

1. Which of the following molecules acts as a Lewis acid ?

- (1) $(CH_3)_3B$ (2) $(CH_3)_2O$ (3) $(CH_3)_3P$ (4) $(CH_3)_3N$

Sol. (1)

2. Which of the following reactions is an example of nucleophilic substitution reaction ?

- (1) $RX + KOH \rightarrow ROH + KX$ (2) $2RX + 2Na \rightarrow R-R + 2NaX$
 (3) $RX + H_2 \rightarrow RH + HX$ (4) $RX + Mg \rightarrow RMgX$

Sol. (1)

3. From the following bond energies :

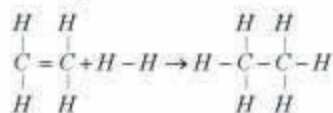
H-H bond energy : $431.37 \text{ kJ mol}^{-1}$

C=C bond energy : $606.10 \text{ kJ mol}^{-1}$

C-C bond energy : $336.49 \text{ kJ mol}^{-1}$

C-H bond energy : $410.50 \text{ kJ mol}^{-1}$

Enthalpy for the reaction,



will be

- (1) $1523.6 \text{ kJ mol}^{-1}$ (2) $-243.6 \text{ kJ mol}^{-1}$ (3) $-121.0 \text{ kJ mol}^{-1}$ (4) $553.0 \text{ kJ mol}^{-1}$

Sol. (3)

4. Which one of the elements with the following outer orbital configurations may exhibit the largest number of oxidation states ?

- (1) $3d^3 4s^2$ (2) $3d^5 4s^1$ (3) $3d^5 4s^2$ (4) $3d^2 4s^2$

Sol. (3)

5. The ionization constant of ammonium hydroxide is 1.77×10^{-5} at 298 K . Hydrolysis constant of ammonium chloride is

- (1) 5.65×10^{-10} (2) 6.30×10^{-12} (3) 5.65×10^{-13} (4) 5.65×10^{-12}

Sol. (1)

6. Which of the following oxides is not expected to react with sodium hydroxide

- (1) B_2O_3 (2) CaO (3) SiO_2 (4) BeO

Sol. (2)

7. Which of the following does not show optical isomerism ?

- (1) $[CO(en)_2Cl_2]^+$ (2) $[CO(NH_3)_3Cl_3]^0$
 (3) $[CO(en)Cl_2(NH_3)_2]^+$ (4) $[CO(en)_3]^{3+}$ (en = ethylenediamine)

Sol. (2)

8. Which one of the following is employed as a tranquilizer ?

- (1) Equanil (2) Naproxen (3) Tetracycline (4) Chlorpheniramine

Sol. (1)

9. Al_2O_3 is reduced by electrolysis at low potentials and high currents. If 4.0×10^4 amperes of current is passed through molten Al_2O_3 for 6 hours, what mass of aluminium is produced ? (Assume 100% current efficiency, At. mass of Al = 27 g mol^{-1})

(1) $9.0 \times 10^3 \text{ g}$

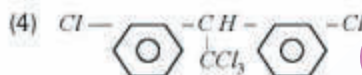
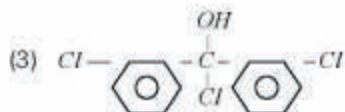
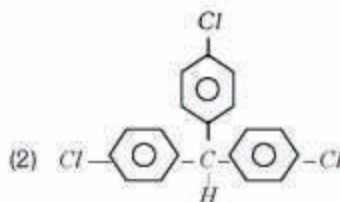
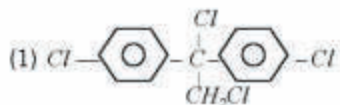
(2) $8.1 \times 10^4 \text{ g}$

(3) $2.4 \times 10^5 \text{ g}$

(4) $1.3 \times 10^4 \text{ g}$

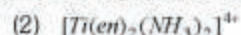
Sol. (2)

10. Trichloroacetaldehyde, CCl_3CHO reacts with chlorobenzene in presence of sulphuric acid and produces :



Sol. (4)

11. Which of the following complex ions is expected to absorb visible light



(At. no. $\text{Zn} = 30$, $\text{Sc} = 21$, $\text{Ti} = 22$, $\text{Cr} = 24$)

Sol. (3)

