Name and Index Number: ( )	Class:

SENG KANG SECONDARY SCHOOL PRELIMINARY EXAMINATION

SCIENCE (PHYSICS / CHEMISTRY) 5076/01

Secondary 4 Express & 5 Normal Academic 30 August 2022

Paper 1 Multiple Choice 1 hour

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write your index number and name on all the work you hand in.
You may use a soft pencil for any diagrams, graphs or rough working.
Do not use staples, paper clips, highlighters, glue or correction fluid.

There are **forty** questions in this 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 Multiple Choice 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 question paper.
The use of an approved scientific calculator is expected, where appropriate.

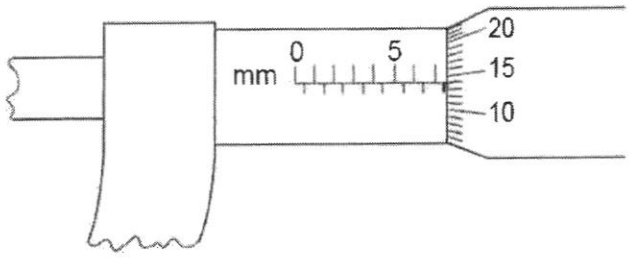
A copy of the Data Sheet is printed on page 14.
A copy of the Periodic Table is printed on page 15.

Parent's / Guardian's Signature: .....

This document consists of **15** printed pages and **1** blank page.

Do not turn over the page until you are told to do so.

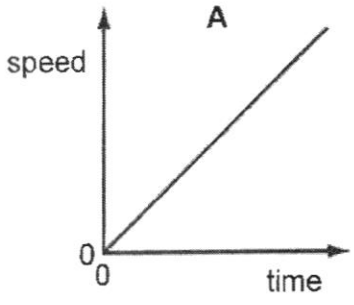
1 The diagram shows a micrometer scale.

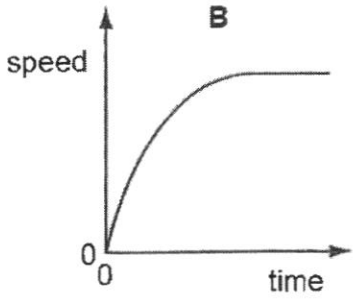


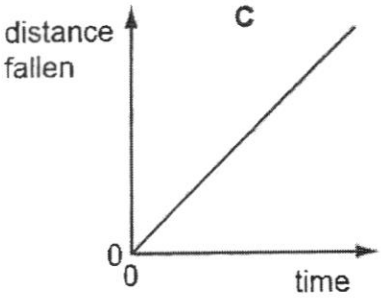
Which reading is shown?

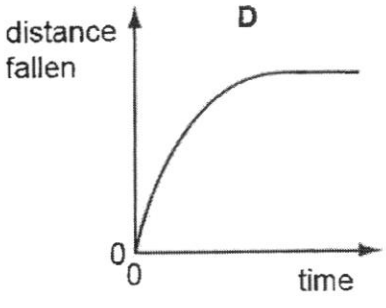
A 5.64 mm **B** 7.14 mm **C** 7.16 mm **D** 7.64mm

2 Which graph shows the motion of a heavy, steel ball falling from a height of 2 m?

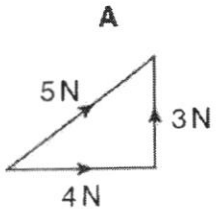


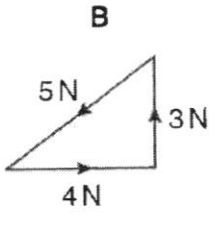


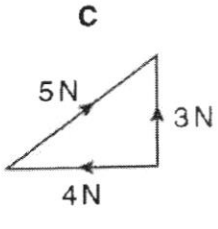


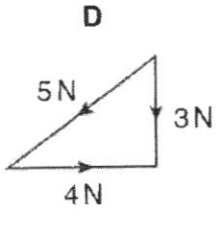


3 Which diagram correctly shows the addition of a 4 N and a 3 N force?









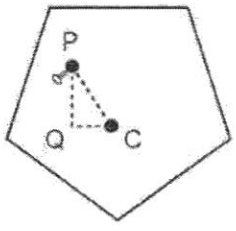
4 An object that has a mass of 15 kg on the Earth is taken to the Moon. The gravitational field strength on the Earth is 10 N/kg and on the Moon is 1.6 N/kg.

What are the mass and the weight of the object on the Moon?

	mass / kg	weight / N
A	15	24
B	15	150
C	24	15
D	150	24

5 A plane lamina is freely suspended from point P.
The weight of the lamina is 2.0 N and the centre of gravity is at C.

PC = 0.50 m
PQ = 0.40 m
QC = 0.30 m



lamina

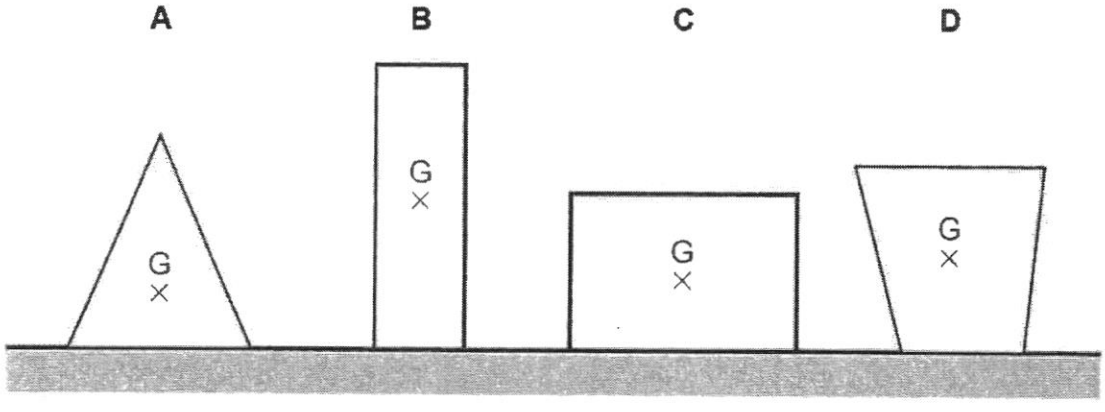
The lamina is displaced to the position shown.

