UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER



**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.

1 **(a)** Most atoms of metallic elements found in the Earth's crust exist in compounds 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.

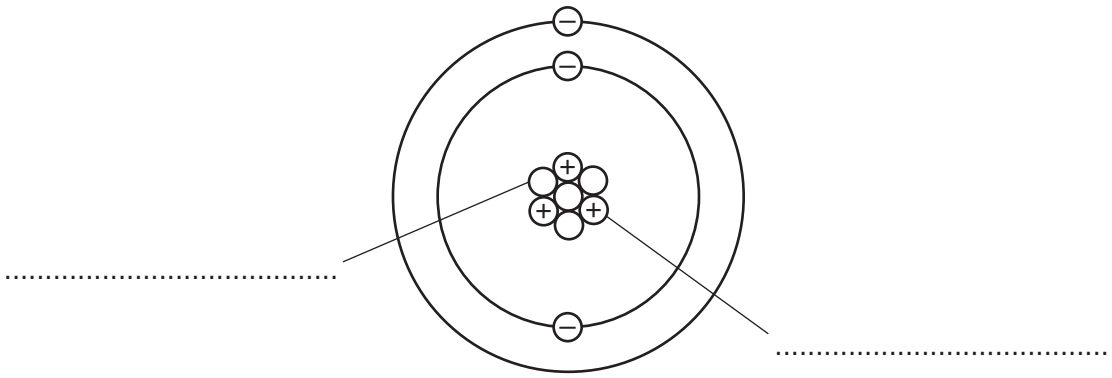
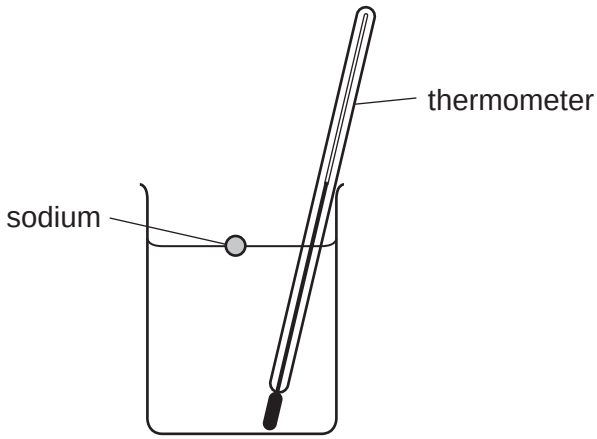


**Fig. 1.1**

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 wa… 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]

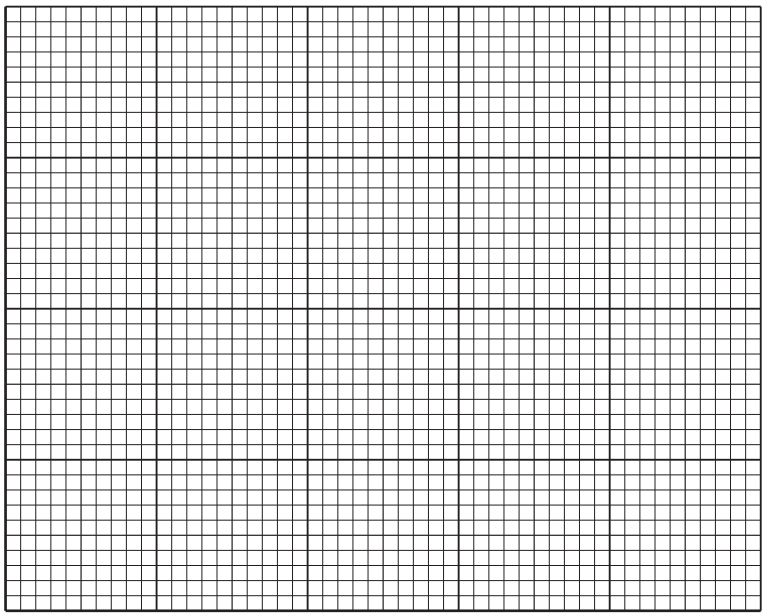
**2** An athlete warms up by running along a race track.

