

K O N G P A P E R  
H O N G K O N G D I P L O M A O F S E C O N D A R Y E D U C A T I O N  
E X A M I N A T I O N 2 0 2 6  
**CHEMISTRY PAPER 1A**

9:00 am – 10:30 am (1½ hours)

**INSTRUCTIONS**

- (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 PAPER' 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.
- (7) A periodic table is printed at the end of the question-answer booklet. Atomic numbers and relative atomic masses of elements can be obtained from the Periodic Table.

This section consists of two parts. There are 23 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 at the end of Question-Answer Book

**PART I**

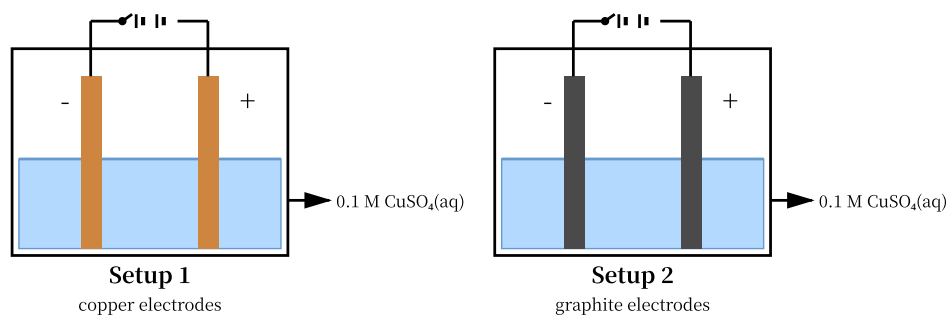
- When 0.001 mol of a gas is passed into 1 dm<sup>3</sup> of water, the resulting solution is weakly acidic (pH 5-6.5). Which gas could this be?
  - 0.001 mol of CO<sub>2</sub>
  - 0.001 mol of H<sub>2</sub>S
  - 0.001 mol of NH<sub>3</sub>
  - 0.001 mol of O<sub>2</sub>
  
- Equal moles of the following bases are each added to excess HCl. Which base produces the highest temperature rise?
  - KOH
  - NH<sub>3</sub>·H<sub>2</sub>O
  - Mg(OH)<sub>2</sub>
  - LiOH
  
- Which of the following methods does NOT effectively prevent iron from rusting?
  - Electroplating with chromium
  - Coating with plastic
  - Attaching magnesium blocks to ship hulls
  - Immersing iron in salt water



4. Which of the following statements concerning zinc is incorrect?
- A. It acts as a reducing agent when placed in  $\text{HCl}(\text{aq})$
  - B. It can displace copper from  $\text{CuSO}_4$  solution
  - C. It forms an acidic solution when placed in hot  $\text{H}_2\text{O}$
  - D. It forms a soluble compound when placed in  $\text{NH}_3(\text{aq})$
5. Which of the following statements about intermolecular forces is INCORRECT?
- A. Hydrogen bonding is responsible for the high surface tension of water.
  - B. All molecules containing hydrogen atoms can form hydrogen bonds.
  - C. The boiling point of ethanol is higher than that of dimethyl ether due to hydrogen bonding.
  - D. Butane has stronger van der Waals' forces than propane due to its larger molecular size.
7. In the electrolysis of  $\text{CuSO}_4(\text{aq})$  with carbon electrodes, which are the products at the anode and cathode respectively?
- A.  $\text{Cu}^{2+}$  and  $\text{Cu}$
  - B.  $\text{O}_2$  and  $\text{H}_2$
  - C.  $\text{O}_2$  and  $\text{Cu}$
  - D.  $\text{Cl}_2$  and  $\text{H}_2$
8. Which statement about soap is incorrect?
- A. The process of making soap is called saponification
  - B. Soap molecules are completely hydrophobic
  - C. Soap is made by reacting fats/oils with sodium hydroxide
  - D. Soap molecules have both hydrophilic and hydrophobic parts

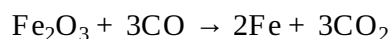
9. Which of the following set-ups can be used to prevent an underground iron pipe from rusting?  
(1) Aluminium block connected to iron pipe in moist soil  
(2) Zinc block connected to iron pipe in moist soil  
(3) Tin block connected to iron pipe in moist soil
- A. (2) only  
B. (1) and (3) only  
C. (1) and (2) only  
D. (1) only
10. What is the mole ratio of sulphuric acid to potassium hydroxide required for complete neutralization?
- A. 1:3  
B. 1:2  
C. 2:1  
D. 1:1
11. Which statement concerning aqueous ammonia is INCORRECT?
- A. When aqueous ammonia is added to  $\text{CuSO}_4(\text{aq})$  until in excess, a deep blue solution is formed.  
B. Concentrated aqueous ammonia is corrosive.  
C. Aqueous ammonia is a weak alkali.  
D. Aqueous ammonia can be used to distinguish between  $\text{Pb}(\text{NO}_3)_2(\text{aq})$  and  $\text{Al}(\text{NO}_3)_3(\text{aq})$ .

