

CHEMISTRY PAPER 1

8:30 am – 11:00 am (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.

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.

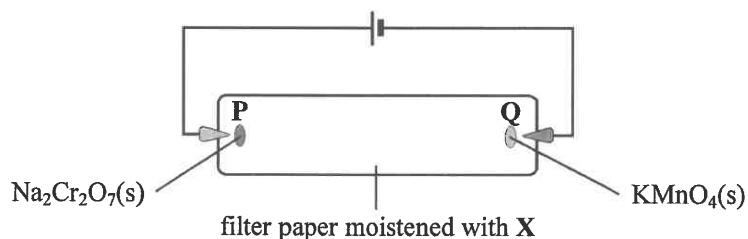
Candidates may refer to the Periodic Table printed on page 20 of Question-Answer Book B.

PART I

1. Which of the following pairs of atomic numbers corresponds to elements with similar chemical properties ?

- A. 4, 14
- B. 8, 18
- C. 9, 35
- D. 19, 38

2. The set-up of an experiment is shown below :



What can be observed after the circuit is closed for a period of time ?

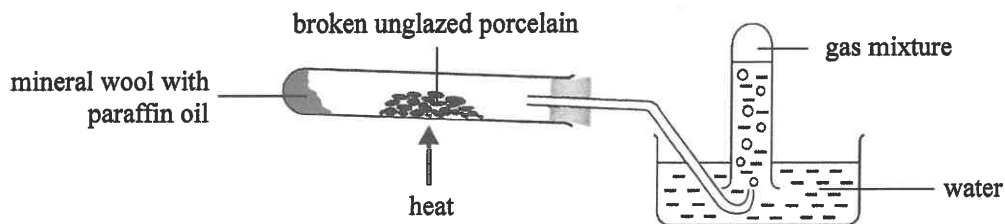
- A. If X is dilute H_2SO_4 , a purple patch migrates towards P.
 - B. If X is dilute H_2SO_4 , an orange patch migrates towards Q.
 - C. If X is ethanol, a purple patch migrates towards P.
 - D. If X is ethanol, an orange patch migrates towards Q.
3. Which of the following processes does NOT involve oxidation and reduction ?
- A. red wine turning sour
 - B. removing rust using white vinegar
 - C. combusting natural gas in a power station
 - D. removing nitrogen oxides in the catalytic converter of a car
4. 25.00 cm^3 of $0.051 \text{ M C}_4\text{H}_4\text{O}_4(\text{aq})$ can completely neutralise 22.18 cm^3 of $0.115 \text{ M KOH}(\text{aq})$. What is the basicity of the acid $\text{C}_4\text{H}_4\text{O}_4$?
- A. 1
 - B. 2
 - C. 3
 - D. 4
5. 25.00 cm^3 of 0.50 M lead(II) nitrate solution is mixed with 50.00 cm^3 of 1.00 M sodium chloride solution. Insoluble lead(II) chloride is formed during mixing. What is the concentration of $\text{Cl}^-(\text{aq})$ in the mixture ?
- A. 0.33 M
 - B. 0.50 M
 - C. 0.75 M
 - D. 1.50 M

6. 2.53 g of $\text{NaHCO}_3(\text{s})$ was heated until no further changes and 1.59 g of a solid remained. Which of the following equations matches with the experimental result ?

(Relative atomic masses : H = 1.0, C = 12.0, O = 16.0, Na = 23.0)

- A. $\text{NaHCO}_3(\text{s}) \rightarrow \text{NaOH}(\text{s}) + \text{CO}_2(\text{g})$
 B. $2\text{NaHCO}_3(\text{s}) \rightarrow \text{Na}_2\text{O}_2(\text{s}) + 2\text{CO}_2(\text{g}) + \text{H}_2(\text{g})$
 C. $2\text{NaHCO}_3(\text{s}) \rightarrow \text{Na}_2\text{CO}_3(\text{s}) + \text{H}_2\text{O}(\text{g}) + \text{CO}_2(\text{g})$
 D. $2\text{NaHCO}_3(\text{s}) \rightarrow \text{Na}_2\text{O}(\text{s}) + \text{H}_2\text{O}(\text{g}) + 2\text{CO}_2(\text{g})$

7. The set-up of an experiment is shown below :



Which of the following statements is INCORRECT ?

