FINAL JEE–MAIN EXAMINATION – APRIL,2019

(Held On Monday 08th APRIL, 2019) TIME : 9 : 30 AM To 12 : 30 PM

CHEMISTRY — TEST PAPER WITH ANSWER & SOLUTION

1. The vapour pressures of pure liquids A and B are 400 and 600 mmHg, respectively at 298K. 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 fraction of components A and B in vapour phase, respectively are-

(1) 500 mmHg, 0.5, 0.5
(2) 450 mmHg, 0.4, 0.6
(3) 450 mmHg, 0.5, 0.5
(4) 500 mmHg, 0.4, 0.6

Official Ans. by NTA (4)

Sol. $P_{total} = X_A.P_A^0 + X_B.P_B^0 = 0.5 \times 400 + 0.5 \times 600$

$= 500$ mmHg

Now, mole fraction of A in vapour,

$$Y_A = \frac{P_A}{P_{total}} = \frac{0.5 \times 400}{500} = 0.4$$

and mole fraction of B in vapour,

$Y_B = 1 - 0.4 = 0.6$

Correct option : (4)

2. 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) $S = \left(\frac{K_{sp}}{929}\right)^{1/9}$ (2) $S = \left(\frac{K_{sp}}{216}\right)^{1/7}$

(3) $S = \left(\frac{K_{sp}}{144}\right)^{1/6}$ (4) $S = \left(\frac{K_{sp}}{6912}\right)^{1/7}$

Official Ans. by NTA (4)

Sol. $Zr_3(PO_4)_4(s) \rightleftharpoons 3Zr^{4+}(aq.) + 4\,PO_4^{3-}(aq.)$

$\qquad\qquad\qquad\qquad 3S\ M \qquad 4S\ M$

$K_{sp} = [Zr^{4+}]^3\,[PO_4^{3-}]^4 = (3S)^3.(4S)^4 = 6912\ S^7$

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

Correct option : (4)

3. In order to oxidise a mixture one mole of each of FeC_2O_4, $Fe_2(C_2O_4)_3$, $FeSO_4$ and $Fe_2(SO_4)_3$ in acidic medium , the number of moles of $KMnO_4$ required is -

(1) 3 (2) 2
(3) 1 (4) 1.5

Official Ans. by NTA (2)

Sol. $n_{eq.}\ KMnO_4 = n_{eq.}[FeC_2O_4 + Fe_2(C_2O_4)_3 + FeSO_4]$

or $n \times 5 = 1 \times 3 + 1 \times 6 + 1 \times 1$

$\therefore n = 2$

Correct option : (2)

4. In the following compounds, the decreasing order of basic strength will be -

(1) $(C_2H_5)_2NH > C_2H_5NH_2 > NH_3$
(2) $(C_2H_5)_2NH > NH_3 > C_2H_5NH_2$
(3) $NH_3 > C_2H_5NH_2 > (C_2H_5)_2NH$
(4) $C_2H_5NH_2 > NH_3 > (C_2H_5)_2NH$

Official Ans. by NTA (1)

Sol. Basic strength order

$(CH_3CH_2)_2\ NH > CH_3CH_2NH_2 > NH_3$

2° amine 1°amine

Correct option : (1)

5. Diborane (B_2H_6) reacts independently with O_2 and H_2O to produce, respectively

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

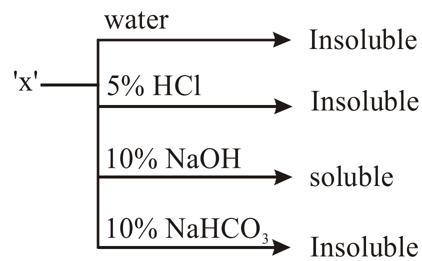
Official Ans. by NTA (3)

Sol. $B_2H_6 + 3H_2O \longrightarrow 2H_3BO_3 + 3H_2$

$B_2H_6 + 3O_2 \longrightarrow B_2O_3 + 3H_2O$

Correct option : (3)

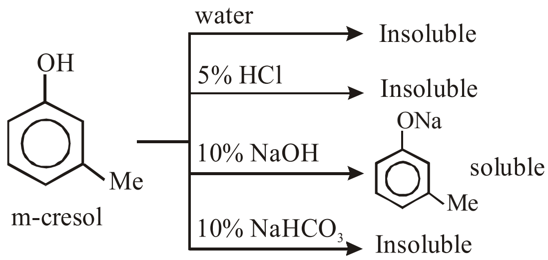
6. An organic compound 'X' showing the following solubility profile is -



(1) m-Cresol (2) Oleic acid
(3) o-Toluidine (4) Benzamide

Official Ans. by NTA (1)

Sol.

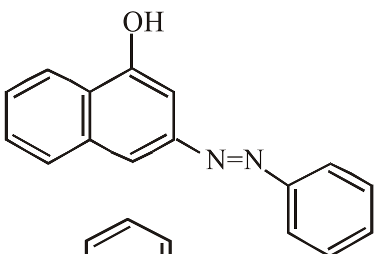


* Oleic acid is also soluble in $NaHCO_3$
* o-toluidine is not soluble in NaOH as well as $NaHCO_3$
* Benzamide is also not soluble in NaOH & $NaHCO_3$.

Correct option : (1)

7. Coupling of benzene diazonium chloride with 1-napthol in alkaline medium will give

(1)



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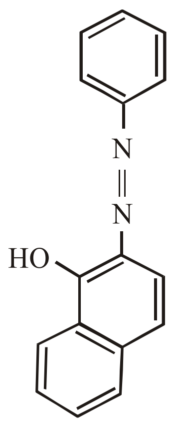

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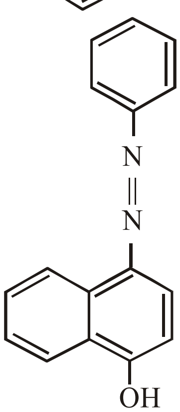

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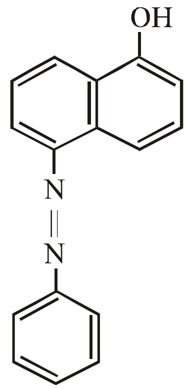
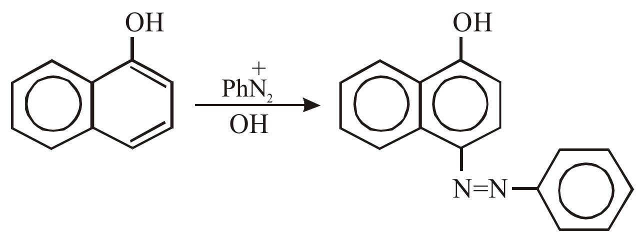


Official Ans. by NTA (3)

Sol.



α-naphthol
(1-naphthol)

orange red dye

8. 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) Cyclic process : $q = -w$

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

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

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

Official Ans. by NTA (3)

Sol. For cyclic process : $\Delta U = 0 \Rightarrow q = -w$

For isothermal process : $\Delta U = 0 \Rightarrow q = -w$

For adiabatic process : $q = 0 \Rightarrow \mathbf{\Delta U = W}$

For isochoric process : $w = 0 \Rightarrow \Delta U = q$

Correct option : (3)

9. The lanthanide ion that would show colour is-

(1) Sm^{3+} (2) La^{3+}

(3) Lu^{3+} (4) Gd^{3+}

Official Ans. by NTA (1)

Sol. Sm^{3+} $(4f^5)$ = yellow colour

Correct option : (1)

10. With respect to an ore, Ellingham diagram helps to predict the feasibility of its -

(1) Vapour phase refining

(2) Zone refining

(3) Electrolysis

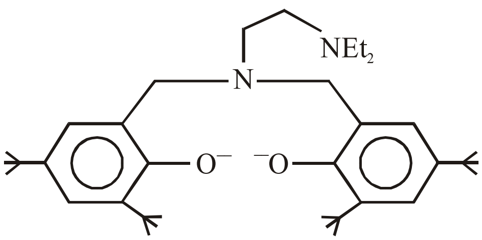
(4) Thermal reduction

Official Ans. by NTA (4)

Sol. Ellingham diagram helps in predicting the feasibiltiy of thermal reduction of ores.

Correct option : (4)

11. The following ligand is



(1) Bidentate (2) Hexadentate

(3) Tetradentate (4) Tridentate

Official Ans. by NTA (3)

Sol. Donating atoms are both nitrogen & oxygen.

Correct option : (3)

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

(1) $Li^+ > Na^+ > K^+ > Rb^+ > Cs^+$

(2) $Li^+ > Na^+ > K^+ > Cs^+ > Rb^+$

(3) $Na^+ > Li^+ > K^+ > Rb^+ > Cs^+$

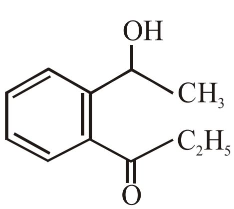
(4) $Na^+ > Li^+ > K^+ > Cs^+ > Rb^+$

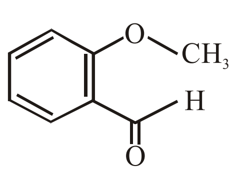
Official Ans. by NTA (1)

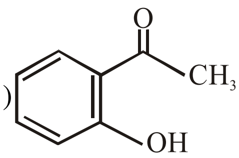
Sol. Hydration enthalpy depends upon ionic potential (charge / size). As ionic potential increases hydration enthalpy increases.

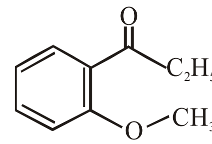
Correct option : (1)

13. 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 -

(1) 

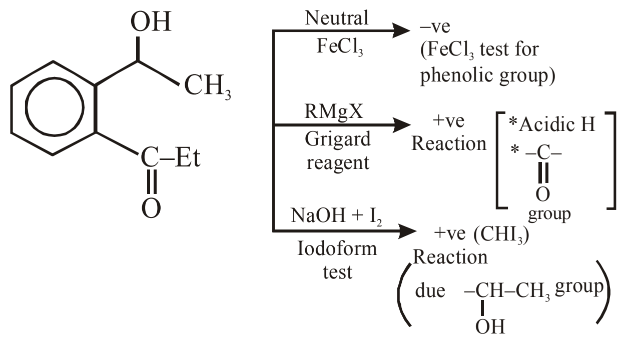
(2) 

(3) 

(4) 

Official Ans. by NTA (1)

Sol.



Correct option : (1)

14. The quantum number of four electrons are given below -

I. $n = 4, l = 2, m_l = -2, m_s = -½$

II. $n = 3, l = 2, m_l = 1, m_s = +½$

III. $n = 4, l = 1, m_l = 0, m_s = +½$

IV. $n = 3, l = 1, m_l = 1, m_s = -½$

The correct order of their increasing energies will be -

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

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

Official Ans. by NTA (2)

Sol. According to $(n+\ell)$ rule : 3p < 3d < 4p < 4d

Correct option : (2)

15. **Assertion :** Ozone is destroyed by CFCs in the upper stratosphere

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

(1) Assertion and reason are correct, but the reason is not the explanation for the assertion

(2) Assertion is false, but the reason is correct

(3) Assertion and reason are incorrect, Assertion and reason are both correct

(4) And the reason is the correct explanation for the assertion

Official Ans. by NTA (1)

Sol. The upper stratosphere consists of ozone (O_3), which protect us from harmful ultraviolet (UV) radiations coming from sun.

Correct option : (1)

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

(1) Principal quantum number of valence shell

(2) Nuclear charge

(3) Azimuthal qunatum number of valence shell

(4) Electron-electron interaction in the outer orbitals

Official Ans. by NTA (2)

Sol. For isoelectronic species the size is compared by nuclear charge.

Correct option: (2)

17. Given that : $E^0_{O_2/H_2O} = +1.23V$,

$E^0_{S_2O_8^{2-}/SO_4^{2-}} = +2.05V$

$E^0_{Br_2/Br^-} = +1.09V$

$E^0_{Au^{3+}/Au} = +1.4V$

The strongest oxidizing agent is -

(1) O_2 (2) Br_2

(3) $S_2O_8^{2-}$ (4) Au^{3+}

Official Ans. by NTA (3)

Sol. For strongest oxidising agent, standard reduction potential should be highest.

Correct option : (3)

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

(1) 21 kJ (2) 16 kJ

(3) 13 kJ (4) 62 kJ

Official Ans. by NTA (4)

Sol. $\Delta H = n\int_{T_1}^{T_2} C_{p,m}dT = 3\times\int_{300}^{1000}(23+0.01T)dT$

$= 3\left[23(1000-300) + \frac{0.01}{2}(1000^2 - 300^2)\right]$

$= 61950\ J \approx 62\ kJ$

Correct option : (4)

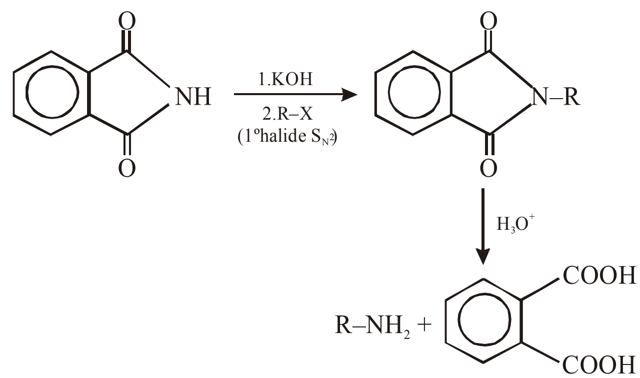
19. Which of the following amines can be prepared by Gabriel phthalimide reaction ?

(1) Neo-pentylamine (2) n-butylamine

(3) triethylamine (4) t-butylamine

Official Ans. by NTA (2)

Sol. Gabriel phthalimide synthesis :



Correct option : (2)

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

(1) Avoiding the use of floodlighted facilities

(2) Restricting the use of vehicles

(3) Using plastic bags

(4) Setting up compost tin in gardens

Official Ans. by NTA (3)

Sol. Correct option : (3)

21. Maltose on treatment with dilute HCI gives :

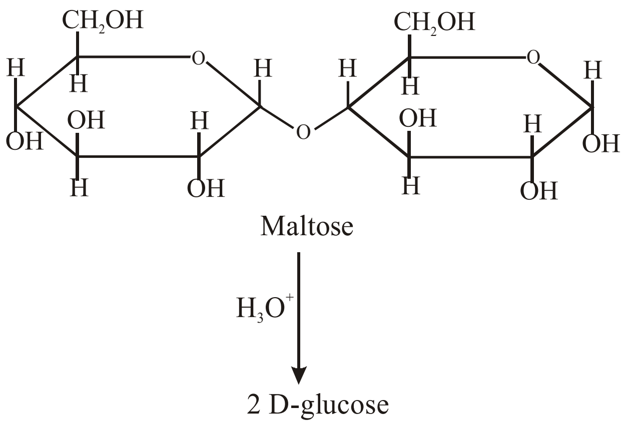
(1) D-Galactose

(2) D-Glucose

(3) D-Glucose and D-Fructose

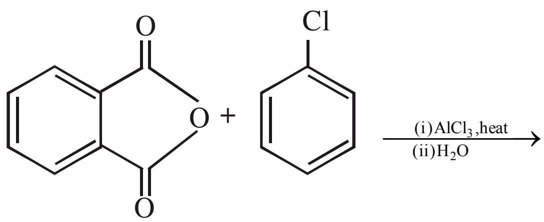
(4) D-Fructose

Official Ans. by NTA (2)



Correct option : (2)

22. The major product of the following reaction is:



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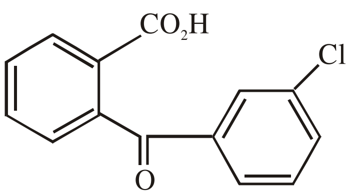

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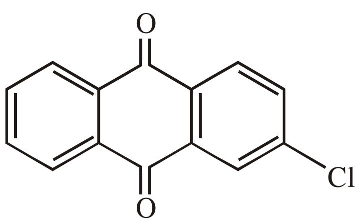

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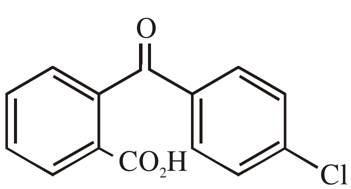

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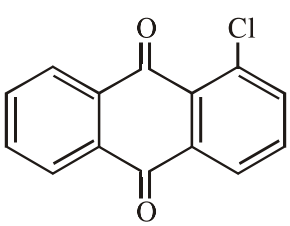
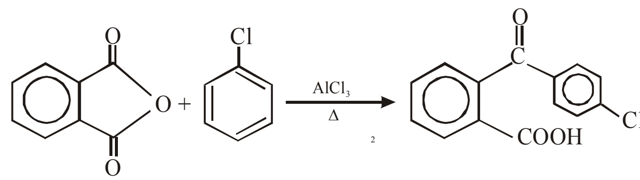


Official Ans. by NTA (3)

Sol.



Fridel-craft acylation. –Cl group is an ortho & para directing

Correct option : (3)

23. The correct order of the spin-only magnetic moment of metal ions in the following low spin complexes, $[V(CN)_6]^{4-}$, $[Fe(CN)_6]^{4-}$, $[Ru(NH_3)_6]^{3+}$, and $[Cr(NH_3)_6]^{2+}$, is :

(1) $V^{2+} > Cr^{2+} > Ru^{3+} > Fe^{2+}$

(2) $V^{2+} > Ru^{3+} > Cr^{2+} > Fe^{2+}$

(3) $Cr^{2+} > V^{2+} > Ru^{3+} > Fe^{2+}$

(4) $Cr^{2+} > Ru^{3+} > Fe^{2+} > V^{2+}$

Official Ans. by NTA (1)

Sol. According to question all the complexes are **low spin.**

Complex	Configuration	No. of unpaired electrons
$[V(CN)_6]^{4-}$	$t_{2g}^3e_g^0$	3
$[Cr(NH_3)_6]^{2+}$	$t_{2g}^4e_g^0$	2
$[Ru(NH_3)_6]^{3+}$	$t_{2g}^5e_g^0$	1
$[Fe(CN)_6]^{4-}$	$t_{2g}^6e_g^0$	0

Correct option : (1)

24. 100 mL of a water sample contains 0.81 g of calcium bicarbonate and 0.73 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 $gmol^{-1}$)

(1) 1,000 ppm (2) 10,000 ppm

(3) 100 ppm (4) 5,000 ppm

Official Ans. by NTA (2)

Sol. $n_{eq.}CaCO_3 = n_{eq}Ca(HCO_3)_2 + n_{eq}Mg(HCO_3)_2$

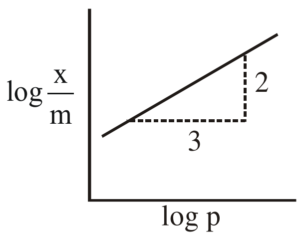
or , $\frac{W}{100}\times 2 = \frac{0.81}{162}\times 2 + \frac{0.73}{146}\times 2$

$\therefore$ w = 1.0

$\therefore$ Hardness = $\frac{1.0}{100}\times 10^6 = 10000ppm$

Correct option : (2)

25. 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^3

(3) $p^{2/3}$ (4) p^2

Official Ans. by NTA (3)

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

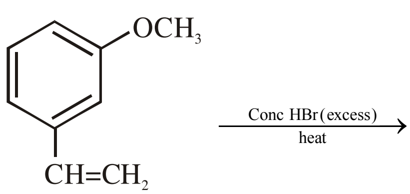
$\therefore \log \frac{x}{m} = \log K + \frac{1}{n}.\log P$

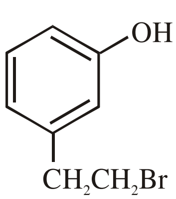
slope $= \frac{1}{n} = \frac{2}{3}$

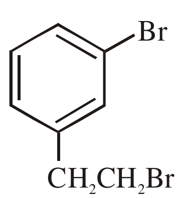
$\therefore \frac{x}{m} = K.p^{2/3}$

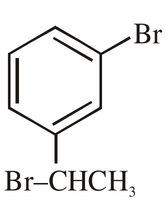
Correct option : (3)

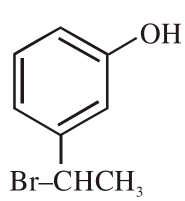
26. The major product of the following reactions:



(1) 

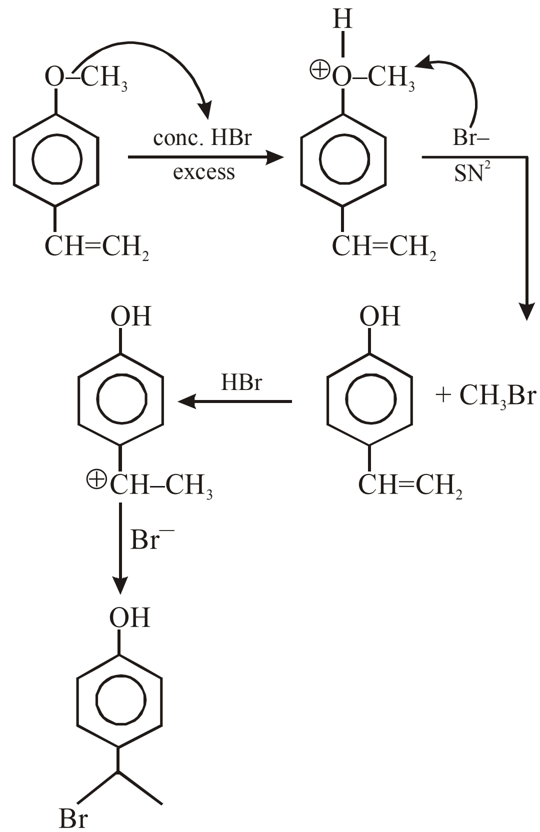
(2) 

(3) 

(4) 

Official Ans. by NTA (4)

Sol.



Correct option : (4)

27. For the reaction 2A +B → 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 $[A]^2[B]^2$

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

Official Ans. by NTA (3)

Sol. $r = K [A]^x [B]^y$

$0.045 = K (0.05)^x (0.05)^y$ ....(1)

$0.090 = K (0.10)^x (0.05)^y$ ....(2)

$0.72 = K (0.20)^x (0.10)^y$ ....(3)

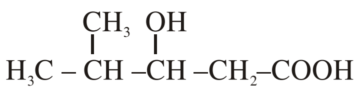
From (1) ÷ (2), $\frac{0.045}{0.090} = \left(\frac{0.05}{0.10}\right)^x \Rightarrow x = 1$

From (2) ÷ (3), $\frac{0.090}{0.720}=\left(\frac{0.10}{0.20}\right)^x\cdot\left(\frac{0.05}{0.10}\right)^y \Rightarrow y=2$

Hence, r = K [A] $[B]^2$

Correct option : (3)

28. The IUPAC name of the following compound is :



(1) 2-Methyl-3Hydroxypentan-5-oic acid

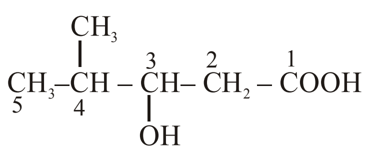
(2) 4,4-Dimethyl-3-hydroxy butanoic acid

(3) 3-Hydroxy-4 -methylpentanoic acid

(4) 4-Methyl-3-hydroxypentanoic acid

Official Ans. by NTA (3)

Sol.

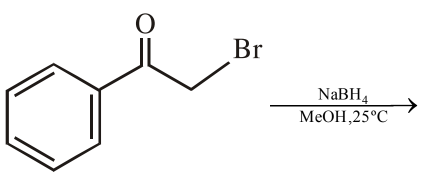


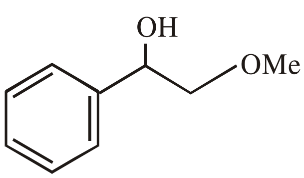
3-Hydroxy-4-methylpentanoic acid

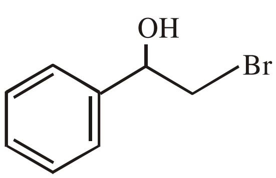
–COOH principal functional group

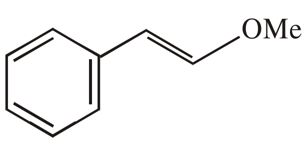
Correct option : (3)

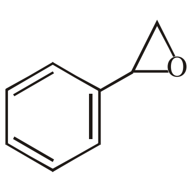
29. The major product of the following reaction is:



(1) 

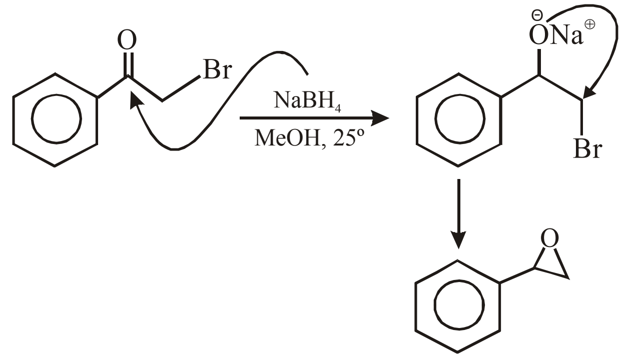
(2) 

(3) 

(4) 

Official Ans. by NTA (4)

Sol.



30. 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) A_2B_2O

(3) A_4B_2O (4) AB_2O_4

Official Ans. by NTA (4)

Sol. $Z_B = 4$, $Z_A = 4\times\frac{1}{2}=2, Z_O = 8$

Formula ; $A_2B_2O_8 \equiv AB_2O_4$

Correct option : (4)