PART : CHEMISTRY

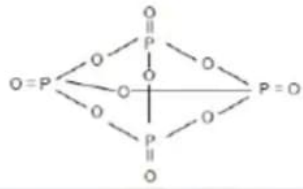
1. Number of P-O-P bond in $H_4P_2O_7$, P_4O_{10} and $(HPO_3)_3$ respectively :

(1) 1, 6, 3 (2) 0, 1, 2 (3) 3, 2, 1 (4) 1, 2, 1

Ans. **(1)**

Sol.

$H_4P_2O_7$: Pyrophosphoric acid



P_4O_{10} : Dimer of phosphorus pentaoxide

$(HPO_3)_3$: Cyclotrimetaphosphoric acid

Number of P-O-P bond	
Pyrophosphoric acid	1
Dimer of phosphorus pentaoxide	6
Cyclotrimetaphosphoric acid	3

2. How many of the following statements are incorrect :

(1) Conductivity (K) decreases with increase in dilution for both strong and weak electrolyte.

(2) Molar conductivity increases with increase in dilution for both strong and weak electrolyte.

(3) Molar conductivity increases with increases in 'α' for weak electrolyte.

(4) Change in molar conductivity is same for both strong and weak electrolyte with increases in dilution.

Ans. **(4)**

Sol. (1) On dilution, Molarity decrease, conductivity decrease, volume increase.

Number of ions per unit volume decrease so conductivity decrease.

(2) Molar conductivity increase on dilution.

(3) On increase 'α' for weak electrolyte Molar conductivity increase.

3. **Statement-I :** According to Bohr's modal, angular momentum is quantised for stationary orbits.

Statement-II : Bohr's modal doesn't follow Heisenberg's uncertainty principle.

(1) Both Statement-I and Statement-II are true. (2) Statement-I is true and Statement-II is false.

(3) Statement-I is false and Statement-II is true. (4) Both Statement-I and Statement-II are false.

Ans. **(1)**

Sol. According to Bohr's modal orbit angular momentum of stationary orbit is quantaized it is equal to $\frac{nh}{2\pi}$ (on = No. of orbit) Heisenberg's uncertainty principle explain orbital concept, which is depends on finding probability of electron.

4. How many of the following are isoelectric species

F^-, Al^{3+}, F, O_2^+, Na^+, Mg^{2+}, Al, Na, O^{2-}

Ans. **(5)**

Sol.

Species :	F^-	Al^{3+}	F	O_2^+	Na^+	Mg^{2+}	Al	Na	O^{2-}
No. of e^- :	10	10	9	15	10	10	13	11	10

5. The interionic distance in Cs Cl structure is
$(r^+ + r^-)$

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

Ans. **(3)**

Sol. CsCl has body centred unit cell (BCC)

So body diagonal $\sqrt{3}a = 2(r^+ + r^-)$

$(r^+ + r^-) = \left(\frac{\sqrt{3}a}{2}\right)$

6. In a complex of Co^{2+} with ligand H_2O in octahedral complex number of unpaired electron in t_{2g} orbital_____

Ans. **(1)**

Sol. $[Co(H_2O)_6]^{2+}$; $Co^{2+} = d^7$ configuration

$t_{2g}^{22''}\ eg^{11}$

No. of unpaired electron = 1 in t_{2g}

7. Which of the following statement are correct ?

(a) NF_3 has triangular planer structure

(b) Bond length of N_2 is smaller than O_2

(c) For isoelectronic species bond order will be some

(d) Dipole moment of H_2S is lesser than H_2O

(1) Only b, c, d

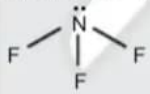
(2) Only a, b, c

(3) Only a, c, d

(4) Only a, b, d

Ans. **(1)**

Sol. (a) NF_3 has triangular pyramidal structure



(b) **Molecule :** N_2 O_2

B.O. 3 2

B. L N_2 < O_2

(d) Dipole moment $H_2S < H_2O$ due to less EN difference b/w H and S as compare to H and O

8. **Assertion :** $BeCl_2$ and $MgCl_2$ give characteristic colour to flame.

Reason : Excitation enthalpy are very high for $BeCl_2$ and $MgCl_2$.

(1) Assertion, Reason both are correct Reason is correct explation of Assertion.

(2) Assertion, Reason both are correct Reason is not correct explation of Assertion.

(3) Assertion is correct Reason is not correct.

(4) Assertion is not correct Reason is correct.

Ans. **(4)**

Sol. Due small size and high EN of Be and Mg.

