SERANGOON SECONDARY SCHOOL
PRELIMINARY EXAMINATION
SECONDARY 4 EXPRESS AND 5 NORMAL ACADEMIC

CANDIDATE NAME	( )	CLASS	
CENTRE NUMBER	S	INDEX NUMBER	

SCIENCE (CHEMISTRY, BIOLOGY)

Paper 1

5078/01
26 August 2022
1 hour

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, highlighters, glue or correction liquid.
Write your name, class, index number and Centre number on the Answer Sheet in the spaces provided unless this has been done for you.
DO **NOT** WRITE IN ANY BARCODES.

There are **forty** questions on this question paper. Answer **all** questions. For each question there are four possible answers **A**, **B**, **C** and **D**.
Choose the one you consider correct and record your choice in **soft pencil** on the separate Answer sheet.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
Any rough working should be done in this booklet.
A copy of the Periodic Table is printed on the last page.
The use of an approved scientific calculator is expected, where appropriate.

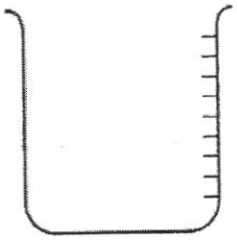
For examiner's use
40

Turn over

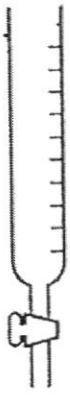
This question paper consists of **21** printed pages, including this **cover** page.

1 Which piece of apparatus is used to measure exactly 25.0 ml of acid?

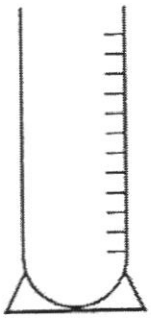
A



B



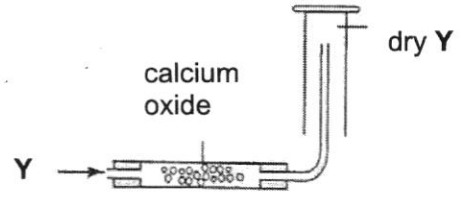
C



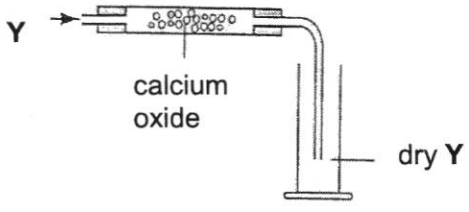
D

2 A gas **Y**, is less dense than air, very soluble in water and is alkaline in nature. Calcium oxide and sulfuric acid are drying agents used to dry this gas. Which method is used to collect a dry sample of the gas?

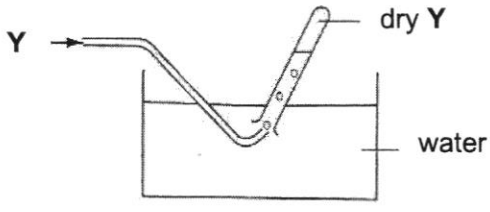
A



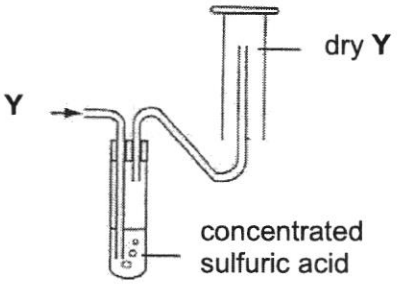
B



C



D



3 Which substance would show a change of state if cooled from room temperature to 0 °C?

substance	melting point / °C	boiling point / °C
A	−305	−42
B	−28	34
C	−18	2
D	−85	127

4 ^{85}Z and ^{87}Z are isotopes of element Z.

How is the ion formed by ^{85}Z different from the ion formed by ^{87}Z?

A it has two less neutrons and two less electrons

B it has two less neutrons but no less electrons

C it has two less protons and two less electrons

D it has two less protons but no less electrons

5 The symbol for an atom of boron is $^{11}_{5}B$.
What does the number 11 represent for an atom of boron?

A the number of protons

B its position in the Periodic Table

C the total number of protons, neutrons, and electrons

D the nucleon number

6 Element Y has the electronic configuration 2, 2.

Element Z has the electronic configuration 2, 8, 7.

What is the formula of the compound formed between Y and Z?

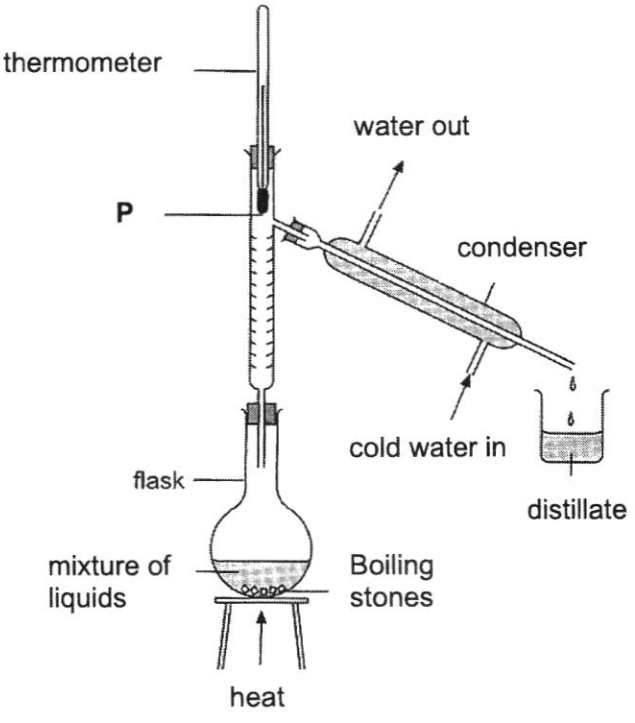
A YZ

B YZ_2

C Y_2Z

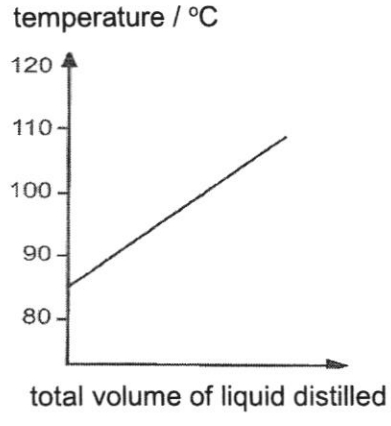
D Y_3Z_2

7 The diagram below shows the apparatus used to separate a mixture of two liquids with boiling points 85 °C and 110 °C.

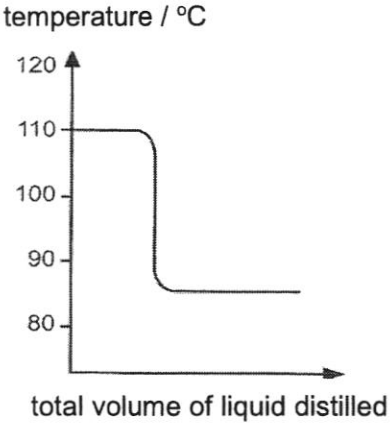


Which graph would be obtained if the temperature at Point **P** was plotted against the total volume of distillate produced?

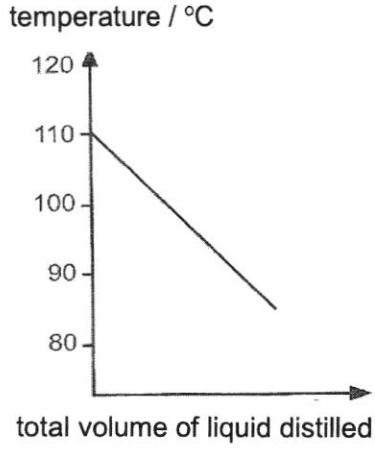
A



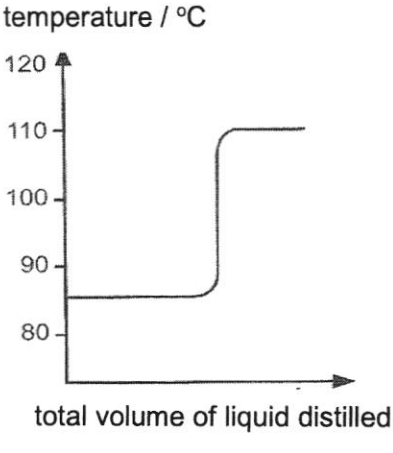
B



C

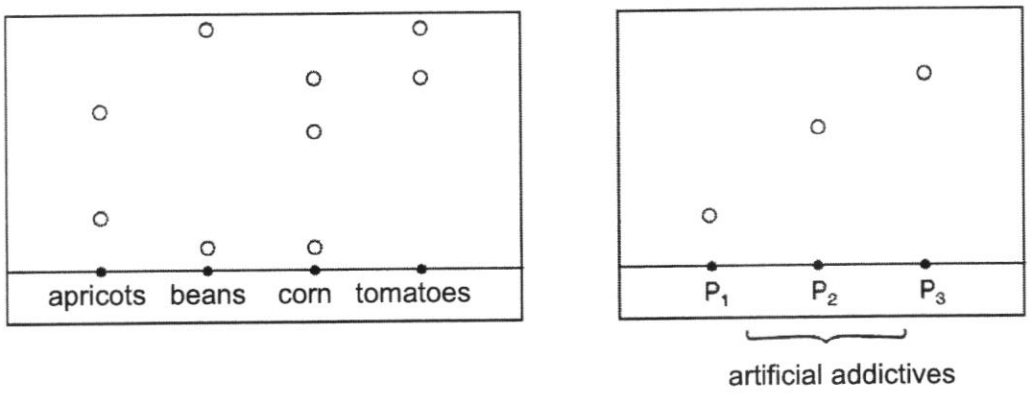


D



8 Samples of canned apricots, beans, corn and tomatoes were tested for additives by chromatography. The chromatograms were compared with those of three artificial additives, P_1, P_2 and P_3.