What is the moment that will cause the lamina to swing?

A 0.60 N m clockwise
B 0.80 N m anticlockwise
C 1.0 N m clockwise
D 1.0 N m anticlockwise

6 Four objects of equal mass rest on a table.
The centre of gravity of each object is labelled G.

Which object is the least stable?



7 Four students exercised in a gym.

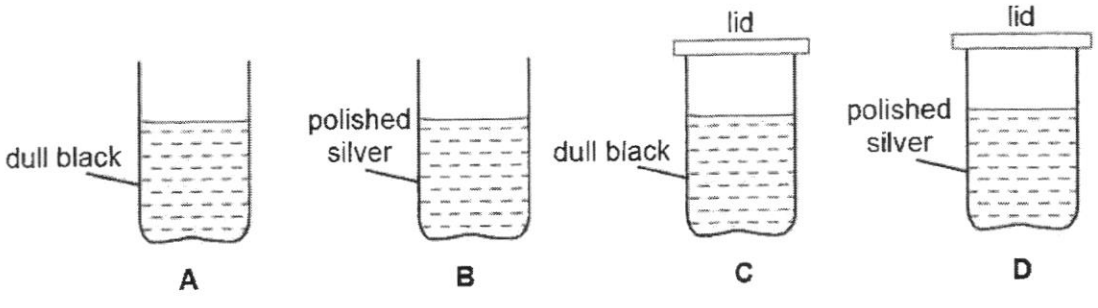
Which student did the most work?

	exercise time / s	power developed / W
A	50	250
B	100	150
C	200	200
D	250	30

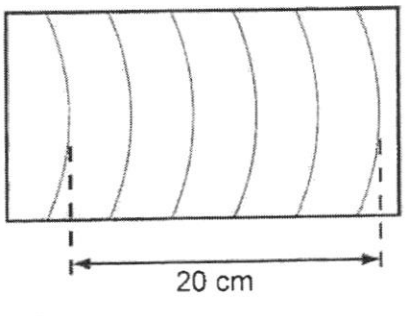
8 Assuming the temperature remains constant, which combination correctly describes the volume and the shape of a gas or liquid?

	gas or liquid	volume	shape
A	gas	fixed	not fixed
B	gas	not fixed	not fixed
C	liquid	fixed	fixed
D	liquid	not fixed	fixed

9 The diagram shows four similar cans. Each can contains the same volume of water initially at 80 °C. After five minutes, which can will contain the coolest water?



10 The dipper in a ripple tank vibrates at a frequency of 4.0 Hz and the resulting wave pattern is photographed. The distance between the two crests shown is 20 cm.



What is the speed of the wave?

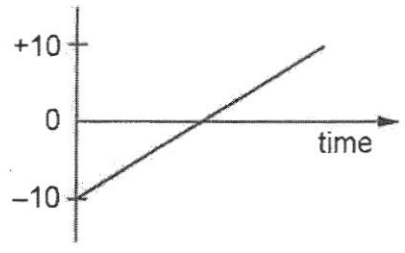
A 4 cm/s **B** 5 cm/s **C** 16 cm/s **D** 20 cm/s

[Turn over

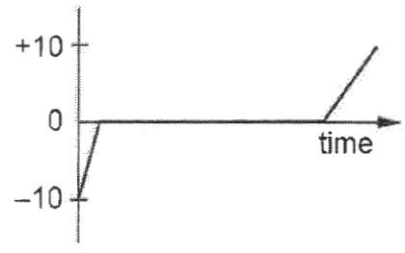
11 Ice at –10 °C is heated at a constant rate until it is water at +10 °C.

Which graph shows how the temperature changes with time?

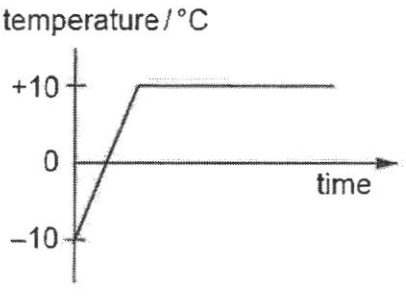
A



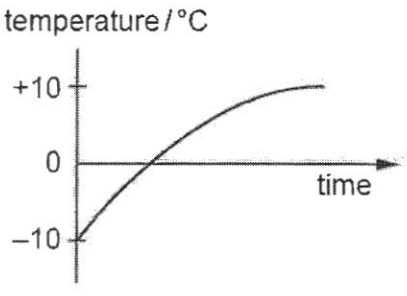
B



C



D



12 The human eye has a converging lens system that produces an image at the back of the eye.

If the eye views a distant object, which type of image is produced?

