JEE MAIN SEP 2020 (MEMORY BASED) | 3rd Sep. SHIFT-2

Note: The answers are based on memory based questions which may be incomplete and incorrect.

1. For a hypothetical case let value of l is defind as 0, 1, 2, 3....(n +1) for principle quantum number n. Then correct statement is.

(1) Atomic number of 1st noble gas is 8

(2) Atomic number of 1st alkali metal is 9

(3) Carbon has electron in $2p_z$

(4) Element with atomic number 13 has half filled sub shell

Ans. (4)

Sol. For n = 1 value of $l = 0, 1, 2$

Electronic configuration = $1s^2\ 1p^6\ 1d^{10}$

(1) 1st noble gas atomic number is 18

(2) 1st alkali metal electronic configuration $\Rightarrow 1s^2\ 1p^6\ 1d^{10}\ 2s^1 \Rightarrow (Z = 19)$

(3) Electronic configuration of C $(Z = 6) \Rightarrow 1s^2\ 1p^4$

(4) Z (13) = $1s^2\ 1p^6\ 1d^5$, so it has half filled d-sub shell.

2. What is the valency of an element if successive ionisation energies given as follows (in KJ/mole)

IE_1	IE_2	IE_3	IE_4	IE_5
525	735	925	12560	14750

(1) 3 (2) 4 (3) 5 (4) 6

Ans. (1)

Sol. As difference in 3rd and 4th ionisation energies is very high so element contains 3 valence electrons.

Hence valency of the element is 3.

3. On passing 2A current through a dichromate solution for 5 minute, 0.104 g of Cr^{3+} ions are formed. Find the percentage efficiency of cell ?

[Given $Cr_2O_7^{2-} + 14H^+ + 6e^- \longrightarrow 2Cr^{3+} + 7H_2O$, Atomic mass of Cr = 52]

Ans. 96.50

Sol. $Q_{actual} = I_{actual} \times t = n \times n_f \times F$

$$I_{actual} = I_{total} \times \frac{(\%\eta)}{100}$$

$$Cr_2O_7^{2-} + 14H^+ + 6e^- \longrightarrow 2Cr^{3+} + 7H_2O$$

$$n_f \text{ of } Cr^{3+} = 3$$

$$\Rightarrow \quad 2 \times 5 \times 60 \times \frac{(\%\eta)}{100} = \frac{0.104}{52} \times 96500 \times 3$$

$$\Rightarrow \quad \%\eta = 96.50$$

4. Two solutions containing protein A and protein B are isotonic. 0.73 gram of protein A is dissolved in 250 ml of solution while 1.65 gram of protein B is dissolved in 1 L solution. What is the ratio of molecular masses of protein A and protein B ?

Ans. (1.77)

Sol. For isotonic solution

$i_1C_1 = i_2C_2$ {For protein $i = 1$}

$$\Rightarrow \frac{0.73 \times 1000}{M_A \times 250} = \frac{1.65}{M_B \times 1}$$

$$\frac{M_A}{M_B} = \frac{0.73 \times 4}{1.65} = 1.77$$

5. The crystal field electronic configuration of complexes $[Ru(en)_3]Cl_2$ and $[Fe(H_2O)_6]^{+2}$ are respectively :

(1) t_{2g}^4, e_g^2 and t_{2g}^6, e_g^0 (2) t_{2g}^6, e_g^0 and t_{2g}^4, e_g^2

(3) t_{2g}^4, e_g^2 and t_{2g}^4, e_g^2 (4) t_{2g}^6, e_g^0 and t_{2g}^6, e_g^0

Ans. (2)

Sol. Ru^{2+} ($4d^6$) always form inner orbital complex.

$[Ru(en)_3]Cl_2 \Rightarrow Ru^{2+} = 4d^6 = t_{2g}^6, e_g^0$

Fe^{2+} ($3d^6$) form outer orbital complex with weak field ligand (i.e. H_2O).

$[Fe(H_2O_6)]^{2+} \Rightarrow Fe^{2+} = 3d^6 = t_{2g}^4, e_g^2$

6. Find out volume (in mL) of 0.1 N NaOH solution required to neutralize 10 mL of 0.1 N phosphonic acid solution ?

Ans. (10.00)

Sol. Phosphonic acid or phosphorous acid (H_3PO_3).

