## BOARD OF INTERMEDIATE EDUCATION, KARACHI

## Chemistry - I

## SECTION - A (Multiple Choice Questions)

Note: This section consists of 33 part questions and all are to be answered. Each question carries one mark.
(33 Marks)
Q. 1
(i) The total number of ions in one formula unit of $\mathrm{FeCl}_{3}$ are:
(a) $6.02 \times 10^{23}$
(b) $12.04 \times 10^{23}$
(c) $18.06 \times 10^{23}$
(d) $24.08 \times 10^{23}$
(ii) When $7.0 \times 10^{12}$ is multiplied by $2.0 \times 10^{-3}$, the answer will be:
(a) $1.4 \times 10^{9}$
(b) $1.4 \times 10^{10}$
(c) $1.4 \times 10^{-15}$
(d) $1.4 \times 10^{-36}$
(iii) Quantum number value for 3d orbitals are:
(a) $\mathrm{n}=2, \ell=1$
(b) $n=3, \ell=2$
(c) $n=3, \ell=3$
(d) $n=2, \ell=3$
(iv) The range of wavelength of $x$-rays lies between;
(a) $0.1 \AA \AA$ to $10 \AA$
(b) $10 \AA$ to $100 \AA$
(c) $100 \AA$ to $500 \AA$
(d) $4000 \AA ̊$ to $7000 \AA ̊$
(v) Bohr's theory cannot be applied on:
(a) H
(b) $\mathrm{H}^{+}$
(c) $\mathrm{He}^{+1}$
(d) $\mathrm{Li}^{+2}$
(vi) What is the hybrid state of carbon in $\mathrm{C}_{2} \mathrm{H}_{2}$ molecule:
(a) $\mathrm{sp}^{3}$
(b) $\mathrm{sp}^{2}$
(c) sp
(d) $\mathrm{dsp}^{2}$
(vii) This molecule has zero dipole moment:
(a) $\mathrm{C}_{6} \mathrm{H}_{6}$
(b) $\mathrm{NH}_{3}$
(c) $\mathrm{H}_{2} \mathrm{~S}$
(d) $\mathrm{NO}_{2}$
(viii) The geometry of $\mathrm{BF}_{3}$ is planar trigonal, its bond angle should be:
(a) $104.5^{\circ}$
(b) $109.5^{\circ}$
(c) $107^{\circ}$
(d) $120^{\circ}$
(ix) VBT tells us about all of the following facts except:
(a) Bond length
(b) Bond strength
(c) Bond energy
(d) Bond order
(x) Cooling appliances like air conditioners and refrigerators are working on the principle of:
(a) Common ion effect
(b) Joule-Thomson effect
(c) Pauli's exclusion principle
(d) Le-Chatlier's principle
(xi) The rate of diffusion of Helium (He) compared with $\mathrm{CH}_{4}$ is:
(a) 0.5 time
(b) Two times
(c) Three times
(d) Four times
(xii) The molar volume of Oxygen $\left(\mathrm{O}_{2}\right)$ is highest at:
(a) $100^{\circ} \mathrm{C}$ and 1 atm
(b) $25^{\circ} \mathrm{C}$ and 2 atm
(c) $200^{\circ} \mathrm{C}$ and 0.5 atm
(d) $40^{\circ} \mathrm{C}$ and 0.5 atm
(xiii) Plasma is the fourth state of matter, it consists of:
(a) Neutral molecules
(b) Positive ions
(c) Negative electrons
(d) All of these
(xiv) Cooking time is reduced in a pressure cooker because:
(a) Boiling point of water rises
(b) Heat is stored in pressure cooker
(c) Vapor pressure of liquid is reduced
(d) Heat is uniformly distributed
(xv) Which of the following molecule possess strongest London forces:
(a) $\mathrm{H}_{2}$
(b) He
(c) $\mathrm{CH}_{4}$
(d) Ne
(xvi) Which of the following pair of compounds may represents isomorphism:
(a) NaCl and $\mathrm{KNO}_{3}$
(b) MgO and NaF
(c) $\mathrm{NaNO}_{3}$ and CdS
(d) NaF and $\mathrm{CaCO}_{3}$
(xvii) A big crystal can be cut or split into smaller size of identical shape; this phenomenon is called:
(a) Anisotropy
(b) Cleavage
(c) Symmetry
(d) Isomorphism
(xviii) $K p=K c$ when $\Delta n$ is equal to:
(a) zero
(b) 1
(c) -1
(d) 2
(xix) The solubility of $\mathrm{MgCl}_{2}$ is $X$, its Ksp will be:
(a) $x^{2}$
(b) $2 x^{2}$
(c) $4 x^{2}$
(d) $4 x^{3}$
( xx ) The unit of rate constant for the first order reaction is:
(a) $\mathrm{Ms}^{-1}$
(b) $\mathrm{s}^{-1}$
(c) $\mathrm{M}^{-1} \mathrm{~s}^{-1}$
(d) $\mathrm{M}^{-2} \mathrm{~s}^{-1}$
(xxi) Amphoteric substance among the following is:
(a) $\mathrm{K}_{2} \mathrm{O}$
(b) $\mathrm{CO}_{2}$
(c) ZnO
(d) MgO
(xxii) Which of the following salt is hydrolyzed in water:
(a) $\mathrm{Na}_{2} \mathrm{SO}_{4}$
(b) KCl
(c) $\mathrm{NH}_{4} \mathrm{Cl}$
(d) $\mathrm{NaNO}_{3}$
(xxiii) Conjugate base of $\mathrm{HCO}_{3}^{-}$is:
(a) $\mathrm{H}_{2} \mathrm{CO}_{3}$
(b) $\mathrm{CO}_{3}^{-2}$
(c) $\mathrm{H}^{+}$
(d) $\mathrm{H}_{2} \mathrm{O}$
(xxiv) The decomposition of $\mathrm{H}_{2} \mathrm{O}_{2}$ is inhibited by:
(a) Ethanol
(b) Glycerine
(c) $\mathrm{MnO}_{2}$
(d) $\mathrm{V}_{2} \mathrm{O}_{5}$
(xxv) The rate constant of a reaction depends upon:
(a) Temperature
(b) Initial concentration
(c) Time of reaction
(d) Extent of reaction
(xxvi) Effect of pressure change play significant role in the solubility of:
(a) Solid into liquid
(b) Liquid into liquid
(c) Gas into liquid
(d) All of them
(xxvii) Milk is an example of this type of colloid:
(a) Gel
(b) Aerosol
(c) Emulsion
(d) Foam
(xxviii) Parts per trillion means:
(a) $10^{3}$
(b) $10^{6}$
(c) $10^{9}$
(d) $10^{12}$
(xxix) Which of the following enthalpy change is always negative:
(a) Enthalpy of formation
(b) Enthalpy of decomposition
(c) Enthalpy of combustion
(d) Enthalpy of reaction
(xxx) Which of the following is not a state function of a system?
(a) Pressure
(b) Enthalpy
(c) Internal energy
(d) Work done
(xxxi) Oxidation number of Cr in $\mathrm{Na}_{2} \mathrm{Cr}_{2} \mathrm{O}_{7}$ is:
(a) +3
(b) +6
(c) +8
(d) +12
(xxxii) Galvanized rode of iron is coated with:
(a) Nickel
(b) Zinc
(c) Chromium
(d) Carbon
(xxxiii) KOH is used as electrolyte in:
(a) Lead accumulator
(b) Fuel cell
(c) Alkaline battery
(d) Dry cell

