UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER			

4522543892

COMBINED SCIENCE **0653/22**

Paper 2 (Core) **May/June 2012**

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.

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

This document consists of **18** printed pages and **2** blank pages.

UNIVERSITY of CAMBRIDGE International Examinations

For Examiner's Use

1 **(a)** Most atoms of metallic elements found in the Earth's crust exist in compounds called ores which are contained in rocks.

The chemical formulae of some metal compounds found in ores, together with the names of the ores, are shown below.

argentite	Ag_2S
chromite	$FeCr_2O_4$
galena	PbS
scheelite	$CaWO_4$

(i) A binary compound is one that contains only two different elements.

State which of the compounds in the list above are binary compounds.

..... [1]

(ii) State the ore from which the metallic element tungsten could be extracted.

..... [1]

(b) Fig. 1.1 shows a diagram of an atom of the element lithium. This atom has a nucleon number (mass number) of seven.

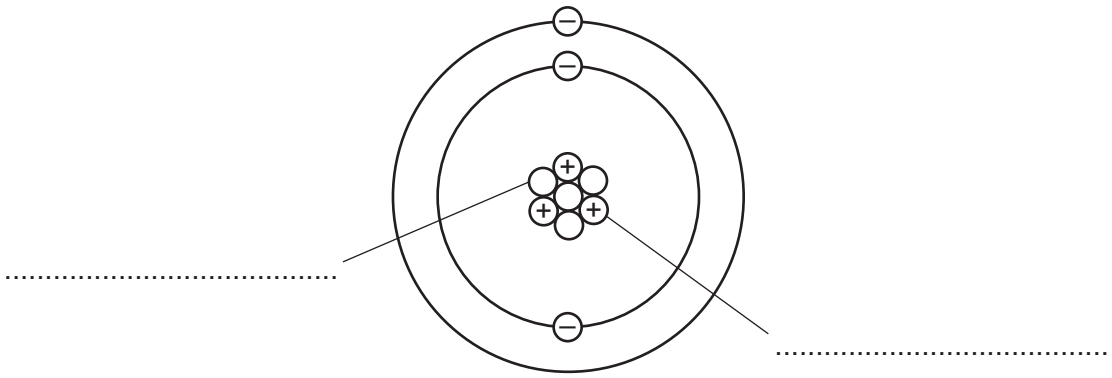
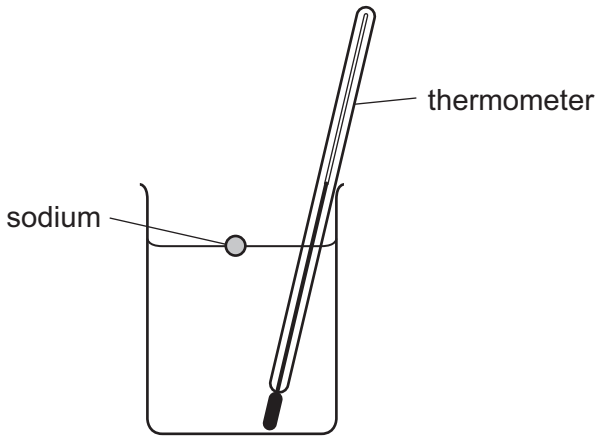


Fig. 1.1

Complete Fig. 1.1 by labelling the particles that exist in the nucleus. [2]

(c) (i) A teacher dropped a small piece of sodium into a beaker containing cold water and a thermometer. She stirred the mixture until all of the sodium had reacted.



Predict **two** observations that could be made as the sodium reacts with the water.

1 .....

.....

2 .....

.....

[2]

(ii) Potassium is another element in the same group of the Periodic Table as sodium.

State **one** way in which the reaction of potassium with cold water would be different from that of sodium.