- A. The broken unglazed porcelain acts as a catalyst.
 B. Fractional distillation is performed in the set-up.
 C. The gas mixture turns acidified potassium permanganate solution from purple to colourless.
 D. When no more gas can be collected, the delivery tube should be taken out of the water before removing the heat source.
8. 39.2 g of an oxide of rubidium (Rb) contains 28.5 g of rubidium. What is the empirical formula of this oxide ?

(Relative atomic masses : O = 16.0, Rb = 85.5)

- A. RbO
 B. RbO₂
 C. Rb₂O
 D. Rb₂O₂

9. It is given that :

Standard enthalpy change of formation of water = -286 kJ mol^{-1}

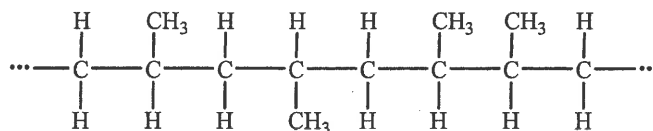
Standard enthalpy change of combustion of propane = $-2222 \text{ kJ mol}^{-1}$

Standard enthalpy change of formation of carbon dioxide = -394 kJ mol^{-1}

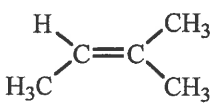
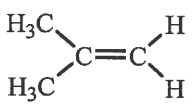
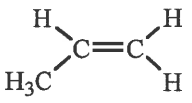
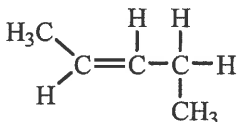
What is the standard enthalpy change of formation of propane ?

- A. -52 kJ mol^{-1}
 B. $+52 \text{ kJ mol}^{-1}$
 C. -104 kJ mol^{-1}
 D. $+104 \text{ kJ mol}^{-1}$

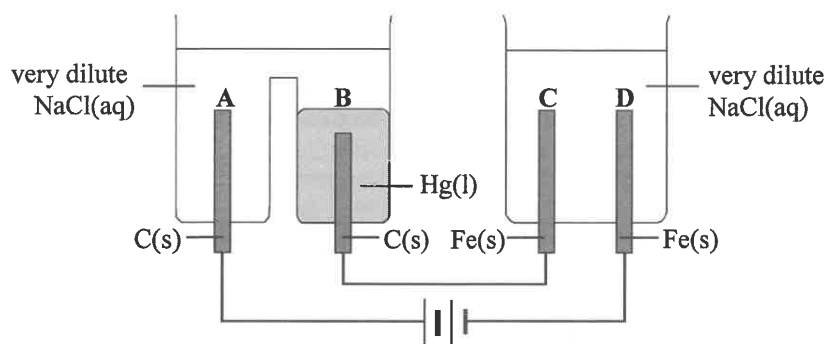
10. A part of the structure of a polymer is shown below :



Which of the following can be a monomer of this polymer ?

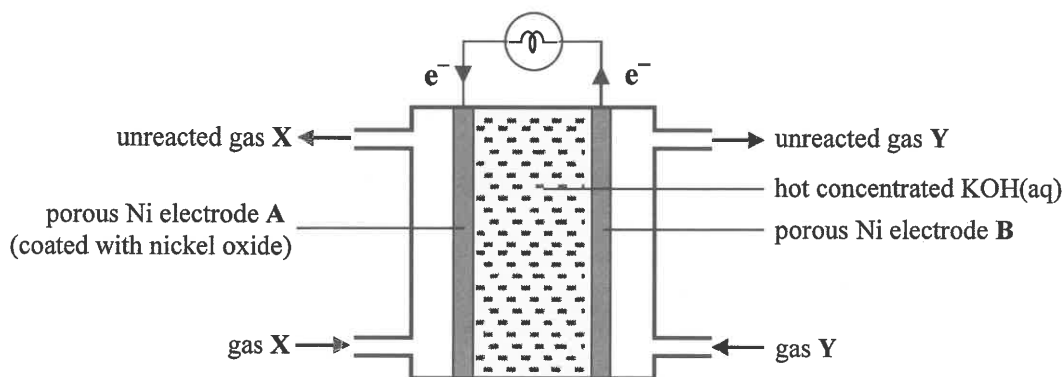
- A.  B. 
- C.  D. 