A real, erect, same size

B real, inverted, diminished

C virtual, erect, diminished

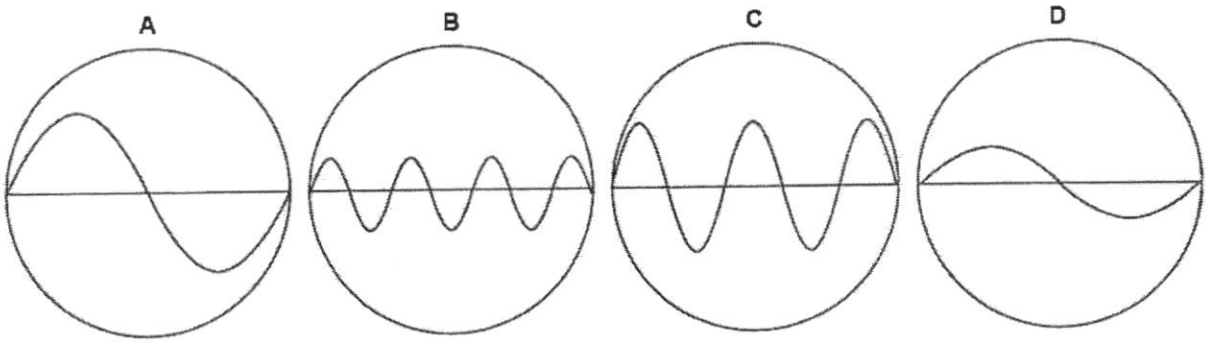
D virtual, inverted, magnified

13 Radio waves, visible light and X-rays are all part of the electromagnetic spectrum.

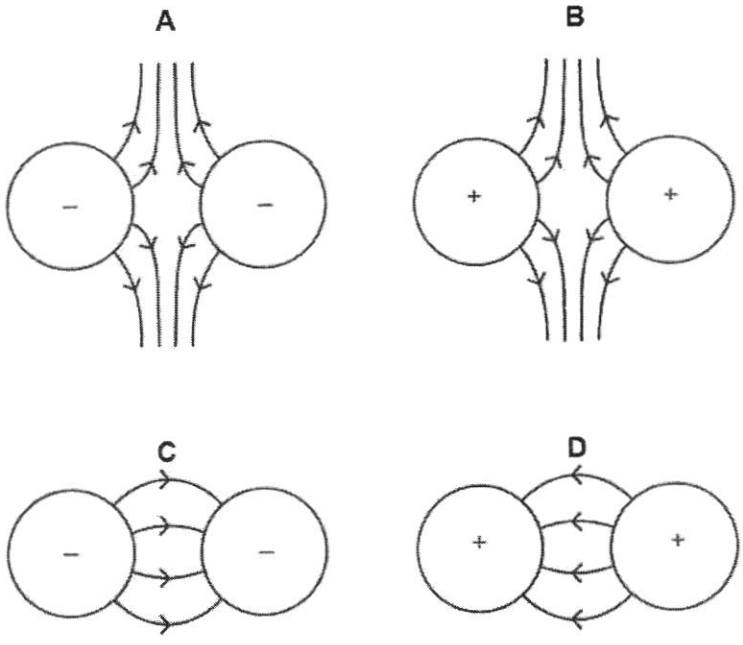
What is the correct order of increasing wavelength?

	shortest ——————————> *longest*		
A	radio waves	visible light	X-rays
B	radio waves	X-rays	visible light
C	X-rays	radio waves	visible light
D	X-rays	visible light	radio waves

14 The diagrams represent sound waves displayed on an oscilloscope.
Assuming the controls of the oscilloscope remain the same for each sound, which diagram represents the quietest sound with the highest frequency?



15 Which diagram correctly shows the electric field between two charged spheres?



16 An electrical quantity is defined as 'the energy converted by a source in driving a unit charge round a complete circuit.'

What is this quantity called?

A current
B electromotive force
C potential difference
D power

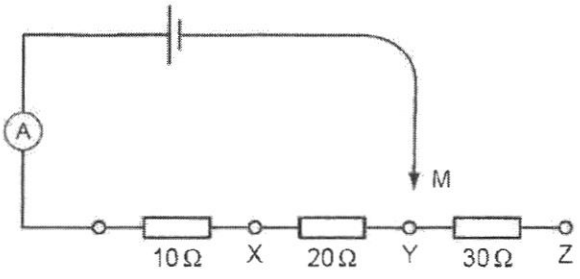
17 A combined bathroom unit of a heater and a lamp is controlled by one switch. The unit contains a 2 kW heater and a 100 W lamp. In one week, the lamp uses 1 kW h of electrical energy.

How much electrical energy is used by the heater alone?

A 2 kW h **B** 4 kW h **C** 10 kW h **D** 20 kW h

[Turn over

18 The diagram shows a cell connected in series with an ammeter and three resistors (10 Ω, 20 Ω, 30 Ω). The circuit can be completed by a moveable contact M.



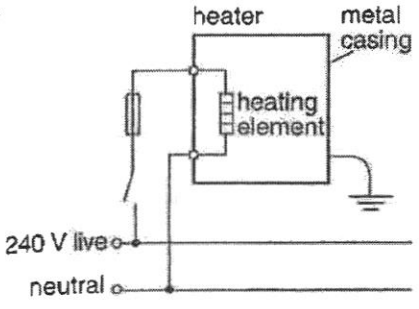
When M is connected to X, the ammeter reads 0.6 A.

What is the ammeter reading when M is connected to Y?

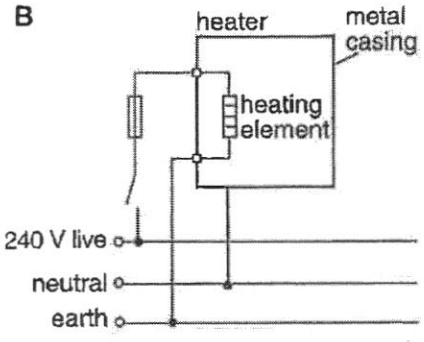
A 0.1 A **B** 0.2 A **C** 0.3 A **D** 0.6 A

