

# PRACTICE PAPER

## CHEMISTRY PAPER 1

(2 hours 30 minutes)

This paper must be answered in English

### GENERAL INSTRUCTIONS

1. There are **TWO** sections, A and B, in this Paper. You are advised to finish Section A in about 45 minutes.
2. Section A consists of multiple-choice questions in this question paper, while Section B contains conventional questions printed separately in Question-Answer Book **B**.
3. Answers to Section A should be marked on the Multiple-choice Answer Sheet while answers to Section B should be written in the spaces provided in Question-Answer Book **B**. **The Answer Sheet for Section A and the Question-Answer Book for Section B will be collected separately at the end of the examination.**
4. A Periodic Table is printed on page 20 of Question-Answer Book **B**. Atomic numbers and relative atomic masses of elements can be obtained from the Periodic Table.

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### INSTRUCTIONS FOR SECTION A (MULTIPLE-CHOICE QUESTIONS)

1. Read carefully the instructions on the Answer Sheet. After the announcement of the start of the examination, you should first stick a barcode label and insert the information required in the spaces provided. No extra time will be given for sticking on the barcode label after the 'Time is up' announcement.
2. When told to open this book, you should check that all the questions are there. Look for the words '**END OF SECTION A**' after the last question.
3. All questions carry equal marks.
4. **ANSWER ALL QUESTIONS.** You are advised to use an HB pencil to mark all the answers on the Answer Sheet, so that wrong marks can be completely erased with a clean rubber. You must mark the answers clearly; otherwise you will lose marks if the answers cannot be captured.
5. You should mark only **ONE** answer for each question. If you mark more than one answer, you will receive **NO MARKS** for that question.
6. No marks will be deducted for wrong answers.

This section consists of two parts. There are 24 questions in PART I and 12 questions in PART II.

Choose the best answer for each question.

Candidates may refer to the Periodic Table printed on page 20 of Question-Answer Book B.

### PART I

1. Element **X** occurs in nature in two isotopes,  $^{69}\text{X}$  and  $^{71}\text{X}$ . The table below lists the relative abundance of each isotope:

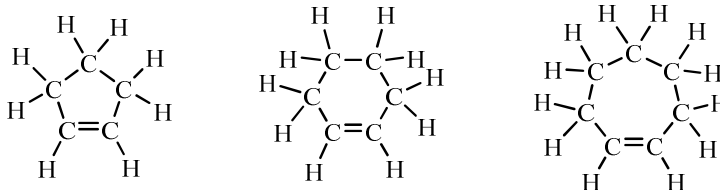
Isotope	Relative abundance (%)
$^{69}\text{X}$	60.0
$^{71}\text{X}$	40.0

What is the relative atomic mass of **X** ?

- A. 69.6  
B. 69.8  
C. 70.0  
D. 70.2
2. Which of the species shown below does NOT follow the 'octet rule' ?
- A.  $\text{Na}_2\text{O}$   
B.  $\text{MgO}$   
C.  $\text{PCl}_3$   
D.  $\text{SCl}_4$
3. Which of the following species is NOT an appropriate example for illustrating dative bond formation ?
- A.  $\text{NH}_3$   
B.  $\text{NH}_4^+$   
C.  $\text{BF}_4^-$   
D.  $\text{BF}_3\text{NH}_3$
4. Which of the following statements about silicon dioxide is correct ?
- A. It consists of discrete molecules.  
B. It melts upon heating in a test tube.  
C. It is ductile.  
D. It is a poor conductor of electricity.