The results were as follows.



Which canned food does **not** contain any artificial additives?

A apricots

B beans

C corn

D tomatoes

9 What is the total number of elements present in one unit of wolframite, $(FeMn)WO_4$?

A 3

B 4

C 7

D 9

10 Two indicators, bromophenol blue and Congo red, show the following colours in acidic solutions and in alkaline solutions.

indicator	acid	alkali
bromophenol blue	yellow	blue
Congo red	violet	red

A few drops of each indicator are added to separate samples of a solution of pH 2.

What are the colours of the indicators in this solution?

	colour of indicator in a solution of pH 2	
	bromophenol blue	Congo red
A	blue	red
B	blue	violet
C	yellow	red
D	yellow	violet

11 Which statement about the elements in the Periodic Table is correct?

A Group 0 elements are unreactive metals.

B Group I elements form covalent chlorides.

C Group VII elements form ions when combined with other elements.

D The elements become more metallic from right to left across a period.

12 An unknown element has the following properties.

1. It floats on water.
2. It is able to conduct electricity
3. It tarnishes easily when exposed to air.
4. When reacted with water, it forms an alkaline solution.

Which group in the Periodic Table does it belong to?

A Group I

B Group II

C Group IV

D Group VII

13 What is the mole ratio between 71 g of chlorine to 2 g of hydrogen?

A 1:1 **B** 2:1

C 71:1 **D** 71:2

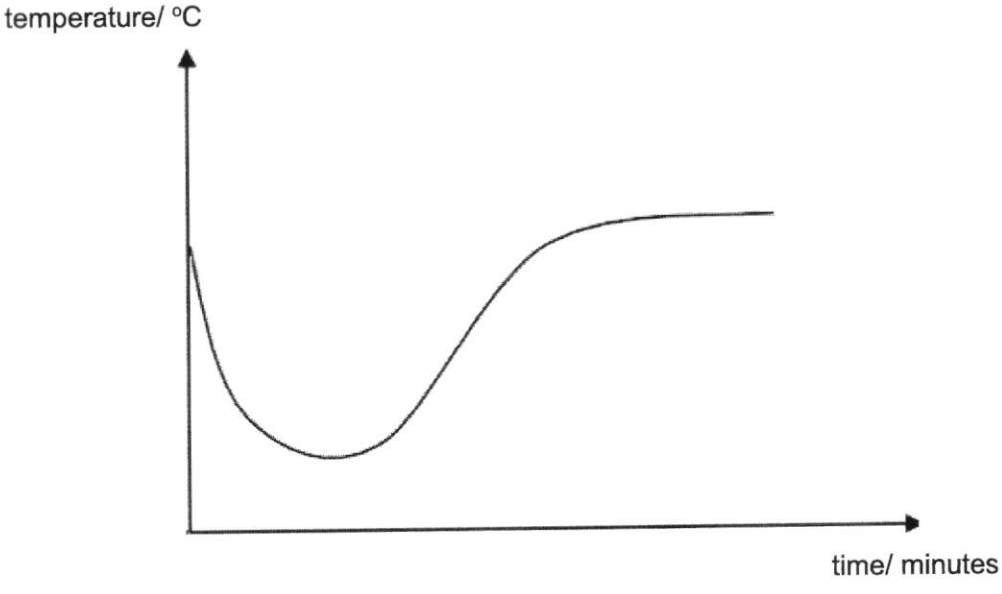
14 Which volume of oxygen (at room temperature and pressure) is needed when 194 g of zinc sulfide is heated in air?

$$2ZnS + 3O_2 \rightarrow 2ZnO + 2SO_2$$

A 24 dm^3 **B** 48 dm^3

C 72 dm^3 **D** 96 dm^3

15 The change in temperature when ammonium nitrate is added into water is shown below.



Which of the following can be derived from the graph?

A A salt and water are formed.

B It is an endothermic process.

C It is an exothermic process.

D The temperature of the water rises.

16 The table below shows some reactions of metals **P** to **S**.

metal	action of hydrochloric acid on metal	action of carbon on heated metal oxide	action of hydrogen gas on heated metal oxide
P	a lot of effervescence seen immediately	reduced	not reduced
Q	a lot of effervescence seen immediately	not reduced	not reduced
R	some effervescence after a long time	reduced	reduced
S	no reaction	reduced	reduced

What is the order of reactivity of the metals in increasing reactivity?

A **P, Q, R, S**

B **Q, P, R, S**

C **S, R, P, Q**

D **S, R, Q, P**

17 Stainless steel is used to make cutlery. Aluminium is used to make food containers.

Which property do **both** stainless steel and aluminium have that makes them suitable for these uses?

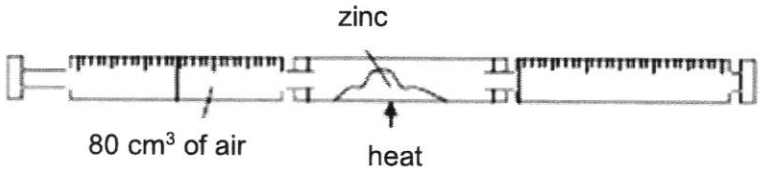
A They are good conductors of electricity.

B They are good conductors of heat.

C They are resistant to corrosion.

D They are ductile.

18 A 80 cm^3 sample of air is trapped in a gas syringe. The air is slowly passed over heated zinc in a tube until there is no further change in the volume of air.



On cooling to room temperature, what is the final volume of air in the gas syringe?

A 16 cm^3

B 21 cm^3

C 32 cm^3

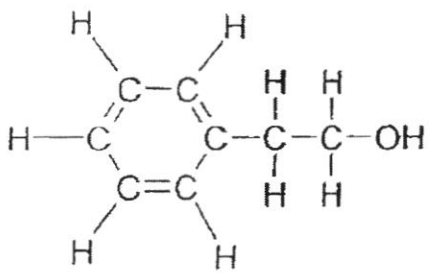
D 63 cm^3

19 Useful fractions are obtained by the fractional distillation of petroleum oil.

Which fraction and its use is correct?

	fraction	use
A	bitumen	fuel in cars
B	lubricating oil	for making waxes and polishes
C	paraffin (kerosene)	for making roads
D	petrol (gasoline)	aircraft fuel

20 The diagram below shows the structure of a substance responsible for the fragrance of roses.



Which of the following statements about this molecule is correct?

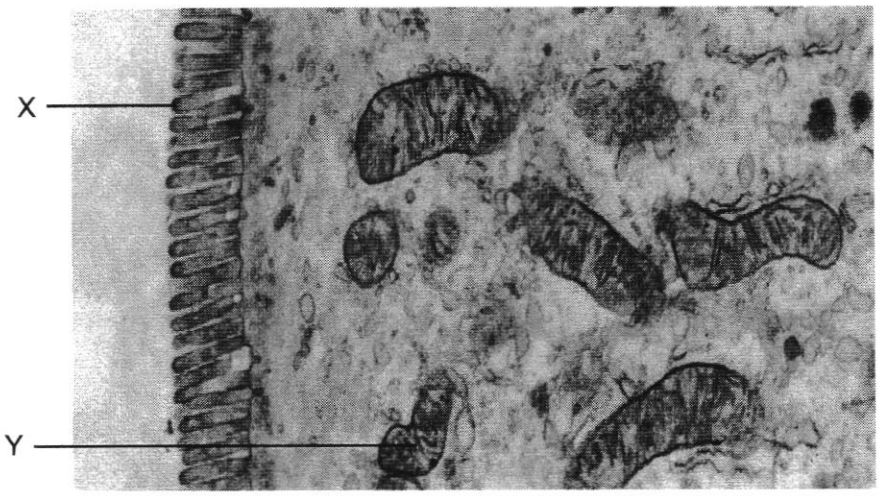
A It is a saturated molecule.

B It can be oxidised by acidified potassium manganate(VII).

C It does not decolourise bromine water under any conditions.

D It can react with reactive metal to form salt.

Refer to the electron micrograph of a section of a small intestine below to answer question **21** and **22**.