19 Which of the following correctly shows how a water heater should be connected to the mains?

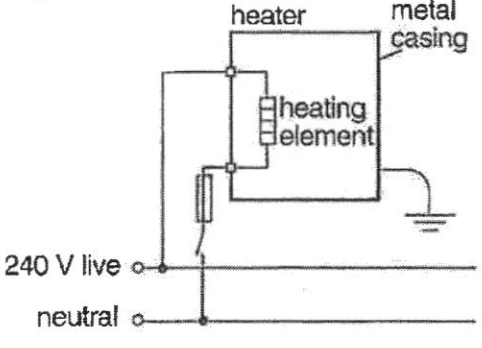
A



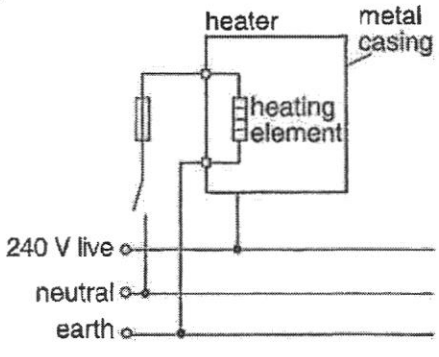
B



C

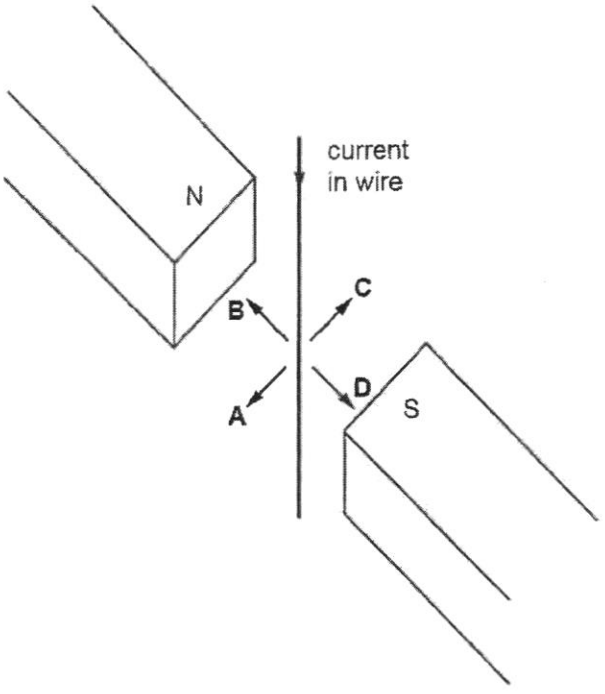


D



20 A wire hangs between the poles of a magnet.

When there is a current in the wire, in which direction does the wire move?



21 A student carried out an experiment to study the rate of reaction when a piece of magnesium was added to some dilute hydrochloric acid.

Which piece of apparatus is **not** required for this experiment?

A Bunsen burner
B conical flask
C gas syringe
D stop-watch

22 An aqueous solution of zinc chloride is tested by adding reagents.

Which observation is correct?

	reagent	observations
A	acidified aqueous barium nitrate	white precipitate
B	aqueous ammonia	white precipitate, soluble in excess
C	aqueous sodium hydroxide	white precipitate, insoluble in excess
D	powdered copper	grey precipitate

23 The particles in substance Z are widely spaced and able to move freely.
Z changes to a state in which the particles are in contact but are still able to move freely.

What is this change called?

A condensation
B evaporation
C freezing
D melting

24 Four atoms are shown.

$^{14}_{6}C$ $^{15}_{7}N$ $^{16}_{8}O$ $^{17}_{9}F$

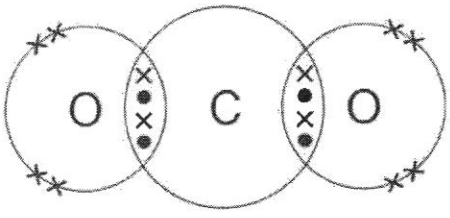
Which statement about all four atoms is correct?

A They have the same number of electrons.
B They have the same number of neutrons.
C They have the same number of nucleons.
D They have the same number of protons.

25 The bonding in a molecule of carbon dioxide can be represented by a 'dot-and-cross' diagram.

Which diagram is correct?

A



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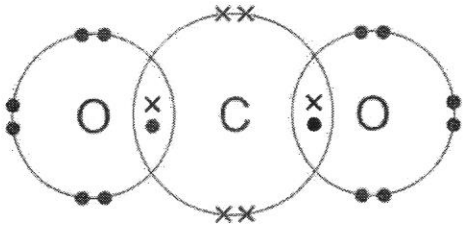
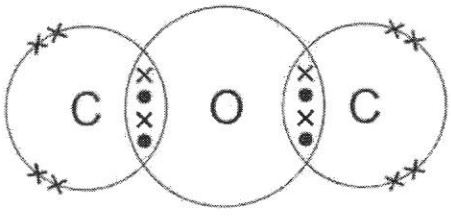


C



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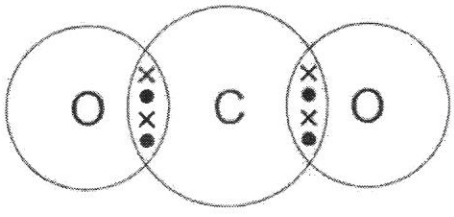


26 The relative atomic mass of chlorine is 35.5.

What is the mass of 2 moles of chlorine gas?

A 17.75 g
B 35.5 g
C 71 g
D 142 g

27 Methane burns in oxygen.

$$CH_4(g) + 2O_2(g) \longrightarrow CO_2(g) + 2H_2O(l)$$

10 cm^3 of methane reacted with 25 cm^3 of oxygen.

What is the total volume of gas that would be measured after the reaction?

Assume all volumes of gases are measured at room temperature and pressure.

A 10 cm^3
B 15 cm^3
C 30 cm^3
D 35 cm^3

28 Solutions of two chemicals are mixed in a beaker.

A reaction occurs and a decrease in temperature is observed.

Which statement is correct?

A An endothermic reaction occurs and the reacting chemicals gain energy.
B An endothermic reaction occurs and the reacting chemicals lose energy.
C An exothermic reaction occurs and the reacting chemicals gain energy.
D An exothermic reaction occurs and the reacting chemicals lose energy.

29 Magnesium oxide reacts with sulfuric acid.

Which change increases the rate of reaction by increasing the movement of the particles?

A increase in concentration of sulfuric acid
B increase in surface area of magnesium oxide
C increase in temperature of sulfuric acid
D using a catalyst

30 Which statements about oxidation and reduction are correct?

1 Reduction can involve the loss of oxygen.
2 Oxidation can involve the loss of hydrogen.
3 Reduction can involve the loss of electrons.

A 1 and 2 only
B 1 and 3 only
C 2 and 3 only
D 1, 2 and 3

31 In a neutralisation reaction, which change in particles occurs?

A atoms $\longrightarrow$ ions
B atoms $\longrightarrow$ molecules
C ions $\longrightarrow$ atoms
D ions $\longrightarrow$ molecules

32 Flowers of a hydrangea bush are blue when grown in acidic soil and pink when the soil is alkaline.

Which substance is added to the soil of a hydrangea with blue flowers so that it produces pink flowers?

