

JEE Main Online Exam 2019

Questions & Solutions

9th April 2019 | Shift - I

CHEMISTRY

Q.1 Liquid 'M' and liquid 'N' form an ideal solution. The vapour pressures of pure liquids 'M' and 'N' are 450 and 700 mmHg, respectively, at the same temperature. Then correct statements is :

(x_M = Mole fraction of 'M' in solution ;

x_N = Mole fraction of 'N' in solution;

y_M = Mole fraction of 'M' in vapour phase;

y_N = Mole fraction of 'N' in vapour phase)

(1) $\frac{x_M}{x_N} < \frac{y_M}{y_N}$

(2) $\frac{x_M}{x_N} = \frac{y_M}{y_N}$

(3) $\frac{x_M}{x_N} > \frac{y_M}{y_N}$

(4) $(x_M - y_M) < (x_N - y_N)$

Ans. [3]

Sol. $P_M^\circ = 450$

$P_N^\circ = 700$

$y_M = \frac{P_M^\circ X_M}{P_S}$

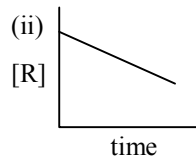
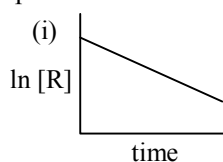
$y_N = \frac{P_N^\circ X_N}{P_S}$

$\frac{y_M}{y_N} = \frac{P_M^\circ}{P_N^\circ} \frac{X_M}{X_N}$

$\frac{y_M}{y_N} = \frac{450}{700} \frac{X_M}{X_N}$

$\frac{X_M}{X_N} > \frac{y_M}{y_N}$

Q.2 The given plots represent the variation of the concentration of a reactant R with time for two different reactions (i) and (ii). The respective orders of the reactions are :



(1) 1, 1

(2) 0, 1

(3) 1, 0

(4) 0, 2

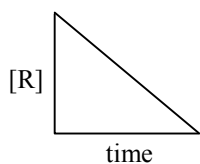
Ans. [3]



For zero order reaction

$(a - x) = -K_0t + a$

$[A]_t = -K_0t + [A]_0$



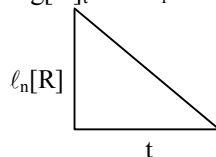
for I order reaction

$$K_1 = \frac{2.3}{t} \log \frac{a}{a-x}$$

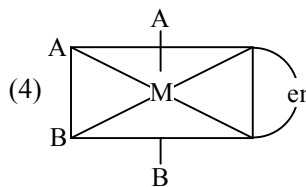
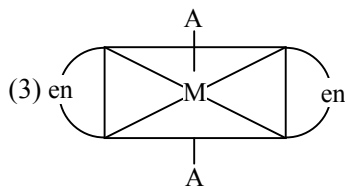
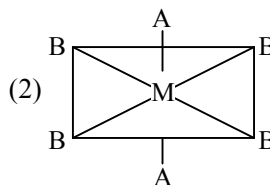
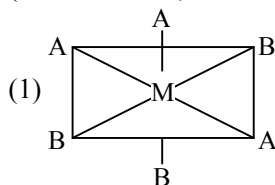
$$K_1 = \frac{1}{t} \ln \frac{a}{a-x}$$

$$K_1 t = \log a - \log a - x$$

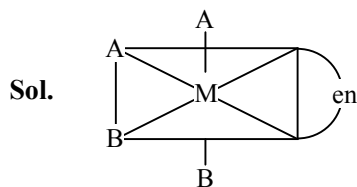
$$\log[A]_t = -K_1 t + \log[A_0]$$



Q.3 The one that will show optical activity is :
(en = ethane-1,2-diamine)

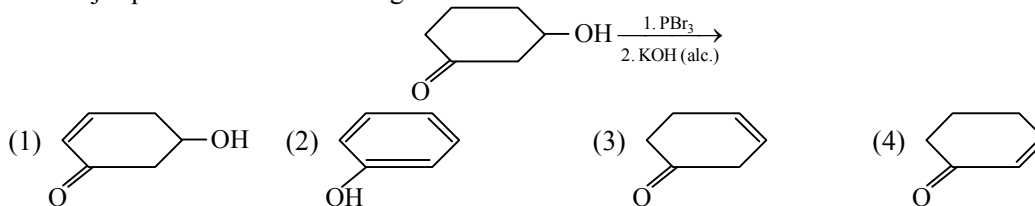


Ans. [4]

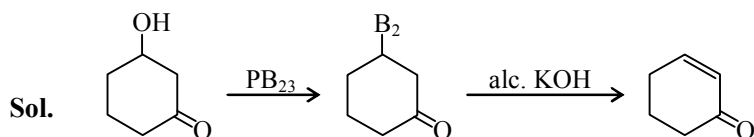


No plane of symmetry \therefore optically active

Q.4 The major product of the following reaction is :



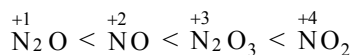
Ans. [4]



- Q.5** The correct order of the oxidation states of nitrogen in NO, N₂O, NO₂ and N₂O₃ is :
 (1) NO₂ < NO < N₂O₃ < N₂O (2) N₂O < NO < N₂O₃ < NO₂
 (3) NO₂ < N₂O₃ < NO < N₂O (4) N₂O < N₂O₃ < NO < NO₂

Ans. [2]

Sol. order of oxidation state –

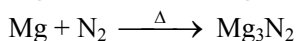
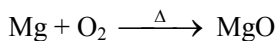


- Q.6** Magnesium powder burns in air to give :

- (1) MgO only (2) MgO and Mg(NO₃)₂
 (3) MgO and Mg₃N₂ (4) Mg(NO₃)₂ and Mg₃N₂

Ans. [3]

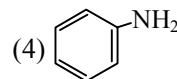
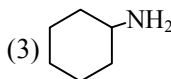
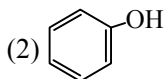
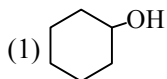
Sol. Air contain both N₂ and O₂



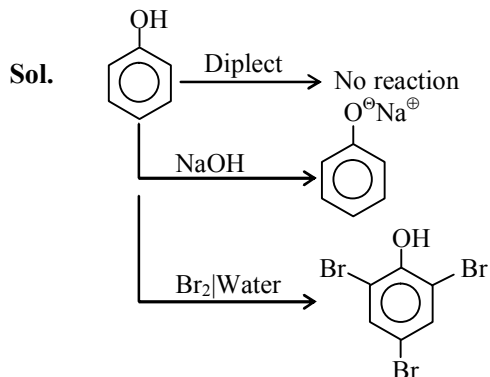
∴ Both MgO and Mg₃N₂ are formed.

- Q.7** The organic compound that gives following qualitative analysis is :

- | Test | Inference |
|----------------------------|-----------------|
| (a) Dil. HCl | Insoluble |
| (b) NaOH solution | soluble |
| (c) Br ₂ /water | Decolourization |



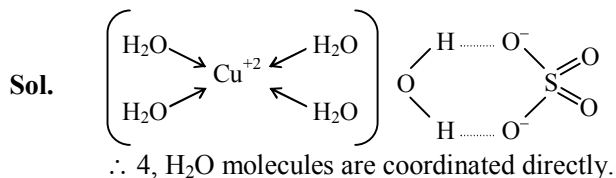
Ans. [2]



- Q.8** The number of water molecule(s) not coordinated to copper ion directly in CuSO₄·5H₂O, is :

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

Ans. [2]



Q.9 Match the catalysts (Column I) with products (Column II).

Column I Catalyst	Column II Product
(A) V_2O_5	(i) Polyethylene
(B) $TiCl_4/Al(Me)_3$	(ii) ethanal
(C) $PdCl_2$	(iii) H_2SO_4
(D) Iron Oxide	(iv) NH_3

(1) (A)-(iii); (B)-(iv); (C)-(i); (D)-(ii)

(2) (A)-(ii); (B)-(iii); (C)-(i); (D)-(iv)

(3) (A)-(iv); (B)-(iii); (C)-(ii); (D)-(i)

(4) (A)-(iii); (B)-(i); (C)-(ii); (D)-(iv)

Ans. [4]

Sol. (A)-(iii); (B)-(i); (C)-(ii); (D)-(iv)

Q.10 Excessive release of CO_2 into the atmosphere results in :

(1) depletion of ozone (2) polar vortex (3) global warming (4) formation of smog

Ans. [3]

Sol. Fact

Q.11 C_{60} , an allotrope of carbon contains :

(1) 16 hexagons and 16 pentagons. (2) 12 hexagons and 20 pentagons.

(3) 18 hexagons and 14 pentagons. (4) 20 hexagons and 12 pentagons.

Ans. [4]

Sol. C_{60} contains
20 hexagons and 12 pentagons

Q.12 Among the following, the molecule expected to be stabilized by anion formation is :

C_2, O_2, NO, F_2

(1) NO (2) O_2 (3) C_2 (4) F_2

Ans. [3]

Sol. The molecule in which B.O. \uparrow with formation of anion, will get stabilize.

F_2	—	F_2^-		C_2	→	C_2^{-1}
BO	1	0.5		BO	2	2.5
NO	—	NO^-		O_2	→	O_2^{-1}
BO	2.5	2.0			2	1.5

\therefore Ans. C_2 (3)

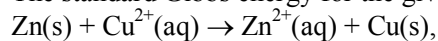
Q.13 The osmotic pressure of a dilute solution of an ionic compound XY in water is four times that of a solution of 0.01 M $BaCl_2$ in water. Assuming complete dissociation of the given ionic compounds in water, the concentration of XY (in $mol\ L^{-1}$) in solution is :

(1) 4×10^{-4} (2) 4×10^{-2} (3) 16×10^{-4} (4) 6×10^{-2}

Ans. [4]

Sol. $\pi_{xy} = 4\pi_{BaCl_2}$
 $iCRT = 4(iCRT)$
 $2C = 4 \times 3(0.01)$
 $C = 0.06 = 6 \times 10^{-2} M$

Q.14 The standard Gibbs energy for the given cell reaction in kJ mol^{-1} at 298 K is :



$$E^\circ = 2\text{V at } 298\text{ K}$$

(Faraday's constant, $F = 96000\text{ C mol}^{-1}$)

(1) - 192

(2) 192

(3) - 384

(4) 384

Ans. [3]

Sol. $\Delta G = -nF E_{\text{cell}}$
 $= -2(96000)^2$
 $= -384000\text{ J/mole}$
 $= -384\text{ KJ/mole}$

Q.15 The element having greatest difference between its first and second ionization energies, is :

(1) Ca

(2) Sc

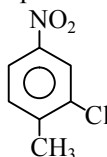
(3) K

(4) Ba

Ans. [3]

Sol. K has $4s^1$ configuration
 \therefore after removal of outermost e^- it acquires inert gas configuration.
 \therefore Greatest jump in I.E. is observed

Q.16 The correct IUPAC name of the following compound is :



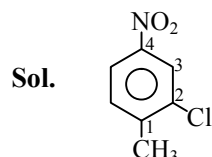
(1) 5-chloro-4-methyl-1-nitrobenzene

(2) 2-chloro-1-methyl-4-nitrobenzene

(3) 2-methyl-5-nitro-1-chlorobenzene

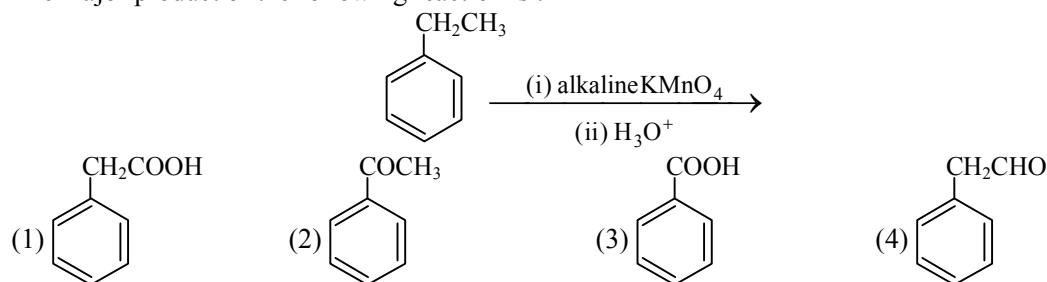
(4) 3-chloro-4-methyl-1-nitrobenzene

Ans. [2]

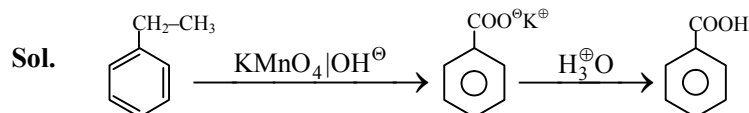


2-Chloro-1-methyl-4-nitrobenzene

Q.17 The major product of the following reaction is :



Ans. [3]



Q.18 The aerosol is a kind of colloid in which :

- (1) gas is dispersed in liquid (2) solid is dispersed in gas
(3) liquid is dispersed in water (4) gas is dispersed in solid

Ans. [2]

Sol. Aerosol = solid is dispersed in gas

Q.19 The ore that contains the metal in the form of fluoride is :

- (1) cryolite (2) magnetite (3) malachite (4) sphalerite

Ans. [1]

Sol. Cryolite = Na_3AlF_6
Contain fluoride

Q.20 The degenerate orbitals of $[\text{Cr}(\text{H}_2\text{O})_6]^{3+}$ are :

- (1) d_{z^2} and d_{xz} (2) d_{yz} and d_{z^2} (3) d_{xz} and d_{yz} (4) $d_{x^2-y^2}$ and d_{xy}

Ans. [3]

Sol. $[\text{Cr}(\text{H}_2\text{O})_6]^{3+}$ has sp^3d^2 hybridization orbitals involved are S, P_x , P_y , P_z , $d_{x^2-y^2}$ and d_{z^2} .

None of the options are correct.

Q.21 Consider the van der Waals constants, a and b, for the following gases.

Gas	Ar	Ne	Kr	Xe
$a/(\text{atm dm}^6 \text{ mol}^{-2})$	1.3	0.2	5.1	4.1
$b/(10^{-2} \text{ dm}^3 \text{ mol}^{-1})$	3.2	1.7	1.0	5.0

Which gas is expected to have the highest critical temperature?

- (1) Xe (2) Ne (3) Kr (4) Ar

Ans. [3]

Sol. $T_c = \frac{8a}{27Rb}$

$$T_c \propto \frac{a}{b}$$

Kr has highest ratio or $\frac{a}{b}$

Q.22 For a reaction,

$\text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) \rightarrow 2\text{NH}_3(\text{g})$; identify dihydrogen (H_2) as a limiting reagent in the following reaction mixtures.

- (1) 14 g of N_2 + 4g of H_2 (2) 28 g of N_2 + 6g of H_2
(3) 56 g of N_2 + 10g of H_2 (4) 35 g of N_2 + 8g of H_2

Ans. [3]

Sol. $\text{N}_2 + 3\text{H}_2 \rightarrow 2\text{NH}_3$

1. 14gm 4gm
 $\frac{1}{2}$ mole 2 mole

$$\text{L.R} \begin{bmatrix} 1 \\ \frac{1}{2} \\ 1 \end{bmatrix} \quad \begin{pmatrix} 2 \\ 3 \end{pmatrix}$$

(N_2)

2. 28 gm 6 gm
 1 mole 3 mole
 $\left(\frac{1}{1}\right)$ $\left(\frac{3}{3}\right)$
3. 56 gm 10 gm
 2 mole 5 mole
 $\left(\frac{2}{1}\right)$ $\left(\frac{5}{3}\right) = (1.66) \text{ H}_2$
4. 35 gm 8 gm
 $\frac{35}{28}$ mole 4 mole
 $\frac{35}{28}$ $\frac{4}{3}$
 = 1.25 1.33
 (N₂)

Q.23 For any given series of spectral lines of atomic hydrogen, let $\Delta \bar{\nu} = \bar{\nu}_{\max} - \bar{\nu}_{\min}$ be the difference in maximum and minimum frequencies in cm^{-1} . The ratio $\Delta \bar{\nu}_{\text{Lyman}} / \Delta \bar{\nu}_{\text{Balmer}}$ is :

- (1) 4 : 1 (2) 9 : 4 (3) 27 : 5 (4) 5 : 4

Ans. [2]

Sol.

$$\frac{\Delta \bar{\nu}_{\text{Lyman}}}{\Delta \bar{\nu}_{\text{Balmer}}} \bar{\nu} = RZ^2 \left(\frac{1}{n_1^2} - \frac{1}{n_2^2} \right)$$

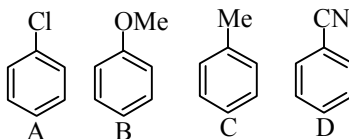
$$= \frac{\Delta \bar{\nu}_{\max} - \Delta \bar{\nu}_{\min}}{\Delta \bar{\nu}_{\max} - \Delta \bar{\nu}_{\min}}$$

$$= \frac{\left[\frac{1}{1} - \frac{1}{\infty} \right] - \left[\frac{1}{1} - \frac{1}{4} \right]}{\left[\frac{1}{4} - \frac{1}{\infty} \right] - \left[\frac{1}{4} - \frac{1}{9} \right]}$$

$$= \frac{\frac{1}{4}}{\frac{1}{9}} = \frac{9}{4}$$

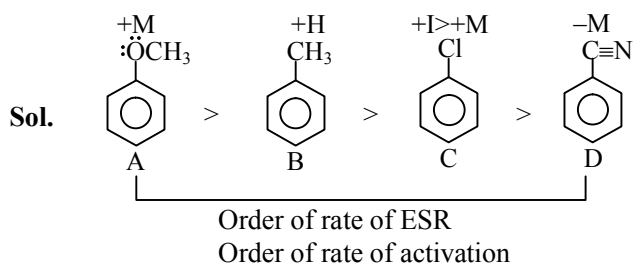
$$= 9 : 4$$

Q.24 The increasing order of reactivity of the following compounds towards aromatic electrophilic substitution reaction is :



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

Ans. [1]



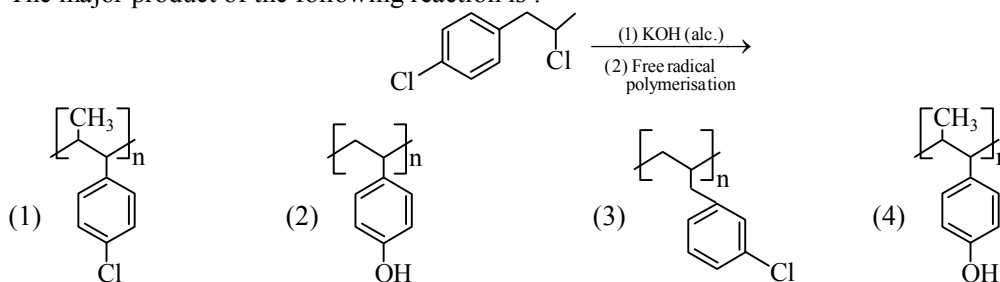
Q.25 Among the following, the set of parameters that represents path functions, is :

- (A) $q + w$ (B) q (C) w (D) $H - TS$
 (A) (A), (B) and (C) (B) (A) and (B) (C) (A) and (D) (D) (B), (C) and (D)

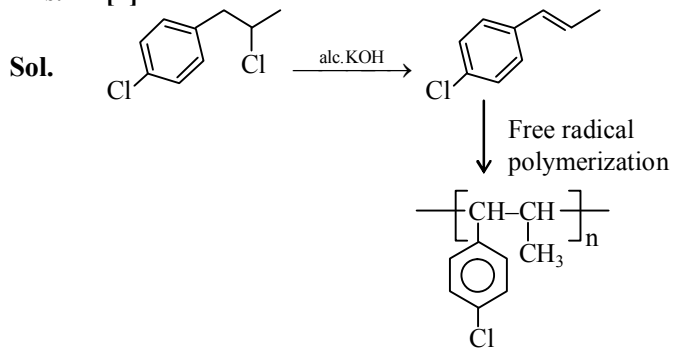
Ans. [2]

- Sol.** (A) $q + w = \Delta E$ state function
 (B) $q =$ Path function
 (C) $w =$ Path function
 (D) $H - TS = G =$ State function

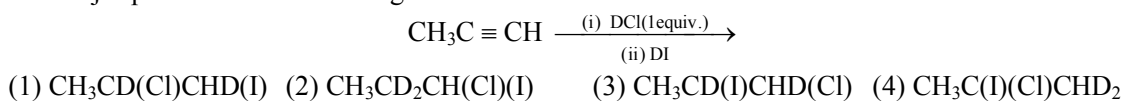
Q.26 The major product of the following reaction is :



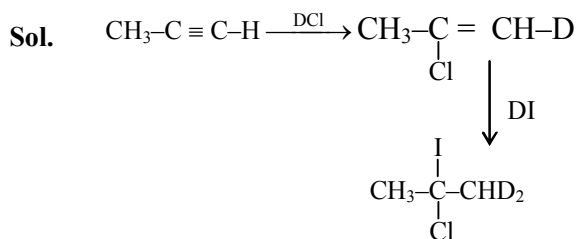
Ans. [1]



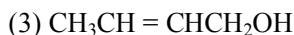
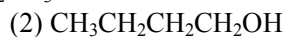
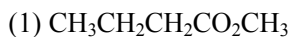
Q.27 The major product of the following reaction is :



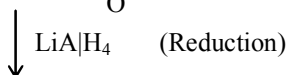
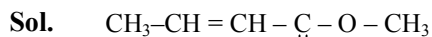
Ans. [4]



Q.28 The major product of the following reaction is :



Ans. [3]



(1°-Alcohol)

Q.29 Which of the following statements is not true about sucrose?

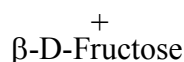
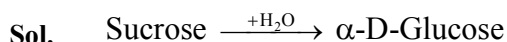
(1) On hydrolysis, it produces glucose and fructose

(2) It is also named as invert sugar. The glycosidic linkage is present

(3) between C_1 of α -glucose and C_1 of β -fructose

(4) It is a non reducing sugar

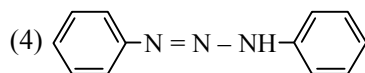
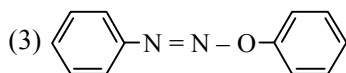
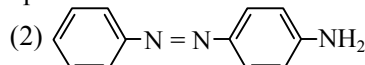
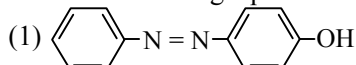
Ans. [3]



In β -D-Fructose \rightarrow C-2 is involved

In β -D-Glucose \rightarrow C-1 is involved

Q.30 Aniline dissolved in dilute HCl is reacted with sodium nitrite at 0°C . This solution was added dropwise to a solution containing equimolar mixture of aniline and phenol in dil. HCl. The structure of the major product is



Ans. [2]

