[CHEMISTRY]

1. The 71st electron of an element X with an atomic number of 71 enters into the orbital:
(A) 5d (B) 4f (C) 6p (D) 6s

Sol. **B**

2. The ground state energy of hydrogen atom is -13.6eV. The energy of second excited state of He^+ ion in eV is:
(A) -54.4 (B) -27.2 (C)-6.04 (D)-3.4

Sol. **C**

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

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

3. An ideal gas undergoes isothermal compression from $5m^3$ to $1\ m^3$ against a constant external pressure of $4Nm^{-2}$. 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 of by:

(A) 2k (B) $\frac{2}{3}K$ (C) $\frac{3}{2}K$ (D) 1K

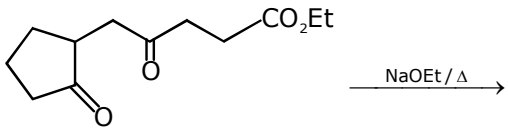
Sol. **B**

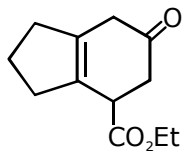
Work done on isothermal irreversible for ideal gas
$= -P_{ext}(V_2 - V_1)$
$= -4\ N/m^2\ (1m^3 - 5m^3)$
$= 16\ Nm$
Isothermal process for ideal gas
$\Delta U = 0$
$q = -w$
$= -16\ Nm$
$= -16\ J$
Heat used to increase temperature of Aℓ
$q = n\ C_m\ \Delta T$

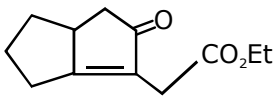
$$16\ J = 1 \times 24\ \frac{J}{mol\ K} \times \Delta T$$

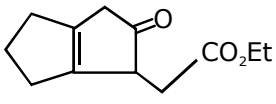
$$\Delta T = \frac{2}{3}\ K$$

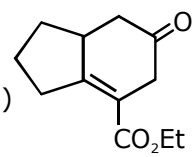
4. The major product obtained in the following reaction is:



(A) 

(B) 

(C) 

(D) 

Sol. **B**

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

(A) $H_2 + Br_2 \rightarrow 2HBr$ (B) $H_2 + Cl_2 \rightarrow 2HCl$ (C) $H_2 + F_2 \rightarrow 2HF$ (D) $H_2 + I_2 \rightarrow 2HI$

Sol. **D**

Because reaction of H_2 and I_2 is Reversible in nature .

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

(A) 1 (B) 2 (C)10 (D) 5

Sol. **A**

$$\overset{+7}{2MnO_4} + 5C_2O^{2-}_4 + 16H^+ \longrightarrow \overset{+2}{2Mn^{2+}} + 10CO_2 + 8H_2O$$

$10e^{\ominus}$ transfer 10 molecule of CO_2 So per molecule of CO_2 transfer of $e^{\ominus}$ is '1'

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

(A) Barfoed test (B)Xanthoproteic test(C) Ninydrin test (D)Biuret test

Sol. **A**

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

(A) H_3PO_3 and H_3PO_2 (B) $H_4P_2O_5$ and $H_4P_2O_6$ (C) H_3PO_2 and $H_4P_2O_5$ (D) $H_4P_2O_5$ and H_3PO_3

Sol. **C**

9. For an elementary chemical reaction, $A_2 \underset{k_{-1}}{\overset{k_1}{\rightleftharpoons}} 2A$, the expression for $\frac{d[A]}{dt}$ is:

(A) $2k_1[A_2] - 2k_{-1}[A]^2$ (B) $k_1[A_2] - k_{-1}[A]^2$ (C) $2k_1[A_2] - k_{-1}[A]^2$ (D) $k_1[A_2] + k_{-1}[A]^2$

Sol. **A**

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

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

10. Elevation in the boiling point for 1 molal solution of glucose is 2 K. the depression in the freezing point for 2 molal solution of glucose in the same solvent is 2 K. The relation betweeen K_b and k_f is:

(A) $K_b = 2K_f$ (B) $K_b = 0.5K_f$ (C) $K_b = 1.5K_f$ (D) $K_b = K_f$

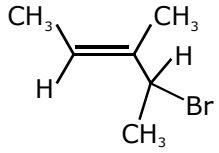
Sol. **A**

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

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

$k_b = 2K_f$

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



(A) 3-Bromo-3-methyl-1, 2-dimethylprop-1-ene
(B) 3-Bromo-1, 2-dimethylbut-1-ene
(C) 4-Bromo-3-methylpent-2-ene
(D) 2-Bromo-3-methylpent-3-ene

Sol. **C**

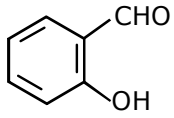
12. Sodium metal on dissolution in liquid ammonia gives a deep blue solution due to the formation of:

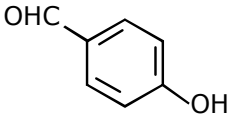
(A) ammoniated electrons (B) sodium ion-ammonia complex

