



UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

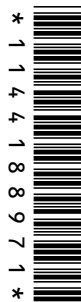
CANDIDATE
NAME

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NUMBER

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COMBINED SCIENCE

0653/21

Paper 2 (Core)

October/November 2010

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 20.

At the end of the examination, fasten all your work securely together.

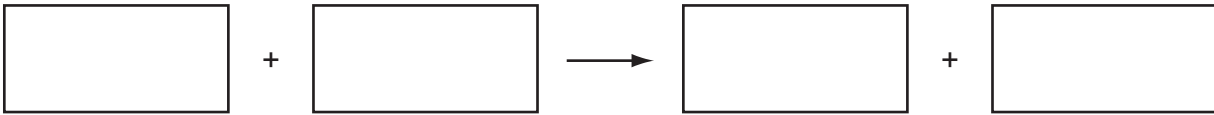
The number of marks is given in brackets [] at the end of each question or part question.

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1	
2	
3	
4	
5	
6	
7	
8	
9	
Total	

This document consists of **20** printed pages.



1 (a) State the word equation for photosynthesis.



[2]

(b) (i) Name the green pigment found in plant leaves which absorbs energy from sunlight.

..... [1]

(ii) Fig. 1.1 is a diagram of a plant cell.

On the diagram, draw a label line to where this green pigment would be found, and label it **P**.

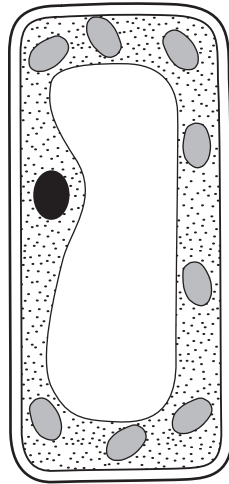


Fig. 1.1

[1]

- (c) A student fixed a piece of black paper over a leaf, which was still attached to the plant. He left the plant in the sun for two days.

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He then removed the leaf from the plant and tested it for starch, after removing the paper.

- (i) Using the letters given, list the correct sequence of the steps he took.

A Add iodine solution to the leaf.

B Place the leaf in boiling water.

C Dip the leaf into water to soften it.

D Place the leaf in hot ethanol.

E Spread the leaf on a white tile.

..... [3]

- (ii) Fig. 1.2 shows the leaf before and after he did the starch test.

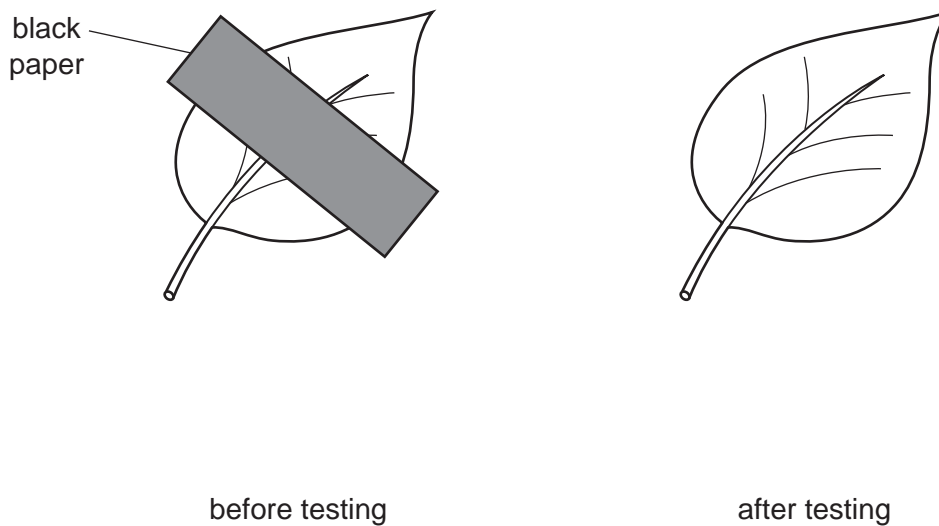


Fig. 1.2

Iodine solution is orange-brown. It turns blue-black when it is in contact with starch.

Complete the diagram of the leaf after testing in Fig. 1.2. Do **not** colour the diagram.