..... [1]

(iii) Complete the **word** chemical equation for the reaction between potassium and water.

potassium	+	water	→		+	

[2]

For Examiner's Use

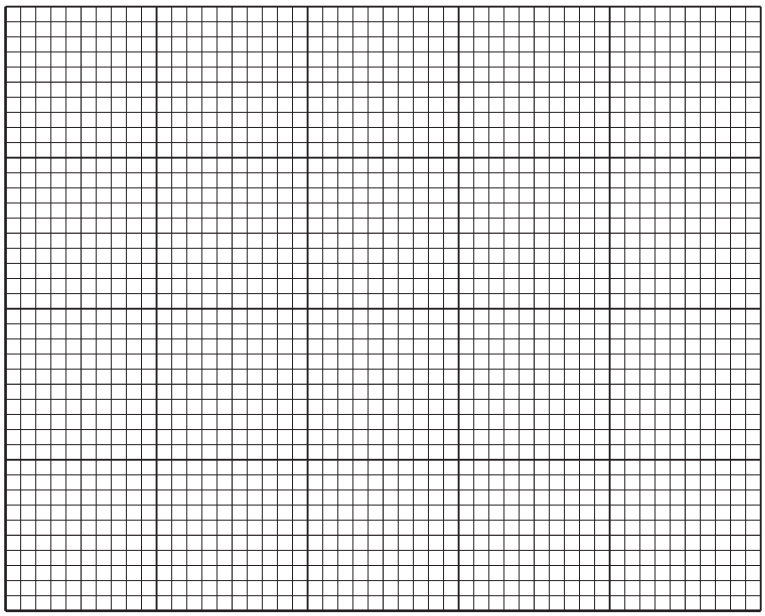
2 An athlete warms up by running along a race track.

(a) He accelerates from rest and after 10 seconds reaches a maximum speed of 7 m / s.

He continues at this speed for another 10 seconds.

During the next 5 seconds, he steadily slows down and stops.

Draw a speed-time graph to show the motion of the athlete.



[4]

(b) During a race the athlete cools down by sweating.

(i) Explain how evaporation cools down the athlete.

.....

.....

..... [2]

(ii) State **two** factors which would increase the rate of evaporation.

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

3 **(a)** Define the term *respiration*.

.....

.....

..... [2]

(b) Table 3.1 shows the percentages of three gases in inspired air and in expired air.

Write the name of each gas in Table 3.1.

Table 3.1

gas	percentage in inspired air	percentage in expired air
	21	17
	0.04	4
	78	78

[3]

(c) Outline how oxygen is transported to a respiring cell in a muscle.

.....

.....

..... [2]

(d) When adrenaline is secreted, oxygen is transported more quickly to the muscles.

(i) How does adrenaline have this effect?

..... [1]

(ii) State **one** situation in which adrenaline secretion increases.

..... [1]

(iii) Name the body organ that destroys adrenaline after it has been secreted.

..... [1]

[Turn over

For Examiner's Use

4 **(a)** Radio waves are electromagnetic waves. Sound waves are not.

State **one** other way in which radio waves differ from sound waves.

.....

..... [1]

(b) Fig. 4.1 shows two lists. The first is a list of different types of electromagnetic wave. The second is a list of some of their uses.

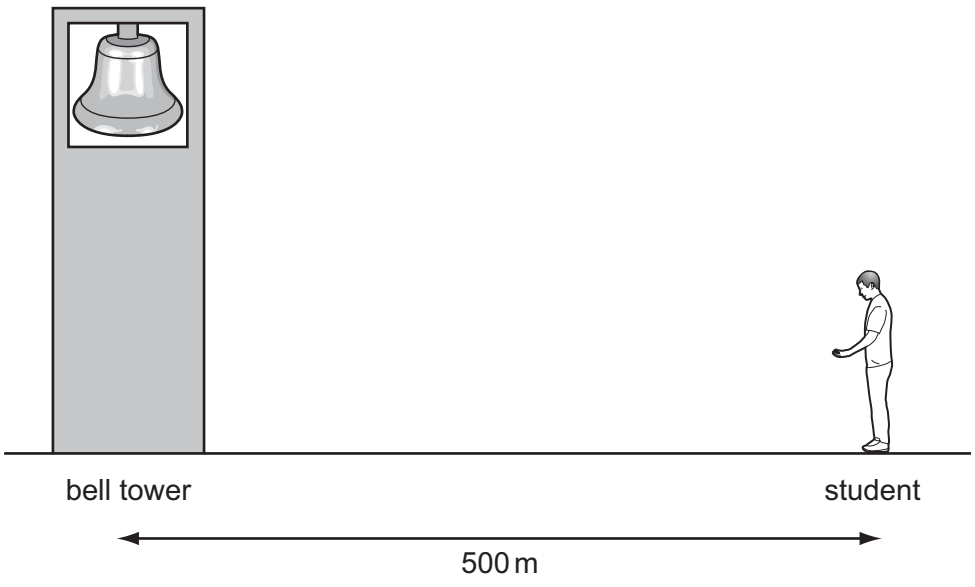
Draw lines to connect each type of radiation to its use. [3]

