

JEE Main Online Exam 2019

Questions & Solutions

8th April 2019 | Shift - I

CHEMISTRY

Q.1 The lanthanide ion that would show colour is -

- (1) La^{3+} (2) Gd^{3+} (3) Sm^{3+} (4) Lu^{3+}

Ans. [3]

Sol. Sm^{+3} (Yellow)

Due to presence of unpaired e^-

Q.2 Given that $E_{\text{O}_2/\text{H}_2\text{O}}^\ominus = +1.23 \text{ V}$; $E_{\text{S}_2\text{O}_8^{2-}/\text{SO}_4^{2-}}^\ominus = 2.05 \text{ V}$

$$E_{\text{Br}_2/\text{Br}^-}^\ominus = +1.09 \text{ V}; E_{\text{Au}^{3+}/\text{Au}}^\ominus = +1.4 \text{ V}$$

The strongest oxidizing agent is -

- (1) $\text{S}_2\text{O}_8^{2-}$ (2) O_2 (3) Au^{3+} (4) Br_2

Ans. [1]

Sol. Strongest oxidising agent \propto lowest position in electrochemical series (ECS)

So Ans. = $\text{S}_2\text{O}_8^{2-}$

Q.3 The size of the iso-electronic species Cl^- , Ar and Ca^{2+} is affected by -

- (1) nuclear charge
(2) azimuthal quantum number of valence shell
(3) electron-electron interaction in the outer orbitals
(4) principal quantum number of valence shell

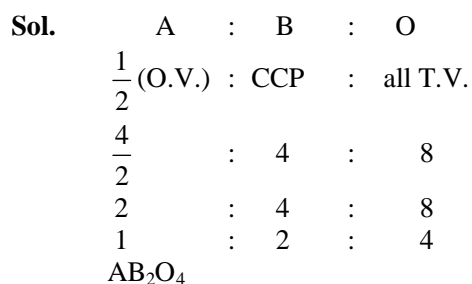
Ans. [1]

Sol. Due to Z_{eff} .

Q.4 Element 'B' forms ccp structure and 'A' occupies half of the octahedral voids, while oxygen atoms occupy all the tetrahedral voids. The structure of bimetallic oxide is -

- (1) A_2BO_4 (2) $\text{A}_4\text{B}_2\text{O}$ (3) AB_2O_4 (4) $\text{A}_2\text{B}_2\text{O}$

Ans. [3]



Q.5 The correct order of hydration enthalpies of alkali metal ions is -

- | | |
|---------------------------------------|---------------------------------------|
| (1) $Li^+ > Na^+ > K^+ > Rb^+ > Cs^+$ | (2) $Na^+ > Li^+ > K^+ > Rb^+ > Cs^+$ |
| (3) $Li^+ > Na^+ > K^+ > Cs^+ > Rb^+$ | (4) $Na^+ > Li^+ > K^+ > Cs^+ > Rb^+$ |

Ans. [1]

Sol. Li^+ having minimum radius so maximum hydration and maximum hydration radii.

Q.6 Diborane (B_2H_6) reacts independently with O_2 and H_2O to produce, respectively -

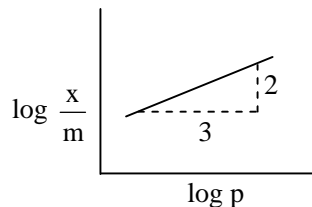
- | | |
|-----------------------------|----------------------------|
| (1) H_3BO_3 and B_2O_3 | (2) B_2O_3 and H_3BO_3 |
| (3) B_2O_3 and $[BH_4]^-$ | (4) HBO_2 and H_3BO_3 |

Ans. [2]

Sol. $B_2H_6 + O_2 \rightarrow B_2O_3$ Boric anhydride

$B_2H_6 + H_2O \rightarrow H_3BO_3$ Boric acid

Q.7 Adsorption of a gas follows Freundlich adsorption isotherm. x is the mass of the gas adsorbed on mass m of the adsorbent. The plot of $\log \frac{x}{m}$ versus $\log p$ is shown in the given graph. $\frac{x}{m}$ is proportional to -

