

AGA KHAN UNIVERSITY EXAMINATION BOARD

HIGHER SECONDARY SCHOOL CERTIFICATE

CLASS XI

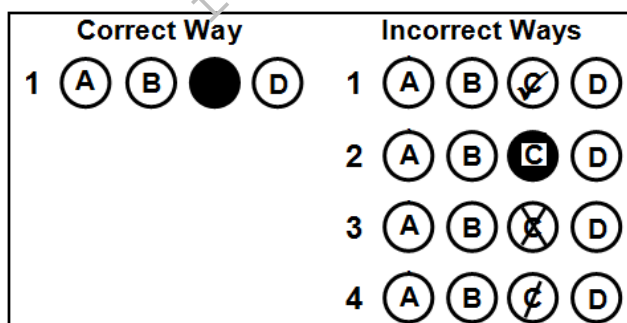
ANNUAL EXAMINATIONS (THEORY) 2025

Chemistry Paper I

Time: 1 hour 30 minutes Marks: 50

INSTRUCTIONS

1. Read each question carefully.
2. Answer the questions on the separate answer sheet provided. DO NOT write your answers on the question paper.
3. There are 100 answer numbers on the answer sheet. Use answer numbers 1 to 50 only.
4. In each question there are four choices A, B, C, D. Choose ONE. On the answer grid black out the circle for your choice with a pencil as shown below.



Candidate's Signature

5. If you want to change your answer, ERASE the first answer completely with a rubber, before blacking out a new circle.
6. DO NOT write anything in the answer grid. The computer only records what is in the circles.
7. You may use a scientific calculator if you wish.

1. How many moles of CO_2 contain 12 g of oxygen?

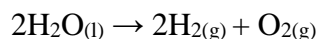
(Note: $^{12}_6\text{C}$ and $^{16}_8\text{O}$)

- A. 0.272
 B. 0.375
 C. 2.667
 D. 3.667
2. The analysis of a sample of 24.81 g of a gaseous compound reveals that it contains 3.01 g of carbon, 4.00 g of oxygen, and 17.81 g of chlorine.

The percentage composition (by mass) of this compound is

	% of Carbon	% of Oxygen	% of Chlorine
A	8.2	16.4	75.4
B	12.1	16.1	71.8
C	18.7	21.0	60.3
D	24.8	25.0	50.2

3. Water undergoes decomposition during electrolysis and forms hydrogen and oxygen gas as follows.



The ratio of products by volume in the given reaction is

	Hydrogen Gas	Oxygen Gas
A	1	8
B	2	1
C	2	16
D	4	32

4. How much volume is occupied by 5.2 g of chlorine gas at standard temperature and pressure (STP)?

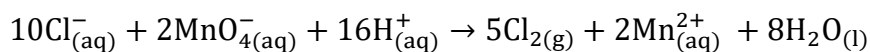
(Note: Molar mass of $\text{Cl} = 35.5 \text{ g mol}^{-1}$)

- A. 0.164 dm^3
 B. 0.328 dm^3
 C. 1.641 dm^3
 D. 3.283 dm^3

5. The oxidation number of iron in Fe_2O_3 is

- A. + 1
- B. + 2
- C. + 3
- D. + 6

6. Consider the given redox reaction.



The option that shows the change in oxidation states of manganese and chloride ions is

	Manganese Ions	Chloride Ions
A	+7 to +2	- 1 to zero
B	+2 to +7	Zero to - 1
C	+7 to +2	Zero to - 1
D	+2 to +7	- 1 to zero

7. Which of the following is NOT a redox reaction?

- A. $2\text{Fe}_{(\text{s})} + 3\text{Cl}_{2(\text{g})} \rightarrow 2\text{FeCl}_{3(\text{s})}$
- B. $\text{H}_2\text{S}_{(\text{g})} + 4\text{NaOCl}_{(\text{aq})} \rightarrow \text{H}_2\text{SO}_{4(\text{aq})} + 4\text{NaCl}_{(\text{aq})}$
- C. $\text{Mg}(\text{OH})_{2(\text{aq})} + \text{H}_2\text{SO}_{4(\text{aq})} \rightarrow \text{MgSO}_{4(\text{aq})} + 2\text{H}_2\text{O}_{(\text{l})}$
- D. $\text{H}_2\text{O}_{(\text{l})} + \text{SO}_{2(\text{g})} + \text{NaOCl}_{(\text{aq})} \rightarrow \text{H}_2\text{SO}_{4(\text{aq})} + \text{NaCl}_{(\text{aq})}$

8. The discharge of a lead storage battery causes the consumption of

- I. $\text{H}_2\text{O}_{(\text{l})}$
 - II. $\text{PbO}_{2(\text{s})}$
 - III. $\text{PbSO}_{4(\text{s})}$
 - IV. $\text{H}_2\text{SO}_{4(\text{aq})}$
- A. I and II.
 - B. I and III.
 - C. II and IV.
 - D. III and IV.