**(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]

**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.

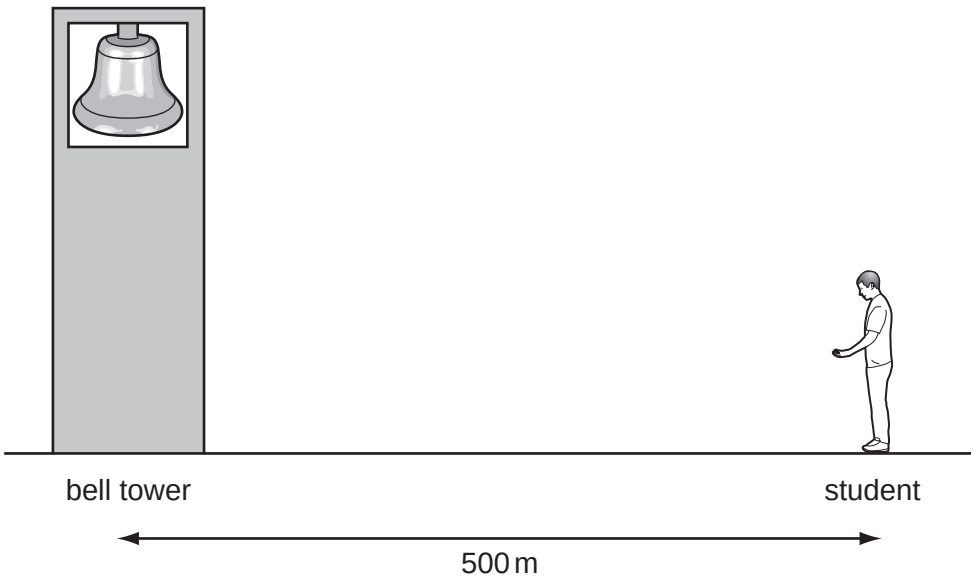
Draw lines to connect each type of radiation to its use. [3]

| 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.

**(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]

**5** Water supplies are often impure and have to be purified to make them safe for hum 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 mix… hexane and water could be separated at room temperature (20 °C) by the me… of filtration.

.....

.....

..... [2]

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

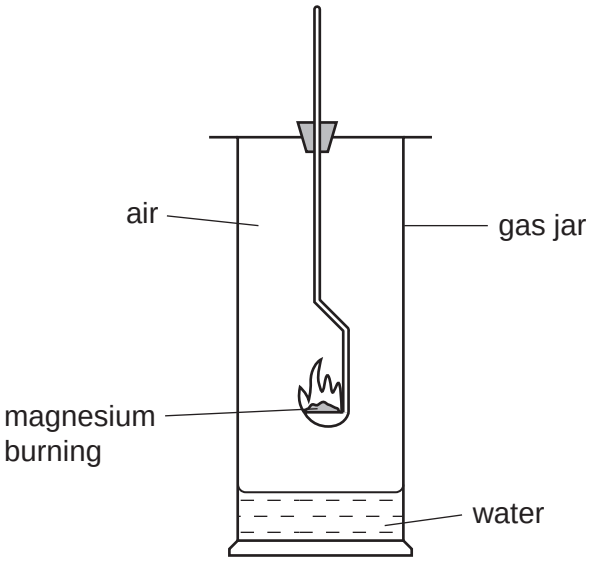



**Fig. 5.1**

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]

**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).

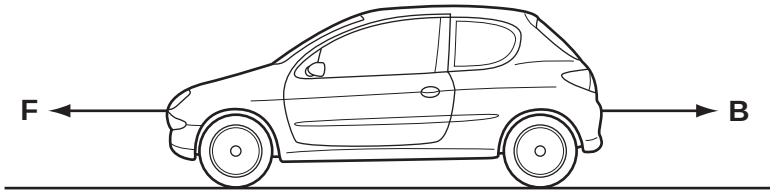



**Fig. 6.1**

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]

**(c)** Using some of the words below, complete the sentences to explain the energy ch
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.

