

DATE:

CLASS: XII

CENTRE:

Chemistry Paper – JEE Main 2019

January Session

1. The weight of Na^+ in the solution of Na_2SO_4 is 92g. Find molality of Na^+ per kg of water?

(1) 2

(2) 4

(3) 6

(4) 8

Answer:

(2)

Solution:

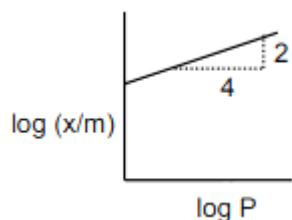
Given: $Na_2SO_4 \longrightarrow Na^+ = 92gm.$

To find: Molality of Na^+ per kg of water

Formula: Molality per kg = $\frac{\text{Wt of solute}}{\text{molecular wt of solute} \times \text{wt of solvent(kg)}}$

$$= \frac{92}{23} = 4$$

2. Which of the following options is correct for given curve?



(1) $\frac{x}{m} \propto (P)^{\frac{1}{2}}$

(2) $\frac{x}{m} \propto (P)$

(3) $\frac{x}{m} \propto (P)^2$

(4) $\frac{x}{m} \propto P^0$

Answer:

(1)

Solution:

According to Freundlich isotherm

$$\frac{x}{m} \propto P^{\frac{1}{n}} \text{ where } \frac{1}{n} \Rightarrow 0 \text{ to } 1$$

$$\frac{x}{m} = k(P)^{\frac{1}{n}} \Rightarrow \log_{10} \frac{x}{m} = \log_{10} k + \frac{1}{n} \log_{10} P$$

$$\text{Slope} = \frac{1}{n} \text{ (From graph Slope} = \tan \theta \Rightarrow \frac{2}{4} \text{)}$$

$$\frac{2}{4} = \frac{1}{n}$$

$$\frac{1}{2} = \frac{1}{n}$$

$$\text{Ans: } \frac{x}{m} \propto P^{\frac{1}{2}}$$

3. 20 ml of 0.1 M H_2SO_4 is added to 30 ml of 0.2 M NH_4OH then calculate pH of resultant solution.

(Given that P^{Kb} of NH_4OH is 4.7)

(1) 9

(2) 9.4

(3) 5.2

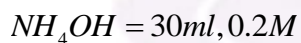
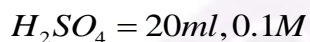
(4) 5

Answer:

(1)

Solution:

Given:



$$20 \times 0.1 \quad 30 \times 0.2$$

$$t = 0 \quad 2 \text{ mm} \quad 6 \text{ mm} \quad 0 \text{ mm} \quad 0 \text{ mm}$$

$$t = t \quad 2 - 2 \quad 6 - 2 \times 2$$

$$= 0 \text{ mm} \quad 2 \text{ mm} \quad 4 \text{ mm} \quad 2 \text{ mm}$$

\therefore It is a complete Neutralisation $r \times n$, So Buffer formula is applied

$$P^{OH} = P^{Kb} + \log_{10} \frac{\text{Salt}}{\text{Base}}$$

$$= 4.7 + \log_{10} \frac{4}{2}$$

$$= 4.7 + \log_{10} 2$$

$$= 4.7 + 0.3010$$

$$P^{OH} = 5$$

$$P^H + P^{OH} = 14$$

$$P^H = 14 - 5 = 9$$

$$P^H = 9$$

4. Which of the following is not correct about Henry's law.
- (1) On increasing temperature value of K_H increases
 - (2) Value of K_H increases solubility of gas increases
 - (3) Value of K_H for two different gases at same temperature is not same
 - (4) None of these

Answer:

(2)

Solution:

According to Henry's law

$$P = K_H \times \text{Solubility}$$

P = Partial pressure of gas

K_H = Henry's constant

$$\text{Solubility} \propto \frac{1}{K_H} \quad (\because K_H \text{ is different for different gas})$$

According to this expression, if the solubility of gas increases the value of K_H decreases

5. $2A + B \longrightarrow \text{Product}$

[A]	[B]	Rate (M min^{-1})
-----	-----	------------------------------

0.1	0.20	6.93×10^{-3}
0.1	0.25	6.93×10^{-3}
0.2	0.3	1.386×10^{-2}

Time when concentration of A becomes half

(1) 1

(2) 10

(3) 100

(4) 5

Answer:

(2)

Solution:

$$\text{Rate} = k[A]^x[B]^y$$

$$6.93 \times 10^{-3} = k[0.1]^x [0.20]^y \quad \dots (1)$$

$$6.93 \times 10^{-3} = k[0.1]^x [0.25]^y \quad \dots (2)$$

$$1.386 \times 10^{-2} = k[0.2]^x [0.30]^y \quad \dots (3)$$

Divide equation (1) by (2)

$$\frac{eq(1)}{eq(2)} = \left[\frac{0.20}{0.25} \right]^y \quad y = 0$$

Divide equation (1) by (3)

$$\frac{eq(1)}{eq(3)} = \frac{1}{2} = \left(\frac{1}{2} \right)^x \times 1 \quad x = 1$$

From equation (i) and (iii) we get $x = 1$, so it is first order with respect to A.

$$\Rightarrow 6.93 \times 10^{-3} = k(0.1)$$

$$k = 6.93 \times 10^{-2} \text{ min}^{-1}$$

$$t_{\frac{1}{2}} = \frac{0.693}{k}$$

$$t_{\frac{1}{2}} = \frac{0.693}{6.93 \times 10^{-2}} = 10$$

6. 0.05 F charge is passed through a lead storage battery. In the anodic reaction, what is the amount of $PbSO_4$ precipitated (Molar mass of $PbSO_4$ is 303 g/mol)

(1) 30.3 g (2) 15.15 g (3) 7.6 g (4) 60.6 g

Answer:

(3)

Solution:

Charge = 0.05 F

Amount of $PbSO_4$ precipitated = W

Molar mass of $PbSO_4$ = 303 g/mol

⇒ According to Faraday's 1st law of electrolysis

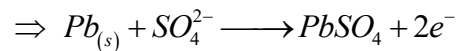
1st method:

$$W = E \times Q$$

$$E = M/2; Q = 0.05$$

$$W = \frac{303 \times 0.05}{2} = 7.6g$$

2nd method:



For 2f current passed, $PbSO_4$ deposited = 303 g/mol

For 0.05 F current passed, $PbSO_4$ deposited = W

$$W = \frac{303 \times 0.05}{2} = 7.6g$$

7. In hydrogen emission spectrum electron transition takes place from $n = 8$ to $n = \infty$. If we plot this graph of $\bar{\nu}$ vs $\frac{1}{nf^2}$. Which of the following statement is correct.

(1) Slope $= -R_H$ (2) Slope $= R_H$ (3) Intercept $= R_H$ (4) Graph is non-linear

Answer:

(2)

Solution:

Transition state $= n = 8$ to $n = \infty$

Graph $\left[\bar{\nu} \text{ vs } \frac{1}{n^2} \right]$

$$\bar{\nu} = R_H z^2 \left[\frac{1}{n_1^2} - \frac{1}{n_2^2} \right] \quad (Z = 1 \text{ for hydrogen emission spectrum})$$

$$\bar{\nu} = R_H \times (1)^2 \left[\frac{1}{nf^2} - \frac{1}{8^2} \right]$$

$$\bar{\nu} = \left[\frac{R_H}{m} \right] \times \frac{1}{nf^2} - \frac{R_H}{64}$$

$$y = \left[\frac{R_H}{m} \right] \times + C$$

$$\text{Slope} = R_H$$

8. Given a mixture with 0.5 mole of gas A and X moles of gas B. Total pressure is 200 pa at 1000 k temperature in a vessel of volume 10m^3 . Then, find x. (R is universal gas constant).

