VIDYAPEETH ACADEMY
SINCE 2013
IIT JEE | NEET | FOUNDATION

Head Office: 216 & 217, 2nd Floor, Grand Plaza, Fraser Road, Dak Bunglow, Patna - 01

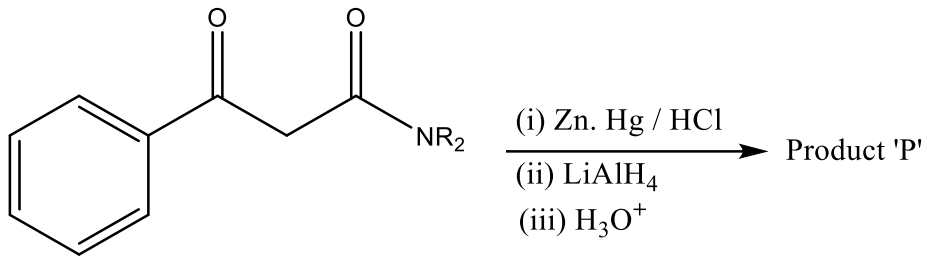
**JEE Main 2023 (Memory based)**

**29 January 2023 - Shift 1**

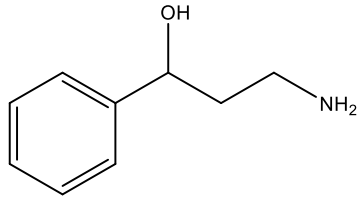
*Answer & Solutions*

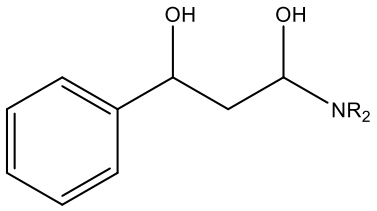
## CHEMISTRY

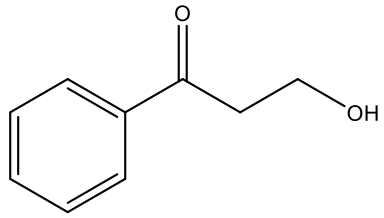
**1.** Consider the following sequence of reactions: -

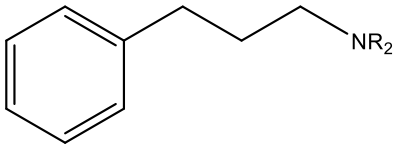



The Product 'P' is?

A. 

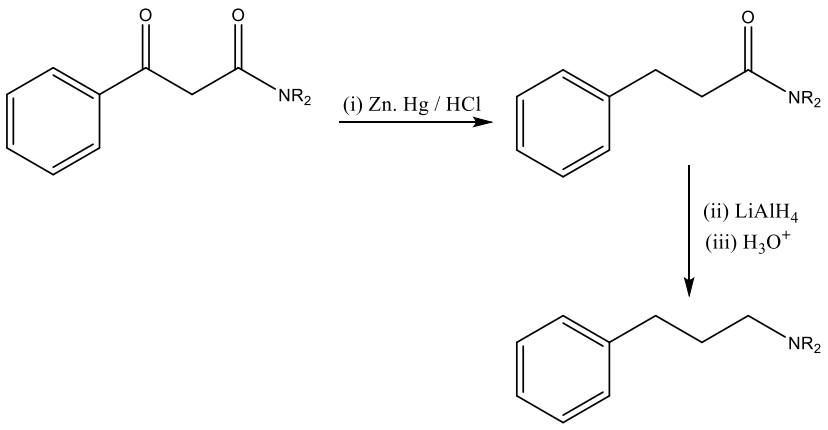

B. 


C. 

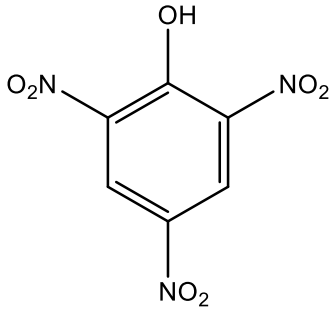

D. 

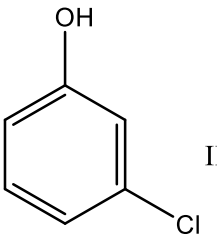

**Answer (D)**

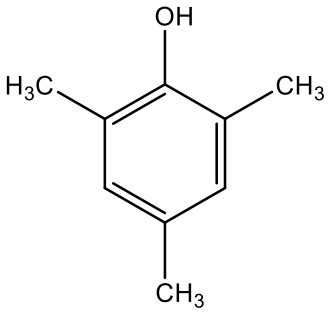
**Solution:**

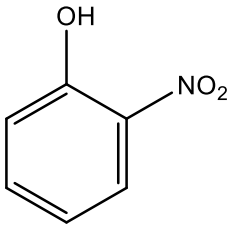


**2.** Following compounds are given

I) 


II) 


III) 


IV) 


Compare $pK_a$ values

A. I > IV > II > III
B. I > IV > III > II
C. III > II > IV > I
D. IV > I > II > III

**Answer (C)**

**Solution:**

Acidic strength $\propto -I, -M$ Groups

Acidic strength $\propto \frac{1}{+I,+M}$ Groups

Acidic strength order: I > IV > II > III

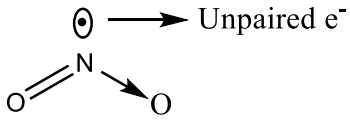
$pK_a$ order: III > II > IV > I

**3.** Which of the following compound(s) is/are paramagnetic
a) $NO_2$
b) $NO$
c) $K_2O$
d) $Na_2O_2$

A. a & b only
B. a, b & c only
C. a, b, c & d
D. a, b & d only

**Answer (A)**

**Solution:**

$\boldsymbol{NO_2}$**:** 


$NO$: ($N_e$ = 15)

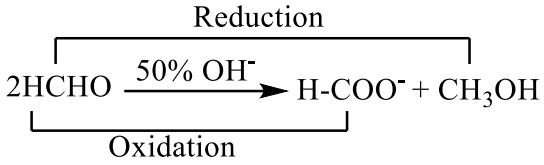
1 Unpaired electron as per MOT.

**4.** Cannizzaro reaction is an example of disproportionation reaction. What is the catalyst used in Cannizzaro reaction?

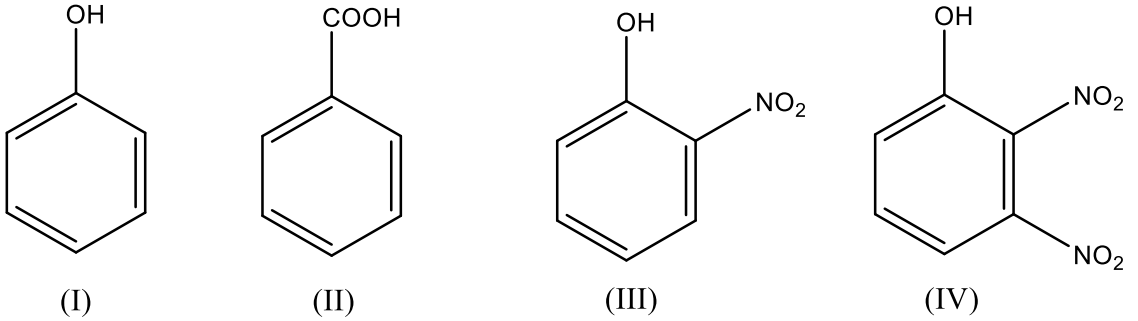
A. $FeCl_3$
B. $NaOH/H_2O$
C. $ZnCl_2/H^+$
D. $H_2/Pd/BaSO_4$

**Answer (B)**

**Solution:**




**5.** Arrange the following in decreasing $pK_a$ values




A. IV > III > II > I
B. I > III > IV > II
C. IV > III > I > II
D. IV > II > III > I

**Answer (B)**

**Solution:**

$Acidity \propto \frac{1}{pK_a}$

The order of acidity is: II > IV > III > I

Therefore, their value of $pK_a$ will be: I > III > IV > II

**6.** Which of the following reaction corresponds to Mond's process

A. $ZrI_4 \xrightarrow{1800\ K} Zr + 2I_2$
B. $Ni(CO)_4 \xrightarrow{450-470\ K} Ni + 4CO$
C. $2[Au(CN)_2]^-(aq) + Zn(s) \rightarrow 2Au(s) + [Zn(CN)_4]^{2-}(aq)$
D. $2Al_2O_3 + 3C \rightarrow 4Al + 3CO_2$

**Answer (B)**

**Solution:**

Mond process for refining Nickel

$Ni + 4CO \xrightarrow{330-350\ K} Ni(CO)_4$

$Ni(CO)_4 \xrightarrow{450-470\ K} Ni + 4CO$

**7.** Which of the following option contains the correct match

| List – I | List - II |
|---|---|
| P. Clemmenson reduction | i. $Con.KOH$ |
| Q. Reimer Tiemann reaction | ii. $Br_2/NaOH$ |
| R. Cannizzaro reaction | iii. $CHCl_3/KOH$ |
| S. Hoffmann bromamide degradation reaction | iv. $Zn - Hg/HCl$ |

A. P–(i), Q–(ii), R–(iii), S–(iv)
B. P–(iv), Q–(iii), R–(i), S–(ii)
C. P–(ii), Q–(iii), R–(iv), S–(i)
D. P–(iii), Q–(iv), R–(i), S–(ii)

**Answer (B)**

**Solution:**

Clemmenson reduction - $Zn - Hg/HCl$

Reimer - Tiemann reaction - $CHCl_3/KOH$

Cannizzaro reaction - $Con.KOH$

Hoffmann bromamide degradation reaction - . $Br_2/NaOH$

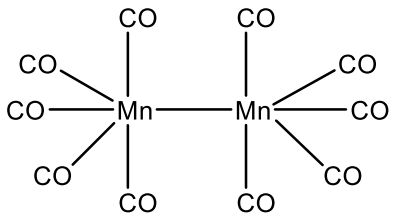
**8.** X: No of Bridge Bonds present in compound $Mn_2(CO)_{10}$
Y: No of Bridge Bonds present in compound $W(CO)_6$

Find out (X+Y)

**Answer (00.00)**

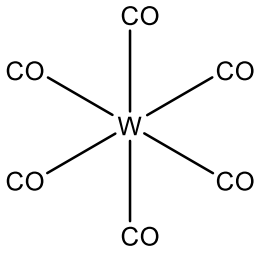
**Solution:**

$Mn_2(CO)_{10}$ :




$$X = 0$$

$W(CO)_6$ :




$Y = 0$

X + Y = 0

**9.** An element ${}^{239}_{92}X \rightarrow {}^{231}_{Z}Y + 2\alpha + 1\beta$

Then find the value of $Z$ in the above reaction?

**Answer (89)**

**Solution:**

${}^{239}_{92}X \rightarrow {}^{231}_{89}Y + 2\,{}^{4}_{2}He^{2+}\,{}^{0}_{-1}e$

Therefore, the value of $Z$ = 89

**10.** The shortest wavelength in Lyman series of H-atom is λ. of the longest wavelength in Balmer series $He^+$ is $\frac{x\lambda}{5}$. Find the value of x.

**Answer (9)**

**Solution:**

The shortest wavelength in Lyman series of H-atom is given by

$$\frac{1}{\lambda} = R_H\left[\frac{1}{(1)^2} - \frac{1}{(\infty)^2}\right] = R_H$$

$$\Rightarrow \lambda = 1/R_H$$

The longest wavelength in Balmer series $He^+$ ion is given by

$$\frac{1}{\lambda'} = (2)^2 R_H\left[\frac{1}{(2)^2} - \frac{1}{(3)^2}\right] = \frac{5R_H}{9}$$

$$\lambda' = \frac{9}{5R_H} = \frac{9\lambda}{5}$$

∴ x = 9

**11.** Assertion: First law of thermodynamics has equation: $\Delta U = q + W$
Reason: First law of thermodynamics is based on the law of conservation of energy

A. Assertion and reason are correct and reason is the correct explanation of assertion
B. Assertion and reason are correct and reason is not the correct explanation of assertion
C. Assertion is correct but reason is incorrect
D. Assertion is incorrect but reason is correct.

**Answer (A)**

**Solution:**

First law of thermodynamics is based on the law of conservation of energy and its equation is, $\Delta U = q + W$

**12.** Match the following.

| | | |
|---|---|---|
| a. | Siderite | i. $ZnCO_3$ |
| b. | Galena | ii. $FeCO_3$ |
| c. | Calamine | iii. PbS |

A. (a) – (i) ; (b) – (ii) ; (c) – (iii)
B. (a) – (ii) ; (b) – (iii) ; (c) – (i)
C. (a) – (iii) ; (b) – (ii) ; (c) – (i)
D. (a) – (ii) ; (b) – (i) ; (c) – (iii)

**Answer (B)**

**Solution:**

The correct match is given as :

Siderite – $FeCO_3$ ; Galena – PbS ; Calamine – $ZnCO_3$

**13.** The number of cyclic tripeptides are formed with two amino acids A and B are :

A. 2
B. 3
C. 4
D. 5

**Answer (C)**

**Solution:**

Cyclic tripeptides contains three amino acids and the combinations possible using amino acids A and B are :

AAA, ABB, AAB, BBB

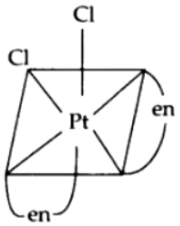
**14.** Which of the following complex is optically active?

A. Cis – $[Pt(NH_3)_2Cl_2]$
B. Trans – $[Pt(NH_3)_2Cl_2]$
C. Cis – $[Pt(en)_2Cl_2]$
D. Trans – $[Pt(en)_2Cl_2]$

**Answer (C)**

**Solution:**

cis – $[Pt(en)_2Cl_2]$ does not have POS and COS and hence is optically active.




**15.** Which of the following will give positive Lassaigne's test

A. $NH_4OH$

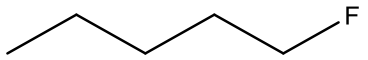
B. $NH_4Cl$
C. $N_2H_4$
D. $CH_3 – NH_2$

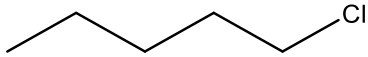
**Answer (D)**

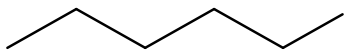
**Solution:**

A compound with C-N bond will give positive Lassaigne's test. Hence, $CH_3 – NH_2$ will give positive Lassaigne's test.

**16.** The decreasing order of the boiling points for the following compounds is given as :

I. 


II. 


III. 


IV. 


A. I > II > III > IV
B. I > II > IV > III
C. III > IV > II > I
D. III > IV > I > II

**Answer (C)**

**Solution:**

Boiling point is directly proportional to molar mass.
Order of molar mass of the given compounds = III > IV > II > I
Hence, order of B.P. = III > IV > II > I

**17.** Which of the following molecule has the highest bond dissociation energy?

A. $I_2$
B. $F_2$
C. $Cl_2$
D. $Br_2$

**Answer (C)**

**Solution:**

$Cl_2$ has the highest bond dissociation energy among the halogens.

**18.** Select the correct statement among the following.

A. Photochemical smog has the high concentration of oxidising agent
B. Classical smog has the high concentration of oxidising agent

C. Classical smog contains $NO_2$

D. None of these

**Answer (A)**

**Solution:**

Photochemical smog has the high concentration of oxidising agent

**19.** Find out the magnetic character of $Li_2O$, $KO_2$ and $MgO$ in that order.

A. Diamagnetic, Paramagnetic and Diamagnetic

B. Paramagnetic, Paramagnetic and Diamagnetic

C. Diamagnetic, Paramagnetic and Paramagnetic

D. Diamagnetic, Diamagnetic and Diamagnetic

**Answer (A)**

**Solution:**

$Li_2O$ has $Li^+$ and $O^{2-}$. Both the cation and anion have all their electrons paired. So, it is diamagnetic.

$KO_2$ has $K^+$ and $O_2^-$. It is paramagnetic as $O_2^-$ has one unpaired electron.

$O_2^-$: $\sigma_{1s^2}\ \sigma *_{1s^2} \sigma_{2s^2} \sigma *_{2s^2} \sigma_{2p_z^2} \pi_{2p_x^2} = \pi_{2p_y^2} \pi *_{2p_x^2} = \pi *_{2p_y^1}$

$MgO$ has $Mg^{2+}$ and $O^{2-}$. It is diamagnetic as $Mg^{2+}$ and $O^{2-}$ have all their electrons paired.

**20.** Which of the following option contains the correct decreasing order of hydration energy of the following ions?
$K^+$, $Mg^{2+}$, $Cs^+$, $Ca^{2+}$, $Rb^+$

A. $Mg^{2+} > Ca^{2+} > K^+ > Rb^+ > Cs^+$

B. $Ca^{2+} > Mg^{2+} > Cs^+ > Rb^+ > K^+$

C. $Mg^{2+} > Ca^{2+} > Cs^+ > Rb^+ > K^+$

D. $Cs^+ > Rb^+ > K^+ > Ca^{2+} > Mg^{2+}$

**Answer (A)**

**Solution:**

Hydration energy α Charge density

Therefore, the correct order is: - $Mg^{2+} > Ca^{2+} > K^+ > Rb^+ > Cs^+$

**21.** How many of the following compounds are odd electron species?
$NO_2$, $NO_2^+$, $ICl_4^-$, $BrF_3$, $NO$

**Answer (2)**

**Solution:**

$NO$ and $NO_2$ are the odd electron species.

**22.** For a hypothetical reaction

$A \leftrightharpoons B$ ; $K_{eq} = 10^2$

(Use $T = 27$ °C, $R = 8.3\,JK^{-1}mol^{-1}$, $ln10 = 2.3$)

If the value of $\Delta G°$ for the above reaction is $-x\ kJ$, the value of $2x$ will be

(Round off to the nearest integer)

**Answer (23)**

**Solution:**

$\Delta G° = -RTlnK_{eq}$

$= -8.3 \times 300 \times 2.3\log(10^2)$

$\Delta G° = -11454\ J$

$\Delta G° = -11.454\ kJ$

$x = 11.454$

$2x = 22.908$

**23.** A radioactive substance decays into products with half life of 30 min. The fraction left after 90 min is given by ($\frac{1}{2t}$). Find out "t".

**Answer (4)**

**Solution:**

$N_0 \xrightarrow{30\ min} \frac{N_0}{2} \xrightarrow{30\ min} \frac{N_0}{4} \xrightarrow{30\ min} \frac{N_0}{8}$

$\Rightarrow \frac{1}{8} = \frac{1}{2t}$

$t = 4$

**24.** How many elements can liberate $H_2$ from dilute acids?

V, Cr, Mn, Fe, Co, Ni, Cu

**Answer (6)**

**Solution:**

Except Cu, all other elements have negative $E^0_{M^{2+}/M}$. Hence, they can liberate $H_2$ from dilute acids.

No. of elements = 6

**25.** Consider the following reaction.

$H_2O(g) \leftrightharpoons H_2(g) + \frac{1}{2} O_2(g)$

If $K_{eq} = 2 \times 10^{-3}$ at 2300 K and initial pressure of $H_2O(g)$ is 1 atm, then degree of dissociation of above reaction will be $x \times 10^{-2}$, the value of $x$ is:

**Answer (2)**

**Solution:**

$$K_{eq} = \frac{(P_{H_2})(P_{O_2})^{1/2}}{P_{H_2O}} = \frac{(\propto)\left(\frac{\propto}{2}\right)^{1/2}}{1-\propto} = 2 \times 10^{-3}$$

$$\Rightarrow \frac{\propto^{\frac{3}{2}}}{2^{1/2}} = 2 \times 10^{-3} \quad (1\text{-}\propto \approx 1)$$

$$\Rightarrow \propto^{\frac{3}{2}} = 2^{\frac{3}{2}} \times (10^{-2})^{\frac{3}{2}}$$

$$\propto = 2 \times 10^{-2}$$

$$x = 2$$