Use labels to show which parts would look orange-brown and which parts would look blue-black. [2]

- 2 Fig. 2.1 shows the apparatus a student used to measure the rate of reaction between some powdered metal and dilute hydrochloric acid.

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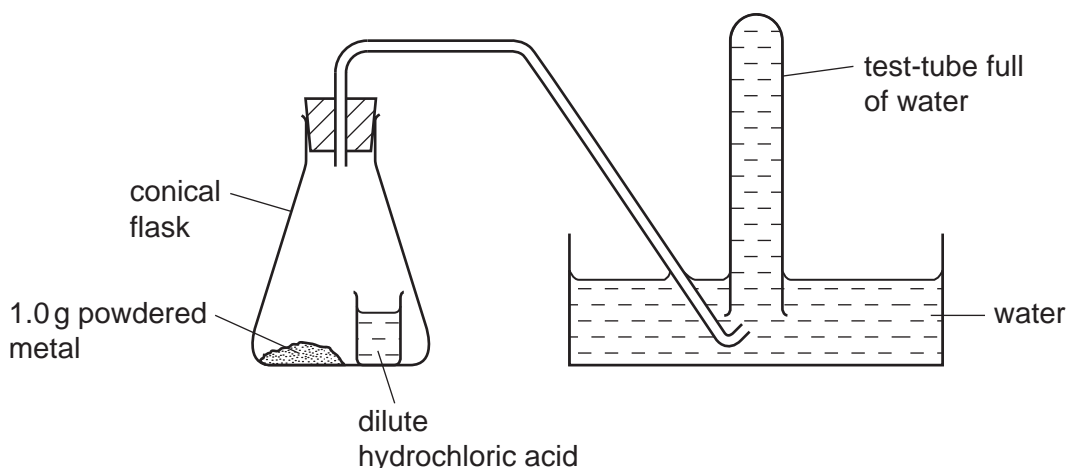


Fig. 2.1

When the student tilted the conical flask, the acid mixed with the powdered metal. If a reaction occurred, any gas which was produced bubbled up into the test-tube, pushing the water out. The student timed how long it took for the test-tube to fill with gas.

- (a) Describe how the student could test the gas to show that it was hydrogen.

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

- (b) The student used the apparatus in Fig. 2.1 to compare the rates of reaction between dilute hydrochloric acid and three powdered metals, **X**, **Y** and **Z**.

The results the student obtained are shown in Table 2.1.

Table 2.1

metal	mass of metal /g	time for gas to fill the test-tube /seconds
X	1.0	150
Y	1.0	45
Z	1.0	no gas was produced

- (i) One of the metals used was copper.

State and explain which metal, **X**, **Y** or **Z**, was copper.

metal

explanation

..... [2]

- (ii) Suggest **two** ways, other than using a catalyst, in which the student could **increase** the rate of reaction between metal **X** and dilute hydrochloric acid.

1

.....

2

..... [2]

- (c) Fig. 2.2 shows another experiment in which the student added zinc carbonate to dilute sulfuric acid. A gas was given off and, when the bubbling stopped, some solid zinc carbonate remained in the mixture.

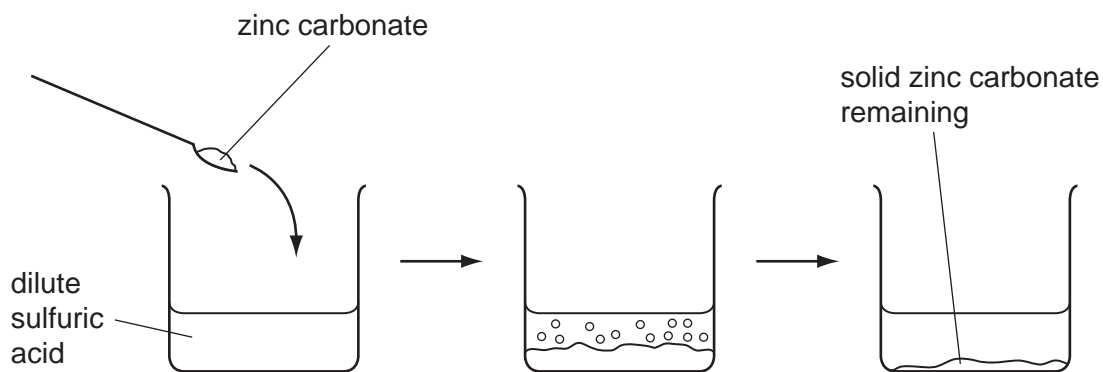


Fig. 2.2

- (i) State the chemical formula of sulfuric acid.