12. Half life period of a first-order reaction is 1386 seconds. The specific rate constant of the reaction is

(1) $5.0 \times 10^{-3} \text{ s}^{-1}$

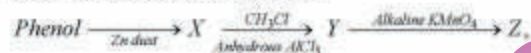
(2) $0.5 \times 10^{-2} \text{ s}^{-1}$

(3) $1.5 \times 10^{-2} \text{ s}^{-1}$

(4) $5.0 \times 10^{-2} \text{ s}^{-1}$

Sol. (3)

13. Consider the following reaction :



The product Z is

(1) Toluene

(2) Benzaldehyde

(3) Benzoic acid

(4) Benzene

Sol. (3)

14. Copper crystallises in a face-centred cubic lattice with a unit cell length of 361 pm. What is the radius of copper atom in pm

(1) 128

(2) 57

(3) 181

(4) 108

Sol. (1)

15. For the reaction $\text{A} + \text{B} \rightarrow \text{products}$, it is observed that :

(a) On doubling the initial concentration of A only, the rate of reaction is also doubled and

(b) On doubling the initial concentrations of both A and B, there is a change by a factor of 8 in the rate of the reaction

The rate of this reaction is given by

(1) $\text{rate} = k[\text{A}]^2[\text{B}]$

(2) $\text{rate} = k[\text{A}][\text{B}]^2$

(3) $\text{rate} = k[\text{A}]^2[\text{B}]^2$

(4) $\text{rate} = k[\text{A}][\text{B}]$

Sol. (2)

16. According to MO theory which of the following lists ranks the nitrogen species in terms of increasing bond order

(1) $\text{N}_2 < \text{N}_2^+ < \text{N}_2^-$

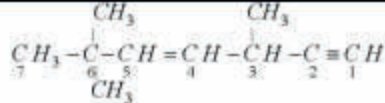
(2) $\text{N}_2^+ < \text{N}_2^- < \text{N}_2$

(3) $\text{N}_2 < \text{N}_2^+ < \text{N}_2^-$

(4) $\text{N}_2^- < \text{N}_2^+ < \text{N}_2$

Sol. (2)

17. The state of hybridization of C_2 , C_3 , C_5 and C_6 of the hydrocarbon



is in the following sequence

- (1) sp, sp^3, sp^2 and sp^3 (2) sp^3, sp^2, sp^2 and sp (3) sp, sp^2, sp^2 and sp^3 (4) sp, sp^2, sp^3 and sp^2

Sol. (1)

18. Among the following which is the strongest oxidising agent

- (1) F_2 (2) Br_2 (3) I_2 (4) Cl_2

Sol. (1)

19. The equivalent conductance of $\frac{M}{32}$ solution of a weak monobasic acid is 8.0 mhos cm^2 and at infinite dilution is 400 mhos cm^2 . The dissociation constant of this acid is

- (1) 1.25×10^{-5} (2) 1.25×10^{-6} (3) 6.25×10^{-4} (4) 1.25×10^{-4}

Sol. (1)

20. Structures of some common polymers are given. Which one is not correctly presented

- (1) Teflon $\text{-(CF}_2\text{-CF}_2\text{)-}_n$ (2) Neoprene $\left[\begin{array}{c} \text{CH}_2 - \text{C} = \text{CH} - \text{CH}_2 - \text{CH}_2 - \\ | \\ \text{Cl} \end{array} \right]_n$
- (3) Terylene $\text{-(OC-} \langle \text{benzene ring} \rangle \text{-COOCH}_2\text{-CH}_2\text{-O)-}_n$ (4) Nylon 66 $\text{-(NH(CH}_2\text{)}_6\text{NHCO(CH}_2\text{)}_4\text{-CO)-}_n$

Sol. (2)

21. Oxidation numbers of P in PO_4^{3-} , of S in SO_4^{2-} and that of Cr in $Cr_2O_7^{2-}$ are respectively

- (1) +5, +6 and +6 (2) +3, +6 and +5 (3) +5, +3 and +6 (4) -3, +6 and +6

Sol. (1)

22. The IUPAC name of the compound having the formula $\text{CH} \equiv \text{C} - \text{CH} = \text{CH}_2$ is

- (1) 3-butene-1-yne (2) 1-buten-3-yne (3) but-1-yne-3-ene (4) 1-butene-3-yne

Sol. (4)

23. In the case of alkali metals, the covalent character decreases in the order

- (1) $MCl > MI > MBr > MF$ (2) $MF > MCl > MBr > MI$ (3) $MF > MCl > MI > MBr$ (4) $MI > MBr > MCl > MF$

Sol. (4)