## SECTION - B (Short Answered Questions) <br> Note: Attempt any eight parts questions. All questions carry equal marks.

## Q. 2

(i) (a) What is meant by actual yield? Why it is always less than theoretical yield in a reaction.
(b) The volume of a sample of Nitrogen gas ( $\mathrm{N}_{2}$ ) at STP is $1120 \mathrm{~cm}^{3}$; calculate the mass and number of molecules of $\mathrm{N}_{2}$ in the sample.
(ii) Aluminum Sulphide is prepared by the reaction of Aluminum metal and sulphur powder at elevated temperature.

$$
2 \mathrm{Al}+3 \mathrm{~S} \rightarrow \mathrm{Al}_{2} \mathrm{~S}_{3}
$$

If 135 g Aluminum and 160 g sulphur are taken for the reaction, calculate what mass of $\mathrm{Al}_{2} \mathrm{~S}_{3}$ will be formed.
(iii) State Pauli and Hund's rule. Write the electronic configuration of the following species:

$$
* \mathrm{Ca}^{+2}(\mathrm{Z}=20) \quad * \mathrm{Br}^{-1}(\mathrm{Z}=35)
$$

(iv) Draw molecular orbital diagram of $\mathrm{O}_{2}$ molecule. Find bond order of $\mathrm{O}_{2}$ molecule and explain why $\mathrm{O}_{2}$ molecule is paramagnetic?
(v) Oxygen gas was collected over water at $24^{\circ} \mathrm{C}$ and a total pressure of 762 torr. If the volume of the gas collected was $300 \mathrm{~cm}^{3}$. Calculate the number of moles and the mole fraction of oxygen gas in the mixture (the vapour pressure of water at 22.4 torr).
(vi) (a) What is Viscosity? Why viscosity decreases with the rise of temperature?
(b) Differentiate between any one of the following:

* Isomorphism and polymorphism * Ionic solids and covalent solids
(vii) State Le-Chatlier principle and discuss its application in the synthesis of ammonia by Haber's process.
(viii) What is Buffer solution? Explain how it resists the change of pH by adding small amount of acid and base.
(ix) Enlist various factors which influence on the rate of chemical reaction and describe the effect of temperature on reaction rate.
(x) The reaction $2 \mathrm{NO}+\mathrm{Cl}_{2} \rightarrow 2 \mathrm{NOCl}$ was studied at $25^{\circ} \mathrm{C}$. the following results were obtained.

| Experiment <br> No. | Initial concentration $\left(\mathrm{mol} / \mathrm{dm}^{3}\right)$ |  | Initial rate <br>  <br>  <br> $\left(\mathrm{mol} / \mathrm{dm}^{3} . \mathrm{s}\right)$ |
| :---: | :---: | :---: | :---: |
|  | 0.1 | $\mathrm{Cl}_{2}$ |  |
| $2.52 \times 10^{-3}$ |  |  |  |
| 2 | 0.1 | 0.2 | $5.04 \times 10^{-3}$ |
| 3 | 0.2 | 0.1 | $10.08 \times 10^{-3}$ |

Determine the rate law and order of reaction.
(xi) (a) How is a true solution differentiate from suspension.
(b) A solution is prepared by dissolving 45 g glucose in 72 g water determine mole fraction of glucose and water in the solution.
(xii) State Raoult's law an derive its mathematical expression in three forms.
(xiii) State and explain First Law of thermodynamics. Derive pressure-volume work of a system.
(xiv) Calculate the standard enthalpy of formation of carbon disulphide from the given data.
$C+2 S$
$\mathrm{CS}_{2} \quad\left(\Delta \mathrm{H}_{\mathrm{f}}=\right.$ ? $)$
$\mathrm{C}+\mathrm{O}_{2}$
$\mathrm{CO}_{2}$
( $\Delta \mathrm{H}=-393.5 \mathrm{KJ} / \mathrm{mol})$
$\mathrm{S}+\mathrm{O}_{2}$
$\mathrm{CS}_{2}+3 \mathrm{O}_{2}$
$\mathrm{SO}_{2}$
( $\Delta \mathrm{H}=-296.8 \mathrm{KJ} / \mathrm{mol})$
$\mathrm{CO}_{2}+2 \mathrm{SO}_{2}$
$(\Delta \mathrm{H}=-1075 \mathrm{KJ} / \mathrm{mol})$

## SECTION - C (Detailed Answer Questions)

Note: Answer any two questions. All questions carry equal marks.
(20 Marks)
Q. 3 (a) What is an Ideal gas? What are the causes of deviation of real gas from ideal behavior? Explain these deviations at low temperature and high pressure.
(b) Derive an expression for the radius of hydrogen atom in the nth orbit by using Bohr model.
Q. 4 (a) Write down the postulates of valence shell electron pair repulsion theory (VSEPR) and predict the shape of the following molecules on the bases of VSEPR theory.

$$
* \mathrm{NH}_{3}+\mathrm{CO}_{2}
$$

(b) For the reaction

$$
2 \mathrm{SO}_{2(\mathrm{~g})}+O_{2(\mathrm{~g})} \rightleftharpoons 2 \mathrm{SO}_{3(\mathrm{~g})}(\Delta \mathrm{H}=-\mathrm{ve})
$$

If there are 5 moles of $\mathrm{SO}_{2}, 3$ moles of $\mathrm{O}_{2}$ and 8 moles of $\mathrm{SO}_{3}$ are present at equilibrium in a $1 \mathrm{dm}^{3}$ flask, at 323 K temperature, calculate its Kc and Kp .
Q. 5 (a) What are colligative properties of solution explain elevation of boiling point and depression of freezing point.
(b) Define redox reaction and balance any one of the following equations by ion electron method.
$\mathrm{Fe}^{+2}+\mathrm{Cr}_{2} \mathrm{O}_{7}^{-2}+\mathrm{H}^{+} \longrightarrow \mathrm{Fe}^{+3}+\mathrm{Cr}^{+3}+\mathrm{H}_{2} \mathrm{O}$ (acidic medium)
$\mathrm{MnO}_{4}^{-}+\mathrm{SO}_{3}^{-2} \longrightarrow \mathrm{Mn}^{+2}+\mathrm{SO}_{4}^{-2}$ (basic medium)
OR
Define electrode potential. Draw a cell diagram of zinc hydrogen galvanic cell. Write down the redox reaction and explain how is the electrode potential of zinc determined.

