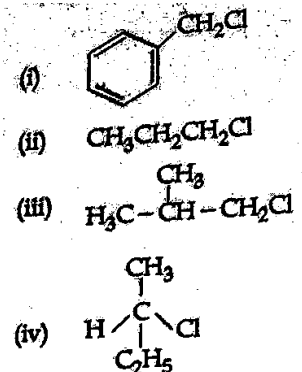# AIPMT 2014 Chemistry Solution (Set – Q)

1. Which of the following compounds will undergo recemisation when solution of KOH hydrolyses?

(i) [benzene ring with CH₂Cl]

(ii) $CH_3CH_2CH_2Cl$

(iii) $H_3C-\underset{\underset{CH_3}{|}}{CH}-CH_2Cl$

(iv) $\underset{C_2H_5}{\overset{CH_3}{H-C-Cl}}$

   (1) (ii) and (iv)
   (2) (iii) and (iv)
   (3) (i) and (iv)
   (4) (i) and (ii)

Solution) The recemization is experienced when bulky groups are attached to the central carbon, so (iii) and (iv) compounds would show recemization.

2. The reaction of aqueous $KMnO_4$ with H_2O_2 in acidic conditions gives:

(1) Mn^{2+} and O_2

(2) Mn^{2+} and O_3

(3) Mn^{4+} and MnO_2

(4) Mn^{4+} and O_2

Sol) The ionic reaction is given by:

$2MnO_4^- + 6H^+ + 5H_2O_2 => 2Mn^{2+} + 8H_2O + 5O_2$
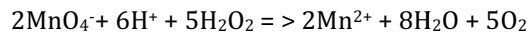
3. Which one of the following is not a common component of Photochemical smog?

   (1) Acrolein
   (2) Peroxyacety nitrate
   (3) Chloroflurocarbons
   (4) Ozone

Sol) Ozone in itself is not a component though it does existin other forms in smog.

4. Which of the following will be most stable diazonum salt $RN_2^+ x^-$?

(1) $C_6H_5N_2^+ X^-$

(2) $CH_3 CH_2 N_2^+ X^-$

(3) $C_6H_5 CH_2 N_2^+ X^-$

(4) $CH_3 N_2^+ X^-$

Sol) The diazo compound formed directly from benzene is the most stable.

5. Which of the following hormones is produced under the condition of stress which stimulates glycogenolysis in the liver of human beings ?

(1) Insulin

(2) Adernaline

(3) Estradiol

(4) Thyroxin

Sol) Adernaline

6. 1.0 g of magnesium is burnt with 0.56 g O_2 in a closed vessel. Which reactant is left in excess and how much ?

(At. wt. Mg = 24; O = 16)

(1) O_2 , 0.16 g
(2) Mg , 0.44 g
(3) O_2 , 0.28 g
(4) Mg, 0.16 g

Sol) The oxygen is the limiting reagent and therefore Mg would be in excess.

7. What products are formed when the following compound is treated with Br_2 in the presence of $FeBr_3$?
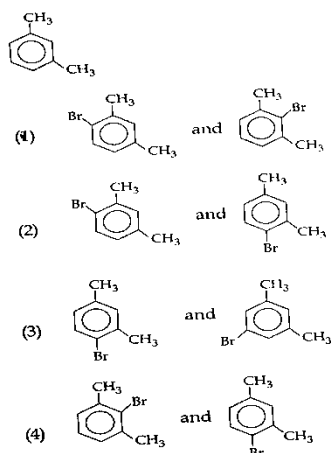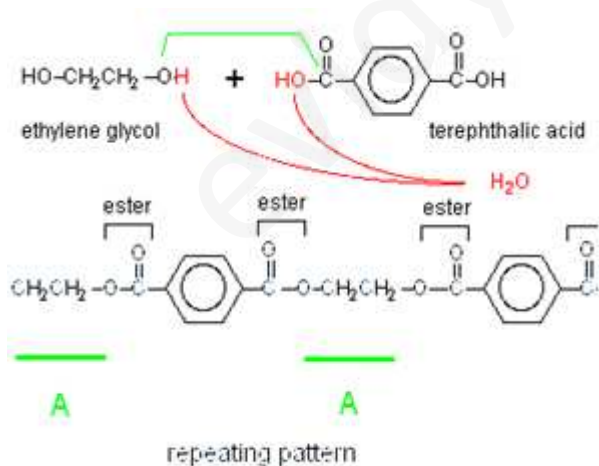
Sol) The ortho and para substituted compounds would be formed.

