CHEMISTRY

SECTION - A

Multiple Choice Questions: This section contains 20 multiple choice questions. Each question has 4 choices (1), (2), (3) and (4), out of which **ONLY ONE** is correct.

Choose the correct answer :

1. Best reducing agent among the given ions is

(1) Ce^{4+} (2) Gd^{2+}

(3) Lu^{3+} (4) Nd^{3+}

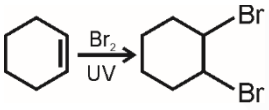
Answer (2)

Sol. Gd^{2+} : [Xe] $5d^1 4f^7$

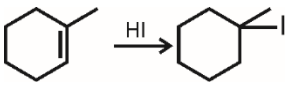
Gd^{2+} would get converted into Gd^{3+} as Gd^{3+} has stable electronic configuration

2. Choose the correct reaction.

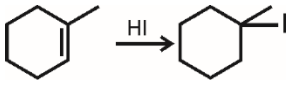
(1) $CH_3-CH_2-\overset{\overset{O}{\|}}{C}-NH_2 \xrightarrow[NaOH]{Br_2} CH_3-CH_2-CH_2-NH_2$

(2) 

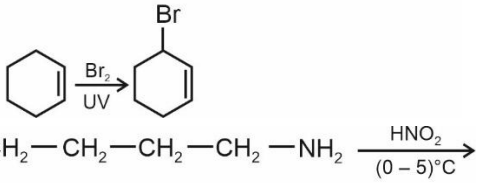
(3) $CH_3-CH_2-CH_2-CH_2-NH_2 \xrightarrow[(0-5)^\circ C]{HNO_2} CH_3-CH_2-CH_2-CH_2-OH$

(4) 

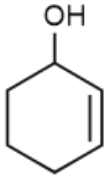
Answer (4)

Sol. 

$CH_3-CH_2-\overset{\overset{O}{\|}}{C}-NH_2 \xrightarrow[NaOH]{Br_2} CH_3-CH_2-NH_2$



$CH_3-CH_2-CH_2-\underset{\underset{OH}{|}}{CH}-CH_3$

3. IUPAC name of compound  is

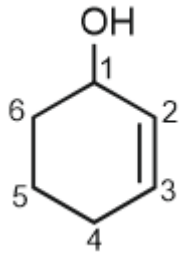
(1) Hex-2-en-1-ol

(2) Cyclohex-2-en-1-ol

(3) 3-hydroxy cyclohexene

(4) Cyclohex-1-en-3-ol

Answer (2)

Sol.  Cyclohex-2-en-1-ol

4. Why does oxygen shows anomalous behaviour?

(1) Large size, high electronegativity

(2) Small size, small electronegativity

(3) Small size, high electronegativity absence of vacant d-orbital

(4) Large size, high electronegativity presence of vacant d-orbital

Answer (3)

Sol. Oxygen shows anomalous behaviour due to small size, high electronegativity and absence of vacant d-orbital.

5. Match the following

(A) Lyman	(i) IR
(B) Balmer	(ii) IR
(C) Paschen	(iii) Visible
(D) Pfund	(iv) UV

(1) A → (iv), B → (iii)
C → (i), D → (ii)

(2) A → (i), B → (iii)
C → (ii), D → (iv)

(3) A → (iv), B → (ii)
C → (iii), D → (iv)

(4) A → (i), B → (ii)
C → (iii), D → (iv)

Answer (1)

Sol. Lyman → UV

Balmer → Visible

Paschen → IR

Pfund → IR

6. IUPAC name of K_2MnO_4 is

(1) Potassium tetraoxomanganate(VI)

(2) Potassium tetraoxomanganate(III)

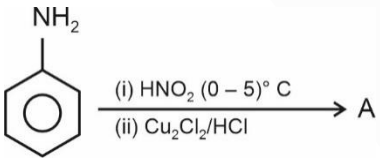
(3) Potassium tetraoxomanganese(VI)

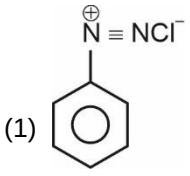
(4) Tetraoxomanganese(VI) potassium

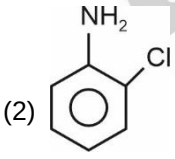
Answer (1)

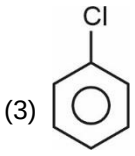
Sol. Correct IUPAC name of K_2MnO_4 is Potassium tetraoxomanganate(vi)

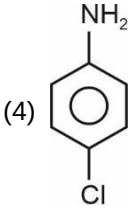
7. Find out final product (A)





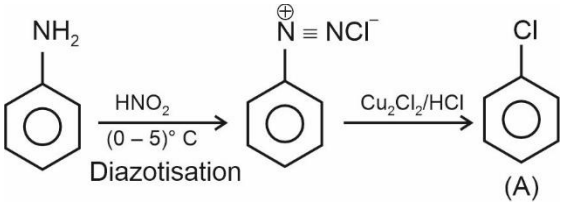






Answer (3)

Sol.



