

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS International General Certificate of Secondary Education

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CANDIDATE NAME						
CENTRE NUMBER			CAND NUMB	IDATE BER		

CO-ORDINATED SCIENCES

0654/02

Paper 2 (Core)

May/June 2009

2 hours

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 28.

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 Exam	For Examiner's Use			
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
Total				

This document consists of 25 printed pages and 3 blank pages.

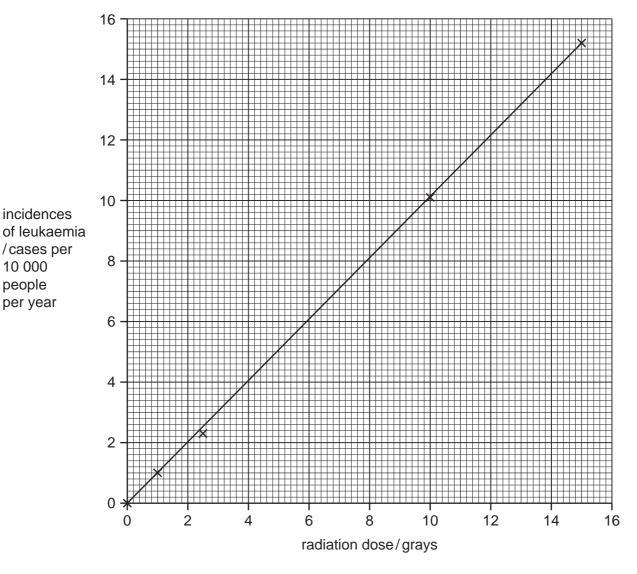


(a) Many people have survived accidents where they have been exposed to 1 radiation from radioactive materials. Such exposure can have serious effects on health.

www.PapaCambridge.com The table and graph show how the dose (amount) of radiation received is linked to a type of cancer called leukaemia. The radiation dose is measured in units called grays.

Table 1.1

radiation dose/grays	incidences of leukaemia/cases per 10 000 people per year
1.0	1.0
2.5	2.3
5.0	
10.0	10.1
15.0	15.2



incidences

/cases per 10 000 people per year

Fig. 1.1

	dh	For iner's
) (of	Se.com

	(i)	The result for 5.0 grays has been missed out of the table.
		Use the graph to help you fill in the missing result in the table.
	(ii)	What is the relationship between the ionising radiation and the incidence of leukaemia?
		[1]
ı	(iii)	Name one other health hazard, apart from leukaemia and other cancers, caused by ionising radiation.
		[1]
(b)		e three types of nuclear radiation from naturally occurring sources are alpha, beta gamma. They can be identified by their different penetrating powers.
		mma radiation can pass through a thick layer of lead. Explain how you could identify ha and beta radiation by their penetrating powers.
	alp	ha radiation
	bet	ta radiation
		[2]
(c)	Rad	don-222 has a half-life of four days.
	(i)	What is meant by the term half-life?
		[1]
	(ii)	1 milligram of radon-222 is allowed to decay.
		Calculate after how many days there would be 0.125 milligrams of radon-222 remaining.
		Show your working.
		[2]

2 Fig. 2.1 shows the water cycle.

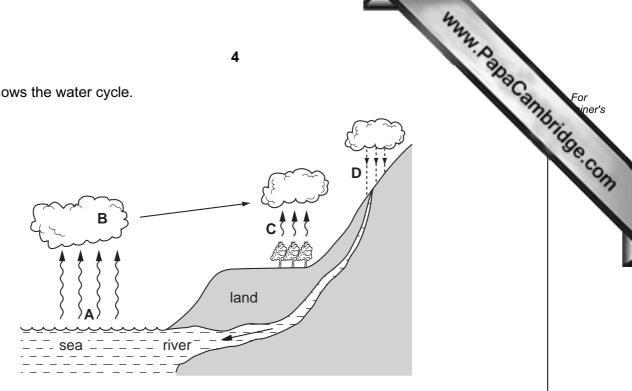


Fig. 2.1

(a) Choose the word from the list below that describes each of the stages A, B, C and D.

		condensation	evaporation	melting	
		osmosis	precipitation	transpiration	
	Α				
	В				
	С				
	D				[4]
(b)	Describe	e two ways in which defor	estation may affect	the water cycle.	
					[2]

		My.	
		5	
(c)		ter is an essential part of the diet. Water is absorbed from the alimentary calblood. It is transported around the body to every cell. Name the part of the blood that transports water around the body.	Can
	(i)	Name the part of the blood that transports water around the body.	
			[1]
	(ii)	Describe how water moves from the blood into a body cell.	
			[3]
d)	Wa	ter that is to be used for drinking is often treated with chlorine.	
	Exp	plain why this is done.	
			[0]

3 Food colourings contain molecules which make food appear coloured.

(a) Explain the meaning of the term *molecule*.

