

# Solution

**Max. Marks: 70**

**Time allowed: 3 Hours**

## **Section-A (1 mark each)**

**Q1.** What is the mass of a proton in amu?

Ans. 1.00727

What is S.I unit of luminous intensity? **OR**

Ans. Candela or Cd.

**Q2.** Bohrium has atomic no 107. Write its IUPAC name?

Ans. Unnilseptium

**Q3.** Mention the geometry of the following molecule?

(a)PCl<sub>5</sub> (b) SF<sub>6</sub>

Ans.

(a)PCl<sub>5</sub> = Trigonal bipyramidal

(b)SF<sub>6</sub> = Octahedral.

**OR**

Name the region of electromagnetic spectrum to which the Balmer series of hydrogen belongs to?

Ans. Visible region

**Q4.** Which method can be used to remove both temporary and permanent hardness of water?

Ans. Permutit process.

**Q5.** Give principle used in the distillation technique.

Ans. Large difference in boiling point is the principle used in the distillation technique.

## **Section-B (2 marks each)**

**Q6.** Naturally occurring boron consists of two isotopes whose atomic weights are 10.01 and 11.01. The atomic weight of natural boron is 10.81. Calculate the percentage of each isotope in natural boron?

Ans.

Let the percentage of the first isotope be ' $\alpha$ '

Percentage of the second isotope will be  $100-\alpha$

$$10.81 = \frac{(\alpha \times 10.01) + [(100 - \alpha)] \times 11.01}{100}$$

After solving;

$$\alpha = 20; 100 - \alpha = 80$$

What is meant by emission spectrum? **OR**

**Ans.** When the radiation emitted from the source is passed directly through the prism and recorded on a photographic film, the spectrum obtained is called emission spectrum.

**Q7.** Arrange the following in the given order:

- (a) Decreasing ionic size:  $Mg^{2+}$ ,  $O^{2-}$ ,  $Na^+$ ,  $F^-$
- (b) Increasing first ionization energy: Mg, Al, Si, Na
- (c) Increasing bond length:  $F_2$ ,  $N_2$ ,  $Cl_2$ ,  $O_2$
- (d) The order of their increasing size:  $Cl^-$ ,  $S^{2-}$ ,  $Ca^{2+}$ ,  $Al^{3+}$

Ans.

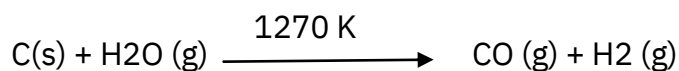
- (a)  $O^{2-} > F^- > Na^+ > Mg^{2+}$
- (b)  $Na < Al < Mg < Si$
- (c)  $N_2 < O_2 < F_2 < Cl_2$
- (d)  $Ca^{2+} < Al^{3+} < Cl^- < S^{2-}$

**OR**

What is water gas? Give the method to prepare it.

Ans. An equimolar mixture of CO and  $H_2$  is called water gas.

Preparation of water gas is done by passing steam over the red hot iron.



**Q8.** Arrange the following:

- (i) Increasing order of ionic radii:  $Li^+$ ,  $Na^+$ ,  $K^+$ ,  $Rb^+$ ,  $Cs^+$
- (ii) Decreasing order of hydration energy:  $Li^+$ ,  $Na^+$ ,  $K^+$ ,  $Rb^+$ ,  $Cs^+$

Ans.

- (i) Increasing order of ionic radii:  $Li^+ < Na^+ < K^+ < Rb^+ < Cs^+$
- (ii) Decreasing order of hydration energy:  $Li^+ > Na^+ > K^+ > Rb^+ > Cs^+$

**Q9.** Give the hybridisation for the following geometry of the planar and linear molecules.

Ans. Planar molecules has  $sp^2$

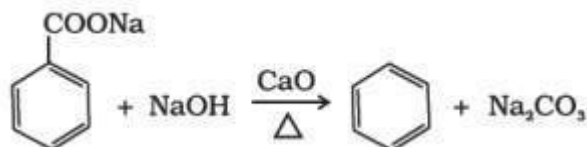
Linear molecule has  $sp$

**Q10.** Give two physical properties of acetylene.

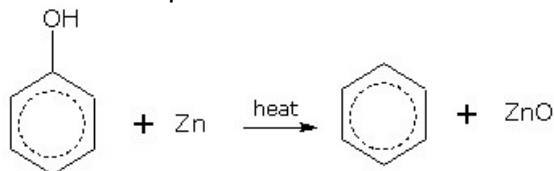
Ans. (i) Lighter than water.  
(ii) They are colourless.