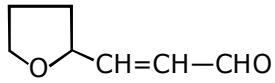
(C) sodium-ammonia complex (D) sodamide

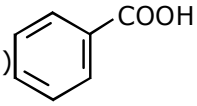
Sol. **A**

13. An aromatic compound 'A' having molecular formula $C_7H_6O_2$ on treating with aqueous ammonia and heating froms 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:

(A) 

(B) 

(C) 

(D) 

Sol. **D**

14. In the cell

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

the cell potential is 0.92 V when a 10^{-6} molal HCl solution is used. The standard electrode potential of ($AgCl/AgCl^-$) electrode is:

(Given, $\frac{2.303RT}{F}$ = 0.06 V at 298 K)

(A) 0.76V (B) 0.40 V (C) 0.94 V (D)0.20 V

Sol. **D**

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

$H_2(g)1 + AgCl(s) \longrightarrow 2H^+ + 2Ag(s) + 2Cl^-(aq)$

$E_{cell} = E^o_{cell} - \frac{0.06}{2} \log_{10} (H^+)^2 (Cl^-)^2$

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

$.92 = 0 + E^0_{AgCl/Ag.Cl^-} - 0.031 \log_{10}(\log^{-6})^4$

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

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

(A) hcp lattice-B, $\frac{2}{3}$ Tetrahedral viods-A (B) hcp lattice-A, $\frac{2}{3}$ Tetrahedral viods-B

(C) hcp lattice-A, $\frac{1}{3}$ Tetrahedral viods-B (D) hcp lattice-B, $\frac{1}{3}$ Tetrahedral viods-A

Sol. **C**

A_2B_3 has HCP lattice

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

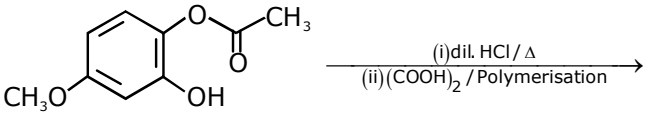
If B form HCP, then $\frac{1^{th}}{3}$ of THV must occupied by A to form A_2B_3

16. 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:

(A) Mn^{2+} (B) Fe^{2+} (C) Co^{2+} (D) Ni^{2+}

Sol. C

17. The major product of the following reaction is:



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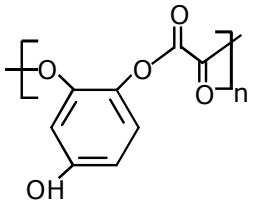

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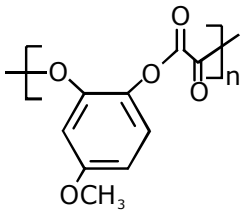

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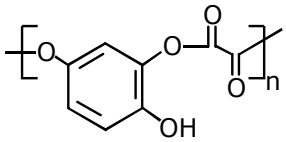

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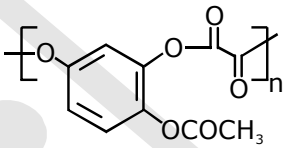
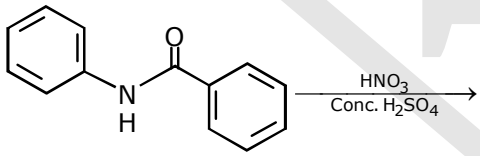
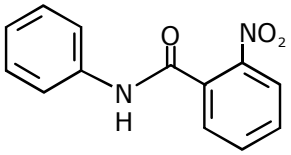


Sol. A/B (NTA)

18. What will be the major product in the following mononitration reaction?



(A)


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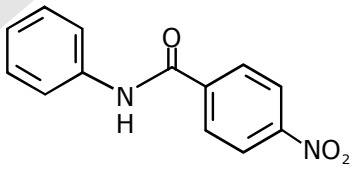

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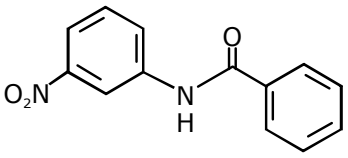

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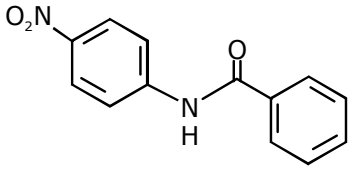


Sol. D

19. 5.1 g 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 Kp of the reaction at 327°C is (R = 0.082 L atm mol^{-1} K^{-1}, Molar mass of S =32 g mol^{-1}, molar mass of N =14 g mol^{-1})

(A) $1\times10^{-4}atm^2$ (B) $4.9\times10^{-3}atm^2$ (C) $0.242\times10^{-4}atm^2$ (D) $0.242atm^2$

Sol. D

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

$n = \frac{5.1}{51}$ = .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 $K_p = P_{NH3} \cdot P_{H_2S} = (.492)(.492)$