24. Given:



Electrode potential, E^\ominus for the reaction, $\text{Cu}^+ + e^- \rightarrow \text{Cu}$, will be

- (1) 0.52 V (2) 0.90 V (3) 0.30 V (4) 0.38 V

Sol. (1)

25. For the reaction, $\text{N}_2 + 3\text{H}_2 \rightarrow 2\text{NH}_3$, if $\frac{d[\text{NH}_3]}{dt} = 2 \times 10^{-4} \text{ mol L}^{-1} \text{ s}^{-1}$, the value of $\frac{-d[\text{H}_2]}{dt}$ would be

- (1) $3 \times 10^{-4} \text{ mol L}^{-1} \text{ s}^{-1}$ (2) $4 \times 10^{-4} \text{ mol L}^{-1} \text{ s}^{-1}$ (3) $6 \times 10^{-4} \text{ mol L}^{-1} \text{ s}^{-1}$ (4) $1 \times 10^{-4} \text{ mol L}^{-1} \text{ s}^{-1}$

Sol. (1)

26. What is the $[\text{OH}^-]$ in the final solution prepared by mixing 20.0 mL of 0.050 M HCl with 30.0 mL of 0.10 M $\text{Ba}(\text{OH})_2$

(1) 0.10 M (2) 0.40 M (3) 0.0050 M (4) 0.12 M

Sol. (1)

27. Out of TiF_6^{2-} , COF_6^{3-} , Cu_2Cl_2 and $NiCl_4^{2-}$ (Z of Ti = 22, CO = 27, Cu = 29, Ni = 28) the colourless species are

- (1) TiF_6^{2-} and COF_6^{3-} (2) Cu_2Cl_2 and $NiCl_4^{2-}$ (3) TiF_6^{2-} and Cu_2Cl_2 (4) COF_6^{3-} and $NiCl_4^{2-}$

Sol. (3)

28. Amongst the elements with following electronic configurations, which one of them may have the highest ionization energy

- (1) $Ne[3s^2 3p^3]$ (2) $Ne[3s^2 3p^2]$ (3) $Ar[3d^{10} 4s^2 4p^3]$ (4) $Ne[3s^2 3p^1]$

Sol. (1)

29. Maximum number of electrons in a subshell of an atom is determined by the following

- (1) $4l+2$ (2) $2l+1$ (3) $4l-2$ (4) $2n$

Sol. (1)

30. Lithium metal crystallises in a body centred cubic crystal. If the length of the side of the unit cell of lithium is 351 pm, the atomic radius of the lithium will be

- (1) 240.8 pm (2) 151.8 pm (3) 75.5 pm (4) 300.5 pm

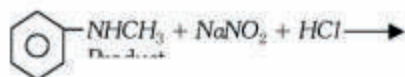
Sol. (2)

31. The segment of DNA which acts as the instrumental manual for the synthesis of the proteins is

- (1) nucleotide (2) ribose (3) gene (4) nucleoside

Sol. (3)

32. Predict the product



- (1)  (2)  (3)  +  (4) 

Sol. (1)

33. Which of the following compounds will exhibit cis-trans (geometrical) isomerism

- (1) 2-Butene (2) Butanol (3) 2-Butyne (4) 2-Butenol

Sol. (1)

34. The values of ΔH and ΔS for the reaction, $C_{(graphite)} + CO_{2(g)} \rightarrow 2CO_{(g)}$ are 170 kJ and 170 JK⁻¹, respectively. This reaction will be spontaneous at

- (1) 710 K (2) 910 K (3) 1110 K (4) 510 K

Sol. (3)

35. $H_2COH \cdot CH_2OH$ on heating with periodic acid gives

- (1) 2 CO₂ (2) 2 HCOOH (3)  (4) 

Sol. (4)

36. The dissociation constants for acetic acid and HCN at 25°C are 1.5×10^{-5} and 4.5×10^{-10} , respectively. The equilibrium constant for the equilibrium



would be

- (1) 3.0×10^5 (2) 3.0×10^{-5} (3) 3.0×10^{-4} (4) 3.0×10^4

Sol. (4)

37. Nitrobenzene can be prepared from benzene by using a mixture of conc. HNO_3 and conc. H_2SO_4 . In the mixture, nitric acid acts as

a/an

- (1) reducing agent (2) acid (3) base (4) catalyst

Sol. (3)

38. In the reaction



The rate of appearance of bromine (Br_2) is related to rate of disappearance of bromide ions as following