8. Which of the following organic compounds polymerizes to form the polyester Dacron ?

(1) Benzoic acid and ethanol

(2) Terephthalic acid and ethylene gycol

(3) Benzoic acid and para HO- (C_6H_4) – OH

(4) Propylene and paraHO- (C_6H_4) – OH

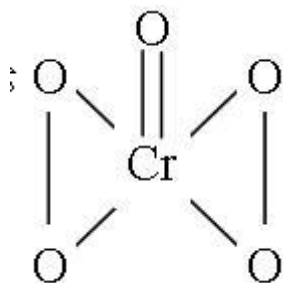Sol) The reaction goes as follows:

9. In acidic medium, ,H_2O_2 changes $Cr_2O_7^{-2}$ to CrO_5 which has two (-O-O-) bonds. Oxidation state of Cr in $CrO_5$is :

(1) +3

(2) +6

(3) -10

(4) +5

Sol) It is +6.The structure of CrO_5 is:

By looking at the above structure, you must have observed that 4 of the O atoms attached, are combined by the peroxide linkage. So, there oxidation states are taken as -1.The other one is normal. So, its oxidation state is taken as -2.

Now, let the oxidation state of Cr be x.
then, $x + 4× (-1) - 2 =0$. Or, $x = 6$

10. Which of the following orders of ionic raddi is correctly represented?

(1) $Na^+> F^-> O^{2-}$

(2) $F^-> O^{2-}> Na^+$

(3) $Al^{3+}> Mg^{2+}> N^{3-}$

(4) $H^-> H^+> H$

Sol) Ionic radii increases with an increase of the number of electrons.

11. Which of the following salts will given highest in water?

(1) NaCl

(2) Na^2CO_3

(3) $CuSO_4$

(4) KCl

Sol) The number of positive charges contributed by sodium carbonate is maximum.

12. Which of the following will not be soluble in sodium bydrogencarbonate ?
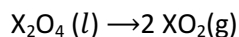
(1) Benzoic acid

(2) o – Nitrophenol

(3) Benzenesulphonic acid

(4) 2, 4, 6 – trinitrophenol

Sol) Benzoic acid is not soluble in sodium hydrogen carbonate.

13. For the reaction :

X_2O_4 (l) $\longrightarrow$ 2 $XO_2(g)$

ΔU = 2.1 k cal, ΔS = 20 cal K^{-1} at 300 K
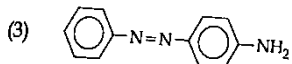
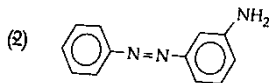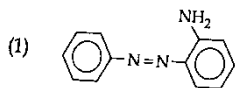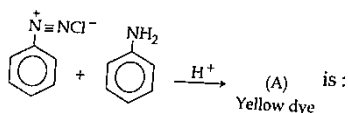Hence, ΔG is :

(1) - 2.7 k cal

(2) 9.3 k cal

(3) -9.3 k cal

(4) 2.7 k cal

Sol) The equation: $\Delta G = \Delta U + P\Delta V - T\Delta S$ needs to be used.

