Q. 1. The energies of activation for forward and reverse reactions for $A_2 + B_2 \leftrightarrow 2\,AB$ *are* $180\,KJ\ mol^{-1}$ *and* $200\,KJmol^{-1}$ respectively. The presence of a catalyst lowers the activation energy of both (forward and reverse) reactions by 100 kJ mol^{-1}. The enthalpy change of the reaction $A_2 + B_2 \rightarrow 2\,AB$ in the presence of catalyst will be (in kJ mol^{-1})

a. 300
b. 120
c. 280
d. 20

Correct choice: (4)

Q. 2. The cell, $Zn\left|Zn^{2+}\ (1\,M)\right|\left|Cu^{2+}\ (1\,M)\right|Cu\ \left(E^{0}_{cell} = 1.10\,V\right)$, was allowed to be completely discharged at 298 K. The relative concentration of Zn^{2+} *to* Cu^{2+} $\left(\frac{\left[Zn^{2+}\right]}{\left[Cu^{2+}\right]}\right)$ *is*

ZnocellE

a. antilog (24.08)
b. 37.3
c. 10^{373}
d. 9.65×10^{4}

Correct choice: (3)

Q. 3. The pK_a of a weak acid (HA) is 4.5. The pOH of an aqueous buffered solution of HA in which 50% of the acid is ionized is

a. 4.5
b. 2.5
c. 9.5
d. 7.0

Correct choice: (3)

Q. 4. Consider the reaction, $2A + B \rightarrow products$ When concentration of B alone was doubled, the half−life did not change. When the concentration of A alone was doubled, the rate increased by two times. The unit of rate constant for this reaction is

a. $L\,mol^{-1}\,s^{-1}$
b. no unit
c. $mol\,L^{-1}\,s^{-1}$
d. s^{-1}

Correct choice: (1)

Q. 5.. Identify the incorrect statement among the following:

a. d−Block elements show irregular and erratic chemical properties among themselves .
b. La and Lu have partially filled d orbitals and no other partially filled orbitals.
c. The chemistry of various lanthanoids is very similar.
d. 4f and 5f orbitals are equally shielded.

Correct choice: (4)

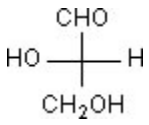
Q. 6. Which one of the following has a square planar geometry?

a. $[CoCl_4]^{2-}$
b. $[FeCl_4]^{2-}$
c. $[NiCl_4]^{2-}$
d. $[PtCl_4]^{2-}$

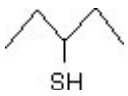
Correct choice: (4)

Q. 7. Which of the following molecules is expected to rotate the plane of plane − polarised light?

a.

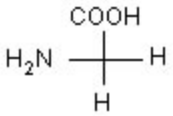


b.



c.

d.



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Correct choice: (1)

Q. 8. The secondary structure of protein refers to:

a. $\alpha-$ helical backbone.
b. hydrophobic interactions.
c. sequence of $\alpha-$ amino acids.
d. fixed configuration of the polypeptide backbone.

Correct choice: (4)

Q. 9. Which of the following reactions will yield 2,2−dibromopropane?

a. $CH_3 - C \equiv CH + 2HBr \rightarrow$
b. $CH_3 - CH = CHBr + HBr \rightarrow$
c. $CH_3 \equiv CH + 2HBr \rightarrow$
d. $CH_3 - CH \equiv CH_2 + HBr \rightarrow$

Correct choice: (1)

Q. 10. In the chemical reaction, $CH_3\,CH_2\,NH_2 + CHCl_3 + 3\,KOH \rightarrow (A) + (B) + 3H_2O$ the compounds (A) and (B) are respectively:

a. $CH_3\,CH_5\,CN \text{ and } 3KCl$
b. $CH_3\,CH_2\,CONH_2 \text{ and } 3KCl$
c. $C_2H_5\,NC \text{ and } K_2CO_3$
d. $C_2H_5\,NC \text{ and } 3KCl$

Correct choice: (4)

Q. 11. The reaction of toluene with Cl_2 in presence of $FeCl_3$ gives predominantly:

a. benzoyl chloride

b. benzyl chloride
c. o− and p−chlorotoluene
d. m−chlorotoluene

Correct choice: (3)

Q. 12. Presence of a nitro group in a benzene ring

a. activates the ring towards electrophilic substitution.
b. renders the ring basic.
c. deactivates the ring towards nucleophilic substitution.
d. deactivates the ring towards electrophilic substitution.

Correct choice: (4)

Q. 13. In which of the following ionization processes, the bond order has increased and the magnetic behaviour has changed?

a. $C_2 \rightarrow C_2^+$
b. $NO \rightarrow NO^+$
c. $O_2 \rightarrow O_2^+$
d. $N_2 \rightarrow N_2^+$

Correct choice: (2)

Q. 14. The actinoids exhibit more number of oxidation states in general than the lanthanoids. This is because

a. the 5f orbitals are more buried than the 4f orbitals.
b. there is a similarity between 4f and 5f orbitals in their angular part of the wave function.
c. the actinoids are more reactive than the lanthanoids.
d. the 5f orbitals extend further from the nucleus than the 4f orbitals.

