <b>Xe</b> Xenon 54	<b>Rn</b> Radon		Lutetium	<b>Lr</b> Lawrencium 103	Astrapapers.com
	II/		19 Fluorine	35.5 <b>C1</b> Chlorine	80 <b>Br</b> Bromine 35	127 <b>T</b> lodine	At Astatine 85		173 <b>Yb</b> Ytterbium 70	Nobelium 102	Se. con
	I		16 Oxygen 8	32 <b>S</b> Sufur 16	Selenium 34	128 <b>Te</b> Tellurium 52	Po Polonium 84		169 <b>Tm</b> Thullum	Md Mendelevium 101	
	>		14 <b>N</b> itrogen 7	31 Phosphorus	75 <b>As</b> Arsenic 33	122 <b>Sb</b> Antimony 51	209 <b>Bi</b> Bismuth 83		167 <b>Er</b> Erbium 68	Fm Fermium 100	- 1
	2		12 Carbon 6	28 <b>Si</b> Silicon	73 <b>Ge</b> Germanium 32	119 <b>Sn</b> Tin	207 <b>Pb</b> Lead 82		165 <b>Ho</b> Holmium 67	Einsteinium	(r.t.p.).
	=		11 Boron 5	27 <b>A1</b> Aluminium 13	70 <b>Ga</b> Gallium 31	115 <b>In</b> Indium 49	204 <b>T 1</b> Thallium 81		162 <b>Dy</b> Dysprosium 66	Californium	The volume of one mole of any gas is 24 dm³ at room temperature and pressure (r.t.p.).
					65 <b>Zn</b> Zinc 30	112 <b>Cd</b> Cadmium 48	201 <b>Hg</b> Mercury 80		159 <b>Tb</b> Terbium 65	<b>Bk</b> Berkelium 97	ature and
					64 <b>Copper</b> Copper 29	108 <b>Ag</b> Silver 47	197 <b>Au</b> Gold		157 <b>Gd</b> Gadolinium 64	Curium 96	n temper.
Group					Nickel	106 <b>Pd</b> Palladium 46	195 <b>Pt</b> Platinum 78		152 <b>Eu</b> Europium 63	Am Americium 95	ካ³ at roor
פֿ					59 <b>Cobalt</b>	103 <b>Rh</b> Rhodium 45	192 <b>Ir</b> Iridium		Sm Samarium 62	<b>Pu</b> Plutonium	as is 24 dı
		1 Hydrogen			56 <b>Fe</b> Iron	Ru Ruthenium 44	190 <b>OS</b> Osmium 76		Pm Promethium 61	Neptunium	of any ga
					Mn Manganese 25	Tc Technetium 43	186 <b>Re</b> Rhenium 75		Neodymium 60		one mole
					52 <b>Cr</b> Chromium 24	96 <b>Mo</b> Molybdenum 42	184 <b>W</b> Tungsten 74		Pr Praseodymium 59	Pa Protactinium 91	olume of
					51 V Vanadium 23	93 <b>Nb</b> Niobium 41	181 <b>Ta</b> Tantalum 73		140 <b>Ce</b> Cerium	232 <b>Th</b> Thorium	The v
					48 Ti	91 <b>Zr</b> Zirconium 40	178 <b>#f</b> Hafnium		1	nic mass Ibol nic) number	
		ſ			Scandium 21	89 <b>×</b>	139 <b>La</b> Lanthanum 57 *	227 <b>AC</b> Actinium †	series eries	<ul> <li>a = relative atomic mass</li> <li>X = atomic symbol</li> <li>b = proton (atomic) number</li> </ul>	
	=	ļ	9 <b>Be</b> Beryllium	24 Mg Magnesium	40 <b>Calcium</b> 20	Sr Strontium	137 <b>Ba</b> Barium 56	226 <b>Ra</b> Radium 88	*58-71 Lanthanoid series 190-103 Actinoid series	e <b>×</b> a	
	_		7 <b>Li</b> Lithium	23 <b>Na</b> Sodium	39 R Potassium	Rubidium	Caesium 55	Francium 87	*58-71 L	Key	

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