Centre Number	Candidate Number	Name

MINISTRY OF EDUCATION, BOTSWANA

in collaboration with

UNIVERSITY OF CAMBRIDGE LOCAL EXAMINATIONS SYNDICATE

Botswana General Certificate of Secondary Education

SCIENCE : DOUBLE AWARD

0569/02

Paper 2

October/November 2006

Candidates answer on the Question Paper
No Additional Materials are required.

2 hours

Read the following carefully before you start.

Write your centre number, candidate number and name in the spaces provided at the top of this page.

Answer **all** questions.

Write your answers in the spaces provided on the question paper.

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

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

You may use a calculator.

A copy of the Periodic Table is printed on Page 20.

For Examiner's Use	
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
TOTAL	

This question paper consists of **19** printed pages and **1** blank page.

1 Fig. 1.1 shows the speed-time graph for the motion of a racing car.

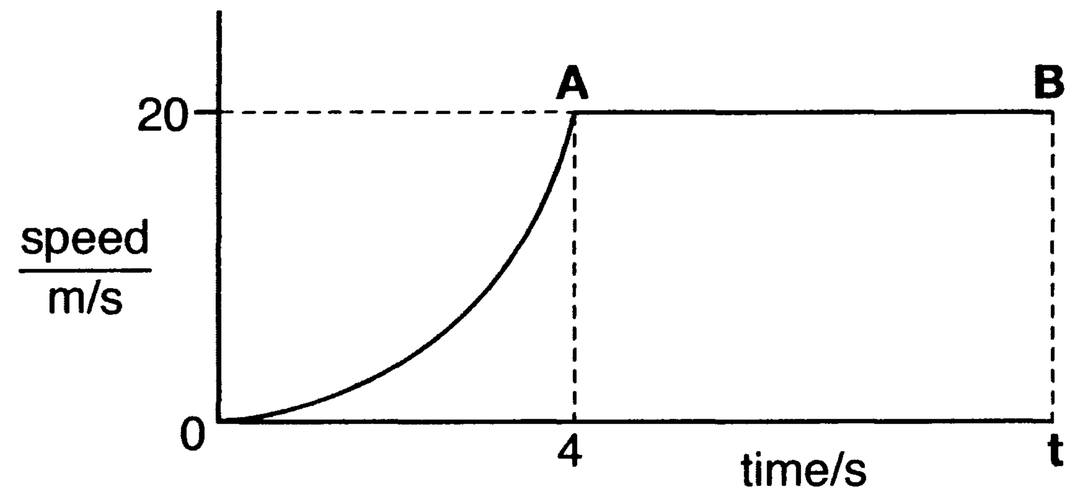


Fig. 1.1

(a) Describe the motion of the racing car between:

(i) OA .....

(ii) AB .....[2]

(b) What is the acceleration of the racing car between **A** and **B**?

acceleration = ... m/s^2 [1]

(c) If the total distance travelled between point **A** and **B** is 600 m, determine the value of time "**t**".

time = ... s [2]

