Name : ..... ( ) Class : .....

ST JOSEPH'S INSTITUTION

MID-YEAR EXAMINATION 2017
SECONDARY 2

LOWER SECONDARY SCIENCE
PAPER 1

12 MAY 2017
45 minutes
1100 – 1145 hrs

Additional Materials: MCQ Answer Sheet

READ THESE INSTRUCTIONS FIRST

1. Answer all questions by shading your answers in the appropriate spaces in the MCQ Answer Sheet.
2. Use a 2B pencil only. Make sure all amendments on the MCQ Answer Sheet are thoroughly erased using a soft eraser.
3. Use pi (π) value preprogrammed in calculator.
4. Do not use staples, paper clips, highlighters, glue or correction fluid/tape.

This document consists of **14** printed pages.

[Turn over]

The Periodic Table of Elements

Group																	
I	II											III	IV	V	VI	VII	0
						1 H hydrogen 1											2 He helium 4
3 Li lithium 7	4 Be beryllium 9		**Key** proton (atomic) number atomic symbol name relative atomic mass									5 B boron 11	6 C carbon 12	7 N nitrogen 14	8 O oxygen 16	9 F fluorine 19	10 Ne neon 20
11 Na sodium 23	12 Mg magnesium 24											13 Al aluminium 27	14 Si silicon 28	15 P phosphorus 31	16 S sulfur 32	17 Cl chlorine 35.5	18 Ar argon 40
19 K potassium 39	20 Ca calcium 40	21 Sc scandium 45	22 Ti titanium 48	23 V vanadium 51	24 Cr chromium 52	25 Mn manganese 55	26 Fe iron 56	27 Co cobalt 59	28 Ni nickel 59	29 Cu copper 64	30 Zn zinc 65	31 Ga gallium 70	32 Ge germanium 73	33 As arsenic 75	34 Se selenium 79	35 Br bromine 80	36 Kr krypton 84
37 Rb rubidium 85	38 Sr strontium 88	39 Y yttrium 89	40 Zr zirconium 91	41 Nb niobium 93	42 Mo molybdenum 96	43 Tc technetium -	44 Ru ruthenium 101	45 Rh rhodium 103	46 Pd palladium 106	47 Ag silver 108	48 Cd cadmium 112	49 In indium 115	50 Sn tin 119	51 Sb antimony 122	52 Te tellurium 128	53 I iodine 127	54 Xe xenon 131
55 Cs caesium 133	56 Ba barium 137	57 – 71 lanthanoids	72 Hf hafnium 178	73 Ta tantalum 181	74 W tungsten 184	75 Re rhenium 186	76 Os osmium 190	77 Ir iridium 192	78 Pt platinum 195	79 Au gold 197	80 Hg mercury 201	81 Tl thallium 204	82 Pb lead 207	83 Bi bismuth 209	84 Po polonium –	85 At astatine –	86 Rn radon –
87 Fr francium –	88 Ra radium –	89 – 103 actinoids	104 Rf Rutherfordium –	105 Db dubnium –	106 Sg seaborgium –	107 Bh bohrium –	108 Hs hassium –	109 Mt meitnerium –	110 Ds darmstadtium –	111 Rg roentgenium –	112 Cn copernicium –		114 Fl flerovium –		116 Lv livermorium –		

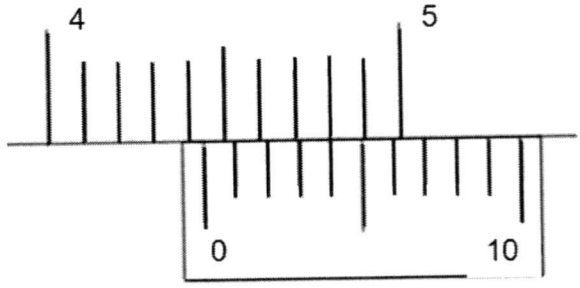
lanthanoids	57 La lanthanum 139	58 Ce cerium 140	59 Pr praseodymium 141	60 Nd neodymium 144	61 Pm promethium –	62 Sm samarium 150	63 Eu europium 152	64 Gd gadolinium 157	65 Tb terbium 159	66 Dy dysprosium 163	67 Ho holmium 165	68 Er erbium 167	69 Tm thulium 169	70 Yb ytterbium 173	71 Lu lutetium 175
actinoids	89 Ac actinium –	90 Th thorium 232	91 Pa protactinium 231	92 U uranium 238	93 Np neptunium –	94 Pu plutonium –	95 Am americium –	96 Cm curium –	97 Bk berkelium –	98 Cf californium –	99 Es einsteinium –	100 Fm fermium –	101 Md mendelevium –	102 No nobelium –	103 Lr lawrencium –

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

Section A (30 marks)

*There are thirty questions in this section. Answer **all** questions. For each question there are four possible answers, **A**, **B**, **C** and **D**. Choose the one you consider correct and shade your choice in the appropriate oval in the answer sheet provided.*

A1 A pair of vernier calipers is used to measure the thickness of a textbook. The diagram below shows the reading on the vernier calipers. What is the thickness of the textbook?



A 4.04 cm
B 4.34 cm
C 4.44 cm
D 5.18 cm

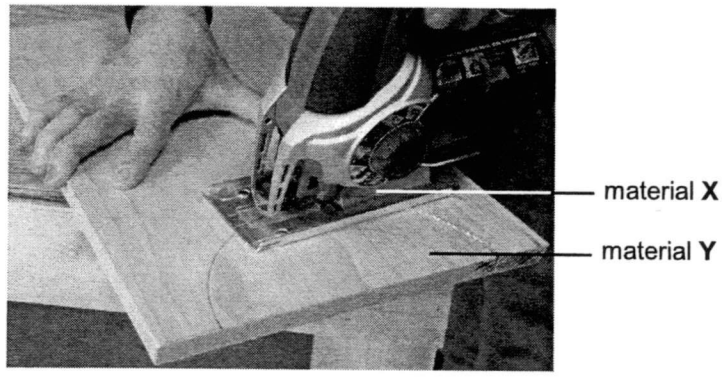
A2 A measuring cylinder contains 100 cm^3 of water. An irregularly-shaped object, of mass 50 g, is slowly lowered into the cylinder.
Given that the density of the object is 5.0 g/cm^3 and it is completely immersed, what is the new reading on the measuring cylinder?

A 105 cm^3
B 110 cm^3
C 150 cm^3
D 155 cm^3

A3 The diameter of the Earth is about 10 Mm, while the diameter of an atom is 0.5 nm. How many atoms, when lined up next to each other, make up the diameter of the Earth?

A 2×10^7
B 2×10^{10}
C 2×10^{16}
D 2×10^{17}

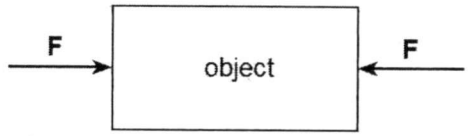
A4 The diagram below shows a process of using material **X** to cut material **Y**.



Which one of the following statements is most appropriate for the above diagram?

A Material **X** can support a heavy load without breaking, but material **Y** cannot.
B Material **X** will sink in water, but material Y will float in water.
C When both materials are rubbed together, only material **Y** has scratches.
D Material **X** can bend without breaking and returns to its original shape after bending, but material **Y** cannot.

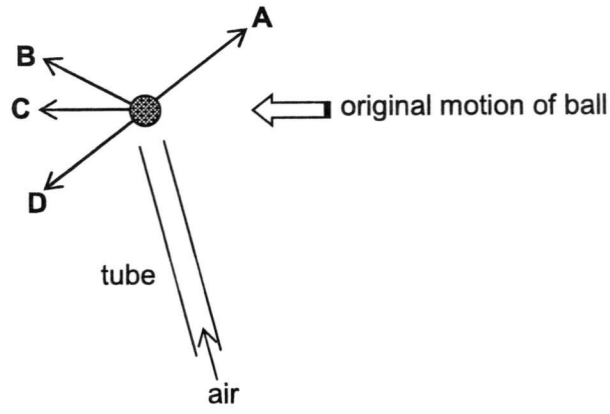
A5 Which of the following is/are possible when an object, as shown below, experiences two equal and opposite forces?



I. If the object is at rest, it will continue to remain stationary.
II. If the object is moving, it will accelerate.
III. If the object is moving, it will continue to move at constant velocity.

A I only
B I and II only
C I and III only
D I, II and III

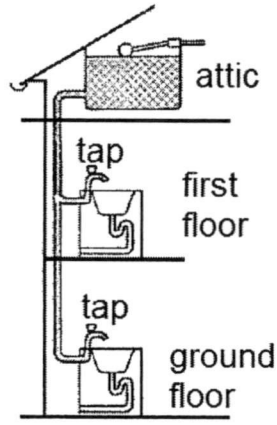
A6 A lightweight ball moves across a table and passes the end of a tube through which air is blown. In which direction will the ball now move?



A7 A cheetah runs very quickly to catch its prey. The air resistance experienced by the cheetah and the friction between the cheetah and the ground vary with the conditions.
Which one of the following conditions below will the cheetah reach its maximum speed?

	Air resistance	**Friction with ground**
A	High	Low
B	High	High
C	Low	Low
D	Low	High

A8 A household water supply has a water tank in the attic.



The rate of water flow at the tap on the ground floor is faster than the rate of water flow at the tap on the first floor. Which one of the following statements is a likely reason for the phenomenon?

A Water pressure increases with height of the water column.
B Water pressure decreases with height of the water column.
C Water has to travel further to get to the tap on the ground floor.
D The tap on the ground floor is closer to sea level where the pressure is zero.

An interesting Science fair exhibit at a primary school involves putting small pieces of solid dry ice into a balloon (with the aid of a funnel). The balloon "magically" inflates although no one is inflating it.

Answer questions **A9** and **A10** below.

A9 Which one of the following describes the process that inflated the balloon?

A Boiling of carbon dioxide
B Evaporation of carbon dioxide
C Melting of carbon dioxide
D Sublimation of carbon dioxide

A10 Which one of the following statements correctly describes the arrangement and movement of particles inside the inflated balloon?

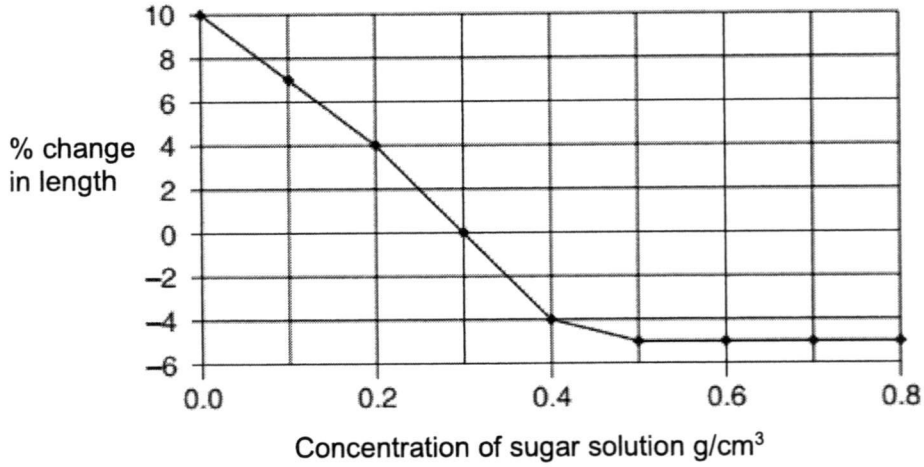
A Closely-packed, vibrating about fixed positions
B Closely-packed, sliding past each other
C Far apart, vibrating about fixed positions
D Far apart, moving rapidly in random directions

A11 Which of these processes happening in a cell requires energy from respiration?

Key ✓ Energy required
× Energy not required

	Diffusion	Osmosis
A	✓	✓
B	✓	×
C	×	✓
D	×	×

A12 Cylinders of potato tissue were placed in different concentrations of a sugar solution. The graph shows the percentage change in length of the cylinders of potato tissue.



Which solution has the same water potential as the potato tissue?

A 0.0 g/cm^3
B 0.2 g/cm^3
C 0.3 g/cm^3
D 0.5 g/cm^3

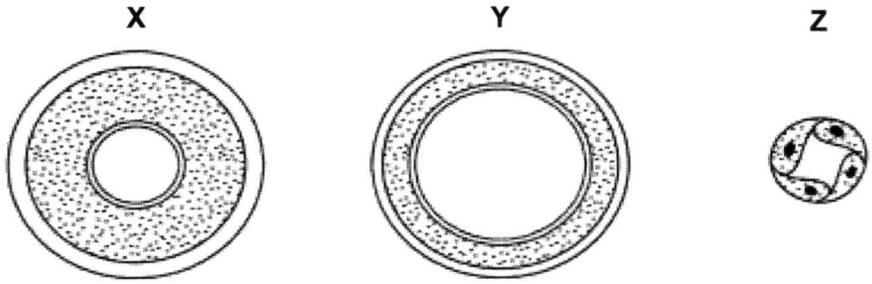
A13 What are the possible end-product and effect of anaerobic respiration in muscle?

	End product	Effect
A	carbon dioxide	muscle contraction
B	ethanol	loss of coordination
C	water	muscle relaxation
D	lactic acid	oxygen debt

A14 Through which sequence does carbon dioxide pass as it leaves the lungs for the environment outside the human body?

A In the alveoli → alveolar wall → capillary wall → blood
B Capillary wall → blood → in the alveoli → alveolar wall
C Blood → capillary wall → alveolar wall → in the alveoli
D Alveolar wall → in the alveoli → blood → capillary wall

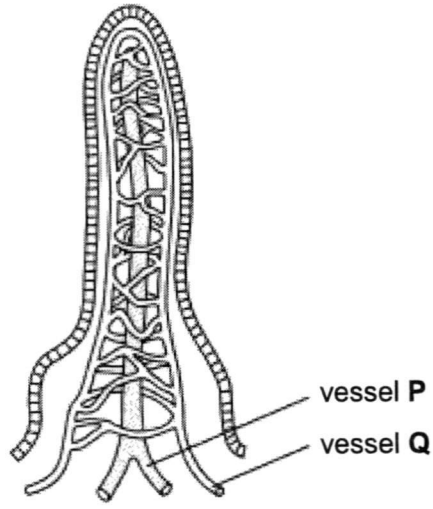
A15 The diagram shows cross-sections of three types of blood vessel, not drawn to the same scale.



What are **X**, **Y** and **Z**?

	X	Y	Z
A	artery	capillary	vein
B	artery	vein	capillary
C	vein	artery	capillary
D	vein	capillary	artery

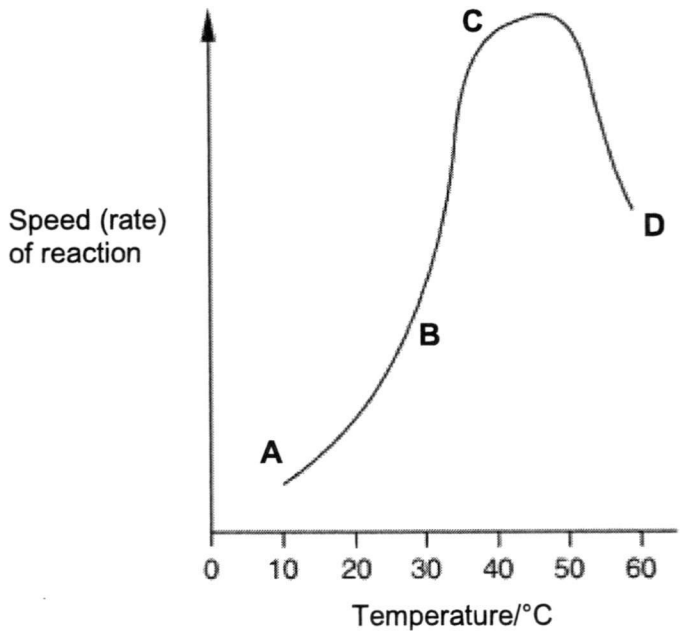
A16 The diagram shows a villus.