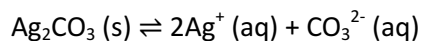14. In the following reaction, the product (A)

(A) is :
Yellow dye

(1)

(2)

(3)

(4)
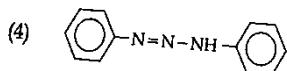
Sol) The reaction goes as follows:

15. Using the Gibbs energy change, $\Delta G° = +63.3$ KJ, for the following reaction

Ag_2CO_3 (s) $\rightleftharpoons$ $2Ag^+$ (aq) + CO_3^{2-} (aq)

The K_{sp} of $Ag_2 CO_3$ (s) in water at 25°C is :

(R = 8.314 J K^{-1} mol^{-1})

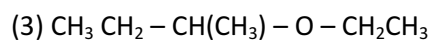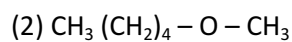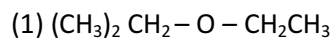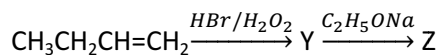(1) 8.0×10^{-12}

(2) 2.9×10^{-3}

(3) 7.9×10^{-2}
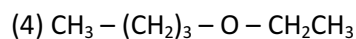
(4) 3.2×10^{-26}

Sol) The equation: $\Delta G = -nRT \ln K_{sp}$ needs to be used.

16. Identity Z in the sequence of reactions:

$CH_3CH_2CH=CH_2 \xrightarrow{HBr/H_2O_2} Y \xrightarrow{C_2H_5ONa} Z$

(1) $(CH_3)_2 CH_2 - O - CH_2CH_3$

(2) $CH_3 (CH_2)_4 - O - CH_3$

(3) $CH_3 CH_2 - CH(CH_3) - O - CH_2CH_3$

Tr sWeb

(4) $CH_3 - (CH_2)_3 - O - CH_2CH_3$

Sol) The reaction would follow the anti markonikoff rule and therefore the ether is going to be formed.

17. In the kjeldahl' method for estimation of nitrogen present in a soil sample, ammonia evolved from .75 g of sample neutralized 10 mL of 1M H_2SO_4. The percentage of nitrogen in the soil is :

(1) 45.33

(2) 35.33

(3) 43.33

(4) 37.33

Sol) The answer is straightforward.

18. Which property of colloids is not dependent on the charge on colloidal particles ?

(1) Electrophoresis

(2) Electro – osmosis

(3) Tyndall effect

(4) Coagulation

Sol) The Tyndall effect doesn't depend on charges.

19. For a given exothermic reaction, K_p and K_p are the equilibrium constants at temperatures T_1 and T_2, respectively. Assuming that heat of reaction is constant in temperature range between T_1 and T_2, it is readily observed that :

(1) $K_p < K_p$

(2) $K_p = K_p$

(3) $K_p = \frac{1}{K}$

(4) $K_p > K_p'$

Sol) With an increase in temperature, the K_p value is going to increase.

20. When 22.4 litres of ofH2(g) is mixed with 11.2 litres of Cl2(g), each at S.T.P., the moles of HCl(g) formed is equal to:

1) 2 mol of HCl (g)

2) 0.5 mol of HCl (g)

3) 1.5 mol of HCl (g)

4) 1 mol of HCl (g)

Sol) The reaction goes as $H_2 + Cl_2 \rightarrow 2HCl$.

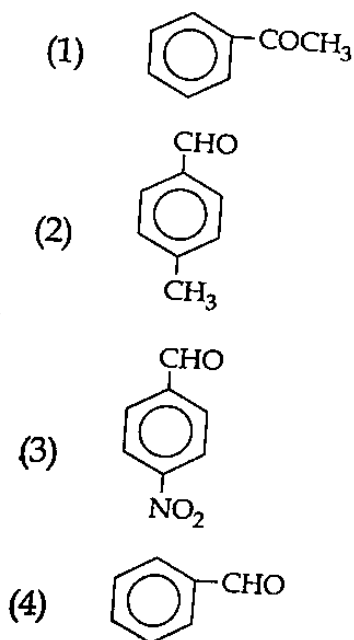Here Cl₂ is the limiting reagent and therefore the number of moles of HCl formed are 1 in number.