For Examiner's Use

2 Fig. 2.1 shows a crane lifting a 200 kg bucket of tools from the bottom of a dam 100 m below. (g = 10 N/kg)

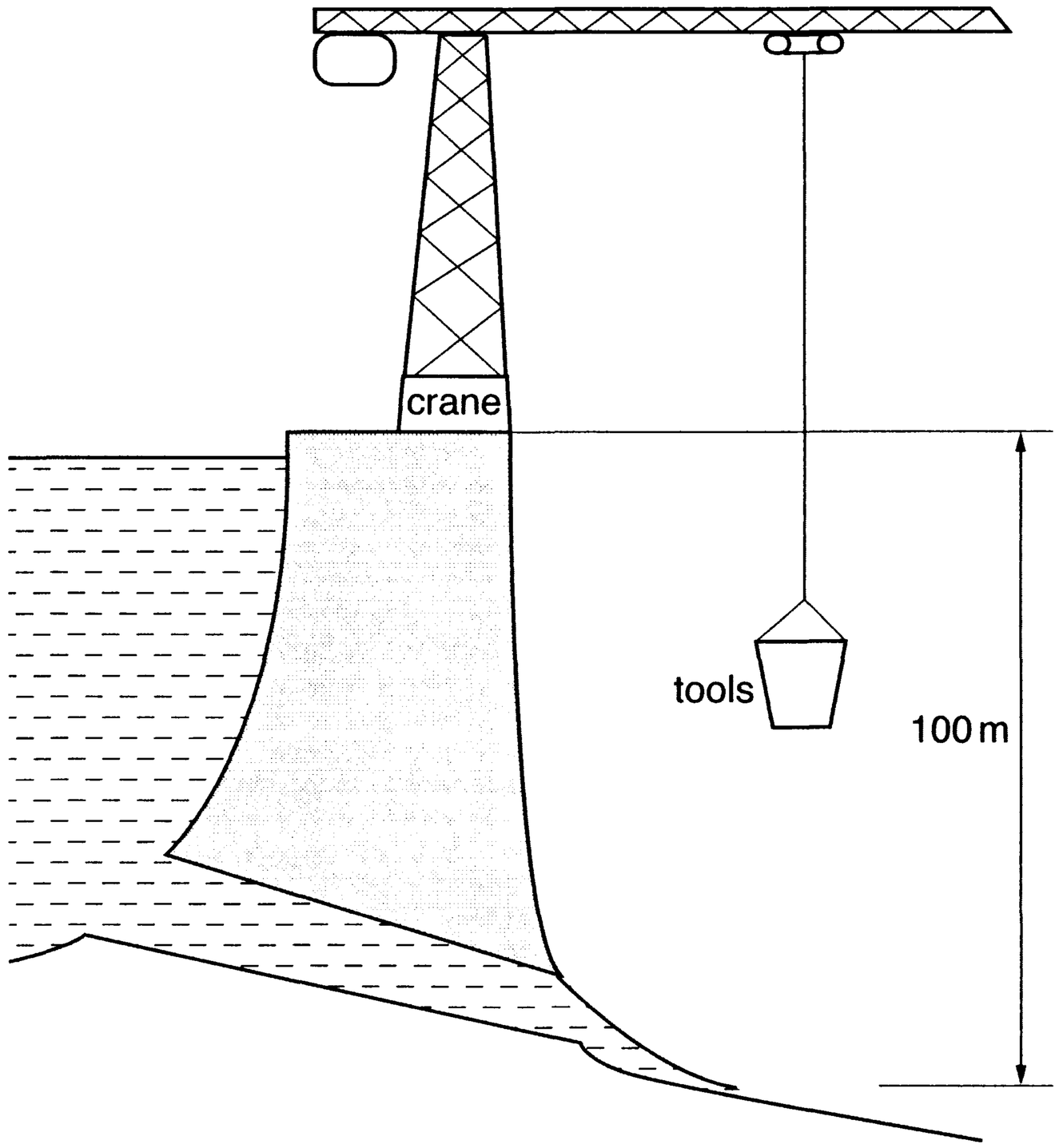


Fig. 2.1

The crane takes 20 seconds to lift the bucket of tools to the surface.

(a) (i) Calculate the potential energy gained by the bucket of tools.

potential energy = ... J [2]

(ii) Calculate the useful work done by the crane in lifting the load.

work done = ... J [1]

For Examiner's Use

(iii) Calculate the power developed by the crane.

power = ... W [2]

(b) The actual energy transferred by the crane is more than the work done by the crane in lifting the load. Give a reason for this.

.....

.....

.....[1]

3 Fig. 3.1 shows an electric kettle used to heat some water of mass 0.5 kg.

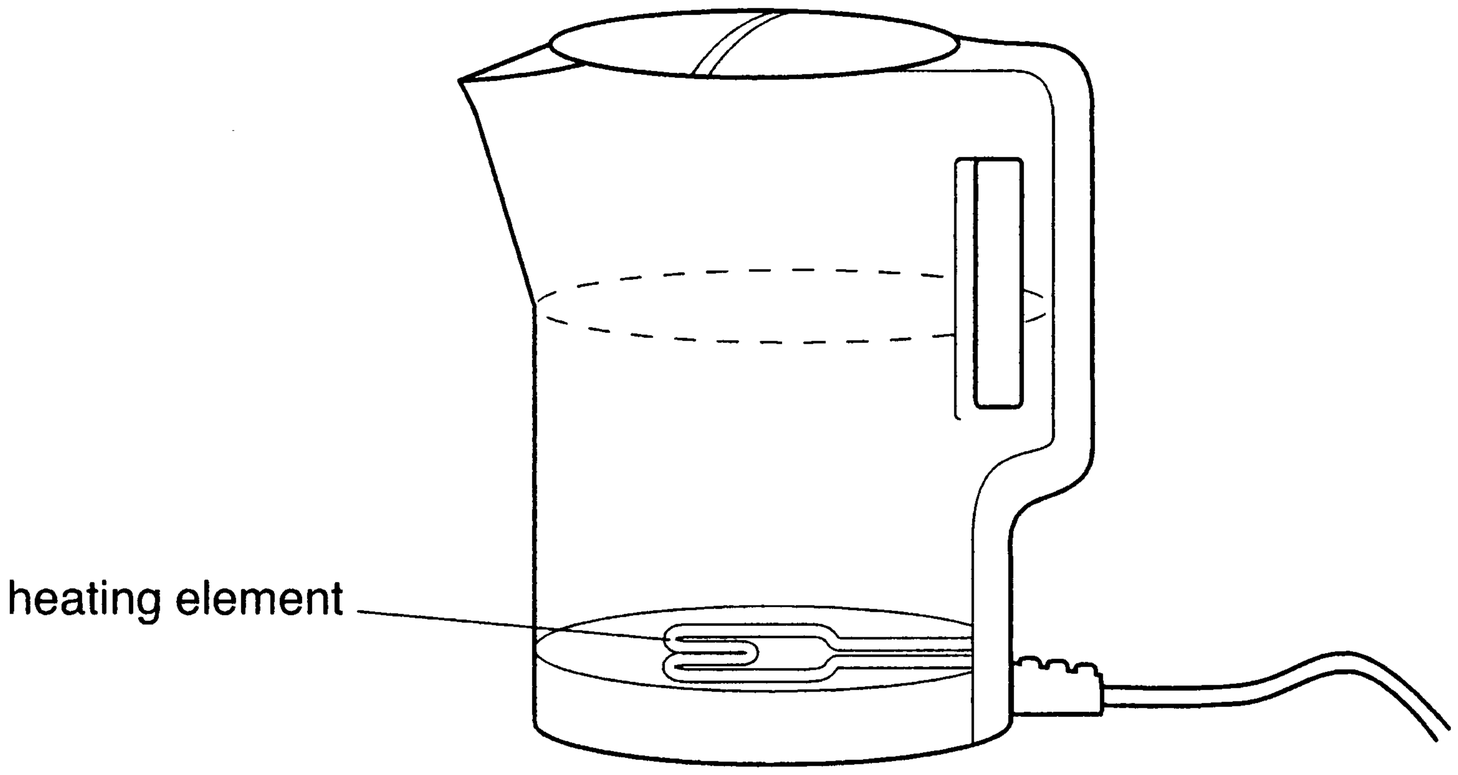


Fig. 3.1

(a) (i) State the method by which heat energy is transferred from the heating element to the water.