**Q11.** Give two methods for preparation of benzene.

Ans. (i) Decarboxylation of aromatic acid:



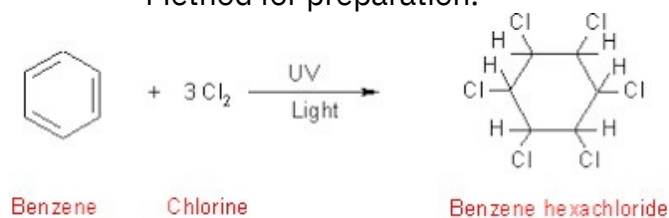
(ii) Reduction of phenol:



**Q12.** Give chemical formula for Gammexene. Also give a method for its preparation.

Ans. Formula for Gammexene is  $C_6H_6Cl_6$  also known as Benzene hexa chloride (BHC)

Method for preparation:



### Section-C (3 marks each)

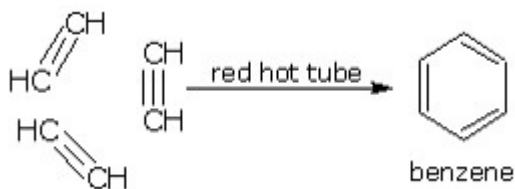
**Q13.** Give the bond order, stability and magnetic nature of  $O_2$  and  $O_2^+$ .

Ans.

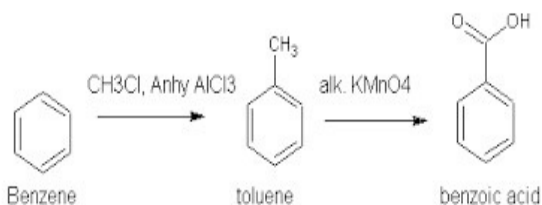
Species	Bond	Stability	Magnetic
$O_2$		Less stable	
$O_2^+$	order	Most stable	nature
	2.0 2.5		Paramagnetic

**Q14.** Convert following to (i) Acetylene to benzene (ii) Benzene to Benzoic acid (iii) Hexane to Benzene.

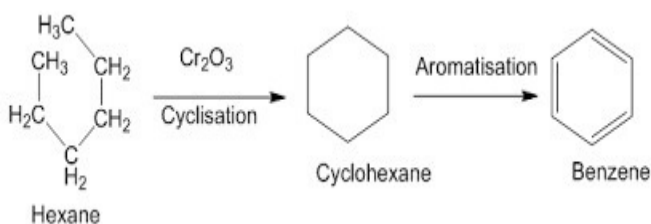
Ans. (i) Acetylene to Benzene



(ii) Benzene to Benzoic acid



(iii) Hexane to Benzene



**Q15.** Give three causes of water pollution.

Ans. (i) Organic wastes: It includes plant parts like leaves, grass etc.

(ii) Pathogens: It includes bacteria and other microorganisms.

(iii) Chemical pollutants: It includes inorganic chemicals Cd, Ni and their salts, petroleum products, polychlorinated biphenyls.

**Q16.** What is ozone hole? Discuss its consequences.

Ans. depletion of ozone layer due to reactions in stratospheric layers is known as ozone hole.

Consequences of ozone hole:

(i) Due to this UV radiations pass through it leading to skin problems like sunburn, skin cancer.

(ii) UV radiations affect the plant proteins resulting in the mutation of the cells.

**OR**

Q(a) What explanation is given by Bohr atomic model?

(b) What does magnetic quantum number specifies?

(c) Give the total number of orbitals in a shell with principal quantum number as n.

Ans. (a) Bohr atomic model explains spectrum of an atom or ion containing one electron only.

(b) Magnetic quantum number specifies Orbital orientation.

(c) The total number of orbitals in a shell with principal quantum number as  $n^2$  is  $n$ .

**Q17.** Give three factors affecting Electron gain enthalpy.

Ans. (i) Atomic size: Smaller the size of an atom higher will be the value for electron gain enthalpy.

(ii) Effective nuclear charge: Greater the nuclear charge higher will be the value for electron gain enthalpy.

(iii) Electronic configuration of the atom: Atom with stable electronic configuration has zero or nearly zero electron gain enthalpy.

**Q18.** Give three differences between metals and non-metals.

Ans.

Metals	Non-metals
These are hard	These are soft
These possess lustre	These do not possess lustre
These have high density	These have low density

**Q19.** Why lanthanides and actinides are placed in separate rows at the bottom of the periodic table.

Ans. Reasons are:

(i) Due to lack of space.

(ii) Elements with similar properties are placed in a single column.

(iii) In lanthanides 4f orbitals are filled and in actinides 5f orbitals are filled.

**OR**

(a) Which gas is responsible for the Bhopal tragedy?

(b) Which compound is formed when CO combines with blood?

(c) Give chemicals which leads to ozone hole.

Ans. (a) Methyl isocyanate (MIC)

(b) Carboxyhaemoglobin

(c) Chloro fluorocarbons (CFCs)

**Q20.** (a) Define bond order.

(b) Give bond order in CO.

(c) How bond order is related to stability of the molecule.

Ans. (a) Bond order: It is defined as the number of bonds between the two atoms in a molecule.

(b) Bond order in CO is 3.

(c) Higher is the bond order, higher will be the stability of the molecule.

**OR**

Give three properties of ionic compounds.

- Ans. (i) These constitute ions.  
 (ii) These have strong electrostatic forces of attraction.  
 (iii) These are non-directional crystals.

**Q21.** Write three properties of anode rays.

- Ans. (i) These are positively charged.  
 (ii) These are made up of material particles.  
 (iii) These rays when strike against a surface produces the heat.

**Q22.** Give three limitations of Bohr's Model.

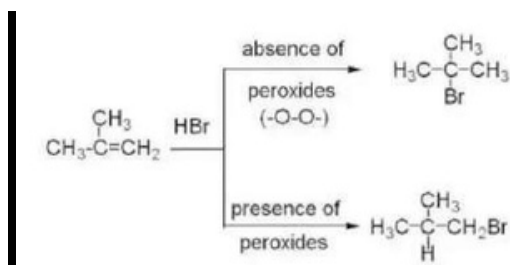
- Ans. (i) It could not explain the spectra and energy of atoms with more than one electron.  
 (ii) It could not explain the reason for the formation of chemical bonds by the atoms.  
 (iii) it could not give the proper explanation for brightness of the spectral lines.

OR

Give S.I. units of (a) Length, (b) Density and (c) Mass.

- (a) Length - Metre  
 (b) Density – -3Kg m  
 (c) Mass - Kg

**Q23.** What is antimarkownikov rule? Give an example. Ans. Markownikov rule: According to this rule, negative part of the reagent goes to C- atom having more number of hydrogen atoms and positive parts will go to the C-atom having less number of hydrogen atoms of the unsymmetrical alkenes.



**Q24.** Write three postulates of Kinetic Molecular Theory of Gases.

- Ans. (i) Gases consists of large number of identical particles.  
 (ii) Molecules of gases are in continuous motion.  
 (iii) Molecules of gases undergo collisions which are perfectly elastic.

### Section-D (5 marks each)

**Q25.** Discuss applications of equilibrium constants.

Ans. Applications of equilibrium constants:

- (a) It predicts the direction and the extent of reaction depending upon the value of equilibrium constant  $K$  as follows:
- If  $K \gg 1$ , when  $K$  value is in the range from  $10^3$  or higher, the reaction reaches completion point, that means all reactants convert to products.
  - If  $K > 1$ , when  $K$  value is more than one, not much higher, the reaction proceeds towards forward direction (products) to greater extent than towards backward direction (reactants).
  - If  $K = 1$ , When  $K$  value is equal to one, then rate of forward direction is equal rate of backward direction.
  - If  $K < 1$ , when  $K$  value is less than one, the reaction proceeds in backward direction more than forward direction.
- (b) Determining the concentrations at the equilibrium: If the value of equilibrium constant  $K$  for the reaction is obtained or known, the concentration of reactants and products can be determined.

**OR**

Discuss various techniques for purification of organic compounds.

Ans. Various techniques for purification of organic compounds are:

- Simple crystallization: In this method the impurities dissolve or remain insoluble in solution and the organic compound can be crystallised out. For example: Sugar with salt as impurity can be crystallised out by dissolving the mixture in hot ethanol.
- Sublimation: In this method solid substance directly converts to gaseous state on heating. For example: Camphor, naphthalene.
- Distillation: This method is used to separate mixture of two liquids having difference in their boiling points. For example: Mixture of ether (308 K) and toluene (384 K).
- Fractional distillation: This method is used to separate two liquids having boiling points close to each other. For example: Mixture acetone (329 K) and methanol (338 K)
- Steam distillation: This method is used to separate the compounds which are volatile in steam. For example: Aniline can be purified by this method as it boils at 371.5 K.
- Differential extraction: This method is used to separate the organic compound from aqueous solution by shaking it with organic solvent in a separating funnel. For example: benzaldehyde being non polar is more soluble than in ether than in water.
- Chromatography: This method is based upon two components which are stationary phase and the mobile phase. For example: chlorophyll pigments present in leaf can be separated using this technique, separation of the components depends upon their affinity for stationary phase and the mobile phase.

**Q26.** Give five differences between sigma and pi bond.

Ans.

sigma bond	pi bond
It is formed by axial overlap	It is formed by sidewise overlap
It is stronger	It is weaker
It involves overlap of s-s, s-p and p-p orbitals	It involves sidewise overlap of p-p orbitals
It has independent existence	It does not have independent existence, it is formed after the sigma bond is formed
In this free rotation is possible	It has restricted rotation

**OR**

Discuss Le Chateliers Principle. Give Factors affecting the equilibria.

Ans. Le Chateliers Principle: A system which is at equilibrium, when subjected to change of temperature, pressure or concentration, tries to proceed in the direction which will nullify the effect of the change.

Factors affecting equilibria are:

- (i)Effect of concentration: If the concentration of reactants is increased the reaction will proceed in forward direction. If the concentration of products are increased, backward reaction will proceed.
- (ii)Effect of pressure: If the pressure is increased, equilibrium will shift in the direction in which there is less number of moles.
- (iii)Effect of temperature: When temperature is increased the reaction will proceed in the direction in which it is endothermic (heat is absorbed). Whereas when the temperature is decreased, the equilibria will shift in the direction in which it is exothermic.
- (iv)Effect of catalyst: It has not effect on the equilibria of a reaction.

- Q27.** (a) What will be the change in the ionic product of water if acid is added to it?  
 (b)Give two example of lewis acids.  
 (c)Give one example of each acidic buffer and basic buffer.

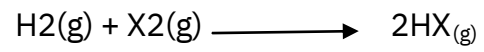
Ans. (a) It remains unchanged.  
 (b) $\text{Cu}^{2+}$ ,  $\text{BF}_3$   
 (c)acidic buffer:  $\text{CH}_3\text{COOH} + \text{CH}_3\text{COONa}$   
 Basic buffer:  $\text{NH}_4\text{OH} + \text{NH}_4\text{Cl}$

**OR**

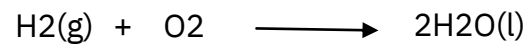
- (a)Give isotopes of hydrogen.
- (b)Give physical properties of hydrogen.
- (c)Give chemical properties of hydrogen.

Ans. (a) There are 3 Isotopes of hydrogen: protium  $^1\text{H}$ , deuterium  $^2\text{H}$ , tritium  $^3\text{H}$   
 (b)Physical properties of hydrogen are:  
 (i)It is colourless, odourless and tasteless gas.  
 (ii)It is lightest gas.  
 (iii)It is a diatomic molecule.  
 (iv)It is sparingly soluble in water.  
 (c)Chemical properties of hydrogen:  
 (i)Reaction with halogen:

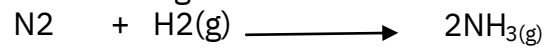




(ii) Reaction with Oxygen:



(iii) Reaction with Nitrogen:



(iv) Reaction with metals:

