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JEE MAIN 2021

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

QUESTIONS & SOLUTIONS

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16 March, 2021 SHIFT-2

03:00 pm to 06:00 pm

Duration : 3 Hours Max. Marks : 300

SUBJECT - CHEMISTRY

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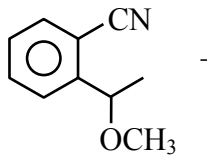
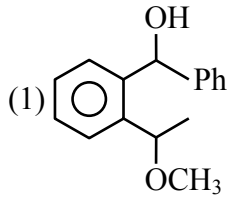
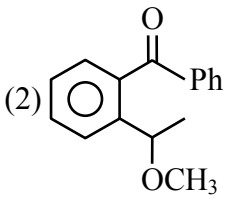
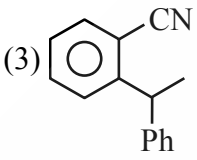
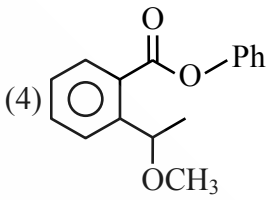
CHEMISTRY

1.  $\xrightarrow[(2)\ H_3O^{\oplus}]{(1)\ PhMgBr\ (1\ eq.)}$ Product is

(1) 

(2) 

(3) 

(4) 

Ans. (2)

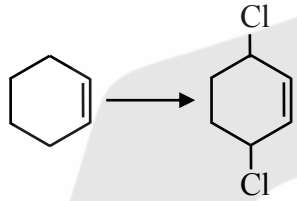
2. Green house gases are

(I) CO_2 (II) Methane (III) O_2 (IV) Water vapour

(1) I, II, III (2) I, II, IV (3) I, III (4) III, IV

Ans. (2)

3. Which of the following reagent is used for given conversion?



(1) Anhydrous $AlCl_3/Cl_2$(dark) (2) $HCl + ZnCl_2$

(3) $Cl_2/h\nu$ (4) Cl_2/CCl_4

Ans. (3)

4. Match the column

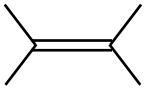
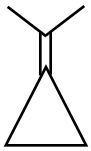
(A) CuO	(I) Halogen
(B) $AgNO_3$	(II) Sulphur
(C) Lassaigne	(III) Carbon
(D) Black ppt with $(CH_3COO)_2Pb$	(IV) Nitrogen

(1) A→ III ; B→ I ; C→ IV , D→ II (2) A→ IV ; B→ III ; C→ II , D→ I

(3) A→ III ; B→ I ; C→ II , D→ IV (4) A→ IV ; B→ I ; C→ III , D→ II

Ans. (1)

5. Compound (X) $\xrightarrow{O_3}$ Y $\xrightarrow{AgNO_3}$ silver mirror
Which of the following is [X]

(1)  (2) $CH_3–C\equiv C–CH_3$ (3)  (4) $CH_3–C\equiv CH$

Ans. (4)

6. Wooden laminates are made by

(1) Urea–formaldehyde resin (2) Melamine–formaldehyde resin

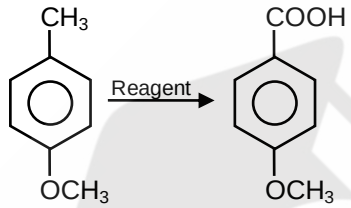
(3) Phenol–formaldehyde resin (4) PVC

Ans. (2)

7. Which of the following is least basic among the following compounds?

(1) Et_3N (2) $(Et)_2NH$ (3) $(CH_3CO)_2NH$ (4) $CH_3–\underset{\underset{O}{\|}}{C}–NH–Et$

Ans. (3)

8. 

Reagent is

(1) $LiAlH_4$ (2) $NaBH_4$ (3) ZnHg/HCl (4) $KMnO_4/H^{\oplus}$

Ans. (4)

9. Ammonolysis of alkyl halide to prepare primary, secondary and tertiary amines followed by NaOH is

(1) to remove acidic impurities

(2) to remove basic impurities

(3) to activate halide

(4) to activate ammonia

Ans. (1)

10. Secondary structure of protein in stabilized by

(1) H-bond (2) Vanderwaal force of attraction

(3) Peptide bond (4) Glycosidic linkage

Ans. (1)

11. **Statement-1:** NaH can be used as an oxidising agent.
Statement-2: Pyridine is basic due to lone pair of nitrogen.
(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. (4)

12. Vapour pressure of pure liquid A & B are 21 & 18 mm of Hg respectively. Determine vapour pressure of a solution (in mm of Hg) obeying Raoult's law containing 1 mole of A & 2 mole of B.