.....[1]

(ii) Explain why the heating element is placed at the bottom.

.....

.....[2]

(b) Explain how heat energy is spread throughout the water by convection.

.....

.....

.....

.....[3]

For Examiner's Use

4 A thunderstorm approaches Tebogo's village. Tebogo then runs towards the base of a nearby cliff.

(a) (i) The thunderstorm produces thunder and lightning. Why does Tebogo see the lightning flash before she hears the thunder?

.....

.....[1]

Tebogo later hears a second sound from the cliff.

(ii) State the **term** used to describe this sound.

.....[1]

(iii) Explain why the first sound is louder than the second sound.

.....

.....[1]

(b) A radio station broadcasts on a frequency of 100 MHz. The speed of radio waves is 3×10^8 m/s. (1 MHz = 1×10^6 Hz).

(i) Calculate the wavelength of the wave.

wavelength = ... m [2]

(ii) How long does the transmission take to travel 6000 km?

time = ... s [2]

For Examiner's Use

5 Fig. 5.1 shows three resistors connected in series with a battery.

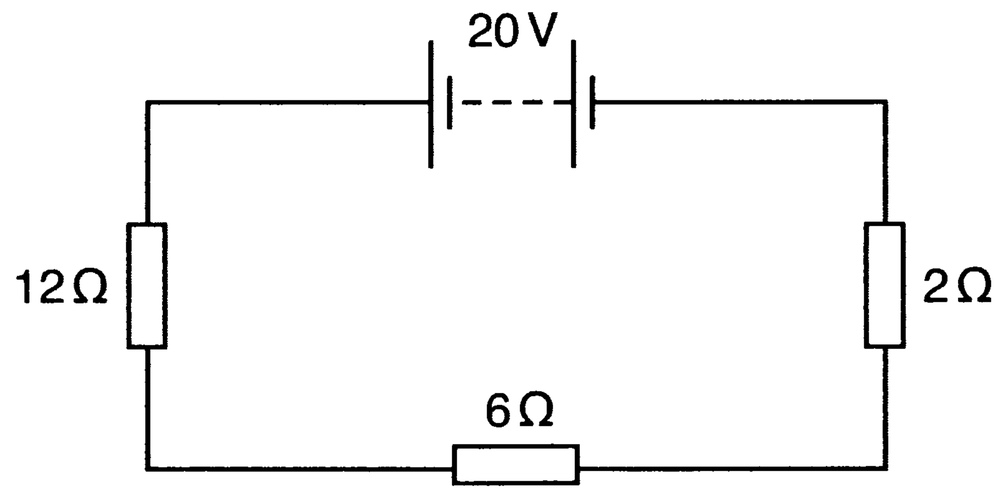


Fig. 5.1

(a) Calculate:

(i) the total resistance of the circuit.

resistance = ... Ω [1]

(ii) the current in the circuit.

current = ... A [2]

(b) The 12 Ω resistor is removed, and the circuit is completed again without it. How will the current in the circuit compare to your answer in **(a)(ii)**?

.....

Explain your answer.

.....

.....[1]

For Examiner's Use

6 An electric heater consists of a 2 kW element, a 30 W indicator lamp and a 20 W fan, switched on for 10 hours.

Calculate:

(a) the total electrical energy in kWh used by the heater.

energy = ... kWh [3]

(b) the cost of using the heater if a unit of electricity is P0.50.

cost = ... [2]

7 A student reacted 12 g of magnesium with excess dilute hydrochloric acid to produce magnesium chloride and hydrogen. The equation for the reaction is shown.

$$Mg(\quad) + 2HCl(\quad) \longrightarrow MgCl_2(\quad) + H_2(\quad)$$

(a) Complete the equation by writing the state symbols for the reactants and products. [2]

(b) Calculate the number of moles of magnesium used.

moles = ... [2]

(c) Calculate the mass of hydrogen gas produced from this reaction.

mass = ... [2]

(d) Suggest why excess hydrochloric acid was used.

.....

.....[2]

(e) State **two** observations made during the reaction.

1 .....

2 .....[2]

For Examiner's Use

8 Liquefied petroleum gas (LPG) is used for cooking and lighting.

(a) Why is liquefied petroleum gas said to be a good fuel for cooking and lighting?

.....[1]

(b) State **two** advantages of using LPG instead of firewood.

1 .....

2 .....[2]

(c) State one disadvantage of using LPG instead of firewood.