A calcium hydroxide
B citric acid
C copper(II) sulfate
D sodium chloride

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

A Elements at the left-hand side of the Periodic Table are more metallic than those, in the same period, near the right-hand side.

B Elements at the top of a group lose electrons more readily than those, in the same group, that are lower in the Periodic Table.

C Elements in the same group of the Periodic Table have the same number of shells of electrons.

D Elements in the same period of the Periodic Table have the same number of electrons in the outer shell.

34 Which statement about the properties of the elements in Group 0 of the Periodic Table, helium to xenon, is correct?

A Argon reacts with iron to form a compound.

B Helium is less dense than air.

C The elements change from gas to solid down the group.

D The elements exist as covalent molecules.

35 Steel is often galvanised.

Which statements about galvanising are correct?

1 Galvanising makes a steel alloy.
2 Galvanising provides a sacrificial protection against rusting.
3 Galvanising coats a layer of zinc onto steel.

A 1 and 2 only
B 1 and 3 only
C 2 and 3 only
D 1, 2 and 3

36 Which pair of substances act as reducing agents in the blast furnace?

A carbon and carbon monoxide
B carbon and oxygen
C carbon dioxide and oxygen
D carbon monoxide and carbon dioxide

37 Which pollutant gas is produced by both lightning activity and internal combustion engines?

A carbon monoxide
B nitrogen dioxide
C ozone
D sulfur dioxide

38 Which statement about alkanes is correct?

A Alkanes are described as being saturated because they are insoluble in water.
B Alkanes react with chlorine in an addition reaction.
C The alkane containing 10 carbon atoms in each molecule has a higher viscosity than the alkane containing 20 carbon atoms.
D The formula of an alkane with 35 carbon atoms in each molecule is $C_{35}H_{72}$.

39 Which petroleum fraction is used as a fuel for aircraft engines?

A bitumen
B diesel
C paraffin
D petrol

40 An organic compound E reacts with acidified potassium manganate(VII) solution causing a colour change.

What is E?

A ethane
B ethanoic acid
C ethanol
D poly(ethene)

END OF PAPER

Name and Index Number: ( )	Class:

SENG KANG SECONDARY SCHOOL PRELIMINARY EXAMINATION

SCIENCE (CHEMISTRY) 5076/03, 5078/03

Secondary 4 Express/
Secondary 5 Normal Academic

24 August 2022

Paper 3 Theory

1 hour 15 minutes

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

READ THESE INSTRUCTIONS FIRST

Write your index number and name on all the work you hand in.
Write in dark blue or black pen on both sides of the paper.
You may use a soft pencil for any diagrams, graphs or rough working.
Do not use staples, paper clips, highlighters, glue or correction fluid.

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

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

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

A copy of the Data Sheet is printed on page 15.
A copy of the Periodic Table is printed on page 16.

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.

For Examiner's use	
Section A	**/ 45**
1	/ 6
2	/ 7
3	/ 6
4	/ 6
5	/ 10
6	/ 10
Section B	**/ 20**
7	/ 10
8	/ 10
9	/ 10
Total	**/ 65**
Total %	**/ 100**

Parent's / Guardian's Signature: .....

This document consists of **16** printed pages and **0** blank page.

Do not turn over the page until you are told to do so.

[Turn over

Section A

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

1 Choose from the following oxides to answer the questions.

aluminium oxide
calcium oxide
carbon monoxide
copper(II) oxide
magnesium oxide
sodium oxide
sulfur dioxide

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

Identify an oxide which:

(a) is amphoteric

..... [1]

(b) contains ions with a 1+ charge

..... [1]

(c) is formed from the incomplete combustion of carbon-containing fuel

..... [1]

(d) contributes to acid rain

..... [1]

(e) is a product of the thermal decomposition of calcium carbonate

..... [1]

(f) is a black solid.

..... [1]

2 **(a)** Group I and Group VII elements show different trends in their properties.

Group I
Li
Na
K
Rb

Group VII
F
Cl
Br
I

(i) Describe the trend in melting point down each group.

.....

..... [1]

(ii) Describe the trend in reactivity down each group.

.....

..... [1]

(b) Table 2.1 shows the **most common** oxidation states of four elements, **A**, **B**, **C** and **D** in their compounds.

Table 2.1

element	most common oxidation state	metal or non-metal?
A	–2	
B	+1	non-metal
C	+3	
D	–1	

(i) Complete Table 2.1 by filling in the last column to show which elements are **metals** or **non-metals**. [1]

(ii) Use the letters **A**, **B**, **C** and **D** to answer the following questions.

(a) Which element is most likely to be hydrogen?

..... [1]

(b) Which element is most likely to be in Group VI?

..... [1]

(c) No elements from Group 0 appear in Table 2.1.
Explain why this statement is true.

.....

..... [2]

[Turn over

3 Simple alcohols form a homologous series. Butanol is an example of an alcohol and has the following structure as shown in Fig. 3.1.

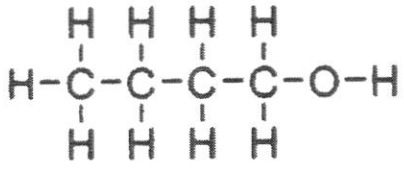


Fig. 3.1

(a) Give the general formula for the homologous series of alcohols.

..... [1]

(b) **(i)** Name and give the chemical formula for the second member of the homologous series.

name .....

chemical formula ..... [2]

(ii) When left exposed to air, this alcohol is slowly oxidised.

Give the name and draw the full structural formula of the product of this oxidation.

name .....

full structural formula

[3]

4 Metals are extracted from their oxides by reduction.
Table 4.1 shows the minimum temperature that is needed for the reduction of some metal oxides by reaction with carbon.

Table 4.1

metal oxide	minimum temperature needed for reduction /°C
calcium oxide	2100
zinc oxide	900
copper(II) oxide	100
magnesium oxide	1600
lead(II) oxide	400

(a) **(i)** How does the temperature needed for reduction relate to the reactivity of the metal?

.....

..... [1]

(ii) Predict the minimum temperature needed for the reduction of iron oxide by reaction with carbon.

Explain your reasoning.

temperature .....°C

reason .....

..... [2]

(b) **(i)** Zinc metal can react with steam.

Give the names of the **two** products of this reaction.

..... and ..... [1]

(ii) Construct a chemical reaction, with state symbols, for the reaction of zinc and steam.

..... [2]

5 Salts can be prepared by different methods.

(a) State the type of reaction that occurs when an acid reacts with an alkali to form a salt and water.

..... [1]

(b) Construct an ionic equation, with state symbols, for the reaction in **(a)**.

..... [2]

(c) Sodium sulfate is soluble in water. To prepare crystals of this salt, a neutral and colourless solution of sodium sulfate must be prepared.

Describe how you would prepare this sodium sulfate solution from sodium hydroxide solution, a suitable indicator and an acid.

.....

.....

.....

..... [3]

(d) Aqueous sodium sulfate is used to prepare barium sulfate according to the following equation.

$$Ba^{2+}(aq) + SO_4^{2-}(aq) \longrightarrow BaSO_4(s)$$

(i) Name the method that is used to prepare barium sulfate.

..... [1]

(ii) State the colour of the barium sulfate that is formed.

..... [1]

(iii) In another experiment 20.0 cm^3 of 0.550 mol/dm^3 of barium nitrate is added to an excess of sodium sulfate as follow.

$$Ba(NO_3)_2(aq) + Na_2SO_4(aq) \longrightarrow BaSO_4(s) + 2NaNO_3(aq)$$

Showing your working clearly, calculate the maximum mass of barium sulfate that could be made in the reaction. Give your answer correct to **three** significant figures.

maximum mass of barium sulfate = ... g [2]

6 **(a)** Calcium reacts with water to form aqueous calcium hydroxide, which is commonly referred to as limewater. A solution of calcium hydroxide has an approximate pH of 8.

Some reactions of calcium and calcium hydroxide are shown in Fig. 6.1.

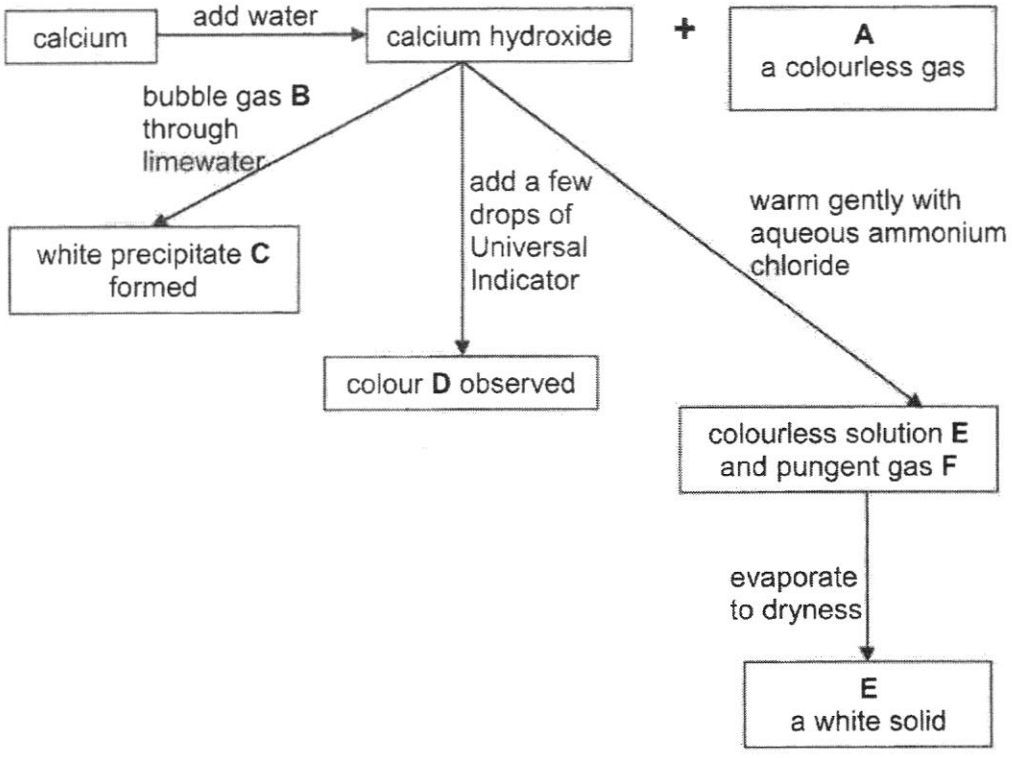


Fig. 6.1

Identify

A .....

B .....

C .....

colour **D** .....

E .....

F ..... [6]

(b) Describe how you would carry out a test to confirm the identity of gas **A**. Include the observation you would expect.

chemical test: .....

observation: .....

..... [1]

(c) Solid **E** has a melting point of 772°C.

(i) Deduce the type of bonding that is present in solid **E**.

..... [1]

(ii) Explain, in terms of structure and bonding, why solid **E** has such a high melting point.

.....

.....

.....

.....

..... [2]

Section B

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

Write your answers in the spaces provided.

7 Iron(II) carbonate powder reacts with dilute sulfuric acid.

$$FeCO_3(s) + H_2SO_4(aq) \longrightarrow FeSO_4(aq) + CO_2(g) + H_2O(l)$$

(a) The graph in Fig. 7.1 shows the volume of carbon dioxide that is produced at 20°C as the reaction proceeds.

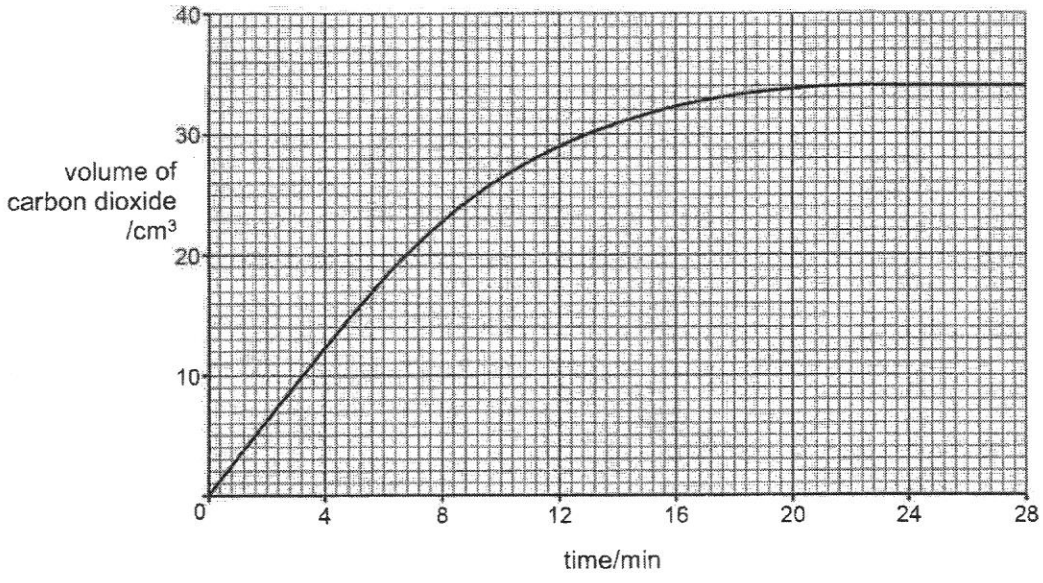


Fig. 7.1

(i) State how long it takes from the start of the experiment to collect 18 cm^3 of carbon dioxide gas.

.....

[1]

(ii) The experiment is repeated at 30°C. All other conditions remain the same.

On the same grid in Fig. 7.1, draw the graph to show how the volume of carbon dioxide gas produced changes with time when the reaction is carried out at 30°C. [2]

(b) **(i)** Explain, in terms of collisions between reacting particles, why a higher temperature affects the rate of reaction. All other conditions remain the same.

.....

.....

.....

[2]

(b) **(ii)** When the reaction between iron(II) carbonate and dilute sulfuric acid is complete, describe how you would carry out a test to show the presence of iron(II) ions in the resulting solution.

Include the observation you would expect.

chemical test: .....

.....

observation: .....

..... [2]

(c) Showing your working clearly, calculate the maximum volume, in dm^3, of carbon dioxide produced when 6.96 g of iron(II) carbonate react with excess dilute sulfuric acid at room temperature and pressure.

maximum volume of carbon dioxide = ... dm^3 [3]

8 Alkenes are a homologous series of hydrocarbons.

(a) **(i)** How does the boiling point of an alkene with three carbon atoms in each molecule compare with the boiling point of an alkene with two carbon atoms?

.....

..... [1]

(ii) Suggest a possible explanation for this difference in **(a)(i)**.

.....

..... [1]

(b) **(i)** Which **two** compounds are formed when an alkene burns in excess air?

..... and ..... [1]

(ii) Write the balanced chemical equation for burning, in excess air, the alkene with two carbon atoms in each molecule.

..... [2]

(c) Margarine is manufactured from vegetable oils using a nickel catalyst.

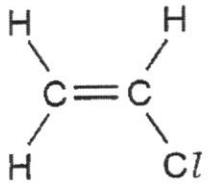
(i) Name the other reactant used in this reaction.

..... [1]

(ii) State the type of chemical reaction which occurs when margarine is manufactured from vegetable oils.

..... [1]

(d) The structure of chloroethene is shown.



Chloroethene is the monomer used to make poly(chloroethene).
Poly(chloroethene) is commonly known as poly(vinyl chloride) (PVC) and is used in the construction industry, for example, in electrical cables and water pipes.
Poly(chloroethene) is non-biodegradable.

(i) Draw the full structural formula of two repeating units of poly(chloroethene). Show all the bonds in your answers.

[2]

(ii) Describe **one** environmental problem caused by the disposal of non-biodegradable plastics.

.....

..... [1]

9 **(a)** Not all of the atoms of bromine are identical. Examples of bromine atoms that occur naturally are ^{79}Br and ^{81}Br.

(i) What name is given to atoms such as ^{79}Br and ^{81}Br?

..... [1]

(ii) Explain why different atoms of bromine can have different masses but have the same chemical properties.

.....

..... [2]

(b) Phosphorus, a non-metal, reacts with bromine to form phosphorus tribromide, PBr_3, according to the following equation.

$$2P + 3Br_2 \longrightarrow 2PBr_3$$

PBr_3 is a colourless liquid. It has to be handled and stored carefully because it is very toxic, and it reacts very vigorously with water.

(i) Draw 'dot-and-cross' diagram to show the bonding in PBr_3.

Show outer electrons only.

[3]

(ii) Deduce the colour change that will be observed when phosphorus reacts with bromine to form phosphorus tribromide.

..... [1]

(iii) The reaction of phosphorus with bromine to form phosphorus tribromide is also a redox reaction.

Use ideas about oxidation states to explain your answer.

.....

.....

.....

..... [2]

(iv) When phosphorus tribromide reacts with water, it forms phosphorus acid, H_3PO_3, and hydrogen bromide, HBr.

Construct a balanced chemical equation for this reaction.

..... [1]

END OF PAPER

2022 4E5NA Science Chemistry Preliminary Examination Answer Scheme

Paper 1

1/21	A	2/22	B	3/23	A	4/24	B	5/25	A
6/26	D	7/27	B	8/28	A	9/29	C	10/30	A
11/31	D	12/32	A	13/33	A	14/34	B	15/35	C
16/36	A	17/37	B	18/38	D	19/39	C	20/40	C

2022 4E5NA Science Chemistry Preliminary Examination Answer Scheme
Paper 3

1 **(a)** aluminium oxide 1

(b) sodium oxide 1

(c) carbon monoxide 1

(d) sulfur dioxide 1

(e) calcium oxide 1

(f) copper(II) oxide 1

2 **(a)** **(i)** Melting point decreases down Group I, and increases down Group VII 1

(ii) Reactivity increases down Group I, and decreases down Group VII 1

(b) **(i)**

element	most common oxidation state	metal or non-metal?
A	–2	**non-metal**
B	+1	non-metal
C	+3	**metal**
D	–1	**non-metal**

All correct - 1

(ii) **(a)** B **(b)** A 1, 1

(c) **The following answers are acceptable:**

Group 0 elements have a full valence shell / completely-filled outer shell / electronically stable, 1

exist as elements and will not form ions 1

OR

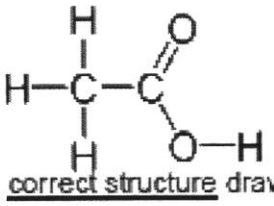
They will not form compounds / will exist as elements 1

Hence, oxidation state is zero and no elements in Table 2.1 have oxidation states of zero. 1

3 (a) $C_nH_{2n+1}OH$ 1

(b) (i) name: ethanol chemical formula: C_2H_5OH 1, 1

(ii) ethanoic acid 1



correct structure drawn, no need to slant bonds; ALL bonds are drawn 1 ,1

4 (a) (i) The more reactive the metal, the higher the temperature. 1
[Accept converse reasoning]

(ii) Any number greater than 400 and less than 900 1

Reason: iron is more reactive than lead. but less reactive than zinc 1

[NO marks if students mention position of metals in reactivity series]

(b) (i) zinc oxide and hydrogen 1

(ii) $Zn(s) + H_2O(g) \rightarrow ZnO(s) + H_2(g)$

All correct formulae and correctly balanced (accept correct multiples) 1

All state symbols are correct *1

*state symbol mark can only be awarded when all the formulae are correct

5 (a) neutralisation

(b) $H^+(aq) + OH^-(aq) \rightarrow H_2O(l)$

All correct formulae and correctly balanced (accept correct multiples) 1

All state symbols are correct *1

*state symbol mark can only be awarded when all the formulae are correct

[NOTE: NO mark if chemical equation is written]

(c) Titrate sodium hydroxide against sulfuric acid with appropriate indicator eg methyl orange (accept screened methyl orange) 1

Brief description of how a neutral sodium sulfate solution is obtained by the change of appropriate colours in indicator used 1

Brief description of appropriate volume of sulfuric acid needed for neutralisation and repeat experiment without the indicator 1

(d) (i) precipitation [NO mark: method 3 ; wrong spelling] 1

(ii) white 1

(iii) no. of moles of $Ba(NO_3)_2 = 0.550 \times (20.0/1000) = 0.0110$ moles (0.011✓) 1

max mass of $BaSO_4 = 0.0110 \times [137+32+4(16)] = 2.563 \approx 2.56$ g (3sf) 1

[NO mark if there is NO working!]

Setter: Mrs S Yap

6	(a)	**A**	hydrogen / H_2	1
		B	carbon dioxide / CO_2	1
		C	calcium carbonate / $CaCO_3$	1
		D	blue	1
		E	calcium chloride / $CaCl_2$	1
		F	ammonia / NH_3	1
	(b)	lighted splint "pop" sound with lighted splint / extinguished with "pop" sound		1
	(c)	(i)	ionic bonding	1
		(ii)	much energy required to overcome the strong electrostatic attraction	1
			between the oppositely-charged ions	1
7	(a)	(i)	6 min [**NO marks** if no unit or wrong unit]	1
		(ii)	initial gradient steeper and starting from origin	1
			horizontal line portion of curve levels off at 34 cm^3 gas	1
	(b)	(i)	rate of reaction increases and	
			① particles move faster / particles have more kinetic energy / more particles obtain minimum activation energy	1
			② more frequent effective collisions	1
			[**NOTE:** rate of reaction increases alone = **NO mark**]	
		(ii)	chemical test: add sodium hydroxide / aqueous ammonia till in excess	1
			observation: green ppt insoluble in excess	1
	(c)		No. of moles of $FeCO_3$ = 6.96 / [56 + 12 + 3(16)] = 0.06 mol	1
			Max vol. of CO_2 = 0.06 x 24 [allow ecf]	1
			= 1.44 dm^3	1
			[**NOTE**: **NO mark** awarded for numbers without working]	
8	(a)	(i)	higher boiling point	1
		(ii)	more energy is required to overcome the greater number of intermolecular forces in alkene with three carbon atoms	1
	(b)	(i)	carbon dioxide **and** water vapour (accept water)	1
		(ii)	$C_2H_4 + 3O_2 \rightarrow 2CO_2 + 2H_2O$	
			all formulae are correct	1
			correctly balanced (accept correct multiples)	1
			State symbols are **NOT** required, if state symbols are written and are wrong, to **award maximum of 1 mark**	

Setter: Mrs S Yap

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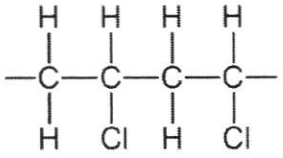
(c) **(i)** hydrogen — 1

(ii) addition — 1

[**NO mark** if hydrogenation is written]

(d) **(i)**



2 repeat units shown — 1
extension bonds at both ends — 1

(ii) Any **one** of the following — 1
- release of toxic gases upon incineration
- take up space in landfills
- endanger marine animals when thrown into sea

9 **(a)** **(i)** Isotopes — 1

(ii) different number of neutrons give rise to different masses — 1

same number of valence electrons → same chemical properties — 1

(b) **(i)** 3 pairs of bonding electrons between each Br and P — 1
6 unpaired electrons on each bromine & 2 unpaired electrons on P — 1
atoms are labelled with P and Br appropriately — 1

(ii) from red-brown to colourless — 1

(iii) P is oxidised, increase in oxidation states from 0 to +3 — 1

Br_2 is reduced, decrease in oxidation states from 0 to –1 — 1

[**NOTE**: just stating oxidised or reduced alone will **not** be awarded marks]

(iv) $PBr_3 + 3H_2O \rightarrow H_3PO_3 + 3HBr$ — 1

Setter: Mrs S Yap

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