21 What is the structure labelled Y?

A chloroplast

B mitochondrion

C ribosome

D vacuole

22 What is the likely function of structure X?

A to slow down movement of food substances by obstructing flow

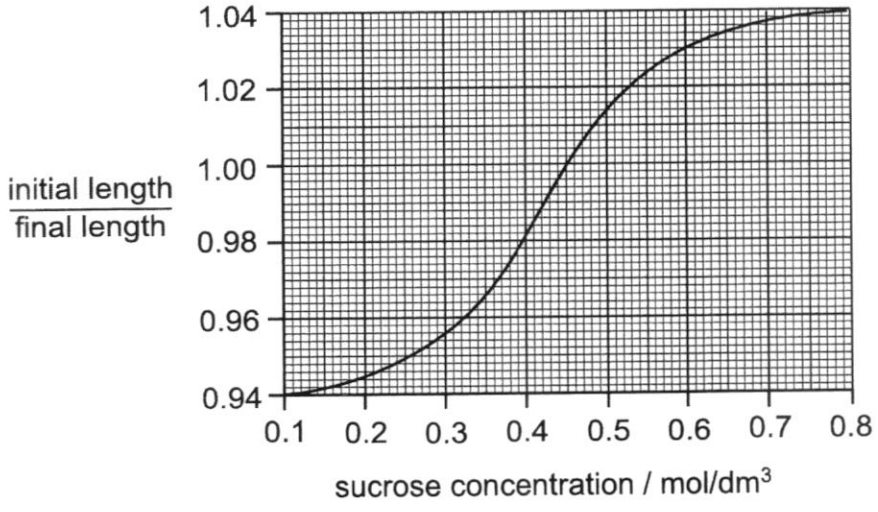
B to increase surface area to volume ratio to enhance absorption of nutrients

C to increase surface area to volume ratio to enhance secretion of digestive enzymes

D to provide sweeping action to move the food substances down the small intestine

23 Strips of plant tissue were soaked in a range of sucrose solutions of different concentrations. Their length was measured before soaking and after 30 minutes in the different solutions.

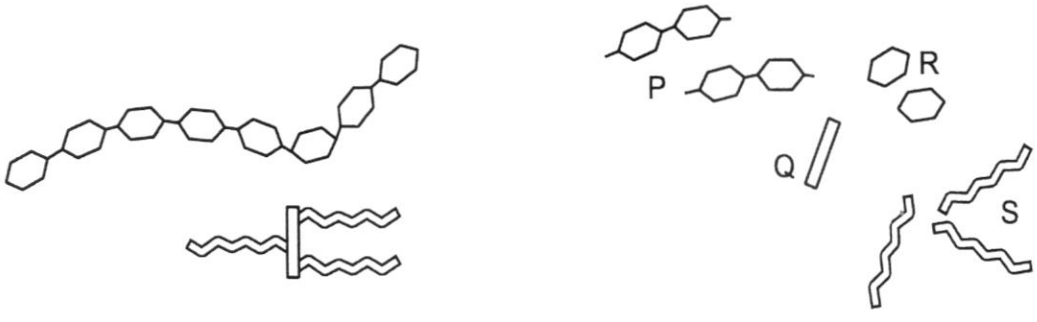
The graph shows the ratio of initial length to final length.



Which concentration of sucrose solution, in mol/dm^3, has the same water potential as the cell sap before immersion?

A 0.10 **B** 0.25 **C** 0.45 **D** 0.80

24 The diagram shows two food molecules before and after they have been digested by enzymes.



Which are the products of fat digestion?

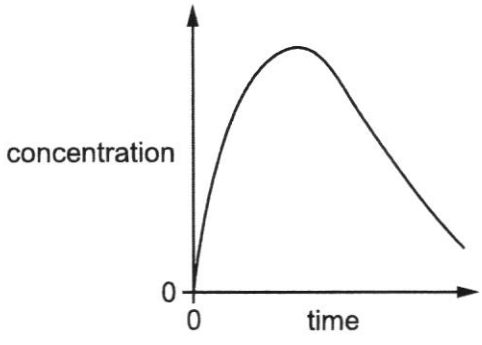
A P and R **B** P and S **C** Q and R **D** Q and S

25 An enzyme was added to an excess of its substrate. All variables were kept constant.

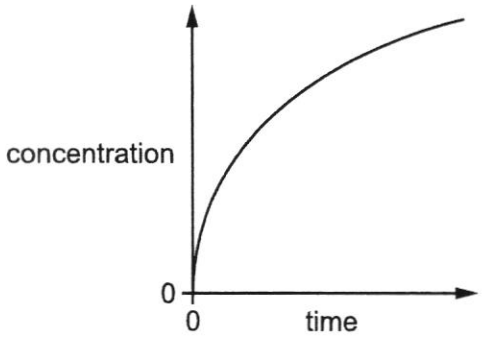
A student was asked to sketch a graph to show how the concentration of enzyme-substrate complex changes over time.

Which graph shows this correctly?

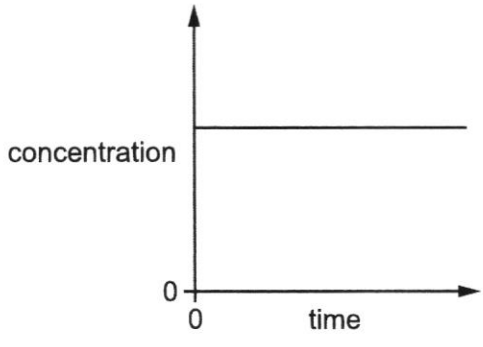
A



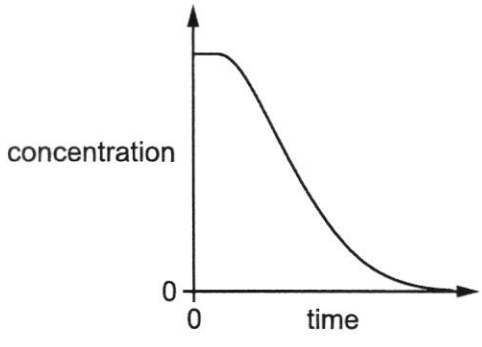
B



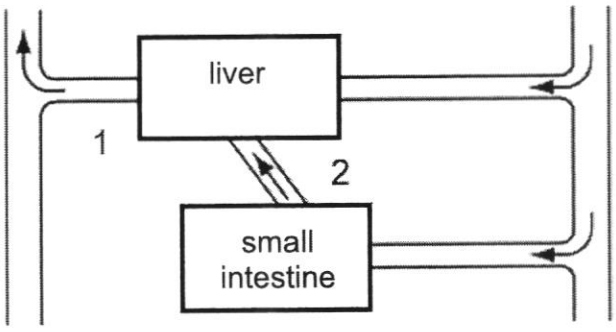
C



D



26 The diagram represents some human organs and their associated blood vessels?



A man has consumed an alcoholic drink.

Which statement about the concentration of alcohol in his blood vessels 1 and 2 is true?

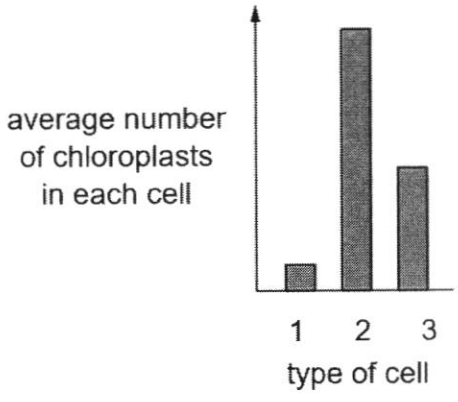
A There is no alcohol in both blood vessels.

B The concentration of alcohol is higher in 1 than 2.

C The concentration of alcohol is lower in 1 than 2.

D The concentration of alcohol is equal in both blood vessels.

27 The bar chart shows the average number of chloroplasts in each of three different cells.



What are the three types of cell?

	1	2	3
A	guard cell	palisade mesophyll cell	spongy mesophyll cell
B	palisade mesophyll cell	spongy mesophyll cell	guard cell
C	spongy mesophyll cell	guard cell	palisade mesophyll cell
D	spongy mesophyll cell	palisade mesophyll cell	guard cell

28 The roots of plants take up nitrates from the soil. Nitrates contain the element nitrogen.

Which nutrient is produced from the nitrates in plants?

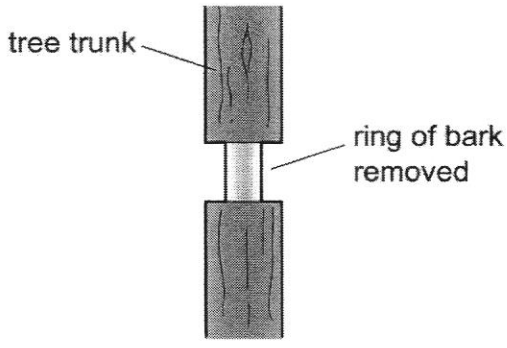
A fats

B glucose

C protein

D starch

29 The diagram shows a part of a tree trunk. A ring of bark including the phloem has been removed.



The tree will eventually die because removing the bark stops the transport of

A mineral salts to the leaves.