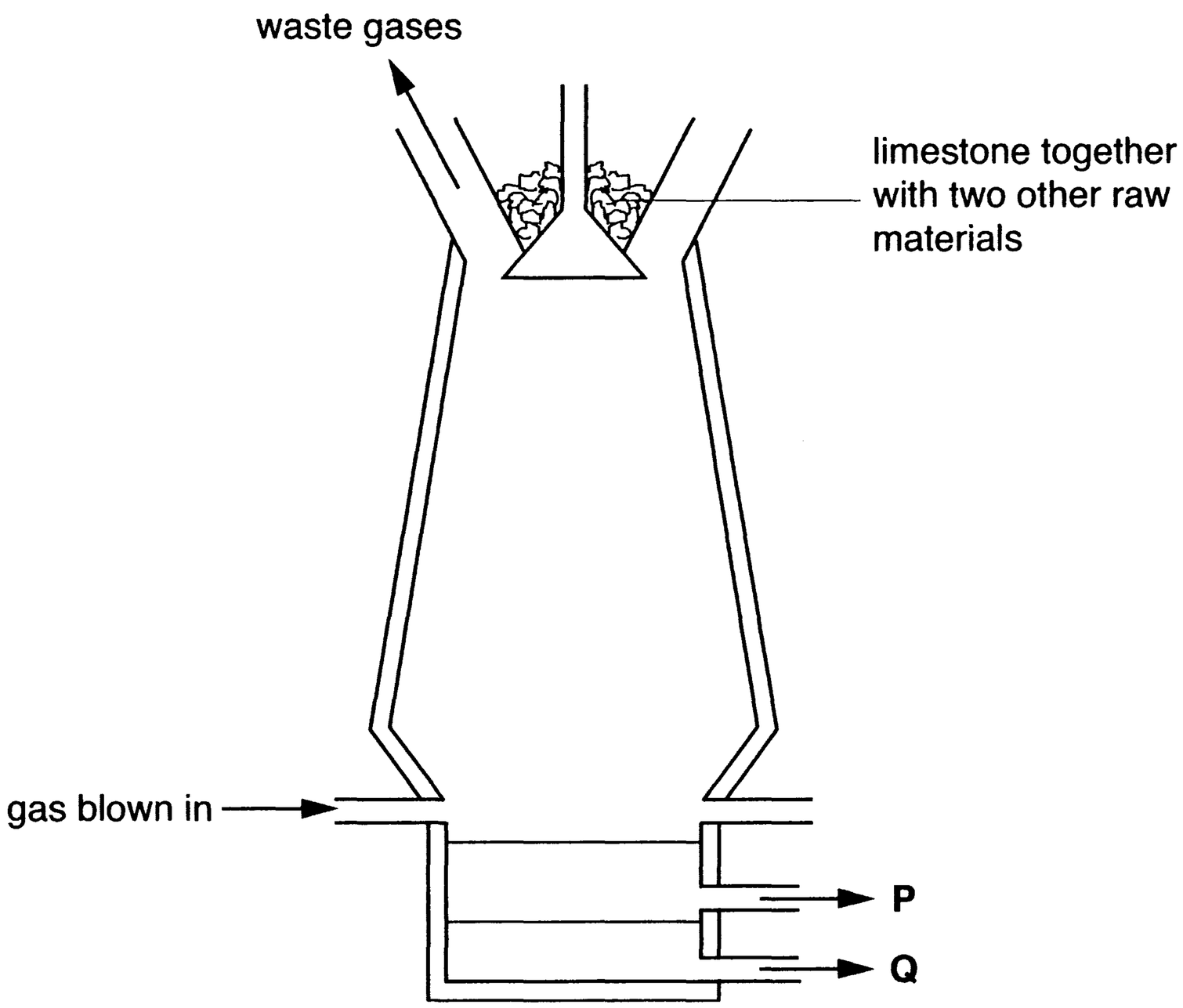
.....[1]

(d) Give **two** examples of fossil fuels other than natural gas.

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

For Examiner's Use

9 The diagram shows a blast furnace used for the extraction of iron.



(a) (i) Name the other **two** raw materials added in at the top of the furnace.

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

(ii) Explain why component **P** is obtained above **Q**. .

.....[1]

(b) In the blast furnace, there is complete combustion and incomplete combustion of some substances.

Write a balanced equation for the incomplete combustion of one of the substances in the blast furnace.

.....[2]

(c) Write the name of one of the components of exhaust gases.

.....[1]

(d) Why is limestone added into the furnace?

.....[1]

For Examiner's Use

(e) The iron produced from the blast furnace can be turned into alloys like steel.

(i) What is an alloy?

.....[1]

(ii) Describe how iron from the blast furnace is turned into steel.

.....

.....[2]

(iii) Explain why pure iron is not used for making kitchen utensils.

.....[1]

10 Carbon exists as different allotropes, diamond and graphite.

(a) What do the allotropes have in common?

.....[1]

(b) Complete the table below relating the properties of diamond and graphite to their uses.

allotrope	property	use
diamond		
graphite	good conductor of electricity	

[3]

(c) Draw arrows to match the organic compounds given to their homologous series. The first one has been done for you.

organic compound	**homologous series**
$CH_3CH_2CH_2OH$	alkanoic acids
CH_2CHCH_3	alkanes
$CH_3CH_2CH_2CH_2CH_3$	alkenes
CH_3COOH	alkanols

[3]