radiation	**use**
gamma	examining bones and teeth
microwave	remote controls for television sets
infra-red	satellite communications
X-rays	sterilising surgical instruments

Fig. 4.1

(c) A student carried out an experiment to find the speed of sound in air by watching and listening to a bell being rung.

He stood 500 m from the bell.



The sound took 1.5 s to travel from the bell to the student.

For Examiner's Use

(i) Calculate the speed of sound.

State the formula that you use and show your working.

formula used

working

..... m / s [2]

(ii) The sound wave produced by the bell had a frequency of 400 Hz.

State the approximate frequency range which humans can hear.

..... Hz to ..... Hz [1]

(iii) The mass of the bell is 10 000 kg and it has a volume of 1.1 m^3.

Calculate the density of the bell.

State the formula that you use and show your working.

formula used

working

..... kg / m^3 [2]

For Examiner's Use

5 Water supplies are often impure and have to be purified to make them safe for humans to drink.

(a) State **one** process that is used to make water safe for humans to drink.

Explain, for the process you have chosen, how this process purifies the water.

process .....

how it purifies .....

..... [2]

(b) Water is a compound which contains the elements hydrogen and oxygen.

Describe **one** difference, other than physical state, between the **compound** water and a **mixture** of the elements hydrogen and oxygen.

.....

.....

..... [2]

(c) Table 5.1 shows information about water and two compounds that can form mixtures with water.

Table 5.1

compound	melting point / °C	boiling point / °C	solubility in water
water	0	100	–
sodium chloride	801	1413	soluble
hexane	–95	69	insoluble

(i) Describe briefly how a sample of sodium chloride could be obtained from a solution of sodium chloride.

.....

.....

..... [2]

(ii) Use the information in Table 5.1 to predict and explain whether or not a mixture of hexane and water could be separated at room temperature (20 °C) by the method of filtration.

.....

.....

..... [2]

(d) A student burned a small piece of magnesium, using the apparatus shown in Fig. 5.1.

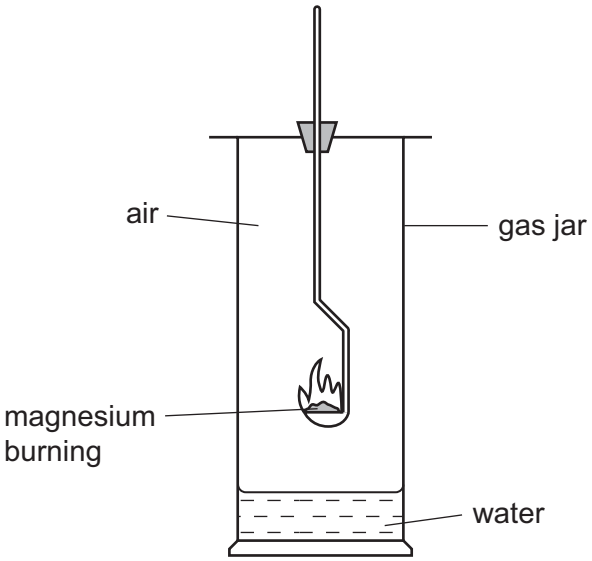


Fig. 5.1

When the reaction finished, the magnesium oxide was mixed with the water in the bottom of the gas jar.

(i) Magnesium oxide is made of positive ions and negative ions.

Describe briefly what happens to an atom when it is converted into a negative ion.

.....

..... [1]

(ii) The student added a few drops of full range indicator solution (Universal Indicator) to the mixture of water and magnesium oxide.

The indicator changed from green to blue.

Explain why this happens.

.....

.....

..... [2]

For Examiner's Use

6 A car is travelling along a road.

(a) Many forces act on the car.

(i) State **two** effects that forces can have on an object.

1 .....

2 .....

[2]

(ii) State the unit used to measure force. ..... [1]

(b) Fig. 6.1 shows a car travelling in a straight line. The car is decelerating (slowing down).

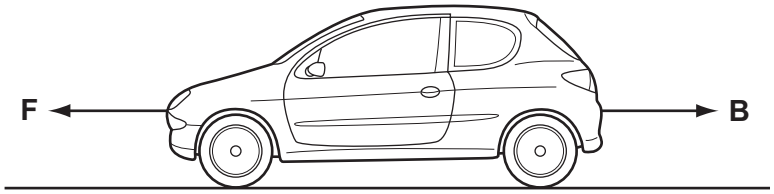


Fig. 6.1

The total forward force on the car is **F** and the total backward force is **B**.

Which force is greater, **F** or **B**? .....

Explain your answer.

.....

..... [1]

For Examiner's Use

(c) Using some of the words below, complete the sentences to explain the energy changes which take place in a car when petrol (gasoline) is used to power the car.

boiled	**burned**	**cooled**	**chemical**
heat	**kinetic**	**nuclear**	**sound**

Petrol (gasoline) contains ..... energy. The petrol is ..... in the engine to produce heat energy. The heat energy is changed into ..... energy which moves the car. This process is not very efficient and much energy is wasted as ..... energy and ..... energy. [5]

(d) Petrol (gasoline) is a mixture of hydrocarbons.

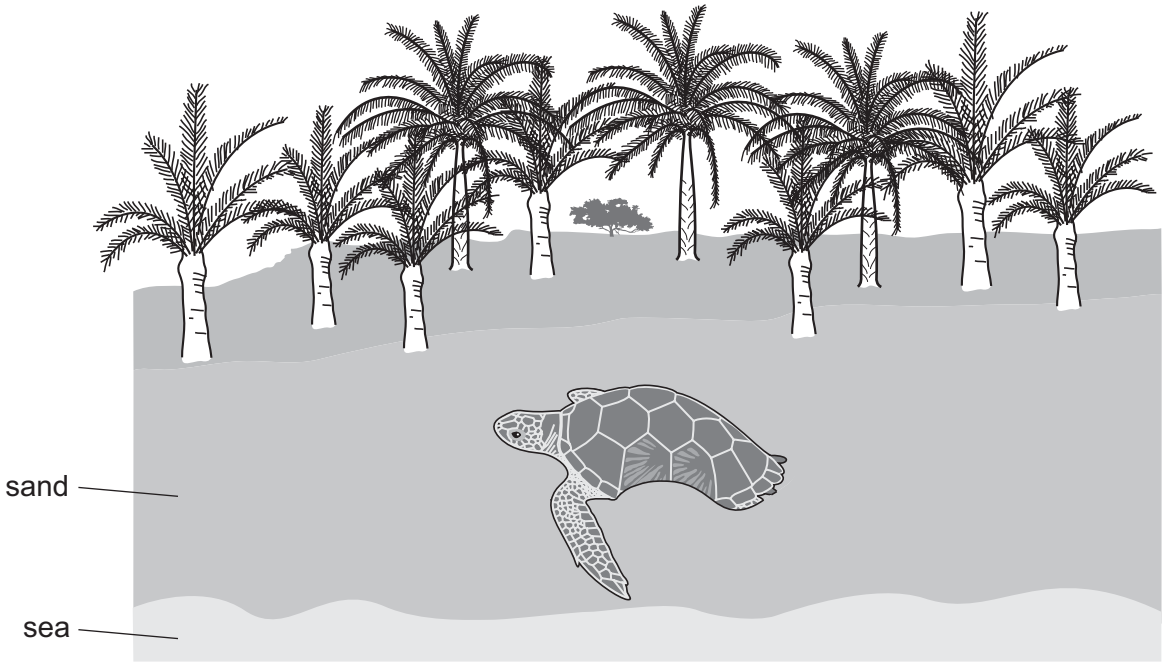
Explain why the mixture of waste gases (exhaust gases) from a car contains carbon dioxide and water vapour.

.....

.....

..... [2]

7 Hawksbill turtles are an endangered species. They lay their eggs in nests in the sand on a beach.



The sex of hawksbill turtles is determined by the temperature of the sand in which the eggs develop.

- At 29 °C, equal numbers of males and females develop.
- Higher temperatures produce more females.
- Lower temperatures produce more males.

(a) Researchers measured the temperature, at a depth of 30 cm, in two different parts of a beach, on Antigua, where hawksbill turtles lay their eggs. The results are shown in Fig. 7.1. The tops of the bars represent the mean temperature.

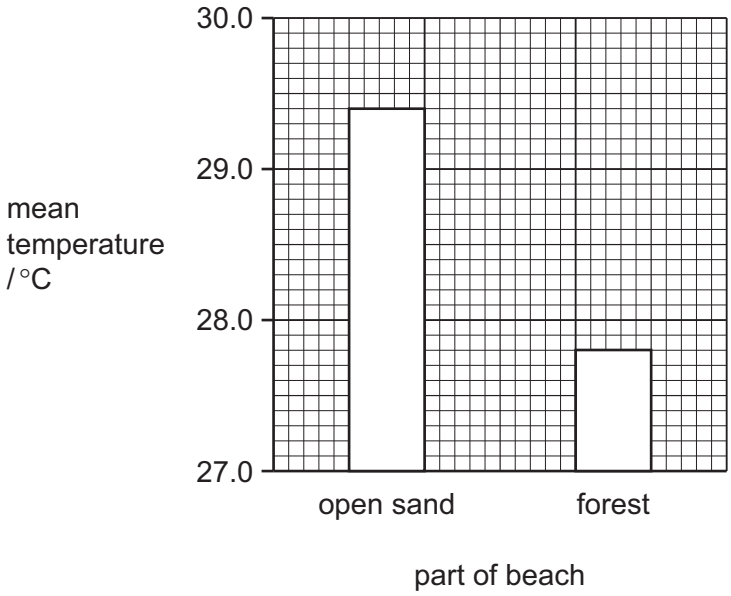


Fig. 7.1

With reference to Fig. 7.1, describe the effect of the forest on the temperature of the sand.

.....

.....

..... [2]

(b) The researchers counted the proportion of male and female turtles hatching from nests in the two different parts of the beach. The results are shown in Table 7.1.

Table 7.1

part of beach	nests producing more males than females	nests producing more females than males	nests producing equal numbers of females and males
open sand	0	16	0
in forest	36	0	0

Use the information in Fig. 7.1 to explain the results for nests in open sand and in forest, shown in Table 7.1.

.....

.....

..... [2]

(c) Suggest why hawksbill turtles might become extinct if all the forest by the beaches is cut down.

.....

.....

..... [2]

(d) State **two** harmful effects to the environment, other than extinction of species, that can result from deforestation.

1 .....

.....

2 .....

.....

[2]

8 Fig. 8.1 shows apparatus a student used to investigate temperature changes that occurred during chemical reactions.

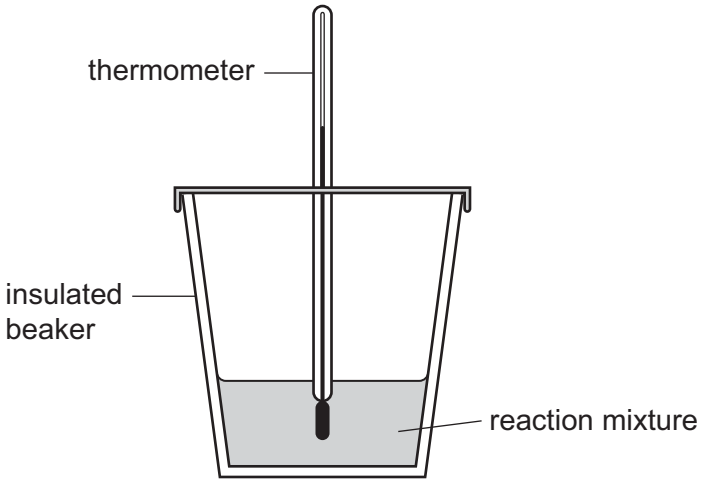


Fig. 8.1

The student added reactants to the insulated beaker and stirred the mixture. She recorded the final temperature of each mixture.

At the start of each experiment, the temperature of the reactants was 22 °C.

Table 8.1 contains the results the student obtained.

Table 8.1

experiment	reactant A	reactant B	final temperature / °C
1	dilute hydrochloric acid	sodium hydrogencarbonate	16
2	dilute hydrochloric acid	potassium hydroxide solution	26
3	magnesium	copper sulfate solution	43
4	copper	magnesium sulfate solution	22

(a) (i) Explain which experiment, **1**, **2**, **3** or **4**, was a neutralisation reaction between an acid and an alkali.

experiment .....

explanation .....

..... [1]

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(ii) State and explain which experiment, **1**, **2**, **3** or **4**, was an endothermic reaction.

experiment .....

explanation .....

..... [1]

(iii) Suggest why the temperature did **not** change when copper was added to magnesium sulfate solution.

..... [1]

(b) The student used the apparatus in Fig. 8.1 to carry out two further experiments, **5** and **6**, to investigate the exothermic reaction between zinc and copper sulfate solution.

In experiment **5** the student used zinc powder and in experiment **6** she used a single piece of zinc.

The mass of zinc in both experiments was the same.

Suggest and explain briefly in which experiment, **5** or **6**, the temperature increased more quickly.

experiment .....

explanation .....

.....

..... [2]

[Turn over

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

.....

.....

..... [2]

(b) Fig. 9.1 shows the effect of pH on the activity of an enzyme.

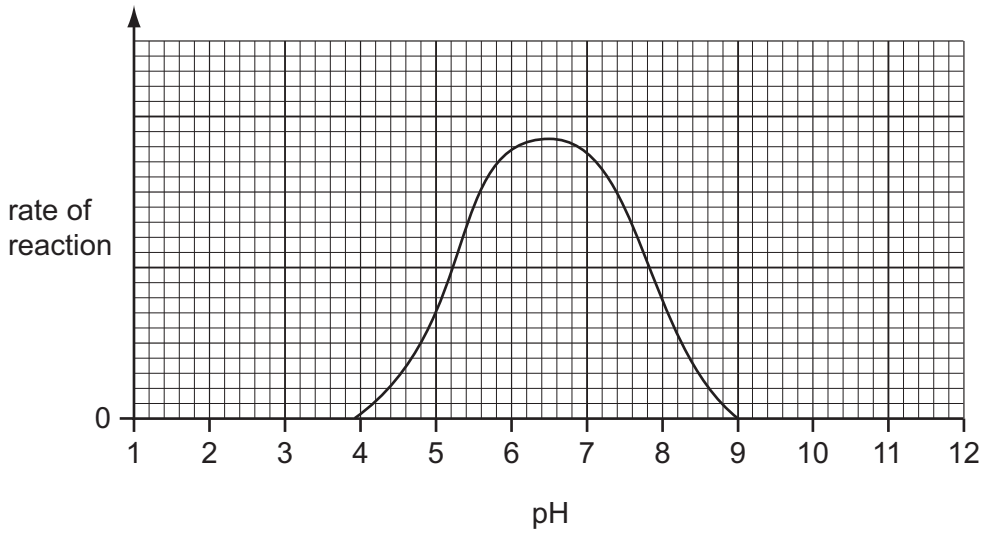

Fig. 9.1

Describe the effect of pH on the activity of this enzyme.