12. The diagrams below show the electrolysis of 0.1 M  $\text{CuSO}_4(\text{aq})$  using different electrodes. In which setup is  $\text{Cu}^{2+}$  NOT produced at the anode?

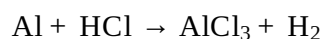


- A. Both setups
- B. Setup 1
- C. Setup 2
- D. Neither setup
13. Consider the following two chemical cells:  
Cell 1: P-R cell  
- Electron flow: from P to R through external circuit  
Cell 2: R-Q cell  
- Electron flow: from Q to R through external circuit  
Which of the following correctly shows the descending order of reactivity of the three metals P, Q and R?
- A.  $P > Q > R$
- B.  $Q > R > P$
- C.  $Q > P > R$
- D.  $P > R > Q$

14. What is the sum of all coefficients in the following balanced equation?



- A. 9
  - B. 11
  - C. 10
  - D. 8
15. When the following equation is balanced:



What is the coefficient of HCl?

- A. 2
  - B. 3
  - C. 6
  - D. 4
16. When copper(ii) ions reduced to copper metal, what color change is observed?
- A. Colorless  $\rightarrow$  orange/brown
  - B. Blue  $\rightarrow$  blue precipitate
  - C. Blue  $\rightarrow$  colorless (with brown solid)
  - D. Yellow/brown  $\rightarrow$  brown precipitate
17. Y is a monobasic acid. The pH of 0.2M Y(aq) is 1.73. Which of the following statements concerning the 0.2M Y(aq) is correct?
- A. It is a dilute solution of a strong acid.
  - B. It is a concentrated solution of a strong acid.
  - C. It is a concentrated solution of a weak acid.
  - D. It is a dilute solution of a weak acid.

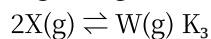
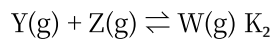
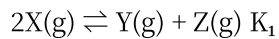
18. Which test can distinguish between  $\text{Li}_2\text{CO}_3(\text{aq})$  and  $\text{CaCl}_2(\text{aq})$ ?
- A. flame test
  - B. adding  $\text{NaOH}(\text{aq})$
  - C. adding acidified  $\text{AgNO}_3$
  - D. adding dilute  $\text{HCl}$
19. Which of the following statements about calcium hydroxide is INCORRECT?
- A. The pH of  $\text{Ca}(\text{OH})_2$  solution is less than 7.
  - B.  $\text{Ca}(\text{OH})_2$  is used in mortar for construction.
  - C.  $\text{Ca}(\text{OH})_2$  reacts with  $\text{CO}_2$  to form  $\text{CaCO}_3$ .
  - D.  $\text{Ca}(\text{OH})_2$  solution turns red litmus paper blue.
20.  $25 \text{ cm}^3$  of  $0.1 \text{ M HCl}$  is mixed with  $30 \text{ cm}^3$  of  $0.1 \text{ M NaOH}$ . What is the pH of the resulting solution at  $25^\circ\text{C}$ ?
- A. pH = 13.0
  - B. pH = 12.0
  - C. pH = 12.2
  - D. pH = 11.0
21. Refer to the following thermochemical equation:  
 $2\text{Mg}(\text{s}) + \text{O}_2(\text{g}) \rightarrow 2\text{MgO}(\text{s}) \quad \Delta H = -1204 \text{ kJ mol}^{-1}$   
Which of the following statements is / are correct?
- (1) The standard enthalpy change of formation of  $\text{MgO}(\text{s})$  is  $-602 \text{ kJ mol}^{-1}$ .
  - (2) The standard enthalpy change of combustion of  $\text{Mg}(\text{s})$  is  $-1204 \text{ kJ mol}^{-1}$ .
  - (3) When 2 mol of  $\text{Mg}(\text{s})$  reacts with 1 mol of  $\text{O}_2(\text{g})$  to form 2 mol of  $\text{MgO}(\text{s})$  under standard conditions, 1204 kJ of heat is released.
- A. (1) only
  - B. (1) and (3) only
  - C. (1) and (2) only
  - D. (3) only

22. Arrange the following substances in order of increasing boiling point.
- A. hexane < chlorine < propane < butane
  - B. hexane < butane < chlorine < propane
  - C. propane < chlorine < butane < hexane
  - D. propane < chlorine < hexane < butane
23. In a hydrogen-oxygen fuel cell, hydrogen is
- A. reduced at the cathode.
  - B. reduced at the anode.
  - C. oxidised at the anode.
  - D. oxidised at the cathode.
24. An alkanolic acid has the molecular formula  $\text{CH}_2\text{O}_2$ . How many carbon atoms does each molecule contain?
- A. 1
  - B. 5
  - C. 4
  - D. 7
25. Refer to the following equilibrium system in a closed container:  
 $\text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) \rightleftharpoons 2\text{NH}_3(\text{g})$   
Which of the following changes would increase the number of moles of  $\text{NH}_3(\text{g})$  in the system?
- (1) removing  $\text{N}_2(\text{g})$
  - (2) adding  $\text{H}_2(\text{g})$
  - (3) adding a catalyst
- A. (2) and (3) only
  - B. (1) and (2) only
  - C. (2) only
  - D. (1), (2) and (3)

26. In which of the following will the initial rate of reaction be the SLOWEST?

- A. 0.2 M HCl + excess Mg powder at 25°C
- B. 0.1 M HCl + excess Mg ribbon at 25°C
- C. 0.05 M HCl + excess Mg ribbon at 15°C
- D. 0.1 M HCl + excess Mg ribbon at 40°C

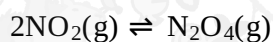
27. Consider the information below:



Which of the following combinations is correct?

- A.  $K_3 = K_1 \times K_2$ ; Unit of  $K_3$ :  $\text{mol dm}^{-3}$
- B.  $K_3 = K_1/K_2$ ; Unit of  $K_3$ :  $\text{mol dm}^{-3}$
- C.  $K_3 = K_2/K_1$ ; Unit of  $K_3$ :  $\text{mol}^{-1} \text{dm}^3$
- D.  $K_3 = K_1 \times K_2$ ; Unit of  $K_3$ : no unit

28. Consider the following equilibrium:



At a certain temperature,  $K_c = 8.0 \text{ (mol}^{-1} \text{ dm}^3\text{)}$ .

At a particular moment, the reaction quotient  $Q_c = 2.0 \text{ (mol}^{-1} \text{ dm}^3\text{)}$ .

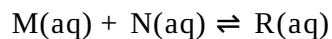
In which direction will the reaction proceed to reach equilibrium?

- A. No change (already at equilibrium)
- B. Backward (towards reactants)
- C. Forward (towards products)
- D. Cannot be determined

29. An acyclic hydrocarbon R has 2 C=C bonds. What volume of hydrogen gas is needed to completely react with 0.5 mol of R at room conditions?  
(Molar volume of gas at room conditions = 24 dm<sup>3</sup>)
- A. 12.0 dm<sup>3</sup>
  - B. 12.0 dm<sup>3</sup>
  - C. 48.0 dm<sup>3</sup>
  - D. 24.0 dm<sup>3</sup>
30. Which of the following statements concerning ethanol are correct?  
(1) It contains a hydroxyl functional group.  
(2) It is a hydrocarbon.  
(3) It can be oxidised to ethanoic acid.
- A. (1) and (2) only
  - B. (1) and (3) only
  - C. (2) and (3) only
  - D. (1), (2) and (3)
31. Which of the following is NOT a characteristic of a homologous series?
- A. Physical properties show gradual change with molecular mass.
  - B. Members have the same molecular formula.
  - C. Members differ by CH<sub>2</sub> unit.
  - D. Members show similar chemical properties.
32. Which of the following statements about transition metals is incorrect?
- A. Transition metals have high melting and boiling points
  - B. Transition metals can act as catalysts
  - C. All transition metals have only one oxidation state
  - D. Transition metals have high densities

33. Which of the following statements about ZnO is correct?
- A. ZnO can react with both dilute acids and alkalis.
  - B. ZnO does not react with either acids or alkalis.
  - C. ZnO reacts with alkalis but not with acids.
  - D. ZnO reacts with acids but not with alkalis.