For Examiner's Use

11 Fig. 11.1 shows a longitudinal section of a kidney.

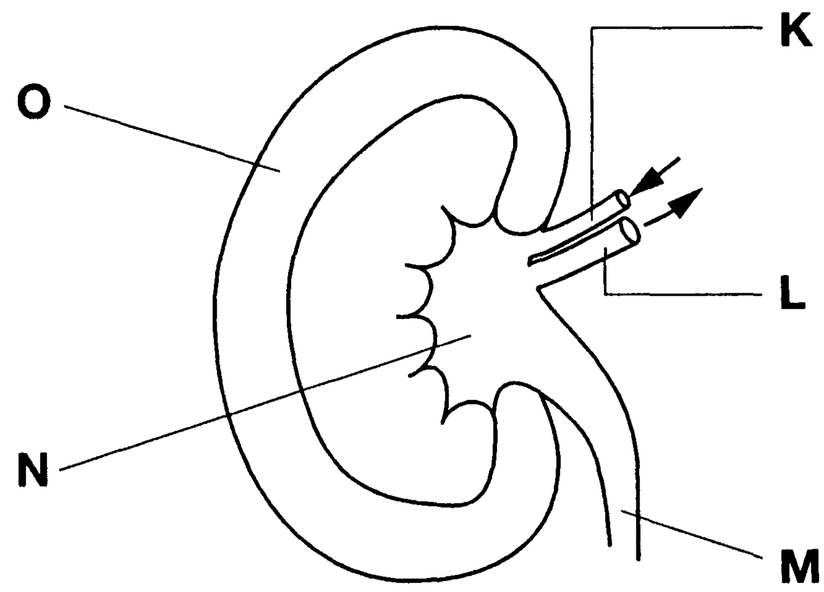


Fig. 11.1

(a) Name the parts labelled **N** and **O**.

N .....

O .....[2]

(b) Two hours after a heavy meal, fluid samples were taken from tubes **K**, **L**, **M**, and analysed for concentrations of water and urea.

Using the words high, low or absent, complete the table to show how the concentrations of water and urea compare in the tubes. Water has been done for you.

substance	**K**	**L**	**M**
water	high	low	high
urea	.....	.....	.....

[3]

(c) State **two** ways in which the kidney contributes to homeostasis.

.....

.....

.....[2]

For Examiner's Use

12 Pule visited a doctor complaining of stomach upset. After diagnosis the doctor said he suspected a bacterial infection and production of too much acid in the stomach. The doctor prescribed two types of drugs.

(a) Which types of drug would the doctor prescribe for each problem?

(i) for the bacterial infection .....

(ii) for the excess acid .....[2]

(b) The doctor advised that treatment for the bacterial infection should be taken as prescribed until finished.
Suggest **two** reasons for this.

.....

.....

.....

.....[2]

13 Fig. 13.1 shows part of the digestive system and its blood supply.

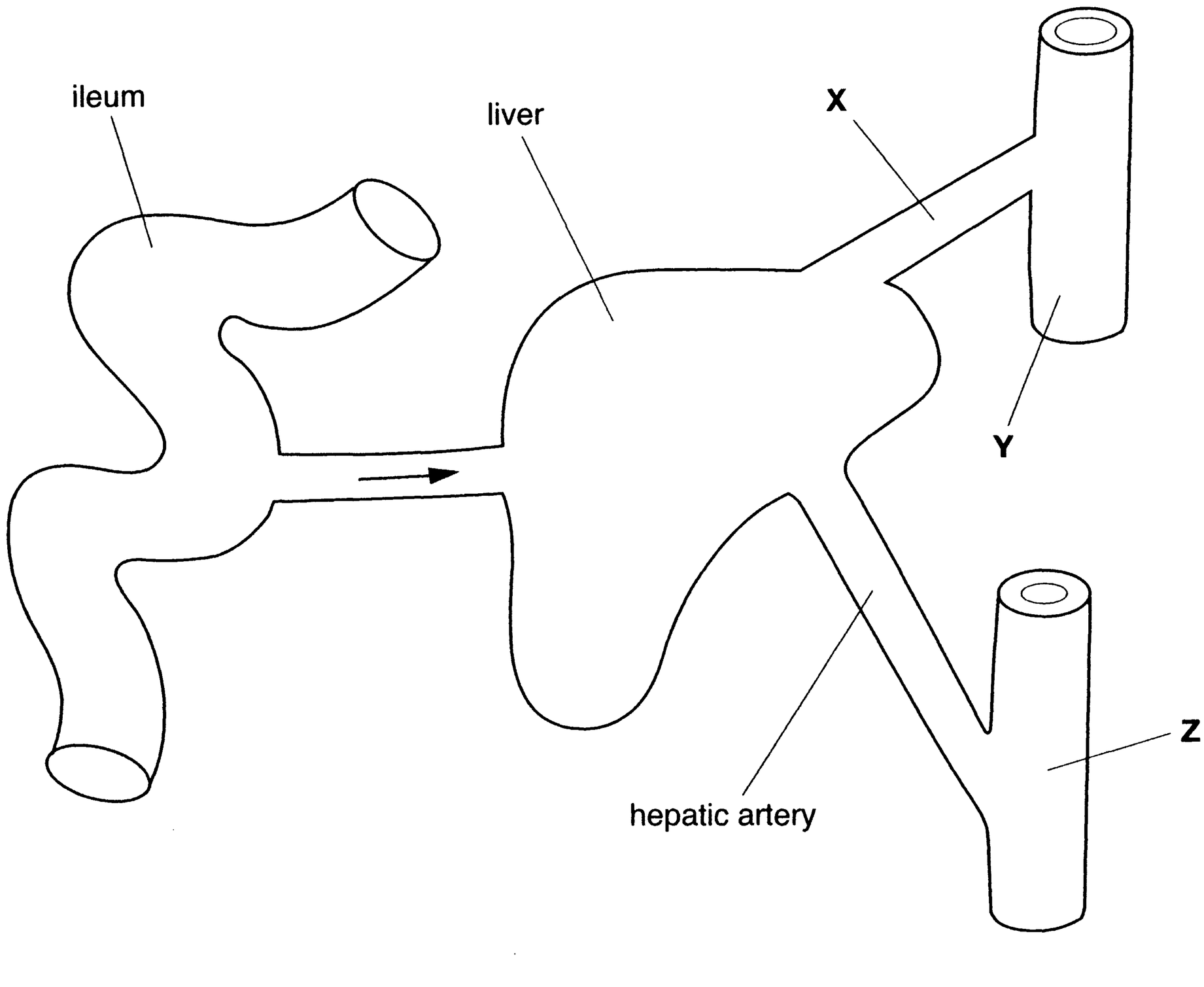


Fig. 13.1

(a) Which blood vessel **X**, **Y** or **Z** carries blood at the highest pressure?