(1) $\frac{4-R}{2R}$ (2) $\frac{4+R}{2R}$ (3) $\frac{2-R}{2R}$ (4) $\frac{2}{2}$

Answer:

(1)

Solution:

Given: Mix	–	Gas A	+	Gas B
		0.5 mole		x mole

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Total pressure = 200 pa

$T = 1000 \text{ K}$

$V = 10 \text{ m}^3$

$x = ?$

$$Pv = nRT$$

$$200 \times 10 = (0.5 + x)R \times 1000$$

$$2 = (0.5 + x)R$$

$$\frac{2}{R} - 0.5 = x$$

$$\frac{2}{R} - \frac{1}{2} = x \Rightarrow \frac{4 - R}{2R} = x$$

9. Which of the following are isotope of hydrogen

(1) Deutrium, Protium

(2) Deutrium, Tritium

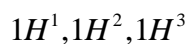
(3) Deutrium, Tritium, Protium

(4) Protium

Answer:

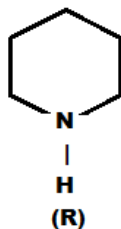
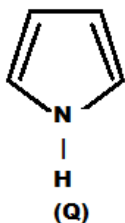
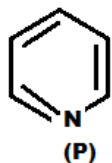
(3)

Solution:



Protium, Deutrium and Tritium

10. Arrange the following in order of K_b value



(1) $P > Q > R$

(2) $Q > P > R$

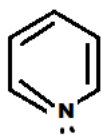
(3) $R > P > Q$

(4) $R > Q > P$

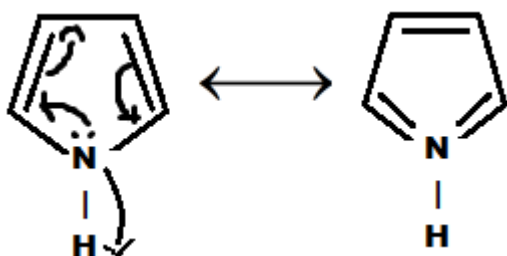
Answer:

(3)

Solution:


 SP^2 Hybridisation (L.P is consider for hybridisation). The lone pair is not conjugation.

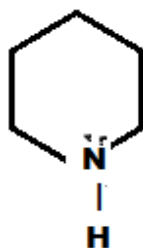
→ (P)



→ (Q)

← SP^2 hybridised.

This nitrogen contains 3σ bond and its hybridisation is SP^2 . Since the lone pair is delocalised inside the ring it doesn't take part in hybridisation and make this compound to be aromatic in nature.



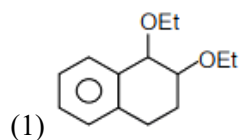
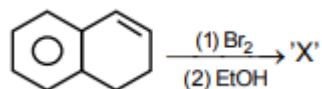
(R)

→ No delocalisation of Lone pair, Hybridisation is SP^3 .

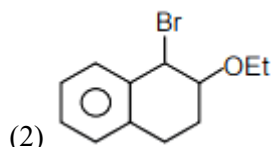
Higher the P-character, more it is basic in nature

Hence the order is $R > P > Q$

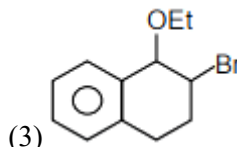
11. Product 'x' major will be



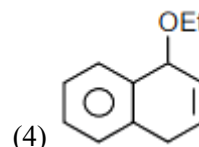
(1)



(2)



(3)



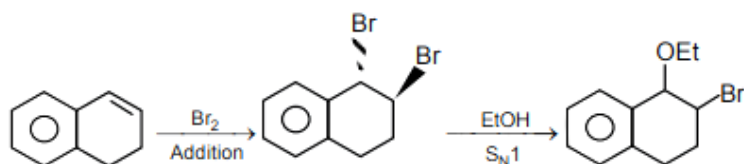
(4)

Answer:

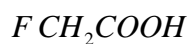
(3)

Solution:

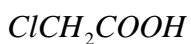
It involves Electrophilic addition of alkenes, followed by Nucleophilic substitution mechanism.



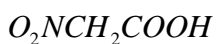
12. Arrange the following in order of K_a value



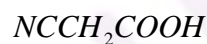
(P)



(Q)



(R)



(S)

(1) $P > Q > R > S$
 $> P$

(2) $R > S > P > Q$

(3) $R > P > S > Q$

(4) $R > S > Q$

Answer:

(2)

Solution:

Based on the order of $-I$ effect.

More the $-I$ effect greater its acidic strength.