34. Consider the following reversible reaction:



At a fixed temperature, the system initially contains a small amount of M and N only. When the system attains chemical equilibrium, the mole ratio is  $[\text{M}]:[\text{R}] = 1:2$ .

Which of the following statements is/are correct?

- (1) If more M is added,  $K_c$  will increase.
- (2) A catalyst will change the equilibrium ratio.
- (3) At equilibrium, the concentrations of all species remain constant.

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

35. A reaction has an activation energy of  $86 \text{ kJ mol}^{-1}$  without a catalyst and  $53 \text{ kJ mol}^{-1}$  with a catalyst. By how much does the catalyst lower the activation energy?

- A.  $33 \text{ kJ mol}^{-1}$
- B.  $53 \text{ kJ mol}^{-1}$
- C.  $86 \text{ kJ mol}^{-1}$
- D.  $139 \text{ kJ mol}^{-1}$

PERIODIC TABLE 周期表

GROUP 族

		atomic number 原子序										relative atomic mass 相對原子質量									
		1										0									
		I										II									
3	4	<b>Li</b> 6.9	<b>Be</b> 9.0																	<b>He</b> 4.0	
11	12	<b>Na</b> 23.0	<b>Mg</b> 24.3																	<b>Ne</b> 20.2	
19	20	<b>K</b> 39.1	<b>Ca</b> 40.1	<b>Sc</b> 45.0	<b>Ti</b> 47.9	<b>V</b> 50.9	<b>Cr</b> 52.0	<b>Mn</b> 54.9	<b>Fe</b> 55.8	<b>Co</b> 58.9	<b>Ni</b> 58.7	<b>Cu</b> 63.5	<b>Zn</b> 65.4	<b>Ga</b> 69.7	<b>Ge</b> 72.6	<b>As</b> 74.9	<b>Se</b> 79.0	<b>Br</b> 79.9	<b>Kr</b> 83.8		
37	38	<b>Rb</b> 85.5	<b>Sr</b> 87.6	<b>Y</b> 88.9	<b>Zr</b> 91.2	<b>Nb</b> 92.9	<b>Mo</b> 95.9	<b>Tc</b> (98)	<b>Ru</b> 101.1	<b>Rh</b> 102.9	<b>Pd</b> 106.4	<b>Ag</b> 107.9	<b>Cd</b> 112.4	<b>In</b> 114.8	<b>Sn</b> 118.7	<b>Sb</b> 121.8	<b>Te</b> 127.6	<b>I</b> 126.9	<b>Xe</b> 131.3		
55	56	<b>Cs</b> 132.9	<b>Ba</b> 137.3	<b>La</b> 138.9	<b>Hf</b> 178.5	<b>Ta</b> 180.9	<b>W</b> 183.9	<b>Re</b> 186.2	<b>Os</b> 190.2	<b>Ir</b> 192.2	<b>Pt</b> 195.1	<b>Au</b> 197.0	<b>Hg</b> 200.6	<b>Tl</b> 204.4	<b>Pb</b> 207.2	<b>Bi</b> 209.0	<b>Po</b> (209)	<b>At</b> (210)	<b>Rn</b> (222)		
87	88	<b>Fr</b> (223)	<b>Ra</b> (226)	<b>Ac</b> (227)	<b>Rf</b> (261)	<b>Db</b> (262)															

* 58	59	60	61	62	63	64	65	66	67	68	69	70	71
<b>Ce</b> 140.1	<b>Pr</b> 140.9	<b>Nd</b> 144.2	<b>Pm</b> (145)	<b>Sm</b> 150.4	<b>Eu</b> 152.0	<b>Gd</b> 157.3	<b>Tb</b> 158.9	<b>Dy</b> 162.5	<b>Ho</b> 164.9	<b>Er</b> 167.3	<b>Tm</b> 168.9	<b>Yb</b> 173.0	<b>Lu</b> 175.0
** 90	91	92	93	94	95	96	97	98	99	100	101	102	103
<b>Th</b> 232.0	<b>Pa</b> (231)	<b>U</b> 238.0	<b>Np</b> (237)	<b>Pu</b> (244)	<b>Am</b> (243)	<b>Cm</b> (247)	<b>Bk</b> (247)	<b>Cf</b> (251)	<b>Es</b> (252)	<b>Fm</b> (257)	<b>Md</b> (258)	<b>No</b> (259)	<b>Lr</b> (260)

## Answers

1. A

Carbon dioxide (CO<sub>2</sub>) weakly acidic.  $\text{CO}_2 + \text{H}_2\text{O} \rightleftharpoons \text{H}_2\text{CO}_3$ . This gives a solution with pH in the weakly acidic (pH 5-6.5) range.