8. Which of the following element has highest 1st Ionization energy?

(1) N (2) C

(3) Si (4) Al

Answer (1)

Sol. N has highest 1st Ionization energy among C, Si, N and Al.

For, N = 1402 kJ mol^{-1} (IE_1)

C = 1086 kJ mol^{-1} (IE_1)

Al = 577 kJ mol^{-1} (IE_1)

Si = 786 kJ mol^{-1} (IE_1)

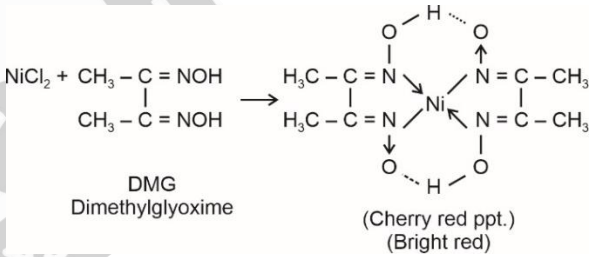
9. Which reagent gives bright red ppt with Ni^{2+} in basic medium?

(1) DMG (2) Nessler's reagent

(3) KCNS (4) $K_4[Fe(CN)_6]$

Answer (1)

Sol.



10. Match the following List-I and List-II

	List-I (Polymer)		**List-II (Monomer)**
(A)	Starch	(i)	β-glucose
(B)	Cellulose	(ii)	Nucleotide
(C)	Nucleic acid	(iii)	α-glucose
(D)	Protein	(iv)	α-Amino acid

(1) A → (i); B → (iii); C → (ii); D → (iv)

(2) A → (iii); B → (i); C → (ii); D → (iv)

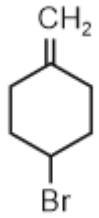
(3) A → (iii); B → (i); C → (iv); D → (ii)

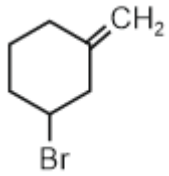
(4) A → (ii); B → (iii); C → (i); D → (iv)

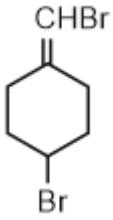
Answer (2)

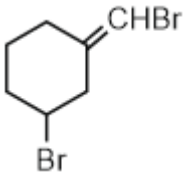
Sol. Starch is polymer of α-D-glucose. Cellulose is polymer of β-D-glucose. Nucleic acid is polymer of nucleotide. Proteins are polymer of α-aminoacids.

11. Which of the following can show geometrical isomerism?

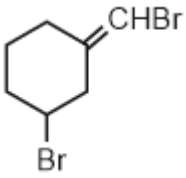
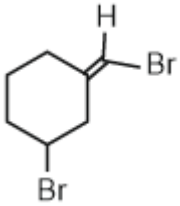
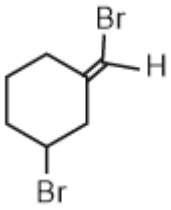
(1) 

(2) 

(3) 

(4) 

Answer (4)

Sol. The two geometrical isomers of  are  and 

12. Which reagent is used to convert alkyl halide into alkyl isocyanide?

(1) KCN (2) AgCN

(3) KNO_2 (4) $AgNO_2$

Answer (2)

Sol. $R-X+AgCN \rightarrow R-N\equiv C+AgX$

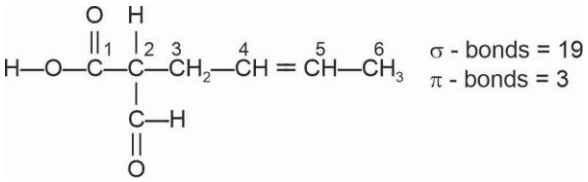
13. Find the total number of sigma (σ) and π bonds in 2-formylhex-4-enoic acid.

