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BROADRICK SECONDARY SCHOOL

SECONDARY 4 EXPRESS

PRELIMINARY EXAMINATION 2024

CHEMISTRY

6092/01

Paper 1 Multiple Choice

August 2024

Additional Materials: Multiple Choice Answer Sheet

1 hour

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

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

Write your name, index number and class on the OTAS answer sheet.

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 separate Multiple Choice answer sheet.

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.

The use of an approved scientific calculator is expected, where appropriate.

A copy of the Periodic Table is printed on page **14**.

For Examiner's Use
40

This document consists of **14** printed pages including this page

1 Which apparatus is **not** required in titration experiments?

- A burette
- B conical flask
- C measuring cylinder
- D white tile

2 Which conditions will give the highest rate of diffusion of a gas?

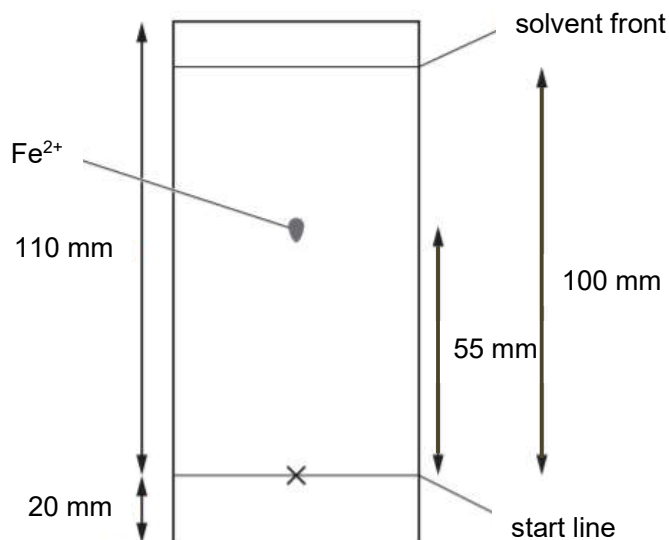
	relative molecular mass of gas	temperature
A	high	low
B	high	high
C	low	low
D	low	high

3 Butyl ethanoate and water are two immiscible liquids with similar boiling points.

Which method is most suitable to separate a mixture of water and butyl ethanoate?

- A evaporation to dryness
- B filtration
- C simple distillation
- D use a separating funnel

- 4 A paper chromatography experiment is used to find the R_f value for $\text{Fe}^{2+}(\text{aq})$. The chromatogram is shown.



To make the spot containing $\text{Fe}^{2+}(\text{aq})$ more visible, the paper is sprayed with a locating agent that forms a precipitate of iron(II) hydroxide on the spot.

In the chromatogram, the R_f of $\text{Fe}^{2+}(\text{aq})$ is given by1.... and the colour of the precipitate is2.....

	gap 1	gap 2
A	0.42	red-brown
B	0.45	green
C	0.50	red-brown
D	0.55	green

- 5 Which technique is involved in all of the following processes?

- 1 obtaining copper(II) sulfate crystals from aqueous copper(II) sulfate
- 2 obtaining ethanol from the fermentation of glucose
- 3 obtaining nitrogen from liquid air

- A** crystallisation
B evaporation
C filtration
D fractional distillation

- 6 During a change in physical state at constant temperature and pressure:
- average distance between the particles has a small change,
 - energy is released as stronger forces of attraction form between the particles.

Which change of state is being described?

- A** gas to solid
- B** gas to liquid
- C** liquid to solid
- D** solid to liquid

- 7 X, Y and Z are elements.

X and Y are in the same period of the Periodic Table.

Y and Z are in the same group of the Periodic Table.

What are the possible electronic configurations for X, Y and Z?

	X	Y	Z
A	2,1	2,7	2,8,4
B	2,1	2,8,1	2,8,8,1
C	2,4	2,8,4	2,8,7
D	2,8,4	2,8,7	2,7

- 8 In which molecule are all the outer electrons of the atoms involved in bonding?

- A** CO₂
- B** CH₄
- C** HBr
- D** NH₃

- 9 Which substance has a giant ionic lattice structure at room temperature?

- A** graphite
- B** methane
- C** potassium oxide
- D** water

- 10 Diamond and graphite are different allotropes of carbon.