.....[1]

(b) On the diagram, show the direction of blood flow in vessel **X**. [1]

(c) Name a gas found in low concentration in the hepatic artery.

.....[1]

(d) State **one** structural difference between vessels **Y** and **Z**.

.....

.....[1]

14 Fig. 14.1 shows some stages which a white blood cell goes through when carrying out its function.

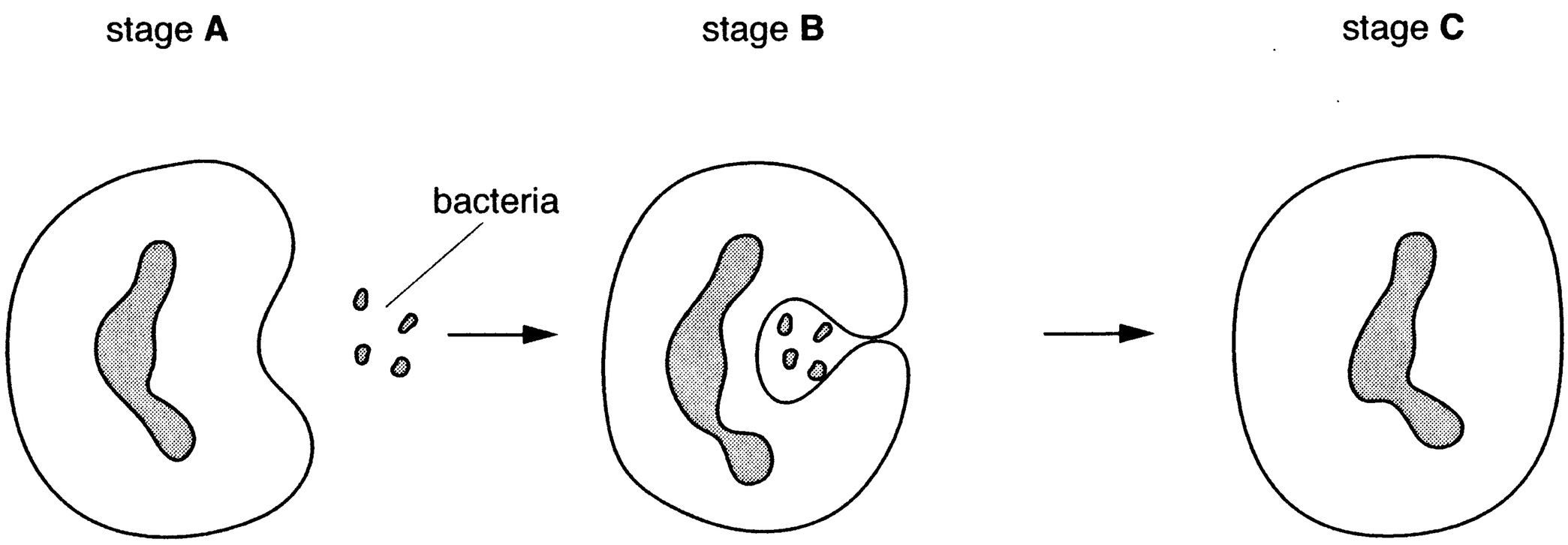


Fig. 14.1

(a) Name the type of white blood cell shown in Fig. 14.1.

.....[1]

(b) Describe what is happening in stage **B**.

.....[1]

(c) Suggest why the bacteria have disappeared in stage **C**.

.....

.....[1]

(d) Platelets, like white blood cells, protect the body against infection.

Describe how platelets carry out this function.

.....

.....

.....[2]

