

RIVER VALLEY HIGH SCHOOL JC 2 PRELIMINARY EXAMINATION

H1 CHEMISTRY 8873/					8873/01	
CENTRE NUMBER	S				INDEX NUMBER	
CLASS	2	3	J			
CANDIDATE NAME						

Paper 1 Multiple Choice

18 September 2024 1 hour

Additional Materials: Multiple Choice Answer Sheet Data Booklet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

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

Write your name, class, centre number and index number on the Answer Sheet in the spaces provided.

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 **15** printed pages and **1** blank page.

8873/01/PRELIMS/24

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

Some isotopes are unstable and decompose naturally. In one type of decomposition, a neutron in the nucleus decomposes to form a proton, which is retained in the nucleus, and an electron, which is expelled from the atom.

Which change describes such a process?

- $A \quad {}^{40}K \rightarrow {}^{40}Ca$
- **B** ${}^{32}P \rightarrow {}^{31}P$
- C $^{22}Na \rightarrow ^{22}Ne$
- $D \quad {}^{11}C \rightarrow {}^{12}C$
- 2 Which statement is correct?
 - A One mole of a compound is the amount that contains the same number of atoms as there are in 12.000 g of carbon-12.
 - **B** The relative isotopic mass of lithium-7 is given by the following expression.

 $\frac{\text{average mass of all isotopes of lithium}}{\frac{1}{12}}$ 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 molecule of carbon-12

3 Atoms of elements have specific electronic arrangements.

Which statements are correct?

- 1 The electrons always occupy the lowest vacant orbitals available.
- 2 The order of filling the orbitals is 1s, 2s, 2p, 3s, 3p, 3d, 4s.
- 3 The shell with the principal quantum number 2 can hold a maximum of 18 electrons.
- **A** 1 only **B** 1 and 2 only **C** 2 and 3 only **D** 1, 2 and 3
- 4 Which statement does **not** correctly describe the graphite lattice?
 - A The lattice contains delocalised electrons.
 - **B** Each carbon atom in the lattice has three closest neighbours.
 - **C** Weak intermolecular forces of attraction hold each layer of carbon atoms together.
 - **D** Conduction of electricity takes place parallel to the axis of the 2p orbitals.
- 5 Use of the Data Booklet is relevant to this question.Which particle contains a single unpaired electron?
 - A a molecule of NO₂
 - **B** a molecule of AlCl₃
 - **C** the copper ion in Cu₂O
 - **D** the lithium ion in lithium aluminium hydride

indicator	colour in acidic solution	pH range	colour in basic solution
Р	red	3.0 – 5.0	yellow
Q	yellow	5.7 – 7.6	blue

6 The pH range and colour changes for two acid-base indicators are given below.

When P and Q are separately added to a solution, the solution turns yellow. What conclusion can be drawn?

- A It is neutral.
- **B** It is weakly acidic.
- **C** It is weakly alkaline.
- **D** It is strongly alkaline.
- 7 Which statement about the HCO_3^- ion and CO_3^{2-} ion is correct?
 - **A** They are isoelectronic.
 - **B** They form the blood buffer system to control pH.
 - C CO₃²⁻ can only exhibit basic properties and HCO₃⁻ can only exhibit acidic properties.
 - **D** They are a conjugate acid-base pair because they are made up of a weak acid and a weak base.

8 The graph shows the change in pH when a solution containing 0.100 mol dm⁻³ acid is gradually added to 10 cm³ of 0.100 mol dm⁻³ sodium hydroxide.



- 9 Which statement about the elements in Period 3 is incorrect?
 - **A** The element with the smallest anion is chlorine.
 - **B** The element with the highest melting point is aluminium.
 - **C** The element with the highest electrical conductivity is aluminium.
 - **D** The element with eight atoms in its molecule is sulfur.

- **10** A beaker contains a mixture of magnesium oxide, aluminium oxide and silicon dioxide. A student was asked to perform the following procedure to separate the compounds:
 - Step I: To the mixture, add NaOH(aq) and stir well with a glass rod.
 - Step II: Filter to obtain the filtrate and residue.
 - Step III: To the residue, add HC*l*(aq) and stir well with a glass rod.
 - Step IV: Filter to obtain the filtrate and residue.

Which of the following information is true about the above procedure?

- **A** The only species that remained unreacted after step IV was silicon dioxide.
- **B** After step II, the filtrate contains only magnesium hydroxide.
- **C** The residue of step III contains only aluminium oxide.
- **D** A gas was produced when HC*l*(aq) was added in step III.
- **11** Which of the following statements is **incorrect** about Group 1 and Group 17 elements?
 - A The ionisation energies of Group 1 and Group 17 elements decrease down the groups.
 - **B** Reducing power of Group 1 elements increases down the group while oxidising power of Group 17 elements decreases down the group.
 - **C** Group 1 elements are good reducing agents while Group 17 elements are good oxidising agents.
 - **D** Group 1 element has smaller atomic radius as compared to Group 17 element in the same Period.

12 Use of Data Booklet is relevant to this question.

Sodium percarbonate, $(Na_2CO_3)_{x=y}(H_2O_2)$, is an oxidising agent in some home and laundry cleaning products.

10.0 cm³ of 0.100 mol dm⁻³ sodium percarbonate releases 48.0 cm³ of carbon dioxide at room conditions on acidification.

An identical sample, on titration with 0.0500 mol dm⁻³ KMnO₄, requires 24.0 cm³ before the first pink colour appears. KMnO₄ reacts with H₂O₂ in the mole ratio 2 : 5.

What is the ratio $\frac{y}{x}$? **A** $\frac{1}{3}$ **B** $\frac{2}{3}$ **C** $\frac{3}{2}$ **D**

13 Use of Data Booklet is relevant to this question.

Hydrogenation of carbon dioxide to form ethanol is found to be effective in the presence of a mixture of K/Cu-Zn-Fe oxide catalyst. The equation for the reaction is shown.

 $2CO_2(g) + 6H_2(g) \longrightarrow C_2H_5OH(I) + 3H_2O(I)$

Calculate the volume of carbon dioxide required to produce 100 kg of ethanol assuming complete reaction at standard temperature and pressure.

Α	104000 dm ³	В	98700 dm ³	С	52200 dm ³	D	49300 dm
Α	104000 dm³	В	98700 dm³	С	52200 dm ³	D	49300 dm

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

Which one of the following has the same number of particles as one mole of helium atoms?

- A the number of ions in 74.6 g of potassium chloride
- **B** the number of atoms in 44.0 g of carbon dioxide gas
- **C** the number of ions in 1 dm³ of 0.50 mol dm⁻³ of aqueous nitric acid
- **D** the number of delocalised electrons in 1 mole of aluminium metal

15 Recovery of any sulfur from petroleum is an important process in oil refineries. Sulfur compounds are converted into the gas hydrogen sulfide, H₂S, by using a catalyst. The H₂S is then oxidised by using a controlled amount of air to give steam, H₂O(g), and sulfur, S(s).

Given that the enthalpy change of formation of $H_2S(g)$ is $-20.5 \text{ kJ mol}^{-1}$ and that of $H_2O(g)$ is $-243.0 \text{ kJ mol}^{-1}$, what is the enthalpy change of reaction per mole of H_2S ?

- A –202.5 kJ mol⁻¹
- **B** –222.5 kJ mol⁻¹
- **C** –263.5 kJ mol⁻¹
- **D** –445.0 kJ mol⁻¹
- **16** The bond dissociation energy of H#F is 565 kJ mol⁻¹. Which equation correctly describes the reaction whereby 565 kJ of energy is released?
 - $\mathbf{A} \qquad \mathsf{H}(\mathsf{g}) + \mathsf{F}(\mathsf{g}) \to \mathsf{HF}(\mathsf{g})$
 - **B** $HF(I) \rightarrow HF(g)$
 - **C** $HF(g) \rightarrow H(g) + F(g)$
 - $\textbf{D} \qquad {}^{1}\!\!{}^{\prime}_{2}H_{2}(g) + {}^{\prime}\!\!{}^{\prime}_{2}F_{2}(g) \rightarrow HF(g)$

17 The diagram below represents the reaction profile of a typical reaction.



Which of the following changes would cause both of the rate constants, k_1 and k_2 to be increased?

- 1 introducing a catalyst
- 2 heating the equilibrium mixture
- 3 increasing the concentrations of the reactants
- A 1, 2 and 3 B 1 and 2 only C 1 and 3 only D 1 only

18 Y and Z react in aqueous solution according to the following equation.

The kinetics of the above reaction was studied by the method of initial rates and the experimental results obtained are shown in the table below.

Expt	Volume of 1.0 mol dm ⁻³ Y / cm ³	Volume of 1.0 mol dm ⁻³ Z / cm ³	Volume of water / cm ³	Total volume of solution / cm ³	Relative initial rate of formation of T
1	50	60	90	200	1
2	25	120	55	200	2
3	50	120	30	200	4

What is the rate equation for the reaction?

- **A** rate = k[Y]
- **B** rate = $k[Z]^2$
- **C** rate = $k[Y][Z]^2$
- **D** rate = $k[Y][Z]^3$
- **19** Methanol is produced by the following reaction.

 $CO(g) + 2H_2(g) = CH_3OH(g)$ $\Delta H = negative$

Which pair of changes will definitely increase the amount of methanol present at equilibrium?

	pressure	temperature
Α	decrease	decrease
В	decrease	increase
С	increase	decrease
D	increase	increase

20 At a body temperature of 36.9 °C, the value of K_w is 2.42×10^{-14} . What is the concentration of OH⁻ when the blood pH value is 7.40?

A 3.98×10^{-8} **B** 1.56×10^{-7} **C** 2.51×10^{-7} **D** 6.08×10^{-7}

- 21 Which statements related to nanoparticles and nano-structures are true?
 - 1 The chemical properties of silver nanoparticles are not the same as its bulk form.
 - 2 There are permanent dipole-permanent dipole forces of attraction between the wall surface and nano-structures of the gecko's feet.
 - 3 Nanoparticles of smaller diameter allows more sites available for heterogeneous catalysis to take place.
 - A 1, 2 and 3 B 1 and 2 only C 1 and 3 only D 2 only
- 22 Nanoparticles are materials with all 3 dimensions measuring less than *x* nm.What is the value of *x*?
 - **A** 0.1
 - **B** 1.0
 - **C** 100
 - **D** 1000
- 23 Polymers are used extensively in our daily lives. Various polymers have found their way into products such as soft contact lenses and shirts that wrinkle less easily.Which row best describes the most suitable polymer to use for each type of product?

	soft contact lenses	wrinkle resistant shirts
Α	poly(vinyl alcohol)	polyamide
В	poly(vinyl chloride)	polyester
С	poly(vinyl chloride)	polyamide
D	poly(vinyl alcohol)	polyester

- 24 Which of the following polymers are suitable for making plastic bottles for containing soft drinks?
 - 1 poly(vinyl alcohol), PVA
 - 2 polyethylene terephthalate, PET
 - 3 nylon-6
 - 4 poly(vinyl chloride), PVC
 - **A** 1 and 2 only **B** 2 and 4 only **C** 1 and 3 only **D** 3 and 4 only
- **25** A section of a polymer showing two repeat units is shown below:



Which statements are true about the polymer above?

- 1 It is an addition polymer.
- 2 The polymer can be broken down by hydrolysis.
- 3 The monomer is 2-chlorobut-2-ene.
- **A** 1 only **B** 1 and 2 only **C** 2 and 3 only **D** 1, 2 and 3

26 Each of the following reactions are carried out using the reagents and conditions stated.

Which reaction would give a good yield?

- A $H_2C=CH_2$ $\xrightarrow{\text{LiA/H_4 in dry ether}} CH_3CH_3$ B CH_3CH_2Br $\xrightarrow{\text{NaOH in CH_3CH_2OH}} H_2C=CH_2$ C CH_3CH_2OH $\xrightarrow{\text{acidified KMnO_4,}} CH_3CHO$ D CH_3CH_2Br $\xrightarrow{\text{excess NH_3 in CH_3CH_2OH}} CH_3CH_2NH_2$
- A sample of methane gas is produced in which all atoms are either ¹²C or ¹H. A sample of chlorine gas is produced in which all atoms are either ³⁵C*l* or ³⁷C*l*. The two gases are mixed in the presence of ultraviolet light to form a mixture of products. The chlorine is in excess. A reaction occurs, giving a mixture of products. What can be present in the products?
 A molecules with an *M*_r value of 15
 - **B** molecules with an M_r value of 48
 - **C** molecules with an *M*^r value of 84
 - **D** molecules with an *M*_r value of 126

28 The following pentapeptide is heated under reflux with 6 mol dm⁻³ HC*l*.

Partial hydrolysis occurs resulting in the production of a mixture of smaller peptides and amino acids.



pentapeptide

Which of the following fragments cannot be formed by this reaction?





29 Carvone is responsible for the odour of spearmint.



carvone

Which reagent and conditions, when added to carvone, would give an observable change?

- A hydrogen gas with nickel catalyst and heat
- **B** excess concentrated sulfuric acid and heat
- C hot acidified potassium dichromate
- **D** bromine in hexane

30 Which statements about ethene and benzene is correct?

- 1 Both molecules have all the atoms on the same plane.
- 2 Each carbon atom in ethene and benzene forms three σ bonds.
- 3 There are delocalised electrons in benzene but none in ethene.
- **A** 1, 2, and 3 **B** 1 and 2 only **C** 1 and 3 only **D** 2 and 3 only

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