$NaOH + H_3PO_3 \longrightarrow NaH_2PO_3 + H_2O$

For neutrilization

$(N_1V_1)_{acid} = (N_2V_2)_{base}$

$0.1 \times 10 = 0.1 \times (V_{mL})_{NaOH}$

$V_{NaOH} = 10\ mL$

7. For the following chemical reaction, choose the correct relation between the rate of reaction of A, B and C

$$2A + 3B + \frac{3}{2}C \longrightarrow 3P$$

(1) $\frac{dn_A}{dt} = \frac{2}{3}\frac{dn_B}{dt} = \frac{4}{3}\frac{dn_C}{dt}$

(2) $\frac{dn_A}{dt} = 3\frac{dn_B}{dt} = \frac{3}{2}\frac{dn_C}{dt}$

(3) $\frac{3}{2}\frac{dn_A}{dt} = \frac{dn_B}{dt} = \frac{3}{4}\frac{dn_C}{dt}$

(4) $2\frac{dn_A}{dt} = 3\frac{dn_B}{dt} = \frac{3}{2}\frac{dn_C}{dt}$

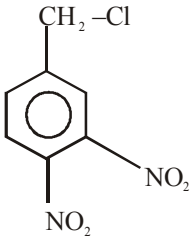
Ans. (1)

Sol. $r = \frac{r_A}{2} = \frac{r_B}{3} = \frac{r_C}{\frac{3}{2}} = \frac{r_P}{3}$

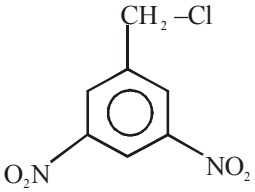
$$r = -\frac{1}{2}\frac{dn_A}{dt} = -\frac{1}{3}\frac{dn_B}{dt} = -\frac{2}{3}\frac{dn_C}{dt}$$

$$r = \frac{dn_A}{dt} = \frac{2}{3}\frac{dn_B}{dt} = \frac{4}{3}\frac{dn_C}{dt}$$

8. What will be the decreasing order of following compounds towards nucleophilic substitution (S_N2) reaction.



(i)



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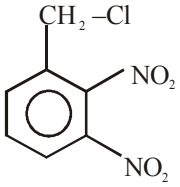

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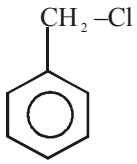


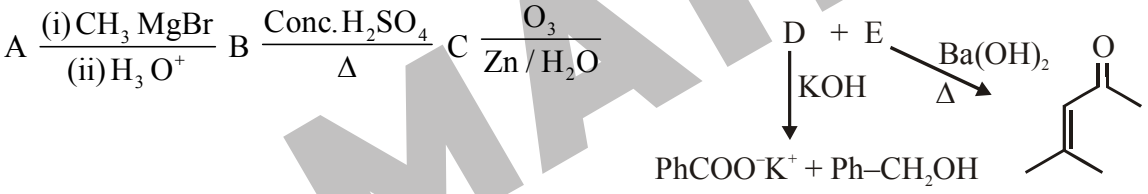
(iv)

(1) i > ii > iii > iv (2) iv > iii > ii > i (3) i > iii > ii > iv (4) iii > i > ii > iv

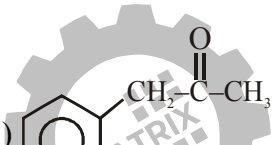
Ans. (3)

Sol. Rate of (S_N2) reaction depend upon factors like steric hinderance and electronic effect. Increase in steric hinderance will decrease rate and increase in –I, –M electronic effect will increase rate.