21. Which one of the following is an example of a thermosetting polymer?

Sol) 4

22. Which one is most reactive towards Nucleophilic addition reaction?

(1)

(2)

(3)

(4)

Sol) Nucelophilic addition reactions are preferred by aldehydic groups over ketonic groups. Further bulky groups hinder the nucleophilic additions.

23. Calculate the energy in joule corresponding to light of wavelength 45 nm: (Planck's constant h = 6.63 × 10-34 Js ; speed of light c = 3 × 108 ms-1)

1) 6.67 × 1011

2) 4.42 × 10-15

3) 4.42 × 10-18

4) 6.67 × 1015

Sol) The energy is given by: $E = \dfrac{hc}{}$

24. Which of the following organic compounds has same hybridization as its combustion product-(CO2)?

1) Ethyne

2) Ethene

3) Ethanol

4) Ethane

Sol) Ethene and CO_2 are Sp^2 **hybridized.**

25. Be^{2+} is isoelectronic with which of the following ions ?

(1) Li$^+$

(2) Na$^+$

(3) Mg^{2+}

(4) H$^+$

Sol) Be^{2+} has 2 electrons in its outermost shell and thus is isoelectronic with Li$^+$

26. Magnetic moment 2.83 BM is given by which of the following ions?

(At. nos. Ti = 22, Cr=24, Mn = 25, Ni = 28)

(1) Ni^{2+}

(2) Cr^{3+}

(3) Mn^{2+}

(4) Ti^{3+}

Sol) Magnetic moment is found by the formula $[n(n+2)]^{1/2}$. Ni^{2+} has 2 electrons in its outermost shell and that shows the required magnetic moment.

27. The weight of silver (at. wt. = 108) displaced by a quantity of electricity which displaces 5600 mL of O$_2$ at STP will be :

(1) 10.8 g

(2) 54.0 g

(3) 108.0 g

(4) 5.4 g

Sol) There are 2 atoms of oxygen, so the charges exchanged are 2 moles for oxygen atom and 1 mole for silver atom.

28.

N$_2$(g) + H$_2$ (g) $\rightleftharpoons$ 2NH$_3$(g) + heat
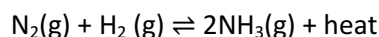
The equilibrium shifts in forward direction :

(1) By decreasing the pressure

(2) B decreasing the concentration of $N_2(g)$ and $H_2(g)$

(3) By increasing pressure and decreasing temperature

(4) By increasing the concentration $NH_3(g)$

Sol) The equilibrium is going to shift in the forward direction when more reactants react and therefore by increasing pressure, more reactants are made to react.

29. The pair of compounds that can exist together is :

(1) $HgCl_2$, $SnCl_2$

(2) $FeCl_2$, $SnCl_2$

(3) $FeCl_3$, KI

(4) $FeCl_3$, $SnCl_2$

Sol) $FeCl_3$ and $SnCl_2$ exist together and react using the following equation:

$8\ FeCl_3 + 6K_3Fe(CN)_6 + 3\ SnI_2 = 2\ Fe_4(Fe(CN)_6)_3 + 3\ I_2 + 18KCl + 3\ SnCl_2$

30. Which of the following complexes is used to be as an anticancer agent ?

(1) cis – $[PtCl_2 (NH_3)_2]$

(2) cis – $K_2 [Pt\ Cl_2\ Br_2]$

(3) Na_2CoCl_4

(4) mer – $[Co(NH_3)_3Cl_3]$

Sol) This is used in Chemotherapy.