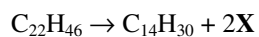
5. Which of the following processes is endothermic ?
- $\text{H}_2\text{O}(\ell) \rightarrow \text{H}_2\text{O}(\text{s})$
  - $\text{CuSO}_4(\text{s}) + 5\text{H}_2\text{O}(\ell) \rightarrow \text{CuSO}_4 \cdot 5\text{H}_2\text{O}(\text{s})$
  - $2\text{H}_2\text{O}(\ell) \rightarrow 2\text{H}_2(\text{g}) + \text{O}_2(\text{g})$
  - $\text{Ca}(\text{s}) + 2\text{H}_2\text{O}(\ell) \rightarrow \text{Ca}(\text{OH})_2(\text{aq}) + \text{H}_2(\text{g})$
6. **X**, **Y** and **Z** are three different metals. When these metals are placed separately into an aqueous solution of tin(II) nitrate, a spongy layer of tin is formed only on **X**. When each of the oxides of these metals is heated strongly, only the oxide of **Y** gives a metallic lustre. Which of the following represents the arrangement of these metals in decreasing order of reactivity ?
- X** > **Y** > **Z**
  - X** > **Z** > **Y**
  - Y** > **X** > **Z**
  - Z** > **X** > **Y**
7. A scientist extracted a sample of 'nitrogen' from air by removing the oxygen and carbon dioxide. The scientist then compared the mass of a known volume of the 'nitrogen' sample ( $m_1$ ) with that of the same volume of pure nitrogen ( $m_2$ ) under the same set of conditions. The experiment was repeated a number of times. It was found that  $m_1$  was consistently greater than  $m_2$ .
- Which of the following gases is likely to be present in the 'nitrogen' obtained to account for the result that  $m_1$  is greater than  $m_2$  ?
- neon
  - argon
  - methane
  - water vapour
8. At 298 K, the pH of  $0.10 \text{ mol dm}^{-3} \text{HCl}(\text{aq})$  is 1. Which of the following statements is correct ?
- At 298 K, the pH of  $0.20 \text{ mol dm}^{-3} \text{HCl}(\text{aq})$  is 2.
  - At 298 K, the pH of  $0.20 \text{ mol dm}^{-3} \text{HCl}(\text{aq})$  is 0.5.
  - At 298 K, the pH of  $0.01 \text{ mol dm}^{-3} \text{HCl}(\text{aq})$  is 2.
  - At 298 K, the pH of  $0.01 \text{ mol dm}^{-3} \text{HCl}(\text{aq})$  is 0.1.
9. When  $25 \text{ cm}^3$  of  $1.00 \text{ mol dm}^{-3} \text{NaOH}(\text{aq})$  is mixed with  $25 \text{ cm}^3$  of  $1.00 \text{ mol dm}^{-3} \text{HCl}(\text{aq})$ , the temperature of the mixture rises by  $6^\circ\text{C}$ . Which of the following reactants, when mixed under the same conditions, would give a similar temperature rise ?
- $25 \text{ cm}^3$  of  $2.00 \text{ mol dm}^{-3} \text{NaOH}(\text{aq})$  and  $25 \text{ cm}^3$  of  $2.00 \text{ mol dm}^{-3} \text{HCl}(\text{aq})$
  - $50 \text{ cm}^3$  of  $1.00 \text{ mol dm}^{-3} \text{NaOH}(\text{aq})$  and  $50 \text{ cm}^3$  of  $1.00 \text{ mol dm}^{-3} \text{HCl}(\text{aq})$
  - $50 \text{ cm}^3$  of  $0.50 \text{ mol dm}^{-3} \text{NaOH}(\text{aq})$  and  $50 \text{ cm}^3$  of  $0.50 \text{ mol dm}^{-3} \text{HCl}(\text{aq})$
  - $100 \text{ cm}^3$  of  $0.25 \text{ mol dm}^{-3} \text{NaOH}(\text{aq})$  and  $100 \text{ cm}^3$  of  $0.25 \text{ mol dm}^{-3} \text{HCl}(\text{aq})$

10. The structures of three cycloalkenes are shown below:



Cycloalkenes can be represented by a general formula. Which of the following is the general formula for cycloalkenes? (In these formulae,  $n$  is an integer greater than 2.)

- A.  $C_nH_{2n-4}$   
 B.  $C_nH_{2n-2}$   
 C.  $C_nH_{2n}$   
 D.  $C_nH_{2n+2}$
11. The equation below represents the cracking of a hydrocarbon:



What is the chemical formula of compound **X**?

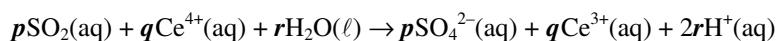
- A.  $C_3H_6$   
 B.  $C_4H_8$   
 C.  $C_8H_{16}$   
 D.  $C_{14}H_{28}$
12. Consider the standard enthalpy changes of the following reactions:



What is the standard enthalpy change of formation of  $ICl_3(s)$ ?