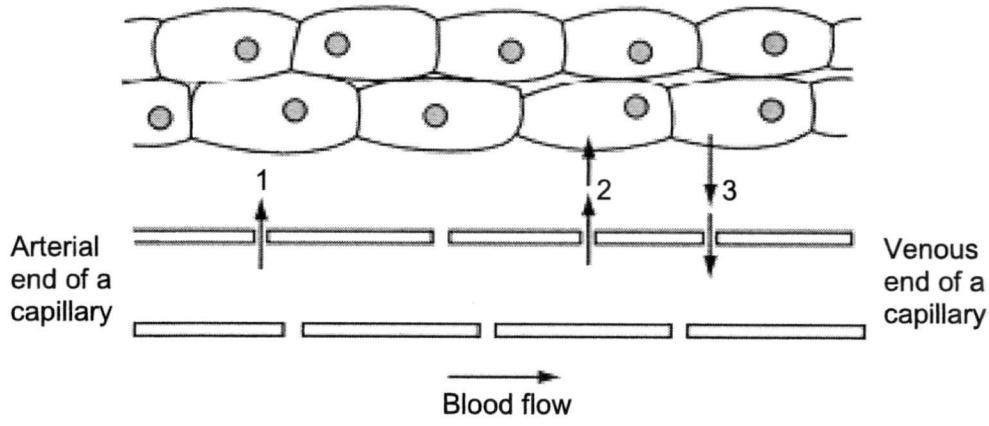
After a meal containing starch and oil, which substance(s) is/are absorbed mainly into vessel **P** and vessel **Q** respectively?

	Vessel P	**Vessel Q**
A	amino acids	water
B	fats	glucose
C	glucose	amino acids
D	water	fats

A17 The graph shows the effect of temperature on a chemical reaction which is controlled by enzymes. At which point are most product molecules being released?



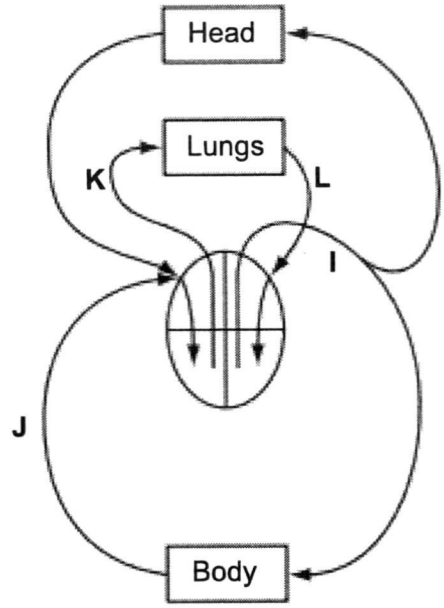
A18 The diagram represents a tissue with an adjacent capillary.



Which substances can **1**, **2** and **3** represent?

	1	**2**	**3**
A	glucose	tissue fluid	carbon dioxide
B	oxygen	carbon dioxide	glucose
C	tissue fluid	glucose	oxygen
D	tissue fluid	oxygen	carbon dioxide

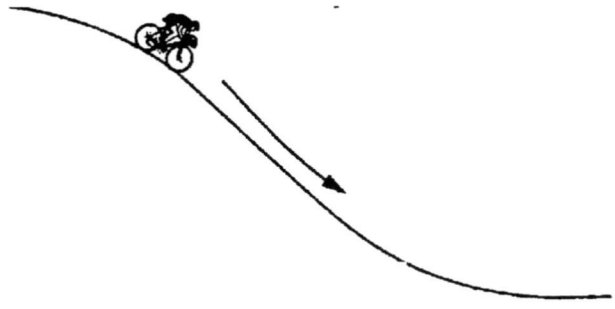
A19 The diagram represents part of the circulatory system.



Which one of the following sets represent possible blood pressures (in kPa) for the vessels at I, J, K and L?

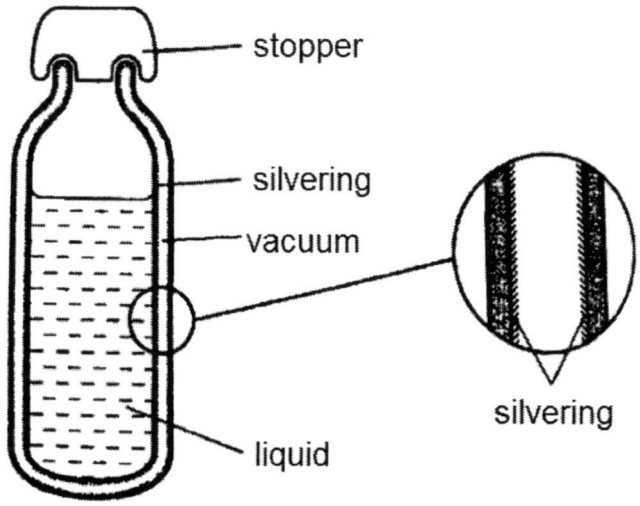
	I	J	K	L
A	1	4	2	16
B	4	16	2	1
C	16	2	4	1
D	16	4	1	2

A20 A cyclist speeds up as he travels down a slope. How does his energy change?



	Gravitational potential energy	**Kinetic energy**
A	Decreases	Decreases
B	Decreases	Increases
C	Increases	Decreases
D	Increases	Increases

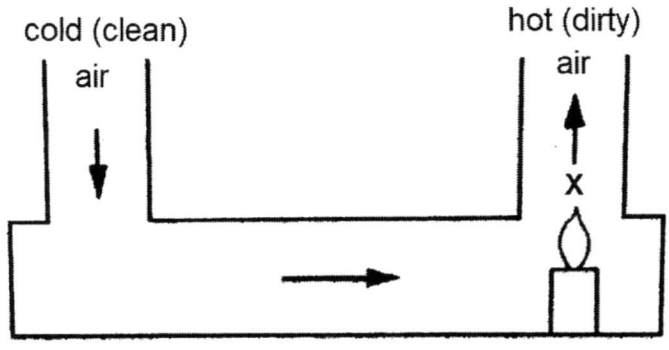
A21 The diagram shows a vacuum flask and an enlarged view of a section through the flask wall.



The main reason for the silvering is to reduce heat transfer by.....

A Conduction only
B Convection only
C Radiation only
D Convection and radiation

A22 The diagram shows a model of a convection system.



What happens to the volume and density of a fixed mass of air at **X** to make it move upwards?

	Volume	**Density**
A	Increases	Decreases
B	Increases	Increases
C	Remains unchanged	Increases
D	Remains unchanged	Decreases

A23 Which types of surface are the best absorbers and emitters of infra-red radiation?

	Best absorber	Best emitter
A	Black and dull	Black and dull
B	Black and shiny	White and shiny
C	White and dull	White and dull
D	White and shiny	Black and shiny

A24 The rate at which thermal energy is conducted through a material depends on its state. What is the correct order of thermal conduction?

Best conductor ⟶ Worst conductor

A	Gas	Liquid	Solid
B	Solid	Liquid	Gas
C	Solid	Gas	Liquid
D	liquid	gas	Solid

A25 A car of mass 1200 kg is travelling at a speed of 30 m/s. The brakes are applied to bring the car to a stop. What is the loss in kinetic energy as the car decelerates to rest?

A 40 J
B 36 000 J
C 540 000 J
D 1 080 000 J

A26 The neutron particle .....

A has a mass of 1g.
B has a mass equal to that of a proton.
C has a charge equal but opposite to that of an electron.
D is present in all atoms.

A27 Which one of the following statements is true about an atom?

A The number of neutrons is equal to the number of protons.
B A positive ion is formed when electrons are added to an atom.
C A positive ion contains more protons than electrons.
D The atomic number is equal to the number of particles inside the nucleus.

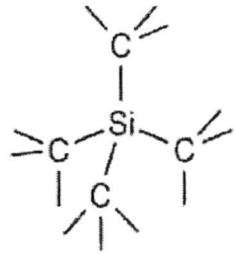
A28 The atoms of an element X have the electronic configuration 2,8,6. Which one of the following statements about element X is correct?

A It forms an ion of charge 2+.
B It reacts with metals and also non-metals.
C It has 6 protons in the outer shell of an atom.
D It forms an ionic compound with oxygen.

A29 In which one of the following sets do all the compounds contain only ionic bonds?

A Methane, ammonia, water.
B Calcium oxide, magnesium oxide, sodium oxide.
C Potassium chloride, carbon dioxide, magnesium sulfide.
D Copper(II) sulfate, hydrogen chloride, sulfur dioxide.

A30 The structure of silicon carbide can be described in the diagram below:



Which one of the following statements about silicon carbide is true?

A Silicon atoms now contain 4 valence electrons each.
B Carbon atoms now contain 4 valence electrons each.
C Silicon carbide is a covalent compound.
D Silicon carbide is an ionic compound.

Name : ..... ( ) Class : .....

ST JOSEPH'S INSTITUTION

MID-YEAR EXAMINATION 2017
SECONDARY 2

LOWER SECONDARY SCIENCE
PAPER 2

12 MAY 2017
1 hour 45 minutes
0800 – 0945 hrs

Additional Materials: NIL

READ THESE INSTRUCTIONS FIRST

1. Answer all the questions in the spaces provided on the question paper.
2. Write in dark blue or black pen. You may use a soft pencil for any diagrams, graphs or rough working.
3. Use pi (π) value preprogrammed in calculator.
4. Express your final answer in 3 significant figures where appropriate, show all working, and include units in all your working.
5. Do not use staples, paper clips, highlighters, glue or correction fluid/tape.

	Section A									
A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11

Section B		
B1	B2	B3

For Markers Use	
Section A	/40
Section B	/30
Total	/70

This document consists of **22** printed pages.

[Turn over]

The Periodic Table of Elements

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19 K potassium 39	20 Ca calcium 40	21 Sc scandium 45	22 Ti titanium 48	23 V vanadium 51	24 Cr chromium 52	25 Mn manganese 55	26 Fe iron 56	27 Co cobalt 59	28 Ni nickel 59	29 Cu copper 64	30 Zn zinc 65	31 Ga gallium 70	32 Ge germanium 73	33 As arsenic 75	34 Se selenium 79	35 Br bromine 80	36 Kr krypton 84
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actinoids	89 Ac actinium –	90 Th thorium 232	91 Pa protactinium 231	92 U uranium 238	93 Np neptunium –	94 Pu plutonium –	95 Am americium –	96 Cm curium –	97 Bk berkelium –	98 Cf californium –	99 Es einsteinium –	100 Fm fermium –	101 Md mendelevium –	102 No nobelium –	103 Lr lawrencium –

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

Section A (40 marks)

*Answer **all** questions in the spaces provided.*

A1 A student is attempting to measure the length of the pencil using the ruler as shown in **Fig. A1**.

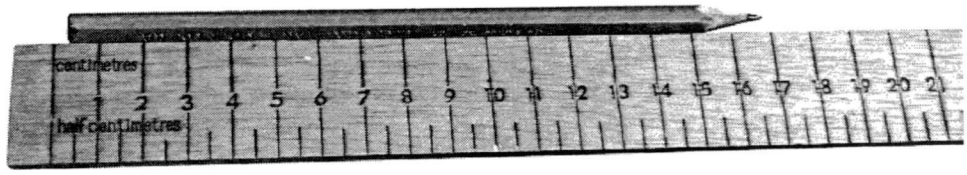


Fig. A1

a) Estimate the length of the pencil to the precision of the ruler.

..... [2]

b) Suggest two ways that the measurement can be improved, without changing the ruler or using additional apparatus.

(1) .....

.....

(2) .....

..... [2]

A2 **Fig. A2.1** shows a box hanging on a spring balance on Earth. The reading on the spring balance is shown in **Fig. A2.2**.

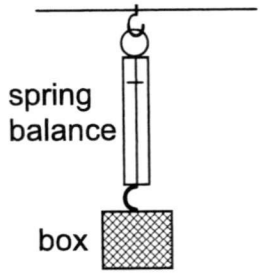


Fig A2.1

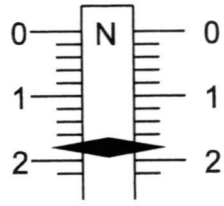


Fig. A2.2

a) Deduce the mass of the box.

Mass = ... [1]

b) The south pole of a magnet is placed near the bottom of the box. The reading on the spring balance decreases to 0.6 N.

i State the value of the magnetic force acting on the box by the magnet.

..... [1]

ii Suggest what can be deduced about the contents of the box.

..... [1]

A3 Jeremy, a civil engineer, is in charge of the design and construction of a bridge in a town. **Fig. A3.1** shows the side view of a proposed design of a bridge, supported by 5 cylindrical pillars.

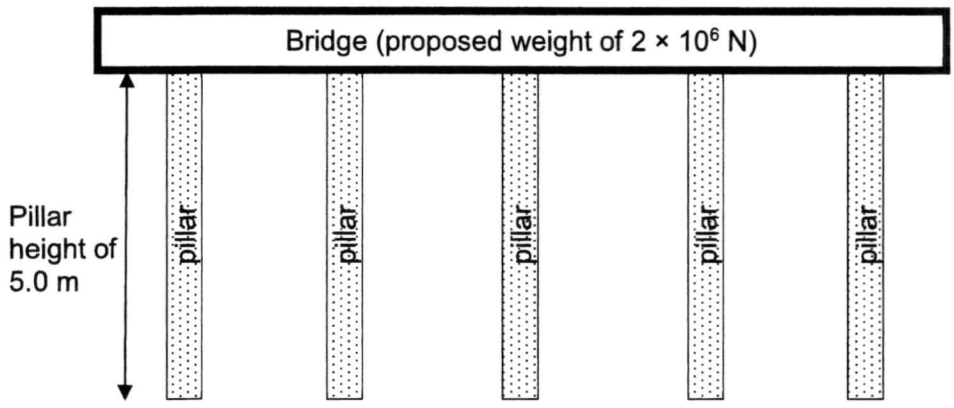


Fig. A3.1

Table A3.2 shows two possible types of raw material that can be used to make the five pillars.

Material	Maximum pressure that the material can support / N m^{-2}	Cost per unit volume / $
Reinforced steel	4 000 000	500
High grade concrete	400 000	170

Table A3.2

a) State and explain one important **physical** property that Jeremy should consider when selecting the raw material to make the pillars.

.....

..... [1]

b) The proposed weight of the bridge is 2×10^6 N. Assuming that the pillars are evenly spaced apart, how much weight must **one** pillar support?

Weight = ... [1]

c) **Fig. A3.3** shows an individual cylindrical pillar under the bridge.

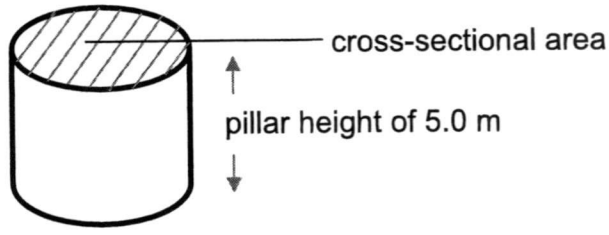


Fig. A3.3 (not drawn to scale)

Using information from **Table A3.2**, calculate the minimum cross-sectional area of **one** pillar when using

i reinforced steel

cross-sectional area = ...[1]

ii high grade concrete

cross-sectional area = ... [1]

d) To select the most appropriate material for constructing the pillar, help Jeremy complete the table below. Show your working clearly in the space provided below the table.

Material	**Volume required to make <u>one</u> pillar / m^3**	**Cost to make <u>one</u> pillar / $**
Reinforced steel		
High grade concrete		

Working: [2]

e) Based on your answers in **d)**, explain which material Jeremy should use to make the pillars.

.....

..... [1]

A4 **Fig. A4** below shows the melting process of a substance **P**.