31. Among the following complexes the one which shows Zero crystal field stabilization energy (CFSE) is :

(1) $[Fe(H_2O)_6]^{+3}$

(2) $[Co(H_2O)_6]^{2+}$

(3) $[Co(H_2O)_6]^{3+}$

(4) $[Mn(H_2O)_6]^{3+}$

Sol) In $[Co(H_2O)_6]^{2+}$, there are 5 electrons in the d shell of Cobalt. Therefore, the CFSE would be given by:

$\Delta E=2\times(-3/5\Delta tet)+3\times(2/5\Delta tet)=0$

32. If a is the length of the side of a cube, the distance between the body centered atom and one corner atom in the cube will be :
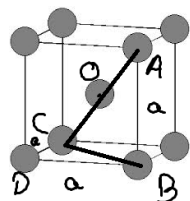
(1) $\frac{4}{\sqrt{3}}a$

(2) $\frac{\sqrt{3}}{4}a$

(3) $\frac{\sqrt{3}}{2}a$
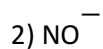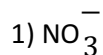
(4) $\frac{2}{\sqrt{3}}a$

Sol) The figure goes as follows:

$CB = a\sqrt{2}$

$AC = a\sqrt{3}$

$AC = OC = \frac{a\sqrt{3}}{2}$

33. Which one of the following species has plane triangular shape?

1) NO_3^-

2) NO^-

3)

4)

Sol)

NO_3^- has a trigonal planar structure.

34. Which of the following molecules has the maximum dipole moment?

1)

2)

3)

4) CO_2

Sol) NH_3 has the maximum value of dipole moment equal to 1.47 D.

35. Acidity of diprotic acids m aqueous solutions increases in the order :

1) H2Se < H2S < H2Te

2) H2Te < H2S < H2Se

3) H2Se < H2Te < H2S

4) H2S < H2Se < H2Te

Sol) The acidic nature increases from H_2O to H_2Te. H_2S is a weak diprotic acid.

36. Reason of lanthanoid contraction is

1) Increasing nuclear charge

2) Deceasing screening effect

4) Negligible screening effect of 'f' orbitals

Sol) Lanthanoid contraction exists because of negligible screening of the 5f orbitals.

37. Which of the following statements is correct for the spontaneous adsorption of a gas?

1) ΔS is negative and therefore, ΔH should be highly negative.

2) ΔS is positive and , therefore, ΔH should be negative.

3) ΔS is positive and, therefore, ΔH should also be highly positive.

4) ΔS is negative and, therefore, ΔH should be highly positive.

Sol) The two driving forcescausing chemical reactionsto occur are:

a. The formation of more stable (low-energy) products from less stable (high-energy)reactants inexothermic reactions (ΔH<0).
b. The formation of products that have more entropy than the reactants (ΔS>0).

38. Artificial sweetner which is stable under cold conditions only is :

(1) Sucralose

(2) Aspartame

(3) Alitame

(4) Saccharine

Sol) Sacchrine is the only sweetener among the rest which exists/is stable at cold temperatures.

39. Equal masses of H_2 , O_2 and methane have been taken in a container of volume V at temperature 27°C in identical conditions. The ratio of the volumes of gasses H_2 : O_2 : methane would be :

(1) 16 : 8 : 1

(2) 16 : 1 : 2

(3) 8 : 1 : 2

(4) 8 : 16 : 1

Sol) Let the equal masses be x g.

Then we have the mole ratios given by:

Hence, the ratio of moles can be rewritten as:
$$\frac{x}{2} : \frac{x}{32} : \frac{x}{16}$$

This is also the ratio of the volumes. $16 : 1 : 2$

40. (a) $H_2O_2 + O_3 \rightarrow H_2O + 2O_2$

(b) $H_2O_2 + Ag_2O \rightarrow 2Ag + H_2O + O_2$

Role of hydrogen peroxide in the above reactions is respectively:

(1) reducing in (a) and oxidizing in (b)

(2) reducing in (a) and (b)

(3) oxidizing in (a) and (b)

(4) oxidizing in (a) and reducing in (b)

Sol) In the first reaction ozone is reduced to oxygen and in the second reaction, silver oxide is reduced to silver metal.