Hence the correct order is $R > S > P > Q$

13. Presence of which makes water unsuitable for drinking.

(1) $Fe = 0.2 \text{ ppm}$

(2) $Cu = 2 \text{ ppm}$

(3) $Mn = 0.5 \text{ ppm}$

(4) $Zn = 0.05 \text{ ppm}$

Answer:

(3)

Solution:

Fact from NCERT

Presence of $Mn \geq 0.05 \text{ ppm}$ concentration makes water unsuitable for drinking.

14. Which of the following is strongest acid

- (1) $CHCl_3$ (2) CHI_3 (3) $CHBr_3$ (4) $CH(CN)_3$

Answer:

(4)

Solution:

Order lies with –I and –M effect.

–I and –M effect in CN is more when compared to Cl, I and Br. After losing H^+ the negative ion on the C will be delocalised to CN making it more stable and acidic.

Ans: $CH(CN)_3$

15. Which of the following alkaline earth metal nitrate does not crystalline with water of crystallization?

- (1) $Ca(NO_3)_2$ (2) $Mg(NO_3)_2$ (3) $Sr(NO_3)_2$ (4) $Ba(NO_3)_2$

Answer:

(4)

Solution:

- It depends on the polarization power of cation.
- The atom which is having larger size will have lesser polarization power and does not have water of crystallization.
- Ba^{2+} ion is larger in size in comparison \bar{c} , Ca^{2+} , Mg^{2+} and Sr^{2+} ion.
- $Ba(NO_3)_2$ is the correct option.

16. Which of the following ore contains iron and copper

- (1) Malachite (2) Azurite (3) Copper pyrite (4) None of these

Answer:

(3)

Solution:

Malachite – Copper ore $CuCO_3.Cu(OH)_2$

Azurite – Copper ore $2CuCO_3.Cu(OH)_2$

Copper pyrite - $Cu + Fe$ $CuFeS_2$ - Copper + Iron ore

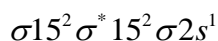
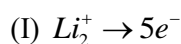
17. Considering MOT comment on the stability:

- (1) Li_2^+ stable Li_2^- unstable (2) Li_2^+ unstable Li_2^- stable
 (3) Li_2^+ unstable Li_2^- unstable (4) Li_2^+ stable Li_2^- stable

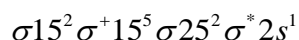
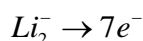
Answer:

(3)

Solution:



$$\text{Bond order} = \frac{N_b - N_A}{2} = \frac{3 - 2}{2} = \frac{1}{2}$$



$$\text{Bond order} = \frac{N_b - N_A}{2} = \frac{4 - 3}{2} = \frac{1}{2}$$

Both Li_2^+ , Li_2^- have same bond order. Unlikely 0.5 bond order does not exist so both Li_2^+ and Li_2^- are unstable.

If option were given as 1) $Li_2^+ > Li_2^-$

2) $Li_2^+ < Li_2^-$

3) $Li_2^+ = Li_2^-$

4) None of these

We can consider if same B.O is present, the species which is having lesser number of electrons present in anti-bonding orbital will be more stable so $Li_2^+ > Li_2^-$.

18. Which of the following property in a group decrease down the group and increase down the group respectively.

- (1) electronegativity and atomic radius
 (2) electronegativity and electro gain enthalpy
 (3) atomic radius and electronegativity
 (4) electro gain enthalpy and electronegativity

Answer:

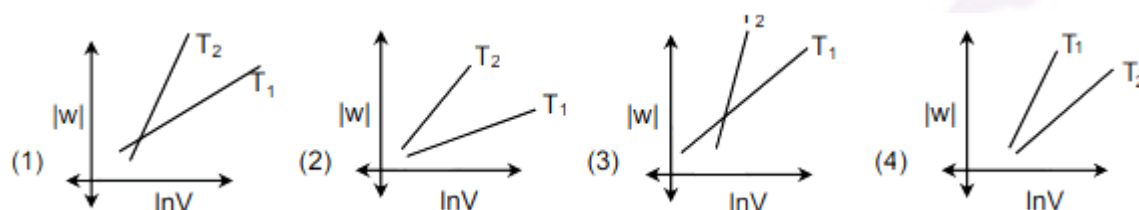
(1)

Solution:

On moving down the group electronegativity decreases.

On moving down the group atomic shell increases there by atomic radius increases.