Which row describes the uses of diamond and graphite?

	use		
	to perform drilling	as an electrode	as a lubricant
A	diamond	graphite	graphite
B	diamond	diamond	diamond
C	graphite	diamond	graphite
D	graphite	graphite	diamond

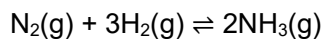
- 11 Which pair of substances is able to conduct electricity due to the presence of mobile ions?

- A** aqueous potassium nitrate and molten potassium nitrate
- B** aqueous potassium nitrate and solid potassium metal
- C** solid graphite and solid potassium metal
- D** solid graphite and molten potassium nitrate

- 12 What is the ionic equation for the reaction between aqueous potassium carbonate and dilute nitric acid?

- A** $\text{H}^+(\text{aq}) + \text{OH}^-(\text{aq}) \rightarrow \text{H}_2\text{O}(\text{l})$
- B** $2\text{K}^+(\text{aq}) + \text{NO}_3^-(\text{aq}) \rightarrow \text{H}_2\text{O}(\text{l})$
- C** $\text{CO}_3^{2-}(\text{aq}) + 2\text{H}^+(\text{aq}) \rightarrow \text{CO}_2(\text{g}) + \text{H}_2\text{O}(\text{l})$
- D** $2\text{NO}_3^-(\text{aq}) + 2\text{H}^+(\text{aq}) \rightarrow 2\text{CO}_2(\text{g}) + \text{H}_2\text{O}(\text{l})$

- 13 Ammonia is manufactured from nitrogen and hydrogen by the Haber process.



What is the percentage yield when 30 kg of ammonia is produced from 30 kg of hydrogen?

- A** 5.9%
- B** 17.6%
- C** 35.3%
- D** 66.7%

- 14 Which hydrocarbon has the highest percentage of hydrogen by mass?
- A CH_4
 - B C_3H_8
 - C C_4H_{10}
 - D C_5H_{12}
- 15 What is a property of halogens?
- A their atoms decrease in size down the group
 - B their melting points increase down the group
 - C they conduct electricity in the solid state
 - D their silver salts are all soluble in water
- 16 Which property is common to ^{40}Ca , ^{39}K and ^{24}Mg ?
- A they sink when added to water
 - B their atoms have more neutrons than protons
 - C their ions have eight electrons in the outermost shell
 - D they are deposited at the anode when their molten chloride is electrolysed
- 17 Three statements about the elements carbon, nitrogen and sulfur are shown.
- 1 They are found in groups next to each other in the Periodic Table.
 - 2 Their proton to neutron ratios are all one to two.
 - 3 They can form acidic oxides.

Which of the statements is/are true?

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

- 18 Helium and xenon are both noble gases.

What is true of both elements?

	they are chemically inert	both atoms have eight electrons in their outer shell
A	✓	✓
B	✓	×
C	×	✓
D	×	×

- 19 Why is ethanoic acid considered as a weak acid?

- A** It is a relatively poor conductor of electricity.
- B** It dissociates partially in water.
- C** It is an acid found in food.
- D** It reacts with very reactive metals.

- 20 A student titrates aqueous sodium hydroxide from a burette with dilute hydrochloric acid in a conical flask. After the titration is complete, the conical flask is emptied.

What is the correct procedure before the next titration?

- A** Rinse out the conical flask with aqueous sodium hydroxide.
- B** Rinse out the conical flask with dilute hydrochloric acid.
- C** Rinse out the conical flask with distilled water.
- D** Use the conical flask again without rinsing

- 21 A white precipitate formed after the addition of dilute nitric acid and aqueous silver nitrate to unknown solution Y.

What could the unknown solution Y be?

- A** barium nitrate
- B** calcium carbonate
- C** copper(II) chloride
- D** potassium sulfate

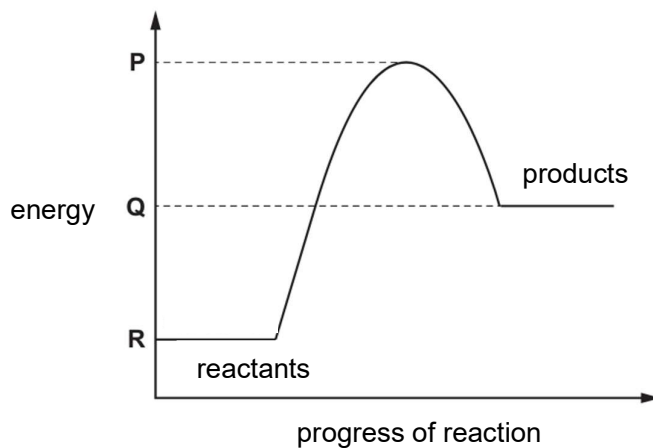
- 22 Which pair of chemicals is most suitable to prepare a pure sample of copper(II) nitrate?