B nutrients to the roots.

C oxygen to the roots.

D water to the leaves.

30 Some functions of the blood are listed below:

1. antibody production
2. dissolve and transport nutrients
3. conversion of fibrinogen into fibrin threads
4. phagocytosis

Which of the functions listed are functions of white blood cells?

A 1 and 3

B 1 and 4

C 2 and 3

D 2 and 4

31 Which statement explains why a lot of dust and micro-organisms are found in the lungs of a heavy smoker?

A He is addicted to nicotine.

B His arteries are blocked with tar.

C The surface area of his lungs is reduced.

D The cilia in his trachea have been damaged.

32 Three directions in which nerve impulses can travel in the nervous system are listed.

1. away from the central nervous system
2. towards the central nervous system
3. within the central nervous system

Which correctly identifies the direction of the nerve impulse in motor and relay neurone?

	motor neurone	relay neurone
A	1	2
B	1	3
C	2	1
D	2	3

33 Which describes pupil reflex in bright light?

A ciliary muscle contract, radial muscles relax, lens become rounder

B ciliary muscle relax, radial muscle contract, lens become flatter

C circular muscles contract, radial muscles relax, pupil constricts

D circular muscles relax, radial muscles contract, pupil dilates

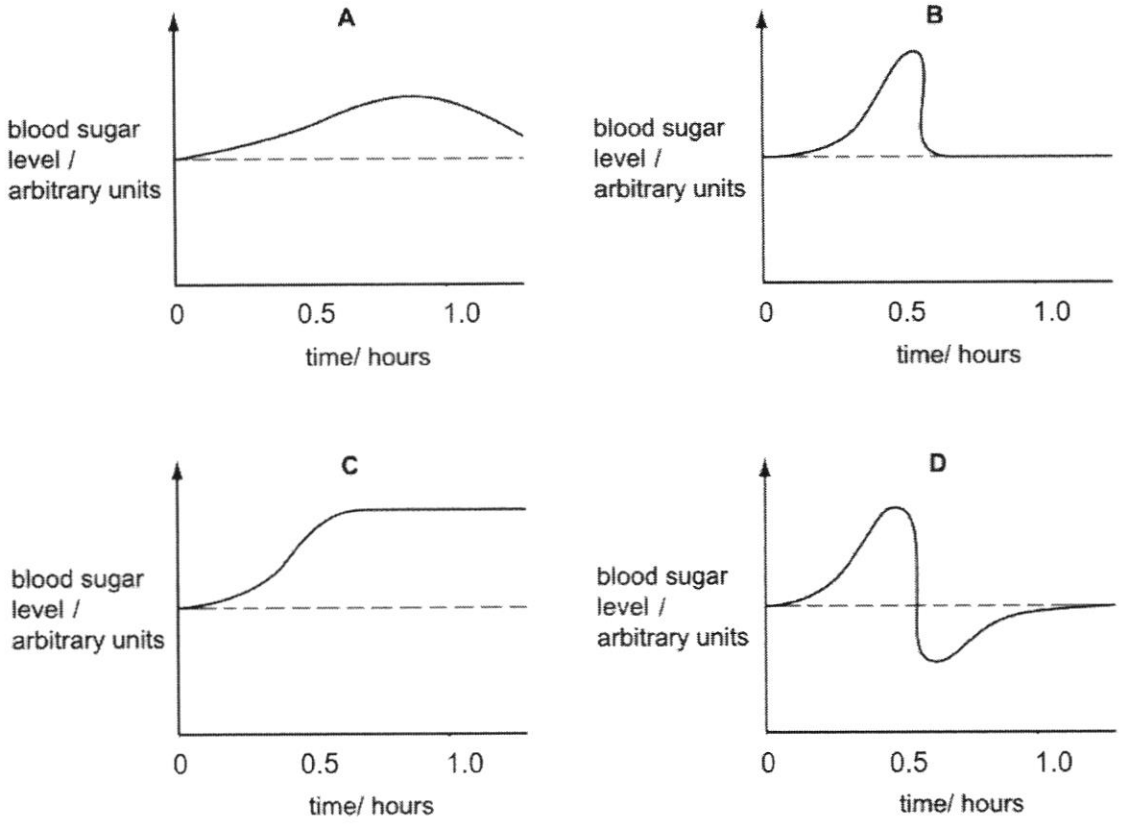
34 The graphs show changes in the amount of sugar in the blood after a person has eaten a sugary meal at time 0.

Which graph shows changes in the amount of blood sugar of a person with untreated diabetes?

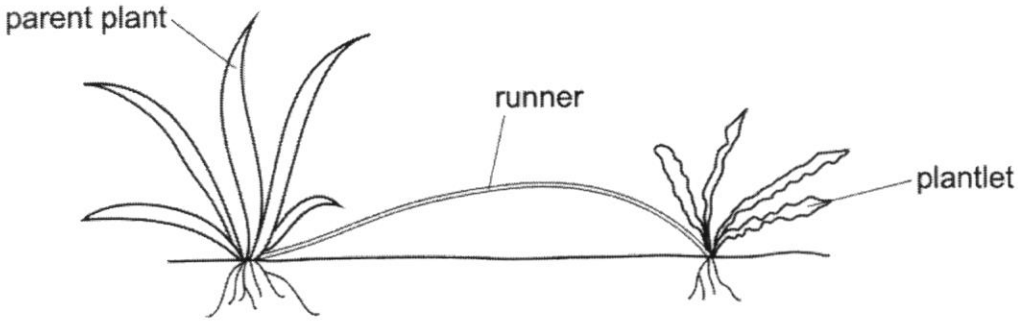
key:

- - - - - - - - - - - - - - - - - -

average blood sugar level in a healthy human



35 The diagram shows a plant reproducing asexually by growing a plantlet from a runner. The leaves of the plantlet appear different to the leaves of the parent plant.



Which statement explains the difference in the leaf shape of the plantlet?

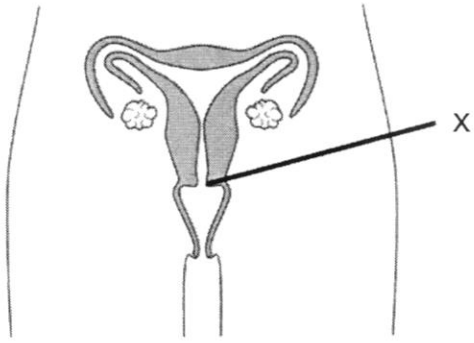
A The plantlet inherited the genes from the parent plant.

B The plantlet showed a recessive phenotype.

C The plantlet was exposed to a chemical mutagen.

D The plantlet was produced by the fusion of gametes.

36 The diagram shows a human female's reproductive organs.



What is structure X?

A cervix

B ovary

C oviduct

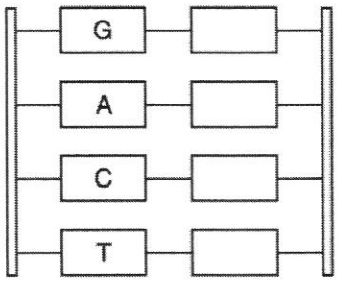
D ovule

37 A man has three daughters.

What is the chance of the fourth child being a daughter?

A 25% **B** 50% **C** 75% **D** 100%

38 The diagram shows a section of DNA, with four bases identified on one strand.



Which shows the correct sequence of bases, from top to bottom?

A AGTC

B CTGA

C GATC

D TCAG

39 It is often suggested that the most energy efficient method to sustain the human population is for humans to consume more cereals and grains rather than fish and meat.

Why might this be the case?

A A greater proportion of energy in the ecosystem would be available to humans.

B A shorter food chain would be less efficient.

C Cereals and grains are digested a lot more efficiently.

D Crop plants would provide more suitable nutrients for humans.

40 Which statements describe why conservation is necessary?

1. to ensure that our food supplies will not run out in future
2. to maintain the biodiversity on Earth
3. to increase the amount of carbon dioxide in the air
4. to prevent disruption of natural cycles such as the water cycle

A 1 and 3 only

B 2 and 4 only

C 1, 2 and 3 only

D 1, 2 and 4 only

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SECONDARY 4 EXPRESS AND 5 NORMAL ACADEMIC

CANDIDATE NAME	( )	CLASS	
CENTER NUMBER	S	INDEX NUMBER	

SCIENCE (PHYSICS, CHEMISTRY)
SCIENCE (CHEMISTRY, BIOLOGY)

Paper 3 **(Section A)**

5076/03
5078/03
24 Aug 2022
1 hour 15 minutes

Candidates answer on the Question Paper.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, index number and name on all the work you hand in.
You may use an HB pencil for any diagrams, graphs, tables or rough working.
Write in dark blue or black pen.
Do not use staplers, paper clips, glue or correction fluid.

The use of an approved scientific calculator is expected, where appropriate.
You may lose marks if you do not show your working or if you do not use appropriate units.

Section A
Answer **all** questions.
Write your answers in the spaces provided on the question paper.

