



- (a)  $\text{NH}_2\text{OH}$
- (b)  $\text{NH}_4\text{NO}_3$
- (c)  $\text{N}_2\text{H}_4$
- (d)  $\text{N}_3\text{H}$

6. Number of angular nodes for 4d orbital is\_\_\_\_\_.
- (a) 4
  - (b) 3
  - (c) 2
  - (d) 1

### Q.7 - Q.8 Assertion-Reason Type Questions

Each question contains statements-1 (Assertion) and Statement-2 (Reason)

Examine the statements carefully and mark the correct answer according to the instruction given below:

- A. If both the statements are true and statement-2 is the correct explanation of statement-1.
  - B. If both the statements are true but statement-2 is not the correct explanation of statement-1.
  - C. If statement-1 is true and statement-2 is false.
  - D. If statement-1 is false and statement-2 is true.
7. Statement-1 For reaction  $\text{A} + \text{B} \rightleftharpoons \text{C}$ ,  $K = 4$  on addition of catalyst  $K$  becomes more than 4.  
Statement-2 Catalyst only helps to attain the equilibrium faster from either end of reaction.

8. Statement-1  $\text{Cl}_2 + 2\text{OH}^- \longrightarrow \text{ClO}^- + \text{Cl}^-$  is a disproportionation reaction.

Statement-2 In disproportionation, the same element gets oxidised as well as reduced.

9. The law of thermodynamics, which helps to determine absolute entropy is:  
(A) Zeroth law  
(B) I law  
(C) II law  
(D) III law
10. Which of the following is a Lewis acid?  
(A)  $\text{AlCl}_3$   
(B)  $\text{MgCl}_2$   
(C)  $\text{CaCl}_2$   
(D)  $\text{BaCl}_2$
11. Which of the following has  $\Delta S = +ve$ ?  
(A)  $\text{H}_2(\text{g}) + \text{Cl}_2(\text{g}) \rightarrow 2\text{HCl}(\text{g})$   
(B) Boiling of egg  
(C) Crystallisation of Sugar  
(D) Formation of Complex Compound
12. The sign of  $\Delta S$  in the reaction,  $\text{N}_2(\text{g}) + \text{O}_2(\text{g}) \rightarrow 2\text{NO}(\text{g})$  is:  
(A) +ve  
(B) -ve  
(C) Zero  
(D) None of these
13. A measured temperature on Fahrenheit scale is  $200^\circ\text{F}$ . What will this reading be on Celsius scale?  
(A)  $40^\circ\text{C}$   
(B)  $94^\circ\text{C}$   
(C)  $93.3^\circ\text{C}$   
(D)  $30^\circ\text{C}$
14. Which of the following arrangements represent increasing oxidation number of the central atom?  
(A)  $\text{CrO}_2^-$ ,  $\text{ClO}_3^-$ ,  $\text{CrO}_4^{2-}$ ,  $\text{MnO}_4^-$   
(B)  $\text{ClO}_3^-$ ,  $\text{CrO}_4^{2-}$ ,  $\text{MnO}_4^-$ ,  $\text{CrO}_2^-$

- (C)  $\text{CrO}_2^-$ ,  $\text{ClO}_3^-$ ,  $\text{MnO}_4^-$ ,  $\text{CrO}_4^{2-}$   
(D)  $\text{CrO}_2^-$ ,  $\text{MnO}_4^-$ ,  $\text{CrO}_2^-$ ,  $\text{ClO}_3^-$

15.  $\text{PCl}_5$ ,  $\text{PCl}_3$  and  $\text{Cl}_2$  are at equilibrium at 500 K in a closed container and their concentrations are  $0.8 \times 10^{-3} \text{ mol L}^{-1}$ ,  $1.2 \times 10^{-3} \text{ mol L}^{-1}$  and  $1.2 \times 10^{-3} \text{ mol L}^{-1}$  respectively. The value of  $K_c$  for the reaction  $\text{PCl}_5(\text{g}) \rightleftharpoons \text{PCl}_3(\text{g}) + \text{Cl}_2(\text{g})$  will be:  
(A)  $1.8 \times 10^3 \text{ mol L}^{-1}$   
(B)  $1.8 \times 10^{-3}$   
(C)  $1.8 \times 10^{-3} \text{ L mol}^{-1}$   
(D)  $0.55 \times 10^4$
16. Ethyne on passing through red hot iron tube at 873K undergoes cyclic polymerisation. Three molecules of ethyne polymerise to form:  
(A) ethane  
(B) ethene  
(C) benzene  
(D) ethanol