19. Reversible isothermal expansion of gas for two temperature T_1 and T_2 ($T_2 > T_1$). Graph versus ($|w|$) and $\ln v$.

**Answer:**

(2)

Solution:

$$w = -nRT \ln \frac{v_f}{v_i} \rightarrow \text{constant is given same in all case.}$$

Take magnitude for W.

$$|w| = nRT \ln v_f - nRT V_i$$

$$T_2 > T_1$$

Lines cannot intersect and Intercept will be negative.

20. Which of the following properties is/are true for a silicone polymer?

- A) Thermally resistant and have low dielectric constant
- B) Resistant towards oxidation and used in grease
- C) Biocompatible
- D) Hydrophobic in nature

(1) A & B

(2) A, B & C

(3) B, C, & D

(4) A, B, C & D

Answer:

(4)

Solution:

All, A, B, C and D are true for a silicone polymer – Concept from NCERT

21. Which of the following is a piezo electric material?

- (1) Silica (2) Quartz (3) Mica (4) Beryl

Answer:

(2)

Solution:

NCERT – SOLID STATE

Piezoelectric → These are the material that produce electrical potential when pressure is applied on parallel and perpendicular phases.

EX - Quarts.

22. Aluminium exist in +3 stable where as thallium exist in both +1 & +3 oxidation state. Reason for this is

- (1) Inert pair effect (2) Lanthanoid contraction
(3) Diagonal relationship (4) None of these

Answer:

(1)

Solution:

Due to inert pair effect thallium exist both 1+ and +3 oxidation state. But Thallium is stable in +1 oxidation state.

23. Maximum spin only magnetic moment for transition metal complex may be

- (1) 5.92 BM (2) 6.92 BM (3) 4.89 BM (4) 3.87 BM

Answer:

(1)

Solution:

In Transition metal complex maximum number of unpaired electron possible is 5 and it will be present in d sub shell

$$\text{Formula} \rightarrow \sqrt{n(n+2)}BM$$

$n \Rightarrow$ no of impaired electron

$$= \sqrt{5(5+2)} = 5.92 \text{ BM}$$

24. Match the following drugs with correct functional group test

- | | |
|--------------------|-----------------------------|
| A) Chloroxylenol | P) Carbylamine |
| B) Penicillin | Q) Baeyer's reagent |
| C) Sulpha Pyridine | R) $FeCl_3$ test |
| D) Norethindrone | S) Sodium hydrogen sulphate |

(1) A \rightarrow R, B \rightarrow P, C \rightarrow S, D \rightarrow Q

(2) A \rightarrow S, B \rightarrow R, C \rightarrow P, D \rightarrow Q

(3) A \rightarrow R, B \rightarrow S, C \rightarrow P, D \rightarrow Q

(4) A \rightarrow Q, B \rightarrow R, C \rightarrow P, D \rightarrow S

Answer:

(2)

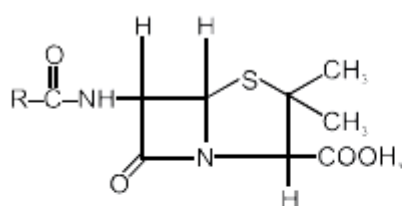
Solution:

Penicillin contains $COOH$ group – respond to sodium hydrogen sulphate test.

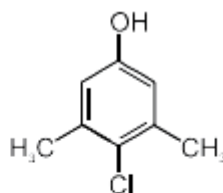
Chloroxylenol contains OH group – respond to neutral $FeCl_3$ test

Sulpha pyridine NH_2 group – respond to carbylamines test

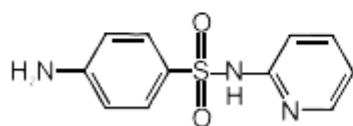
Norethindrone $C \equiv CH$ – respond to Bayer's test



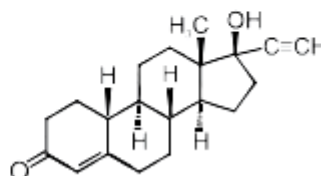
Penicillin



Chloroxylenol

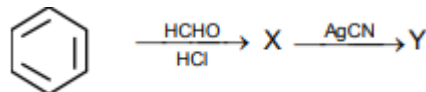


Sulphapyridine



Norethindrone

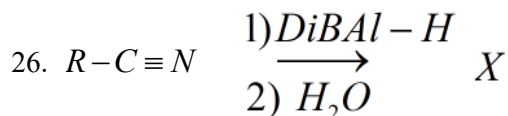
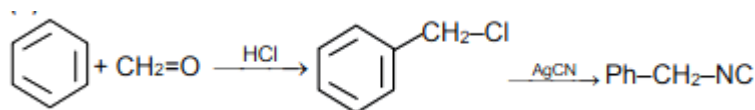
25. Product X \rightarrow Y will be



- | | |
|------------------|--------------|
| (1) $Ph-CH_2-Cl$ | $Ph-CH_2-NC$ |
| (2) $PhCH_2OH$ | $Ph-CH_2-CN$ |
| (3) $PhCH_2Cl$ | $Ph-CH_2-CN$ |
| (4) $Ph-OH$ | $Ph-CH_2-CN$ |

Answer:

(1)

Solution:

X will be

- (1) $R-CH=O$ (2) $R-CH_2-NH_2$ (3) $R-COOH$ (4) $R-NH_2$

Answer:

(1)

Solution:Classical reduction \longrightarrow Aldehyde is formed.

27. Arrange the following amino acids in order of their PKa order.

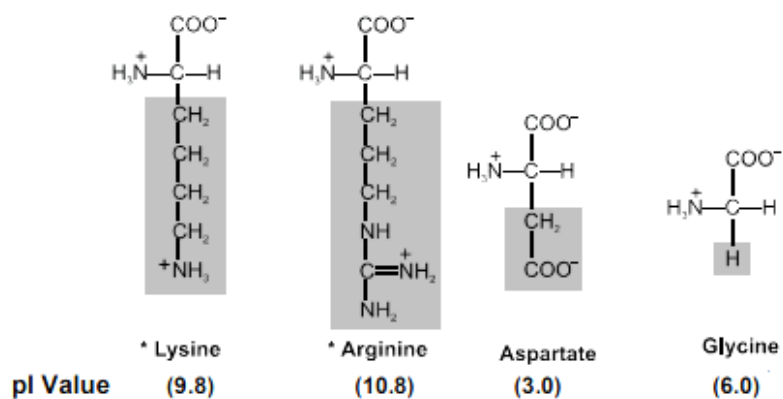
Lysine, Aspartic acid, Arginine, Glycine.

- (1) $lys > Arg > Gly > Asp$ (2) $Arg > Lys > Asp > Gly$
 (3) $Gly > Asp > Arg > Lys$ (4) $Arg > Lys > Gly > Asp$

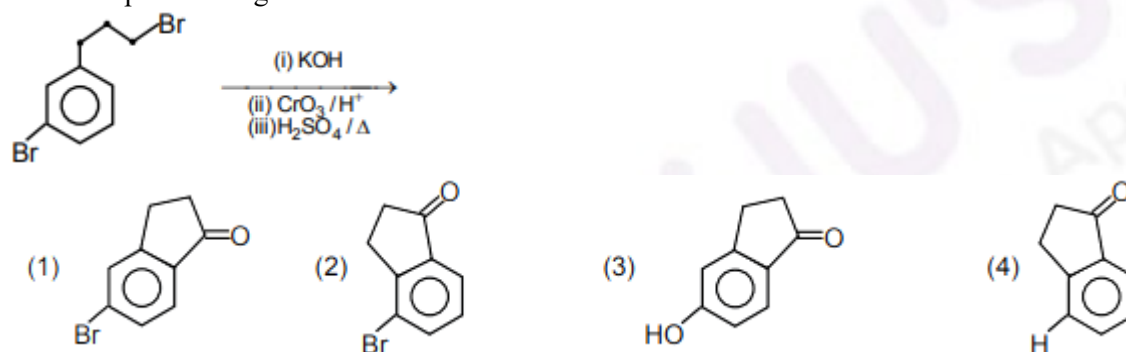
Answer:

(4)

Solution:



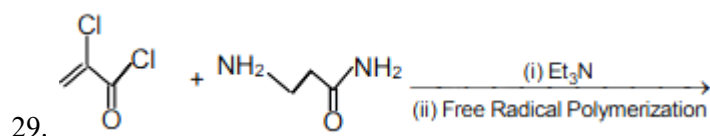
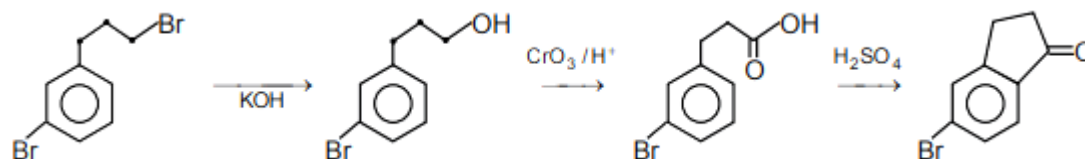
28. Write the product of given reaction:

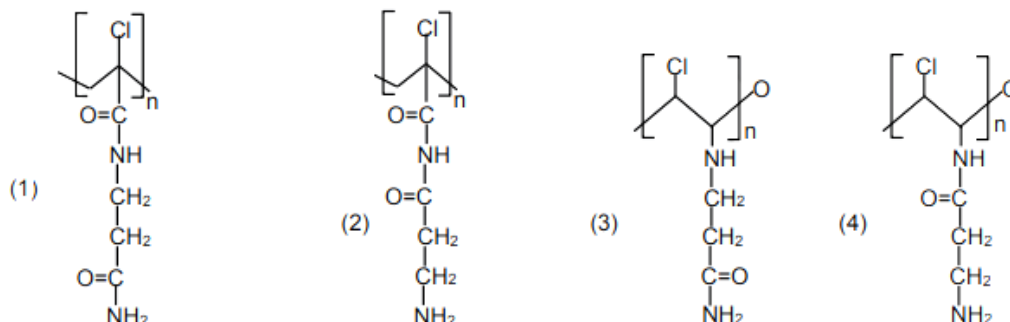


Answer:

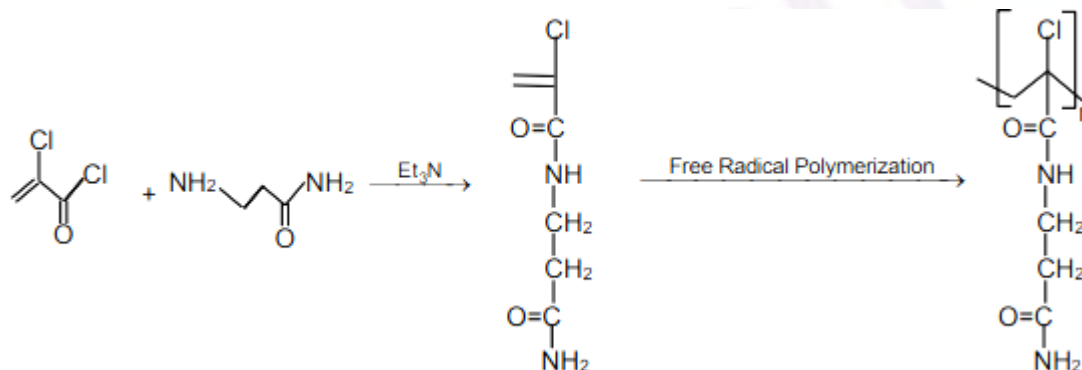
(1)

Solution: It involves nucleophilic substitution reaction (SN^2) followed by oxidation with oxidising agent and removal of water molecule.



**Answer:**

(1)

Solution:

30. Consider the compound A $[Cr(H_2O)_6]Cl_3$; yellow B $[Cr(NH_3)_6]Cl_3$; violet. Then which of the following is incorrect.

- (1) $(\Delta_0)_A < (\Delta_0)_B$
- (2) The crystal field splitting parameter can be measured by wavelengths of complementary colors for (A) and (B) respectively.
- (3) Both are paramagnetic with three unpaired electrons each.
- (4) the crystal field splitting parameter can be measured by wavelength of yellow and violet colors for (A) and (B) respectively.

Answer:

(4)

Solution:

The crystal field splitting parameter can't be measured by wavelength of yellow and violet colours for (A) & (B) respectively.