Correct choice: (4)

Q. 15. Equal masses of methane and oxygen are mixed in an empty container at 25^0C. The fraction of the total pressure exerted by oxygen is

a. $\frac{2}{3}$

b. $\frac{1}{3} \times \frac{273}{298}$

c. $\frac{1}{3}$

d. $\frac{1}{2}$

Ans: C

Q. 16. . A 5.25% solution of a substance is isotonic with a 1.5% solution of urea (molar mass = 60 g mol^{-1}) in the same solvent. If the densities of both the solutions are assumed to be equal to 1.0 g cm–3, molar mass of the substance will be

a. 90.0 g mol^{-1}
b. 115.0 g mol^{-1}
c. 105.0 g mol^{-1}
d. 210.0 g mol^{-1}

Correct choice: (4)

Q. 17. Assuming that water vapour is an ideal gas, the internal energy change ΔU when 1 mol of water is vapourised at 1 bar pressure and 100^0C,(Given: Molar enthalpy of vapourisation of water at 1 bar and 373 K = 41 kJ mol^{-1} and R = 8.3 J $mol^{-1}K^{-1}$) will be:

a. 4.100 kJ mol−1
b. 3.7904 kJ mol−1
c. 37.904 kJ mol−1
d. 41.00 kJ mol−1

Correct choice: (3)

Q. 18. In a saturated solution of the sparingly soluble strong electrolyte $AgIO_3$(Molecular mass = 283) the equilibrium which sets in is $AgIO_2(s) \leftrightarrow Ag^+(aq) + 10_3^-(aq)$ If the solubility product constant K spof $AgIO_3$ at a given temperature is, what is the mass of $AgIO_3$contained in 100 ml of its saturated solution?

a. 28.3×10^{-2} g
b. 2.83×10^{-3} g
c. 1.0×10^{-7} g
d. 1.0×10^{-4} g

Correct choice: (2)

Q. 19. A radioactive element gets spilled over the floor of a room. Its half–life period is 30 days. If the initial activity is ten times the permissible value, after how many days will it be safe to enter the room?

a. 1000 days
b. 300 days
c. 10 days
d. 100 days

Correct choice: (4)

Q. 20. Which one of the following conformations of cyclohexane is chiral?

a. Twist boat
b. Rigid
c. Chair
d. Boat

Correct choice: (1)

Q. 21. Which of the following is the correct order of decreasing SN_2 reactivity?

a. $RCH_2X > R_3CX > R_2CHX$
b. $RCH_2X > R_2CHX > R_3CX$
c. $R_3CX > R_2CHX > RCH_2X$
d. $R_2CHX > R_3CX > RCH_2X$
(X = a halogen)

Correct choice: (2)

Q. 22. In a following sequence of reactions,

$$CH_3CH_2OH \xrightarrow{p+I_2} A \xrightarrow{Mg} B \xrightarrow{HCHO} C \xrightarrow{H_2O} D$$

the compound 'D' is ether

a. butanal
b. n–butyl alcohol
c. n–propyl alcohol
d. propanal

Correct choice: (3)

Q. 23. Which of the following sets of quantum numbers represents the highest energy of an atom?

a. $n = 3, l = 1, m = 1, s = +\frac{1}{2}$
b. $n = 3, l = 2, m = 1, s = +\frac{1}{2}$
c. $n = 4, l = 0, m = 0, s = +\frac{1}{2}$
d. $n = 3, l = 0, m = 0, s = +\frac{1}{2}$

Correct choice: (2)

Q. 24. Which of the following hydrogen bonds is the strongest?

a. O–H….N
b. F–H….F
c. O–H….O
d. O–H….F

Correct choice: (2)

Q. 25. In the reaction, $2A\,(s) + 6HCl\,(aq) \rightarrow 2Al^{3+}\,(aq) + 6Cl^{-}\,(aq) + 3H_2\,(g)$

a. 6 L HCl(aq) is consumed for every 3 L H_2(g) produced.
b. 33.6 L H_2(g) is produced regardless of temperature and pressure for every mole Al that reacts.
c. 67.2 L H_2(g) at STP is produced for every mole Al that reacts.
d. 11.2 L H_2(g) at STP is produced for every mole HCl(aq) consumed.

Correct choice: (4)

Q. 26. Regular use of which of the following fertilizers increases the acidity of soil?

a. Potassium nitrate
b. Urea
c. Superphosphate of lime
d. Ammonium sulphate

Correct choice: (4)

Q. 27. Identify the correct statement regarding a spontaneous process:

a. For a spontaneous process in an isolated system, the change in entropy is positive.
b. Endothermic processes are never spontaneous.

c. Exothermic processes are always spontaneous.
d. Lowering of energy in the reaction process is the only criterion for spontaneity.