41. Among the following sets of reactants which one produces anisole?

(1) C_6H_5OH; NaOH; CH_3I

(2) C_6H_5OH ; neutral Fe Cl_3

(3) $C_6H_5 - CH_3$; CH_3COCl ; $AlCl_3$

(4) CH_3CHO ;RMgX

Sol) The reaction is given by:

$C_6H_5O^-Na^+ + CH_3Br \rightarrow CH_3OC_6H_5 + NaBr$
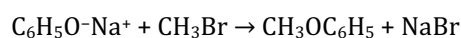
42. When 0.1 molMnO_4^{2-} is oxidised the quantity of electricity required to completely oxidise MnO_4^{2-} to MnO_4^- is :

(1) 2 x 96500 C

(2) 9650 C

(3) 96.50 C

(4) 96500 C

Sol) The quantity of charge flow required is:$1 \times 0.1 \times 96500 = 9650\ C$.

43. Of the following 0.10 m aqueous solutions, which one will exhibit the largest freezing point depression ?

(1) $C_6H_{12}O_6$

(2) $Al_2 (SO_4)_3$

(3) K_2SO_4

(4) KCl

Sol) The largest freezing point depression would be expressed by the compound with the largest molar mass.

44. What is the maximum number of orbitals that can be identified with the following quantum numbers ?
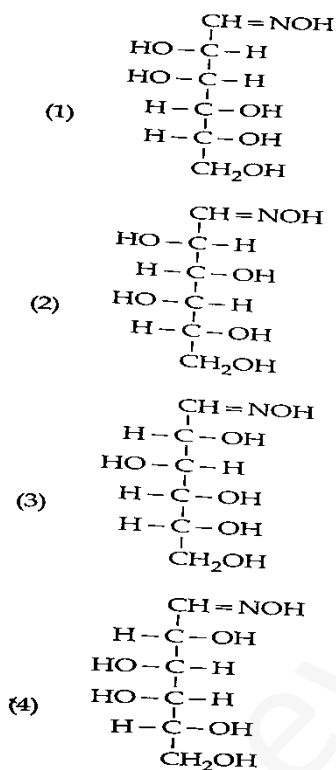
n = 3, l = 1 ,M_l = 0
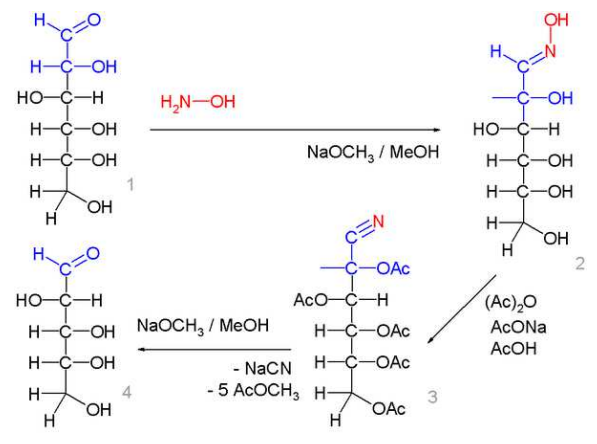
(1) 1

(2) 3

(3) 4

(4) 1

Sol) There are 2 spins possible for the given quantum mechanical configuration.

45. D (+) glucose reacts with hydroxyl amine and yields an oxime. The structure of the oxime would be :

(1)
$$
\begin{array}{c}
CH=NOH \\
HO-C-H \\
HO-C-H \\
H-C-OH \\
H-C-OH \\
CH_2OH
\end{array}
$$

(2)
$$
\begin{array}{c}
CH=NOH \\
HO-C-H \\
H-C-OH \\
HO-C-H \\
H-C-OH \\
CH_2OH
\end{array}
$$

(3)
$$
\begin{array}{c}
CH=NOH \\
H-C-OH \\
HO-C-H \\
H-C-OH \\
H-C-OH \\
CH_2OH
\end{array}
$$

(4)
$$
\begin{array}{c}
CH=NOH \\
H-C-OH \\
HO-C-H \\
HO-C-H \\
H-C-OH \\
CH_2OH
\end{array}
$$

Sol)   The reaction goes as follows: