

1 Mark Questions

- In ice, each oxygen atom of water molecule is
 - bonded only covalently to two hydrogen atoms
 - bonded covalently to two hydrogen atoms and hydrogen bonded to two other hydrogen atoms
 - hydrogen bonded to four hydrogen atoms
 - bonded only covalently to four hydrogen atoms
- I_2 exists in the solid form under normal temperature and pressure. The principal intermolecular forces holding together iodine molecules in solid is
 - covalent
 - metallic
 - ionic
 - van der Waals'
- Burning of phosphorus in the presence of air produces a highly hygroscopic white compound, which reacts with water to yield
 - H_3PO_4
 - H_3PO_2
 - $H_4P_2O_7$
 - $H_4P_2O_5$
- The minimum uncertainty in the speed of an electron in a one dimensional box of length 10^{-10} m is
 - 580 m/s
 - 580 km/s
 - 1160 km/s
 - 5800 km/s
- Which one of the following explains the origin of colligative properties correctly?
 - Increase of the chemical potential of the liquid solvent due to added solute
 - Reduction of the chemical potential of the liquid solvent due to added solute
 - Influence of the solute on the chemical potential of the solvent vapour
 - Influence of the solute on the chemical potential of the solid solvent
- For a zero order reaction, $A \rightarrow P$, if the initial concentration of species A is $[A]_0$, then $t_{1/2}$ can be expressed as
 - $[A]_0/k$
 - $1/k$
 - $2[A]_0/k$
 - $[A]_0/2k$
- A transition element M forms the oxides MO , M_2O_3 , MO_3 and M_2O_7 . Which of the following statements about these oxides is true?
 - MO is the most acidic
 - M_2O_3 is the one most likely to be a strong oxidising agent
 - MO_3 is the most basic
 - M_2O_7 is the one that cannot be a reducing agent
- For a compound to be aromatic, how many π electrons must be in the π cloud?
 - An even number of pairs
 - An odd number
 - An even number
 - An odd number of pairs
- Which one of the following alkyl halides would be the most stable in water?
 - Cyclopropenyl bromide
 - Cyclopentadienyl bromide
 - Cyclopropyl bromide
 - Bromobenzene
- What starting materials must be used in order to have a 1,4-cyclohexadiene to be the product of a Diels Alder reaction?
 - A conjugated diene and an alkene
 - A conjugated diene and an alkyne
 - A 1,4-diene and an alkyne
 - A 1,2-diene and an alkyne

2 Marks Questions

- The single bond length between carbon and the elements *viz.*, carbon, nitrogen, oxygen and fluorine follow the order $C-C > C-N > C-O > C-F$. This trend is due to