..... [1]

- (ii) Explain why the reaction eventually stopped even though some zinc carbonate powder remained.

.....

..... [1]

3 Fig. 3.1 shows a rock that is falling from the top of a cliff into the river below.

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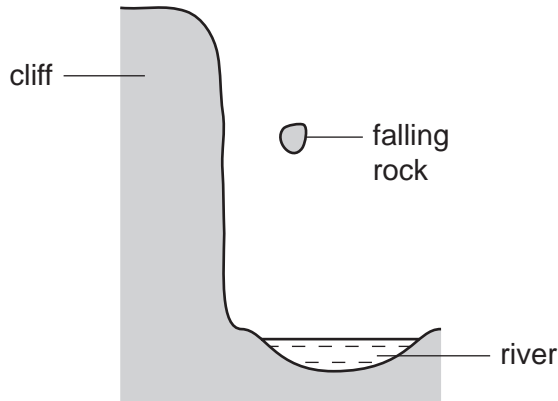


Fig. 3.1

(a) (i) As the rock falls, it gains kinetic energy.

Name the form of energy the rock had at the top of the cliff.

..... [1]

(ii) Suggest what happens to the kinetic energy of the rock when the rock hits the water.

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

(b) Fig. 3.2 shows a speed-time graph for the motion of the rock.

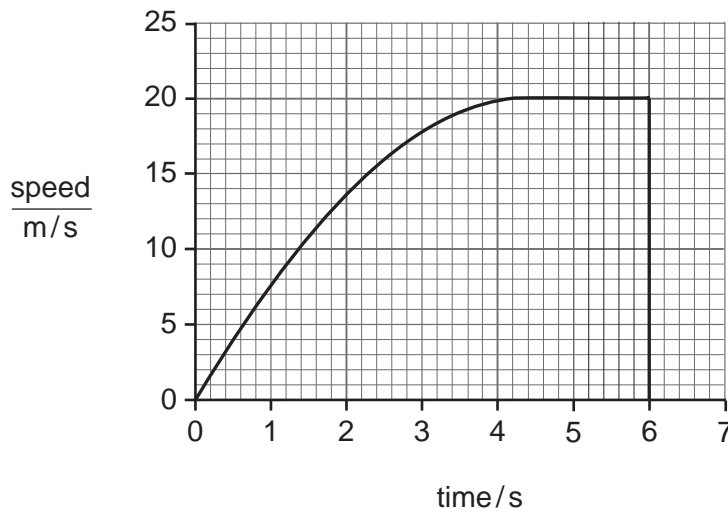


Fig. 3.2

(i) After how many seconds was the speed of the rock 15 m/s?

.....s [1]

(ii) The rock is accelerating. Explain the meaning of the term *accelerating*.

.....
..... [1]

(c) The rock contains radioactive substances emitting high levels of ionising radiation.

(i) State how the radioactivity could be detected.

..... [1]

(ii) Explain why it would be dangerous for a person to handle this rock without proper protection.

.....
..... [1]

4 Copper metal reacts with oxygen gas to form the black solid, copper oxide.

(a) (i) Use this example to describe **one** difference between *elements* and *compounds*.

.....

 [2]

(ii) State why this reaction is an example of *oxidation*.

.....
 [1]

(iii) Name the type of chemical bonding found in copper oxide.

..... [1]

(b) Fig. 4.1 shows apparatus used in the electrolysis of copper chloride solution.

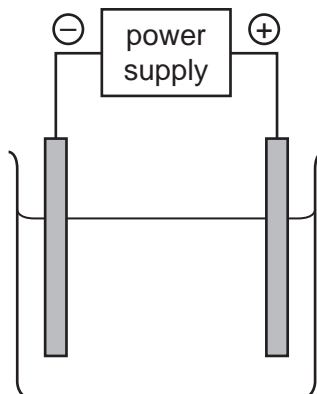


Fig. 4.1

(i) On the diagram, clearly label the **anode** and the **electrolyte**. [2]

(ii) Copper chloride solution contains copper ions and chloride ions in water.