11. Consider the following electrolytic cells :



What would happen during electrolysis ?

- A. Oxygen forms around A.
 B. Chlorine forms around B.
 C. Hydrogen forms around C.
 D. Iron(II) ions form around D.
12. Which of the following statements concerning the fuel cell below that can form water is INCORRECT ?



- A. It is a primary cell.
 B. Ni also acts as a catalyst.
 C. X can be obtained from fractional distillation of liquid air.
 D. The equation for the change at electrode B is : $4\text{OH}^- \rightarrow 2\text{H}_2\text{O} + \text{O}_2 + 4\text{e}^-$

13. Which of the following combinations is correct ?

	Molecule	Molecular shape
A.	OF ₂	linear
B.	CS ₂	V shaped
C.	NCl ₃	trigonal planar
D.	PF ₃	trigonal pyramidal

14. Consider the following reaction :



Which of the following statements is / are correct ?

- (1) The oxidation number of chromium decreases.
- (2) Only covalent bonds are broken and formed.
- (3) Green solid turns to orange solid.

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

15. Which of the following methods can slow down the corrosion of an iron-made object ?

- (1) Connect it to a piece of lead.
- (2) Plate a layer of copper coating completely onto its surface.
- (3) Connect it to the cathode of a chemical cell.

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

16. Which of the following chemicals can be used to distinguish concentrated hydrochloric acid from concentrated nitric acid ?

- (1) sodium carbonate solid
- (2) silver nitrate solution
- (3) copper metal

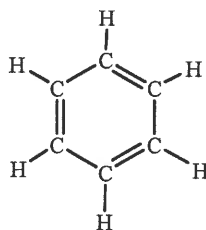
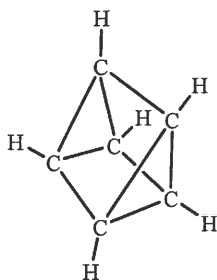
- A. (1) only
- B. (2) only
- C. (1) and (3) only
- D. (2) and (3) only

17. Which of the following metal oxides can be reduced to a metal when heated with carbon using a Bunsen burner ?

- (1) lead(II) oxide
- (2) magnesium oxide
- (3) copper(II) oxide

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

18. Consider the following two compounds :



Which of the following statements is / are correct ?

- (1) They are both soluble in water.
- (2) They have the same empirical formula.
- (3) They are in the same homologous series.

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

19. In which of the following reactions does the underlined chemical act as a reducing agent ?

- (1) $2\underline{\text{C}_4\text{H}_{10}} + 13\text{O}_2 \rightarrow 8\text{CO}_2 + 10\text{H}_2\text{O}$
- (2) $\underline{\text{Ba}(\text{NO}_3)_2} + \text{Na}_2\text{SO}_4 \rightarrow \text{BaSO}_4 + 2\text{NaNO}_3$
- (3) $\underline{\text{Zn}(\text{OH})_2} + 2\text{NaOH} \rightarrow \text{Na}_2\text{Zn}(\text{OH})_4$

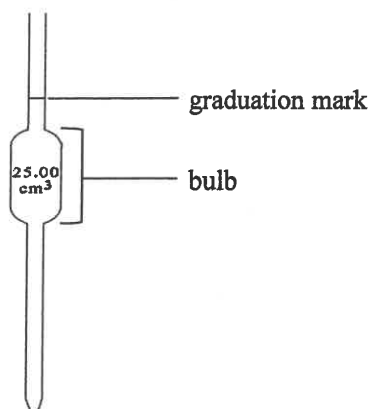
- A. (1) only
- B. (2) only
- C. (1) and (3) only
- D. (2) and (3) only

20. Aqueous calcium hydroxide can be used to

- (1) neutralise acidic substances in soil.
- (2) distinguish carbon dioxide from carbon monoxide.
- (3) remove sulphur dioxide from a polluted air sample.

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

21. The diagram below shows a common glass apparatus :



Which of the following statements concerning the transfer of an acid using this apparatus are INCORRECT ?