For Examiner's Use

15 Fig. 15.1 shows the pathway taken by an impulse in a reflex action.

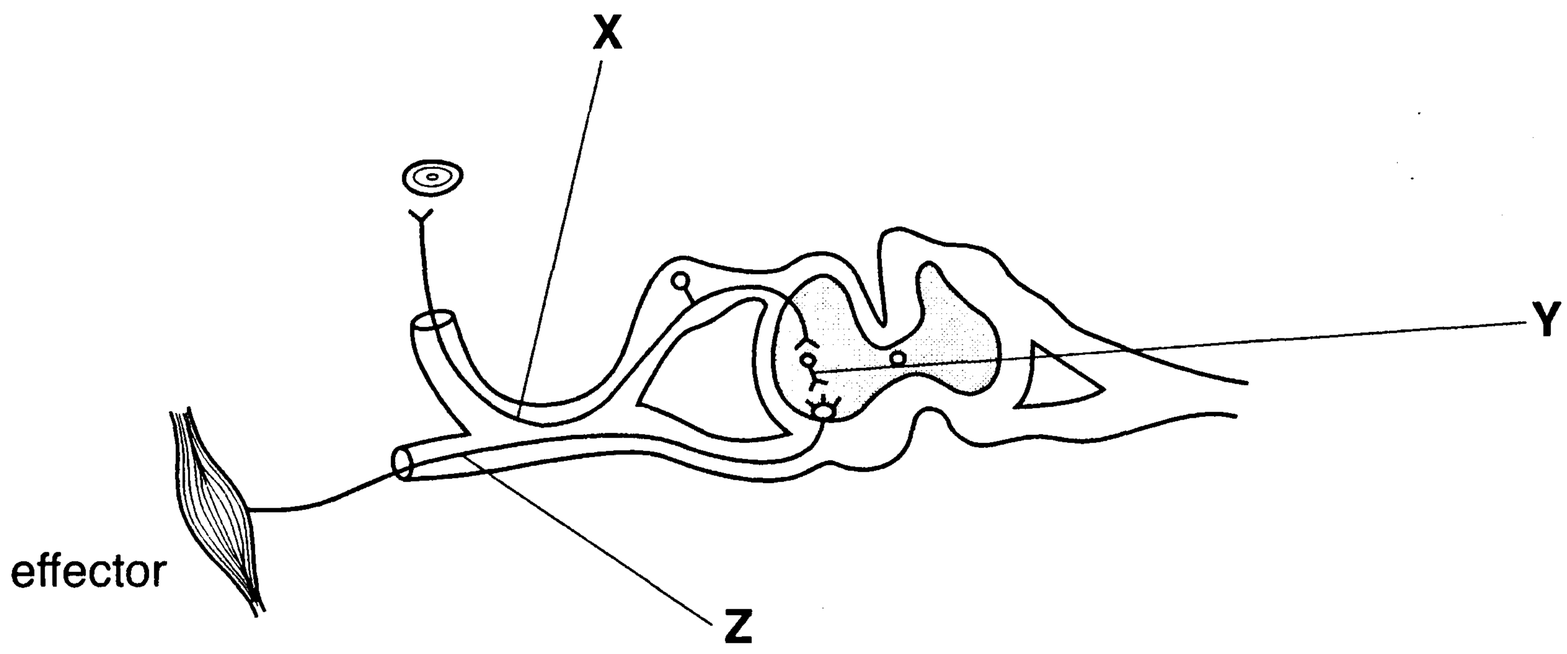


Fig. 15.1

(a) Identify the structure labelled **Y**.

.....[1]

(b) On the diagram draw arrows to show the direction in which impulses travel at **X** and **Z**. [1]

(c) What is the role of the effector?

.....[1]

