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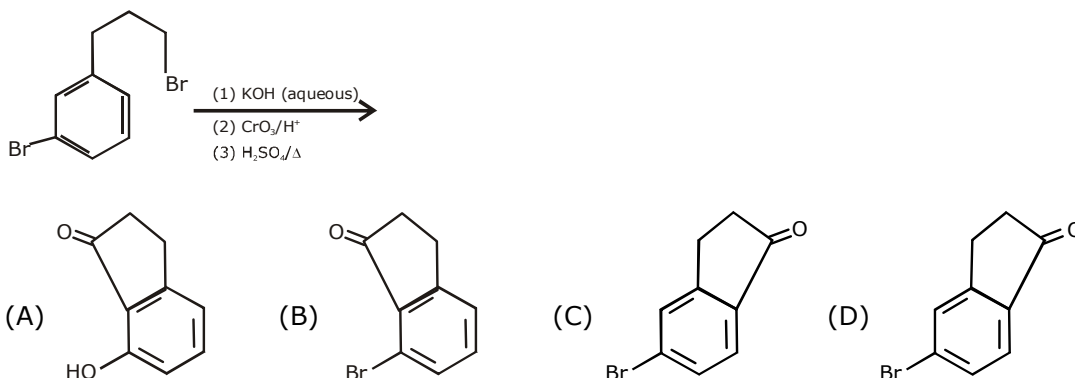
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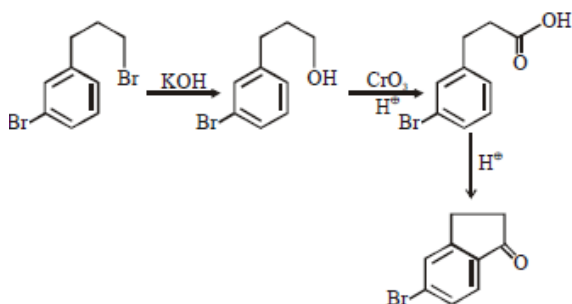
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[CHEMISTRY]

1. The major product of the following reaction



Sol. D



During AES Br is o/p directing and major product will be formed on less hindrance p position :

2. Aluminium is usually found in +3 oxidation state . In contrast, thallium exists in +1 and +3 oxidation states. This is due to :
- (A) diagonal relationship (B) inert pair effect
(C) lattice effect (D) lanthanoid contraction

Sol. B

Inert pair effect is prominent character of p- block element.

3. The highest value of the calculated spin only magnetic moment (in BM) among all the transition metal complexes is :
- (A) 5.92 (B) 3.87 (C) 4.90 (D) 6.93

Sol. A

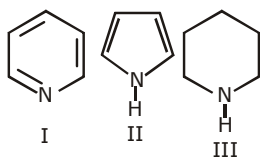
$$\mu = \sqrt{n(n+2)} \text{ B.M.}$$

n = Number of unpaired electrons

n = Maximum number of unpaired electron = 5

Ex : Mn^{2+} complex.

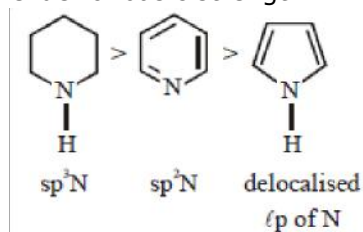
4. Arrange the following amines in the decreasing order of basicity :



- (A) III > II > I (B) I > II > III (C) III > I > II (D) I > III > II

Sol. C

Order of basic strength :



5. 0.5 moles of gas A and x moles of gas B exert a pressure of 200 Pa in container of volume 10m^3 at 1000 K. Given R is the gas constant in $\text{JK}^{-1}\text{mol}^{-1}$, x is :

- (A) $\frac{4+R}{2R}$ (B) $\frac{2R}{4-R}$ (C) $\frac{2R}{4+R}$ (D) $\frac{4-R}{2R}$

Sol. D/A (NTA)

$$n_T = (0.5 + x)$$

$$PV = n \times R \times T$$

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

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

$$\frac{2}{R} = \frac{1}{2} + x$$

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

$$\boxed{\frac{4-R}{2R} = x}$$

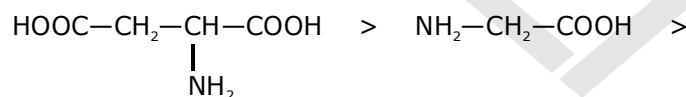
6. The increasing order of pKa of the following amino acids in aqueous solution is :

Gly Asp Lys Arg

- (A) Arg < Lys < Gly < Asp (B) Gly < Asp < Arg < Lys
 (C) Asp < Gly < Lys < Arg (D) Asp < Gly < Arg < Lys

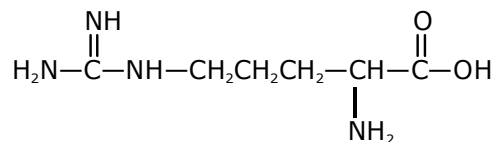
Sol. C

Order of acidic strength :



Aspartic acid

Glycine



Arginine

So, pKa

AsP < Gly < Arg < Lys

7. Which one of the following statements regarding Henry's law is not correct ?

- (A) The value of K_H increases with function of the nature of the gas
 (B) Higher the value of K_H at a given pressure, higher is the solubility of the gas in the liquids.
 (C) Different gases have different K_H (Henry's law constant) values at the same temperature.
 (D) vapour phase is proportional to the mole fraction of the gas in the solution

Sol. B

Liquid solution

$$P_{\text{gas}} = K_H \times X_{\text{gas}}$$

More is K_H less is solubility, lesser solubility is at higher temperature. So more is temperature more is K_H .

8. Two complexes $[\text{Cr}(\text{H}_2\text{O})_6]\text{Cl}_3$ (A) and $[\text{Cr}(\text{NH}_3)_6]\text{Cl}_3$ (B) are violet and yellow coloured, respectively. The incorrect statement regarding them is :

(A) Δ_0 value for (A) is less than that of (B)

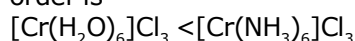
(B) both absorb energies corresponding to their complementary colors.

(C) Δ_0 values of (A) and (B) are calculated from the energies of violet and yellow light, respectively.

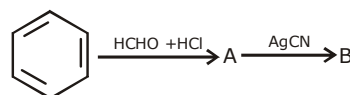
(D) both are paramagnetic with three unpaired electrons.

Sol. C

Δ_0 order will be compared by spectro chemical series not by energies of violet & yellow light so Δ_0 order is



9. The compounds A and B in the following reaction are, respectively :

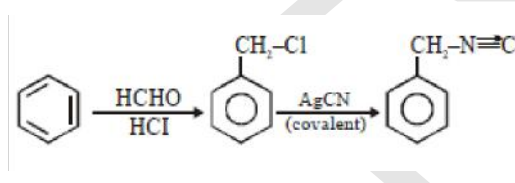


(A) A = Benzyl chloride, B = Benzyl isocyanide

(B) A = Benzyl chloride, B = Benzyl cyanide

(C) A = Benzyl alcohol, B = Benzyl cyanide

(D) A = Benzyl alcohol, B = Benzyl isocyanide

Sol. A

10. The isotopes of hydrogen are :

(A) Protium, deuterium and tritium

(B) Protium and deuterium only

(C) Deuterium and tritium only

(D) Tritium and protium only

Sol. A

Isotopes of hydrogen is :

Protium Deuterium Tritium

11. Correct statements among a to d regarding silicones are :

(1) They are polymers with hydrophobic character .

(2) They are biocompatible.

(3) In general, they have high thermal stability and low dielectric strength.

(4) Usually, they are resistant to oxidation and used as greases.

(A) (a), (b) and (d) only

(B) (a), (b) and (c) only

(C) (a), (b), (c) and (d)

(D) (a) and (b) only

Sol. A

These are properties and uses of silicones.

12. For emission line of atomic hydrogen from $n_1 = 8$ to n , the plot of wave number ($\bar{\nu}$) against $\left(\frac{1}{n^2}\right)$ will

be (The Rydberg constant, R_H is wave number unit)(A) Linear with intercept $-R_H$

(B) Non linear

(C) Linear with slope R_H (D) Linear with slope $-R_H$

Sol. C/D(NTA)

$$\frac{1}{\lambda} = \bar{\nu} = R_H Z^2 \left(\frac{1}{n_1^2} - \frac{1}{n_2^2} \right)$$

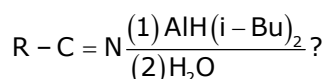
$$\bar{\nu} = R_H \times \frac{1}{n_1^2} - \frac{R_H}{8^2}$$

$$\bar{\nu} = R_H \times \frac{1}{n_1^2} - \frac{R_H}{64}$$

$$m = R_H$$

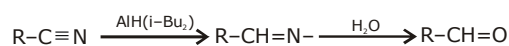
Linear with slope R_H

13. The major product of following reaction is :

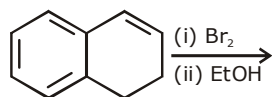


- (A) RCHO (B) RCH_2NH_2 (C) RCOOH (D) $RCONH_2$

Sol. A

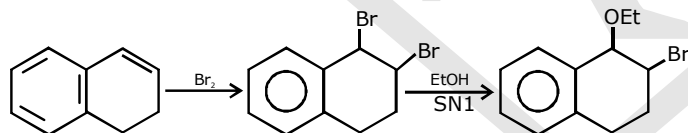


14. The major product of the following reaction is :



- (A) (B) (C) (D)

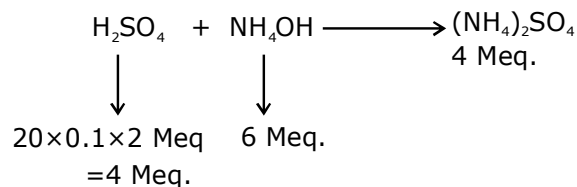
Sol. D



15. 20 mL of 0.1 M H_2SO_4 solution is added to 30 mL of 0.2 M NH_4OH solution. The pH of the resultant mixture is : [pK_b of $NH_4OH = 4.7$]

- (A) 5.0 (B) 5.2 (C) 9.4 (D) 9.0

Sol. D



It is a basic buffer

$$pOH = pK_b + \log \frac{4}{2} = 4.7 + 0.3 = 5.0$$

$$pH = 9$$

16. The alkaline earth metal nitrate that does not crystallise with water molecules, is :

- (A) $Sr(NO_3)_2$ (B) $Ba(NO_3)_2$
(C) $Ca(NO_3)_2$ (D) $Mg(NO_3)_2$

Sol. B

Smaller in size of center atoms more water molecules will crystallize hence $Ba(NO_3)_2$ is answer due to its largest size of '+ve' ion.

17. A water sample has ppm level concentration of the following metals :
 $\text{Fe} = 0.2$; $\text{Mn} = 5.0$; $\text{Cu} = 3.0$; $\text{Zn} = 5.0$ The metal that makes the water sample unsuitable for drinking to is :

(A) Mn (B) Zn (C) Cu (D) Fe

Sol. **A**

(i) Zn = 0.2 (ii) Fe = 0.2
 (iii) Mn = 5.0 (iv) Cu = 3.0

18. According to molecular orbital theory, which of the following is true with respect to Li_2^+ and Li_2^- ?
 (A) Li_2^+ is unstable and Li_2^- is stable (B) Li_2^+ is stable and Li_2^- is unstable
 (C) Both are unstable (D) Both are stable

Sol. **D (Same bond order)**

19. The correct match between Item-I and Item-II is :

Item-I
(drug)

Item-II
(test)

A Chloroxylenol
 B Norethindrone
 C Sulphapyridine
 D Penicillin

P Carbylamine test
 Q Sodium hydrogencarbonate test
 R Ferric chloride test
 S Bayer's test

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

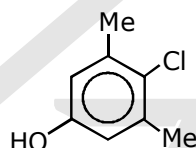
(B) $A \rightarrow Q$; $B \rightarrow S$; $C \rightarrow P$; $D \rightarrow R$

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

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

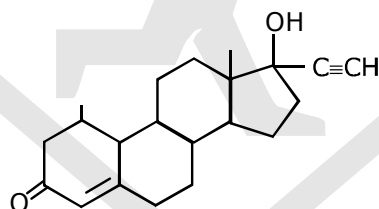
Sol. **D**

(A) Chloroxylenol



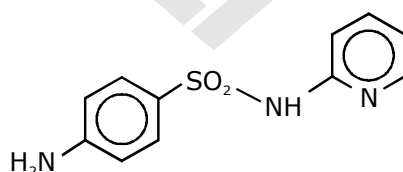
FeCl_3 test

(B) Norethindrone



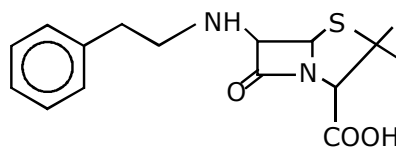
Bayer's test

(C) Sulphapyridine



carbylamine test

(D) Penicillin



Sodium hydrogen carbonate test

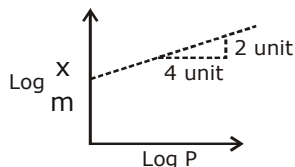
20. Which amongst the following is the strongest acid ?

(A) CHI_3 (B) CHCl_3
 (C) $\text{CH}(\text{CN})_3$ (D) CHBr_3

Sol. **C**

CN makes amino most stable so answer is $\text{CH}(\text{CN})_3$

21. Adsorption of a gas follows Freundlich adsorption isotherm. In the given plot, x is the mass of the gas adsorbed on mass m of the adsorbent at pressure p. $\frac{x}{m}$ is proportional to :



- (A) $p^{1/2}$ (B) $p^{1/4}$ (C) p (D) p^2

Sol. A

$$\frac{x}{m} = K \times p^{1/n}$$

$$\log \frac{x}{m} = \log K + \frac{1}{n} \log P$$

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

$$\text{So, } \frac{x}{m} = K \times p^{1/2}$$

22. The one that is extensively used as a piezoelectric material is :

- (A) quartz (B) tridymite (C) mica (D) amorphous silica

Sol. A

Quartz (Information)

23. The following results were obtained during kinetic studies of the reaction ;

Experiment	[A] (in mol L ⁻¹)	[B] (in mol L ⁻¹)	Initial Rate of reaction (in mol L ⁻¹ min ⁻¹)
I	0.10	0.20	6.93×10^{-3}
II	0.10	0.25	6.93×10^{-3}
III	0.20	0.30	1.386×10^{-2}

- (A) 1 (B) 10 (C) 5 (D) 100

Sol. C

$$6.93 \times 10^{-3} = K \times (0.1)^x (0.2)^y$$

$$6.93 \times 10^{-3} = K \times (0.1)^x (0.25)^y$$

$$\text{So } y = 0$$

$$\text{and } 1.386 \times 10^{-2} = K \times (0.2)^x (0.30)^y$$

$$\frac{1}{2} = \left(\frac{1}{2}\right)^x = x = 1$$

$$\text{So } r = K \times (0.1) \times (0.2)^0$$

$$6.93 \times 10^{-3} = K \times 0.1 \times (0.2)^0$$

$$K = 6.93 \times 10^{-2}$$

$$t_{1/2} = x = \frac{0.693}{2K} = \frac{0.693}{0.693 \times 10^{-1} \times 2} = \frac{10}{2} = 5$$

24. The correct decreasing order for acid strength is ;

- (A) $\text{NO}_2\text{CH}_2\text{COOH} > \text{NCCH}_2\text{COOH} > \text{FCH}_2\text{COOH} > \text{ClCH}_2\text{COOH}$
 (B) $\text{CNCH}_2\text{COOH} > \text{O}_2\text{NCH}_2\text{COOH} > \text{FCH}_2\text{COOH} > \text{ClCH}_2\text{COOH}$
 (C) $\text{NO}_2\text{CH}_2\text{COOH} > \text{FCH}_2\text{COOH} > \text{CNCH}_2\text{COOH} > \text{ClCH}_2\text{COOH}$
 (D) $\text{FCH}_2\text{COOH} > \text{NCCH}_2\text{COOH} > \text{NO}_2\text{CH}_2\text{COOH} > \text{ClCH}_2\text{COOH}$

Sol. A

EWG increase acidic strength
 $\text{NO}_2\text{CH}_2\text{COOH} > \text{NCCH}_2\text{COOH} >$
 $\text{FCH}_2\text{COOH} > \text{ClCH}_2\text{COOH}$

25. The ore that contains both iron and copper is :

(A) malachite (B) copper pyrites (C) azurite (D) dolomite

Sol. B

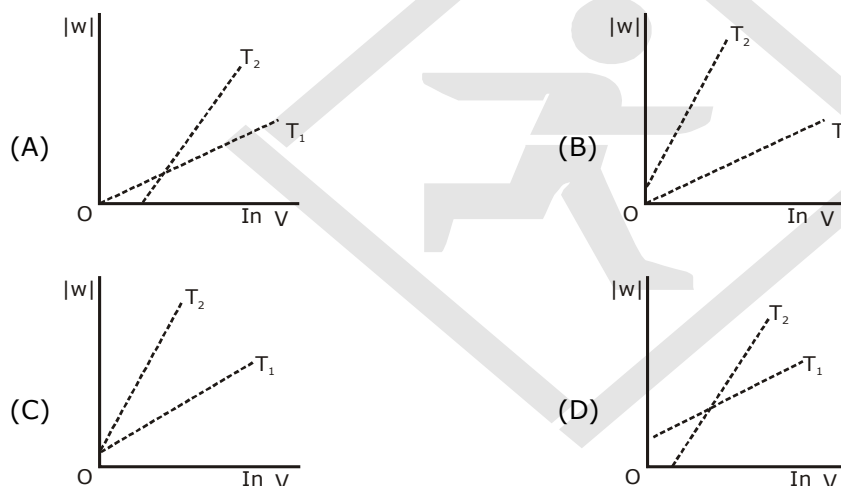
Copper pyrites : CuFeS_2
 Malachite : $\text{Cu}(\text{OH})_2 \cdot \text{CuCO}_3$
 Azurite $\text{Cu}(\text{OH})_2 \cdot 2\text{CuCO}_3$
 Dolomite $\text{CaCO}_3 \cdot \text{MgCO}_3$

26. In general, the properties that decrease and increase down a group in the periodic table, respectively, are :

(A) electronegativity and atomic radius (B) electron gain enthalpy and electronegativity
 (C) atomic radius and electronegativity (D) electronegativity and electron gain enthalpy.

Sol. A

Electronegativity decreases as we go down the group and atomic radius increases as we go down the group.

27. Consider the reversible isothermal expansion of an ideal gas in a closed system at two different temperatures T_1 and T_2 ($T_1 < T_2$). The correct graphical depiction of the dependence of work done (w) on the final volume (V) is :**Sol. A**

$$w = -nRT \ln \frac{V_2}{V_1}$$

$$w = -nRT \ln \frac{V_b}{V_1}$$

$$|w| = nRT \ln \frac{V_b}{V_i}$$

$$|w| = nRT (\ln V_b - \ln V_i)$$

$$Y = m x - C$$

So, slope of curve 2 is more than curve 1 and intercept of curve 2 is more negative than curve 1.

28. A solution of sodium sulfate contains 92 g of Na^+ ions per kilogram of water. The molality of Na^+ ions in that solution in mol kg^{-1} is :

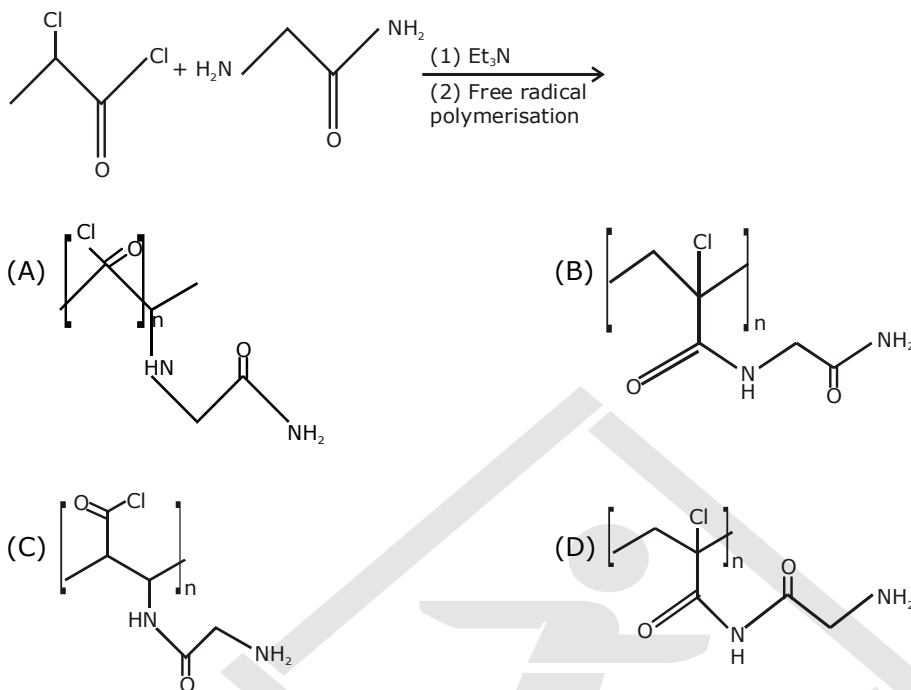
(A) 4 (B) 8 (C) 12 (D) 16

Sol. A

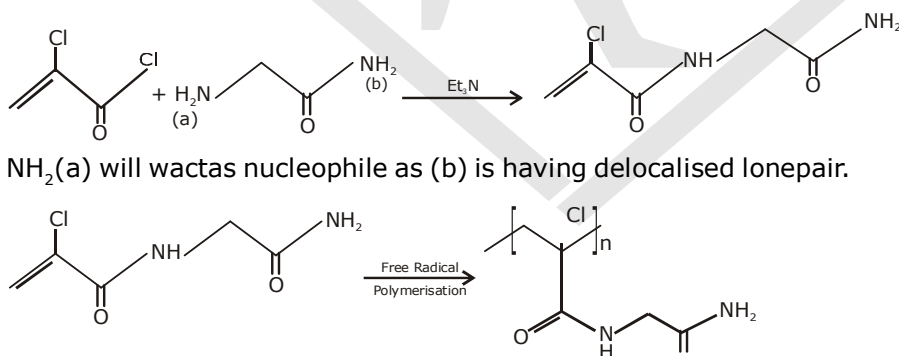
$$n_{\text{Na}^+} = \frac{92}{23} = 4$$

So molality = 4

29. Major product of the following reaction is :



Sol. B



NH₂(a) will act as nucleophile as (b) is having delocalised lone pair.

30. The anodic half-cell of lead-acid battery is recharged using electricity of 0.05 Faraday. The amount of PbSO₄ electrolyzed in g during the process is : (Molar mass of PbSO₄ = 303 g mol⁻¹)
 (A) 11.4 (B) 22.8 (C) 7.6 (D) 15.2

Sol. C