- (1) The bulb should be firmly held in the hand when being filled with acid.
 - (2) Exactly 20.00 cm³ of acid can be transferred using this apparatus.
 - (3) The apparatus should first be rinsed by distilled water, then immediately followed by the transfer of acid.
- A. (1) and (2) only
B. (1) and (3) only
C. (2) and (3) only
D. (1), (2) and (3)

22. Which of the following are exothermic ?

- (1) thermal decomposition of mercury(II) oxide solid
 - (2) dilution of concentrated sulphuric acid with water
 - (3) reaction of magnesium ribbon with dilute hydrochloric acid
- A. (1) and (2) only
B. (1) and (3) only
C. (2) and (3) only
D. (1), (2) and (3)

23. Which of the following statements concerning ethanol are correct ?

- (1) It is flammable.
 - (2) It is soluble in water.
 - (3) It is more volatile than water.
- A. (1) and (2) only
B. (1) and (3) only
C. (2) and (3) only
D. (1), (2) and (3)

24. Consider the following statements and choose the best answer :

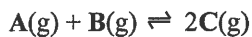
1st statement
Mercury has good electrical conductivity at room temperature.

2nd statement
Mercury has delocalised electrons.

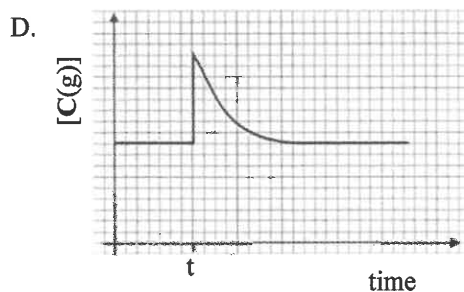
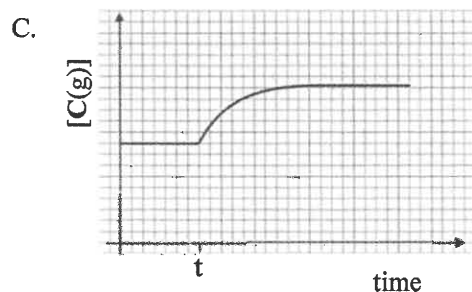
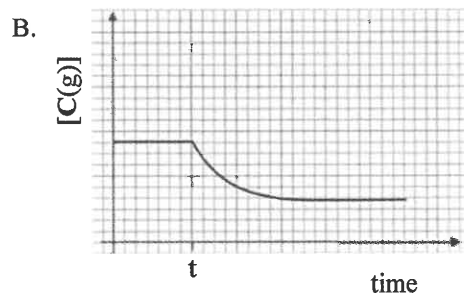
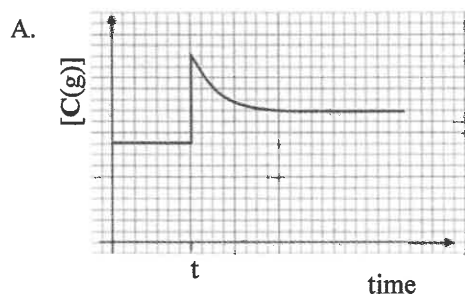
- A. Both statements are true and the 2nd statement is a correct explanation of the 1st statement.
B. Both statements are true but the 2nd statement is NOT a correct explanation of the 1st statement.
C. The 1st statement is false but the 2nd statement is true.
D. Both statements are false.

PART II

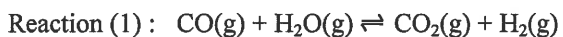
25. Consider the following equilibrium system in a closed container of fixed volume :



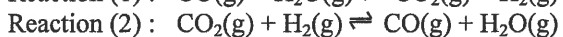
A small amount of B(g) is added at time t and finally a new equilibrium is attained at the same temperature. Which of the following graphs can represent the variation of [C(g)] with time ?



26. Consider the following two reactions at a certain temperature :



Equilibrium constant $K_c = 0.8$



Equilibrium constant $K_c = X$

What is X ?

- A. 0.8
- B. 1.25
- C. $0.8 \text{ mol}^{-1}\text{dm}^3$
- D. $1.25 \text{ mol}^{-1}\text{dm}^3$

27. The decomposition of HI(g) into H₂(g) and I₂(g) is reversible. In a closed container of 3.0 dm³ keeping at a fixed temperature, an equilibrium mixture contains 0.10 mol of HI(g), 0.60 mol of H₂(g) and 0.60 mol of I₂(g). What is the equilibrium constant K_c for the decomposition at this temperature ?