For Examiner's Use

16 Fig. 16.1 shows changes in Mpho's pulse rate immediately after dancing.

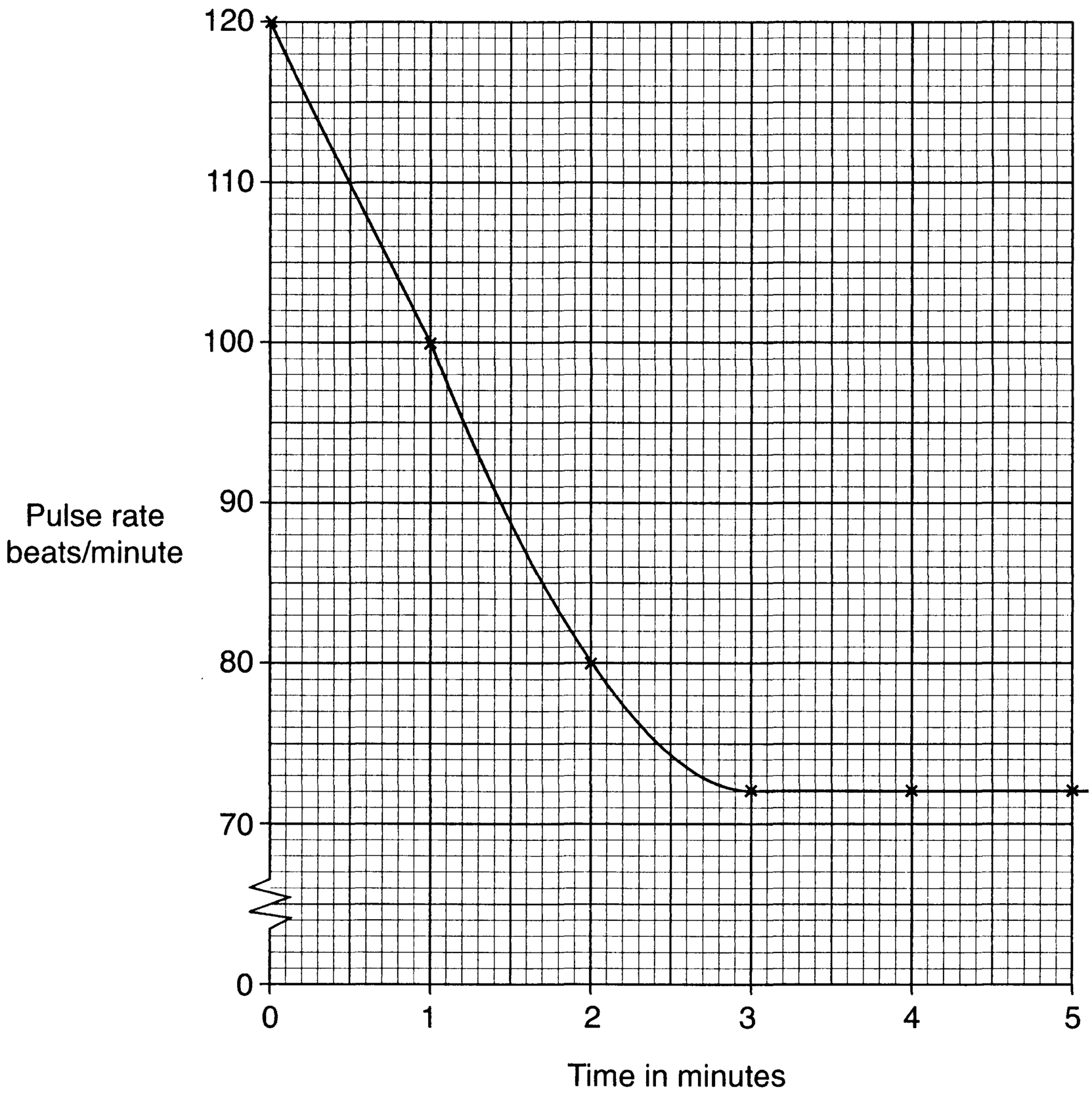


Fig. 16.1

(a) Describe the change in pulse rate between 0 to 4 minutes.

.....

.....

.....[2]

(c) Explain why the pulse rate is high immediately after Mpho has stopped dancing.

.....

.....

.....[1]

For Examiner's Use

17 Fig. 17.1 shows the energy needs for people of different age groups.

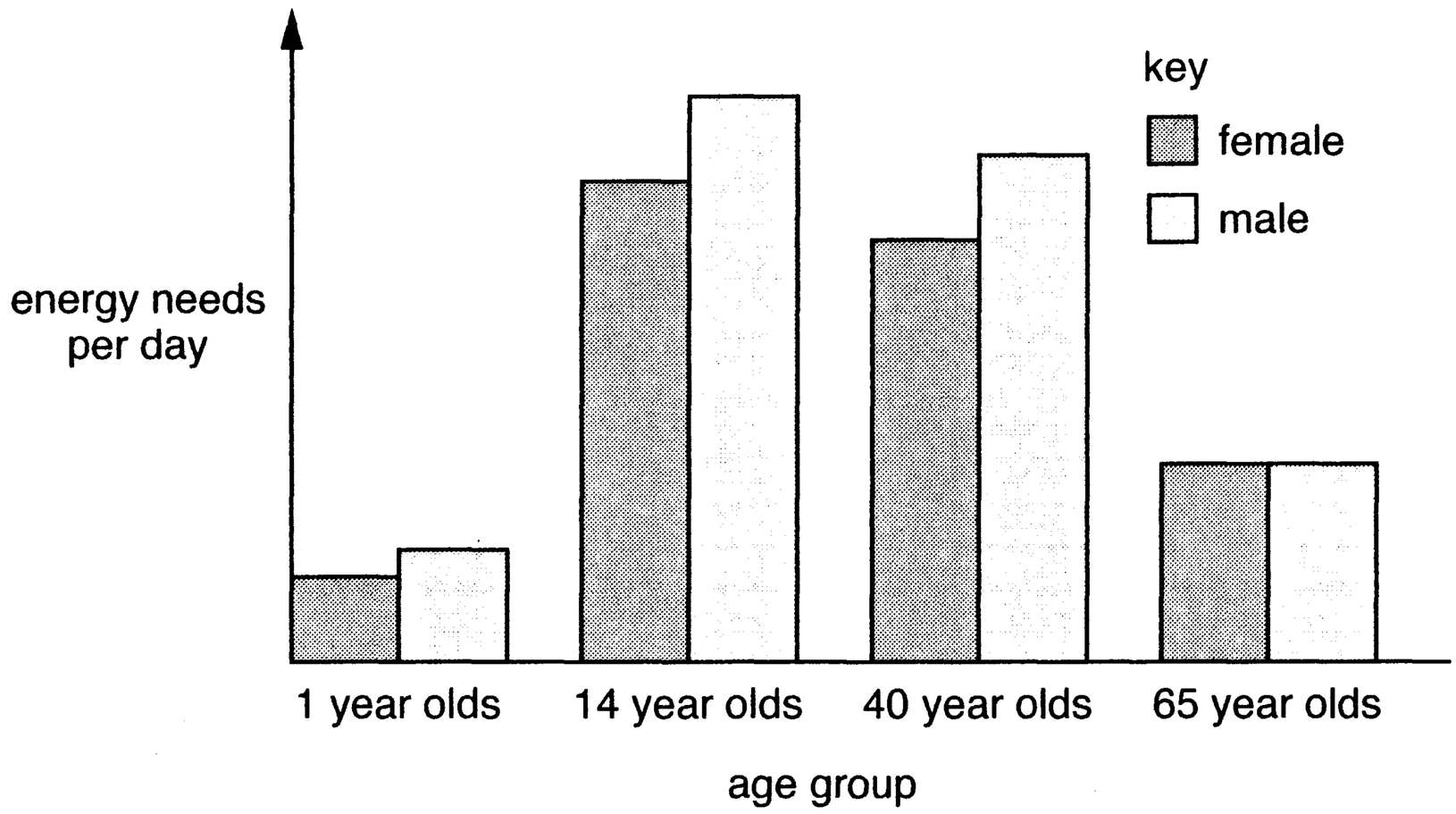


Fig. 17.1

(a) (i) State **two** factors which affect energy needs in human beings.

1 .....

2 .....[2]

(ii) Explain why 14 year olds have higher energy needs than 65 year olds.

.....

.....

.....[2]

(b) A 65 year old man eats a protein rich meal. Suggest how his body may use the large quantities of amino acids absorbed.

.....

.....

.....[3]

BLANK PAGE

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 Sulphur 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
X
b

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.).