9. Identify structure of A in following reaction sequence.



(1)



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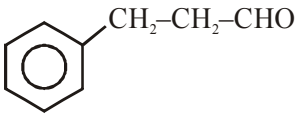

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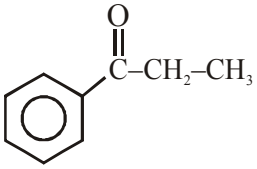
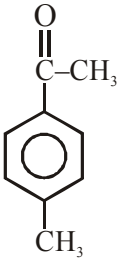
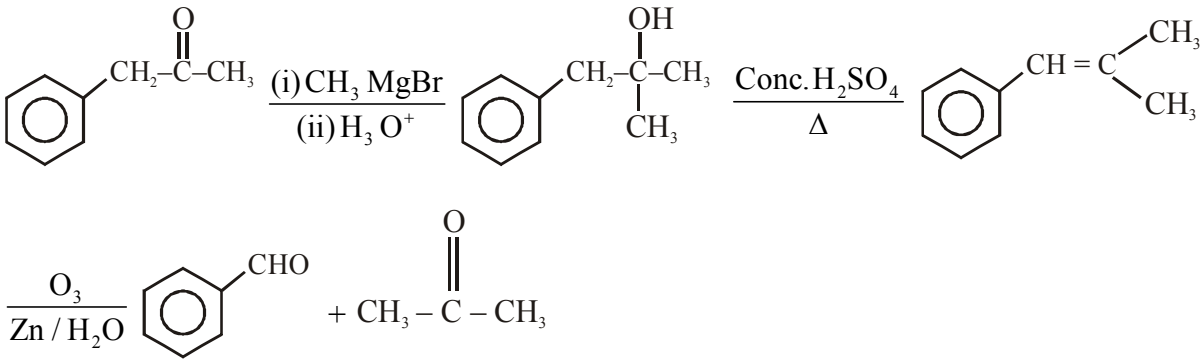


(4)



Ans. (1)

Sol.



10. Mass of 6.022×10^{22} molecules of a compound X is 10 g. If the molarity of solution containing 5g of 'X' in 2 L solution is $P \times 10^{-3}$ Mole/ L then find the value of P

Ans. (25.00)

Sol. $\text{Number of mole of X} = \frac{6.022\times10^{22}}{6.022\times10^{23}} = \frac{10}{\text{Molar mass of X}}$

So molar mass of X = 100 g

$\text{Molarity} = \frac{5}{100\times2} = 0.025\ \text{M}$

$P \times 10^{-3} = 0.025M$

$P = 25$

11. Choose the incorrect statements for acid rain :

(A) It corrodes water pipes

(B) It is not harmful for trees and plants

(C) It does not cause breathing problem in human being and animals

(D) It damages building and other structures made of stone or metal.

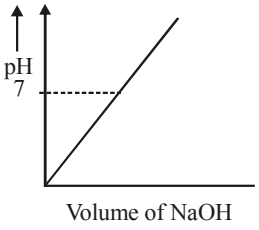
(1) A and B (2) B and C (3) A and C (4) B and D

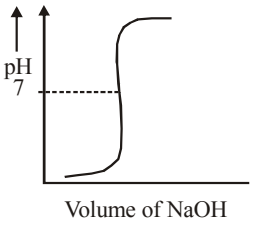
Ans. (2)

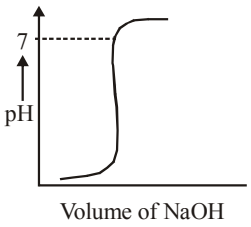
Sol. (B) It is harmful for trees and plants

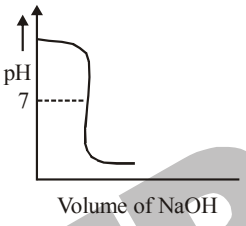
(C) It causes breathing problem in human being and animals.

12. 0.1 M HCl solution is titrated with 0.1 M NaOH solution then choose the correct pH curve for the given titration.

(1) 

(2) 

(3) 

(4) 

Ans. (2)

Sol. During titration of strong acid and strong base, pH becomes 7 at equivalence point and pH will increase as NaOH is added.

