



مدونة المناهج السعودية

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الموقع التعليمي لجميع المراحل الدراسية

في المملكة العربية السعودية

Topics Covered by Chemistry Aptitude Test for Admission and Placement

| Subject | Items |
|---|--|
| 1- Atomic structure for chemical compounds and their physical properties | Elements, compounds and mixtures - State of Matter and Properties - Chemical symbols - Predicting the number of elements in a compound - Predicting the number of atoms in a compound - Density - Periodic table - Atomic structure - Electronic configuration - Predicting the number of protons, neutrons and electrons - Chemical bonds . |
| 2- Chemical equations and naming of inorganic compounds-chemical calculations | Chemical formulae - Naming of inorganic compounds – Ionic compounds - Calculating the formula mass - Calculating the number of moles - Calculating the number of grams - Calculating the mass of one atom - Atom and mole ratio in a compound - Calculating the number of atoms and molecules - Balancing chemical equations - Predicting the products of chemical reactions - Predicting the mole ratio from a balanced chemical equation - Predicting the type of chemical reaction. |
| 3- Chemical equilibrium for acids, bases, salts and oxidation - reduction reactions | Predicting the number of ions in a formula unit - Assigning oxidation numbers - Assigning atoms changing their oxidation state in redox reactions - Acids and bases - Acid-base reactions - Calculating the $[H^+]$ and pH - Calculating the $[OH^-]$ and pOH - Acid dissociation constants (K_a) - Base dissociation constants (K_b) - Buffer solutions - Acid - base titration - Equilibrium expressions - Equilibrium constants - The solubility and solubility product (K_{sp}). |
| 4- Solution chemistry | Molarity. |
| 5- Organic compounds and functional groups | Hydrocarbon compounds - Aromatic hydrocarbons – Functional groups. |

Details of the Test Topics

The students should be able to understand the following basic concepts in chemistry and solve problems related to items for each concept.

1- Atomic Structure for Chemical Compounds and Their Physical Properties:

i) Elements, Compounds and Mixtures:

Example 1.1: Vitamin B₁₂ is necessary for proper health. It is used in the treatment of anemia. Vitamin B₁₂ has the molecular formula, C₆₃H₈₈CoN₁₄O₁₄P. How many elements are present in Vitamin B₁₂?

- A) 5 B) 181 C) 6 D) 7

Example 1.2: Which of the following is classified as a mixture?

- A) Water B) A pure gold coin C) Table salt D) Air

ii) State of Matter and Properties:

Example 1.3: Which of the following substances exist as a liquid under ordinary conditions of temperature and pressure?

- A) Sodium carbonate B) Carbon monoxide
C) Mercury D) Hydrogen

Example 1.4: How many phases are present in the following well-mixed system: [sand + salt + sugar + water + gasoline]

- A) 5 B) 3 C) 2 D) 4

Example 1.5: All of the following are properties of oxygen. Which one represents a chemical property?

- A) It is a gas at 25°C B) It causes iron to form rust
C) It can be compressed D) It freezes at -219°C

Example 1.6: A safety razor blade, made of iron and with a density greater than that of water, can be made to float on water if placed carefully. Which of the following properties is responsible for this phenomenon?

- A) Specific heat B) Surface tension C) Melting point D) Viscosity

iii) Chemical Symbols:

Example 1.7: Which of the following elements is paired with the wrong symbol?

- A) Silver - Ag B) Nitrogen - Ni
C) Magnesium - Mg D) Lithium - Li

iv) Predicting the Number of Elements in a Compound & Predicting the Number of Atoms in a Compound:

Example 1.8: Which of the following oxyanions (anion containing oxygen atoms) contain four oxygen atoms?

- A) Nitrate B) Sulfate C) Carbonate D) Bicarbonate

See example 1.1

v) **Density:**

Example 1.9: A graduated cylinder contains 50.0 mL of water. Uniform stones, each weighing 5.000 g and having a density of 2.5 g/mL, are placed into the graduated cylinder until the water level rises to 130.0 mL. How many stones are in the cylinder?

- A) 60 B) 40 C) 32 D) 25

vi) **Periodic Table, Atomic Structure and Electronic Configuration-Predicting the Number of Protons, Number of Neutrons and Electrons:**

Example 1.10: The electron configuration of the magnesium atom (Mg) in the outermost shell (last energy level) is:

- A) $2s^22p^5$ B) $3s^2$ C) $2s^22p^1$ D) $3s^23p^1$

Example 1.11: How many neutrons are in the ion ${}^{52}_{24}\text{Cr}^{3+}$?