(1) 20 (2) 22

(3) 18 (4) 24

Answer (2)

Sol. The structure of 2-formylhex-4-enoic acid is



14. A gas 'X' is added to Nessler's reagent then brown precipitate is formed, gas X is

(1) NH_3 (2) SO_2

(3) Cl_2 (4) Br_2

Answer (1)

Sol. $\underset{\text{Nessler's reagent}}{2K_2HgI_4+3KOH+NH_3} \longrightarrow \underset{\text{Brown ppt}}{\left[OHg_2\cdot NH_2\right]I}+7KI+2H_2O$

Ammonia gas on reaction with Nessler's reagent to form brown ppt. Brown ppt formed is also called iodide of million's base (H_2N — Hg — O — Hg — I)

15. Match the following

I (compounds)		II (pKa)	
(a)	p-nitrophenol	(i)	10
(b)	m-nitrophenol	(ii)	16
(c)	Ethanol	(iii)	7.1
(d)	Phenol	(iv)	8.3

(1) (a)→(i); (b)→(ii); (c)→(iii); (d)→(iv)

(2) (a)→(iii); (b)→(iv); (c)→(ii); (d)→(i)

(3) (a)→(iv); (b)→(iii); (c)→(ii); (d)→(i)

(4) (a)→(iii); (b)→(iv); (c)→(i); (d)→(ii)

Answer (2)

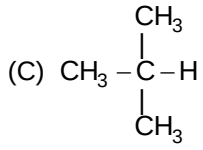
Sol. Acidic strength order:

p-nitrophenol > m-nitrophenol > Phenol >> ethanol

16. We have given some hydrocarbons

(A) $HC\equiv CH$

(B) $H_2C = CH_2$

(C) 

(D) $CH_3 - CH_2 - CH_2 - H$

Correct order of acidic strength of above hydrocarbons.

(1) A > B > C > D (2) A > B > D > C

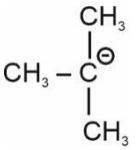
(3) C > D > B > A (4) A > C > B > D

Answer (2)

Sol. More the stability of conjugate base of given acids, more will be the acidic strength.

(A) $HC\equiv C^{\ominus}$ (more % s character more will be stability of anion)

(B) $H_2C = CH^{\ominus}$

(C)  (Alkyl group increases electron density on carbon so stability decreases)

(D) $CH_3 - CH_2 - \overset{\ominus}{C}H_2$

Order of stability of conjugate base

A > B > D > C

So order of acidic strength

A > B > D > C

17. In chromatographic techniques, which of the following follows preferential adsorption?

(A) Column chromatography

(B) Thin layer chromatography

(C) Paper chromatography

(1) A only (2) B only

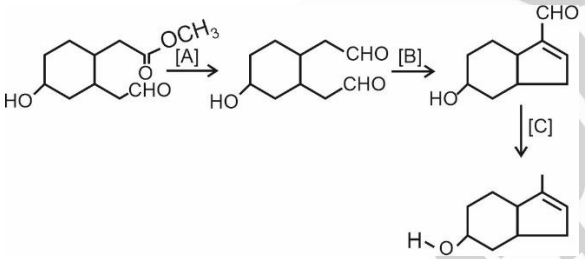
(3) C only (4) A and B both

Answer (4)

Sol. Column chromatography, Thin layer chromatography] Separation based on absorption of substance

Paper chromatography→ Partition chromatography

18. Consider the following sequence of reactions



Fina A, B and C

(1) A: DiBAL-H

B: NaOH (dil)

C: Zn – Hg/HCl

(2) A: $LiAlH_4$

B: KOH (alcoholic)

C: $NH_2 - NH_2/KOH$

(3) A: DiBAL – H

B: NaOH (dil)

C: $NH_2 - NH_2/KOH$

(4) A: $NaBH_4$

B: KOH (aqueous)

C: Zn – Hg/HCl

Answer (3)

Sol. (A) DiBALH – Convert ester to aldehyde

(B) dil NaOH – Aldol condensation

(C) $NH_2 - NH_2/KOH$ – Wolff Kishner reduction

19. The correct statement about Zn, Cd, Hg are

(1) All are solid metals at room temperature

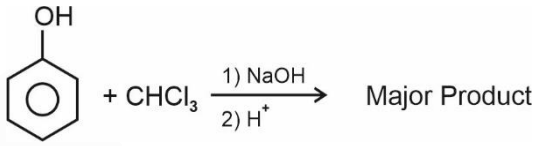
(2) They have high enthalpy of atomization

(3) All are paramagnetic

(4) Zn, Cd cannot show variable oxidation state but Hg can show variable oxidation state

Answer (4)

Sol. Hg can show +1 and +2 O.S.

20. 

The major product in the above reaction is

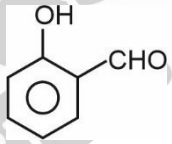
(1) 2-hydroxybenzaldehyde

(2) 2-hydroxybenzoic acid

(3) 4-hydroxybenzaldehyde

(4) 3-hydroxybenzaldehyde

Answer (1)

Sol.  is the major product in Reimer-Tiemann reaction

SECTION - B

Numerical Value Type Questions: This section contains 10 Numerical based questions. The answer to each question should be rounded-off to the nearest integer.

21. Oxidation state of Fe (Iron) in complex formed in brown ring test.

Answer (1)

Sol. Complex formed during brown ring test is $[Fe(H_2O)_5NO]SO_4$.

NO is present as NO^+ here.

$x + 5 \times 0 + 1 = +2$

$\boxed{x = +1}$

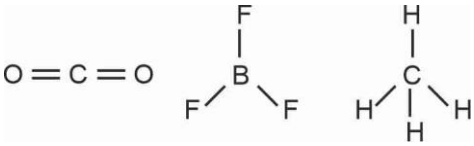
Oxidation state of Fe is +1

22. How many of the following compounds have zero dipole moment?

NH_3, H_2O, HF, CO_2, SO_2, BF_3, CH_4

Answer (3)

Sol. CO_2, BF_3 and CH_4 have symmetrical structures leading to $\mu = O$



23. Calculate equilibrium constant for the given following reaction at 500K.

$$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$$

Given molarity of $NH_3(g)$, $N_2(g)$ and $H_2(g)$ at equilibrium is 1.5×10^{-2}M, 2×10^{-2} M and 3×10^{-2} M respectively.

Answer (417)

Sol. $$K_C = \frac{[NH_3]^2}{[N_2][H_2]^3}$$

$$K_C = \frac{(1.5\times10^{-2})^2}{(2\times10^{-2})\times(3\times10^{-2})^3}$$

$$K_C = \frac{2.25\times10^{-4}}{2\times10^{-2}\times27\times10^{-6}}$$

$$K_C = 0.04167\times10^4$$

$$K_C = 416.7 \approx 417$$

24. 50 ml of 0.5 M oxalic acid is completely Neutralised by 25 ml of NaOH solution. Find out amount of NaOH (in gm) present in 25 ml of given NaOH solution.

Answer (2)

Sol. $M_1V_1N_1 = M_2V_2N_2$

(50) (0.5) (2) = (M_2) (25) (1)

$M_2 = 2$

Moles of NaOH = $\frac{2\times25}{1000} = \frac{1}{20}$

Mass of NaOH = $\frac{1}{20}\times40 = 2gm$

25. If standard enthalpy of vaporization of CCl_4 is 30.5 kJ/mol, find heat absorbed for vaporization of 294 gm of CCl_4. [Nearest integer] [in kJ]

Answer (58)

Sol. Vaporization of 1 mole CCl_4 requires 30.5 kJ

294 gm is $\frac{294}{154} = 1.91$ moles

Vaporization of 1.91 moles of CCl_4 will require 30.5×1.91 kJ = 58.255 kJ

26. Find out molality of 0.8 M H_2SO_4 solution having density of solution equal to 1.02 gm/ml (Nearest integer)

Answer (1)

Sol. $$m = \frac{1000\,M}{10008 - M(\mu)}$$

$$= \frac{1000\,(0.8)}{1000\,(1.02) - (0.8)\,(98)} = \frac{800}{1020 - 78.4}$$

$$= \frac{800}{941.6} = 0.849$$

$$\approx 1$$

27. Aqueous solution of $[AuCl_4]^-$ on electrolysis by passing current for 10 minutes, the mass of Au deposited at Cathode is 1.97 gm. Find out current required (in A) (Nearest integer)

Answer (5)

Sol. $Au^{3+} + 3e^- \longrightarrow Au(s)$

1.97 gm

0.03 mole $\frac{1.97}{197} = 0.01$ mole

Charge = 0.03×96500

Current = $\frac{0.03\times96500}{10\times60}$

= 4.825 A

$\approx$ 5A

28. If half life of radioactive bromine (Br-82) is 36 hr, find percentage remaining after one day. [nearest integer]

Answer (63)

Sol. $$\ln\frac{N_0}{N} = \lambda t = \frac{\ln2}{36}\times24$$

$$= \frac{2}{3}\ln2$$

$$\Rightarrow \frac{N_0}{N} = 2^{2/3}$$

$$\Rightarrow \frac{N}{N_0} = \frac{1}{2^{2/3}}$$

% age remaining = $100\frac{N}{N_0} = \frac{100}{2^{2/3}} = 62.99$

29.

30.