VIDYAPEETH
ACADEMY
IIT JEE | NEET | OLYMPIAD | KVPY | NTSE

JEE MAIN 2021

PAPER-1 (B.E. / B.TECH)

QUESTIONS & SOLUTIONS

Reproduced from Memory Retention

📅 **17 March, 2021**   SHIFT-1

🕐 **09:00 am to 12 Noon**

Duration : 3 Hours   **Max. Marks : 300**

SUBJECT - CHEMISTRY

CHEMISTRY

1. The structure of tyrosine amino acid is

(1)
$$H_2N-\underset{\underset{CH_2-\text{(phenyl)}}{|}}{\overset{\overset{H}{|}}{C}}-COOH$$

(2)
$$H_2N-\underset{\underset{CH_2-\text{(phenol)}-OH}{|}}{\overset{\overset{H}{|}}{C}}-COOH$$

(3)
$$H_2N-\underset{\underset{CH_2-\text{(aryl)}-OH}{|}}{\overset{\overset{H}{|}}{C}}-COOH$$

(4)
$$H_2N-\underset{\underset{CH_2CH_2-\text{(phenyl)}}{|}}{\overset{\overset{H}{|}}{C}}-COOH$$

Ans. (2)

2.

$$\xrightarrow[\text{(2) } H^{\oplus}]{\text{(1) Ethylene glycol}}$$ Product is :

(1)

(2)

(3)

(4)

Ans. (1)

3.

 $\xrightarrow[\text{CCl}_4]{\text{HBr}}$

(1)

(2)

(3)

(4)
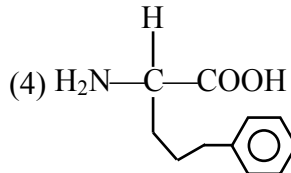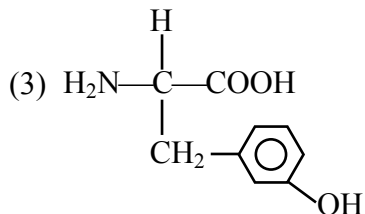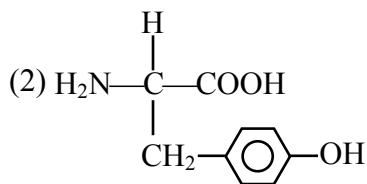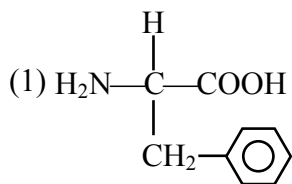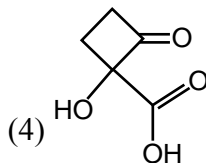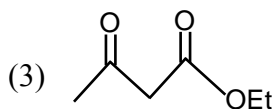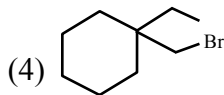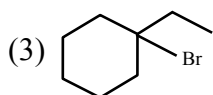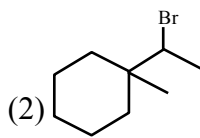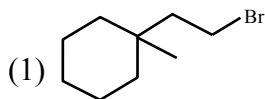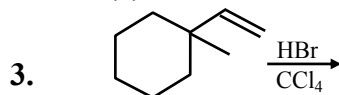
Ans. (2)

4. Which of the following reaction is ammonolysis reaction?

(1) $R-C\equiv N \xrightarrow{[H]} R-CH_2-NH_2$

(2) $R-CH_2-Cl \xrightarrow{\overset{\cdot\cdot}{NH_3}} R-CH_2-NH_2$

(3) $\underset{\underset{O}{\|}}{R-C-Cl} \xrightarrow{NH_3} \underset{\underset{O}{\|}}{R-C-NH_2}$

(4) $R-CH_2-Cl \xrightarrow{KCN} R-CH_2-CN$
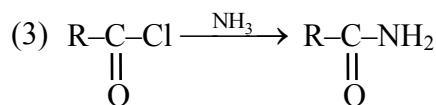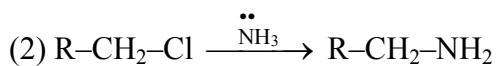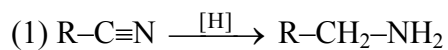
Ans. **(2)**

5. Reducing smog contains

(1) Smoke + fog + SO_2

(2) Smoke + fog + $CH_3-\underset{\underset{O}{\|}}{C}-H$

(3) Smoke + fog + hydrocarbon

(4) Smoke + fog + nitrogen oxide

Ans. **(1)**

6. Which of the following compound is aromatic in nature?

(1)

(2)

(3)

(4)

Ans. **(1)**

7. + NaOH $\xrightarrow{?}$
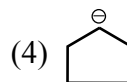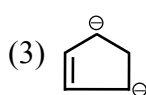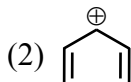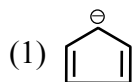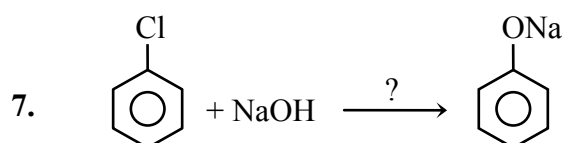
What is the condition of temperature and pressure in above reaction?

(1) 623K, Cu, 300 atm

(2) 573K, 300 atm

(3) 573K, Cu, 300 atm

(4) 623K and 300 atm

Ans. **(4)**

8. A benzamide undergoes Hoffman's Bromamide reaction to give (A), which reacts with chloroform and KOH to give (B). Identify compounds (A) and (B) -

(1)

(2)

(3)

(4)

Ans. **(2)**

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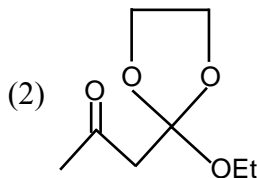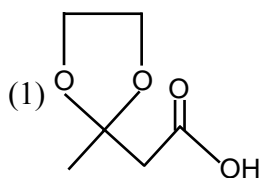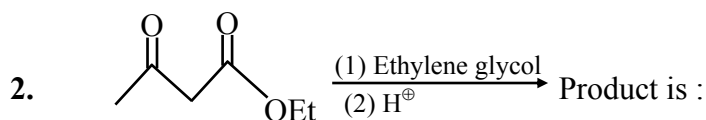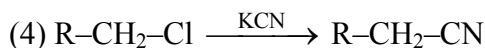
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Page - 03
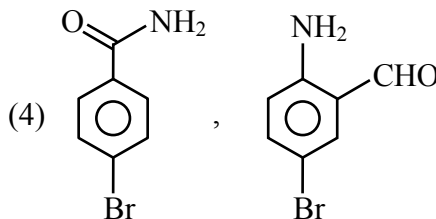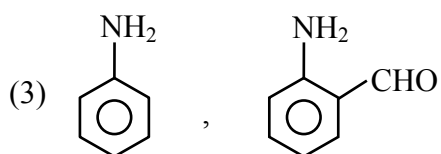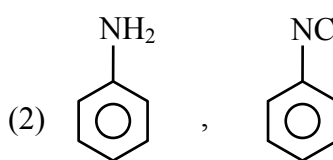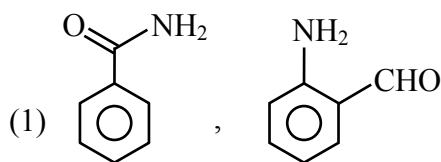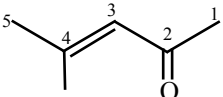
9. What is IUPAC name of Mesityloxide ?

(1) 2–Methyl–4–oxopentan–2–ene

(2) 4–Methyl–2–oxopent–3–ene

(3) 4–Methylpent–3–en–2–one

(4) 2–Methylpent–2–en–4–one

Ans. (3)

Sol. Mesityloxide (4–Methylpent–3–en–2–one)

10. S-1 : R_f can be measured in the form of metre/centimetre

S-2 : R_f of a compound is same for all solvents

(1) Both Statement-1 and Statement-2 are correct

(2) Both Statement-1 and Statement-2 are false

(3) Statement-1 is correct and Statement-2 is false

(4) Statement-1 is false and Statement-2 is correct

Ans. (2)

11. Which of the following statement is incorrect about allosteric site?

(1) Allosteric site changes the shape of active site.

(2) Non competitive inhibitor changes the active site of enzyme binding at allosteric site.

(3) Some drug bind to a different site of enzyme which is allosteric site.

(4) Competitive inhibitors attach to the allosteric site.

Ans. (4)

12. Which of the following is false for heavy water?

(A) It is a byproduct in some fertilizer industries.

(B) It is used in exchange reactions for the study of reaction mechanism.

(C) Its dielectric constant is higher than H_2O.

(D) It is used as a moderator in nuclear reactor.

(1) A,B,C   (2) A,B,C,D   (3) C only   (4) A,B

Ans. (3)

Sol. Fact based (Dielectric constant of D_2O is lesser than H_2O).

13. Determine number of radial nodes in orbital represented by $n = 4$ & $m_\ell = -3 \Rightarrow \ell = 3$

Ans. (0)

Sol. $n = 4$ & $m_\ell = -3 \Rightarrow \ell = 3$

$RN = n - \ell - 1 = 4 - 3 - 1 = 0$

14. Mole fraction of 100 molal aqueous solution of a solute is x. Given value of $x \times 10^{-1}$.

Ans. (6)

Sol. Let wt. of H_2O be 1000 g $\Rightarrow$ moles of solute = 100

& mole of $H_2O = \dfrac{1000}{18}$

$\Rightarrow$ mole fraction of solute $= \dfrac{\text{moles of solute}}{\text{total mole}}$

$= \dfrac{100}{100 + \dfrac{1000}{18}}$

$= \dfrac{1800}{2800} = 6.4 \times 10^{-1}$

$\Rightarrow$ x = 6.4

15. S-1 : Potassium permanganate on heating decomposes to produce potassium manganate.

S-2 : Potassium permanganate and potassium manganate are both paramagnetic.

(1) Both S1 and S2 are correct and S2 is a correct explanation of S1.

(2) Both S1 and S2 are correct but S2 is not correct explanation of S1.

(3) S1 is correct and S2 is incorrect.

(4) S1 is incorrect and S2 is correct.

Ans. (3)

16. 0.01 mole of weak acid HA ($K_a = 2 \times 10^{-6}$) is mixed in 1L of 0.1 M HCl. Find α of HA in solution. ($\alpha \ll 1$). Report your answer as 'x' where $\alpha = x \times 10^{-5}$.

Ans. (2)

Sol.

	HA	$\rightleftharpoons$	H^+	+	A^-
C_i	0.01		0		0
C_{eq}	0.01 (1 $-\alpha$)		0.01α + 0.1		0.01 α
	$\approx$ 0.01		$\approx$ 0.1		

$\dfrac{0.1 \times 0.01\alpha}{0.01} = 2 \times 10^{-6}$ $\qquad \therefore \alpha = 2 \times 10^{-5}$ $\qquad \therefore$ x = 2
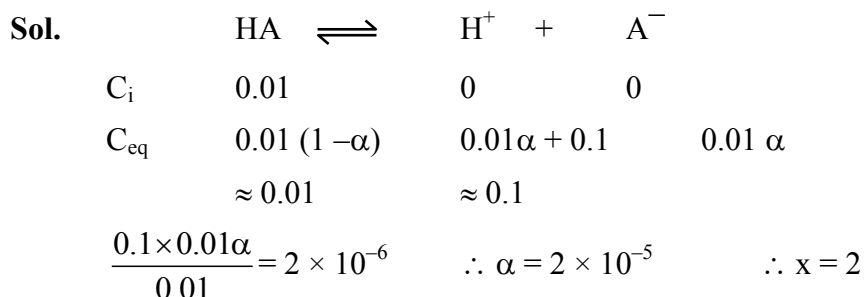
17. Given : $\Delta H_f^\circ (Al_2O_{3(s)}) = -1596$ KJ/mol

$\Delta H_f^\circ (CaO_{(s)}) = -635$ KJ/mol

$3CaO(s) + 2Al(s) \rightarrow 3Ca(s) + Al_2O_3(s); \Delta_r H^\circ = ?$ (in KJ)
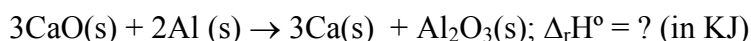
Ans. **(309)**

Sol. $\Delta_r H^\circ = \Delta H_f^\circ (products) - \Delta H_f^\circ (reactants)$

$= \Delta H_f^\circ (Al_2O_{3(s)}) - 3 \Delta H_f^\circ (CaO_{(s)})$

$= (-1596) - 3(-635)$

$= 309$ KJ

18. In a molecule the central atom has 2 lone pairs and makes 3 bonds. What will be the shape of molecule

(1) See-Saw   (2) T-shape   (3) Trigonal pyramidal (4) Triangular planar

Ans. **(2)**

19. Arrange the following ions in conductivity order in aqueous solution.

(1) $Na^+ < K^+ < Rb^+ < Cs^+$ (2) $Cs^+ < Rb^+ < K^+ < Na^+$

(3) $K^+ < Rb^+ < Cs^+ < Na^+$ (4) $Rb^+ < Cs^+ < Na^+ < K^+$

Ans. **(1)**

20. Order of magnitude of electron gain enthalpy ($\Delta_{eg}H$) of F, Cl, Br, I is

(1) $Cl > F > Br > I$ (2) $F > Cl > Br > I$

(3) $I > Br > Cl > F$ (4) $Cl > F > I > Br$

Ans. **(1)**

Sol. Electron gain enthalpy decreases down the group but 3rd period p-block element has more electron gain enthalpy than 2nd period element.

21. Spin magnetic moment of divalent ion (z = 25) in aqueous solution is :

(1) 5.9 BM   (2) 5.1 BM   (3) 5 BM   (4) 0 BM

Ans. **(1)**

Sol. $Mn^{2+} \Rightarrow 3d^5$ (n = 5)

$\mu = \sqrt{5(5+2)} = \sqrt{35} = 5.9$ BM

22. In Ellingham diagram, the intersection point & the point at which graph changes its slope, represent (respectively):
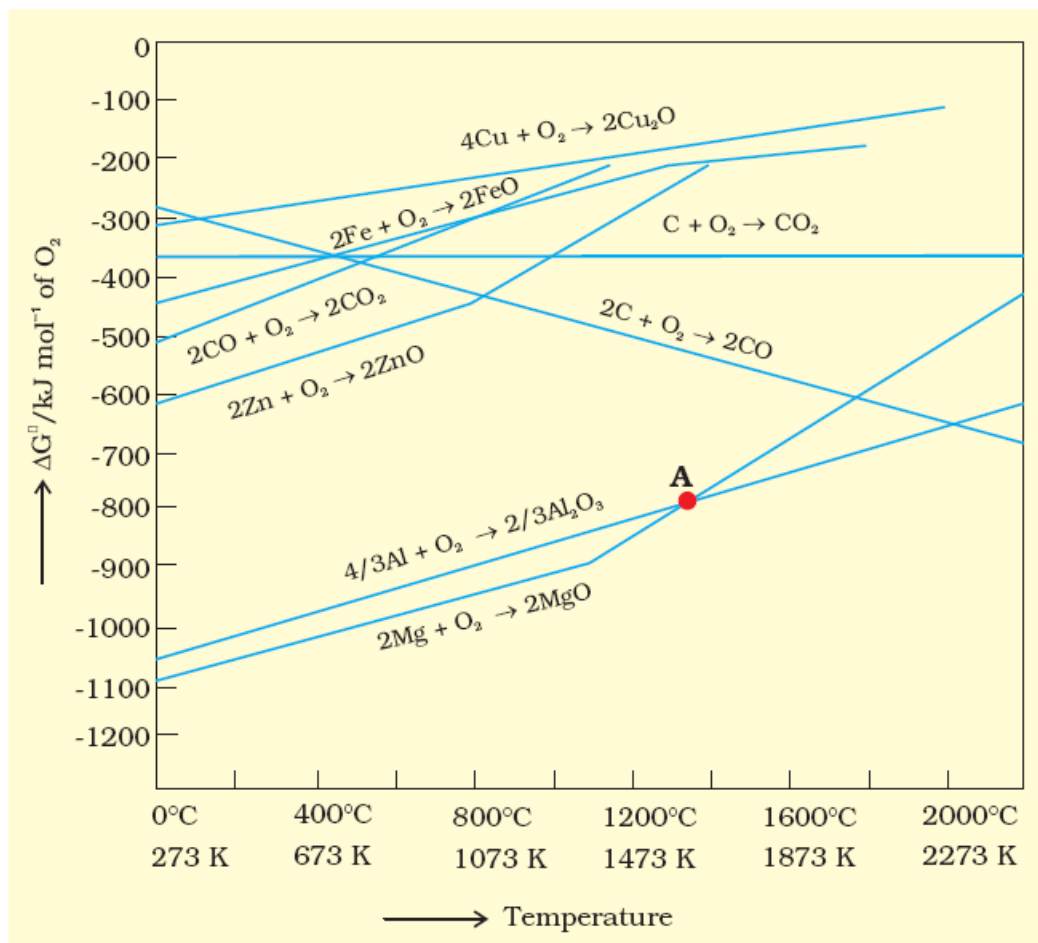
(1) $\Delta_r G° = 0$, Melting point of metal

(2) $\Delta_r G° < 0$, Decomposition of metal oxide

(3) $\Delta_r G° > 0$, Decomposition of metal oxide

(4) $\Delta_r G° = 0$, Reduction of metal oxide

Ans. **(1)**

23. A non-reacting gas mixture of 6.4 g CH_4 & 8.8 g CO_2 is present in a 10L container at 27°C. Pressure in KPa =? (R = 8.314 J/K-mol)
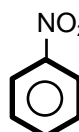
Ans. **(150)**

Sol. $PV = n_{total} RT$

$P \times 10 \times 10^{-3} = (0.4 + 0.2) \times 8.314 \times 300$

$P = 149652$ Pa

$= 149.652$ KPa

24.

Determine percentage yield of reaction if 0.4 mole of $C_6H_5NO_2$ is formed by 39 g of C_6H_6

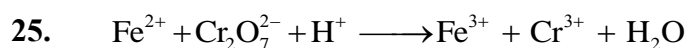**Ans.** **(80)**

Sol. Moles of $C_6H_6 = \dfrac{39}{78} = 0.5$

By conserving moles of carbon, moles of formed theoretically are 0.5

$\Rightarrow$ % yield $= \dfrac{\text{moles formed actually}}{\text{moles formed theoretically}} \times 100$

$= \dfrac{0.4}{0.5} \times 100 = 80\ \%$

25. $Fe^{2+} + Cr_2O_7^{2-} + H^+ \longrightarrow Fe^{3+} + Cr^{3+} + H_2O$

Molarity of Fe^{2+} solution (15 ml), which reacts with 0.03 M, 20 mL $Cr_2O_7^{2-}$ solution is $x \times 10^{-2}$ M. Find x.

Ans. **(24)**

Sol. m eq. Fe^{2+} = m eq. $Cr_2O_7^{2-}$

$M \times 15 \times 1 = 0.03 \times 6 \times 20$

$\therefore M = 0.24\ M \quad \therefore\ x = 24$

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Page - 08