- A) 24 B) 28 C) 25 D) 27

vii) **Chemical Bonds:**

Example 1.12: The bond formed between ammonia molecule (NH_3) and hydrogen ion (H^+) is known as:

- A) Ionic bond B) Covalent bond
C) Coordinate covalent bond (dative bond) D) Metallic bond

2- **Chemical Equations and Naming of Inorganic Compounds-Chemical Calculations:**

i) **Chemical Formulae & Naming of Inorganic Compounds:**

Example 2.1: Choose the pair of name and formula that do not match?

| <u>Formula</u> | <u>Name</u> |
|----------------------------|--------------------|
| A) AlCl_3 | Aluminium chloride |
| B) NaNO_3 | Sodium nitrate |
| C) CaO | Carbon monoxide |
| D) H_2SO_4 | Sulfuric acid |

ii) **Ionic Compounds:**

Example 2.2: How many ions per formula unit would you find if you dissolve $(\text{NH}_4)_2[\text{Ce}(\text{NO}_3)_6]$ in water?

- A) 3 B) 9 C) 2 D) 6

iii) **Calculating the Formula Mass:**

Example 2.3: Calculate the molar mass of $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$.

- A) 120.37 g/mole B) 126.14 g/mole
C) 246.54 g/mole D) 222.57 g/mole

iv) **Calculating the Number of Moles:**

Example 2.4: How many moles of nitrogen (N) atoms are in 75.0 g of penicillin, $\text{C}_{16}\text{H}_{18}\text{O}_4\text{N}_2\text{S}$? [molar mass of penicillin = 334.28 g/mole]

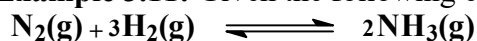
- A) 0.224 B) 0.896 C) 0.449 D) 0.296

Example 2.5: Which of the following contains 2.00 moles of carbon atoms?

- A) 60.0 g ethane (C_2H_6) B) 26.0 g benzene (C_6H_6)
C) 2.00 moles oxalic acid ($\text{H}_2\text{C}_2\text{O}_4$) D) 5.00 g methane (CH_4)

viii) **Equilibrium Expressions and Equilibrium Constants:**

Example 3.11: Given the following equilibrium system, what is the expression of K_c ?



A) $K_c = [\text{NH}_3]^2 / [\text{N}_2] + 3[\text{H}_2]$

B) $K_c = [\text{NH}_3]^2 / [\text{N}_2][\text{H}_2]^3$

C) $K_c = [\text{N}_2][\text{H}_2]^3 / [\text{NH}_3]^2$

D) $K_c = 2[\text{NH}_3] / [\text{N}_2] + 3[\text{H}_2]$

ix) **The Solubility and Solubility Product (K_{sp}):**

Example 3.12: The solubility product (K_{sp}) of Ag_2CrO_4 is given by:

A) $K_{sp} = 2[\text{Ag}^+][\text{CrO}_4^{2-}]$

B) $K_{sp} = 1/[\text{Ag}^+]^2 [\text{CrO}_4^{2-}]$

C) $K_{sp} = [2\text{Ag}^+][\text{CrO}_4^{2-}]$

D) $K_{sp} = [\text{Ag}^+]^2 [\text{CrO}_4^{2-}]$

4- **Solution Chemistry:**

- **Molarity:**

Example 4.1: What is the molarity of a solution made by dissolving 2.40 mole of KI in enough water to make 2.75 L of solution?

A) 0.200 M

B) 0.873 M

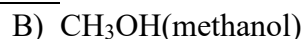
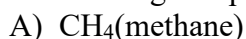
C) 0.255 M

D) 0.542 M

5- **Organic Compounds and Functional Groups:**

- **Hydrocarbon Compounds, Aromatic Hydrocarbons, and Functional Groups:**

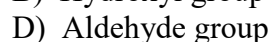
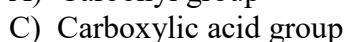
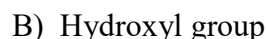
Example 5.1: Not all carbon containing compounds are organic compounds. Which one of the following compounds is an inorganic compound?



Example 5.2: Which of the following is an aromatic compound?



Example 5.3: What is the functional group ($-\overset{\text{O}}{\parallel}{\text{C}}-$) in $\text{CH}_3-\overset{\text{O}}{\parallel}{\text{C}}-\text{CH}_3$.



Data You May Need

Physical Constants:

Avogadro's number = 6.022×10^{23} objects/mole

Atomic Masses:

H = 1.01; C = 12.0; N = 14.0; O = 16.0; Mg = 24.3; S = 32.1
Cl = 35.5; K = 39.1

Atomic Number:

H = 1; N = 7; Mg = 12