9. Oxidation number of Cr in chromyl chloride vapour.

Ans. **6**

Sol. Chromyl chloride : CrO_2Cl_2

Oxidation number of Cr = +6

$\mathbf{Cr}O_2Cl_2$

$x + 2(-2) + 2(-1) = 0$

$x = +6$

10. Find the vapour pressure (in mm of Hg) of aqueous solution having 30% mass by volume glucose (Given : $P^0_{H_2O} = 760$ mm of Hg) (density of solution = 1.2 g/mol) (Report your answer in nearest integer)

Ans. **729 mm of Hg**

Sol. $\frac{P^oA - Ps}{Ps} = \frac{n}{N}$

density of solution $= \frac{\text{Mass}}{\text{volume}}$

density of solution = 100 ml

Mass = 120g

weight of glucose $= 120 \times \frac{30}{100} = 36g$

weight of $H_2O = 120 - 36 = 84g$

mole of glucose = 36/180 = 0.2 mole

mole of $H_2O = \frac{84}{18} = 4.6$ mole

$\frac{760 - Ps}{Ps} = \frac{0.2}{4.67}$

$760 - Ps = 0.0428\ Ps$

$Ps = \frac{760}{1.0428} = 728.8$ mm of Hg

$= 729$ mm of Hg

11. Find change in Oxidation number of Mn when $KMnO_4$ react with aqueous KI solution in acidic medium.

Ans. **5**

Sol. $10KI + \underset{(+7)}{2KMnO_4} - 8H_2SO_4 \longrightarrow \underset{(+2)}{2MnSO_4} + 8H_2O + 5I_2 + 6K_2SO_4$

change on Oxidation number of Mn = ((+7) – (+2)) = 5

12. What is the Ratio of silica to alumina in cement

(1) 3 (2) 2 (3) 4.5 (4) 1.5

Ans. **(1)**

Sol. For gas good quality of cement the ratio of silica (SiO_2) to Alumina (Al_2O_3) should be between 2.5 and 4 : 1

13. Which of the following reaction is not a calcination process.

(1) $CaCO_3 \longrightarrow CaO + CO_2$

(2) $CaCO_3.MgCO_3 \xrightarrow{\Delta} MgO + CaO + CO_2$

(3) $PbS + O_2 \longrightarrow PbO + SO_2$

(4) $Fe_2O_3.\ xH_2O \xrightarrow{\Delta} Fe_2O_3 + xH_2O$

Ans. **(3)**

Sol. $PbS + O_2 \longrightarrow PbO + SO_2$ is a roasting reaction.

14. Which of the following having highest value of splitting energy (Δ_0).

(1) $[Ti(H_2O)_6]^{+2}$ (2) $[Fe(H_2O)_6]^{+3}$

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

Ans. **(2)**

Sol. From L to R in 3d series M^{3+} ion size decreases, change density increase, so attraction b/w M^{3+} and ligand increase so Δ_0 increase.

15. For water gas shift reaction, which of the following is correct.

(1) CO get oxidised in CO_2

(2) CO_2 get reduced in CO

(3) Water get vaporised

(4) CO get reduced in CH_4

Ans. **(1)**

Sol. The production of dihydrogen can be increased by reacting CO of Syn gas mixture with steam in the presence of iron chromate as catalyst

$$CO(g) + H_2O(g) \xrightarrow[\text{Catalyst}]{673K} CO_2(g) + H_2(g)$$

Water gas shift Reaction

16. For a radioactive decay $t_{\frac{1}{2}} = 15$ years, what will be the rate constant (yr^{-1})

Ans. **$0.05\ yr^{-1}$**

Sol. radioactive decay is I^{st} order,

so rate constant $K = \frac{0.693}{t_{1/2}} = \frac{0.693}{15} = 0.0462$

$= 0.05\ yr^{-1}$

17. **Statement-I :** pH of 10^{-8} M HCl is 8 at 25°C

Statement-II : Titration of weak acid and strong base at half equivalence point gives $pH = \frac{pK_a}{2}$

(1) Both Statement-I and Statement-II are correct.

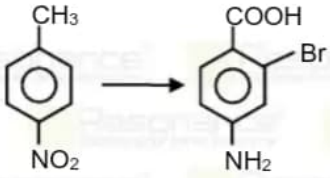
(2) Both Statement-I and Statement-II are incorrect.

(3) Statement-I is incorrect and Statement-II is correct.

(4) Statement-II is incorrect and Statement-I is correct.

Ans. **(2)**

18.