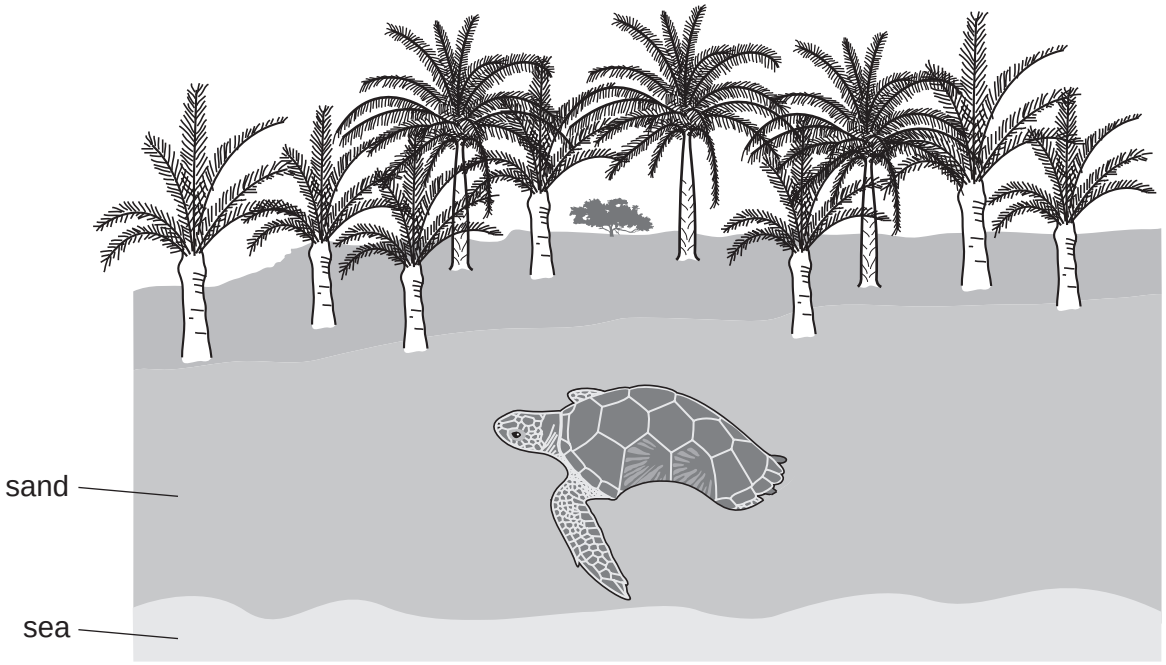
Explain why the mixture of waste gases (exhaust gases) from a car contains carbon dioxide and water vapour.

.....

.....

..... [2]

**7** Hawksbill turtles are an endangered species. They lay their eggs in nests in the sa… 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.

