FINAL JEE–MAIN EXAMINATION – JANUARY, 2019
Held On Thrusday 10th JANUARY, 2019
TIME: 02 : 30 PM To 05 : 30 PM

1. An ideal gas undergoes isothermal compression from 5 m^3 against a constant external pressure of 4 Nm^{-2}. Heat released in this process is used to increase the temperature of 1 mole of Al. If molar heat capacity of Al is 24 J mol^{-1} K^{-1}, the temperature of Al increases by :

(1) $\frac{3}{2}$K (2) $\frac{2}{3}$K (3) 1 K (4) 2 K

Ans. (2)

Sol. Work done on isothermal irreversible for ideal gas

$= -P_{ext}(V_2 - V_1)$

$= -4\ N/m^2\ (1m^3 - 5m^3)$

$= 16$ Nm

Isothermal process for ideal gas

$\Delta U = 0$

$q = -w$

$= -16$ Nm

$= -16$ J

Heat used to increase temperature of Aℓ

$q = n\ C_m\ \Delta T$

$$16\ J = 1 \times 24\ \frac{J}{mol.K} \times \Delta T$$

$$\Delta T = \frac{2}{3}K$$

2. The 71st electron of an element X with an atomic number of 71 enters into the orbital :

(1) 4f (2) 6p (3) 6s (4) 5d

Ans. (1)

3. The number of 2-centre-2-electron and 3-centre-2-electron bonds in B_2H_6, respectively, are :

(1) 2 and 4 (2) 2 and 1

(3) 2 and 2 (4) 4 and 2

Ans. (4)

4. The amount of sugar ($C_{12}H_{22}O_{11}$) required to prepare 2 L of its 0.1 M aqueous solution is :

(1) 68.4 g (2) 17.1 g (3) 34.2 g (4)136.8 g

Ans. (1)

Sol. $$\text{Molarity} = \frac{(n)_{solute}}{V_{solution}\ (\text{in lit})}$$

$$0.1 = \frac{wt./342}{2}$$

wt ($C_{12}H_{22}O_{11}$) = 68.4 gram

5. Among the following reactions of hydrogen with halogens, the one that requires a catalyst is :

(1) $H_2 + I_2 \rightarrow 2HI$ (2) $H_2 + F_2 \rightarrow 2HF$

(3) $H_2 + Cl_2 \rightarrow 2HCI$ (4) $H_2 + Br_2 \rightarrow 2HBr$

Ans. (1)

6. Sodium metal on dissolution in liquid ammonia gives a deep blue solution due to the formation of:

(1) sodium ion-ammonia complex

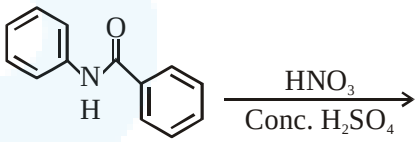
(2) sodamide

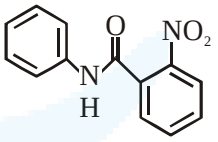
(3) sodium-ammonia complex

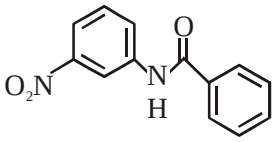
(4) ammoniated electrons

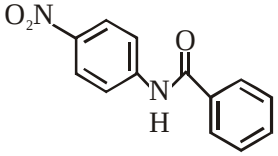
Ans. (4)

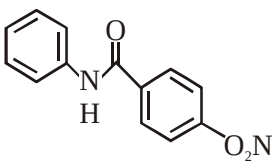
7. What will be the major product in the following mononitation reaction ?



(1) 

(2) 

(3) 

(4) 

Ans. (3)

8. In the cell $Pt(s)|H_2(g, 1bar|HCl(aq)|Ag(s)|Pt(s)$ the cell potential is 0.92 when a 10^{-6} molal HCl solution is used. THe standard electrode potential of $(AgCl/Ag,Cl^-)$ electrode is :

$$\left\{given, \frac{2.303RT}{F} = 0.06V at 298K\right\}$$

(1) 0.20 V (2) 0.76 V (3) 0.40 V (4) 0.94 V

Ans. (1)

Sol. $Pt(s)|H_2(g, 1bar)|HCl(aq)|AgCl(s)|Ag(s)|Pt(s)$

10^{-6} m

Anode: $H_2 \longrightarrow 2H^+ + 2e \times 1$

Cathode : $e^- + AgCl(s) \longrightarrow Ag(s) + Cl^-(aq) \times 2$

$H_2(g)l + AgCl(s) \longrightarrow 2H^+ + 2Ag(s) + 2Cl^-(aq)$

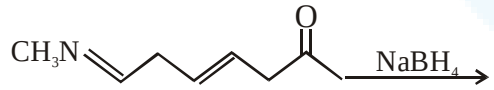
$$E_{cell} = E^0_{cell} - \frac{0.06}{2}\log_{10}\left((H^+)^2 \cdot (Cl^-)^2\right)$$

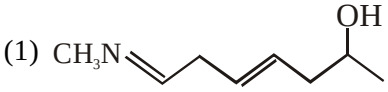
$$.925 = \left(E^0_{H_2/H^+} + E^0_{AgCl/Ag, Cl^-}\right) - \frac{0.06}{2}\log_{10}\left((10^{-6})^2 (10^{-6})^2\right)$$

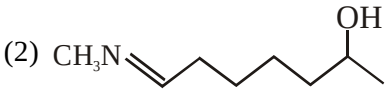
$$.92 = 0 + E^0_{AgCl/Ag,Cl^-} - 0.03\log_{10}(10^{-6})^4$$

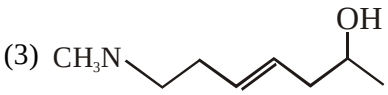
$$E^0_{AgCl}/Ag, Cl^- = .92 + .03 \times -24 = 0.2 \text{ V}$$

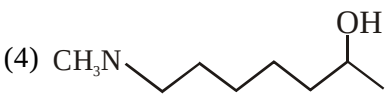
9. The major product of the following recation is:



(1) 

(2) 

(3) 

(4) 

Ans. (3)

10. The pair that contains two P–H bonds in each of the oxoacids is :

(1) H_3PO_2 nad $H_4P_2O_5$

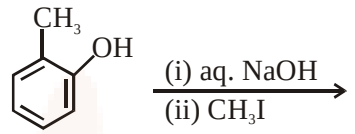
(2) $H_4P_2O_5$ and $H_4P_2O_6$

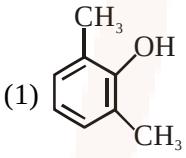
(3) H_3PO_3 and H_3PO_2

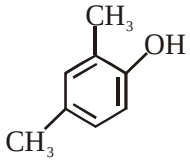
(4) $H_4P_2O_5$ nad H_3PO_3

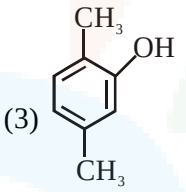
Ans. (1)

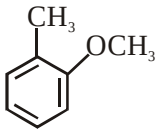
11. The major product of the following reaction is:



(1) 

(2) 

(3) 

(4) 

Ans. (4)

12. The difference in the number of unpaired electrons of a metal ion in its high-spin and low-spin octahedral complexes is two. The metal ion is :

(1) Fe^{2+} (2) Co^{2+} (3) Mn^{2+} (4) Ni^{2+}

Ans. (2)

13. A compound of formula A_2B_3 has the hcp lattice. Which atom forms the hcp lattice and what fraction of tetrahedral voids is occupied by the other atoms :

(1) hcp lattice-A, $\frac{2}{3}$ Tetrachedral voids-B

(2) hcp lattice-B, $\frac{1}{3}$ Tetrachedral voids-A

(3) hcp lattice-B, $\frac{2}{3}$ Tetrachedral voids-A

(4) hcp lattice-A $\frac{1}{3}$ Tetrachedral voids-B

Ans. (2)

Sol. A_2B_3 has HCP lattice

If A form HCP, then $\frac{3}{4}^{th}$ of THV must occupied by B to form A_2B_3

If B form HCP, then $\frac{1}{3}^{th}$ of THV must occupied by A to form A_2B_3

14. The reaction that is NOT involved in the ozone layer depletion mechanism is the stratosphere is:

(1) $HOCl(g) \xrightarrow{h\upsilon} \dot{O}H(g) + \dot{C}l(g)$

(2) $CF_2Cl_2(g) \xrightarrow{uv} \dot{C}l(g) + \dot{C}F_2Cl(g)$

(3) $CH_4 + 2O_3 \rightarrow 3CH_2 = O + 3H_2OP$

(4) $\dot{C}lO(g) + O(g) \rightarrow \dot{C}l(g) + O_2(g)$

Ans. (3)

15. The process with negative entropy change is :

(1) Dissolution of iodine in water

(2) Synthesis of ammonia from N_2 and H_2

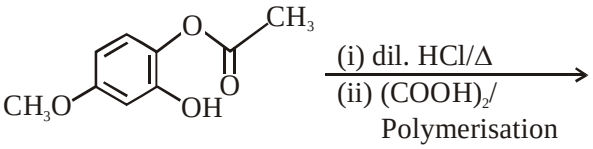
(3) Dissolution of $CaSO_4(s)$ to $CaO(s)$ and $SO_3(g)$

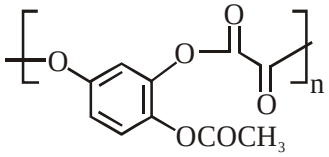
(4) Subimation of dry ice

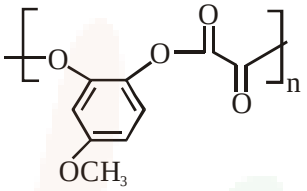
Ans. (2)

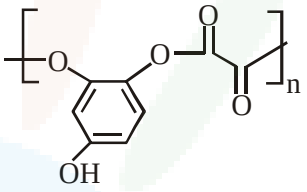
Sol. $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$; $\Delta n_g < 0$

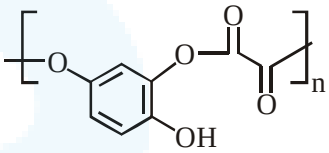
16. The major product of the following reaction is:



(1) 

(2) 

(3) 

(4) 

Ans. (3)

17. A reaction of cobalt(III) chloride and ethylenediamine in a 1 : 2 mole ratio generates two isomeric products A (violet coloured) B (green coloured). A can show optial actively, B is optically inactive. What type of isomers does A and B represent ?

(1) Geometrical isomers

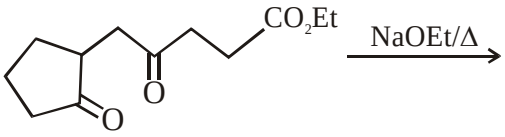
(2) Ionisation isomers]

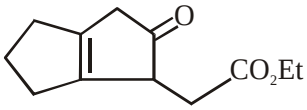
(3) Coordination isomers

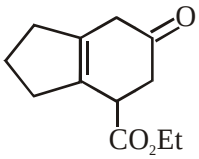
(4) Linkage isomers

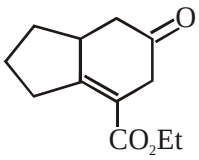
Ans. (1)

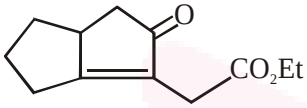
18. The major product obtained in the following reaction is :



(1) 

(2) 

(3) 

(4) 

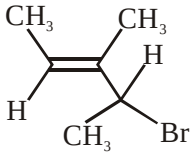
Ans. (4)

19. Which of the following tests cannot be used for identifying amino acids ?

(1) Biuret test (2) Xanthoproteic test
(3) Barfoed test (4) Ninhydrin test

Ans. (3)

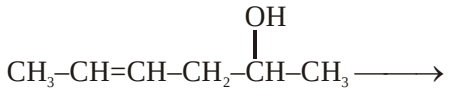
20. What is the IUPAC name of the following compound ?



(1) 3-Bromo-1, 2-dimethylbut-1-ene]
(2) 4-Bromo-3-methylpent-2-ene
(3) 2-Bromo-3-methylpent-3-ene
(4) 3-Bromo-3-methyl-1, 2-dimethylprop-1-ene

Ans. (2)

21. Which is the most suitable reagent for the following transformation ?



(1) alkaline $KMnO_4$ (2) I_2/NaOH
(3) Tollen's reagent (4) CrO_2/CS_2

Ans. (2)

22. The correct match between item 'I' and item 'II' is :

Item 'I' (compound)	Item 'II' (reagent)
(A) Lysine	(P) 1-naphthol
(B) Furfural	(Q) ninhydrin
(C) Benzyl alcohol	(R) $KMnO_4$
(D) Styrene	(S) Ceric ammonium nitrate

(1) (A)→(Q), (B)→(P), (C)→(S), (D)→(R)
(2) (A)→(Q), (B)→(R), (C)→(S), (D)→(P)
(3) (A)→(Q), (B)→(P), (C)→(R), (D)→(S)
(4) (A)→(R), (B)→(P), (C)→(Q), (D)→(S)

Ans. (1)

23. In the reaction of oxalate with permaganate in acidic medium, the number of electrons involved in producing one molecule of CO_2 is :

(1) 10 (2) 2 (3) 1 (4) 5

Ans. (3)

Sol.

$$2\overset{+7}{M}nO_4 + 5C_2O_4^{2-} + 16H^+ \longrightarrow 2\overset{+2}{M}n^{2+} + 10CO_2 + 8H_2O$$

10 e^- trans for 10 molecules of CO_2 so per molecule of CO_2 transfer of e^- is '1'

24. 5.1g NH_4SH is introduced in 3.0 L evacuated flask at 327°C. 30% of the solid NH_4SH decomposed to NH_3 and H_2S as gases. The K_p of the reaction at 327°C is (R = 0.082 L atm $mol^{-1}K^{-1}$, Molar mass of S = 32 g $mol^{/01}$, molar mass of N = 14g mol^{-1})

(1) 1×10^{-4} atm^2 (2) 4.9×10^{-3} atm^2
(3) 0.242 atm^2 (4) 0.242×10^{-4} atm^2

Ans. (3)

Sol.

$$NH_4SH(s) \rightleftharpoons NH_3(g) + H_2S(g)$$

$n = \frac{5.1}{51} = .1$mole	0	0
$.1(-1-\alpha)$	$.1\alpha$	$.1\alpha$

α = 30% = .3
so number of moles at equilibrium

.1 (1 – .3)	.1 × .3	.1 × .3
= .07	=.03	=.03

Now use PV = nRT at equilibrium
$P_{total} \times 3$ lit = (.03 + .03) × .082 × 600
P_{total} = .984 atm
At equilibrium

$$P_{NH_3} = P_{H_2S} = \frac{P_{total}}{2} = .492$$

So $k_p = P_{NH_3} \cdot P_{H_2S} = (.492)(.492)$
k_p = .242 atm^2

25. The electrolytes usually used in the electroplating of gold and silver, respectively, are :
(1) $[Au(OH)_4]^-$ and $[Ag(OH)_2]^-$
(2) $[Au(CN)_2]^-$ and $[Ag\ CI_2]^-$
(3) $[Au(NH_3)_2]^+$ and $[Ag(CN)_2]^-$
(4) $[Au(CN)_2]^-$ and $[Ag(CN)_2]^-$

Ans. **(4)**

26. Elevation in the boiling point for 1 molal solution of glucose is 2 K. The depression in the freezing point of 2 molal solutions of glucose in the same solvent is 2 K. The relation between K_b and K_f is:
(1) $K_b = 0.5\ K_f$ (2) $K_b = 2\ K_f$
(3) $K_b = 1.5\ K_f$ (4) $K_b = K_f$

Ans. **(2)**

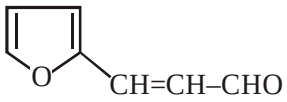
Sol. **Ans.(2)**

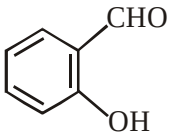
$$\frac{\Delta T_b}{\Delta T_f} = \frac{i.m \times k_b}{i \times m \times k_f}$$

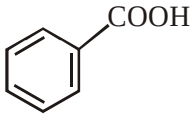
$$\frac{2}{2} = \frac{1 \times 1 \times k_b}{1 \times 2 \times k_f}$$

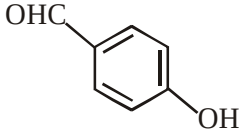
$$k_b = 2k_f$$

27. An aromatic compound 'A' having molecular formula $C_7H_6O_2$ on treating with aqueous ammonia and heating forms compound 'B'. The compound 'B' on reaction with molecular bromine and potassium hydroxide provides compound 'C' having molecular formula C_6H_7N. The structure of 'A' is :

(1) 

(2) 

(3) 

(4) 

Ans. **(3)**

28. The ground state energy of hydrogen atom is –13.6 eV. The energy of second excited state He^+ ion in eV is :
(1) –6.04 (2) –27.2 (3) –54.4 (4) –3.4

Ans. **(1)**

Sol. $$(E)_{n^{th}} = (E_{GND})_H \cdot \frac{Z^2}{n^2}$$

$$E_{3^{rd}}(He^+) = (-13.6\,eV) \cdot \frac{2^2}{3^2} = -6.04\ eV$$

29. For an elementary chemical reaction,

$A_2 \underset{k_{-1}}{\overset{k_1}{\rightleftharpoons}} 2A$, the expression for $\frac{d[A]}{dt}$ is :
(1) $2k_1[A_2] - k_{-1}[A]^2$ (2) $k_1[A_2] - k_{-1}[A]^2$
(3) $2k_1[A_2] - 2k_{-1}[A]^2$ (4) $k_1[A_2] + k_{-1}[A]^2$

Ans. **(3)**

Sol. **Ans.(3)**

$$A_2 \underset{K_{-1}}{\overset{K_1}{\rightleftharpoons}} 2A$$

$$\frac{d[A]}{dt} = 2k_1[A_2] - 2k_{-1}[A]^2$$

30. Haemoglobin and gold sol are examples of :
(1) negatively charged sols
(2) positively charged sols]
(3) negatively and positively charged sols, respectively
(4) positively and negatively charged sols, respectively

Ans. **(4)**

Sol. **Ans.(4)**
Haemoglobin $\longrightarrow$ positive sol
Ag – sol $\longrightarrow$ negative sol