- (a) increase in electronegativity
 (b) increase in bond polarity
 (c) increase in atomic weight
 (d) decrease in atomic size
12. By applying the VSEPR model on the XeF_4 molecule, which one of the following statements is true?
 (a) It has four bonding pairs and a lone pair
 (b) It has octahedral geometry and square planar shape
 (c) It has square planar geometry and octahedral shape
 (d) It has tetrahedral geometry and tetrahedral shape
13. Which one of the following statements is not true for borazine and benzene?
 (a) They are isoelectronic
 (b) Both are aromatic
 (c) Both undergo addition reactions
 (d) Both undergo substitution reactions
14. The action of NH_3 on S_2Cl_2 produces a thermochromic crystalline compound, whose chemical formula is
 (a) $\text{S}_3\text{N}_3\text{Cl}$ (b) $\text{S}_4\text{N}_3\text{Cl}$
 (c) S_2N_2 (d) S_4N_4
15. The oxidation state of Fe and S in $\text{Na}_2[\text{Fe}(\text{CO})_4\text{Cl}_2]$ and $\text{K}_2\text{S}_2\text{O}_8$, respectively are
 (a) 0 and +6 (b) +2 and +7
 (c) +4 and +6 (d) 0 and +4
16. The structure of $\text{Ni}(\text{CO})_4$ is
 (a) square planar (b) trigonal pyramidal
 (c) tetrahedral (d) distorted octahedral
17. The reaction of CuCO_3 with acetic acid produces a blue crystalline compound with its magnetic moment (μ_{eff}) being $\sim 1.4 \text{ BM/Cu}$. The compound is
 (a) $\text{Cu}(\text{CH}_3\text{COO})_2 \cdot 2\text{H}_2\text{O}$
 (b) $\text{Cu}_2\text{CO}_3(\text{CH}_3\text{COO})_2 \cdot 2\text{H}_2\text{O}$
 (c) $\text{Cu}(\text{CH}_3\text{COO})_2$
 (d) $\text{Cu}_2(\text{CH}_3\text{COO})_2 \cdot 2\text{H}_2\text{O}$
18. The limiting ionic conductivities of Mg^{2+} and Cl^- in H_2O at 298 K are 10.60 and 7.635 $\text{mS m}^2/\text{mol}$, respectively. The limiting molar conductivity (in $\text{mS m}^2/\text{mol}$) of MgCl_2 in H_2O at 298 K is
 (a) 18.235 (b) 25.870
 (c) 28.835 (d) 60.893
19. The longest wavelength transition in the Balmer series of atomic hydrogen is
 (a) 656.5 nm (b) 6564.7 nm
 (c) 15233 nm (d) 65647 nm
20. In a liquid-vapour phase boundary, a plot of \ln vapour pressure against the reciprocal to temperature would yield as slope
 (a) $\Delta_{\text{vap}} H/R$ (b) $-\Delta_{\text{vap}} H/R$
 (c) $\Delta_{\text{vap}} H/\Delta_{\text{vap}} V$ (d) $\Delta_{\text{vap}} H/R^2$
21. For a first order reaction $A \rightarrow P$, the time required to complete 80% of the reaction is
 (a) $\ln 1.25/k$ (b) $\ln 8/k$
 (c) $\ln 5/k$ (d) $\ln 80/k$
22. If the molar enthalpy and the entropy of fusion of water are 6.01 kJ/mol and 22.0 J/mol-K, respectively, then ΔG for the melting of ice at 10°C is
 (a) -6220 kJ/mol
 (b) -214 kJ/mol
 (c) -5.79 kJ/mol
 (d) -0.22 kJ/mol
23. When steady state approximation is applied in enzyme kinetics, which one of the following statements is correct with regard to the concentration of the enzyme substrate complex, $[\text{ES}]$?
 (a) $\frac{d[\text{ES}]}{dt} = 0$ (b) $\frac{d[\text{ES}]}{dt} = \text{constant}$
 (c) $[\text{ES}] = 0$ (d) $\frac{d[\text{ES}]}{dt} = \text{infinity}$
24. The wavelength possessed by a cricket ball of mass 1 kg travelling with a velocity of 40 m/s is
 (a) $1.66 \times 10^{-38} \text{ m}$ (b) $1.66 \times 10^{-35} \text{ m}$
 (c) $2.65 \times 10^{-32} \text{ m}$ (d) $1.66 \times 10^{33} \text{ m}$
25. Which one of the following reaction sequences will convert toluene to *para*-chlorobenzoic acid?
 (a) (i) $\text{Cl}_2 / \text{light}$, (ii) Hot $\text{KMnO}_4 / \text{H}^+$
 (b) (i) Hot $\text{KMnO}_4 / \text{H}^+$ (ii) $\text{Cl}_2 / \text{FeCl}_3$
 (c) (i) $\text{Cl}_2 / \text{FeCl}_3$, (ii) Hot $\text{KMnO}_4 / \text{H}^+$
 (d) (i) N-chlorosuccinimide, (ii) Hot $\text{KMnO}_4 / \text{H}^+$
26. For 2,3-dibromobutane, which one of the following statement is true?
 (a) (2S, 3S) and (2R, 3S) is a pair of diastereomers; (2R, 3R) and (2S, 3S) is a pair of enantiomers
 (b) (2S, 3S) and (2R, 3S) is a pair of diastereomers; (2R, 3S) and (2S, 3R) is a pair of enantiomers
 (c) (2R, 3R) and (2S, 3S) is a pair of diastereomers; (2S, 3S) and (2R, 3S) is a pair of enantiomers
 (d) (2R, 3R) and (2S, 3S) is a pair of diastereomers; (2R, 3R) and (2S, 3S) is a pair of enantiomers

27. When *trans*-1-bromo-2-methylcyclohexane reacts with methoxide ion, what products are formed under S_N2 and S_N1 conditions?

- (a) S_N2 and S_N1 both form *cis* and *trans*-1-methoxy-2-methylcyclohexane
- (b) S_N2 forms *cis*-1-methoxy-2-methylcyclohexane and S_N1 forms *cis* and *trans*-1-methoxy-2-methylcyclohexane
- (c) S_N2 forms *cis*-1-methoxy-2-methylcyclohexane and S_N1 forms 1-methoxy-1-methylcyclohexane
- (d) S_N2 forms *cis*-1-methoxy-2-methylcyclohexane and S_N1 forms *trans*-1-methoxy-2-methylcyclohexane

28. What product(s) is (are) formed when HBr is eliminated from (2*S*, 3*S*)-2-bromo-3-phenylbutane in an E2 reaction?

- (a) (*Z*)-2-phenyl-2-butene
- (b) (*Z*) and (*E*)-2-phenyl-2-butene
- (c) (*E*)-2-phenyl-2-butene
- (d) (*E*)-3-methyl-3-phenyl-1-butene

29. The major product that would be formed in a Diels-Alder reaction between (*E*)-penta-1,3-diene (*trans*-1-methyl-1,3-butadiene) and methyl acrylate is

- (a) 1,2-product (*ortho*) with Me and CO₂Me *cis* to each other
- (b) 1,2-product (*ortho*) with Me and CO₂Me *trans* to each other
- (c) 1,3-product (*meta*) with Me and CO₂Me *cis* to each other
- (d) 1,3-product (*meta*) with Me and CO₂Me *trans* to each other

30. How many resonance structure contributors can be written for the carbocation intermediate formed when phenol undergoes electrophilic substitution in the *ortho*, *meta*, and *para* positions?

- (a) *ortho*:3, *meta*:3 and *para*:4
- (b) *ortho*:3, *meta*:3 and *para*:3
- (c) *ortho*:4, *meta*:3 and *para*:4
- (d) *ortho*:3, *meta*:3 and *para*:4