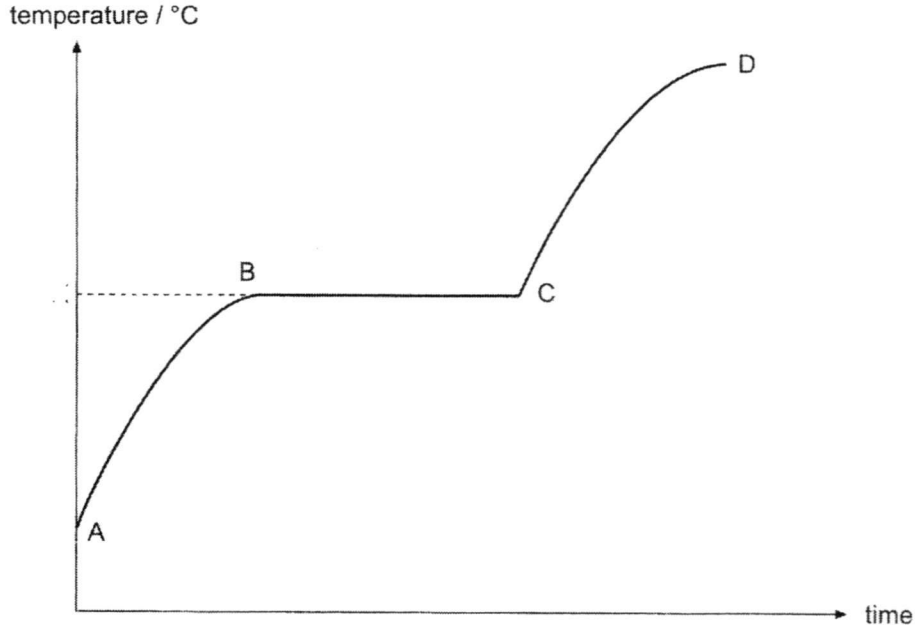


Fig. A4

a) What is the state of **P** in the period between **A** and **B**?

..... [1]

b) Draw the arrangement of the particles of **P** in this state.

[1]

c) State, with a reason, whether substance **P** is likely to be a mixture or a compound.

.....

..... [1]

A5 **Fig. A5** shows the mean distance that gas molecules must travel during gas exchange between air in the lungs and blood in the circulatory system in birds and mammals. This distance is known as the thickness of the blood-gas barrier.

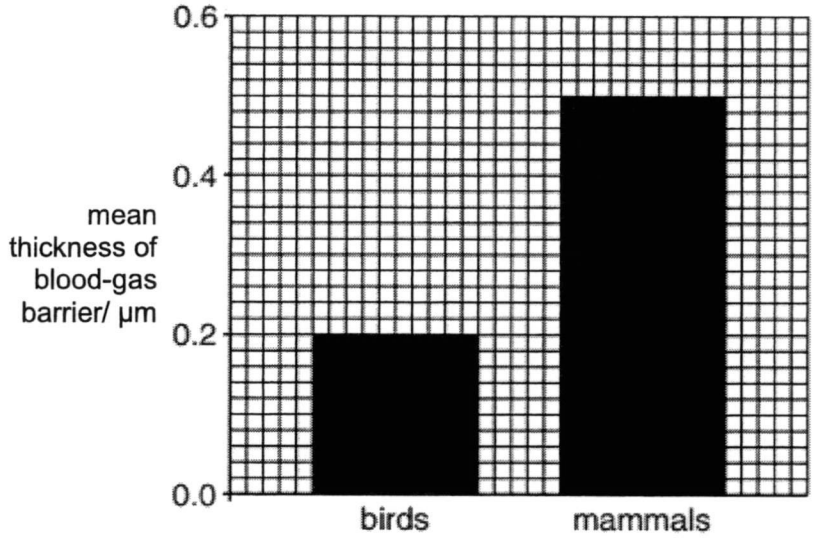


Fig. A5

a) Name **two** gases that cross the blood-gas barrier during gas exchange.

1 .....

2 ..... [1]

b) **i** Use **information** from **Fig. A5** to **compare** the thickness of the blood-gas barrier in birds and mammals.

.....

..... [1]

ii Briefly explain how the difference in thickness of the blood-gas barrier suggests that movement of birds by flying require more energy than movement by mammals on land.

.....

.....

.....

..... [2]

A6 **Fig. A6.1** shows some parts of the human alimentary canal and associated organs.

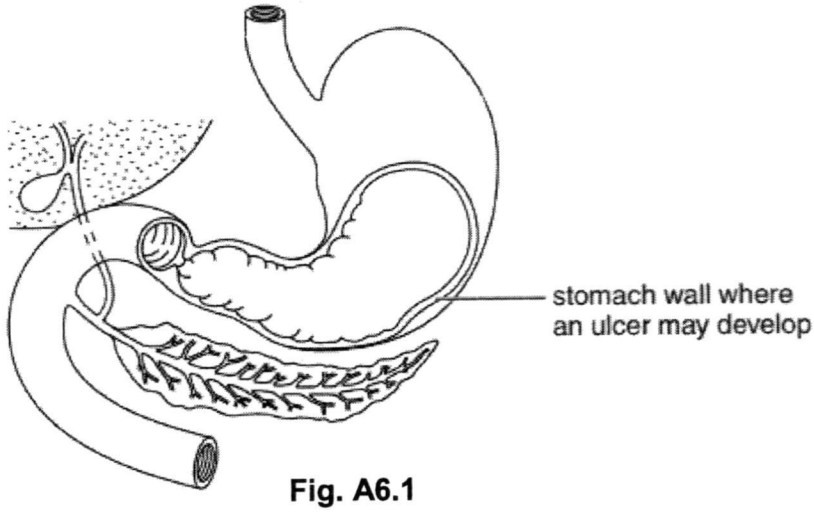


Fig. A6.1

a) The pain from the stomach ulcer may be relieved by taking a drug that reduces the amount of acid produced by the cells in the stomach wall. Identify this acid and state its function in the stomach.

Name of acid: .....

Function: .....

..... [1]

b) **Fig. A6.2** shows a villus found in the small intestine.

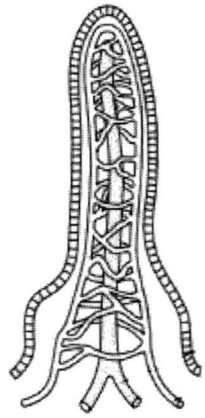


Fig. A6.2

There are many factors affecting the rate of diffusion of digested food substances into the villus. State **one** structural adaptation of the villi and explain how that adaptation increases the rate of diffusion into the villi.

Structural adaptation: .....

Explanation: .....

..... [2]

A7 **Fig. A7.1** shows a vertical section through a human heart viewed from the front. Two chambers, **V** and **W**, are labelled.

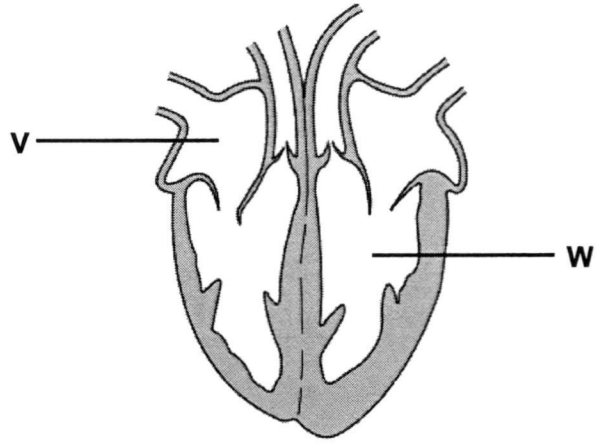


Fig. A7.1

With reference to **Fig. A7.1**, complete **Table A7.2**.

Chamber	Name of chamber	Name of blood vessel connected to this chamber
V		
W		

Table A7.2 [2]

A8 **Fig. A8** shows the design of a solar cooker. A metal cooking pot, containing water, is placed in the cooker. A lid covers over the pot. When the cooker is in operation, it heats up the water using infrared radiation from the Sun.

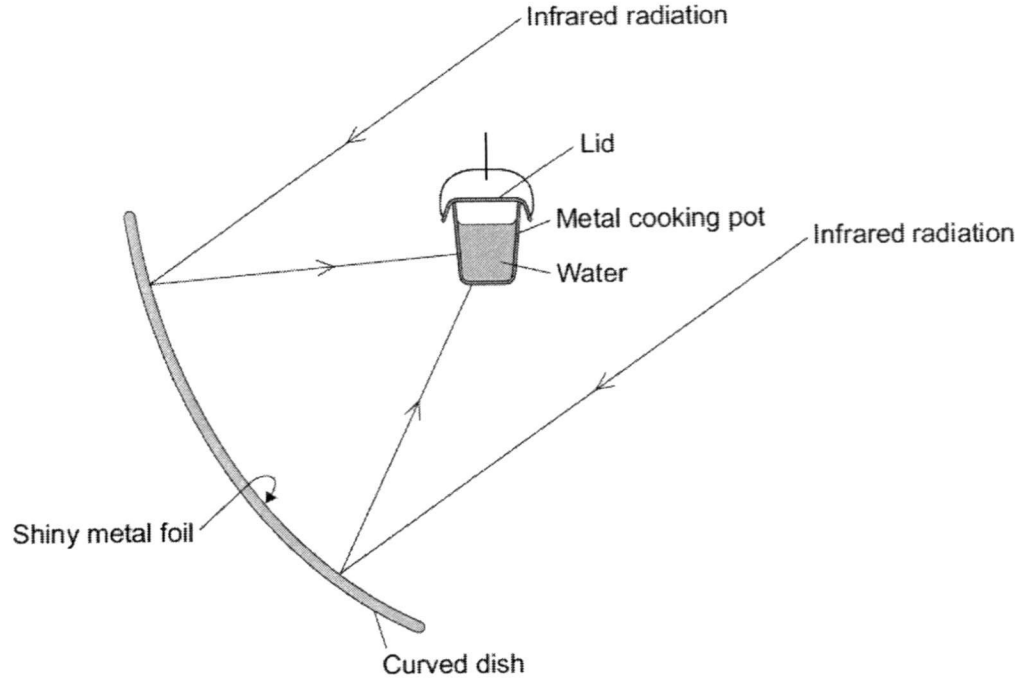


Fig. A8

a) Explain why the inside of the large curved dish is covered with shiny metal foil.

..... [1]

b) Suggest the best colour to paint the outside of the metal cooking pot. Explain your answer.

.....

.....

..... [2]

c) Why does the cooking pot have a lid?

.....

.....[1]

A9 **Fig. A9** shows a boy standing on his skateboard at the top of a rough track. The total weight of the boy and the skateboard is 580 N.

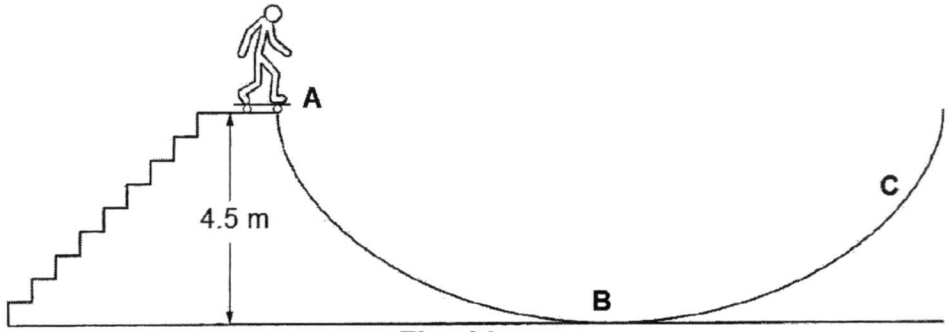


Fig. A9

a) How much work is done by the boy in carrying his skateboard from the bottom to the top of the stairs?

Work done = ... [1]

b) The boy travels on his skateboard along the rough track until he reaches point **C**, where he stops momentarily.

i Explain why point **C** is lower than point **A**.

.....

..... [1]

ii As the boy moves down the track from point **A** to point **B**, state the energy conversion that occurs.

..... [1]

A10 Use the Periodic Table to help you to complete the **Table A10**.

Particle	No. of protons	No. of neutrons	No. of electrons	Electronic configuration
magnesium atom				2,8,2
	8	8	10	
nitride ion	7	7		

Table A10 [3]

A11 **Fig. A11** below shows the experimental setup that is used to separate solid-liquid mixtures such as sodium chloride solution.

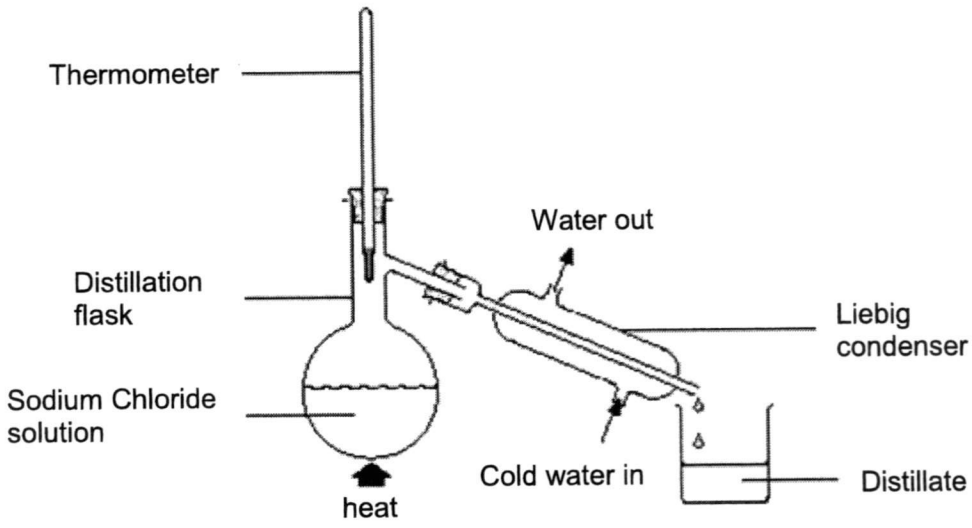


Fig. A11

a) The distillate collected is a colourless liquid that melts at 0°C and boils at 100°C.

Write down the chemical name and formula of this distillate and hence state whether this substance exists as atoms, ions or molecules at room temperature.

Chemical name :.....

Chemical formula: .....

Exists as : ..... [2]

b) The substance that will remain in the round-bottomed flask is a white solid known as sodium chloride, which is an example of an ionic compound. In the space below, using dot and cross diagram, draw the full electronic structure of sodium chloride. [2]

Section B (30 marks)

Answer all the questions in the spaces provided on the question paper.

B1 **Fig. B1.1** shows three plastic cups **A**, **B** and **C**.

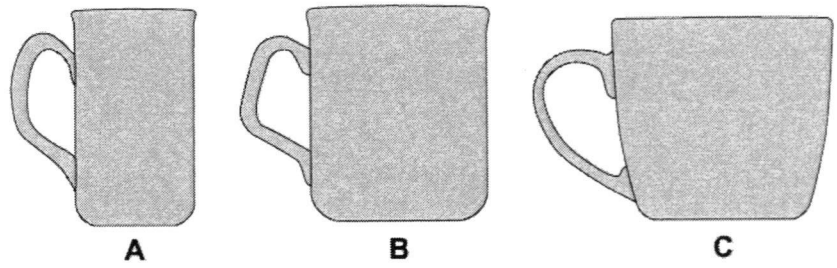


Fig. B1.1

Energy is transferred from hot water in the plastic cups to the surroundings.

a) Explain,

i using the kinetic model of matter, how energy is transferred from hot water to the cups by conduction.

.....

.....

..... [2]

ii how energy is transferred from the surface of hot water to the surroundings by convection.

.....

.....

..... [2]

b) An experiment was carried out to determine the relationship between rate of cooling and surface area of water in contact with air. An equal amount of water was poured into cups **A**, **B** and **C** and the temperature of the water was recorded at regular time intervals.

The results are shown on **Fig. B1.2**.