6 Many Day	
d colourings contain molecules which make food appear coloured.	For
Explain the meaning of the term <i>molecule</i> .	78 iner's
	36.C
	O'M
[2]	

(b) Fig. 3.1 shows two pieces of cloth, **A** and **B**, stained with the same food colouring.

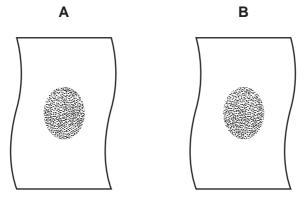


Fig. 3.1

Cloth A was washed with soap in hard water.

Cloth **B** was washed in the same way with the same amount of soap in soft water.

Fig. 3.2 shows the pieces of cloth after washing.

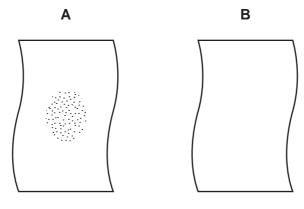


Fig. 3.2

Explain briefly, in terms of water hardness, why more of the food colouring was removed from cloth B than from cloth A. [3]

(c)		e compound which causes hardness in water is calcium hydrogencare $HCO_3)_2$.
	(i)	State the total number of atoms which are shown combined in the formula of calcium hydrogencarbonate.
		[1]
	(ii)	State the number of electrons in the outer energy level (shell) of a calcium atom.
		Explain your answer briefly.
		number of outer electrons
		explanation
		וכיז

For iner's

www.PapaCambridge.com (a) A student investigated how a change in potential difference across a lamp affect current flowing through it.

She used wires to connect the components shown in Fig. 4.1 to make a circuit.

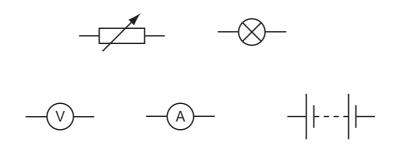


Fig. 4.1

(i) Using the correct symbols from Fig. 4.1, draw a diagram to show the circuit she used.

г	2	٦
ı	٠	. 1
ı	v	1

(ii) Explain why the variable resistor is included in the circuit.

Her results are shown in	9 n Table 4.1.		AAAAA DADACAAAA For ine
	Table 4.1		Midde
potential difference across lamp/V	current through lamp / A	resistance of lamp filament/Ω	100
4	1.2	3.3	1 `
8	1.5		
12	1.7	7.1	

Complete the table by calculating the missing resistance and writing your answer in the empty box.

State the formula that you use and show your working	
--	--

formula

working

(iv) The student concluded that the relationship between potential difference and current did not correspond to Ohm's law.

did not correspond to Ohm's law.	•
	•••••
	[2]

Explain why the relationship between potential difference and current for the lamp

[2]

Identify and explain the electrical hazard shown in Fig. 4.2.

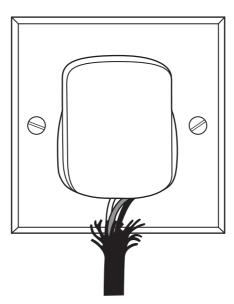


Fig. 4.2

[2]

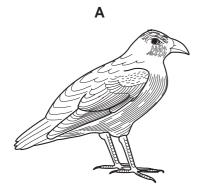
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Please turn over for Question 5.

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5 Fig. 5.1 shows three vertebrates.





В

c

Fig. 5.1

(a)	(i)	Animal A is a bird. State two features, visible on Fig. 5.1, that are characteristic of
		birds.

	1		
	2		[2]
(ii)	Nam	ne the classes to which animals B and C belong.	
	В		
	С		[2]
(iii)	Anin	nal C belongs to the genus <i>Rana</i> and the species <i>temporaria</i> .	
	Write	e the binomial for animal C .	
			[1]

(iv) Animal C spends part of its time in water.

Describe **one** way, visible in Fig. 5.1, in which animal **C** is adapted for life in water.

 •••••
[2]

www.PapaCambridge.com (b) Fig. 5.2 shows how the temperatures of animal A and animal C change wh temperature of their environment changes.