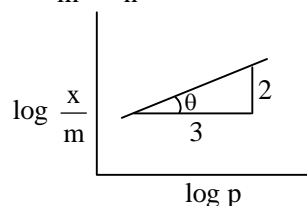


- | | | | |
|---------------|---------------|-----------|-----------|
| (1) $p^{3/2}$ | (2) $p^{2/3}$ | (3) p^3 | (4) p^2 |
|---------------|---------------|-----------|-----------|

Ans. [2]

Sol. $\frac{x}{m} = Kp^{1/n}$

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



$$\text{Slope} = \tan \theta = \frac{2}{3} = \frac{1}{n}$$

$$\frac{x}{m} \propto p^{2/3}$$

Q.8 The quantum number of four electrons are given below :

I. $n = 4, l = 2, m_l = -2, m_s = -\frac{1}{2}$

II. $n = 3, l = 2, m_l = 1, m_s = +\frac{1}{2}$

III. $n = 4, l = 1, m_l = 0, m_s = +\frac{1}{2}$

IV. $n = 3, l = 1, m_l = 1, m_s = -\frac{1}{2}$

The correct order of their increasing energies will be -

(1) $I < III < II < IV$

(2) $IV < II < III < I$

(3) $I < II < III < IV$

(4) $IV < III < II < I$

Ans. [2]

Sol. Higher the value of $(n + l)$

Higher will be energy of orbital. If $(n + l)$ are equal, then higher the value n higher will be energy

I. $n + l = 6$ $n = 4$

II. $n + l = 5$ $n = 3$

III. $n + l = 5$ $n = 4$

IV. $n + l = 4$ $n = 3$

$IV < II < III < I$

Q.9 In order to oxidise a mixture of one mole of each of FeC_2O_4 , $\text{Fe}_2(\text{C}_2\text{O}_4)_3$, FeSO_4 and $\text{Fe}_2(\text{SO}_4)_3$ in acidic medium, the number of moles of KMnO_4 required is -

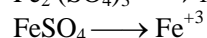
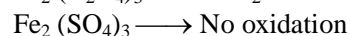
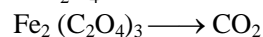
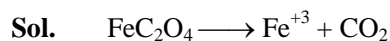
(1) 2

(2) 1

(3) 1.5

(4) 3

Ans. [1]



$\text{g}_m \text{ E} (\text{KMnO}_4) = \text{g}_m \text{ E} (\text{FeC}_2\text{O}_4) + \text{g}_m \text{ E} [\text{Fe}_2(\text{C}_2\text{O}_4)_3] + \text{g}_m \text{ E} (\text{FeSO}_4)$

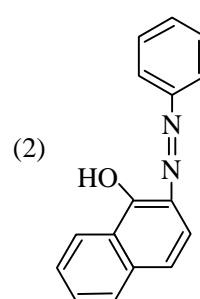
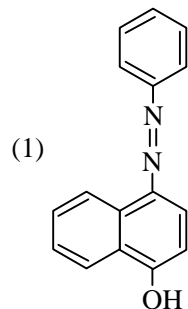
$\text{moles} \times \text{V.F.} = \text{moles} \times \text{V.F.} + \text{moles} \times \text{V.F.} + \text{mole} \times \text{V.F.}$

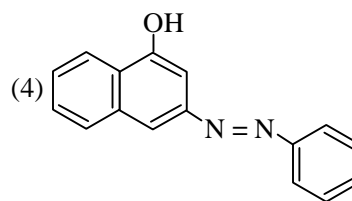
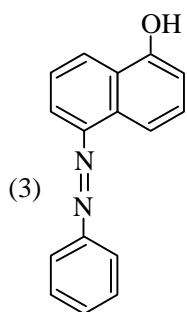
$x \times 5 = (1 \times 3) + (1 \times 6) + (1 \times 1)$

$5x = 10$ ($\text{MnO}_4^- \longrightarrow \text{Mn}^{+2}$)

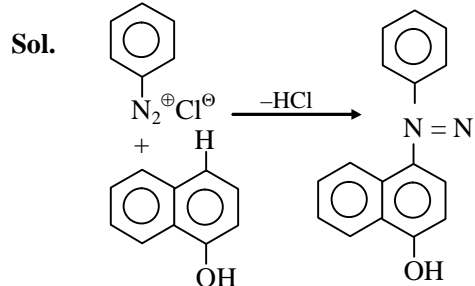
$x = 2$

Q.10 Coupling of benzene diazonium chloride with 1-naphthol in alkaline medium will give -

