

HWA CHONG INSTITUTION C2 Preliminary Examination Higher 1

CANDIDATE NAME		CT GROUP	23S
CENTRE NUMBER		INDEX NUMBER	
CHEMIST	RY		8873/01
Paper 1 Multip	ple Choice	16 \$	September 2024
Additional Ma	aterials: Multiple Choice Answer Sheet Data Booklet		1 hour

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

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

Write your name and CT group in the space provided at the top of this page.

Complete the information on the Answer Sheet as shown below.



There are **thirty** questions on 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 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.

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

This document consists of **9** printed pages and **1** blank page.

1 Use of the Data Booklet is relevant to this question.

Which species has one unpaired electron?

- **A** Li⁺ **B** P **C** C*l* **D** Cu⁺
- 2 Use of the Data Booklet is relevant to this question.

The mineral pyrite contains sulfur and iron. A sample of pyrite was analysed and four different types of atom were identified; **V**, **W**, **X** and **Y**. Table 1.1 shows information about the four types of atom found in the sample.

Table	1	.1	
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Atom	relative mass	relative % abundance
V	31.97	63.8
W	33.97	2.8
X	53.94	31.4
Y	55.95	2.0

What is the relative atomic mass of sulfur in this sample?

A	21.35	В	32.05	С	39.04	D	54.06
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- **3** A substance, Z, has the following properties.
 - melting point –39 °C
 - boiling point 357 °C
 - insoluble in water
 - conducts electricity when solid and when molten

What is the structure of Z?

- A giant molecular B ionic C metallic D simple molecular
- 4 What happens as ice melts at 0°C?
 - 1 Molecules gain kinetic energy and temperature increases.
 - 2 Energy is gained to overcome the hydrogen bonds between molecules.
 - 3 Molecules gain sufficient energy to move from fixed positions.
 - **A** 1 only **B** 1 and 2 only **C** 1 and 3 only **D** 2 and 3 only

- 5 Which compound has the highest boiling point?
- 6 Ethene is the monomer of the polymer, poly(ethene).

How do the carbon-carbon bond length and the H–C–H bond angle in ethene compare with that in poly(ethene)?

	carbon-carbon bond length is	H–C–H bond angle is
Α	longer in ethene	larger in ethene
В	longer in ethene	smaller in ethene
С	shorter in ethene	larger in ethene
D	shorter in ethene	smaller in ethene

7 Use of the Data Booklet is relevant to this question.

Which diagram shows the correct trends when the melting points of the elements Mg, Al, Si and P are plotted against their first ionisation energies?



- 8 Which method can be used to distinguish HCl(aq) and HCO₂H(aq) of equal concentrations?
 - **A** measuring the electrical conductivity of 20 cm³ of each solution.
 - **B** measuring the total mass loss when reacting with 1.0 g of K₂CO₃(s)
 - **C** measuring the volume of NaOH(aq) needed to neutralise 20 cm^3 of each solution.
 - **D** measuring the total volume of gas produced when reacting with 2.0 g of Mg ribbon.
- 9 Which two species act as Bronsted-Lowry acids in the reaction?

 $H_2PO_4^{-}(aq) + OH^{-}(aq) \implies HPO_4^{2-}(aq) + H_2O(l)$

- **A** $HPO_4^{2-}(aq)$ and $OH^{-}(aq)$
- **B** $H_2PO_4^{-}(aq)$ and $HPO_4^{2-}(aq)$
- **C** HPO₄^{2–}(aq) and H₂O(l)
- **D** $H_2PO_4^{-}(aq)$ and $H_2O(l)$
- **10** The dissociation of water is given as:

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

 $\Delta H = +57 \text{ kJ mol}^{-1}$

 $K_{\rm w}$ is the ionic product of water.

What happens to the values of K_w and $[H^+]$ if the temperature of water is increased?

	K_{w}	[H+]
Α	increase	decrease
В	increase	increase
С	decrease	decrease
D	decrease	increase

11 Which oxide produces an aqueous solution with the highest pH?

Α	Na₂O	В	MgO	С	SiO ₂	D	P ₄ O ₁₀
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12 Which property increases down the group for Group 1 (Na to Cs)?

- A charge density of the cation
- B reactivity of the element with water
- **C** magnitude of lattice energies of the oxides
- D melting point of the elements

- 13 Which statement about the properties of phosphorus or its compounds is incorrect?
 - **A** The oxide of phosphorus reacts with water to give an acidic solution.
 - **B** Phosphorus exist as simple molecules in its elemental state.
 - **C** Phosphorus is the only element in Period 3 whose chloride reacts with water to form HC*l*.
 - **D** Phosphorus has the highest first ionisation energy compared to its adjacent elements within the same period.
- **14** Which statement is correct?
 - A One mole of a compound is the amount that contains the same number of atoms as there are atoms in 12.000 g of carbon-12.
 - **B** The relative isotopic mass of lithium-7 is given by the following expression.

average mass of all isotopes of lithium $\frac{1}{12}$ the mass of one atom of carbon-12

C The relative atomic mass of oxygen is given by the following expression.

average mass of one atom of oxygen $\frac{1}{12}$ the mass of one atom of carbon-12

D The relative molecular mass of a compound *E* is given by the following expression.

average mass of one atom of *E*
$$\frac{1}{12}$$
 the mass of one atom of carbon-12

15 Use of the Data Booklet is relevant to this question.

Which of the following has the value of 6.02×10^{23} in 32.0 g of methanol?

- 1 the number of methanol molecules
- 2 the number of oxygen atoms
- 3 the number of hydrogen atoms

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

16 Lead reacts with nitrate ions in the redox reaction below.

..... Pb (s) + NO₃⁻(aq) + H⁺(aq) \rightarrow NO (g) + Pb²⁺(aq) + H₂O (l)

What is the coefficient for H⁺ in the correctly balanced equation?

A 2 B 4 C 6	D	8
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- **17** Which statement is correct?
 - A In an exothermic reaction, the products have more energy than the reactants.
 - **B** In an exothermic reversible reaction, the activation energy of the forward reaction is greater than that of the reverse reaction.
 - **C** In an endothermic reaction, the products are more stable than the reactants.
 - **D** In an endothermic reversible reaction, the activation energy of the forward reaction is greater than that of the reverse reaction.
- 18 Which change is exothermic?
 - A $Cl_2(g) \rightarrow 2Cl(g)$
 - $\textbf{B} \quad H_2O(g) \to H_2O(l)$
 - ${\boldsymbol{\mathsf{C}}} \qquad {\mathsf{K}}(g) \to {\mathsf{K}}^{\scriptscriptstyle +}(g) + e^{\scriptscriptstyle -}$
 - **D** $\operatorname{KC}l(s) \to \operatorname{K}^{+}(g) + \operatorname{C}l^{-}(g)$
- **19** The initial rate of a reaction can be determined from concentration-time graphs.

What is the value of the initial rate of the reaction as determined from the graph below?



20 What are the correct axes labels for a Maxwell-Boltzmann energy distribution curve?

	x-axis	y-axis
Α	proportion of particles	kinetic energy
В	kinetic energy	proportion of particles
С	progress of reaction	energy
D	energy	progress of reaction

21 Melphalan is a drug used in chemotherapy. When dissolved in blood, the decrease in its concentration has a constant half-life of 90 minutes.

A 100 mg melphalan tablet is dissolved in 4.0 dm³ of blood. What is the concentration, in mg dm⁻³, of melphalan in the blood six hours later?

A 1.56 **B** 3.13 **C** 12.5 **D** 25.0

22 Which of these changes would shift the position of equilibrium to the right?

 $[Co(H_2O)_6]^{2+}(aq) + 4Cl^{-}(aq) \implies CoCl_4^{2-}(aq) + 6H_2O(l)$

- 1 Addition of aqueous silver nitrate
- 2 Addition of concentrated hydrochloric acid
- 3 Evaporation of water
- **A** 2 only **B** 1 and 3 only **C** 2 and 3 only **D** 1, 2 and 3
- **23** For the reaction $I_2(g) + 3Cl_2(g) \rightleftharpoons 2ICl_3(g)$ at a certain temperature, the equilibrium concentrations of each species are given below:

	I_2	Cl_2	ICl ₃
equilibrium concentration/ mol dm ⁻³	0.20	0.20	2.0

What is the value of K_c ?

Α	0.25	В	50	С	2500	D	5000
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- 24 Which statement about a condition used in Haber process is correct?
 - A A pressure of 200 atmospheres is used because a high pressure will favour the side of the equilibrium with the greater number of molecules.
 - **B** An iron catalyst is used in order to get a higher percentage ammonia in the equilibrium mixture.
 - **C** A temperature of 400°C to 500°C is used because a high temperature will increase the equilibrium yield of ammonia.
 - **D** A temperature of 400°C to 500°C is used because a high temperature will increase the rate of reaction.
- **25** Compound G is a diesel fuel additive which reduces the amount of soot formed when the fuel burns.



compound G

How many moles of oxygen gas are needed to completely burn 1 mole of compound G?

- **A** 8.5 **B** 10.0 **C** 12.0 **D** 13.5
- **26** How many non-cyclic isomers are there with the molecular formula $C_3H_4Br_2$?
 - A five constitutional isomers, one of which has cis-trans isomerism
 - **B** five constitutional isomers, two of which has cis-trans isomerism
 - C four constitutional isomers, one of which has cis-trans isomerism
 - **D** four constitutional isomers, two of which has cis-trans isomerism
- **27** The reaction when chloroethane is added to NaOH(aq) occurs at a slower rate than when iodoethane is added to NaOH(aq).

Which statement explains these observations?

- A The C–C*l* bond is more polar than the C–I bond.
- **B** The C–C*l* bond is less polar than the C–I bond.
- **C** The C–C*l* bond is weaker than the C–I bond.
- **D** The C-Cl bond is stronger than the C-I bond.

28 When compound R, $C_xH_yO_z$, is treated with LiA/H₄, it forms a product, $C_xH_{y+2}O_z$. When the same compound R is treated with H₂ + Ni, it forms a product, $C_xH_{y+4}O_z$.

What could be the structure of R?



29 Pentaerythritol can be used in the manufacture of paint. It has the molecular formula $C_5H_{12}O_4$ and contains four primary alcohol groups.

After prolonged heating under reflux with an excess of $Cr_2O_7^{2-}/H^+$, it forms Q which also has five carbon atoms.

Which statement about pentaerythritol and Q is correct?

- **A** Q has four more π bonds and four fewer σ bonds than pentaerythritol.
- **B** Q has four more π bonds and eight fewer σ bonds than pentaerythritol.
- **C** Q has four more π bonds than pentaerythritol only.
- **D** Q has eight more σ bonds than pentaerythritol only.
- **30** Polylactide (PLA) is a thermoplastic often made from sugar cane or corn starch. A repeat unit of PLA is shown below.



Which statement about PLA is incorrect?

- **A** PLA is formed via condensation polymerisation.
- **B** PLA containers are biodegradable.
- **C** PLA is derived from lactic acid, $CH_3CH(OH)CO_2H$.
- **D** PLA is a suitable packaging material for foods pickled in vinegar.

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