- A.  $-81 \text{ kJ mol}^{-1}$   
 B.  $-74 \text{ kJ mol}^{-1}$   
 C.  $+74 \text{ kJ mol}^{-1}$   
 D.  $+81 \text{ kJ mol}^{-1}$
13.  $10 \text{ cm}^3$  of  $0.25 \text{ mol dm}^{-3}$  calcium nitrate solution is mixed with  $40 \text{ cm}^3$  of  $0.10 \text{ mol dm}^{-3}$  nitric acid. What is the concentration of nitrate ions in the resulting solution?
- A.  $0.18 \text{ mol dm}^{-3}$   
 B.  $0.13 \text{ mol dm}^{-3}$   
 C.  $0.080 \text{ mol dm}^{-3}$   
 D.  $0.050 \text{ mol dm}^{-3}$

14. Consider the following chemical equation:



(Ce is the chemical symbol for cerium.)

Which of the following combinations is correct ?

	<i>p</i>	<i>q</i>	<i>r</i>
A.	1	1	1
B.	1	1	2
C.	1	2	2
D.	2	1	2

15. Which of the following statements best describes metallic bonding ?

- A. It is an attractive force between ions.
- B. It is an attractive force between polar chemical species.
- C. It is an attractive force between atomic nuclei and bond-pair electrons.
- D. It is an attractive force between cations and delocalised electrons.

16. Which of the following molecules is non-polar ?

- A.  $\text{BeCl}_2$
- B.  $\text{NH}_3$
- C.  $\text{H}_2\text{O}$
- D.  $\text{HCl}$

17. Ammonia is very soluble in water. Which of the following statements best accounts for this phenomenon ?

- A. Both ammonia molecule and water molecule are polar.
- B. Ammonia molecule and water molecule are of comparable sizes.
- C. Ammonia undergoes ionisation in water.
- D. Ammonia forms hydrogen bond with water.

18. Barium (Ba) is an element in Group II of the Periodic Table. Which of the following is/are the expected observation(s) when a small piece of barium is added to a trough of water containing a few drops of phenolphthalein ?

- (1) A colourless gas is liberated.
- (2) The piece of barium floats on the water surface.
- (3) The resulting solution in the trough is colourless.

- A. (1) only
- B. (2) only
- C. (1) and (3) only
- D. (2) and (3) only

19. Which of the following reagents would undergo neutralisation with limewater ?

- (1)  $\text{HCl(aq)}$
- (2)  $\text{Na}_2\text{SO}_4\text{(aq)}$
- (3)  $\text{SO}_2\text{(g)}$

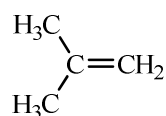
- A. (1) only
- B. (2) only
- C. (1) and (3) only
- D. (2) and (3) only

20. A salt has the formula  $(\text{NH}_4)_2\text{SO}_4 \cdot \text{FeSO}_4 \cdot 6\text{H}_2\text{O}$ . Which of the following is/are the expected observation(s) when an aqueous solution of this salt is treated with aqueous sodium hydroxide solution ?

- (1) formation of a dirty green precipitate
- (2) formation of a brown precipitate
- (3) evolution of a gas with a pungent odour

- A. (1) only
- B. (2) only
- C. (1) and (3) only
- D. (2) and (3) only

21. Consider the following organic compound:



Which of the following statements about this compound is/are correct ?

- (1) Its systematic name is 1,1-dimethylethene.
- (2) It can decolourise an acidified solution of potassium permanganate.
- (3) It is the monomer of Perspex.

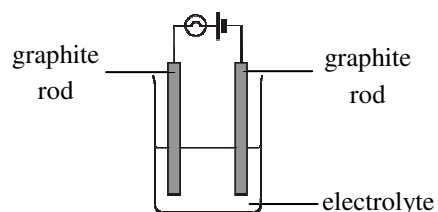
- A. (1) only
- B. (2) only
- C. (1) and (3) only
- D. (2) and (3) only

22. Consider the electrolysis experiments using the following combinations of electrolyte solution, anode and cathode:

	<u>Electrolyte solution</u>	<u>Anode</u>	<u>Cathode</u>
(1)	copper(II) sulphate solution	copper	copper
(2)	copper(II) chloride solution	graphite	graphite
(3)	potassium sulphate solution	platinum	platinum

In which of these experiments will the concentration of the electrolyte solution remain UNCHANGED ?

- A. (1) only  
 B. (2) only  
 C. (1) and (3) only  
 D. (2) and (3) only
23. Which of the following statements about lithium-ion batteries is/are correct ?
- (1) In lithium-ion batteries, the electrolyte is a lithium salt in water.  
 (2) Lithium-ion batteries are rechargeable.  
 (3) The disposal of lithium-ion batteries causes less harm to the environment than that of nickel-cadmium batteries.
- A. (1) only  
 B. (2) only  
 C. (1) and (3) only  
 D. (2) and (3) only
24. Which of the following methods can be used to distinguish between  $0.1 \text{ mol dm}^{-3} \text{ HCl(aq)}$  and  $0.1 \text{ mol dm}^{-3} \text{ CH}_3\text{CO}_2\text{H(aq)}$  ?
- (1) Add magnesium ribbon of the same length to each solution and compare the rate of evolution of gas bubbles.  
 (2) Add  $10 \text{ cm}^3$  of  $0.1 \text{ mol dm}^{-3} \text{ NaOH(aq)}$  to  $10 \text{ cm}^3$  of each solution and compare the temperature change.  
 (3) Use each solution as electrolyte in the set-up shown on the right and compare the brightness of the bulb.

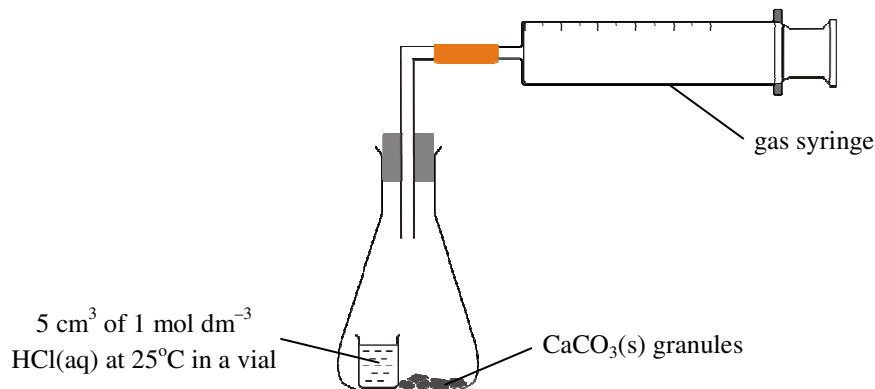


- A. (1) and (2) only  
 B. (1) and (3) only  
 C. (2) and (3) only  
 D. (1), (2) and (3)

**END OF PART I**

## PART II

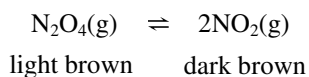
25. The set-up shown below is used in an experiment to study the rate of the reaction:



The conical flask is shaken to overturn the vial in order to start the reaction. The initial rate of the reaction with respect to the gas liberated is determined. The experiment is then repeated with only one of the conditions changed while the others remain unchanged.

Under which of the following situations would the initial rate be the same as that in the original experiment ?

- A. using 10 cm³ of 1 mol dm⁻³ HCl(aq)
  - B. using 5 cm³ of 2 mol dm⁻³ HCl(aq)
  - C. using 5 cm³ of 1 mol dm⁻³ HCl(aq) which is preheated to 50°C
  - D. using powdered CaCO₃(s) of the same mass
26. A mixture of N₂O₄(g) and NO₂(g) is allowed to attain equilibrium in a gas syringe at room temperature:

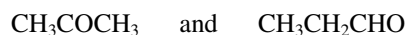


The gas mixture in the syringe is compressed rapidly. Which of the following statements correctly describes the expected observation ?

- A. The colour of the mixture becomes paler.
- B. The colour of the mixture becomes darker.
- C. The colour of the mixture becomes paler instantaneously and then darker.
- D. The colour of the mixture becomes darker instantaneously and then paler.



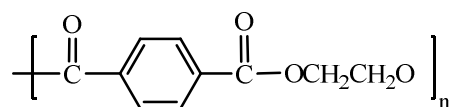
27. Consider the isomeric compounds shown below:



Which of the following reagents can be used to distinguish between the two compounds ?

- A. acidified potassium dichromate solution
- B. lithium aluminium hydride
- C. dilute sulphuric acid
- D. pH indicator

28. The structure of polymer **X** is shown below:



Which of the following statements about **X** is correct ?

- A. It possesses a ketone functional group.
  - B. It can undergo degradation in an acidic environment.
  - C. It has a giant covalent network structure.
  - D. It has a sharp melting point.
29. 0.40 g of an impure sample of zinc granules reacts with excess dilute sulphuric acid to give 100 cm<sup>3</sup> of hydrogen, measured at room temperature and pressure. Assuming that the impurities in the zinc granules do not react with sulphuric acid, what is the percentage by mass of zinc in the sample ?