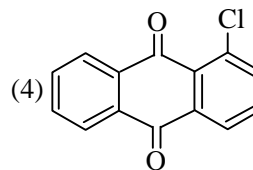
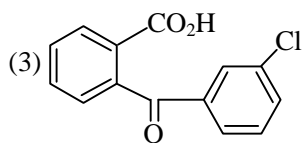
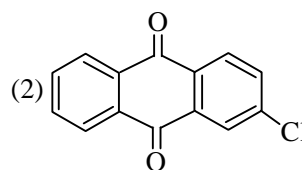
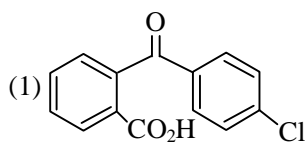
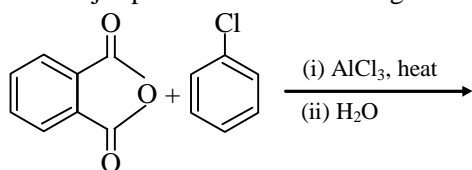




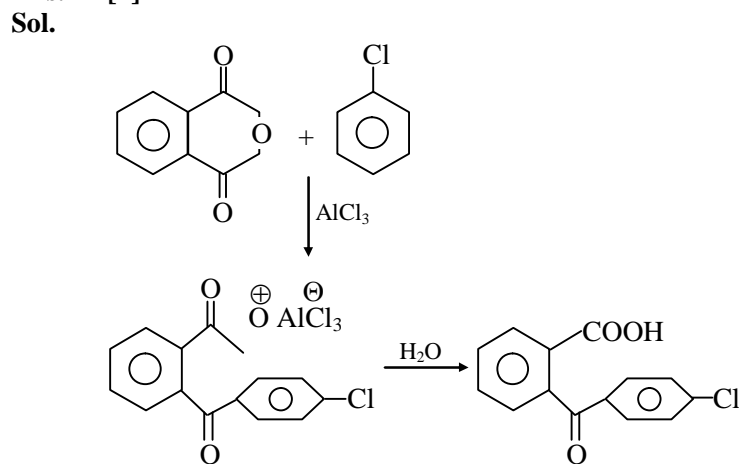
Ans. [1]



Q.11 The major product of the following reaction is -



Ans. [1]



Q.12 Which one of the following equations does not correctly represent the first law of thermodynamics for the given processes involving an ideal gas ? (Assume non-expansion work is zero)

(1) Adiabatic process : $\Delta U = -w$

(2) Cyclic process : $q = -w$

(3) Isothermal process : $q = -w$

(4) Isochoric process : $\Delta U = q$

Ans. [1]

Sol. Ist law of thermodynamics

$$\Delta E = q + w$$

1. Adiabatic process

$$q = 0, (\Delta E = w) \text{ or } (\Delta U = w)$$

2. Cyclic process

$$\Delta E = 0, (q = -w)$$

3. Isothermal process

$$\Delta E = nC_V\Delta T, (\Delta T = 0)$$

$$\Delta E = 0, (q = -w)$$

4. Isochoric process $\Delta V = 0$

$$w = P\Delta V = 0$$

$$\Delta E = q$$

Q.13 The vapour pressures of pure liquids A and B are 400 and 600 mmHg, respectively at 298 K. On mixing the two liquids, the sum of their initial volumes is equal to the volume of the final mixture. The mole fraction of liquid B is 0.5 in the mixture. The vapour pressure of the final solution, the mole fractions of components A and B in vapour phase, respectively are -

(1) 500 mmHg, 0.5, 0.5

(2) 450 mmHg, 0.5, 0.5

(3) 500 mmHg, 0.4, 0.6

(4) 450 mmHg, 0.4, 0.6

Ans. [3]

Sol. $P_A^\circ = 400 \text{ mmHg}$

$$P_B^\circ = 600 \text{ mmHg}$$

$$x_B = 0.5, P_S = ?, y_A = ?, y_B = ?$$

$$P_S = P_A^\circ x_A + P_B^\circ x_B$$

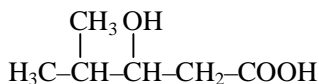
$$= 400 (0.5) + 600 (0.5)$$

$$= 200 + 300 = 500$$

$$y_A = \frac{P_A}{P_S} = \frac{200}{500} = \frac{2}{5} = 0.4$$

$$y_B = 0.6$$

Q.14 The IUPAC name of the following compound is -



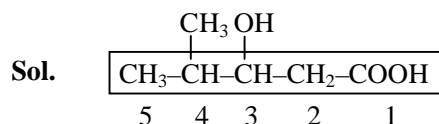
(1) 4,4-Dimethyl-3-hydroxybutanoic acid

(2) 2-Methyl-3-hydroxypentan-5-oic acid

(3) 4-Methyl-3-hydroxypentanoic acid

(4) 3-Hydroxy-4-methylpentanoic acid

Ans. [4]



- Q.15** With respect to an ore, Ellingham diagram helps to predict the feasibility of its -
- (1) Electrolysis (2) Thermal reduction
(3) Zone refining (4) Vapour phase refining

Ans. [2]

Sol. Thermal reduction
Reduction by (C) and (CO)

- Q.16** The correct order of the spin-only magnetic moment of metal ions in the following low spin complexes, $[\text{V}(\text{CN})_6]^{4-}$, $[\text{Fe}(\text{CN})_6]^{4-}$, $[\text{Ru}(\text{NH}_3)_6]^{3+}$, and $[\text{Cr}(\text{NH}_3)_6]^{2+}$ is -

- (1) $\text{V}^{2+} > \text{Cr}^{2+} > \text{Ru}^{3+} > \text{Fe}^{2+}$ (2) $\text{V}^{2+} > \text{Ru}^{3+} > \text{Cr}^{2+} > \text{Fe}^{2+}$
(3) $\text{Cr}^{2+} > \text{Ru}^{3+} > \text{Fe}^{2+} > \text{V}^{2+}$ (4) $\text{Cr}^{2+} > \text{V}^{2+} > \text{Ru}^{3+} > \text{Fe}^{2+}$

Ans. [1]

Sol. Due to unpaired electron and pairings electrons due to strong ligands.

- Q.17** In the following compounds, the decreasing order of basic strength will be -

- (1) $\text{C}_2\text{H}_5\text{NH}_2 > \text{NH}_3 > (\text{C}_2\text{H}_5)_2\text{NH}$ (2) $\text{NH}_3 > \text{C}_2\text{H}_5\text{NH}_2 > (\text{C}_2\text{H}_5)_2\text{NH}$
(3) $(\text{C}_2\text{H}_5)_2\text{NH} > \text{NH}_3 > \text{C}_2\text{H}_5\text{NH}_2$ (4) $(\text{C}_2\text{H}_5)_2\text{NH} > \text{C}_2\text{H}_5\text{NH}_2 > \text{NH}_3$

Ans. [4]

Sol. Due to +I effect

- Q.18** **Assertion :** Ozone is destroyed by CFCs in the upper stratosphere.

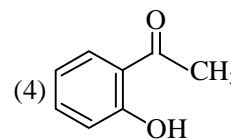
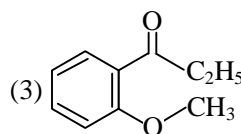
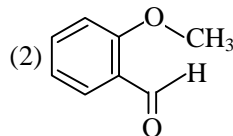
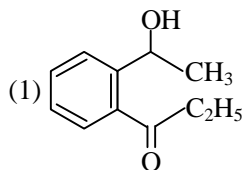
Reason : Ozone holes increase the amount of UV radiation reaching the earth.

- (1) Assertion is false, but the reason is correct
(2) Assertion and reason are incorrect
(3) Assertion and reason are both correct, and the reason is the correct explanation for the assertion
(4) Assertion and reason are correct, but the reason is not the explanation for the assertion

Ans. [4]

Sol. Ozonolayer is depleted due to CFCS

- Q.19** An organic compound neither reacts with neutral ferric chloride solution nor with Fehling solution. It however, reacts with Grignard reagent and gives positive iodoform test. The compound is -



Ans. [1]

Sol. No phenolic group
No Aldehyde group

Q.20 For the reaction $2A + B \rightarrow C$, the values of initial rate at different reactant concentrations are given in the table below. The rate law for the reaction is :

[A] (mol L ⁻¹)	[B] (mol L ⁻¹)	Initial Rate (mol L ⁻¹ s ⁻¹)
0.05	0.05	0.045
0.10	0.05	0.090
0.20	0.10	0.72

(1) Rate = $k[A][B]$

(2) Rate = $k[A][B]^2$

(3) Rate = $k[A]^2[B]^2$

(4) Rate = $k[A]^2[B]$

Ans. [2]

Sol. $r = k[A]^p[B]^q$

$$\frac{r_2}{r_1} = \left[\frac{A_2}{A_1} \right]^p \left[\frac{B_2}{B_1} \right]^q$$

$$2^1 = 2^p \quad (p = 1)$$

$$\frac{r_3}{r_2} = \left[\frac{A_3}{A_2} \right]^1 \left[\frac{B_3}{B_2} \right]^q$$

$$\frac{0.720}{0.090} = 2(2)^q$$

$$\frac{720}{90 \times 2} = 2^q = 4 = 2^2$$

$$q = 2$$

$$r = k[A]^1[B]^2$$

Q.21 If solubility product of $Zr_3(PO_4)_4$ is denoted by K_{sp} and its molar solubility is denoted by S , then which of the following relation between S and K_{sp} is correct ?

(1) $S = \left(\frac{K_{sp}}{216} \right)^{1/7}$

(2) $S = \left(\frac{K_{sp}}{6912} \right)^{1/7}$

(3) $S = \left(\frac{K_{sp}}{144} \right)^{1/6}$

(4) $S = \left(\frac{K_{sp}}{929} \right)^{1/9}$

Ans. [2]

Sol. $Zr_3(PO_4)_4$

$$K_{sp} = (3S)^3 (4S)^4$$

$$K_{sp} = 6912S^7$$

$$S = \left(\frac{K_{sp}}{6912} \right)^{1/7}$$

Q.22 An organic compound 'X' showing the following solubility profile is –

'X'	Water	→ insoluble
	5% HCl	→ insoluble
	10% NaOH	→ soluble
	10% NaHCO ₃	→ insoluble

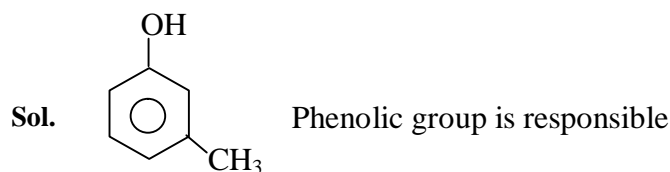
(1) Benzamide

(2) Oleic acid

(3) m-Cresol

(4) o-Toluidine

Ans. [3]



Q.23 For silver, $C_p(\text{JK}^{-1} \text{mol}^{-1}) = 23 + 0.01 T$. If the temperature (T) of 3 moles of silver is raised from 300 K to 1000 K at 1 atm pressure, the value of ΔH will be close to -

(1) 13 kJ

(2) 16 kJ

(3) 62 kJ

(4) 21 kJ

Ans. [3]

Sol. $C_p = 23 + 0.01 T$

$n = 3$ moles

$T_1 = 300$ K

$T_2 = 1000$ K

$\Delta H = nC_p \Delta T$

$$\Delta H = n \int_{T_1}^{T_2} C_p \Delta T$$

$$= 3 \int_{300}^{1000} (23 + 0.01T) dT$$

$$= 3 \int_{300}^{1000} \left(23T + \frac{0.01T^2}{2} \right)$$

$$= 61.95 \text{ kJ/mole}$$

$$= 62 \text{ kJ/mole}$$

Q.24 Which is wrong with respect to our responsibility as a human being to protect our environment ?

(1) Restricting the use of vehicles

(2) Avoiding the use of floodlighted facilities

(3) Setting up compost tin in gardens

(4) Using plastic bage

Ans. [4]

Sol. Plastic bags

- Q.25** 100 mL of a water sample contains 0.81 g of calcium bicarbonate and 0.73 g of magnesium bicarbonate. The hardness of this water sample expressed in terms of equivalents of CaCO_3 is -
 (molar mass of calcium bicarbonate is 162 g mol^{-1} and magnesium bicarbonate is 146 g mol^{-1})
 (1) 100 ppm (2) 1,000 ppm (3) 5,000 ppm (4) 10,000 ppm

Ans. [4]

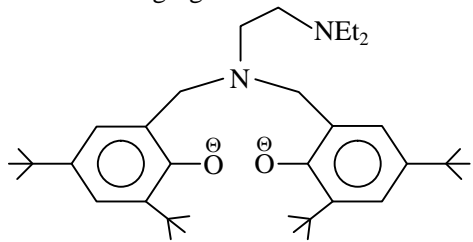
Sol. ppm of $\text{CaCO}_3 = ?$

$$\text{degree of hardness} = \frac{\text{weight of hardness causing salt}}{\text{Mw}} \times 100$$

1 ppm = 1 part CaCO_3 eq in 10^6 parts water

$$\begin{aligned} \text{ppm of } \text{CaCO}_3 &= \frac{\left(\frac{0.73}{146} + \frac{0.81}{162}\right) \times 100}{100} \times 10^6 \\ &= 10^4 \text{ ppm} \\ &= 10,000 \text{ ppm} \end{aligned}$$

- Q.26** The following ligand is -



(1) bidentate

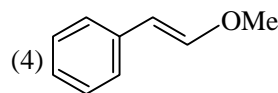
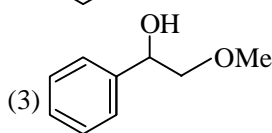
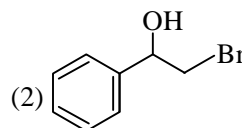
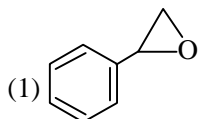
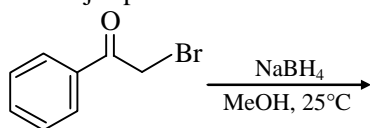
(2) tridentate

(3) tetradentate

(4) hexadentate

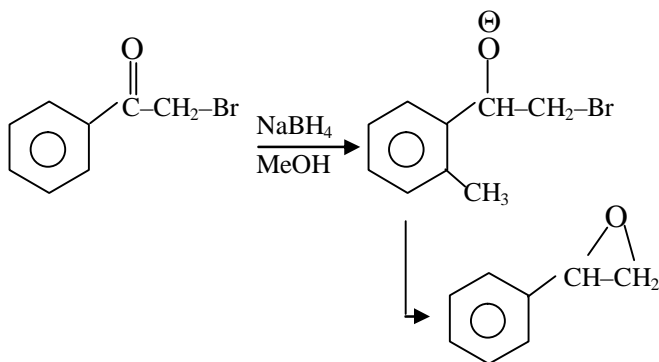
Ans. [3]

- Q.27** The major product of the following reaction is -



Ans. [1]

Sol.

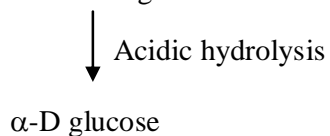


Q.28 Maltose on treatment with dilute HCl gives -

- (1) D-Glucose (2) D-Fructose
 (3) D-Glucose and D-Fructose (4) D-Galactose

Ans. [1]

Sol. Dimer of α -D glucose



Q.29 Which of the following amines can be prepared by Gabriel phthalimide reaction ?

- (1) triethylamine (2) t-butylamine (3) neo-pentylamine (4) n-butylamine

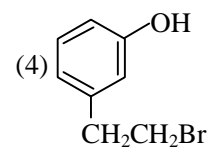
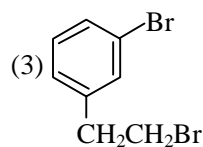
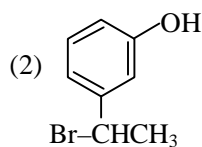
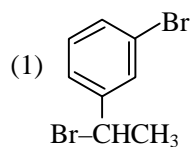
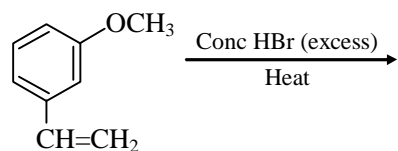
Ans. [4]

Sol. n - Butyl amine



only unhindered 1° Amines are products of this reaction

Q.30 The major product of the following reaction is -



Ans. [2]

Sol.