- (1) $\frac{d(Br_2)}{dt} = -\frac{3}{5} \frac{d(Br^-)}{dt}$ (2) $\frac{d(Br_2)}{dt} = -\frac{5}{3} \frac{d(Br^-)}{dt}$ (3) $\frac{d(Br_2)}{dt} = \frac{5}{3} \frac{d(Br^-)}{dt}$ (4) $\frac{d(Br_2)}{dt} = \frac{3}{5} \frac{d(Br^-)}{dt}$

Sol. (1)

39. In which of the following molecules/ions BF_3 , NO_2^- , NH_2^- and H_2O , the central atom is sp^2 hybridised

- (1) NO_2^- and NH_2^- (2) NH_2^- and H_2O (3) NO_2^- and H_2O (4) BF_3 and NO_2^-

Sol. (4)

40. Which of the following hormones contains iodine

- (1) insulin (2) testosterone (3) adrenaline (4) thyroxine

Sol. (4)

41. 10 g of hydrogen and 64 g of oxygen were filled in a steel vessel and exploded. Amount of water produced in this reaction will be

- (1) 2 mol (2) 3 mol (3) 4 mol (4) 1 mol

Sol. (3)

42. The energy absorbed by each molecule (A_2) of a substance is $4.4 \times 10^{-19} J$ and bond energy per molecule is $4.0 \times 10^{-19} J$. The kinetic energy of the molecule per atom will be

- (1) $2.0 \times 10^{-20} J$ (2) $2.2 \times 10^{-19} J$ (3) $2.0 \times 10^{-19} J$ (4) $4.0 \times 10^{-20} J$

Sol. (1)

43. The straight chain polymer is formed by

- (1) hydrolysis of $(CH_3)_3 SiCl$ followed by condensation polymerisation
(2) hydrolysis of $CH_3 SiCl_3$ followed by condensation polymerisation
(3) hydrolysis of $(CH_3)_4 Si$ by addition polymerisation
(4) hydrolysis of $(CH_3)_2 SiCl_2$ followed by condensation polymerisation

Sol. (4)

44. The stability of +1 oxidation state increases in the sequence

- (1) $Al < Ga < In < Tl$ (2) $Tl < In < Ga < Al$ (3) $In < Tl < Ga < Al$ (4) $Ga < In < Al < Tl$

Sol. (1)

45. Consider the following reaction, ethanol $\xrightarrow{PBr_3} X \xrightarrow{alc. KOH} Y \xrightarrow[\text{(ii) } H_2O, \text{ heat}]{\text{(i) } H_2SO_4, \text{ room temperature}} Z$; the product Z is

- (1) $CH_2=CH_2$ (2) $CH_3CH_2-O-CH_2-CH_3$ (3) $CH_3-CH_2-O-SO_3H$ (4) CH_3CH_2OH

Sol. (4)

46. A 0.0020 m aqueous solution of an ionic compound $Co(NH_3)_5(NO_2)Cl$ freezes at $-0.00732^\circ C$. Number of moles of ions which 1 mol of ionic compound produces on being dissolved in water will be ($k_f = -1.86^\circ C/m$)

- (1) 2 (2) 3 (3) 4 (4) 1

Sol. (1)

47. What is the dominant intermolecular force or bond that must be overcome in converting liquid CH_3OH to a gas

- (1) Hydrogen bonding (2) Dipole-dipole interaction (3) Covalent bonds (4) London dispersion force

Sol. (1)

48. Benzene reacts with CH_3Cl in the presence of anhydrous $AlCl_3$ to form

- (1) Toluene (2) Chlorobenzene (3) Benzylchloride (4) Xylene

Sol. (1)

49. Which of the following is not permissible arrangement of electrons in an atom

- (1) $n = 4, l = 0, m = 0, s = -\frac{1}{2}$ (2) $n = 5, l = 3, m = 0, s = +\frac{1}{2}$
(3) $n = 3, l = 2, m = -3, s = -\frac{1}{2}$ (4) $n = 3, l = 2, m = -2, s = -\frac{1}{2}$

Sol. (3)

50. Propionic acid with Br_2/P yields a dibromo product. Its structure would be

- (1) $CH_2Br-CHBr-COOH$ (2) $\begin{array}{c} Br \\ | \\ H-C-CH_2COOH \end{array}$
(3) CH_2Br-CH_2-COBr (4) $\begin{array}{c} Br \\ | \\ CH_3-C-COOH \\ | \\ Br \end{array}$

Sol. (4)

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