(Relative atomic masses: H = 1.0, Zn = 65.4;  
molar volume of gas at room temperature and pressure = 24 dm<sup>3</sup>)

- A. 25
  - B. 34
  - C. 68
  - D. 73
30. In which of the following reactions, is/are the transition metal species NOT acting as a catalyst ?
- (1) action of acidified  $\text{MnO}_4^-$ (aq) on  $\text{SO}_3^{2-}$ (aq) at room temperature
  - (2) action of Ni(s) on a mixture of  $\text{H}_2\text{C}=\text{CH}_2$ (g) and  $\text{H}_2$ (g) at high temperature
  - (3) action of Pt(s) on a mixture of CO(g) and  $\text{O}_2$ (g) at high temperature
- A. (1) only
  - B. (2) only
  - C. (1) and (3) only
  - D. (2) and (3) only

31. Which of the following is/are characteristic(s) of chemical equilibrium ?

- (1) When a catalyst is added to an equilibrium mixture, the equilibrium position changes.
- (2) When equilibrium is attained, the rate of forward reaction and that of backward reaction are equal.
- (3) Equilibrium can be attained from either direction of the reaction.

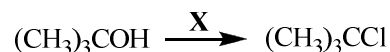
- A. (1) only
- B. (2) only
- C. (1) and (3) only
- D. (2) and (3) only

32. Some brands of washing powder contain enzymes. Which of the following statements about the action of the enzymes is/are correct ?

- (1) The activity of the enzymes increases with temperature.
- (2) The enzymes facilitate the removal of specific kinds of dirt.
- (3) The enzymes reduce the surface tension of water.

- A. (1) only
- B. (2) only
- C. (1) and (3) only
- D. (2) and (3) only

33. Consider the following organic conversion:

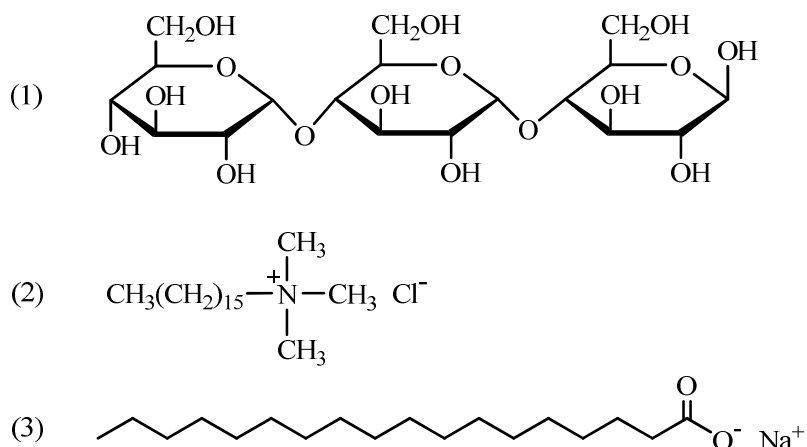


Which of the following reagents can X be ?

- (1)  $\text{Cl}_2(\text{g})$
- (2)  $\text{PCl}_3(\ell)$
- (3) concentrated  $\text{HCl}(\text{aq})$

- A. (1) only
- B. (2) only
- C. (1) and (3) only
- D. (2) and (3) only

34. Consider the following compounds:



Which of these compounds can be used as active ingredients of detergents ?

- A. (1) and (2) only
- B. (1) and (3) only
- C. (2) and (3) only
- D. (1), (2) and (3)

**Directions** : Each question below (Questions 35 to 36) consists of two separate statements. Decide whether each of the two statements is true or false; if both are true, then decide whether or not the second statement is a *correct* explanation of the first statement. Then select one option from A to D according to the following table :

A. Both statements are true and the 2nd statement is a correct explanation of the 1st statement.
B. Both statements are true but the 2nd statement is NOT a correct explanation of the 1st statement.
C. The 1st statement is false but the 2nd statement is true.
D. Both statements are false.

1st statement	2nd statement
35. The melting point of the non-metals in Period 3 of the Periodic Table decreases from sulphur to argon.	The relative atomic mass increases from sulphur to argon in Period 3 of the Periodic Table.
36. The structural formula $\text{H}_2\text{C}=\text{CF}_2$ can represent two different compounds.	The rotation of the $\text{CF}_2$ group relative to the $\text{CH}_2$ group in $\text{H}_2\text{C}=\text{CF}_2$ is restricted by the $\text{C}=\text{C}$ bond.

**END OF SECTION A**