9. The Azimuthal quantum number of an orbital describes its

- A. shape and angular momentum.
- B. shape and orientation in space.
- C. size and energy level in which electron resides.
- D. size and orientation of the spin axis of an electron.

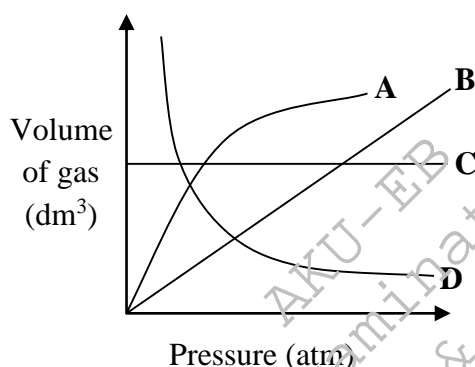
10. In Balmer series of hydrogen spectrum, the electron falls from outer orbit to the
- first orbit.
 - second orbit.
 - third orbit.
 - fourth orbit.
11. The radius of the 2nd orbit of hydrogen atom is

(Note: $a^\circ = \frac{\epsilon_0 \cdot h^2}{\pi m e^2} = 0.529 \text{ \AA}$)

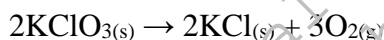
- 0.265 \AA .
 - 1.058 \AA .
 - 2.116 \AA .
 - 3.781 \AA .
12. According to Hund's rule, the ground-state electronic configuration of ${}_{24}^{52}\text{Cr}$ is
- $[\text{Ar}]4s^0, 3d^6$
 - $[\text{Ar}]4s^2, 3d^4$
 - $[\text{Ar}]4s^1, 3d_{xy}^1, 3d_{yz}^1, 3d_{xz}^1, 3d_{x^2-y^2}^1, 3d_{z^2}^1$
 - $[\text{Ar}]4s^2, 3d_{xy}^1, 3d_{yz}^1, 3d_{xz}^1, 3d_{x^2-y^2}^1, 3d_{z^2}^0$
13. An INCORRECT description about the hybridisation type 'sp' is that it
- is also known as diagonal hybridisation.
 - forms three new equivalent hybrid orbitals.
 - produces linear molecules at an angle of 180° .
 - contains the same amount of s and p characters.
14. With reference to the types of hybridisation, the shape of ethane molecule is
- diagonal.
 - trigonal.
 - tetrahedral.
 - octahedral.
15. With reference to valence shell electron pair repulsion (VSEPR) theory, the combination that stands TRUE for a molecule of COCl_2 is

	Number of Bonding Electron Pair	Number of Non-Bonding Electron Pair	Molecular Geometry	Bond Angle
A	2	0	Linear	180
B	3	0	Trigonal planar	120
C	2	1	Trigonal planar	< 120
D	3	1	Trigonal pyramidal	< 109.5

16. The chloride of which of the following elements is insoluble in water?
- Carbon
 - Calcium
 - Potassium
 - Aluminum
17. An element that can chemically react with an atom of hydrogen to form an ionic compound is
- carbon.
 - sodium.
 - chlorine.
 - nitrogen.
18. Which of the following plots (A to D) on the graph represents Boyle's law?



19. Consider the given chemical equation



How much amount of KClO_3 would be required to produce 30.5 dm^3 of oxygen at 125°C and 760 torr ?

(Note: $R = 62.4 \text{ dm}^3 \text{ torr K}^{-1} \text{ mol}^{-1}$ and molar mass of $\text{KClO}_3 = 122.55 \text{ g mol}^{-1}$)

- 38.1 g
 - 76.2 g
 - 114.3 g
 - 242.8 g
20. Which of the following statements is CORRECT regarding three 1.0 L flasks filled with H_2 , O_2 and Ne at standard temperature and pressure (STP)?
- The density of gases in each flask is the same.
 - All flasks contain an equal number of gas molecules.
 - Gas molecules exhibit identical velocities in each flask.
 - The quantity of O_2 and H_2 molecules is double than that of Ne atoms.