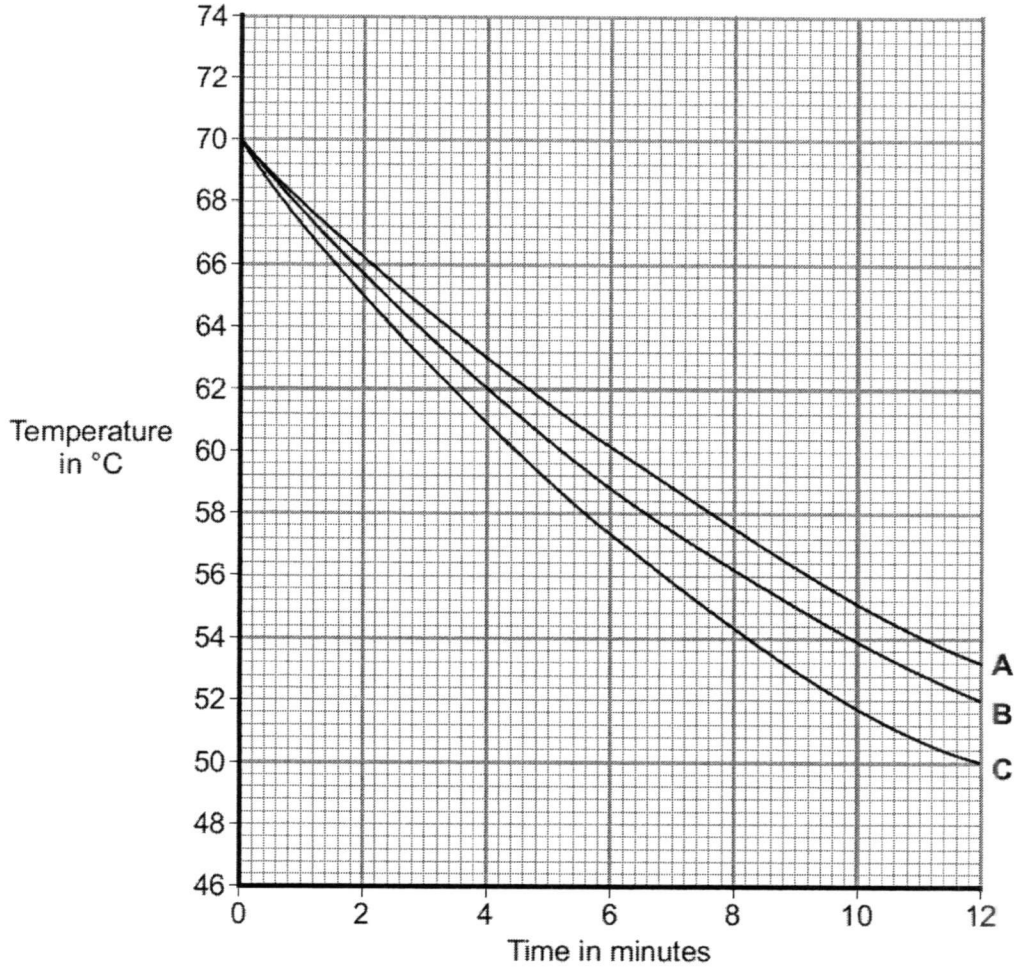


Fig. B1.2

i State the initial temperature of the water in each cup.

..... [1]

ii After a few hours, the temperature of the water in each of the cups was 25°C. Suggest why the temperature does not fall below 25°C.

.....

..... [1]

iii Which cup, **A**, **B**, or **C** has the greatest rate of cooling? Using the graph, give a reason for your answer.

.....

.....

..... [2]

iv The investigation was repeated using a plastic bowl shown in **Fig B1.3**. The same volume of water and starting temperature were used.

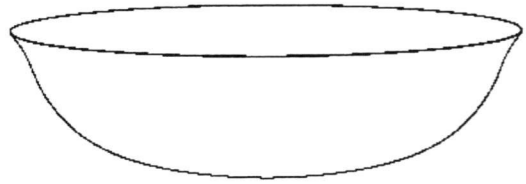


Fig. B1.3

Draw another line on **Fig B1.2** which could represent the temperature of the water in this bowl over the same period of time. [2]

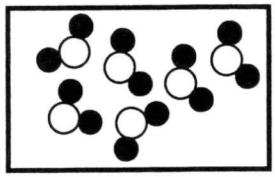
B2

a) From the list of substances below, select one which is the most suitable to match the particle diagram on the left.

brass **nitrogen & oxygen** **zinc** **fluorine**

carbon dioxide & chlorine **steel** **copper**

sodium chloride **water** **oxygen**



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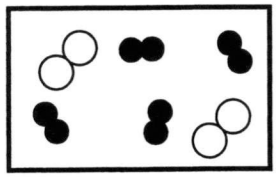

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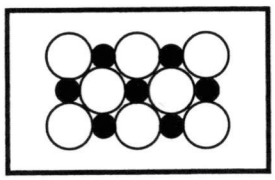

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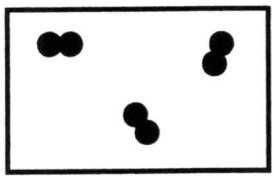

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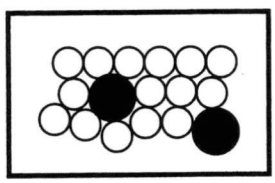


..... [5]

b) **Table B2** below shows the atomic structure of five particles represented by the letters **A** to **E**. The particles are atoms or ions. The letters are **NOT** the symbols of **the elements**.

Particle	Electrons	Protons	Neutrons
A	8	8	6
B	10	10	8
C	10	12	12
D	10	12	14
E	18	15	14

Table B2

i Which particle is an atom of a noble gas?

..... [1]

ii Draw the full electronic structure of particle **D**. [1]

iii **A** exists as diatomic molecules. Using the dot & cross diagram, draw the electronic structure of one such molecule (showing only valence electrons) in the space below. Then state the chemical formula of this molecule.

Drawing: [2]

Chemical formula: ..... [1]

B3 **Fig. B3.1** shows the effect of exercise on the concentration of oxygen in the blood and the concentration of lactic acid in the muscles of a healthy person over a 5-minute period.

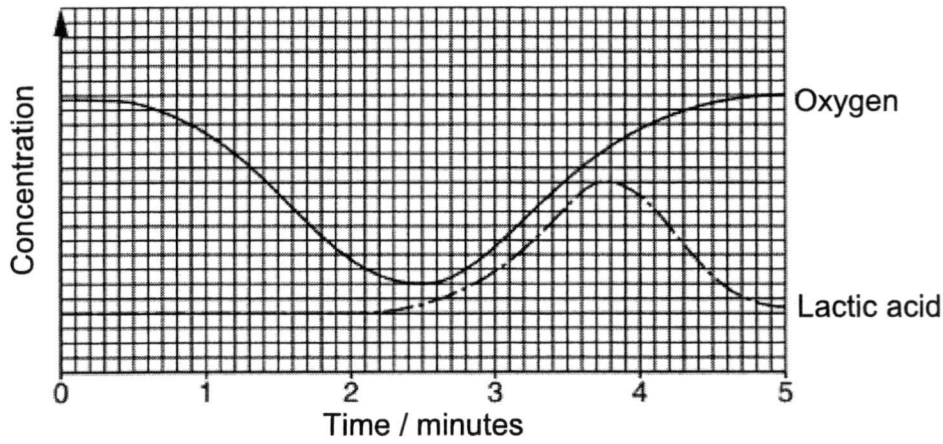


Fig. B3.1

a) Use **Fig. B3.1** to find the time at which the person started to exercise.

..... [1]

b) **i** Write the word equation of the process that causes the build-up of lactic acid in the person exercising.

..... [1]

ii Write the word equation of the process that causes the change in oxygen concentration during the first 2 minutes on **Fig. B3.1**.

..... [1]

c) **i** The digestion of food provides substances required for the process stated in **B3 b)**. Define digestion.

.....

..... [1]

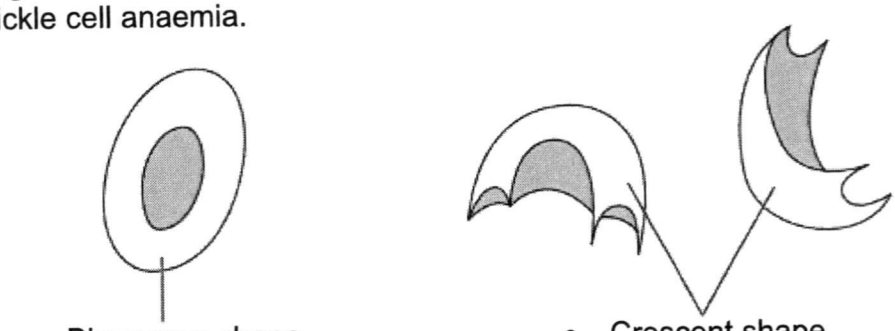
ii Describe how digested food substance moves from the small intestine into the blood capillary.

.....

.....

..... [2]

Fig. B3.2 shows red blood cells from a healthy person and from a person with sickle cell anaemia.



- Biconcave shape
- Elastic
- Non-sticky

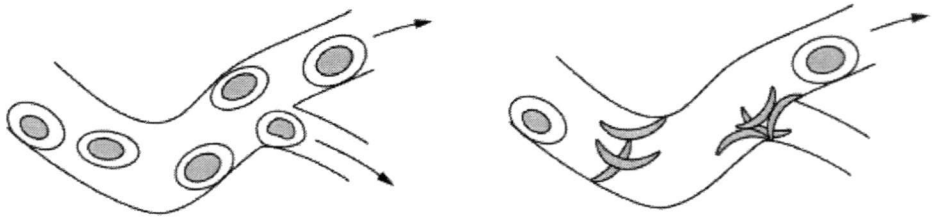
Healthy person

- Crescent shape
- Non-elastic
- Sticky

Person with sickle cell anaemia

Fig. B3.2

Fig. B3.3 shows the flow of red blood cells through a blood vessel in a healthy person and in a person with sickle cell anaemia.



Healthy person

Person with sickle cell anaemia

Fig. B3.3

d) **i** With reference to **Fig. B3.2** and **Fig. B3.3** suggest how the oxygen and lactic acid graphs on **Fig. B3.1** might be different if the person suffers from sickle cell anaemia.

Oxygen graph: .....

.....

Lactic acid graph: .....

..... [2]

ii Suggest **two** explanations for the change in the oxygen and lactic acid graphs of a person with the sickle cell anaemia condition.

.....

.....

.....

..... [2]

End of paper

Section A

A1	**a)**		16.0 cm	2
	b)		Put the pencil above the marking on the ruler Place the pencil such that the left side is aligned with the 1 cm mark. Align the pencil to the side of the ruler with the 0.5 cm markings. Not accepted: parallax error or take average reading (more like precautions)	2
A2	**a)**		m = W ÷ g = 1.8 ÷ 10 [½] = 0.18 kg [½]	1
	b)	**i**	1.8 – 0.6 = 1.2 N	1
		ii	Another magnet with the south pole facing downwards is in the box. Not accepted: contents are magnetic. Magnetic materials are materials that experience a magnetic attractive force when placed in a magnetic field.	1
A3	**a)**		Strength. This property is considered to ensure that the pillars do not break under the heavy weight of the bridge. Not accepted: durability: vague, must be a specific physical property	1
	b)		$2 \times 10^6 \div 5 = 400\,000$ N (accept 4×10^5 N)	1
	c)	**i**	Area = F / P = 400 000 / 4 000 000 = 0.1 m^2	1
		ii	Area = F / P = 400 000 / 400 000 = 1 m^2	1
	d)		Working absent: zero marks	

Material	Volume required to make <u>one</u> pillar / m^3	Cost to make <u>one</u> pillar / $
Reinforced steel	**0.5**	**250**
High grade concrete	**5**	**850**

		Volume of reinforced steel for one pillar = 0.1 x 5 = 0.5 m^3 Cost of reinforced steel for one pillar = 500 x 0.5 = $250 Volume of high grade concrete for one pillar = 1 x 5 = 5 m^3 Cost of high grade concrete for one pillar = 170 x 5 = $850		2
	e)	He should use reinforced steel because it is three times cheaper than concrete.		1
A4	**a)**	P is a solid		1
	b)	Drawing must show particles in orderly arrangement and closely packed.		1
	c)	Compound [1], melts at fixed temperature		2
A5	**a)**	1 Carbon dioxide 2 Oxygen (vice versa)		1
	b)	**i**	thicker in mammals or thinner in birds (by 2.5 times/use of comparative figures – not compulsory)	1
		ii	thinner barrier in birds results in faster/greater gas exchange/diffusion more oxygen supplied/more carbon dioxide removed suggest greater rate of aerobic respiration suggest higher energy demand by muscles in birds for flight	2
A6	**a)**	Hydrochloric acid Provides acidic environment for stomach enzymes		1
	b)	Structural adaptation: one cell thick wall / microvilli in the small intestine / network of blood capillaries Factor increasing rate of diffusion: thinner barrier leads to faster diffusion rates / many villi increase surface area leads to faster diffusion rate / increase network of blood capillaries increase surface area to volume ratio		2

A7

chamber	Name of chamber	Name of blood vessel carrying blood away from chamber
V	Right Atrium	Vena cava
W	Left ventricle	Aorta

1

A8 **a)** Shiny metal is a good reflector of thermal radiation — 1

b) Black. It is a good absorber of thermal radiation. — 2

c) It reduces heat loss to the surroundings through convection/evaporation. — 1

A9 **a)** 580 x 4.5 = 2610 N — 1

b) **i** Choose one:
- Some of the energy is converted to <u>thermal energy</u> (accept <u>heat</u>)
- There is <u>work done</u> against <u>friction</u>.

1

ii Gravitational potential energy → kinetic energy + heat (+ sound). No ½ mark. — 1

A10

Particle	No. of protons	No. of neutrons	No. of electrons	Electronic configuration
magnesium atom	**12**	**12**	**12**	2,8,2
Oxide ion	8	8	10	**2,8**
nitride ion	7	7	**10**	**2,8**

3

A11 **a)** Water [0.5]
H_20 [0.5]
Molecules [1] — 2

	b)	Dot-and-cross diagram of NaCl - if all dots / crosses [-1 mark] - no charge in square brackets [-1 mark]	2

Section B

B1	**a)**	**i**	Heat is conducted from the water through the body of the cup. Particles nearer the water **gain** energy and **vibrate** faster. They **collide** with neighbouring particles and transfer their energy.	2
		ii	Heat is removed from the surface of the water through convection. The air near the water surface is heated and becomes less dense. Less dense air rises and cooler air sinks. This cycle is repeated which causes the water to cool down.	2
	b)	**i**	70°C	1
		ii	The water is in thermal equilibrium with its surroundings at room temperature of 25°C.	1
		iii	C Choose any one: • The decrease in temperature over the same period of time is the greatest for cup. • C has the steepest line	2
		iv	Downward sloping Steeper than A, B and C	1 1
B2	**a)**	Box 1: water Box 2: nitrogen & oxygen Box 3: sodium chloride Box 4: oxygen Box 5: brass or steel 1 mark each		5
	b)	**i**	B	1
		ii	Dot and cross diagram of 2+ ion	1
		iii	Dot and cross diagram of oxygen molecule Formula: A_2	2 1

B3	**a)**	0.3–0.4 minutes		1
	b)	**i**	glucose → energy + lactic acid	1
		ii	glucose + oxygen → energy + carbon dioxide + water	1
	c)	**i**	The mechanical & chemical breaking down of food into smaller components that can be absorbed into the blood stream.	1
		ii	Digested substances in small intestine move from area of high concentration to the area of lower concentration in the blood stream by process of diffusion. Or Active transport also occurs if the concentration of digested food substances in the small intestine is lower than that in the blood capillary.	2
	d)	**i**	O_2 line not as high at start/ finish O_2 line drops more quickly / Or reverse argument lactic acid line rises sooner/ higher / takes longer to return to normal	2
		ii	Any two of following: • reduction in surface area / volume • so less haemoglobin →less AW oxygen + carriage / absorption / in blood (cell) • loss of elasticity + more difficult to move through blood vessels sticky + may clump together / clot • (causing) blockage of blood vessel →reduction of blood flow (to tissue)	2

Answers to LSS Sec 2 – Paper 1

Mid-Year Examination 2017

Section A

1	C		**11**	D		**21**	C
2	B		**12**	C		**22**	A
3	C		**13**	D		**23**	A
4	C		**14**	C		**24**	B
5	C		**15**	B		**25**	C
6	B		**16**	B		**26**	B
7	B		**17**	C		**27**	C
8	A		**18**	D		**28**	B
9	D		**19**	C		**29**	B
10	D		**20**	A		**30**	C

Name : ..... ( ) Class : .....

ST JOSEPH'S INSTITUTION

MID-YEAR EXAMINATION 2017
SECONDARY 2

LOWER SECONDARY SCIENCE **12 MAY 2017**

PAPER 1 **45 minutes**

1100 – 1145 hrs

Additional Materials: MCQ Answer Sheet

READ THESE INSTRUCTIONS FIRST

1. Answer all questions by shading your answers in the appropriate spaces in the MCQ Answer Sheet.

2. Use a 2B pencil only. Make sure all amendments on the MCQ Answer Sheet are thoroughly erased using a soft eraser.

3. Use pi (π) value preprogrammed in calculator.

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

This document consists of **14** printed pages.

[Turn over]

The Periodic Table of Elements

Group																	
I	II											III	IV	V	VI	VII	0
							1 H hydrogen 1										2 He helium 4
3 Li lithium 7	4 Be beryllium 9		**Key** proton (atomic) number atomic symbol name relative atomic mass									5 B boron 11	6 C carbon 12	7 N nitrogen 14	8 O oxygen 16	9 F fluorine 19	10 Ne neon 20
11 Na sodium 23	12 Mg magnesium 24											13 Al aluminium 27	14 Si silicon 28	15 P phosphorus 31	16 S sulfur 32	17 Cl chlorine 35.5	18 Ar argon 40
19 K potassium 39	20 Ca calcium 40	21 Sc scandium 45	22 Ti titanium 48	23 V vanadium 51	24 Cr chromium 52	25 Mn manganese 55	26 Fe iron 56	27 Co cobalt 59	28 Ni nickel 59	29 Cu copper 64	30 Zn zinc 65	31 Ga gallium 70	32 Ge germanium 73	33 As arsenic 75	34 Se selenium 79	35 Br bromine 80	36 Kr krypton 84
37 Rb rubidium 85	38 Sr strontium 88	39 Y yttrium 89	40 Zr zirconium 91	41 Nb niobium 93	42 Mo molybdenum 96	43 Tc technetium -	44 Ru ruthenium 101	45 Rh rhodium 103	46 Pd palladium 106	47 Ag silver 108	48 Cd cadmium 112	49 In indium 115	50 Sn tin 119	51 Sb antimony 122	52 Te tellurium 128	53 I iodine 127	54 Xe xenon 131
55 Cs caesium 133	56 Ba barium 137	57 – 71 lanthanoids	72 Hf hafnium 178	73 Ta tantalum 181	74 W tungsten 184	75 Re rhenium 186	76 Os osmium 190	77 Ir iridium 192	78 Pt platinum 195	79 Au gold 197	80 Hg mercury 201	81 Tl thallium 204	82 Pb lead 207	83 Bi bismuth 209	84 Po polonium –	85 At astatine –	86 Rn radon –
87 Fr francium –	88 Ra radium –	89 – 103 actinoids	104 Rf Rutherfordium –	105 Db dubnium –	106 Sg seaborgium –	107 Bh bohrium –	108 Hs hassium –	109 Mt meitnerium –	110 Ds darmstadtium –	111 Rg roentgenium –	112 Cn copernicium –		114 Fl flerovium –		116 Lv livermorium –		

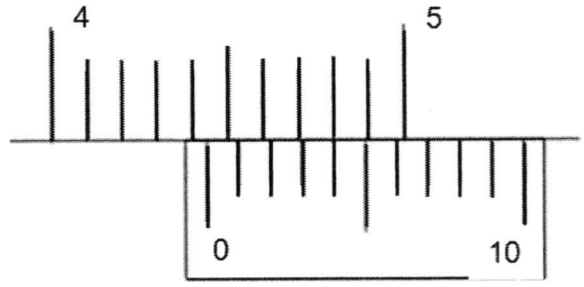
lanthanoids	57 La lanthanum 139	58 Ce cerium 140	59 Pr praseodymium 141	60 Nd neodymium 144	61 Pm promethium –	62 Sm samarium 150	63 Eu europium 152	64 Gd gadolinium 157	65 Tb terbium 159	66 Dy dysprosium 163	67 Ho holmium 165	68 Er erbium 167	69 Tm thulium 169	70 Yb ytterbium 173	71 Lu lutetium 175
actinoids	89 Ac actinium –	90 Th thorium 232	91 Pa protactinium 231	92 U uranium 238	93 Np neptunium –	94 Pu plutonium –	95 Am americium –	96 Cm curium –	97 Bk berkelium –	98 Cf californium –	99 Es einsteinium –	100 Fm fermium –	101 Md mendelevium –	102 No nobelium –	103 Lr lawrencium –

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

Section A (30 marks)

*There are thirty questions in this section. Answer **all** questions. For each question there are four possible answers, **A**, **B**, **C** and **D**. Choose the one you consider correct and shade your choice in the appropriate oval in the answer sheet provided.*

A1 A pair of vernier calipers is used to measure the thickness of a textbook. The diagram below shows the reading on the vernier calipers. What is the thickness of the textbook?



A 4.04 cm
B 4.34 cm
C 4.44 cm
D 5.18 cm

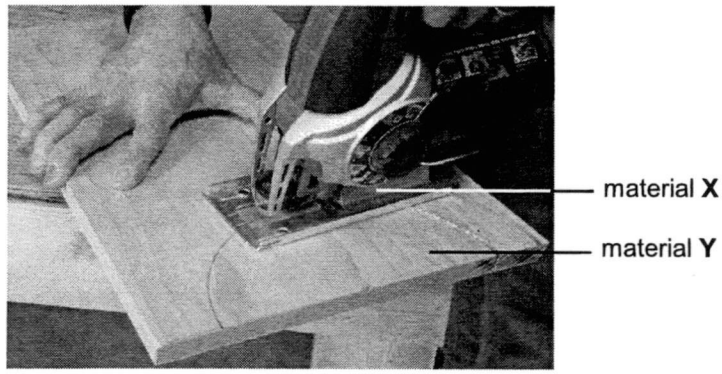
A2 A measuring cylinder contains 100 cm^3 of water. An irregularly-shaped object, of mass 50 g, is slowly lowered into the cylinder.
Given that the density of the object is 5.0 g/cm^3 and it is completely immersed, what is the new reading on the measuring cylinder?

A 105 cm^3
B 110 cm^3
C 150 cm^3
D 155 cm^3

A3 The diameter of the Earth is about 10 Mm, while the diameter of an atom is 0.5 nm. How many atoms, when lined up next to each other, make up the diameter of the Earth?

A 2×10^7
B 2×10^{10}
C 2×10^{16}
D 2×10^{17}

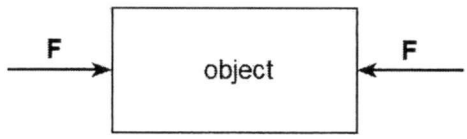
A4 The diagram below shows a process of using material **X** to cut material **Y**.



Which one of the following statements is most appropriate for the above diagram?

A Material **X** can support a heavy load without breaking, but material **Y** cannot.
B Material **X** will sink in water, but material Y will float in water.
C When both materials are rubbed together, only material **Y** has scratches.
D Material **X** can bend without breaking and returns to its original shape after bending, but material **Y** cannot.

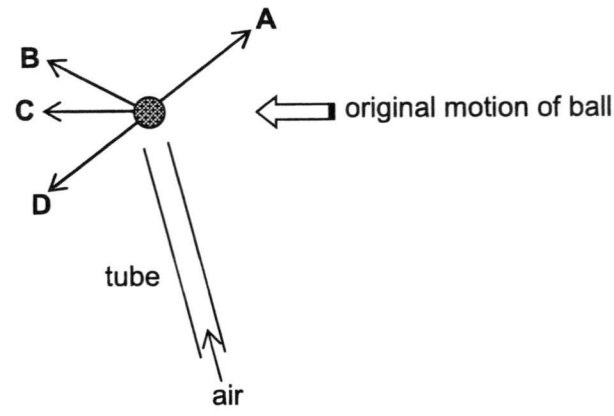
A5 Which of the following is/are possible when an object, as shown below, experiences two equal and opposite forces?



I. If the object is at rest, it will continue to remain stationary.
II. If the object is moving, it will accelerate.
III. If the object is moving, it will continue to move at constant velocity.

A I only
B I and II only
C I and III only
D I, II and III

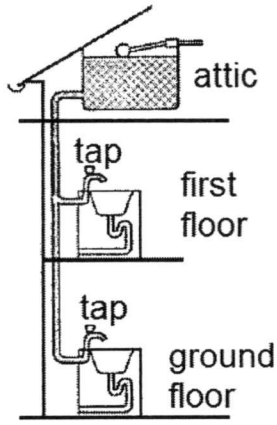
A6 A lightweight ball moves across a table and passes the end of a tube through which air is blown. In which direction will the ball now move?



A7 A cheetah runs very quickly to catch its prey. The air resistance experienced by the cheetah and the friction between the cheetah and the ground vary with the conditions.
Which one of the following conditions below will the cheetah reach its maximum speed?

	Air resistance	**Friction with ground**
A	High	Low
B	High	High
C	Low	Low
D	Low	High

A8 A household water supply has a water tank in the attic.



The rate of water flow at the tap on the ground floor is faster than the rate of water flow at the tap on the first floor. Which one of the following statements is a likely reason for the phenomenon?

A Water pressure increases with height of the water column.
B Water pressure decreases with height of the water column.
C Water has to travel further to get to the tap on the ground floor.
D The tap on the ground floor is closer to sea level where the pressure is zero.

An interesting Science fair exhibit at a primary school involves putting small pieces of solid dry ice into a balloon (with the aid of a funnel). The balloon "magically" inflates although no one is inflating it.

Answer questions **A9** and **A10** below.

A9 Which one of the following describes the process that inflated the balloon?

A Boiling of carbon dioxide
B Evaporation of carbon dioxide
C Melting of carbon dioxide
D Sublimation of carbon dioxide

A10 Which one of the following statements correctly describes the arrangement and movement of particles inside the inflated balloon?

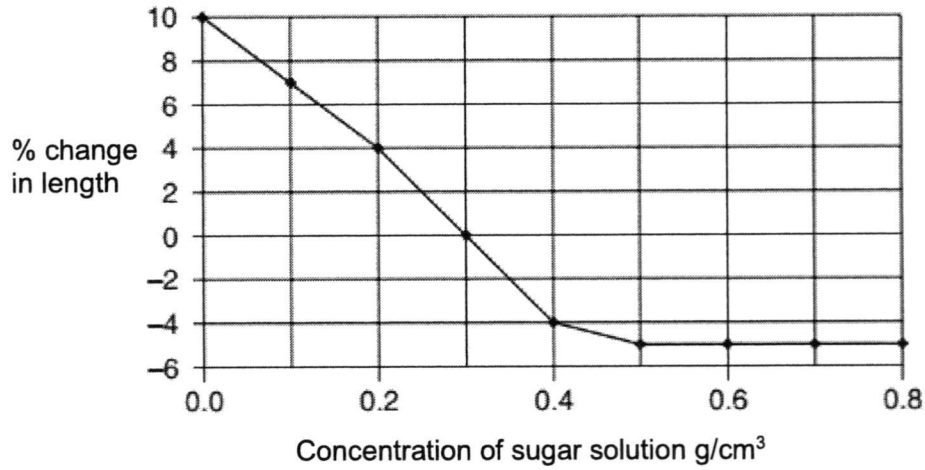
A Closely-packed, vibrating about fixed positions
B Closely-packed, sliding past each other
C Far apart, vibrating about fixed positions
D Far apart, moving rapidly in random directions

A11 Which of these processes happening in a cell requires energy from respiration?

Key ✓ Energy required
× Energy not required

	Diffusion	Osmosis
A	✓	✓
B	✓	×
C	×	✓
D	×	×

A12 Cylinders of potato tissue were placed in different concentrations of a sugar solution. The graph shows the percentage change in length of the cylinders of potato tissue.



Which solution has the same water potential as the potato tissue?

A 0.0 g/cm^3
B 0.2 g/cm^3
C 0.3 g/cm^3
D 0.5 g/cm^3

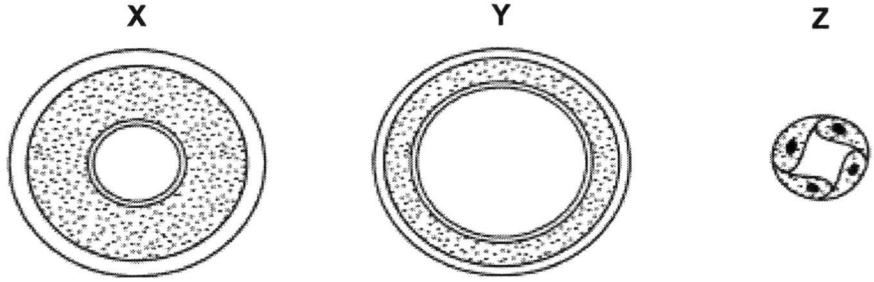
A13 What are the possible end-product and effect of anaerobic respiration in muscle?

	End product	Effect
A	carbon dioxide	muscle contraction
B	ethanol	loss of coordination
C	water	muscle relaxation
D	lactic acid	oxygen debt

A14 Through which sequence does carbon dioxide pass as it leaves the lungs for the environment outside the human body?

A In the alveoli → alveolar wall → capillary wall → blood
B Capillary wall → blood → in the alveoli → alveolar wall
C Blood → capillary wall → alveolar wall → in the alveoli
D Alveolar wall → in the alveoli → blood → capillary wall

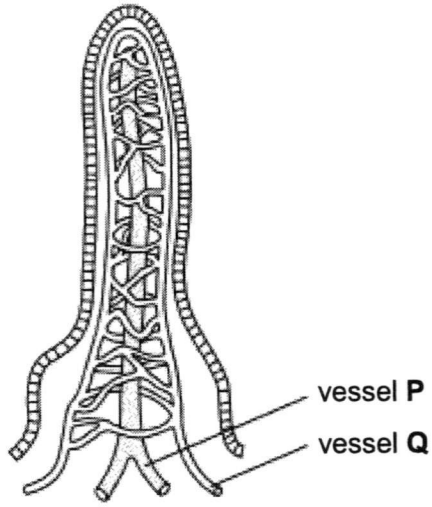
A15 The diagram shows cross-sections of three types of blood vessel, not drawn to the same scale.



What are **X**, **Y** and **Z**?

	X	Y	Z
A	artery	capillary	vein
B	artery	vein	capillary
C	vein	artery	capillary
D	vein	capillary	artery

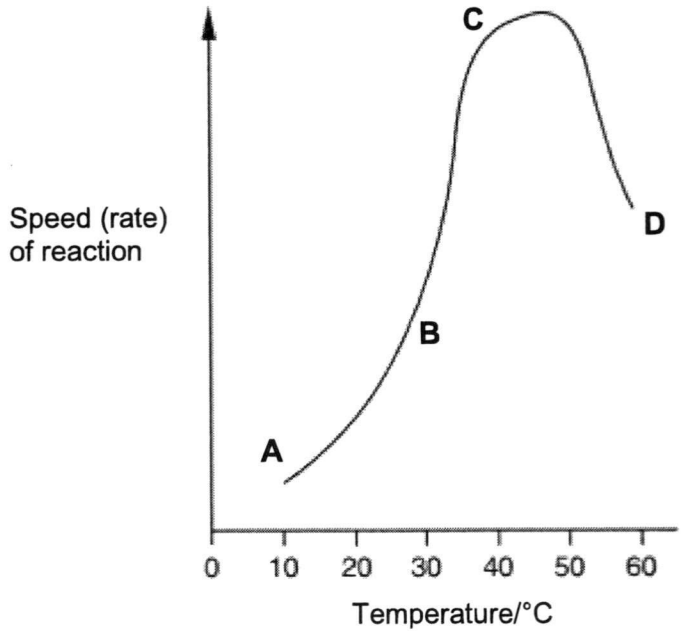
A16 The diagram shows a villus.



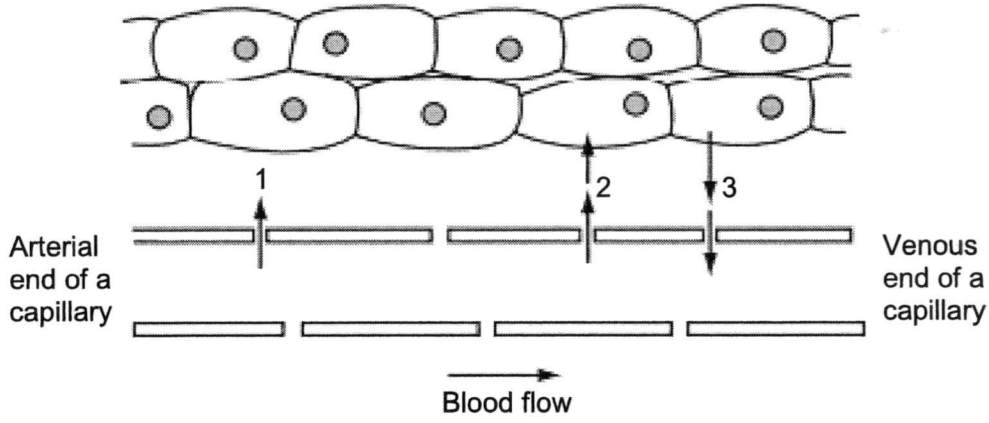
After a meal containing starch and oil, which substance(s) is/are absorbed mainly into vessel **P** and vessel **Q** respectively?

	Vessel P	**Vessel Q**
A	amino acids	water
B	fats	glucose
C	glucose	amino acids
D	water	fats

A17 The graph shows the effect of temperature on a chemical reaction which is controlled by enzymes. At which point are most product molecules being released?



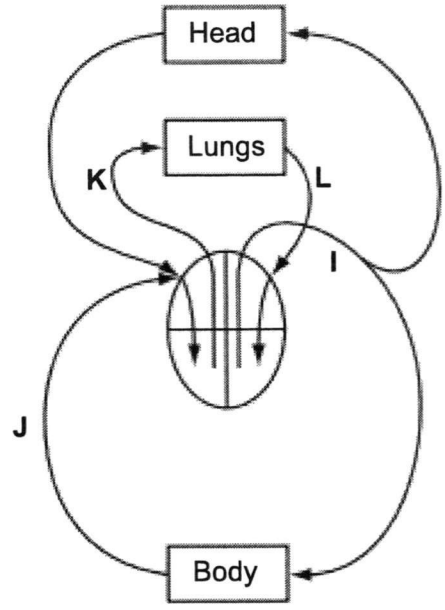
A18 The diagram represents a tissue with an adjacent capillary.



Which substances can **1**, **2** and **3** represent?

	1	**2**	**3**
A	glucose	tissue fluid	carbon dioxide
B	oxygen	carbon dioxide	glucose
C	tissue fluid	glucose	oxygen
D	tissue fluid	oxygen	carbon dioxide

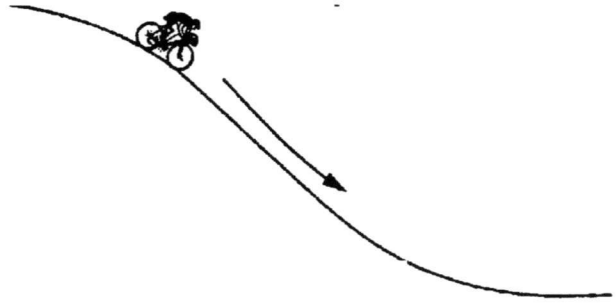
A19 The diagram represents part of the circulatory system.



Which one of the following sets represent possible blood pressures (in kPa) for the vessels at I, J, K and L?

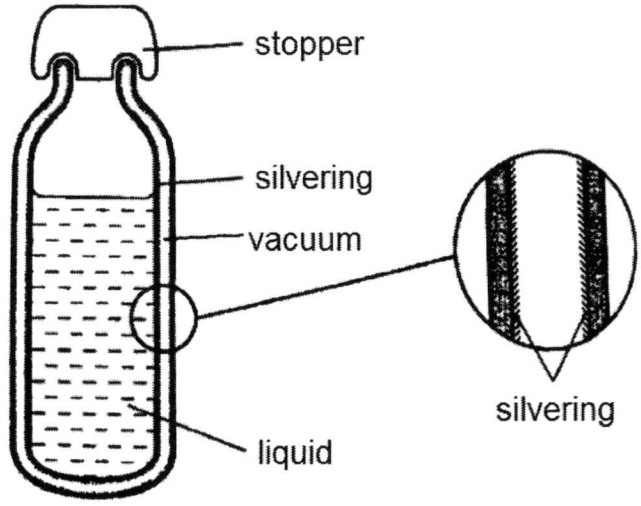
	I	J	K	L
A	1	4	2	16
B	4	16	2	1
C	16	2	4	1
D	16	4	1	2

A20 A cyclist speeds up as he travels down a slope. How does his energy change?



	Gravitational potential energy	**Kinetic energy**
A	Decreases	Decreases
B	Decreases	Increases
C	Increases	Decreases
D	Increases	Increases

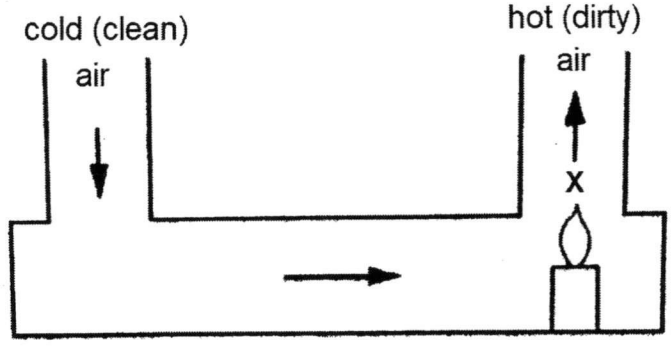
A21 The diagram shows a vacuum flask and an enlarged view of a section through the flask wall.



The main reason for the silvering is to reduce heat transfer by.....

A Conduction only
B Convection only
C Radiation only
D Convection and radiation

A22 The diagram shows a model of a convection system.



What happens to the volume and density of a fixed mass of air at **X** to make it move upwards?

	Volume	**Density**
A	Increases	Decreases
B	Increases	Increases
C	Remains unchanged	Increases
D	Remains unchanged	Decreases

A23 Which types of surface are the best absorbers and emitters of infra-red radiation?

	Best absorber	Best emitter
A	Black and dull	Black and dull
B	Black and shiny	White and shiny
C	White and dull	White and dull
D	White and shiny	Black and shiny

A24 The rate at which thermal energy is conducted through a material depends on its state. What is the correct order of thermal conduction?

Best conductor ⟶ Worst conductor

A	Gas	Liquid	Solid
B	Solid	Liquid	Gas
C	Solid	Gas	Liquid
D	liquid	gas	Solid

A25 A car of mass 1200 kg is travelling at a speed of 30 m/s. The brakes are applied to bring the car to a stop. What is the loss in kinetic energy as the car decelerates to rest?

A 40 J
B 36 000 J
C 540 000 J
D 1 080 000 J

A26 The neutron particle .....

A has a mass of 1g.
B has a mass equal to that of a proton.
C has a charge equal but opposite to that of an electron.
D is present in all atoms.

A27 Which one of the following statements is true about an atom?

A The number of neutrons is equal to the number of protons.
B A positive ion is formed when electrons are added to an atom.
C A positive ion contains more protons than electrons.
D The atomic number is equal to the number of particles inside the nucleus.

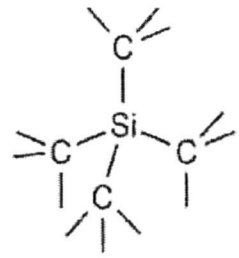
A28 The atoms of an element X have the electronic configuration 2,8,6. Which one of the following statements about element X is correct?

A It forms an ion of charge 2+.
B It reacts with metals and also non-metals.
C It has 6 protons in the outer shell of an atom.
D It forms an ionic compound with oxygen.

A29 In which one of the following sets do all the compounds contain only ionic bonds?

A Methane, ammonia, water.
B Calcium oxide, magnesium oxide, sodium oxide.
C Potassium chloride, carbon dioxide, magnesium sulfide.
D Copper(II) sulfate, hydrogen chloride, sulfur dioxide.

A30 The structure of silicon carbide can be described in the diagram below:



Which one of the following statements about silicon carbide is true?

A Silicon atoms now contain 4 valence electrons each.
B Carbon atoms now contain 4 valence electrons each.
C Silicon carbide is a covalent compound.
D Silicon carbide is an ionic compound.

Name : ..... ( ) Class : .....

ST JOSEPH'S INSTITUTION

MID-YEAR EXAMINATION 2017
SECONDARY 2

LOWER SECONDARY SCIENCE
PAPER 2

12 MAY 2017
1 hour 45 minutes
0800 – 0945 hrs

Additional Materials: NIL

READ THESE INSTRUCTIONS FIRST

1. Answer all the questions in the spaces provided on the question paper.
2. Write in dark blue or black pen. You may use a soft pencil for any diagrams, graphs or rough working.
3. Use pi (π) value preprogrammed in calculator.
4. Express your final answer in 3 significant figures where appropriate, show all working, and include units in all your working.
5. Do not use staples, paper clips, highlighters, glue or correction fluid/tape.

	Section A									
A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11

Section B		
B1	B2	B3

For Markers Use	
Section A	/40
Section B	/30
Total	/70

This document consists of **22** printed pages.

[Turn over]

The Periodic Table of Elements

Group																	
I	II											III	IV	V	VI	VII	0
							1 H hydrogen 1										2 He helium 4
3 Li lithium 7	4 Be beryllium 9		**Key** proton (atomic) number atomic symbol name relative atomic mass									5 B boron 11	6 C carbon 12	7 N nitrogen 14	8 O oxygen 16	9 F fluorine 19	10 Ne neon 20
11 Na sodium 23	12 Mg magnesium 24											13 Al aluminium 27	14 Si silicon 28	15 P phosphorus 31	16 S sulfur 32	17 Cl chlorine 35.5	18 Ar argon 40
19 K potassium 39	20 Ca calcium 40	21 Sc scandium 45	22 Ti titanium 48	23 V vanadium 51	24 Cr chromium 52	25 Mn manganese 55	26 Fe iron 56	27 Co cobalt 59	28 Ni nickel 59	29 Cu copper 64	30 Zn zinc 65	31 Ga gallium 70	32 Ge germanium 73	33 As arsenic 75	34 Se selenium 79	35 Br bromine 80	36 Kr krypton 84
37 Rb rubidium 85	38 Sr strontium 88	39 Y yttrium 89	40 Zr zirconium 91	41 Nb niobium 93	42 Mo molybdenum 96	43 Tc technetium -	44 Ru ruthenium 101	45 Rh rhodium 103	46 Pd palladium 106	47 Ag silver 108	48 Cd cadmium 112	49 In indium 115	50 Sn tin 119	51 Sb antimony 122	52 Te tellurium 128	53 I iodine 127	54 Xe xenon 131
55 Cs caesium 133	56 Ba barium 137	57 – 71 lanthanoids	72 Hf hafnium 178	73 Ta tantalum 181	74 W tungsten 184	75 Re rhenium 186	76 Os osmium 190	77 Ir iridium 192	78 Pt platinum 195	79 Au gold 197	80 Hg mercury 201	81 Tl thallium 204	82 Pb lead 207	83 Bi bismuth 209	84 Po polonium –	85 At astatine –	86 Rn radon –
87 Fr francium –	88 Ra radium –	89 – 103 actinoids	104 Rf Rutherfordium –	105 Db dubnium –	106 Sg seaborgium –	107 Bh bohrium –	108 Hs hassium –	109 Mt meitnerium –	110 Ds darmstadtium –	111 Rg roentgenium –	112 Cn copernicium –		114 Fl flerovium –		116 Lv livermorium –		

lanthanoids	57 La lanthanum 139	58 Ce cerium 140	59 Pr praseodymium 141	60 Nd neodymium 144	61 Pm promethium –	62 Sm samarium 150	63 Eu europium 152	64 Gd gadolinium 157	65 Tb terbium 159	66 Dy dysprosium 163	67 Ho holmium 165	68 Er erbium 167	69 Tm thulium 169	70 Yb ytterbium 173	71 Lu lutetium 175
actinoids	89 Ac actinium –	90 Th thorium 232	91 Pa protactinium 231	92 U uranium 238	93 Np neptunium –	94 Pu plutonium –	95 Am americium –	96 Cm curium –	97 Bk berkelium –	98 Cf californium –	99 Es einsteinium –	100 Fm fermium –	101 Md mendelevium –	102 No nobelium –	103 Lr lawrencium –

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

Section A (40 marks)

*Answer **all** questions in the spaces provided.*

A1 A student is attempting to measure the length of the pencil using the ruler as shown in **Fig. A1**.

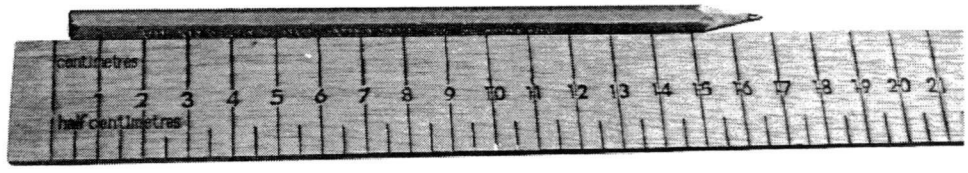


Fig. A1

a) Estimate the length of the pencil to the precision of the ruler.

..... [2]

b) Suggest two ways that the measurement can be improved, without changing the ruler or using additional apparatus.

(1) .....

.....

(2) .....

..... [2]

A2 **Fig. A2.1** shows a box hanging on a spring balance on Earth. The reading on the spring balance is shown in **Fig. A2.2**.

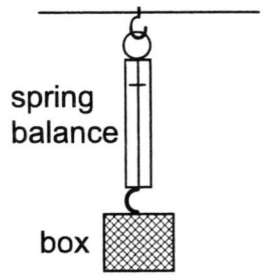


Fig A2.1

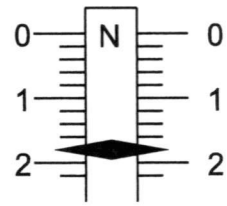


Fig. A2.2

a) Deduce the mass of the box.

Mass = ... [1]

b) The south pole of a magnet is placed near the bottom of the box. The reading on the spring balance decreases to 0.6 N.

i State the value of the magnetic force acting on the box by the magnet.

..... [1]

ii Suggest what can be deduced about the contents of the box.

..... [1]

A3 Jeremy, a civil engineer, is in charge of the design and construction of a bridge in a town. **Fig. A3.1** shows the side view of a proposed design of a bridge, supported by 5 cylindrical pillars.

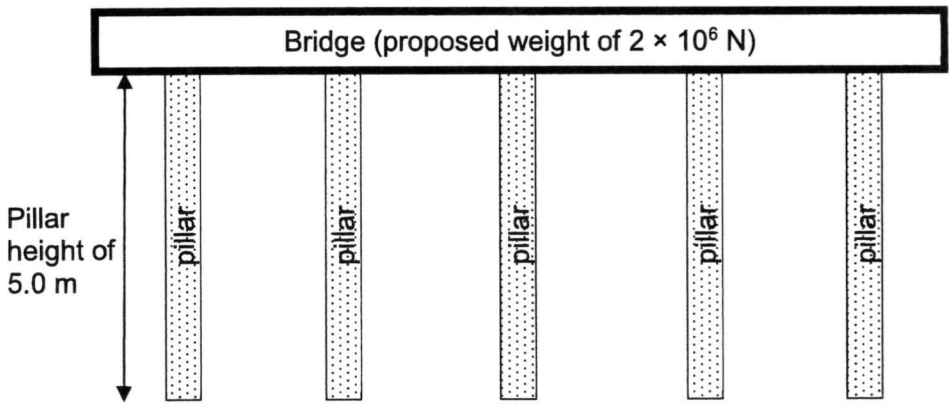


Fig. A3.1

Table A3.2 shows two possible types of raw material that can be used to make the five pillars.

Material	Maximum pressure that the material can support / N m^{-2}	Cost per unit volume / $
Reinforced steel	4 000 000	500
High grade concrete	400 000	170

Table A3.2

a) State and explain one important **physical** property that Jeremy should consider when selecting the raw material to make the pillars.

.....

..... [1]

b) The proposed weight of the bridge is 2×10^6 N. Assuming that the pillars are evenly spaced apart, how much weight must **one** pillar support?

Weight = ... [1]

c) **Fig. A3.3** shows an individual cylindrical pillar under the bridge.

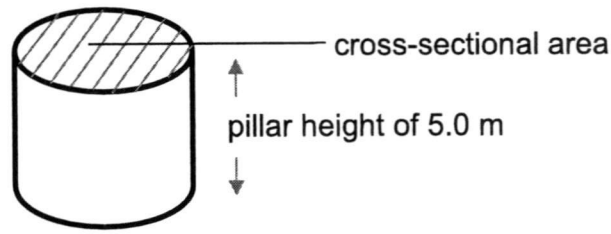


Fig. A3.3 (not drawn to scale)

Using information from **Table A3.2**, calculate the minimum cross-sectional area of **one** pillar when using

i reinforced steel

cross-sectional area = ...[1]

ii high grade concrete

cross-sectional area = ... [1]

d) To select the most appropriate material for constructing the pillar, help Jeremy complete the table below. Show your working clearly in the space provided below the table.

Material	**Volume required to make <u>one</u> pillar / m^3**	**Cost to make <u>one</u> pillar / $**
Reinforced steel		
High grade concrete		

Working: [2]

e) Based on your answers in **d)**, explain which material Jeremy should use to make the pillars.

.....

..... [1]

A4 **Fig. A4** below shows the melting process of a substance **P**.

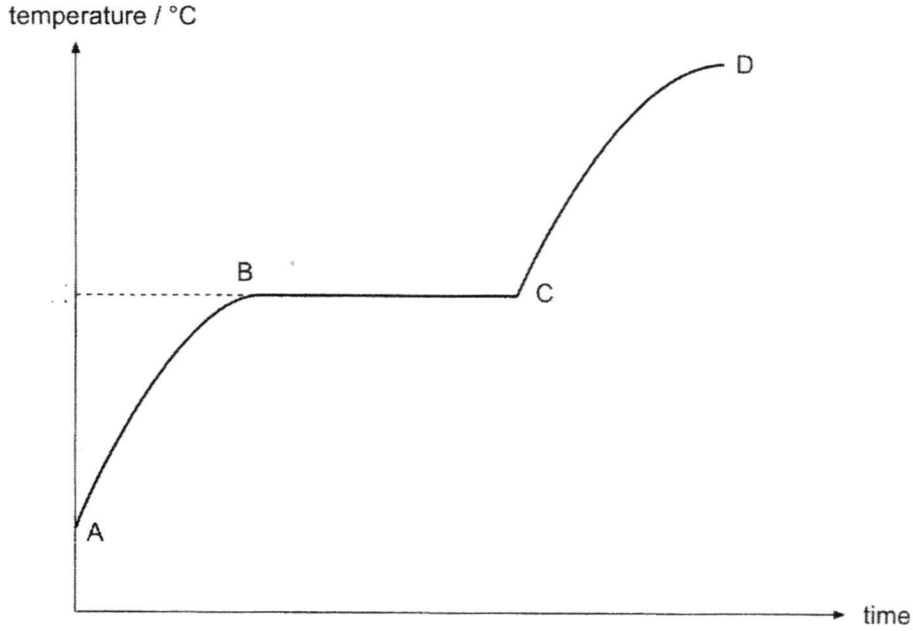


Fig. A4

a) What is the state of **P** in the period between **A** and **B**?

..... [1]

b) Draw the arrangement of the particles of **P** in this state.

[1]

c) State, with a reason, whether substance **P** is likely to be a mixture or a compound.

.....

..... [1]

A5 **Fig. A5** shows the mean distance that gas molecules must travel during gas exchange between air in the lungs and blood in the circulatory system in birds and mammals. This distance is known as the thickness of the blood-gas barrier.

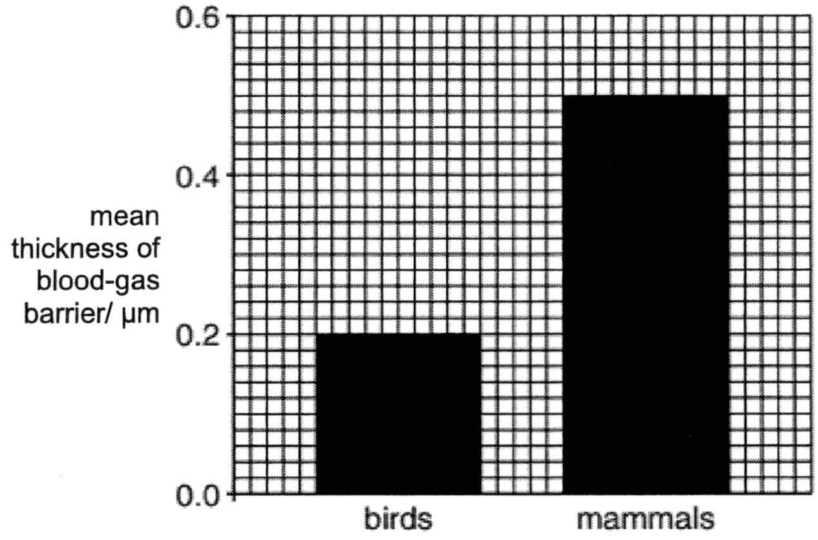


Fig. A5

a) Name **two** gases that cross the blood-gas barrier during gas exchange.

1 .....

2 ..... [1]

b) **i** Use **information** from **Fig. A5** to **compare** the thickness of the blood-gas barrier in birds and mammals.

.....

..... [1]

ii Briefly explain how the difference in thickness of the blood-gas barrier suggests that movement of birds by flying require more energy than movement by mammals on land.

.....

.....

.....

..... [2]

A6 **Fig. A6.1** shows some parts of the human alimentary canal and associated organs.

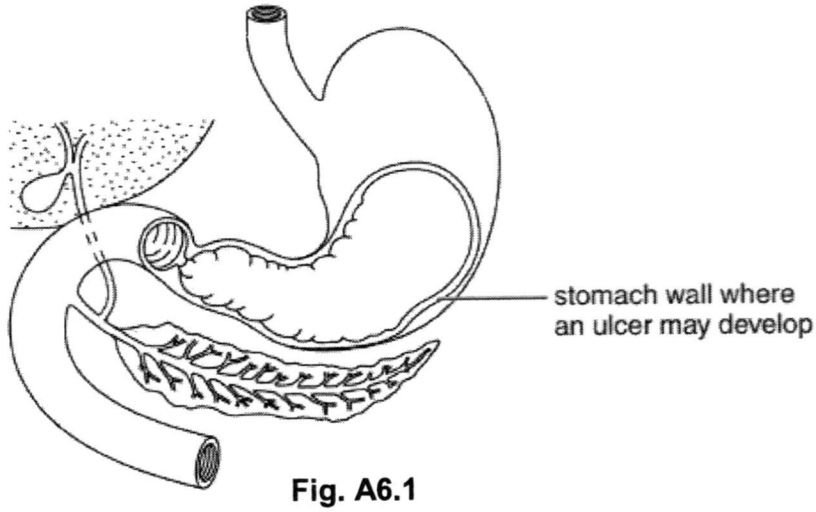


Fig. A6.1

a) The pain from the stomach ulcer may be relieved by taking a drug that reduces the amount of acid produced by the cells in the stomach wall. Identify this acid and state its function in the stomach.

Name of acid: .....

Function: .....

..... [1]

b) **Fig. A6.2** shows a villus found in the small intestine.

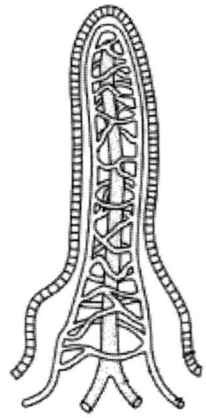


Fig. A6.2

There are many factors affecting the rate of diffusion of digested food substances into the villus. State **one** structural adaptation of the villi and explain how that adaptation increases the rate of diffusion into the villi.

Structural adaptation: .....

Explanation: .....

..... [2]

A7 **Fig. A7.1** shows a vertical section through a human heart viewed from the front. Two chambers, **V** and **W**, are labelled.

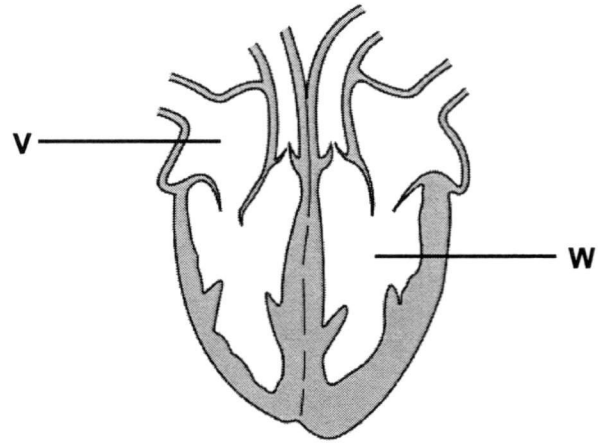


Fig. A7.1

With reference to **Fig. A7.1**, complete **Table A7.2**.

Chamber	Name of chamber	Name of blood vessel connected to this chamber
V		
W		

Table A7.2 [2]

A8 **Fig. A8** shows the design of a solar cooker. A metal cooking pot, containing water, is placed in the cooker. A lid covers over the pot. When the cooker is in operation, it heats up the water using infrared radiation from the Sun.

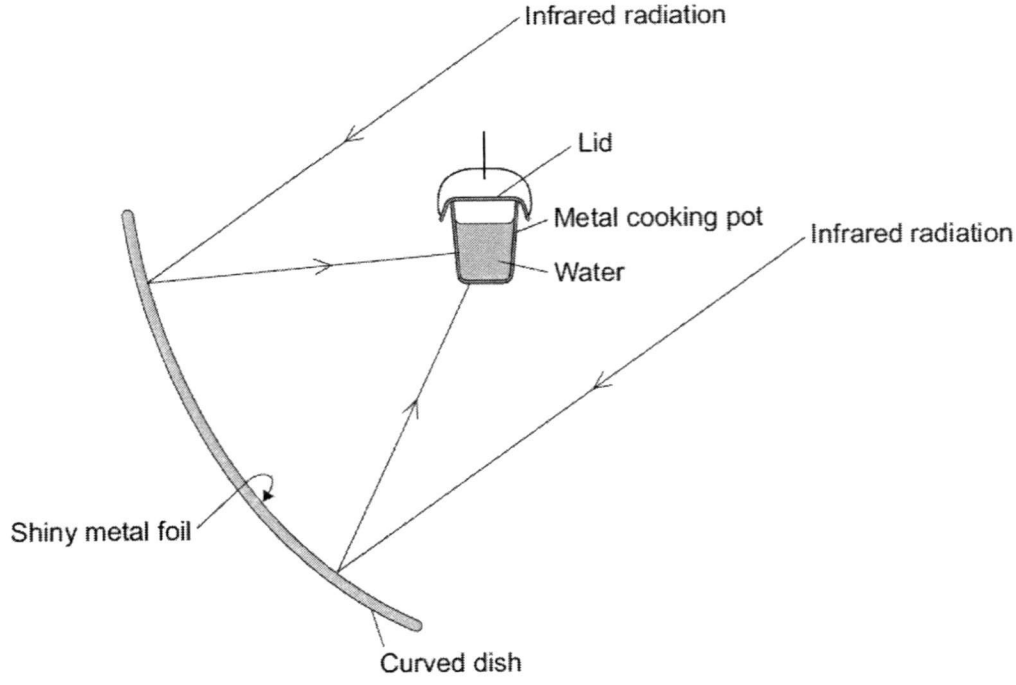


Fig. A8

a) Explain why the inside of the large curved dish is covered with shiny metal foil.

..... [1]

b) Suggest the best colour to paint the outside of the metal cooking pot. Explain your answer.

.....

.....

..... [2]

c) Why does the cooking pot have a lid?

.....

.....[1]

A9 **Fig. A9** shows a boy standing on his skateboard at the top of a rough track. The total weight of the boy and the skateboard is 580 N.

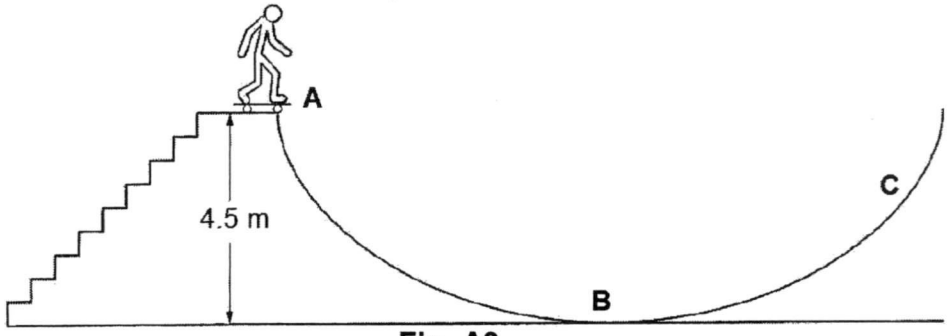


Fig. A9

a) How much work is done by the boy in carrying his skateboard from the bottom to the top of the stairs?

Work done = ... [1]

b) The boy travels on his skateboard along the rough track until he reaches point **C**, where he stops momentarily.

i Explain why point **C** is lower than point **A**.

.....

..... [1]

ii As the boy moves down the track from point **A** to point **B**, state the energy conversion that occurs.

..... [1]

A10 Use the Periodic Table to help you to complete the **Table A10**.

Particle	No. of protons	No. of neutrons	No. of electrons	Electronic configuration
magnesium atom				2,8,2
	8	8	10	
nitride ion	7	7		

Table A10 [3]

A11 **Fig. A11** below shows the experimental setup that is used to separate solid-liquid mixtures such as sodium chloride solution.

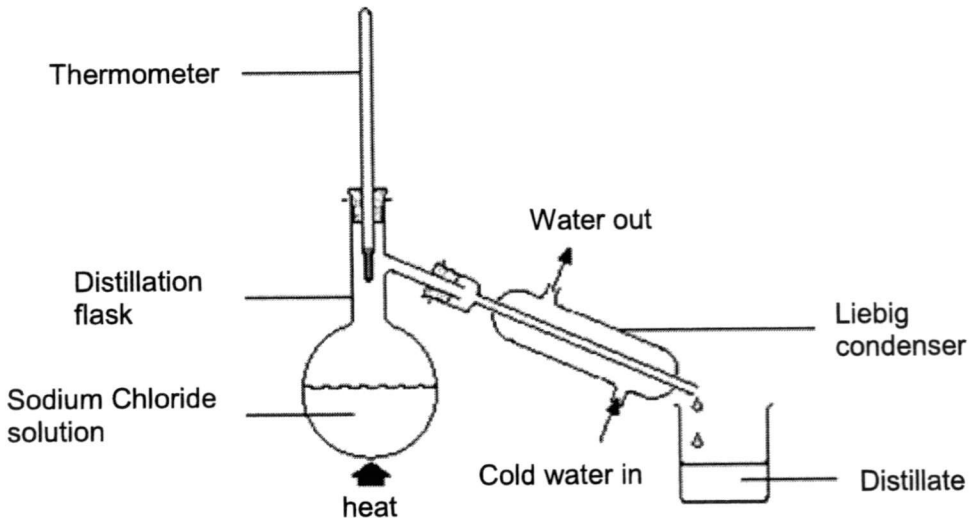


Fig. A11

a) The distillate collected is a colourless liquid that melts at 0°C and boils at 100°C.

Write down the chemical name and formula of this distillate and hence state whether this substance exists as atoms, ions or molecules at room temperature.

Chemical name :.....

Chemical formula: .....

Exists as : ..... [2]

b) The substance that will remain in the round-bottomed flask is a white solid known as sodium chloride, which is an example of an ionic compound. In the space below, using dot and cross diagram, draw the full electronic structure of sodium chloride. [2]

Section B (30 marks)

Answer all the questions in the spaces provided on the question paper.

B1 **Fig. B1.1** shows three plastic cups **A**, **B** and **C**.

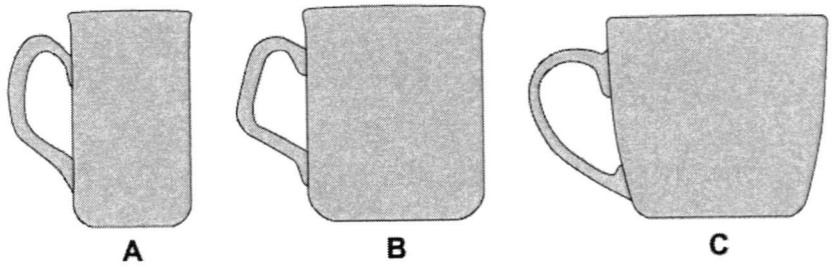


Fig. B1.1

Energy is transferred from hot water in the plastic cups to the surroundings.

a) Explain,

i using the kinetic model of matter, how energy is transferred from hot water to the cups by conduction.

.....

.....

..... [2]

ii how energy is transferred from the surface of hot water to the surroundings by convection.

.....

.....

..... [2]

b) An experiment was carried out to determine the relationship between rate of cooling and surface area of water in contact with air. An equal amount of water was poured into cups **A**, **B** and **C** and the temperature of the water was recorded at regular time intervals.

The results are shown on **Fig. B1.2**.

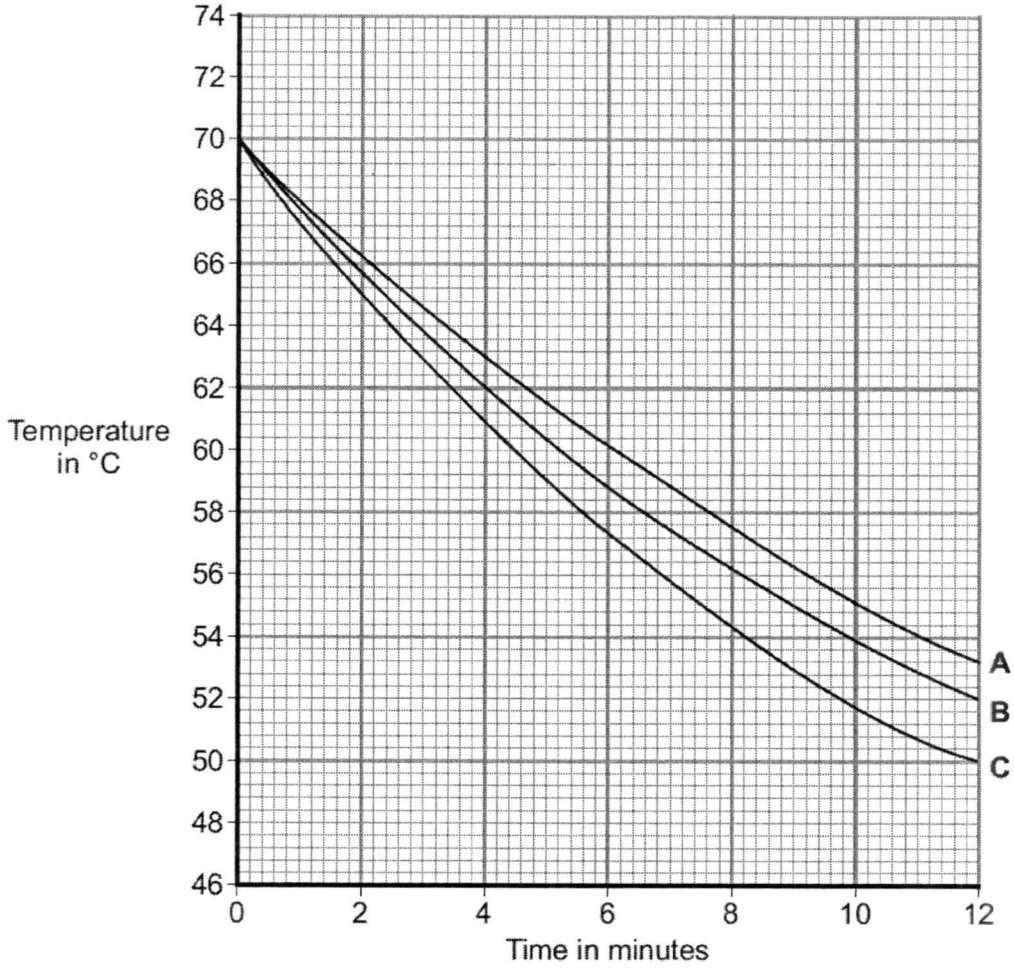


Fig. B1.2

i State the initial temperature of the water in each cup.

..... [1]

ii After a few hours, the temperature of the water in each of the cups was 25°C. Suggest why the temperature does not fall below 25°C.

.....

..... [1]

iii Which cup, **A**, **B**, or **C** has the greatest rate of cooling? Using the graph, give a reason for your answer.

.....

.....

..... [2]

iv The investigation was repeated using a plastic bowl shown in **Fig B1.3**. The same volume of water and starting temperature were used.

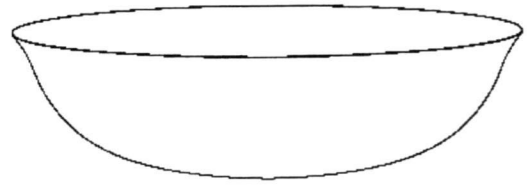


Fig. B1.3

Draw another line on **Fig B1.2** which could represent the temperature of the water in this bowl over the same period of time. [2]

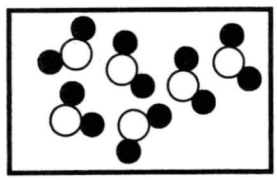
B2

a) From the list of substances below, select one which is the most suitable to match the particle diagram on the left.

brass **nitrogen & oxygen** **zinc** **fluorine**

carbon dioxide & chlorine **steel** **copper**

sodium chloride **water** **oxygen**



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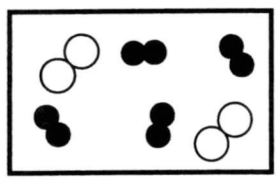

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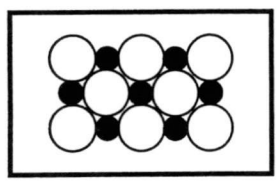

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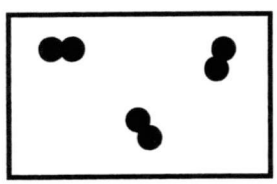

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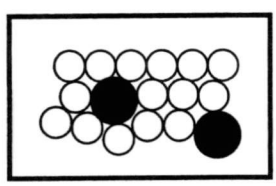


..... [5]

b) **Table B2** below shows the atomic structure of five particles represented by the letters **A** to **E**. The particles are atoms or ions. The letters are **NOT** the symbols of **the elements**.

Particle	Electrons	Protons	Neutrons
A	8	8	6
B	10	10	8
C	10	12	12
D	10	12	14
E	18	15	14

Table B2

i Which particle is an atom of a noble gas?

..... [1]

ii Draw the full electronic structure of particle **D**. [1]

iii **A** exists as diatomic molecules. Using the dot & cross diagram, draw the electronic structure of one such molecule (showing only valence electrons) in the space below. Then state the chemical formula of this molecule.

Drawing: [2]

Chemical formula: ..... [1]

B3 **Fig. B3.1** shows the effect of exercise on the concentration of oxygen in the blood and the concentration of lactic acid in the muscles of a healthy person over a 5-minute period.

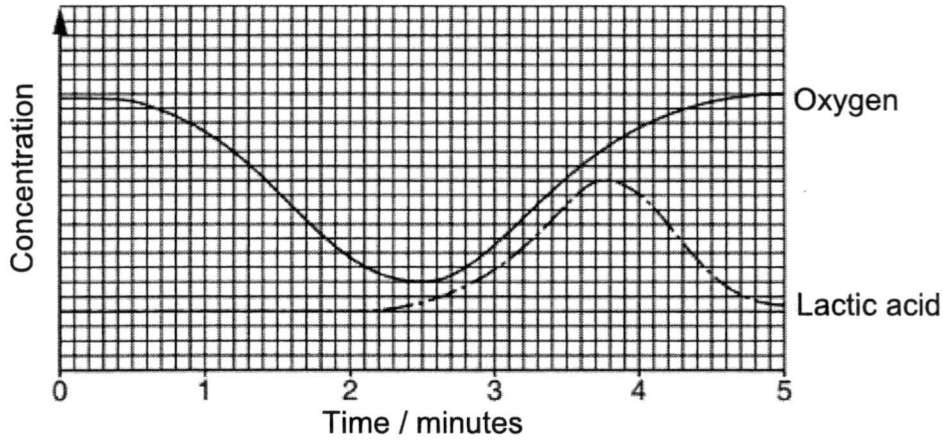


Fig. B3.1

a) Use **Fig. B3.1** to find the time at which the person started to exercise.

..... [1]

b) **i** Write the word equation of the process that causes the build-up of lactic acid in the person exercising.

..... [1]

ii Write the word equation of the process that causes the change in oxygen concentration during the first 2 minutes on **Fig. B3.1**.

..... [1]

c) **i** The digestion of food provides substances required for the process stated in **B3 b)**. Define digestion.

.....

..... [1]

ii Describe how digested food substance moves from the small intestine into the blood capillary.

.....

.....

..... [2]

Fig. B3.2 shows red blood cells from a healthy person and from a person with sickle cell anaemia.

- Biconcave shape
- Elastic
- Non-sticky

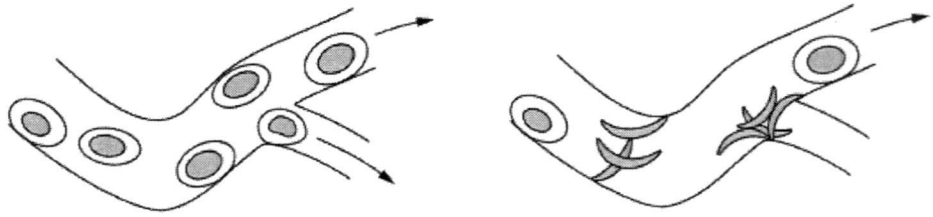
Healthy person

- Crescent shape
- Non-elastic
- Sticky

Person with sickle cell anaemia

Fig. B3.2

Fig. B3.3 shows the flow of red blood cells through a blood vessel in a healthy person and in a person with sickle cell anaemia.



Healthy person

Person with sickle cell anaemia

Fig. B3.3

d) **i** With reference to **Fig. B3.2** and **Fig. B3.3** suggest how the oxygen and lactic acid graphs on **Fig. B3.1** might be different if the person suffers from sickle cell anaemia.

Oxygen graph: .....

.....

Lactic acid graph: .....

..... [2]

ii Suggest **two** explanations for the change in the oxygen and lactic acid graphs of a person with the sickle cell anaemia condition.

.....

.....

.....

..... [2]

End of paper

Answers to LSS Sec 2 – Paper 2

Mid-Year Examination 2017

Section A

A1	**a)**		16.0 cm	2
	b)		Put the pencil above the marking on the ruler Place the pencil such that the left side is aligned with the 1 cm mark. Align the pencil to the side of the ruler with the 0.5 cm markings. Not accepted: parallax error or take average reading (more like precautions)	2
A2	**a)**		m = W ÷ g = 1.8 ÷ 10 [½] = 0.18 kg [½]	1
	b)	**i**	1.8 – 0.6 = 1.2 N	1
		ii	Another magnet with the south pole facing downwards is in the box. Not accepted: contents are magnetic. Magnetic materials are materials that experience a magnetic attractive force when placed in a magnetic field.	1
A3	**a)**		Strength. This property is considered to ensure that the pillars do not break under the heavy weight of the bridge. Not accepted: durability: vague, must be a specific physical property	1
	b)		$2 \times 10^6 \div 5 = 400\,000$ N (accept 4×10^5 N)	1
	c)	**i**	Area = F / P = 400 000 / 4 000 000 = 0.1 m^2	1
		ii	Area = F / P = 400 000 / 400 000 = 1 m^2	1
	d)		Working absent: zero marks	

Material	Volume required to make <u>one</u> pillar / m^3	Cost to make <u>one</u> pillar / $
Reinforced steel	**0.5**	**250**
High grade concrete	**5**	**850**

		Volume of reinforced steel for one pillar = 0.1 x 5 = 0.5 m^3 Cost of reinforced steel for one pillar = 500 x 0.5 = $250 Volume of high grade concrete for one pillar = 1 x 5 = 5 m^3 Cost of high grade concrete for one pillar = 170 x 5 = $850		2
	e)	He should use reinforced steel because it is three times cheaper than concrete.		1
A4	**a)**	P is a solid		1
	b)	Drawing must show particles in orderly arrangement and closely packed.		1
	c)	Compound [1], melts at fixed temperature		2
A5	**a)**	1 Carbon dioxide 2 Oxygen (vice versa)		1
	b)	**i**	thicker in mammals or thinner in birds (by 2.5 times/use of comparative figures – not compulsory)	1
		ii	thinner barrier in birds results in faster/greater gas exchange/diffusion more oxygen supplied/more carbon dioxide removed suggest greater rate of aerobic respiration suggest higher energy demand by muscles in birds for flight	2
A6	**a)**	Hydrochloric acid Provides acidic environment for stomach enzymes		1
	b)	Structural adaptation: one cell thick wall / microvilli in the small intestine / network of blood capillaries Factor increasing rate of diffusion: thinner barrier leads to faster diffusion rates / many villi increase surface area leads to faster diffusion rate / increase network of blood capillaries increase surface area to volume ratio		2

A7

chamber	Name of chamber	Name of blood vessel carrying blood away from chamber
V	Right Atrium	Vena cava
W	Left ventricle	Aorta

1

A8 **a)** Shiny metal is a good reflector of thermal radiation — 1

b) Black. It is a good absorber of thermal radiation. — 2

c) It reduces heat loss to the surroundings through convection/evaporation. — 1

A9 **a)** 580 x 4.5 = 2610 N — 1

b) **i** Choose one:
- Some of the energy is converted to <u>thermal energy</u> (accept <u>heat</u>)
- There is <u>work done</u> against <u>friction</u>.

1

ii Gravitational potential energy → kinetic energy + heat (+ sound). No ½ mark. — 1

A10

Particle	No. of protons	No. of neutrons	No. of electrons	Electronic configuration
magnesium atom	**12**	**12**	**12**	2,8,2
Oxide ion	8	8	10	**2,8**
nitride ion	7	7	**10**	**2,8**

3

A11 **a)** Water [0.5]
H_2O [0.5]
Molecules [1] — 2

	b)	Dot-and-cross diagram of NaCl - if all dots / crosses [-1 mark] - no charge in square brackets [-1 mark]	2

Section B

B1	**a)**	**i**	Heat is conducted from the water through the body of the cup. Particles nearer the water **gain** energy and **vibrate** faster. They **collide** with neighbouring particles and transfer their energy.	2
		ii	Heat is removed from the surface of the water through convection. The air near the water surface is heated and becomes less dense. Less dense air rises and cooler air sinks. This cycle is repeated which causes the water to cool down.	2
	b)	**i**	70°C	1
		ii	The water is in thermal equilibrium with its surroundings at room temperature of 25°C.	1
		iii	C Choose any one: • The decrease in temperature over the same period of time is the greatest for cup. • C has the steepest line	2
		iv	Downward sloping Steeper than A, B and C	1 1
B2	**a)**	Box 1: water Box 2: nitrogen & oxygen Box 3: sodium chloride Box 4: oxygen Box 5: brass or steel 1 mark each		5
	b)	**i**	B	1
		ii	Dot and cross diagram of 2+ ion	1
		iii	Dot and cross diagram of oxygen molecule Formula: A_2	2 1

B3	**a)**	0.3–0.4 minutes		1
	b)	**i**	glucose → energy + lactic acid	1
		ii	glucose + oxygen → energy + carbon dioxide + water	1
	c)	**i**	The mechanical & chemical breaking down of food into smaller components that can be absorbed into the blood stream.	1
		ii	Digested substances in small intestine move from area of high concentration to the area of lower concentration in the blood stream by process of diffusion. Or Active transport also occurs if the concentration of digested food substances in the small intestine is lower than that in the blood capillary.	2
	d)	**i**	O_2 line not as high at start/ finish O_2 line drops more quickly / Or reverse argument lactic acid line rises sooner/ higher / takes longer to return to normal	2
		ii	Any two of following: • reduction in surface area / volume • so less haemoglobin →less AW oxygen + carriage / absorption / in blood (cell) • loss of elasticity + more difficult to move through blood vessels sticky + may clump together / clot • (causing) blockage of blood vessel →reduction of blood flow (to tissue)	2

Answers to LSS Sec 2 – Paper 1

Mid-Year Examination 2017

Section A

1	C		**11**	D		**21**	C
2	B		**12**	C		**22**	A
3	C		**13**	D		**23**	A
4	C		**14**	C		**24**	B
5	C		**15**	B		**25**	C
6	B		**16**	B		**26**	B
7	B		**17**	C		**27**	C
8	A		**18**	D		**28**	B
9	D		**19**	C		**29**	B
10	D		**20**	A		**30**	C