2. A

KOH is a strong, soluble base that reacts completely and vigorously with HCl, producing the greatest temperature rise.

3. D

"Immersing iron in salt water" is NOT effective for preventing corrosion.

Reason: Salt acts as electrolyte and accelerates corrosion.

Corrosion prevention methods:

- Barrier methods: painting, oiling, plastic coating, electroplating
- Sacrificial protection: using more reactive metals (Zn, Mg) as anodes
- Avoid contact with less reactive metals (Cu, Sn) which accelerate corrosion

4. C

The statement "It forms an acidic solution when placed in hot H<sub>2</sub>O" is FALSE.

Reason: Zinc reacts with steam to form ZnO (amphoteric), not acidic.

5. B

Not all molecules containing hydrogen can form hydrogen bonds. Hydrogen bonding requires hydrogen bonded to highly electronegative atoms (N, O, or F). For example, methane (CH<sub>4</sub>) contains hydrogen but cannot form hydrogen bonds.

7. C

Anode: O<sub>2</sub>

Cathode: Cu

8. B

Soap is made by saponification of fats/oils. It has both hydrophilic (ionic head) and hydrophobic (long carbon chain) parts.

9. C

Sacrificial protection (cathodic protection) works by connecting a more reactive metal to iron.

The more reactive metal acts as the anode and corrodes instead of iron.

Analysis:

- Setup (1): Aluminium is more reactive than iron, so it protects iron
- Setup (2): Zinc is more reactive than iron, so it protects iron

- Setup (3): Tin is less reactive than iron, so it does NOT protect iron

10. B

For complete neutralization of sulphuric acid (2-basic) with potassium hydroxide (1-acidic):

Mole ratio = 1:2

11. D

The incorrect statement is: Aqueous ammonia can be used to distinguish between  $\text{Pb}(\text{NO}_3)_2(\text{aq})$  and  $\text{Al}(\text{NO}_3)_3(\text{aq})$ .

12. C

In Setup 1,  $\text{Cu}^{2+}$  is produced at the anode. In Setup 2,  $\text{O}_2$  is produced instead.

13. A

In an electrochemical cell:

- The more reactive metal is the anode (negative terminal)
- Electrons flow from anode to cathode through the external circuit
- The metal that loses electrons (oxidised) is more reactive

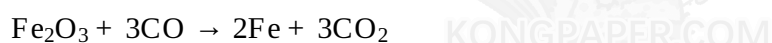
From the cells:

- P is more reactive than R
- Q is more reactive than R

Descending reactivity:  $\text{P} > \text{Q} > \text{R}$

14. A

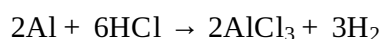
The balanced equation is:



Sum of coefficients =  $1 + 3 + 2 + 3 = 9$ .

15. C

The balanced equation is:



The coefficient of HCl is 6.

16. C

Reaction: Copper(II) ions reduced to copper metal

Equation:  $\text{Cu}^{2+} \rightarrow \text{Cu}$

Color change: blue  $\rightarrow$  colorless (with brown solid)

This is a redox reaction.

17. D

1. Concentration: 0.2 M is a dilute solution ( $< 1$  M).
2. Strength: For a 0.2 M monobasic strong acid,  $\text{pH} = -\log(0.2) \approx 0.70$ . Since the actual pH (1.73) is higher than the theoretical pH, the acid is weak (partially ionized).

18. C

Adding acidified  $\text{AgNO}_3$  can distinguish the two solutions.

Flame test:  $\text{Li}^+$  (red) vs  $\text{Ca}^{2+}$  (brick red)

19. A

The incorrect statement is: The pH of  $\text{Ca(OH)}_2$  solution is less than 7.

Reason:  $\text{Ca(OH)}_2$  is alkaline; its solution has  $\text{pH} > 7$ .