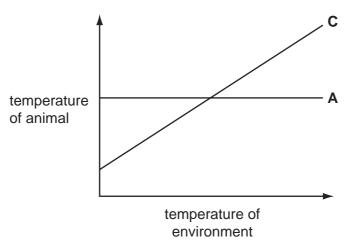


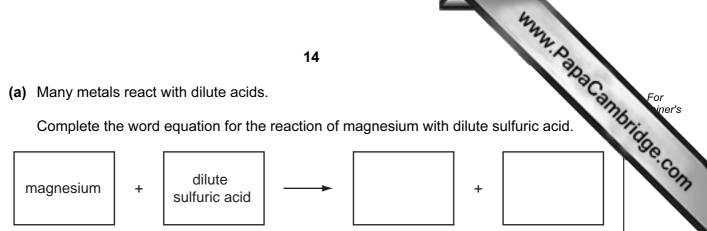
Fig. 5.2

(i)	Explain how Fig. 5.2 shows that animal A regulates its temperature but animal C does not.
	[1]
(ii)	Name one group of vertebrates, other than birds, that regulates body temperature.
	[1]
(iii)	Explain why it is useful to regulate body temperature.
	[2]
(iv)	Animals that regulate their body temperature need to eat much more food than animals that do not.
	Suggest an explanation for this.
	[2]

[2]

(a) Many metals react with dilute acids. 6

Complete the word equation for the reaction of magnesium with dilute sulfuric acid.



(b) A student used the apparatus shown in Fig. 6.1 to investigate the rate of reaction between sulfuric acid and magnesium.

To start the reaction, she tilted the flask to mix the reactants.

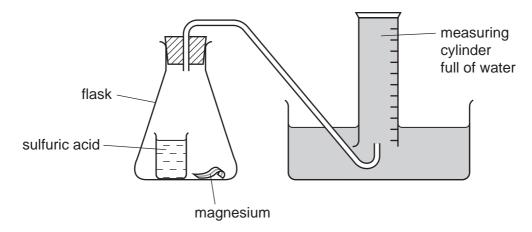


Fig. 6.1

She timed how long it took for 30.0 cm³ of gas to collect in the measuring cylinder.

Some of her results are shown in Table 6.1.

Table 6.1

experiment number	time to collect 30 cm ³ gas/seconds
1	73
2	41
3	119

(i)	Explain in which experiment, 1, 2 or 3, the rate of reaction was highest.	
		[1]
		•

	ny	
	15	
(ii)	Suggest two changes to the reaction conditions in experiment 1 that would the rate of reaction to decrease.	For ine
	Suggest two changes to the reaction conditions in experiment 1 that would the rate of reaction to decrease. 1	de c
	2	
	[2]	
(iii)	During experiment 1, the student noticed that the flask became warm.	
	Explain this observation.	
	[2]	

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7	
80	
00	١

7 A diver is working under water, wearing a diving suit and helmet.

(a) The diving helmet has a plastic window of area 100 cm². The air pressure inside the helmet is the same as the water pressure outside.

hel	met is the same as the water pressure outside.
(i)	At a depth of 40 m, the diver breathes air at a pressure of 50 N/cm ² .
	Calculate the force exerted by the air on the helmet window at this depth.
	Use the formula
	pressure = force/area
	Show your working.
	N [2
(ii)	At the surface of the sea, the pressure of the atmosphere is 10 N/cm ² .

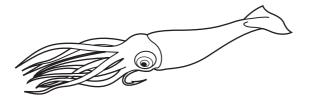
Suggest a value for the pressure at a depth of 10 m. Explain your answer.

N/cm²

[2]

(b) The diver sees a squid. A squid moves by forcing out a jet of water.





This moving water has momentum.

The mass of water forced out is 1.2 kg and has a velocity of 10 m/s.

Calculate the momentum of the moving water.

State the formula that you use and show your working.

formula

working

		kg m/s	[2]
(c)	Wa	ter waves on the surface of the sea are transverse waves.	
	(i)	Give one other example of a transverse wave.	
			[1]
	(ii)	How does a transverse wave differ from a longitudinal wave?	
			[1]

www.PapaCambridge.com 8 A student carried out an investigation into the response of plant shoots to light.

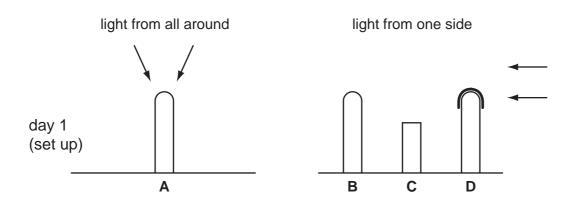
He grew four maize seedlings and treated them as follows.