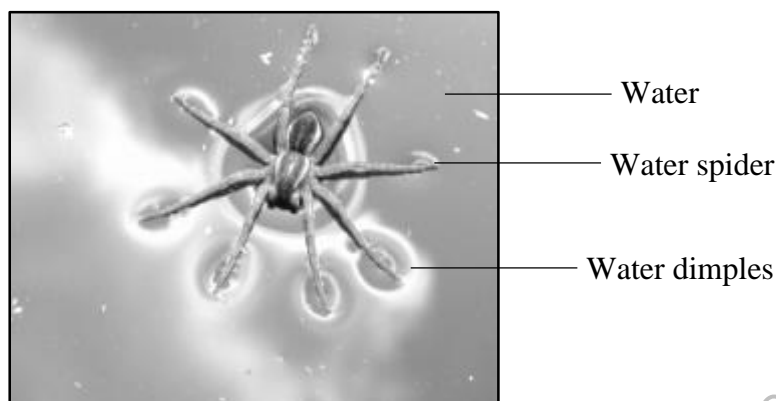
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21. What prevents the liquefaction of an ideal gas?
- A. The relatively tiny size of its molecules
 - B. The negligible forces of attraction among its molecules
 - C. The consistently higher critical temperature of the ideal gas
 - D. The transformation into a solid state before achieving a liquid state
22. The order of stages **I**, **II**, and **III** in which air experiences the liquefaction process using Linde's method is

	I	II	III
A	compression	cooling	expansion
B	expansion	cooling	compression
C	compression	heating	expansion
D	expansion	heating	compression

23. At boiling point of a pure liquid, until the entire liquid is converted into gas, the temperature of the system will
- A. increase.
 - B. decrease.
 - C. remain constant.
 - D. initially decrease and then increase.
24. Liquid crystal is used in temperature sensor devices because it
- A. eliminates any risks of error.
 - B. resists surface temperature changes.
 - C. works at high temperature ranges only.
 - D. changes colour at varying temperatures.
25. In contrast to ethane (C_2H_6), hexane (C_6H_{14}) has
- A. greater polarity.
 - B. lower boiling point.
 - C. lesser polarisability.
 - D. stronger attractive forces.
26. Which of the following modifications would lead to an increase in the vapour pressure of a liquid?
- A. An increase in temperature of the liquid
 - B. An addition of non-volatile solute in the container
 - C. An addition in the volume of liquid in the container
 - D. An increase in the intermolecular forces within the liquid

27. The given figure shows the formation of water dimples when a water spider lifts its feet while walking on the water.



The physical property of water that facilitates the movement of spider is

- A. viscosity.
 B. evaporation.
 C. surface tension.
 D. vapour pressure.
28. Given table shows two different phenomena, **I** and **II**, in which crystal lattices exist.

I		II	
Crystal Lattices of an Ionic Solid		Crystal Lattices of an Element	
Rhombohedral	Orthorhombic	Cubic	Hexagonal

The option that CORRECTLY identifies these phenomena is

	I	II
A	allotropy	polymorphism
B	polymorphism	isomorphism
C	isomorphism	allotropy
D	polymorphism	allotropy

29. The repetition of faces, angles or edges when a crystal is rotated by 360° along its axis is termed as
- A. symmetry.
 B. anisotropy.
 C. crystal's habit.
 D. cleavage plane.

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30. Consider the given characteristics of a type of solids.

- Exhibit high melting points
- Are hard and brittle in nature
- Act as insulators in the solid-state but are conductors in molten and aqueous states

Based on the given characteristics, the option that shows the CORRECT identification of the type of solids and their example is

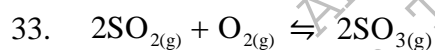
	Type of Solid	Example
A	Ionic Solids	CaF ₂
B	Molecular Solids	SO ₂
C	Ionic Solids	SO ₂
D	Molecular Solids	CaF ₂

31. Amorphous solids exhibit isotropic behaviour because

- they have well defined cleavage plane.
- their properties are direction-dependent.
- they have a long range ordered and repeating structure.
- their components are randomly arranged in all directions.

32. Solids have negligible compressibility due to

- indefinite volume and shape.
- very less interparticle spaces.
- very high interparticle velocities.
- weak intermolecular forces of attraction.



If the value of K_c in this reaction at 500 K is 5.0×10^{-2} , then the value of K_p for this reaction will be

(Note: $R = 0.0821 \text{ dm}^3 \text{ atm K}^{-1} \text{ mol}^{-1}$)

- 5.0×10^{-2}
- 1.2×10^{-3}
- 2.9×10^{-5}
- 7.2×10^{-7}

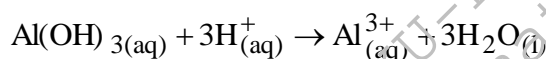
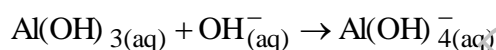
34. If pressure on the given equilibrium systems is increased, the reaction that will shift in the reverse direction is