.....

.....

..... [2]

(c) An enzyme works in the human stomach, where hydrochloric acid is secreted. This enzyme is adapted to work best in these conditions.

(i) **On Fig. 9.1**, sketch a curve to show how pH affects the activity of this stomach enzyme. [1]

(ii) After the food has been in the stomach for a while, it passes into the duodenum. Pancreatic juice, which contains sodium hydrogencarbonate, is mixed with the food in the duodenum.

Explain why the stomach enzyme stops working when it enters the duodenum.

.....

.....

..... [2]

(d) Enzymes in the human digestive system help to break down large food molecules into smaller molecules.

Explain why this is important.

.....

.....

..... [2]

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DATA SHEET
The Periodic Table of the Elements

Group																	
I	II											III	IV	V	VI	VII	0
							1 **H** Hydrogen 1										4 **He** Helium 2
7 **Li** Lithium 3	9 **Be** Beryllium 4											11 **B** Boron 5	12 **C** Carbon 6	14 **N** Nitrogen 7	16 **O** Oxygen 8	19 **F** Fluorine 9	20 **Ne** Neon 10
23 **Na** Sodium 11	24 **Mg** Magnesium 12											27 **Al** Aluminium 13	28 **Si** Silicon 14	31 **P** Phosphorus 15	32 **S** Sulfur 16	35.5 **Cl** Chlorine 17	40 **Ar** Argon 18
39 **K** Potassium 19	40 **Ca** Calcium 20	45 **Sc** Scandium 21	48 **Ti** Titanium 22	51 **V** Vanadium 23	52 **Cr** Chromium 24	55 **Mn** Manganese 25	56 **Fe** Iron 26	59 **Co** Cobalt 27	59 **Ni** Nickel 28	64 **Cu** Copper 29	65 **Zn** Zinc 30	70 **Ga** Gallium 31	73 **Ge** Germanium 32	75 **As** Arsenic 33	79 **Se** Selenium 34	80 **Br** Bromine 35	84 **Kr** Krypton 36
85 **Rb** Rubidium 37	88 **Sr** Strontium 38	89 **Y** Yttrium 39	91 **Zr** Zirconium 40	93 **Nb** Niobium 41	96 **Mo** Molybdenum 42	**Tc** Technetium 43	101 **Ru** 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 50	122 **Sb** Antimony 51	128 **Te** Tellurium 52	127 **I** Iodine 53	131 **Xe** Xenon 54
133 **Cs** Caesium 55	137 **Ba** Barium 56	139 **La** Lanthanum 57 *	178 **Hf** Hafnium 72	181 **Ta** Tantalum 73	184 **W** Tungsten 74	186 **Re** Rhenium 75	190 **Os** Osmium 76	192 **Ir** Iridium 77	195 **Pt** Platinum 78	197 **Au** Gold 79	201 **Hg** Mercury 80	204 **Tl** Thallium 81	207 **Pb** Lead 82	209 **Bi** Bismuth 83	**Po** Polonium 84	**At** Astatine 85	**Rn** Radon 86
Fr Francium 87	226 **Ra** Radium 88	227 **Ac** Actinium 89 †															
				140 **Ce** Cerium 58	141 **Pr** Praseodymium 59	144 **Nd** Neodymium 60	**Pm** Promethium 61	150 **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	175 **Lu** Lutetium 71
				232 **Th** Thorium 90	**Pa** Protactinium 91	238 **U** Uranium 92	**Np** Neptunium 93	**Pu** Plutonium 94	**Am** Americium 95	**Cm** Curium 96	**Bk** Berkelium 97	**Cf** Californium 98	**Es** Einsteinium 99	**Fm** Fermium 100	**Md** Mendelevium 101	**No** Nobelium 102	**Lr** Lawrencium 103

*58-71 Lanthanoid series
†90-103 Actinoid series

Key: a above **X**, b below

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

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