20. B

Step 1: Calculate moles of each reactant

Moles of HCl =  $(25/1000) \times 0.1 = 0.0025$  mol

Moles of NaOH =  $(30/1000) \times 0.1 = 0.0030$  mol

Step 2:  $\text{HCl} + \text{NaOH} \rightarrow \text{NaCl} + \text{H}_2\text{O}$  (1:1 ratio)

Excess  $\text{OH}^- = 0.0030 - 0.0025 = 0.0005$  mol

Step 3: Total volume =  $25 + 30 = 55 \text{ cm}^3 = 0.055 \text{ dm}^3$

Step 4:  $[\text{OH}^-] = 0.0005 / 0.055 = 0.0091$  M

Step 5:  $\text{pOH} = -\log(0.0091) = 2.04$

Step 6:  $\text{pH} = 14 - 2.04 = 11.96$

21. B

Analysis:

(1) Correct

(2) Incorrect (combustion enthalpy per mol =  $-1204/2 = -602.0 \text{ kJ mol}^{-1}$ )

(3) Correct

Answer: (1) and (3) only

22. C

Correct order: propane  $<$  chlorine  $<$  butane  $<$  hexane. Boiling points: propane ( $-42^\circ\text{C}$ ), chlorine ( $-34^\circ\text{C}$ ), butane ( $-1^\circ\text{C}$ ), hexane ( $69^\circ\text{C}$ )

23. C

In a hydrogen-oxygen fuel cell,  $\text{H}_2$  is oxidised at the anode (loses electrons):  $2\text{H}_2 + 4\text{OH}^- \rightarrow 4\text{H}_2\text{O} + 4\text{e}^-$

24. A

The molecular formula  $\text{CH}_2\text{O}_2$  corresponds to methanoic acid.

Its structural formula is  $\text{HCOOH}$ , which has 1 carbon atom(s).

For straight-chain monocarboxylic acids ( $C_nH_{2n}O_2$ ), the number of carbon atoms can be determined from the molecular formula.

25. C

(1) Decreases  $NH_3$ . (2) Increases  $NH_3$ . (3) No effect on equilibrium position.

26. C

The answer is: 0.05 M HCl + excess Mg ribbon at 15°C

Reason: Low concentration, low temperature, small surface area

Factors affecting reaction rate:

1. Concentration - higher concentration = faster rate
2. Temperature - higher temperature = faster rate
3. Surface area - larger surface area (powder > ribbon > lump) = faster rate
4. Catalyst - presence of catalyst = faster rate

27. A

Eq3 = Eq1 + Eq2, so  $K_3 = K_1 \times K_2$ . Unit: 1 species / 2 species =  $\text{mol dm}^{-3}$

28. C

Since  $Q_c (2.0) < K_c (8.0)$ , there is too little product.

The reaction will proceed in the forward direction to produce more products until  $Q = K$ .

29. D

Each C=C bond reacts with 1 mol  $H_2$

$$n(H_2) = 0.5 \times 2 = 1.0 \text{ mol}$$

$$V(H_2) = 1.0 \times 24 = 24.0 \text{ dm}^3$$

30. B

Analysis of statements:

- (1) It contains a hydroxyl functional group. - TRUE
- (2) It is a hydrocarbon. - FALSE
- (3) It can be oxidised to ethanoic acid. - TRUE

Only statements 1 and 3 are correct.

31. B

The incorrect statement is: "Members have the same molecular formula."

Reason: Members have different molecular formulas (differ by  $CH_2$ ).

This is NOT a characteristic because members of a homologous series have different molecular formulas (differing by  $CH_2$ ).

32. C

The statement "All transition metals have only one oxidation state" is FALSE.

Reason: Variable oxidation states are characteristic of transition metals.

Key characteristics of transition metals:

- Variable oxidation states
- Coloured compounds
- Catalytic activity
- Complex ion formation
- High density, melting point, and boiling point

33. A

ZnO is an amphoteric oxide. It can react with both acids and bases:

With acid:  $\text{ZnO} + 2\text{HCl} \rightarrow \text{ZnCl}_2 + \text{H}_2\text{O}$

With base:  $\text{ZnO} + 2\text{NaOH} \rightarrow \text{Na}_2\text{ZnO}_2 + \text{H}_2\text{O}$

34. B

(1) Incorrect:  $K_c$  depends only on temperature.

(2) Incorrect: A catalyst speeds up both forward and backward reactions equally, without affecting equilibrium position.

(3) Correct: This is a characteristic of equilibrium.

35. A

Activation energy lowered =  $86 - 53 = 33 \text{ kJ mol}^{-1}$

The catalyst provides an alternative pathway with lower activation energy.