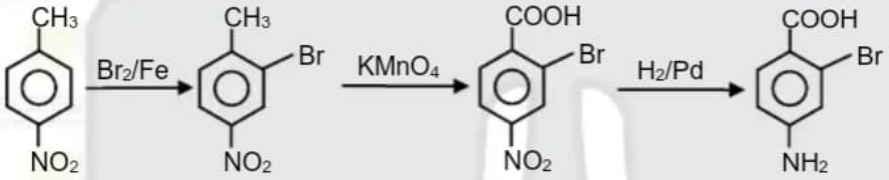


(1) $Br_2/Fe, KMnO_4, LiAlH_4$ (2) $H_2/Pd, Br_2/Fe, KMnO_4$

(3) $Br_2/Fe, KMnO_4, H_2/Pd$ (4) $KMnO_4, Br_2/Fe, LiAlH_4$

Ans. **(3)**

Sol.



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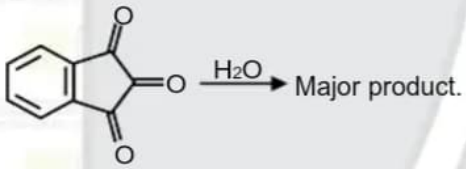
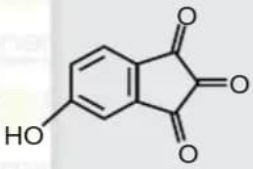
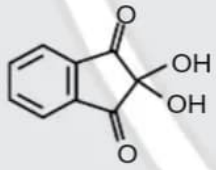


(1)



(2)



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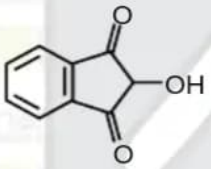

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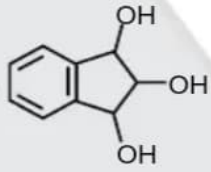
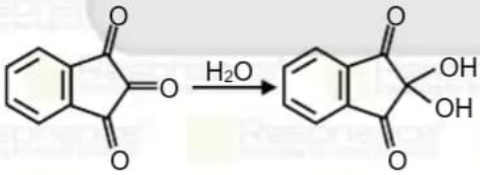


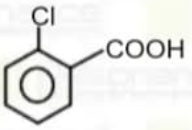
Ans. **(2)**

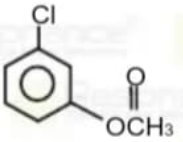
Sol.

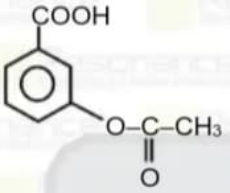


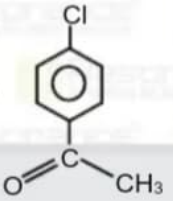
Ninhydrin Ninhydrin-hydrate

20. Friedel-craft acylation in chlorobenzene gives.

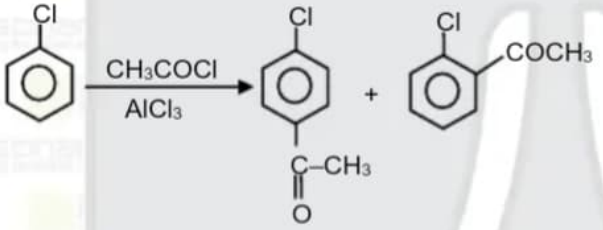
(1) 

(2) 

(3) 

(4) 

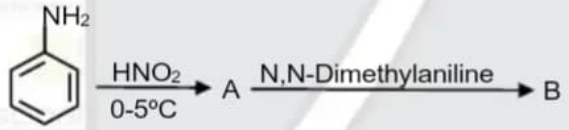
Ans. **(4)**

Sol. 

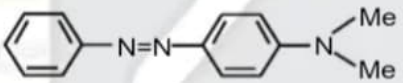
21. Photochemical smog is minimum

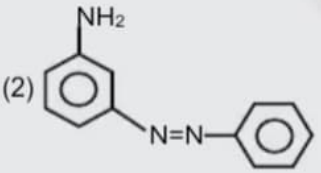
(1) In Kolkata (October)
(2) In Mumbai - (May)
(3) In Chennai (July)
(4) In Jammu & Kashmir (January & February)

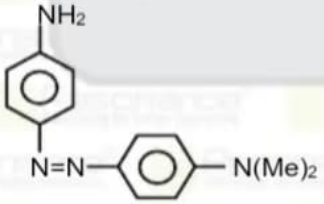
Ans. **(4)**

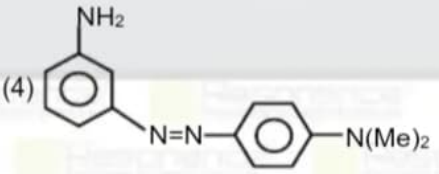
22. 

Find B.