- He did nothing to seedlings A and B.
- He cut the tip off seedling C.
- He covered the tips of seedling **D** with black paper.

He placed seedling **A** where it received light from all directions.

He placed seedlings B, C and D in a container where they received light from one side only.

Fig. 8.1 shows the appearance of the four seedlings when the experiment was first set up, and after one day.



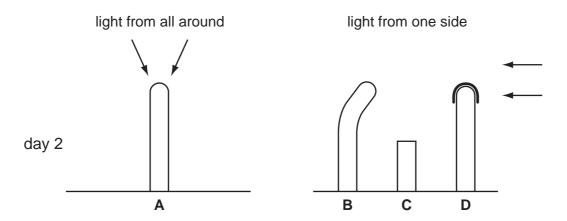


Fig. 8.1

	*
	The student concluded that the tip of a shoot is needed for growth. Describe the evidence in Fig. 8.1 that supports his conclusion.
(a)	The student concluded that the tip of a shoot is needed for growth.
	Describe the evidence in Fig. 8.1 that supports his conclusion.
	[2]
b)	Compare the appearance of shoots A and B on day 2.
	[2]
(c)	Explain how the results of this experiment show that the receptor that is sensitive to light is at the tip of the shoot.
	[2]
d)	Explain why it is useful for a plant to grow towards the light.
	[2]

www.PapaCambridge.com (a) Fig. 9.1 shows apparatus that a student used to investigate the electrolysis of 9 chloride solution.

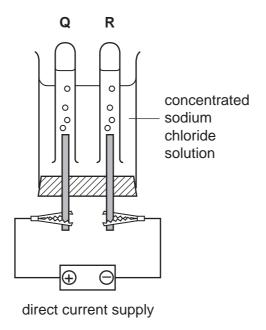


Fig. 9.1

When an electric current flowed through the circuit, gases collected in tubes **Q** and **R**. (i) Label the cathode in Fig. 9.1. [1] (ii) The gas in tube Q bleached damp litmus paper. Name the gas which collected in tube Q. [1] (iii) Name the gas which collected in tube **R**. [1] (iv) During this electrolysis, the pH of the solution increased. Explain why this occurred.

(b)		nen chlorine gas is bubbled through a colourless solution of potassium iodication turns dark brown because the element iodine is formed.
	(i)	Name this type of chemical reaction and explain briefly why it has occurred.
		name of chemical reaction
		why the reaction occurred
		[2]
	(ii)	Write a word equation for the reaction.

[1]

10 (a) A plate on the back of an electric cooker gives this information.

		44
2	22	4. Day
ne back of an electric cooker ç	gives this information.	For viner's
power	5000 W	artig
voltage	250 V	Se.Com
a.c. frequency	50 Hz	

Fig. 10.1

(i)	Explain what is meant by an a.c. frequency of 50 Hz.
	[2]
(ii)	Calculate the current which would flow when the cooker was using 5000 W of power.
	Use the formula
	power = voltage x current
	Show your working.
	A [1]
(b) The	e manufacturers of the cooker claim that it has an efficiency of 50%.
Ex	plain what this means.
••••	[2]
••••	[2]

	23	M. Day	
(c)	Explain, in terms of heat transfer, why saucepans used on the cooker	TO COL	For
	are made of aluminium,	Bill	ite s
			COM
	have wooden handles.		
			_
		[2]	

Soy	/bea	ns (soya beans) provide amino acids, which humans need for growth and rep
(a)	(i)	Name the type of compound that is formed when amino acids link together in polymer molecules.
		[1]
	(ii)	Write the chemical symbol of the element that is found in all amino acids, but which is not found in carbohydrates.
		[1]
(b)	the	beans contain soybean oil. This is extracted by crushing the beans and then adding hydrocarbon solvent, hexane. The oil dissolves in hexane which is then separated in the solution by heating.
	(i)	Suggest why it is possible to remove hexane from the soybean oil by heating the solution.
		[4]
		[1]
	(ii)	Hexane is a saturated hydrocarbon.
		Explain the meaning of the term saturated hydrocarbon.
		[2]
((iii)	Hexane molecules contain covalent bonds.
		Describe briefly, in terms of electrons, what happens when a covalent bond forms between two atoms.
		[2]

For iner's

(c) Increasing amounts of soybean oil are being used to produce biodiesel. Biodies alternative fuel to diesel, obtained from petroleum (crude oil).

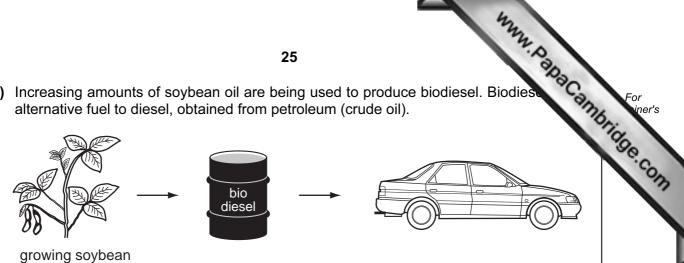


Fig. 11.1

Burning diesel and biodiesel produces similar amounts of carbon dioxide.

plants

However, it is believed that burning biodiesel will cause less increase in the carbon dioxide concentration in the atmosphere.

	Suggest the reason for this.
	[2]
(d)	Biodiesel contains hardly any sulfur compounds.
	Explain why this is an advantage of biodiesel when compared to diesel.
	[2]

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The Periodic Table of the Elements DATA SHEET

	0	01	20 Ne Neon	40 Ar Argon	84 Kryp ton 36	Xe Xenon 54	Radon 86		175 Lu Lutetium
	II/		19 Fluorine	35.5 C1 Chlorine	80 Br Bromine 35	127 I lodine	At Astatine 85		173 Yb Ytterbium
			16 Oxygen	32 Sulfur	Selenium	128 Te Tellurium 52	Po Polonium 84		169 Tm Thullum
	>		14 N itrogen 7	31 Phosphorus 16	75 AS Arsenic	122 Sb Antimony 51	209 Bi Bismuth		167 Er Erbium
	2		12 Carbon	28 Si icon	73 Ge Germanium	S 119	207 Pb Lead 82		165 Ho Holmium
	=		11 Boron 5	27 A1 Aluminium	70 Ga Gallium 31	115 In Indium	204 T 1 Thallium		162 Dy Dysprosium
						Cadmium 48	201 Hg Mercury 80		159 Tb Terbium
					64 Copper 29	108 Ag Silver 47	197 Au Gold		157 Gd Gadolinium
Group					59 Nickel	106 Pd Palladium 46			152 Eu Europium
Gr					59 Co Cobalt	103 Rh Rhodium 45	192 Ir		150 Sm Samarium
		1 H Hydrogen			56 Fe Iron	Ru Ruthenium 44	190 OS Osmium 76		Pm Promethium
					Mn Manganese	Tc Technetium 43	186 Re Rhenium 75		144 Ne odymium
					52 Cr Chromium 24	96 Mo Molybdenum 42	184 W Tungsten 74		Pr Praseodymium
					51 Vanadium 23	Nobium 41	181 Ta Tantalum		140 Ce
					48 T Trtanium	2r Zrconium 40	178 #f Hafnium 72		
					45 Scandium	89 ×	139 La Lanthanum *	227 Actinium 89	series eries
	=		9 Be Beryllium	24 Mg Magnesium	40 Ca Calcium	Strontium	137 Ba Barium 56	226 Ra Radium 88	*58-71 Lanthanoid series 190-103 Actinoid series
	_		7 L.i Lithium 3	23 Na Sodium	39 K Potassium 19	85 Rb Rubidium 37	133 Cs Caesium 55	Fr Francium 87	*58-71 L ₂
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8/	88	88															
*58-7′ 190-1(*58-71 Lanthanoid serie 190-103 Actinoid series	*58-71 Lanthanoid series 190-103 Actinoid series	140 Ce Cerium 58	141 Pr Praseodymium 59	Neodymium 60	Pm Promethium 61	Sm Samarium 62	152 Eu Europium 63	157 Gd Gadolinium 64	159 Tb Terbium 65	162 Dy Dysprosium 66	165 Ho Holmium 67	167 Er Erbium 68	169 Tm Thulium 69	173 Yb Ytterbium 70	Lu Lutetium 71	
Key	т ×	a = relative atomic mass X = atomic symbol	232 Th	Ра	238 U	ΝD	Pu	Am	Cm	Bk	ర	Es	F	Md	N _o	۲	m.
_	q	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.
			The v	The volume of one mole of any gas is 24 dm³ at room temperature and pressure (r.t.p.).	one mole	of any ga	ıs is 24 dr	n³ at roon	n temper.	ature and	pressure	(r.t.p.).			ale con	Cambri	O apac ambridge com
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