	chemical 1	chemical 2
A	copper	dilute nitric acid
B	copper	aqueous potassium nitrate
C	copper(II) carbonate	dilute nitric acid
D	copper(II) carbonate	aqueous potassium nitrate

- 23 Ammonia gas is produced using the Haber process.

Which statement best explains why a higher temperature of 450 °C is used although a lower temperature of 250 °C produces a higher yield of ammonia.

- A** At 250 °C, smaller volume of ammonia will be collected.
B At 250 °C, the rate of ammonia production is too low.
C At 450 °C, the catalyst will be more effective.
D At 450 °C, ammonia will be collected in the gaseous state.
- 24 The diagram shows the energy profile diagram for a chemical reaction.



Which of the following can be deduced from the diagram?

	nature of reaction	activation energy
A	endothermic	$P - R$
B	endothermic	$P - Q$
C	exothermic	$P - R$
D	exothermic	$P - Q$

25 Which method of preparation of magnesium nitrate is an example of a redox reaction?

- A $\text{Mg} + 2\text{HNO}_3 \rightarrow \text{Mg}(\text{NO}_3)_2 + \text{H}_2$
 B $\text{MgO} + 2\text{HNO}_3 \rightarrow \text{Mg}(\text{NO}_3)_2 + \text{H}_2\text{O}$
 C $\text{Mg}(\text{OH})_2 + 2\text{HNO}_3 \rightarrow \text{Mg}(\text{NO}_3)_2 + 2\text{H}_2\text{O}$
 D $\text{MgCO}_3 + 2\text{HNO}_3 \rightarrow \text{Mg}(\text{NO}_3)_2 + \text{CO}_2 + \text{H}_2\text{O}$

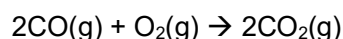
26 A student is presented with two gases, X and Y. He bubbled both gases in different solutions and made the following observations.

gas	observations
X	colourless solution of potassium iodide turns brown
Y	purple acidified potassium manganate(VII) turns colourless

What are the roles of X and Y based on these observations?

	gas X	gas Y
A	oxidising agent	oxidising agent
B	oxidising agent	reducing agent
C	reducing agent	oxidising agent
D	reducing agent	reducing agent

27 Carbon monoxide reacts with oxygen in a sealed container to produce carbon dioxide.



Which change in conditions would increase the rate of reaction?

- 1 increasing the volume of the container
 - 2 increasing the pressure inside the container
 - 3 increasing the temperature inside the container
- A 1, 2 and 3
 B 1 and 2 only
 C 1 and 3 only
 D 2 and 3 only

28 Which statements describes a catalyst?

- 1 A catalyst can be continually reused.
- 2 It lowers the activation energy required in a chemical reaction.
- 3 It causes all reactant particles to have more energy and move faster.

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

29 Which statement about global warming is correct?

- A** Methane produced by digestion in animals have no effect on global warming.
B The products of combustion have no effect on global warming.
C The products of respiration have no effect on global warming.
D The products of photosynthesis have no effect on global warming.

30 Methane and sulfur dioxide are two air pollutants found in the Earth's atmosphere.

Which row correctly describes their source?

	methane	sulfur dioxide
A	decaying plants	lightning activity
B	decaying plants	volcanoes
C	lightning activity	lightning activity
D	lightning activity	volcanoes

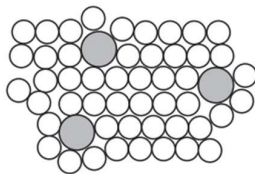
31 Three statements about the properties of metals are shown.

- 1 All metals conduct electricity.
- 2 All metals have high melting point.
- 3 All metals have one electron in the innermost electron shell.

Which statement(s) is/are true?

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

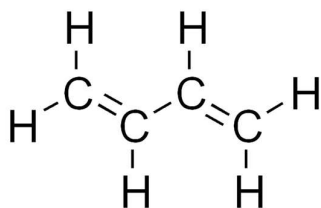
- 32 The diagram shows the structure of an alloy.



Which statement about alloys is correct?

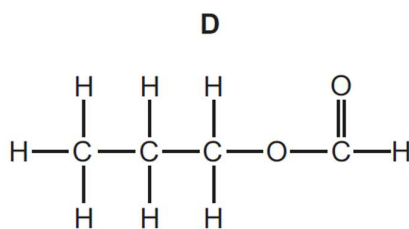
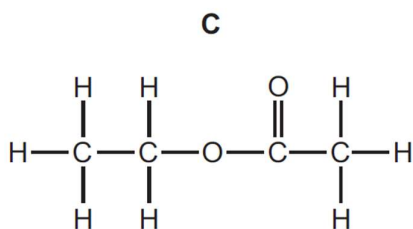
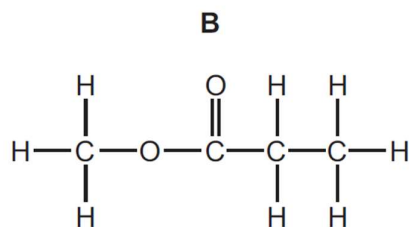
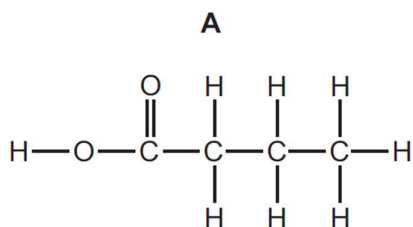
- A Alloys can only be formed by a metal with other metals.
 - B High carbon steel alloys are soft and easily shaped.
 - C In an alloy there is attraction between positive ions and a 'sea of delocalised electrons'.
 - D The alloy brass has a chemical formula.
- 33 Which metal carbonate is most likely to melt but **not** decompose upon heating?
- A copper(II) carbonate
 - B iron(III) carbonate
 - C lead(II) carbonate
 - D potassium carbonate
- 34 Which metal can be obtained from its oxide by heating with carbon and from its aqueous halide by electrolysis?
- A copper
 - B lead
 - C iron
 - D potassium
- 35 Which product is formed at the anode when molten silver chloride is electrolysed?
- A silver atoms
 - B silver ions
 - C chloride ions
 - D chlorine molecules
- 36 When crude oil undergoes fractional distillation, which compounds will leave from the top of the fractionating column?
- A the compounds that are most viscous
 - B the compounds that have the darkest colour
 - C the compounds with the lowest boiling points
 - D the compounds with the highest relative molecular mass

- 37 A series of experiments were conducted on the hydrocarbon shown below.

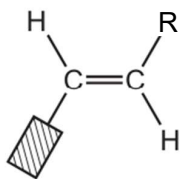


Which of the following statements about the hydrocarbon is correct?

- A It decolourises aqueous bromine in the absence of ultraviolet light.
 - B It decolourises acidified potassium manganate(VII) to become colourless.
 - C It reacts rapidly with aqueous sodium carbonate.
 - D It is formed when an alcohol reacts with a carboxylic acid.
- 38 How many different isomers of propanol exist, given its molecular formula C_3H_7OH ?
- A 2
 - B 3
 - C 4
 - D 5
- 39 What is the structural formula of methyl propanoate?



- 40 The diagram below shows the monomer. R represents the methyl group.



Which of the following corresponds to the type of polymerisation that the monomer is most likely to be involved in and a possible partial structure of the polymer?

	type of polymerisation	possible partial structure of polymer
A	addition	
B	addition	
C	condensation	
D	condensation	

End of Paper

[Turn Over

The Periodic Table of Elements

Group																					
1	2	Key												13	14	15	16	17	18		
		proton (atomic) number atomic symbol name relative atomic mass																			
		1 H hydrogen 1																			
3 Li lithium 7	4 Be beryllium 9													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 —				
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 —	113 Nh nihonium —	114 Fl flerovium —	115 Mc moscovium —	116 Lv livermorium —	117 Ts tennessine —				
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 —					

volume of one mole of any gas is 24 dm^3 at room temperature and pressure (r.t.p.).
 Avogadro constant, $L = 6.02 \times 10^{23} \text{ mol}^{-1}$.