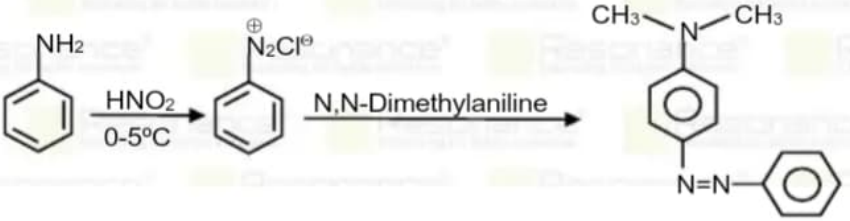
(1) 

(2) 

(3) 

(4) 

Ans. **(1)**

Sol. 

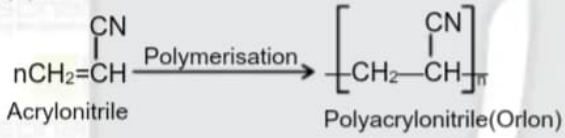
23. The correct match is.

	LIST-I (Monomer)		LIST-II (Polymer)
(A)	Tetrafluoroethene	(I)	Orlon
(B)	Caprolactum	(II)	Natural rubber
(C)	Acrylonitrile	(III)	Nylon-6
(D)	Isoprene	(IV)	Teflon

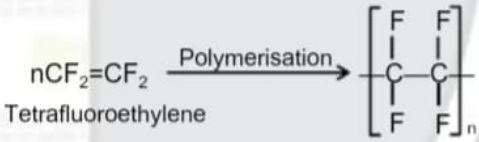
(1) (A) – (IV) ; (B) – (III) ; (C) – (II) ; (D) – (I)
(2) (A) – (IV) ; (B) – (II) ; (C) – (III) ; (D) – (I)
(3) (A) – (IV) ; (B) – (III) ; (C) – (I) ; (D) – (II)
(4) (A) – (III) ; (B) – (II) ; (C) – (IV) ; (D) – (I)

Ans. **(3)**

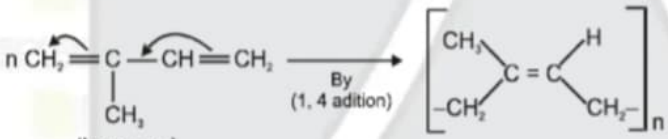
Sol.



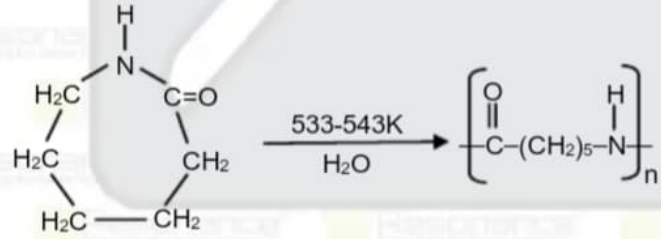
Acrylonitrile — Polyacrylonitrile(Orlon)



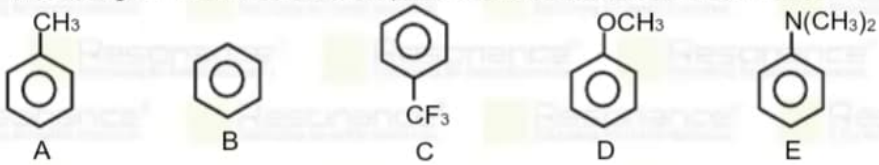
Tetrafluoroethylene — Teflon



(Isoprene) — cis-polyisoprene or Natural rubber



24. Increasing order of rate of electrophilic aromatic substitution reaction is



A B C D E

(1) C < B < A < D < E
(2) C < B < A < E < D
(3) C < B < D < E < A
(4) C < A < D < E < B

Ans. **(1)**

Sol. Rate of electrophilic substitution reaction $\propto$ Electron density in benzene ring.

25. $CH_3–CH=CH_2 \xrightarrow[2.\ H_2O_2\ 3.\ PCC\ 4.\ CH_3MgX]{1.\ B_2H_6} P$

Product 'P' is

(1) $CH_3–CH_2–\overset{\overset{O}{\|}}{C}–OCH_3$

(2) $CH_3–CH_2–CH_2–CH_2–OH$

(3) $CH_3–CH_2–\underset{\underset{OH}{|}}{CH}–CH_3$

(4) $CH_3–\underset{\underset{CH_3}{|}}{\overset{\overset{OH}{|}}{C}}–CH_3$

Ans. **(3)**

Sol.

$$CH_3–CH=CH_2 \xrightarrow[H_2O_2/OH^{\ominus}]{B_2H_6} CH_3–\underset{\underset{OH}{|}}{CH}–CH_2$$

$$\downarrow PCC$$

$$CH_3–\underset{\underset{O}{\|}}{CH}–CH_3 \xrightarrow{CH_3MgX} CH_3–\underset{\underset{OH}{|}}{CH}–CH_3$$