JEE–MAIN EXAMINATION – JUNE, 2022

25 June S - 02 Paper Solution

SECTION-A

1. The minimum energy that must be possessed by photons in order to produce the photoelectric effect with platinum metal is:

[Given: The threshold frequency of platinum is $1.3 \times 10^{15}\ s^{-1}$ and $h = 6.6 \times 10^{-34}$ J s.**]**

(A) 3.21×10^{-14} J (B) 6.24×10^{-16} J

(C) 8.58×10^{-19} J (D) 9.76×10^{-20} J

Ans. (C)

Sol. $W = h\nu$

$= 6.6 \times 10^{-34} \times 1.3 \times 10^{15}$

$= 8.58 \times 10^{-19}$ J

2. At 25°C and 1 atm pressure, the enthalpy of combustion of benzene (1) and acetylene (g) are –3268 kJ mol^{-1} and –1300 kJ mol^{-1}, respectively. The change in enthalpy for the reaction $3\ C_2H_2(g) \rightarrow C_6H_6(l)$, is

(A) + 324 kJ mol^{-1} (B) +632 kJ mol^{-1}

(C) – 632 kJ mol^{-1} (D) – 732 kJ mol^{-1}

Ans. (C)

Sol. $\Delta H = \Delta\sum H_{Combustion}$ (Reactant) - $\Delta\sum H_{Combustion}$ (Product)

$= 3 \times (-1300) - [-3268]$

$= -632$ kJ mol^{-1}

3. Solute A associates in water. When 0.7 g of solute A is dissolved in 42.0 g of water, it depresses the freezing point by 0.2°C. The percentage association of solute A in water, is

[Given : Molar mass of A = 93 g mol^{-1}. Molal depression constant of water is 1.86 K kg mol^{-1}]

(A) 50 % (B) 60 %

(C) 70 % (D) 80 %

Ans. (D)

Sol. $\Delta T = i\ k_f \times m$

$$0.2 = i \times 1.86 \times \frac{0.7}{93} \times \frac{1000}{42}$$

$$i = \frac{0.2 \times 93 \times 6}{1.86 \times 100}$$

$i = 0.60$

$2A \rightleftharpoons A_2$

$1 - \alpha \qquad \frac{\alpha}{2}$

$$i = 1 - \alpha + \frac{\alpha}{2}$$

$$i = 1 - \frac{\alpha}{2}$$

$$1 - \frac{\alpha}{2} = 0.60$$

$$1 - 0.60 = \frac{\alpha}{2}$$

$\alpha = 0.80$

4. The K_{sp} for bismuth sulphide (Bi_2S_3) is 1.08×10^{-73}. The solubility of Bi_2S_3 in mol L^{-1} at 298 K is

(A) 1.0×10^{-15} (B) 2.7×10^{-12}

(C) 3.2×10^{-10} (D) 4.2×10^{-8}

Ans. (A)

Sol. $Bi_2S_3 \rightleftharpoons \underset{2s}{2Bi^{3+}} + \underset{3s}{3S^{2-}}$

$k_{sp} = (2s)^2\ (3s)^3$

$= 4s^2 \times 27\ (s)^3$

$= 108\ (s)^5$

$$(s)^5 = \frac{1.08 \times 10^{-73}}{108}$$

$\Rightarrow s = 10^{-15}$

5. Match List I with List II.

List I	List II
A. Zymase	I. Stomach
B. Diastase	II. Yeast
C. Urease	III. Malt
D. Pepsin	IV. Soyabean

Choose the correct answer from the options given below:

(A) A-II, B-III, C-I, D-IV

(B) A-II, B-III, C-IV, D-I

(C) A-III, B-II, C-IV, D-I

(D) A-III, B-II, C-I, D-IV

Ans. (B)

Sol. Zymase naturally occurs in yeast.

Diastase is found in malt.

Urease is found in soyabean

Pepsin is found in stomach

6. The correct order of electron gain enthalpies of Cl, F, Te and Po is

(A) F < Cl < Te < Po (B) Po < Te < F < Cl

(C) Te < Po < Cl < F (D) Cl < F < Te < Po

Ans. (D)

Sol. As Cl has maximum electron affinity among all elements.

Element	**$\Delta_{eg}H$ (kJ/mol)**
F	–328
Cl	–349
Te	–190
Po	–174

7. Given below are two statements.

Statement I: During electrolytic refining, blister copper deposits precious metals

Statement II: In the process of obtaining pure copper by electrolysis method, copper blister is used to make the anode.

In the light of the above statements, choose the correct answer from the options given below.

(A) Both Statement I and Statement II are true.

(B) Both Statement I and Statement II are false.

(C) Statement I is true but Statement II is false.

(D) Statement I is false but Statement II is true.

Ans. (A)

Sol. In the electro-refining, impure metal (here blister copper) is used as an anode while precious metal like Au, Pt get deposited as anode mud.

8. Given below are two statements one is labelled as **Assertion A** and the other is labelled as **Reason R:**

Assertion A : The amphoteric nature of water is explained by using Lewis acid/base concept.

Reason R : Water acts as an acid with NH_3 and as a base with H_2S.

In the light of the above statements choose the correct answer from the options given below :

(A) Both A and R are true and R is the correct explanation of A.

(B) Both A and R are true but R is NOT the correct explanation of A.

(C) A is true but R is false.

(D) A is false but R is true.

Ans. (D)

Sol. $\underset{\text{Acid}}{H_2S} + \underset{\text{Base}}{H_2O} \rightleftharpoons H_3O^+ + HS^-$

$\underset{\text{Acid}}{H_2O} + \underset{\text{Base}}{NH_3} \rightleftharpoons NH_4OH$

9. The correct order of reduction potentials of the following pairs is

A. Cl_2/Cl^-

B. I_2/I^-

C. Ag^+/Ag

D. Na^+/Na

E. Li^+/Li

Choose the correct answer from the options given below.

(A) A > C > B > D > E

(B) A > B > C > D > E

(C) A > C > B > E > D

(D) A > B > C > E > D

Ans. (A)

Sol. $E^{\circ}_{Cl_2/Cl^-} = +1.36\,V$

$E^{\circ}_{I_2/I^-} = +0.54\,V$

$E^{\circ}_{Ag^+/Ag} = +0.80\,V$

$E^{\circ}_{Na^+/Na} = -2.71\,V$

$E^{\circ}_{Li^+/Li} = -3.05\,V$

10. The number of bridged oxygen atoms present in compound B formed from the following reactions is

$Pb(NO_3)_2 \xrightarrow{673\ K} A + PbO + O_2$

$A \xrightarrow{\text{Dimerise}} B$

(A) 0 (B) 1

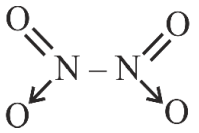
(C) 2 (D) 3

Ans. (A)

Sol. $Pb(NO_3)_2 \xrightarrow[673\ K]{\Delta} PbO + NO_2 + O_2$

(A)

$2\underset{A}{NO_2} \xrightarrow{\text{Dimerise}} \underset{B}{N_2O_4}$



(no bridged oxygen)

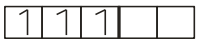
11. The metal ion (in gaseous state) with lowest spin-only magnetic moment value is

(A) V^{2+} (B) Ni^{2+}

(C) Cr^{2+} (D) Fe^{2+}

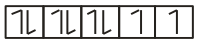
Ans. (B)

Sol. V^{2+} : $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^3$



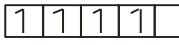
(3d) (unpaired e^- = 3)

Ni^{2+} : $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^8$



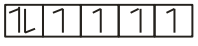
(3d) (unpaired e^- = 2)

Cr^{2+} : $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^4$



(3d) (unpaired e^- = 4)

Fe^{2+} : $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^6$



(3d) (unpaired e^- = 4)

12. Given below are two statements: one is labelled as **Assertion A** and the other is labelled as **Reason R**

Assertion A: Polluted water may have a value of BOD of the order of 17 ppm.

Reason R: BOD is a measure of oxygen required to oxidise both the biodegradable and non-biodegradable organic material in water.

In the light of the above statements, choose the most appropriate answer from the options given below.

(A) Both A and R are correct and R is the correct explanation of A.

(B) Both A and R are correct but R is NOT the correct explanation of A.

(C) A is correct but R is not correct.

(D) A is not correct but R is correct.

Ans. (C)

Sol. Clean water have BOD less than 5 ppm while highly polluted water has BOD greater or equal to 17 ppm. So, assertion is correct.

BOD is measure of oxygen required to oxidise only bio-degradable organic matter. So, reason is false.

13. Given below are two statements: one is labelled as **Assertion A** and the other is labelled as **Reason R.**

Assertion A: A mixture contains benzoic acid and napthalene. The pure benzoic acid can be separated out by the use of benzene.

Reason R: Benzoic acid is soluble in hot water.

In the light of the above statements, choose the most appropriate answer from the options given below.

(A) Both A and R are true and R is the correct explanation of A.

(B) Both A and R are true but R is NOT the correct explanation of A.

(C) A is true but R is false.

(D) A is false but R is true.

Ans. (D)

Sol. Benzoic acid and Napthalene can be effectively separated by crystallization. Benzoic acid is soluble in hot water whereas Napthalene is insoluble.

Hence assertion is incorrect but reason is correct

14. During halogen test, sodium fusion extract is boiled with concentrated HNO_3 to

(A) remove unreacted sodium

(B) decompose cyanide or sulphide of sodium

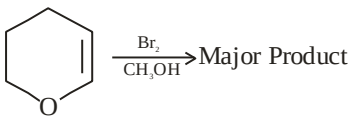
(C) extract halogen from organic compound

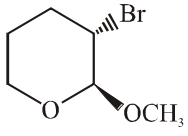
(D) maintain the pH of extract

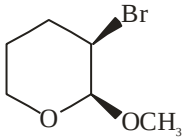
Ans. (B)

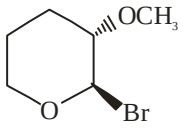
Sol. Sodium fusion extract is boiled with concentrated HNO_3 to remove sodium cyanide and sodium sulphide

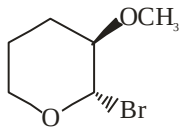
15. Amongst the following, the major product of the given chemical reaction is



(A) 

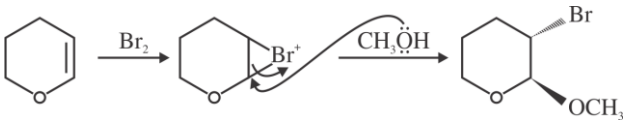
(B) 

(C) 

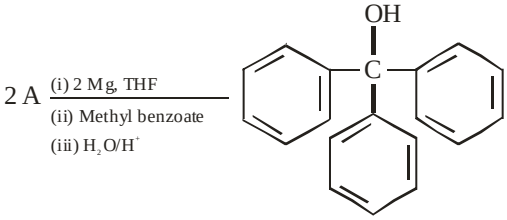
(D) 

Ans. (A)

Sol.



16. In the given reaction



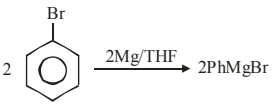
'A' can be

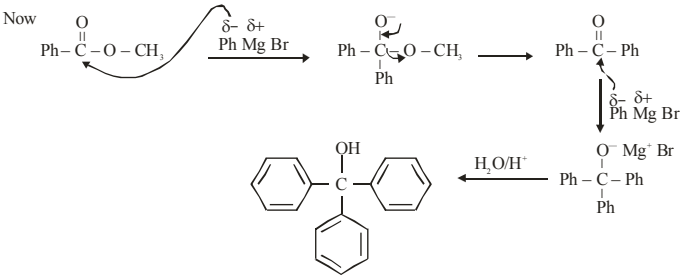
(A) benzyl bromide (B) bromobenzene

(C) cyclohexyl bromide (D) methyl bromide

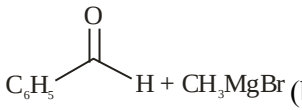
Ans. (B)

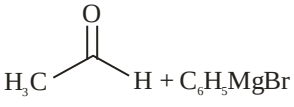
Sol.

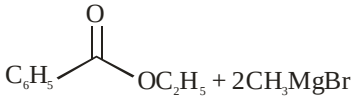




17. Which of the following conditions or reaction sequence will NOT give acetophenone as the major product ?

(A) (a)  (b) $Na_2Cr_2O_7$, H^+

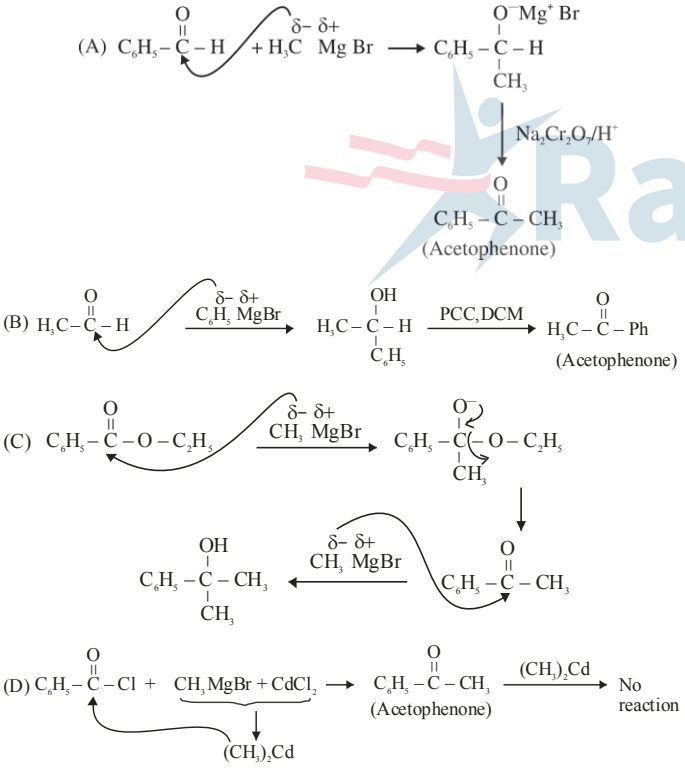
(B) (a)  (b) PCC, DCM

(C) 

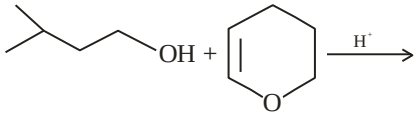
(D) 

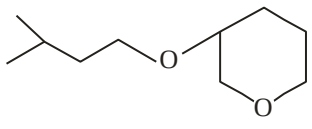
Ans. (C)

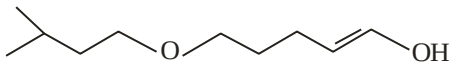
Sol.

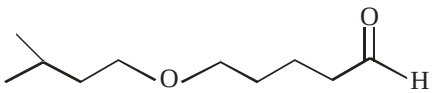


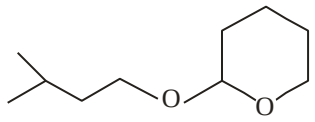
18. The major product formed in the following reaction, is



(A) 

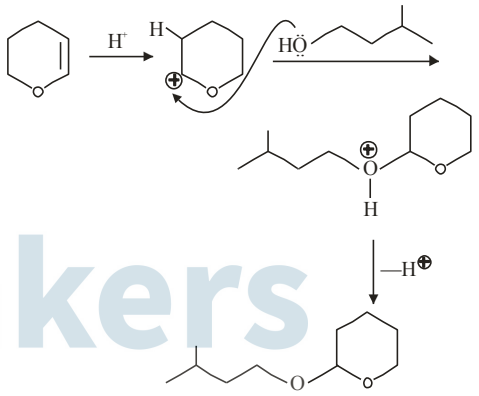
(B) 

(C) 

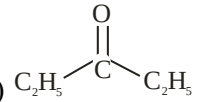
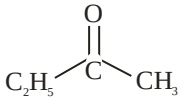


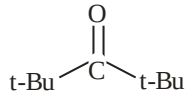
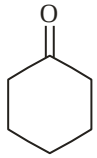
(D) **Ans. (D)**

Sol.



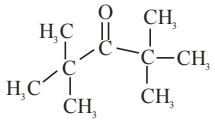
19. Which of the following ketone will NOT give enamine on treatment with secondary amines? [where t-Bu is $-C(CH_3)_3$]

(A)  (B) 

(C)  (D) 

Ans. (C)

Sol. Enamine formation is an example of nucleophilic addition elimination reaction

Since in ketone  Carbonyl

Group is highly sterically hindered hence attack of nucleophile will not be possible.

20. An antiseptic dettol is a mixture of two compounds 'A' and 'B' where A has 6π electrons and B has 2π electrons. What is 'B'?

(A) Bithionol

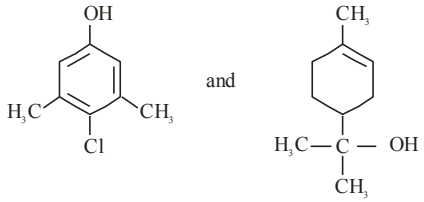
(B) Terpineol

(C) Chloroxylenol

(D) Chloramphenicol

Ans. (B)

Sol. Dettol is mixture of



Chloroxylenol (Compound A) It has $6\pi e^-$

Terpineol (Compound B) It has $2\pi e^-$

Hence compound 'B' is Terpineol.

SECTION-B

1. A protein 'A' contains 0.30% of glycine (molecular weight 75). The minimum molar mass of the protein 'A' is_____ × 10^3 g mol^{-1} [nearest integer]

Ans. (25)

Sol. 0.30 % glycine is equal to 75

$$1\ \% \longrightarrow \frac{75}{0.30}$$

$$100\ \% \longrightarrow \frac{75}{0.30}\times 100$$

$$= 25000\ g$$

2. A rigid nitrogen tank stored inside a laboratory has a pressure of 30 atm at 06:00 am when the temperature is 27 °C. At 03:00 pm, when the temperature is 45°C, the pressure in the tank will be _____atm. [nearest integer]

Ans. (32)

Sol. $\frac{P_1}{T_1} = \frac{P_2}{T_2}$

$$\frac{30}{300} = \frac{P_2}{318}$$

$$P_2 = \frac{30}{300}\times 318$$

$$= \frac{1}{10}\times 318$$

$$= 32$$

3. Amongst BeF_2, BF_3, H_2O, NH_3, CCl_4 and HCl, the number of molecules with non-zero net dipole moment is _____.

Ans. (3)

Sol. BeF_2, BF_3 and $CCl_4 \Rightarrow \mu_{net} = 0$

H_2O, NH_3 and $HCl \Rightarrow \mu_{net} \neq 0$

4. At 345 K, the half life for the decomposition of a sample of a gaseous compound initially at 55.5 kPa was 340 s. When the pressure was 27.8 kPa, the half life was fund to be 170 s. The order of the reaction is_____. [integer answer]

Ans. (0)

Sol. $t_{1/2} \times \frac{1}{[P_0]^{n-1}}$

$$\frac{t_1}{t_2} = \frac{(P_2)^{n-1}}{(P_1)^{n-1}}$$

$$\frac{340}{170} = \left(\frac{27.8}{55.5}\right)^{n-1}$$

$$\Rightarrow\ 2 = \frac{1}{(2)^{n-1}}$$

$$n = 0$$

5. A solution of $Fe_2(SO_4)_3$ is electrolyzed for 'x' min with a current of 1.5 A to deposit 0.3482 g of Fe. The value of x is_____. [nearest integer]

Given : 1 F = 96500 C mol^{-1}

Atomic mass of Fe = 56 g mol^{-1}

Ans. (20)

Sol. $Fe^{3+} + 3e^- \longrightarrow Fe$

$3F \longrightarrow 1$ mole Fe is deposited

For 56 g $\longrightarrow 3 \times 96500$ (required charge)

For 1g $\longrightarrow \frac{3\times96500}{56}$ (required charge)

For 0.3482 g $\longrightarrow \frac{3\times96500}{56}\times0.3482$

$= 1800.06$

$Q = it$

$1800.06 = 1.5\ t$

$t = 20$ min

6. Consider the following reactions :

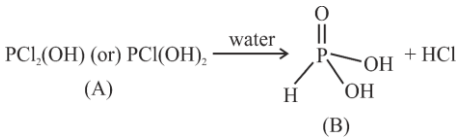
$PCl_3 + H_2O \longrightarrow A + HCl$

$A + H_2O \longrightarrow B + HCl$

number of ionisable protons present in the product B_____.

Ans. (2)

Sol. $PCl_3 + H_2O \xrightarrow[\text{hydrolysis}]{\text{Partial}} PCl_2(OH)$ (or) $PCl(OH)_2 +$ HCl



(A) (B)

no. of ionisable protons in B = 2

7. Amongst $FeCl_3.3H_2O$, $K_3[Fe(CN)_6]$ and $[Co(NH_3)_6]Cl_3$, the spin-only magnetic moment value of the inner-orbital complex that absorbs light at shortest wavelength is_____ B.M. [nearest integer]

Ans. (2)

Sol. $[Fe(H_2O)_3Cl_3]$, $\underbrace{K_3[Fe(CN)_6], [Co(NH_3)_6]Cl_3}_{\text{inner orbital complexes}}$

$K_3[Fe(CN)_6]$ has more value of Δ_0 than that of $[Co(NH_3)_6]Cl_3$; as $\bar{C}N$ is stronger ligand.

More $\Delta_0 \Rightarrow$ smaller value of absorbed λ

$K_3[Fe(CN)_6]$: Fe^{3+} : $3d^5$ $4s^0$ $4p^0$

1 unpaired e^- d^2sp^3

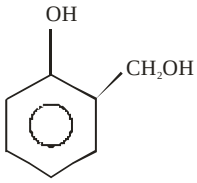
Spin only magnetic moment (μ) = $\sqrt{3}$ BM

$= 1.732$ BM

Rounding off $\Rightarrow 2$

8. The Novolac polymer has mass of 963 g. The number of monomer units present in it are

Ans. (9)

Sol. Monomer unit of Novolac is 

its molecular mass is 124 amu.

Upon considering molecular weight of polymer as 963 amu (In question its given as 963 gram)

Now if during formation of Novolac, (n–1) unit of water are removed then

$n \times 124 = 963 + [18 \times (n-1)]$

$n = 9$

9. How many of the given compounds will give a positive Biuret test _____ ? Glycine, Glycylalanine, Tripeptide, Biuret

Ans. (2)

Sol. Biuret test is given by all proteins and peptides having atleast two peptide linkages.

Hence positive test must be given by tripeptide and Biuret.

10. The neutralization occurs when 10 mL of 0.1 M acid 'A' is allowed to react with 30 mL of 0.05 M base $M(OH)_2$. The basicity of the acid 'A' is_____. [M is a metal]

Ans. (3)

Sol. Acid + Base $\longrightarrow$ Salt + H_2O

0.1 M $M(OH)_2$

10ml 0.05 M

30 ml

at equivalence point

equivalent of acid = equivalent of base

$0.1 \times 10 \times n = 30 \times 0.05 \times 2$

$n = 3$