#### SECTION-B

17. (i) What are the number of waves made by a Bohr electron in an orbit of maximum magnetic quantum number 3?  
(ii) If kinetic energy of a particle is doubled. What will happen to de Broglie wavelength as compared to previous de Broglie wavelength.
18. (i) Why  $\text{PbCl}_2$  is more stable than  $\text{PbCl}_4$ ?  
(ii) Why Electron gain enthalpy of Mg is positive?

OR

- (i) Second I.E. (Ionisation Enthalpy) is always more than first Ionisation energy.  
(ii) Why first electron gain enthalpy of sulphur is more negative than oxygen.
19. Balance the following reaction by (ion-electron or oxidation number method)
- $$\text{Cl}_2\text{O}_7(\text{g}) + \text{H}_2\text{O}_2(\text{aq.}) \rightarrow \text{ClO}_2^-(\text{aq.}) + \text{O}_2(\text{g}) + \text{H}^+(\text{Acidic medium})$$

20. (i) What is the difference between hydrolysis and hydration?  
 (ii) Arrange the following in order of increasing electrical conductance  $\text{CaH}_2$ ,  $\text{BeH}_2$  and  $\text{TeH}_2$ .
21. A sample of 0.5g of an organic compound was treated according to Kjeldahl's method. The ammonia evolved was absorbed in 50 ml of 0.5 M  $\text{H}_2\text{SO}_4$ . The residual acid required 60 mL of 0.5 solution of NaOH for neutralisation. Find the percentage composition of nitrogen in the compound.

#### SECTION-C

22. (i) Out of benzene, m-dinitrobenzene and toluene, which will undergo nitration most easily and why?  
 (ii) What effect does branching of an alkane chain has on its boiling point?
23. (a) What is a nucleophile?  
 (b) Reduction of alkyl halides takes place in which conditions?

#### SECTION-C

24. A crystalline salt on being rendered anhydrous loses 45.6% of its weight.  
 The percentage composition of the anhydrous salt is  
 Al = 10.50%, K = 15.1%, S = 24.96%, O = 49.92%  
 Find the simplest formula of the anhydrous and crystalline salt.  
 (Atomic Mass : K = 39, Al = 27, S = 32, O = 16).
25. Explain following with example :  
 (i) Aufbau's Rule  
 (ii) Hund's Rule  
 (iii) Pauli's Exclusion Principle

OR

An ion with mass number 81 contains 31.7% more neutrons as compared to protons. Assign the atomic symbol.

26. Explain the bonding in  $\text{SF}_6$  using hybridisation concept and define what is hybridisation.

OR

On the basis of molecular orbital theory find the bond order, molecular orbital configuration and magnetic nature of  $\text{O}_2^+$ .

27. (a) Arrange the following species in increasing order of their ionic size :  
 $N^{3-}$ ,  $Na^+$ ,  $F^-$ ,  $O^{2-}$   
(b) How does atomic radius vary in a period and in a group?  
How do you explain the variation ?
28. Explain Born Haber cycle with by considering example of formation of  $MgCl_2$  as given in the chemical reaction
- $$Mg(s) + Cl_2(g) \rightarrow MgCl_2(s)$$

#### SECTION -D

29. Read the passage given below and answer the questions given below it:  
The branch of science dealing with the relations between energy, heat, work and accompanying changes in the nature and behaviour of various substances around us is called thermodynamics. The main aim of the study of chemical thermodynamics is to learn (i) transformation of energy from one form into another form, (ii) utilization of various forms of energy and (iii) changes in the properties of systems produced by chemical or physical effects. The laws of thermodynamics apply only when a system is in equilibrium or moves from one equilibrium state to another equilibrium state. Macroscopic properties like pressure and temperature do not change with time for a system in equilibrium state.

Answer the questions :

i) A system which can neither exchange matter nor energy with the surroundings is called \_\_\_\_\_

- (A) Open system
- (B) Isolated system
- (C) Closed system
- (D) Ideal system

ii)

Which of the following is intensive property?

- (A) Molarity
- (B) Temperature
- (C) Density
- (D) All of these

iii)

Temperature and heat are \_\_\_\_\_ [1]

- (A) Extensive properties
- (B) Intensive properties
- (C) Intensive and extensive properties respectively
- (D) Extensive and intensive properties respectively

iv)  
In adiabatic process, [1]

- (A)  $q > 0$
- (B)  $q = 1$
- (C)  $q = 0$
- (D)  $q < 0$

30. Read the passage given below and answer the following questions:

Because ethane exists as a gas at normal temperature and pressure, exposure occurs by inhalation. Concentrations of ethane in natural gas range from 5 to 10%. It is also found in the exhaust of diesel (−1.8%) and gasoline (1.3 – 2.0%) engines. Small amounts of ethane, along with other Q and C4 alkanes and alkenes, have been detected in mined coal samples. Ethane emissions from cigarettes have been measured at 1600 ug per cigarette. Typical background air concentrations in major US cities range from 0.05 to 0.5 ppm. Because it is lighter than air, a major spill would not be expected to migrate and affect adjacent properties or neighbourhoods. It is possible to spill liquid ethane from a refrigerated tank, causing frostbite upon contact with the skin due to rapid evaporation and .. loss of heat.

Answer the following:

- i) Calculate the number of moles of carbon atoms in 3 moles of ethane .
- ii) How many moles of hydrogen atom is present in 3 moles of ethane?
- iii) How many molecules of ethane will be there in 3 moles of ethane? Can liquid ethane cause frostbite? How?

#### SECTION-E

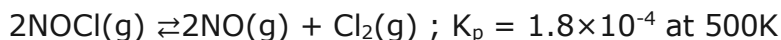
31. (a) What is a buffer solution? Give example.
- (b) What is common ion effect?

(c) Define Le-Chatlier principle and explain effect of following :

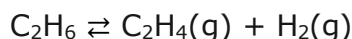
(ii) Change of concentration (ii) Change of pressure

OR

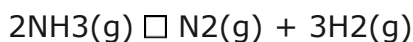
(a) Find out  $K_c$  for following reaction



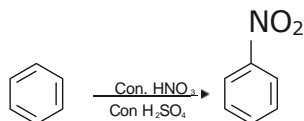
(b)  $K_p = 0.04$  atm at 899K. What is the equilibrium concentration of  $\text{C}_2\text{H}_6$  where it is placed in a flask at 4.0 atm pressure and allow to come to equilibrium



(c) What is the unit of  $K_p$  for the following chemical reaction?



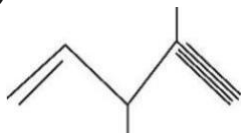
32. (i) Explain with the help of mechanism



(ii) Draw the Newman structure of (a) 2-Methyl butane

(b) 1-Methyl prop-1-ene

(iii) Calculate total number of s and p bond(s) in



OR

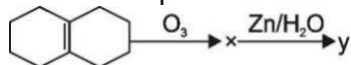
(ii) Explain Kolbe's electrolysis with mechanism.

(iii) State Huckel Rule's.



Check whether is an aromatic or non aromatic, anti-aromatic.

(iv) Write the product





33. (a) What is the free expansion? Determine work done in case of free expansion of an ideal gas.

(b) 4.0 mol of ideal gas at 2 atm and 25°C expands isothermally to 2 times of its original volume against the external pressure of 1 atm. Calculate work done. If the same gas expands isothermally in a reversible manner,

OR

(a) What is reversible process in thermodynamics ?

(b) Name the thermodynamic process for which

(i)  $q = 0$

(ii)  $\Delta U = 0$

(iii)  $\Delta V = 0$

(iv)  $\Delta p = 0$