- $3\text{O}_{2(g)} \rightleftharpoons 2\text{O}_{3(g)}$
- $\text{N}_2\text{O}_{4(g)} \rightleftharpoons 2\text{NO}_{2(g)}$
- $\text{N}_{2(g)} + \text{O}_{2(g)} \rightleftharpoons 2\text{NO}_{(g)}$
- $2\text{PbO}_{(s)} + \text{O}_{2(g)} \rightleftharpoons 2\text{PbO}_{2(s)}$

35. For a chemical reaction at 400 K, the value of $K_c = 0.078$, while that of $Q = 0.011$.

Based on these values, it can be inferred that the chemical reaction

- A. is at equilibrium.
 - B. will proceed in the reverse direction.
 - C. will proceed in the forward direction.
 - D. produces more reactants than products.
36. If the pH of a solution is 10, then the hydroxide ion concentration in the solution will be
- A. 10^{-10}
 - B. 10^{-4}
 - C. 10^4
 - D. 10^{10}
37. Study the given reactions of aluminium hydroxide.



The nature of aluminium hydroxide in the given reactions indicates that it is a/an

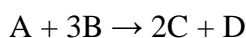
- A. strong acid.
 - B. strong base.
 - C. amphoteric species.
 - D. nucleophilic species.
38. Which set of solutions when combined would form a buffer solution?
- A. Ammonia and sodium phosphate
 - B. Ammonia and ammonium phosphate
 - C. Hydrochloric acid and sodium chloride
 - D. Sodium hydroxide and sodium chloride
39. With reference to the concentration of ions, the CORRECT description of a basic solution is that it has
- A. lower concentrations of both hydronium and hydroxyl ions.
 - B. higher concentrations of both hydronium and hydroxyl ions.
 - C. lesser concentration of hydronium ions than that of hydroxyl ions.
 - D. greater concentration of hydronium ions than that of hydroxyl ions.
40. Which of the following is an example of immiscible solution in liquid phase?
- A. Phenol-water system
 - B. Nicotine-water system
 - C. Benzene-water system
 - D. Triethylamine-water system

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41. Milk is a colloid that is composed of dispersed molecules of
- A. water in oil.
 - B. fat in water.
 - C. water in fat.
 - D. fat and water in oil.
42. Toothpaste is a sol because the dispersed phase and dispersion medium in this colloidal system comprise of

	Dispersed Phase	Dispersion Medium
A	solid	liquid
B	solid	gas
C	liquid	solid
D	liquid	gas

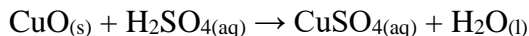
43. According to Raoult's law, what happens to the vapour pressure of a solution when a non-volatile solute is added?
- A. Increases
 - B. Decreases
 - C. Remains constant
 - D. First increases and then becomes constant
44. The given reaction is first order with respect to reactant A and second order with respect to reactant B.



What will be the effect on the rate of reaction when the concentration of A is doubled and the concentration of B is reduced to half?

- A. It will increase two times.
 - B. It will decrease two times.
 - C. It will increase four times.
 - D. It will decrease four times.
45. If the rate of reaction is entirely independent of the concentration of reactant molecules, then the reaction is said to be
- A. zero order.
 - B. third order.
 - C. second order.
 - D. pseudo first order.

46. Which of the following change in conditions would NOT alter the rate of the given reaction?



- A. An increase in the concentration of sulphuric acid
B. An increase in the temperature of the reacting mixture
C. A decrease in the size of the particles of copper(II) oxide
D. A decrease in the pressure at which the reaction takes place
47. A macroscopic property of a system which has some definite values for the initial and final states and is independent of the path adopted to bring about a change is known as
- A. enthalpy.
B. state function.
C. internal energy.
D. thermodynamics.
48. The lattice enthalpy of MgO is $-3791 \text{ kJ mol}^{-1}$ and that of NaCl is -771 kJ mol^{-1} .
Both are ionic compounds, but the difference in their lattice enthalpy arises because
- A. the ionic radii of Cl^- is smaller than that of O^{2-} .
B. the ionic radii of Na^+ is smaller than that of Mg^{2+} .
C. there is greater force of attraction between Na^+ and Cl^- ions.
D. there is greater force of attraction between Mg^{2+} and O^{2-} ions.
49. An isolated system is a thermodynamic system in which, across the system's boundaries,
- A. matter can enter or exit but not energy.
B. energy can enter or exit but not matter.
C. both matter and energy can enter or exit.
D. both matter and energy cannot enter or exit.
50. What will be the change in internal energy of a gaseous system when the work done on the system is 12 J and heat added to it is 20 J?
- A. 32 J
B. 8 J
C. -8 J
D. -32 J

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