State briefly **two** differences between a chlorine *atom* and a chloride *ion*.

.....

 [2]

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(iii) Copper is a pink/orange metal and chlorine is a gas.

Describe what would be **observed** at the positive and negative electrodes during electrolysis of copper chloride solution.

observation at positive electrode

.....

observation at negative electrode

..... [2]

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5 (a) Fig. 5.1 shows some of the different types of radiation in the electromagnetic spectrum.

gamma		ultra-violet	visible light	infra-red		radio waves
-------	--	--------------	---------------	-----------	--	-------------

Fig. 5.1

Write the names of the missing types of radiation in the two empty spaces. [2]

(b) Fig. 5.2 shows a ray of light hitting a mirror.

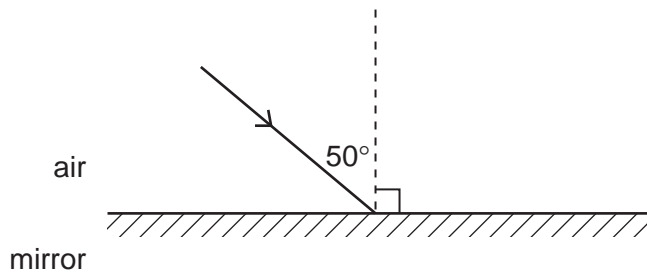


Fig. 5.2

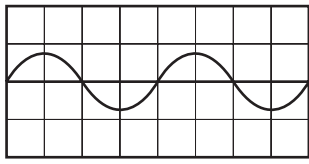
- (i) On Fig. 5.2, label the normal. [1]
- (ii) On Fig. 5.2, draw the reflected ray. [1]
- (iii) State the value of the angle of reflection.° [1]

(c) A sound wave has a frequency of 500 Hz.

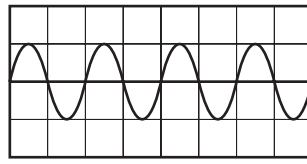
- (i) Explain the meaning of the term *frequency*.
.....
..... [1]
- (ii) State the approximate range of audible frequencies detected by the normal human ear.
..... [1]

(d) Fig. 5.3 shows the wave traces made by four sounds.

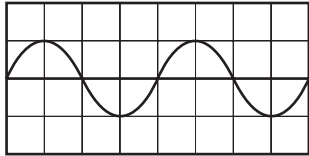
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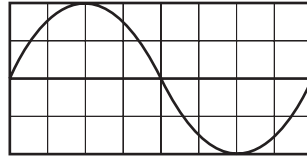
trace A



trace B



trace C



trace D

Fig. 5.3

(i) Which trace shows the sound wave with the lowest pitch?

..... [1]

(ii) Which trace shows the sound wave with the smallest amplitude?

..... [1]

6 (a) Complete the sentences about the human nervous system, using some of the words in the list.

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Use

- biceps**
- brain**
- detectors**
- effectors**
- nerves**
- receptors**

Specialised cells in the human nervous system detect external stimuli. These cells are called They convert the stimulus into electrical impulses in, which carry the impulse to the central nervous system.

The central nervous system then sends impulses to parts of the body that respond to the stimulus, such as muscles or glands. These parts are called [3]

(b) When we smell food, the salivary glands respond by secreting saliva.

Saliva contains the enzyme amylase, which breaks down large starch molecules to smaller sugar molecules.

(i) Explain what is meant by the term *enzyme*.

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

(ii) Name the process by which large molecules are broken down to small ones in the alimentary canal.

..... [1]


(iii) Explain why this process is necessary.

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

- 7 (a) Complete Table 7.1 to show the correct symbols of these electrical components. One symbol has been drawn for you.

For
Examiner's
Use

Table 7.1

component	electrical symbol
lamp	
ammeter	
fixed resistor	

[2]

- (b) A student set up the electric circuit in Fig. 7.1.

It contained three lamps **L1**, **L2** and **L3**.

It contained three switches **S1**, **S2** and **S3**.

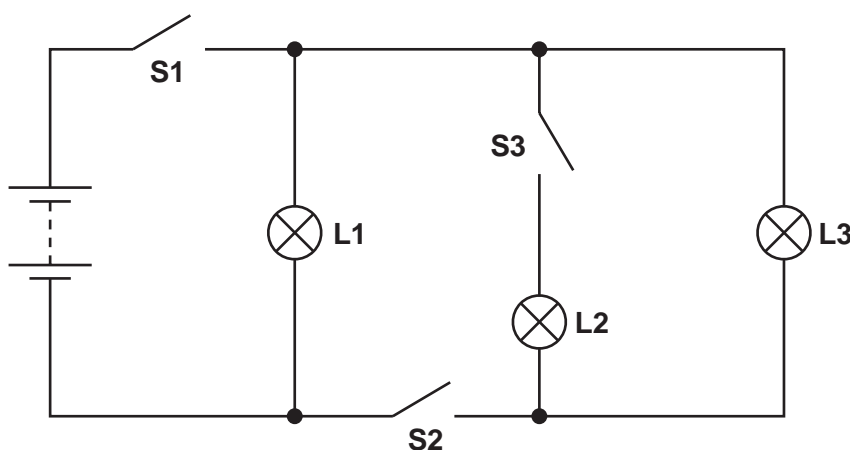


Fig. 7.1

In Table 7.2, write the words 'on' or 'off' to show when each lamp is lit or not lit for each set of switch positions.

Table 7.2

switch position			lamp 'on' or 'off'		
S1	S2	S3	L1	L2	L3
closed	closed	closed			
closed	closed	open			
closed	open	open			

[3]

(c) The student then set up another electric circuit shown in Fig. 7.2.

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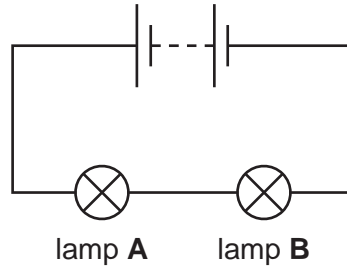


Fig. 7.2

She noticed that neither lamp **A** nor lamp **B** lit up. She found nothing wrong with lamp **A** but the filament in lamp **B** was broken.

(i) Explain why lamp **A** did not light up.

.....
 [1]

(ii) She replaced lamp **B** with a new lamp **C**. The resistance of both lamp **A** and lamp **C** was 5 ohms when lit.

Calculate the combined resistance of both lamps in the working circuit.

State the formula that you use and show your working.

formula used

working

..... ohms [2]

(d) Fig. 7.3 shows an electrical device.

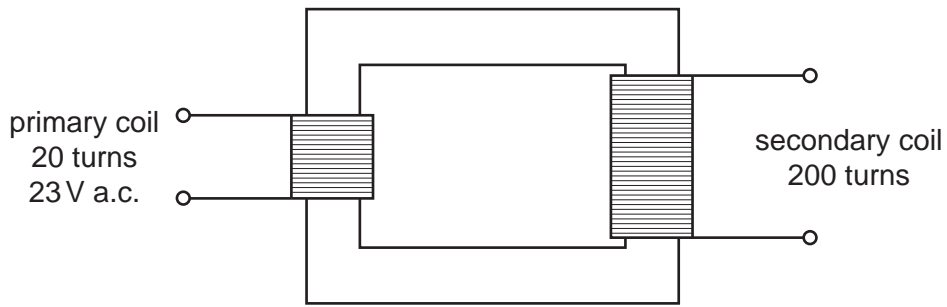


Fig. 7.3

(i) Name the device. [1]

(ii) Calculate the output voltage.

Use the formula $V_p/V_s = N_p/N_s$.

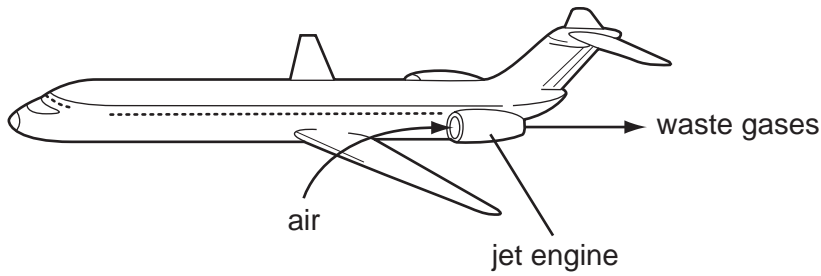
Show your working.

..... V [1]

For
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- 8 In jet engines, hydrocarbon molecules from the jet fuel mix with air and burn. This releases a large amount of energy and produces a mixture of waste gases. These waste gases pass out through the back of the jet engine into the atmosphere.

For
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Use



- (a) Fig. 8.1 shows a molecule of octane, which is a typical hydrocarbon molecule in jet fuel.

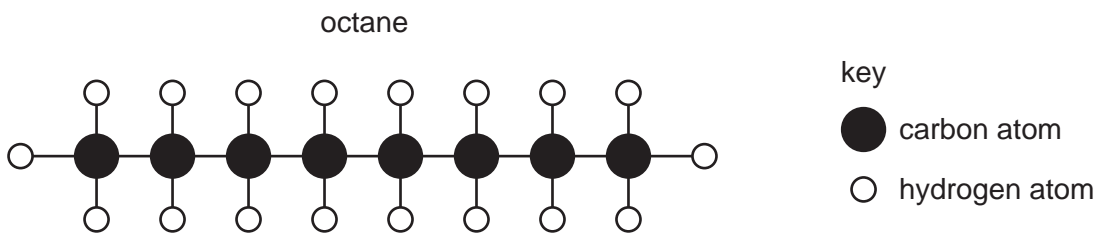


Fig. 8.1

- (i) State the chemical formula of octane.

..... [1]

- (ii) Complete the word equation below for the complete combustion of octane.



[2]

- (iii) Explain why the mixture of gases coming from the rear of the jet engine contains a large amount of nitrogen.

.....

 [2]

- (iv) Explain why the metallic parts of the jet engine become hot when it is working.

.....
 [1]

- (b) (i) A carbon atom has a proton (atomic) number 6 and a nucleon (mass) number 12.

State the number of neutrons and electrons in this carbon atom.

number of neutrons

number of electrons [2]

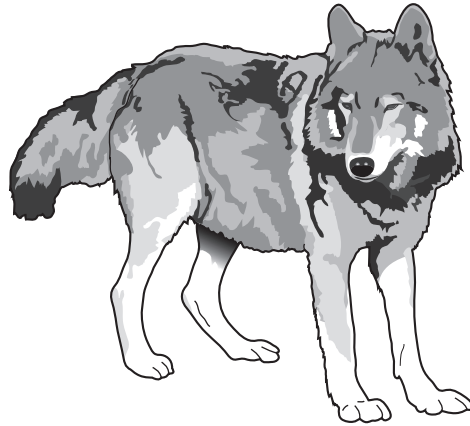
- (ii) State the chemical symbol of another element which is in the same **group** in the Periodic Table as carbon.

..... [1]

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9 The gray wolf is a predator that lives in North America.

For
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Use



(a) The gray wolf's diet consists mainly of white-tailed deer, beavers and snowshoe hares.

These are all herbivores. They eat plants.

(i) Construct a food web including all the organisms mentioned above.

[3]

(ii) State what the arrows in your food web represent.

..... [1]

(iii) Name the producers in the food web you have drawn.

..... [1]

(b) Some of the chemicals in a gray wolf's body contain carbon. When a wolf dies, its body is broken down by decomposers and the carbon is returned to the air.

(i) Name **one** type of chemical in a wolf's body that contains carbon.

..... [1]

(ii) Explain how the carbon from a wolf's body is returned to the air after the wolf dies.

.....

 [2]

(c) Some gray wolves are born with darker fur than others. They can pass this fur colour to their offspring.

If wolves live in cold places, they grow longer fur than wolves that live in warm places. They cannot pass their fur length to their offspring.

Tick **two** boxes to show the cause of each of these types of variation in wolves' fur.

cause	fur colour	fur length
genes only		
environment only		
genes and environment		

[2]

DATA SHEET
The Periodic Table of the Elements

		Group										
		I	II	III	IV	V	VI	VII	VIII	IX	X	
		1 H Hydrogen 1										
7	9											
Li Lithium 3	Be Beryllium 4											
23	24											
Na Sodium 11	Mg Magnesium 12											
39	40											
K Potassium 19	Ca Calcium 20	45	48	51	52	55	56	59	59	64	65	
		Sc Scandium 21	Ti Titanium 22	V Vanadium 23	Cr Chromium 24	Mn Manganese 25	Fe Iron 26	Co Cobalt 27	Ni Nickel 28	Cu Copper 29	Zn Zinc 30	
85	88	89	91	93	96	101	101	103	106	108	112	
Rb Rubidium 37	Sr Strontium 38	Y Yttrium 39	Zr Zirconium 40	Nb Niobium 41	Mo Molybdenum 42	Ru Ruthenium 44	Rh Rhodium 45	Pd Palladium 46	Ag Silver 47	Cd Cadmium 48		
133	137	139	178	181	184	190	190	192	195	197	201	
Cs Caesium 55	Ba Barium 56	La Lanthanum 57	Hf Hafnium 72	Ta Tantalum 73	W Tungsten 74	Os Osmium 76	Ir Iridium 77	Pt Platinum 78	Au Gold 79	Hg Mercury 80		
226	227											
Fr Francium 87	Ra Radium 88	Ac Actinium 89										
*58-71 Lanthanoid series †90-103 Actinoid series												
		140	141	144	150	152	157	159	162	165	167	
		Ce Cerium 58	Pr Praseodymium 59	Nd Neodymium 60	Pm Promethium 61	Sm Samarium 62	Eu Europium 63	Gd Gadolinium 64	Dy Dysprosium 66	Ho Holmium 67	Er Erbium 68	
		232	238	238	238	238	238	238	238	238	238	
		Th Thorium 90	Pa Protactinium 91	U Uranium 92	Np Neptunium 93	Pu Plutonium 94	Am Americium 95	Cm Curium 96	Cf Californium 98	Es Einsteinium 99	Fm Fermium 100	
		169	173	173	173	173	173	173	173	173	173	
		Tm Thulium 69	Yb Ytterbium 70	Lu Lutetium 71	No Nobelium 102	Md Mendelevium 101	Fm Fermium 100	Er Erbium 68	Ho Holmium 67	Dy Dysprosium 66	Ho Holmium 67	
		175	175	175	175	175	175	175	175	175	175	
		Lu Lutetium 71	Yb Ytterbium 70	Lu Lutetium 71	No Nobelium 102	Md Mendelevium 101	Fm Fermium 100	Er Erbium 68	Ho Holmium 67	Dy Dysprosium 66	Ho Holmium 67	
		86	86	86	86	86	86	86	86	86	86	
		Rn Radon 86	At Astatine 85	Po Polonium 84	Bi Bismuth 83	Pb Lead 82	Tl Thallium 81	Pb Lead 82	Bi Bismuth 83	Po Polonium 84	At Astatine 85	
		131	131	131	131	131	131	131	131	131	131	
		Xe Xenon 54	I Iodine 53	Te Tellurium 52	Sb Antimony 51	Sn Tin 50	In Indium 49	Cd Cadmium 48	Ag Silver 47	Hg Mercury 80	Xe Xenon 54	
		84	84	84	84	84	84	84	84	84	84	
		Kr Krypton 36	Br Bromine 35	Se Selenium 34	As Arsenic 33	Ge Germanium 32	Ga Gallium 31	Zn Zinc 30	Cu Copper 29	Hg Mercury 80	Kr Krypton 36	
		40	40	40	40	40	40	40	40	40	40	
		Ar Argon 18	Cl Chlorine 17	S Sulfur 16	P Phosphorus 15	Si Silicon 14	Al Aluminium 13	Ne Neon 10	O Oxygen 8	Ne Neon 10	Ar Argon 18	
		20	20	20	20	20	20	20	20	20	20	
		Ne Neon 10	F Fluorine 9	O Oxygen 8	N Nitrogen 7	C Carbon 6	B Boron 5	Ne Neon 10	O Oxygen 8	Ne Neon 10	Ar Argon 18	
		2	2	2	2	2	2	2	2	2	2	
		He Helium 2	F Fluorine 9	O Oxygen 8	N Nitrogen 7	C Carbon 6	B Boron 5	He Helium 2	O Oxygen 8	He Helium 2	Ar Argon 18	

The volume of one mole of any gas is 24 dm³ at room temperature and pressure (r.t.p.).

	a	X	a = relative atomic mass
Key	b	X	X = atomic symbol
			b = proton (atomic) number

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