$K_p = .242\ atm^2$

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

(A) $Cl\dot{O}(g) + O(g) \rightarrow \dot{C}l(g) + O_2(g)$ (B) $HOCl(g) \xrightarrow{h\upsilon} \dot{O}H(g) + \dot{C}l(g)$

(C) $CF_2Cl_2(g) \xrightarrow{uv} \dot{C}l(g) + \dot{C}F_2Cl(g)$ (D) $CH_4 + 2O_3 \rightarrow 3\,CH_2 = O + 3H_2O$

Sol. D

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

$CH_3-CH=CH-CH_2-\underset{\displaystyle OH}{\underset{|}{CH}}-CH_3 \longrightarrow$

$CH_3-CH=CH-CH_2CO_2H$

(A) CrO_2Cl_2/CS_2 (B) Tollen's reagent (C) I_2/NaOH (D) alkaline $KMnO_4$

Sol. C

22. The electrolytes usually used in the electroplating of gold and silver, respectively, are :

(A) $[Au(CN)_2]^-$ and $[Ag(CN)_2]^-$ (B) $[Au(NH_3)_2]^+$ and $[Ag(CN)_2]^-$

(C) $[Au(CN)_2]^-$ and $[Ag\,Cl_2]^-$ (D) $[Au(OH)_4]^-$ and $[Ag(OH)_2]^-$

Sol. A

23. The process with negative entropy change is :

(A) Dissociation of $CaSO_4(s)$ to $CaO(s)$ and $SO_3(g)$

(B) Synthesis of ammonia from N_2 and H_2

(C) Sublimation of dry ice

(D) Dissolution of iodine in water

Sol. B

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

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

(A) 2 and 4 (B) 4 and 2 (C) 2 and 1 (D) 2 and 2

Sol. B

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

(A) Linkage isomers (B) Coordination isomers

(C) Geometrical isomers (D) Ionisation isomers

Sol. C

26. Haemoglobin adn gold sol are examples of :
(A) negatively charged sols
(B) positively and negatively charged sols, respectively
(C) positively charged sols
(D) negatively and positively charged sols, respectively

Sol. **B**
Haemoglobin $\longrightarrow$ positive sol
Ag –sol $\longrightarrow$ negative sol

27. The amount of sugar ($C_{12}H_{22}O_{11}$) required to prepare 2 L of its 0.1 M aqueous solution is :
(A) 136.8g (B) 68.4 g (C) 17.1 g (D) 34.2 g

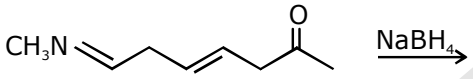
Sol. **B**

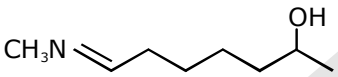
$$\text{Molarity} = \frac{(n)_{solute}}{V_{solution}(\text{in lit})}$$

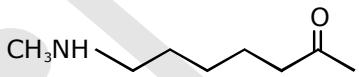
$$0.1 = \frac{wt/342}{2}$$

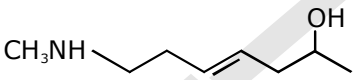
wt ($C_{12}H_{22}O_{11}$) = 68.4 gram

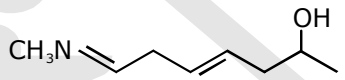
28. The major product of the following reaction is :



(A) 

(B) 

(C) 

(D) 

Sol. **C**

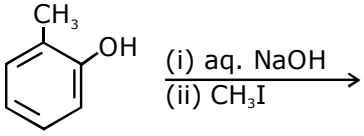
29. The correct match between item 'I' and item 'II' is :

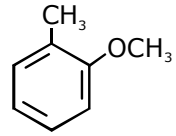
	Item 'I' Compound		**Item 'II' reagent**
(A)	Lysine	(P)	1-naphthol
(B)	Furfural	(Q)	ninhydrin
(C)	Benzyl alcohol	(R)	$KMnO_4$
(D)	Styrene	(S)	Ceric ammonium nitrate

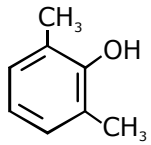
(A) A $\rightarrow$ Q ; B $\rightarrow$ P ; C $\rightarrow$ R ; D $\rightarrow$ S
(B) A $\rightarrow$ Q ; B $\rightarrow$ R ; C $\rightarrow$ S ; D $\rightarrow$ P
(C) A $\rightarrow$ R ; B $\rightarrow$ P ; C $\rightarrow$ Q ; D $\rightarrow$ S
(D) A $\rightarrow$ Q ; B $\rightarrow$ P ; C $\rightarrow$ S ; D $\rightarrow$ R

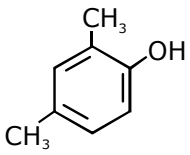
Sol. **D**

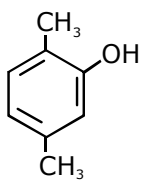
30. The major product of the following reaction is :



(A) 

(B) 

(C) 

(D) 

Sol. **A**