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

For examiner's use	
Section A	45

This question paper consists of **11** printed pages, including this cover page.

Section A [45 marks]

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

1 Choose from the following oxides to answer the questions below.

Al_2O_3	CaO	CO	CuO
SO_2	SO_3	NO	SiO_2

Each oxide can be used once, more than once or not at all.

Identify an oxide which

(a) is formed during the incomplete combustion of propene. ..... [1]

(b) reacts with sulfuric acid to give a blue solution. ..... [1]

(c) removes acidic impurities in the extraction of iron. ..... [1]

(d) can react with either sodium hydroxide or hydrochloric acid. ..... [1]

(e) is used as catalyst for cracking of large alkanes. ..... [1]

2 In Fig. 2.1, **A** to **F** represent the particles of different substances at room temperature.

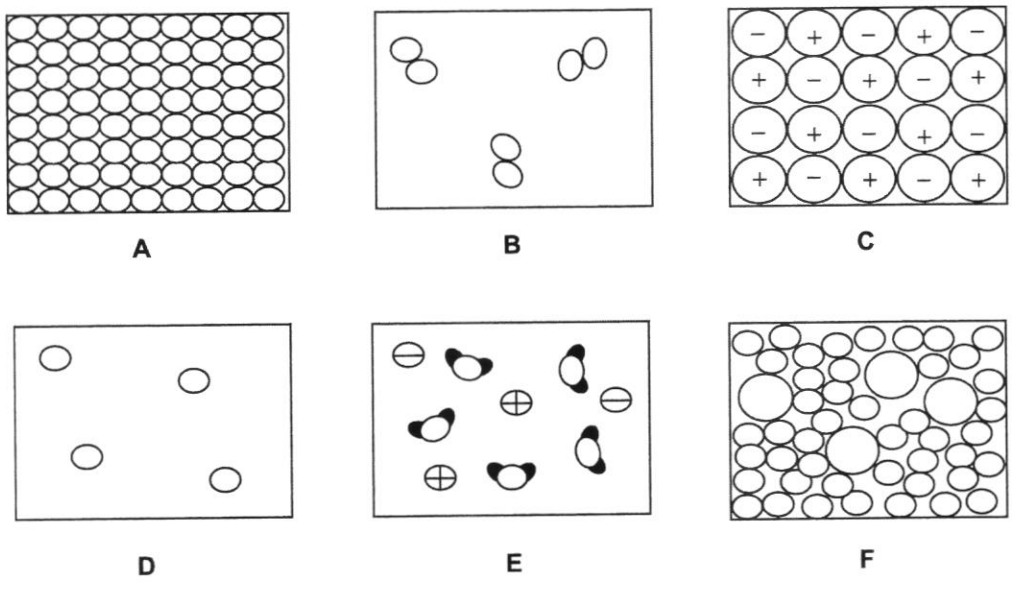


Fig. 2.1

Write the letter of the diagram which best represents each of the following substances below. Each letter may be used once, more than once, or not at all.

(a) solid sodium chloride ..... [1]

(b) brass ..... [1]

(c) magnesium ribbon ..... [1]

(d) neon gas ..... [1]

3 Carbon disulfide, CS_2, is a simple covalent compound used in manufacturing polymers and fibres.

(a) Draw a 'dot and cross' diagram to show the bonding in carbon disulfide. Show the outer shell electrons only.

[2]

(b) Using your understanding of bonding and structure, which of these statements would you predict to be true and which would you predict to be false?

Put a tick (√) in one box in each row.

	true	false
Carbon disulfide has a low boiling point.		
Carbon disulfide has good electrical conductivity when molten.		
Carbon disulfide is very soluble in water.		
Carbon disulfide is a crystalline solid at room temperature.		

[2]

4 Fluorine, chlorine and bromine are elements in Group VII of the Periodic Table. Group VII elements are also known as halogens.

(a) Use your knowledge on electronic structures to explain why chlorine is placed below fluorine in the Periodic Table.

.....

.....

..... [2]

(b) Table 4.1 shows different halogens react with hydrogen under different conditions.

Table 4.1

element	observations for reaction with hydrogen
fluorine	explosively
chlorine	vigorous
bromine	-
iodine	little reaction

Suggest the observations for the reaction of bromine with hydrogen. Explain your answer.

.....

.....

..... [2]

5 **(a)** Fig. 5.1 shows three beakers containing different metal solutions.
Tin metal was dipped into each metal solutions.

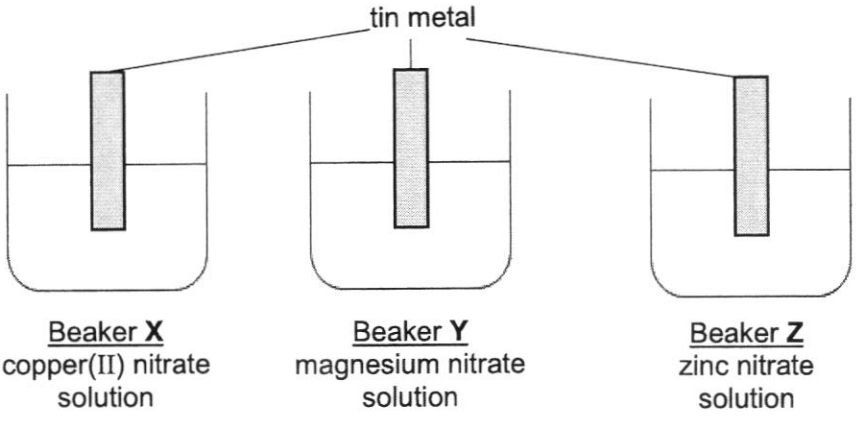


Fig. 5.1

A few minutes later, it was observed that only Beaker **X** showed a change.

(i) What can you conclude about the relative positions of tin, copper, magnesium and zinc in the metal reactivity series?

.....

..... [1]

(ii) State the change observed in Beaker **X**. Explain.

.....

.....

..... [2]

(b) Two separate blocks of iron were each coated with a layer of metal as shown in Fig. 5.2. One was coated with copper and the other was coated with zinc. A small portion of the layer was scratched off.

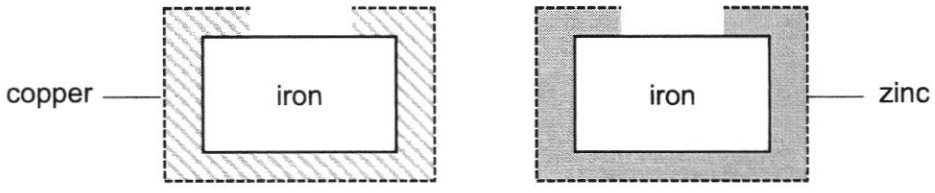


Fig. 5.2

It was found that only the iron block coated with copper rusted while the one coated with zinc did not rust. Explain the difference in the observations.

.....

.....

.....

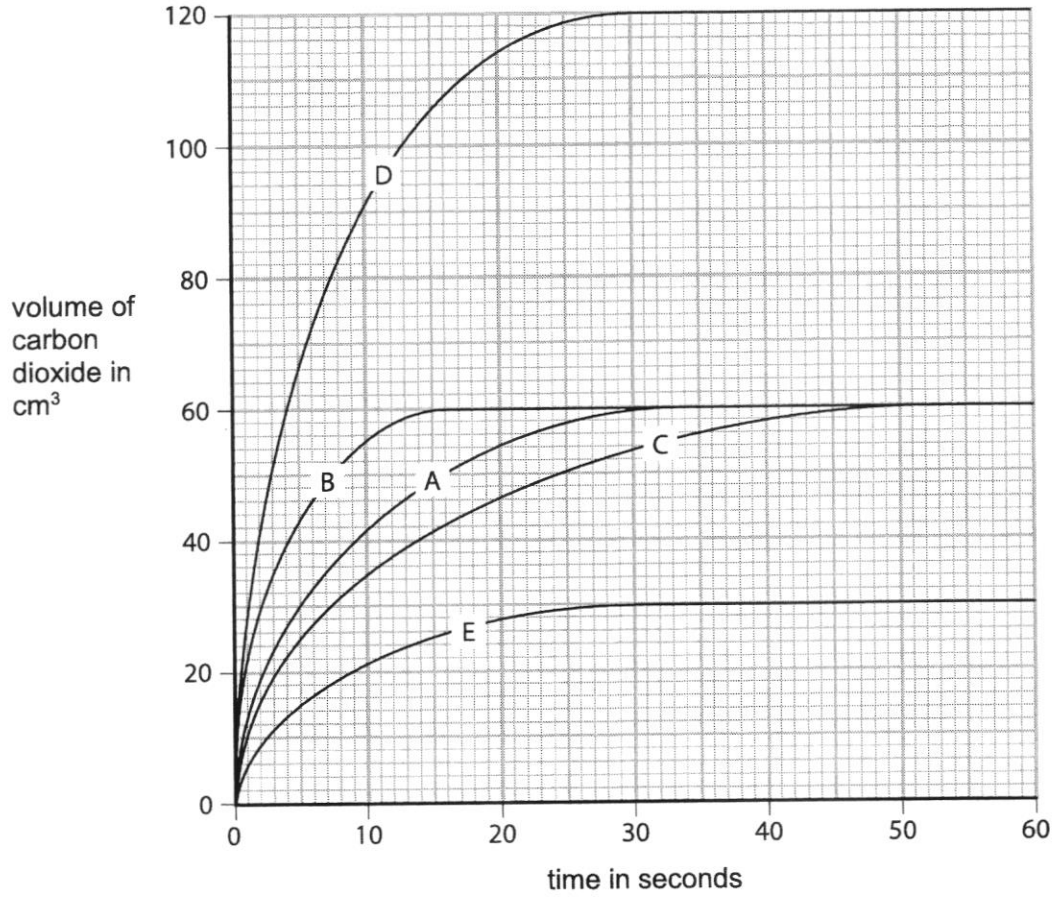
..... [3]

(c) State one disadvantage of extracting metals from their ores instead of recycling them.

.....

..... [1]

6 The graph shows the volumes of carbon dioxide given off when lumps of magnesium carbonate were added to sulfuric acid in five different experiments, **A** to **E**.



Curve **A** shows the volume of carbon dioxide collected when 5.0 g of magnesium carbonate lumps were added to an excess of 1.0 mol/dm^3 sulfuric acid at room temperature and pressure. The experiment was then repeated four more times, each time with a different condition modified.

(a) Calculate the average speed for experiment **A** in cm^3/s for the first 20s.

average speed: ..... cm^3/s [1]

(b) The experiment is repeated using 5 g of powdered magnesium carbonate. Identify the curve, **B** to **E**, that corresponds to the modification and explain your choice in terms of collisions between reacting particles.

.....

.....

.....

..... [3]

(c) State the condition for the experiment that will produce curve **C**.

.....

..... [1]

7 The neutralisation reaction between sulfuric acid and sodium hydroxide is represented by the chemical equation below.

$$H_2SO_4\ (aq) + 2NaOH\ (aq) \rightarrow Na_2SO_4\ (aq) + 2H_2O\ (l)$$

In the experimental setup, 25.0 cm^3 of 0.1 mol/dm^3 sulfuric acid was used to neutralise 20.0 cm^3 of sodium hydroxide exactly.

(a) Calculate, in mol/dm^3, the concentration of sodium hydroxide used in the reaction.

concentration: ..... mol/dm^3 [3]

(b) Determine the mass of sodium sulfate produced.

mass: ..... g [2]

8 Fig. 8.1 below describes some of the properties and reactions of several substances.

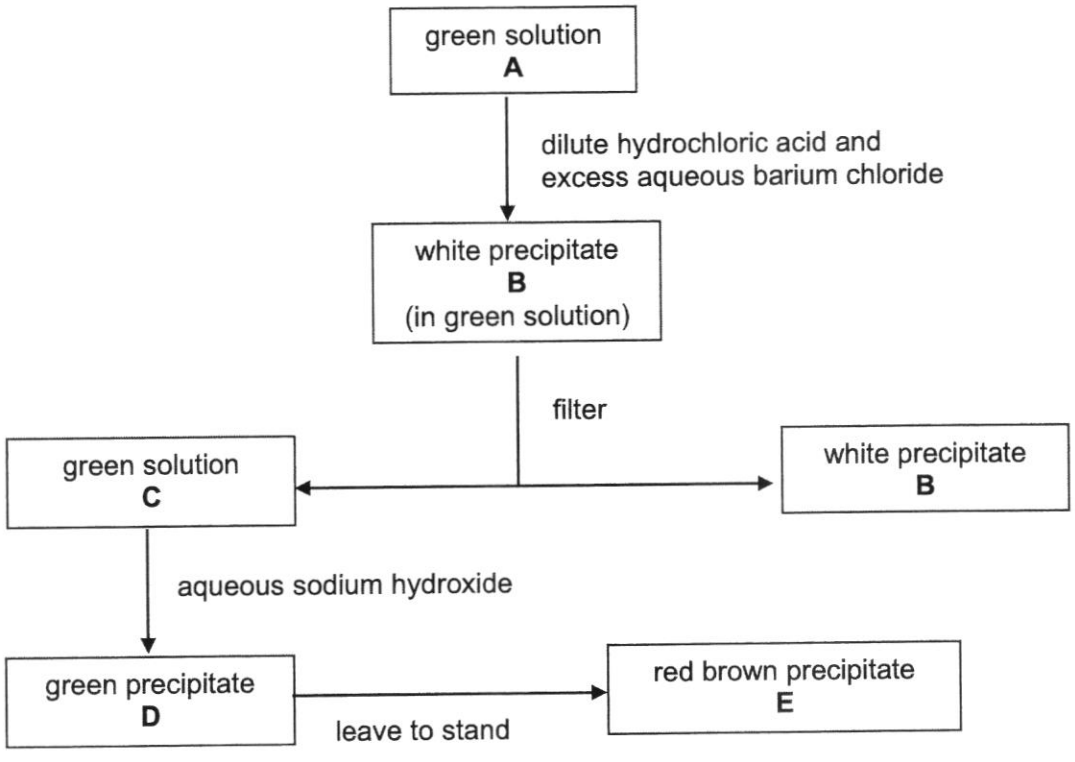


Fig. 8.1

(a) Suggest the identity of the following substances:

A .....

B .....

C .....

D .....

E ..... [5]

(b) Write a chemical equation for the formation of green precipitate **D**.

..... [2]

9 **(a)** Fig. 9.1 shows an addition polymer **X**.

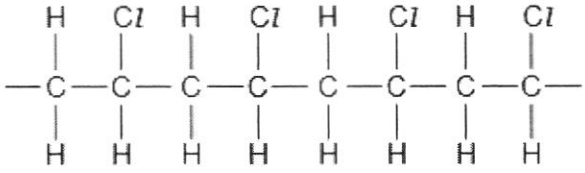


Fig. 9.1

(i) Draw the structure of the monomer from which polymer **X** is formed.

[1]

(ii) Polymer **X** is non-biodegradable. Explain the term 'non-biodegradable'.

.....

..... [1]

(b) Linalool, ($C_{10}H_{17}OH$) an alcohol, is an essential oil used in perfume making. It gives a sweet, lavender-like smell.

The structural formula of linalool is shown in Fig. 9.2.

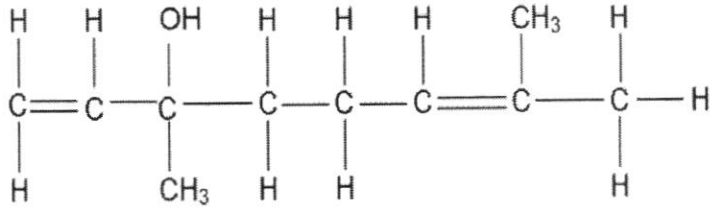


Fig. 9.2

(i) Describe what would be observed when aqueous bromine is added to linalool.

.....

..... [1]

(ii) Draw the product formed when linalool reacts with excess aqueous bromine.

[1]

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SERANGOON SECONDARY SCHOOL
PRELIMINARY EXAMINATION
SECONDARY 4 EXPRESS AND 5 NORMAL ACADEMIC

CANDIDATE NAME	( )	CLASS	
CENTER NUMBER	S	INDEX NUMBER	

SCIENCE CHEMISTRY

Paper 3 **(Section B)**

5076/03
24 August 2022
1 hour 15 minutes

Candidates answer on the Question Paper.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, index number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staplers, paper clips, glue or correction fluid.

The use of an approved scientific calculator is expected, where appropriate.
You may lose marks if you do not show your working or if you do not use appropriate units.

Section B
Answer any **two** questions.
Write your answers in the spaces provided on the question paper.

The number of marks is given in brackets [ ] at the end of each question or part question.
A copy of the Periodic Table is printed on the last page.

For examiner's use	
Section B	
Total	20

This question paper consists of **10** printed pages, including this cover page.

Section B [20 marks]

Answer **any two** questions in this section.

Write your answers in the spaces provided.

10 **(a)** State **one** physical property of acids.

..... [1]

(b) Briefly describe **three** characteristic reactions of acids.

.....

.....

..... [3]

(c) **(i)** Describe a way to prepare a pure sample of lead(II) chloride, $PbCl_2$, from lead(II) carbonate, $PbCO_3$.

Use the following information to help you.

- both lead(II) chloride and lead(II) carbonate are insoluble in water.
- all nitrates are soluble in water.

.....

.....

.....

.....

..... [4]

(ii) Write a balanced equation for the reaction to produce $PbCl_2$ in **(c) (i).** State symbols are **not** required.

..... [2]

11 The chloroalkanes are a homologous series of organic compounds. Some properties of the chloroalkanes are given in Table 11.1 below.

name of chloroalkane	chemical formula	boiling point/°C
chloromethane	CH_3Cl	−24
chloroethane	C_2H_5Cl	8
chloropropane	C_3H_7Cl	
chlorobutane	C_4H_9Cl	78
chloropentane	$C_5H_{11}Cl$	110

Table 11.1

(a) State the general formula of the chloroalkanes.

..... [1]

(b) **(i)** State the reagent(s) and condition(s) required to produce chloromethane from methane.

..... [2]

(ii) Name the type of reaction described in **(b) (i)**.

..... [1]

(c) **(i)** State the product(s) formed when alkanes undergo complete combustion.

..... [1]

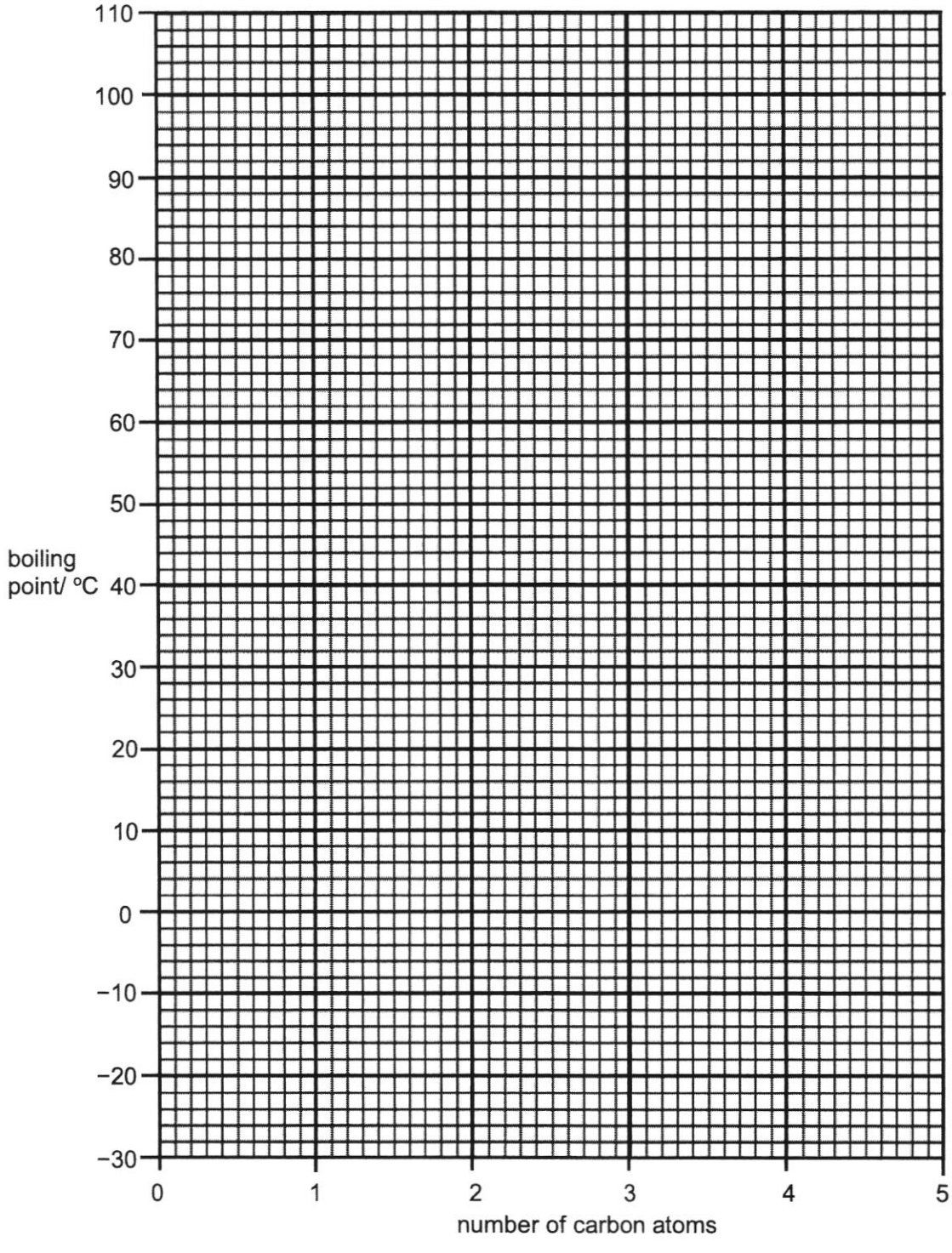
(ii) Would you expect the same product(s) as in **(c) (i)** to be formed when chloroalkanes undergo complete combustion? Explain your answer.

.....

..... [2]

(d) **(i)** In the grid below, plot the boiling point against the number of carbon atoms for the chloroalkanes, marking each point with a cross (x).

Draw a line of best fit taking into account all your plotted points.



[2]

(ii) Use your graph to predict the boiling point of chloropropane.

..... [1]

12 Fig 12.1 below shows how the carbon monoxide concentration in the air in a city changes across different times in the same day.

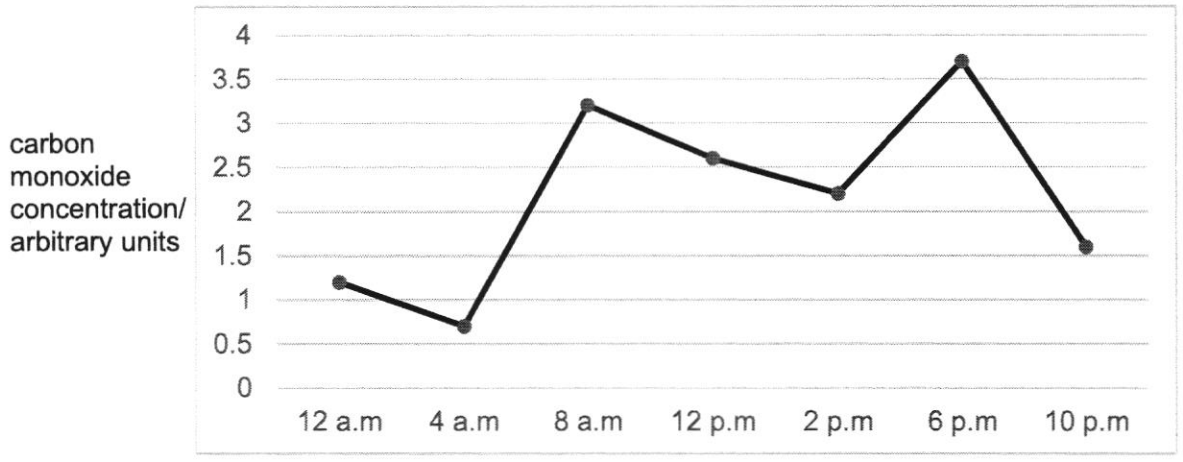


Fig 12.1

(a) **(i)** State the time of the day at which the carbon monoxide concentration in air is the lowest and suggest a reason for this observation.

.....

.....

..... [1]

(ii) Explain why carbon monoxide is harmful to human health.

.....

..... [1]

(iii) Besides carbon monoxide, name another common air pollutant and state **one** source of its production.

.....

.....

..... [2]

The carbon monoxide concentration in a sample of polluted air can be determined by passing the polluted air over solid iodine pentoxide, I_2O_5.

The carbon monoxide present will react with iodine pentoxide according to the following equation:

$$I_2O_5\ (s) + 5CO\ (g) \rightarrow I_2\ (s) + 5CO_2\ (g)$$

(b) With reference to the equation given above, state and explain, in terms of oxidation state, the substance that has been reduced.

.....

.....

..... [2]

In an experiment, 1500 cm^3 of polluted air, which contains carbon monoxide, was passed over excess iodine pentoxide. It was found that 0.046 g of iodine pentoxide was required to react with all the carbon monoxide present in the sample of polluted air.

(c) **(i)** Calculate the number of moles of iodine pentoxide present in 0.046 g.

number of moles of iodine pentoxide = ... mol [1]

(ii) Using your answer to **(c) (i),** calculate the volume of carbon monoxide, measured at room temperature and pressure, which reacts with 0.046 g of iodine pentoxide.

volume of carbon monoxide = ... cm^3 [2]

(ii) Hence, calculate the percentage of carbon monoxide in the sample of polluted air.

percentage of carbon monoxide = ... % [1]

-END OF PAPER-

Serangoon Secondary School

2022 4E5N Science Chemistry Preliminary Examination Marking Scheme

Paper 1

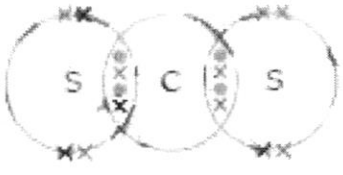
1	D	**6**	B	**11**	D	**16**	C
2	A	**7**	D	**12**	A	**17**	C
3	C	**8**	B	**13**	A	**18**	D
4	B	**9**	B	**14**	C	**19**	B
5	D	**10**	D	**15**	B	**20**	B

Paper 3

Section A

1	a		CO	[1]
	b		CuO	[1]
	c		CaO	[1]
	d		Al_2O_3	[1]
	e		Al_2O_3	[1]

2	a		C	[1]
	b		F	[1]
	c		A	[1]
	d		D	[1]

3	a		 C: 8 outer electrons (1m) O: 8 outer electrons (1m)	[2]
	b			[2]

	true	false
Carbon disulfide has a low boiling point.	√	
Carbon disulfide has good electrical conductivity when molten.		√
Carbon disulfide is very soluble in water.		√
Carbon disulfide is a crystalline solid at room temperature.		√

			4 \ : 2; 3 \ : 1; 2 \ : 1; 1 \ : 0	

4	a		The electronic structures of chlorine and fluorine are 2.8.7 and 2.7 respectively. [1] Having one more electron shell [1] in an atom of chlorine, it is placed one period below fluorine.	[2]
	b		Bromine is less reactive than chlorine [1] would probably react in slowly with hydrogen. [1]	[2]

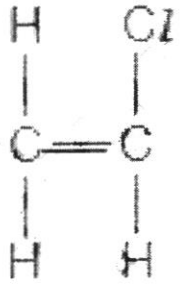
5	a	i	Tin lies below magnesium and zinc metal but above copper metal in the reactivity series. (accept: reactivity in increasing/decreasing order)	[1]
	a	ii	Blue solution turns colourless OR Reddish-brown deposit seen. [ ] Tin is more reactive than copper and displaces copper from copper(II) nitrate solution. [1]	[2]
	b		When the layers of metal are scratched, the iron is exposed to corrosion by oxygen and moisture in air. [1] Zinc is more reactive than iron and will corrode in place of iron. Hence, the iron block will not rust. [ ] Copper is less reactive than iron and will not corrode in place of iron. Hence, the iron block will rust. [ ]	[3]
	c		Extracting metals is more expensive and uses more energy than recycling. Extracting metals from their ores uses up our earth's finite resources of metals. Extracting metals from their ores uses up the limited resource of fossil fuels. Any one.	[1]

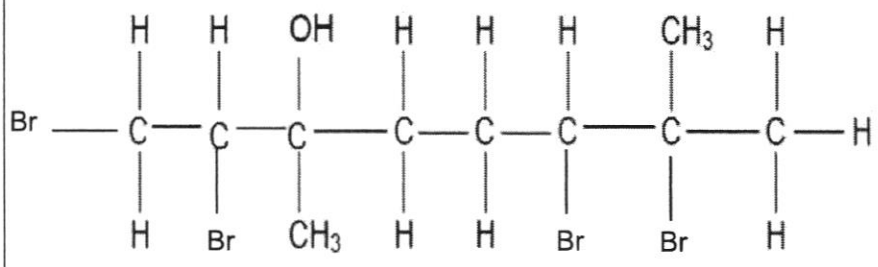
6	a		Vol of CO_2 produced = 54 cm^3 Average speed = 54 / 20 = 2.70cm^3/s	[1]
	b		B. [1] For powedered form, the surface area increases which leads to higher frequency of effective collisions between particles.[1] Hence the rate of reaction increases which is shown by steeper gradient. [1] *To give mark for explanation even if graph used is wrong*	[3]

	c		Lower temperature/ lower concentration of acid	[1]

7	a		H_2SO_4 (aq) + 2NaOH (aq) → Na_2SO_4 (aq) + $2H_2O$ (l) no. of mol of H_2SO_4 = 0.1 x 25.0/1000 = 0.0025 mol [1] no. of mol of NaOH = 2 x 0.0025 mol = 0.005 mol [1] concentration of NaOH in mol/dm^3 = 0.005/(20.0 ÷ 1000) = 0.25 mol/dm^3 [1]	[3]
	b		no. of mol of Na_2SO_4 = 0.0025 mol [1] mass of Na_2SO_4 = 0.0025 x (46 + 32 +64) = 0.355 g [1]	[2]

8	a		**A** iron(II) sulfate **B** barium sulfate **C** Iron(II) chloride **D** iron(II) hydroxide **E** iron (III) hydroxide	[5]
	b		$FeCl_2$ + 2NaOH → 2NaCl + $Fe(OH)_2$	[2]

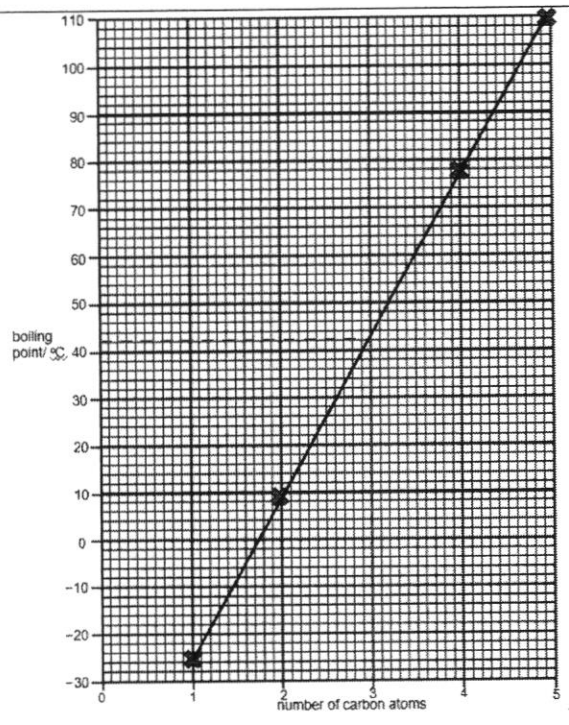
9	a	i		[1]
	a	ii	It does not decompose easily by bacteria/ or other living organisms./ Cannot be broken down naturally by bacteria.	[1]
	b	i	Reddish-brown aqueous bromine will be decolourised. *Reject: if student merely writes the final colour.*	[1]

	b	ii		[1]

Section B

10	a		Sour taste/turn blue litmus red/pH less than 7	[1]
	b		Reactive metals react with acids to form salts and hydrogen gas. [1] Metal carbonates react with acids to form salts, carbon dioxide and water. [1] Bases react with acids to form salt and water [1] accept if students give metal oxides or metal hydroxides instead of bases	[3]
	c		• Add **excess $PbCO_3$** to warm dilute nitric acid [1] • Filter the mixture, **collect the filtrate** (aqueous $Pb(NO_3)_2$) [1] • Add **aqueous sodium chloride/potassium chloride/hydrochloric acid** (any soluble chloride) to the filtrate [1] • Filter the mixture, **collect the residue** [1] • Wash the residue with distilled water and tap dry.	[4]
	d		Magnesium and sulfuric acid react to form magnesium sulfate & hydrogen. $Mg + H_2SO_4 \rightarrow MgSO_4 + H_2$ 1M – correct formulae 1M – balancing Metal must be above H in the Reactivity Series (reject if students use Cu or Ag)	[2]

11	a		$C_nH_{2n+1}Cl$	[1]
	b	i	**chlorine gas/Cl_2** [1] presence of **UV light/sunlight** [1]	[2]
		ii	**substitution** reaction	[1]

	c	i	carbon dioxide, water both products correct for 1M	[1]
		ii	No [1] Chloroalkanes **contain chlorine atoms in addition to carbon and hydrogen**. (Thus, chlorine-containing products will be formed as well) [1]	[1]
	d	i	 All 4 points plotted correctly – 1M Straight line of best fit through all 4 points – 1M	[2]
		ii	42°C (accept 40°C – 44°C)	[1]

12	a	i	4 a.m. There is the **least amount of traffic** on the roads at 4 a.m. Both must be correct for 1M.	[1]
		ii	It prevents **red blood cells from binding to and transporting oxygen**, leading to **breathlessness, suffocation and death**. Students must mention: • Mode of action of CO At least one effect (either breathlessness, suffocation or death)	[1]
		Iii	Sulfur dioxide OR nitrogen oxides [1]	[2]

			Sulfur dioxide: combustion of fossil fuels OR volcanic activity [1] Nitrogen oxides: reaction of nitrogen and oxygen in the air due to high temperatures, in car engines OR due to lightning activity.	
	b		**<u>Iodine pentoxide</u>** is reduced [1] as it **<u>lost oxygen</u>** to form iodine. [1]	**[2]**
	c	i	number of moles of $I_2O_5 = \frac{mass}{M_r} = \frac{0.046}{2 \times 127 + 5 \times 16}$ = 0.000138 mol (1.38×10^{-4} mol) – 3 s.f.	**[1]**
		ii	Mole ratio: I_2O_5 : CO = 1:5 ∴ number of moles of CO = $1.38 \times 10^{-4} \times 5 = 6.9 \times 10^{-4}$ mol [1] Volume of CO = $6.9 \times 10^{-4} \times 24000$ = **<u>16.56</u>** cm^3 [1] Accept if students round off to 3 s.f. = 16.6 cm^3	**[2]**
		iii	% of CO in the sample = $\frac{16.56}{1500} \times 100\%$ = **<u>1.10</u>**% - 3 s.f. [1] Note: if students used 16.6 cm^3, same answer of 1.10% should be obtained.	**[1]**