13. What will be the correct order of rate of Nucleophilic addition reaction of following compounds :

Propanal, Butanone, Propanone, Benzaldehyde

(1) Propanal > Butanone > Propanone > Benzaldehyde

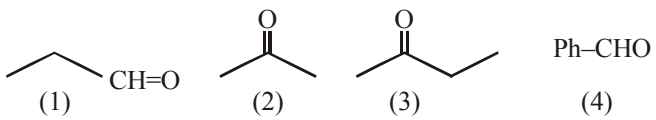
(2) Propanal > Benzaldehyde > Propanone > Butanone

(3) Propanone > Propanal > Butanone > Benzaldehyde

(4) Propanone > Butanone > Benzaldehyde > Propanal

Ans. (2)

Sol. Rate of Nucleophilic addition reaction is directly proportional to δ^+ on carbonyl carbon



(1) (2) (3) (4)

1 > 4 > 2 > 3

14. Among the following statements identify the correct set of statements.

(a) Both Be and Al does not react with nitrogen

(b) Ionisation energy of Be is greater than Al

(c) Both Be and Al form covalent compounds readily

(d) Size of Be is smaller than Mg

(1) a, b, c (2) a, c, d (3) b, c, d (4) a, b, d

Ans. (3)

Sol. (a) Both Be and Al react with nitrogen to form nitride

$3Be + N_2(air) \xrightarrow{\Delta} Be_3N_2$

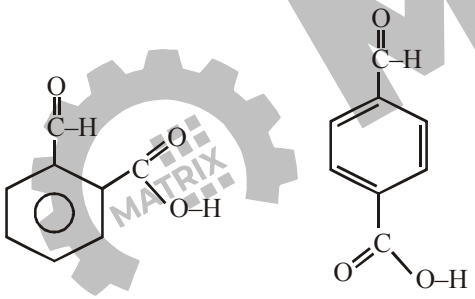
$6Al + 3N_2 \xrightarrow{\Delta} 6AlN$

(b) I.E. : Be > Al

(c) Due to having high polarization power (ϕ value) of Be^{+2} and Al^{+3}, they form usually covalent compound.

(d) Atomic radii increases on moving down the group : Mg > Be.

15.



(A) (B)

(A) B is less water soluble than A

(B) B is more crystalline in nature than A

(C) B has more boiling point than A

Select correct statments regarding above structures.

(1) A, B are correct (2) B, C are correct (3) Only C are correct (4) A, B, C all are correct

Ans. (2)

Sol. Due to inter molecular H-bonding in B, than A, B is more soluble and having more B. P point than A.

16. Find incorrect statement about manganate and permanganate ions.

(1) Manganate ion is green colour while permanganate ion is purple colour

(2) Both manganate and permanganate ions have tetrahedral shape

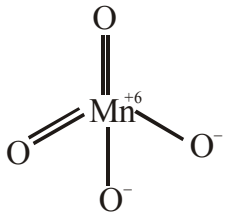
(3) In manganate and permanganate ions Mn from pπ-dπ bond with oxygen

(4) Both manganate and permanganate ions are Paramagnetic

Ans. (4)

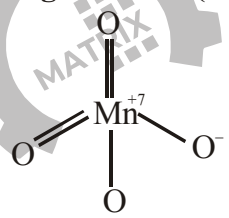
Sol.

Manganate ion (MnO_4^{2-})

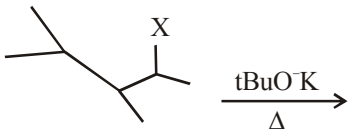


Paramagnetic (Mn^{+6} having one unpaired electron), green colour is due to ligand to metal charge transfer, tetrahedral & contains pπ-dπ bond

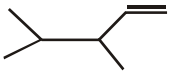
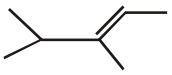
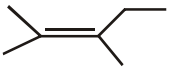
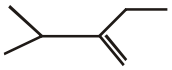
Permanganate ion (MnO_4^-)



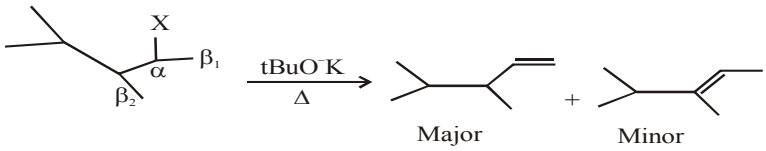
Diamagnetic (Mn^{+7} having zero unpaired electron), purple colour is due to ligand to metal charge transfer, tetrahedral & contains pπ-dπ bond

17. 

What will be the major product of above reaction :

(1)  (2)  (3)  (4) 

Ans. (1)

Sol. 