- A. 0.4
- B. 3.6
- C. 9.0
- D. 36.0

28. Consider the following reaction :



What is the minimum volume of 0.5 M NaOH(aq) needed to completely react with 480 cm³ of N₂O₄(g) at room conditions ?

(Molar volume of gas at room conditions = 24 dm³)

- A. 8 cm³
- B. 12.5 cm³
- C. 40 cm³
- D. 80 cm³

29. The structure of limonene is shown below :



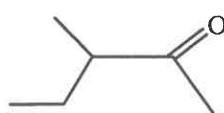
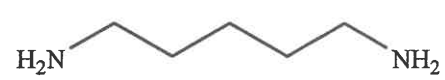
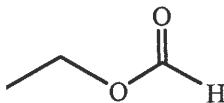
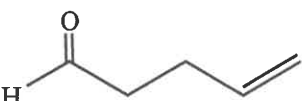
It reacts with excess HCl(g) to give Z as the major product. Which of the following is Z ?

- A.
- B.
- C.
- D.

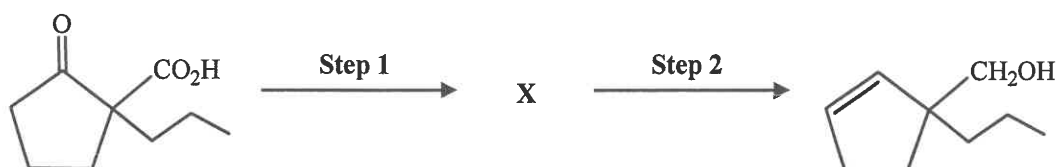
30. Choose one combination from below in which X can make an addition polymer; while Y can make a condensation polymer.

- | | X | Y |
|----|---|---|
| A. | | |
| B. | | |
| C. | | |
| D. | | |

31. Which of the following combinations is correct ?

	Structure	Systematic name
A.		3-ethylbutanone
B.		pentane-1,5-diamide
C.		ethyl methanoate
D.		pent-1-enal

32. Consider the following conversion of organic compounds :



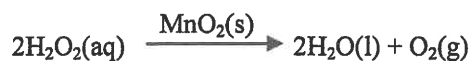
Which of the following combinations of steps is correct ?

	Step 1	Step 2
A.	LiAlH_4 , dry ether; then $\text{H}^+(\text{aq})$	$\text{NaOH}(\text{aq})$, heat
B.	NaBH_4 , ethanol; then $\text{H}^+(\text{aq})$	$\text{NaOH}(\text{aq})$, heat
C.	LiAlH_4 , dry ether; then $\text{H}^+(\text{aq})$	concentrated $\text{H}_2\text{SO}_4(\text{l})$, heat
D.	NaBH_4 , ethanol; then $\text{H}^+(\text{aq})$	concentrated $\text{H}_2\text{SO}_4(\text{l})$, heat

33. Which of the following does NOT exhibit a characteristic of iron as a transition metal ?

- A. Iron corrodes readily.
- B. Iron can be used as a catalyst.
- C. Iron can form two chlorides.
- D. Iron(II) sulphate solution is green.

34. Consider the following reaction :

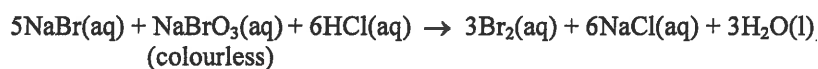


Which of the following statements is / are correct if the concentration of $\text{H}_2\text{O}_2(\text{aq})$ changes from 2 M to 1 M, while the other conditions remain unchanged ?

- (1) The consumption of $\text{MnO}_2(\text{s})$ will decrease.
- (2) The rate of formation of $\text{O}_2(\text{g})$ will decrease.
- (3) The volume of $\text{O}_2(\text{g})$ formed will decrease.

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

35. Consider the following reaction :



Which of the following can be measured in order to follow the progress of the reaction ?

- (1) pH of the reacting mixture
- (2) pressure of the reaction system
- (3) colour intensity of the reacting mixture

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

36. Consider the following statements and choose the best answer :

1st statement
 $\text{CH}_2=\text{CHCH}(\text{CH}_3)\text{C}_2\text{H}_5$ can exhibit optical activity.

2nd statement
 $\text{CH}_2=\text{CHCH}(\text{CH}_3)\text{C}_2\text{H}_5$ has one chiral centre.

- 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.

END OF SECTION A