Correct choice: (1)

Q. 28. Which of the following nuclear reactions will generate an isotope?

a. neutron particle emission
b. positron emission
c. $\alpha -$ particle emission
d. $\beta -$ particle emission

Correct choice: (1)

Q. 29. The equivalent conductances of two strong electrolytes at infinite dilution in H_2O (where ions move freely through a solution) at 25^0C are given below: $\wedge^0 CH_3 COONa = 91.0S\ cm^2\ /\ equiv; \wedge^0 C_{HCl} = 426.2\ S\ cm^2\ /\ equiv$
What additional information/quantity one needs to calculate of an aqueous solution of acetic acid?

a. $\wedge^0 of\ NaCl$
b. $\wedge^0 of\ CH_3 COOK$
c. (C) The limiting equivalent conducted of $H^+ \left(\lambda^o_{H+}\right)$
d. $\wedge^0 of\ chloracetic\ acid\ (ClCH_2COOH)$

Correct choice: (1)

Q. 30. Which one of the following is the strongest base in aqueous solution?

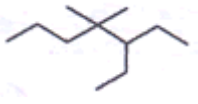
a. Trimethylamine
b. Aniline
c. Dimethylamine
d. Methylamine

Correct choice: (3)

Q. 31. The compound formed as a result of oxidation of ethyl benzene by $KMnO_4$ is

a. benzophenone
b. acetophenone
c. benzoic acid
d. benzyl alcohol

Correct choice: (3)

Q. 32. The IUPAC name of  is

a. 1,1–diethyl–2,2–dimethylpentane
b. 4,4–dimethyl–5,5–diethylpentane
c. 5,5–diethyl–4,4–dimethylpentane
d. 3–ethyl–4,4–dimethylheptane

Correct choice: (4)

Q. 33. Which of the following species exhibits the diamagnetic behaviour?

a. O_2^{2-}
b. O_2^{+}
c. O_2
d. NO

Correct choice: (1)

Q. 34. The stability of dihalides of Si, Ge, Sn and Pb increases steadily in the sequence

a. $GeX_2 << SiX_2 << SnX_2 << PbX_2$
b. $SiX_2 << GeX_2 << PbX_2 << SnX_2$
c. $SiX_2 << GeX_2 << SnX_2 << PbX2$
d. $PbX_2 << SnX_2 << GeX_2 << SiX_2$

Correct choice: (3)

Q. 35. Identify the incorrect statement among the following:

a. Ozone reacts with SO_2 to give SO_3.
b. Silicon reacts with NaOH(aq) in the presence of air to give $Na2SiO_3$ and H_2O.
c. Cl_2 reacts with excess of NH_3 to give N_2 and HCl.
d. Br_2 reacts with hot and strong NaOH solution to give NaBr, $NaBrO_4$ and H_2O.

Correct choice: (4)

Q. 36. The charge/size ratio of a cation determines its polarizing power. Which one of the following sequences represents the increasing order of the polarizing power of the cationic species, K^+, Ca^{2+}, Mg^{2+}, Be^{2+}?

a. $Mg^{2+} < Be^{2+} < K^{+} < Ca^{2+}$
b. $Mg^{2+} < Be^{2+} < K^{+} < Ca^{2+}$

c. $Be^{2+} < K^{+} < Ca^{2+} < Mg^{2+}$
d. $K^{+} < Ca^{2+} < Mg^{2+} < Be^{2+}$
e. $K^{+} < Ca^{2+} < Mg^{2+} < Be^{2+}$

Correct choice: (3)

Q. 37. The density (in g mL^{-1}) of a 3.60 M sulphuric acid solution that is 29% H_2SO_4 (Molar mass = 98 g mol^{-1}) by mass will be

a. .64
b. 1.88
c. 1.22
d. 1.45

Correct choice: (3)

Q. 38. The first and second dissociation constants of an acid H_2A are 1.0×10^{-5} and 5.0×10^{-10} respectively. The overall dissociation constant of the acid will be

a. 5.0×10^{-5}
b. 5.0×10^{15}
c. 5.0×10^{-15}
d. 0.2×10^{5}

Correct choice: (3)

Q. 39. A mixture of ethyl alcohol and propyl alcohol as vapour pressure of 290 mm at 300 K. The vapour pressure of propyl alcohol is 200 mm. If the mole fraction of ethyl alcohol is 0.6, its vapour pressure (in mm) at the same temperature will be

a. 350
b. 300
c. 700
d. 360

Correct choice: (1)

Q. 40. In conversion of lime–stone to lime, $CaCO_3\ (s) \rightarrow CaO\ (s) + CO_2\ (g)$
The values of ΔH^0 and ΔS^0 are +179.1 kJ mol^{-1} and 160.2 J/K respectively at 298 K and 1 bar. Assuming that ΔH^0 and ΔS^0 do not change with temperature, temperature above which conversion of limestone to lime will be spontaneous is

a. 1008 K
b. 1200 K
c. 845 K
d. 1118 K

Correct choice: (4)