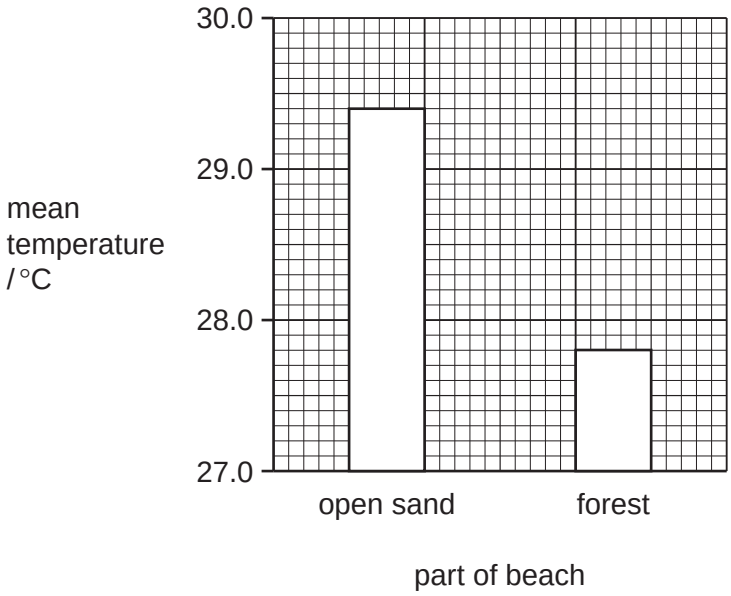



**Fig. 7.1**

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

.....

.....

..... [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 oc
during chemical reactions.

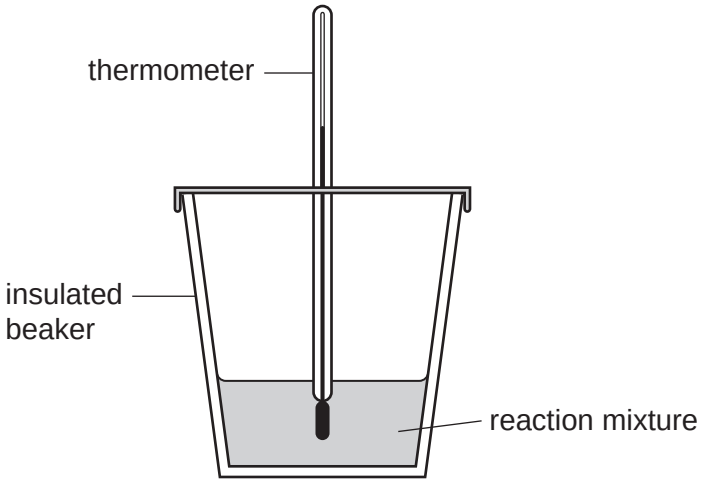



**Fig. 8.1**

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]

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

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]

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.

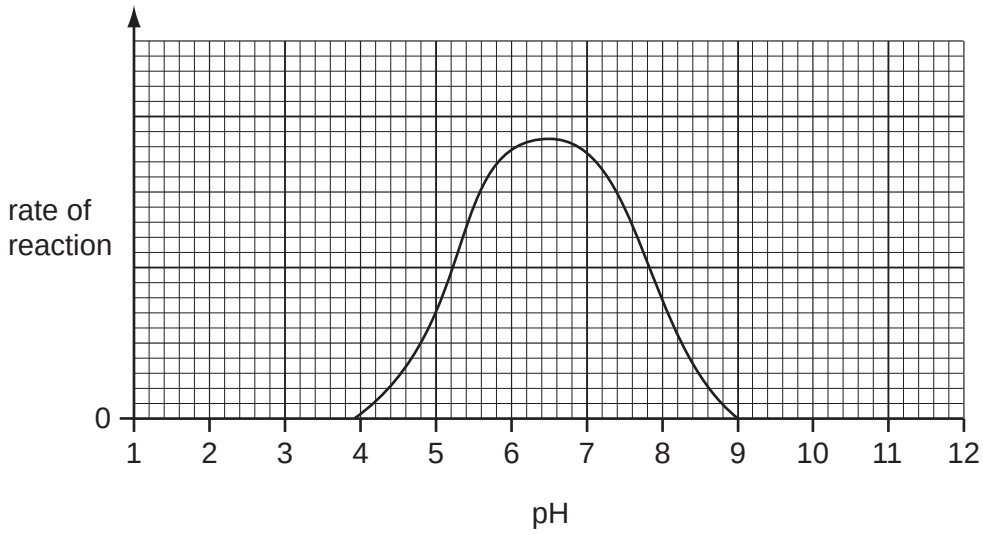



**Fig. 9.1**

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 molecu
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 = 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.).