This is an example of E_2 reaction and due to bulky base final product is Hoffmann alkene

18. What will be the molarity and % (w/w) of 5.6 V H_2O_2 solution ? (Given molar mass of H_2O_2 = 34 g/mol, density = 1 g/mL)

(1) 0.5, 1.70 (2) 0.25, 1.70 (3) 0.5, 0.85 (4) 0.25, 0.85

Ans. (1)

Sol. For H_2O_2 solution, Volume strength = 11.2 × Molarity

$$\text{Molarity} = \frac{\text{Volume strength}}{11.2} = \frac{5.6}{11.2} = 0.5\ \text{M}$$

$$\& \text{ Molarity} = \frac{\%(\text{w/ w}) \times 10 \times \text{density}}{\text{Molar mass}}$$

$$0.5 = \frac{\%(\text{w/ w}) \times 10 \times 1}{34}$$

$$\%\ (\text{w/w}) = \frac{0.5 \times 34}{10} = 1.7$$

19. Match the columns :

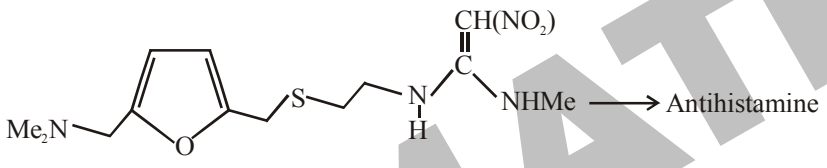
Column-I	**Column-II**
(A) Chloramphenicol	(1) Antacid
(B) Ranitidine	(2) Antihistamine
(C) Phenelzine (nardil)	(3) Antibiotic
(D) Morphine	(4) Analgesic
	(5) Antidepressent

(1) A-1, B-2, C-4, D-5 (2) A-3, B-2, C-5, D-4

(3) A-2, B-4, C-5, D-1 (4) A-3, B-2, C-1, D-5

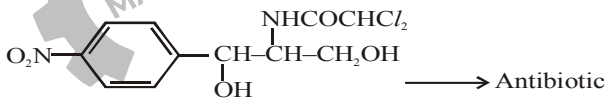
Ans. (2)

Sol.

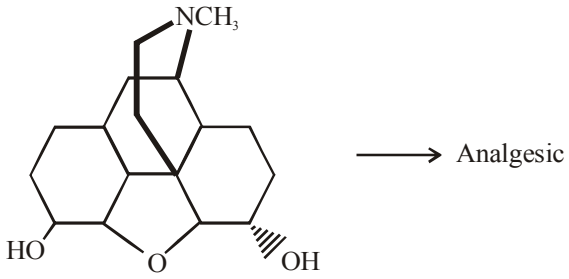


Ranitidine

Phenelzine (Nardil)



Chloramphenicol



Morphine

20. A mixture containing one mole of each of $H_2(g)$, $O_2(g)$ and He(g) in a container of volume V at temperature T, having partial pressure of $H_2(g)$ is 2 atm. Find out total pressure in the container :

(1) 24 atm (2) 18 atm (3) 6 atm (4) 33 atm

Ans. (3)

Sol. Since, at constant T & V

$P \propto n$

$n_{H_2} = n_{He} = n_{O_2}$

$P_{H_2} = P_{He} = P_{O_2} = 2atm$

So, $P_{Total} = P_{H_2} + P_{O_2} + P_{He}$

$= 6$ atm

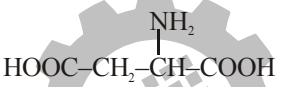
21. Calculate the number of $\overset{O}{\overset{\|}{C}}$ in given structure of peptide chain

Asp–Gly–Lys

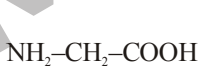
Ans. 4

Sol.

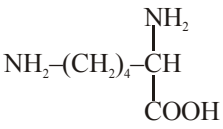
Aspartic acid

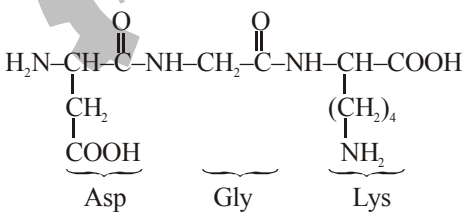


Glycine



Lysine





Asp Gly Lys