Ans. (19)

Sol. $X_A = \frac{1}{1+2} = \frac{1}{3}$ $\quad X_B = \frac{2}{3}$

$P_A^\circ = 21$ mm of Hg $\quad P_B^\circ = 18$ mm of Hg

$P_{total} = P_A^\circ X_A + P_B^\circ X_B$

$= 21 \times \frac{1}{3} + 18 \times \frac{2}{3}$

$= 7 + 12 = 19$ mm of Hg

13. Two elements A & B have following ionisation energy data:

	IE_1	IE_2
A	400	4000 (in kJ/mol)
B	700	1400 (in kJ/mol)

A & B are respectively :
(1) Na, Mg (2) Mg, Na (3) Na, F (4) Mg, F

Ans. (1)

14. Half life time of two first order reactions
$A \longrightarrow$ Products
$B \longrightarrow$ Products
are 54 & 18 min respectively. Starting with equimolar quantities of A & B, determine the time after which [A] = 16 [B]

Ans. (108)

Sol. $[A]_t = \frac{[A]_0}{2^{\frac{Time}{54}}}$ $\quad [B]_t = \frac{[B]_0}{2^{\frac{Time}{18}}}$

$\because [A]_0 = [B]_0$ and $[A]_t = 16\,[B]_t$

$$\frac{[A]_0}{2^{\frac{T}{54}}} = 16\ \frac{[A]_0}{2^{\frac{T}{18}}}$$

$$16 = 2^{\frac{T}{18}-\frac{T}{54}}$$

$$16 = 2^{\frac{2T}{54}}$$

$$2^4 = 2^{\frac{2T}{54}}$$

$$4 = \frac{2T}{54}$$

$T = 108$ min

15. If both FeX_2 & FeY_3 are found to exist, X & Y can be :

(1) X = F, Cl, Br, I Y = F, Cl, Br (2) X = Cl, Br, I Y = F, Cl, Br, I

(3) X = F, Cl, Br Y = Cl, Br, I (4) X = F, Cl, Br, I Y = F, Cl, Br, I

Ans. (1)

Sol. FeI_3 does not exist because of I^- being very good reducing agent.

16. Which of the following cannot be reduced by coke?

(1) Al_2O_3 (2) ZnO (3) Fe_2O_3 (4) Cu_2O

Ans. (1)

17. Volume of 1 M NaOH solution required to neutralise 50 mL 1M H_3PO_3 & 100 ml 2M H_3PO_2 respectively are

(1) 100 ml, 200 ml (2) 200 ml, 100 ml (3) 50 ml, 100 ml (4) 100 ml, 50 ml

Ans. (1)

Sol. (1) $\underset{100\text{ m mole}}{2NaOH} + \underset{50\text{ m mole}}{H_3PO_3} \longrightarrow Na_2HPO_3 + 2H_2O$

$100\text{ m mole} = M \times V_{ml}$

$100\text{ m mole} = 1 \times V_{ml}$

$V_{ml} = 100$ ml

(2) $\underset{200\text{ m mole}}{NaOH} + \underset{200\text{ m mole}}{H_3PO_2} \longrightarrow NaH_2PO_2 + H_2O$

$200\text{ m mole} = M \times V_{ml}$

$V_{ml} = 200$ ml

18. Elements with atomic number 33, 53 & 83 are respectively

(1) Metalloid, Non-metal, Metal (2) Metal, Non-metal, Metalloid

(3) Non-metal, Metal, Metalloid (4) Metalloid, Metal, Non-metal

Ans. (1)

Sol. Atomic number Element

33 → As (Metalloid)

53 → I (Non-metal)

83 → Bi (Metal)

19. Which of the following are correct for H_2O_2

(A) Used in pollution control treatment of industrial effluents.

(B) H_2O_2 can act as both oxidising agent & reducing agent

(C) Miscible in water

(D) two hydroxy groups are in same plane

(1) ABC (2) ACD (3) ABCD (4) BCD

Ans. (1)

Sol. In $H_2O_2^{-1}$ oxidation state of oxygen is –1 therefore acts both as oxidising agent & reducing agent.

H_2O_2 is miscible in water due to intermolecular H-bonding.

H_2O_2 has open book structure in which both –OH groups are not in same plane

20. Arrange the following compounds (assuming to be high spin) in increasing order of spin magnetic moment :

(1) $(NH_4)_2[Ce(NO_3)_6] < Eu(NO_3)_3 < Gd(NO_3)_3$

(2) $(NH_4)_2[Ce(NO_3)_6] < Gd(NO_3)_3 < Eu(NO_3)_3$

(3) $Eu(NO_3)_3 < Gd(NO_3)_3 < (NH_4)_2[Ce(NO_3)_6]$

(4) $Gd(NO_3)_3 < (NH_4)_2[Ce(NO_3)_6] < Eu(NO_3)_3$

Ans. (1)

Sol. $(NH_4)_2[Ce(NO_3)_6]$ (n=0) $\Rightarrow \mu = 0$ BM

$Eu(NO_3)_3$ (n=6) $\Rightarrow \mu = 6.93$ BM

$Gd(NO_3)_3$(n=7) $\Rightarrow \mu = 7.94$ BM

21. Gallium (At. Mass = 70) crystallises in HCP lattice. If the total number of voids in 0.581 gram of gallium is $x \times 10^{21}$ then determine 'x' :

Ans. 15

Sol. No. of moles of Ga = $\frac{0.581}{70}$

No. of atoms of Ga = $\frac{0.581}{70} \times N_A$

$\therefore$ Total no. of voids = $\frac{0.581}{70} \times N_A \times 3$

$= 0.0249 \times 6 \times 10^{23}$

$= 15 \times 10^{21}$

As there are one octahedral void and two tetrahedral voids per atom.

22. Which of the following is incorrect?

(1) $Al^{3+} > Na^{+}$ flocculation power

(2) Colloids show Brownian motion

(3) Colloids show colligative property

(4) Colloidal solution can not pass through ordinary filter paper

Ans. (4)

Sol. Colloidal solution can pass through ordinary filter paper but can not pass through special filter paper.

23. Number of orbitals having $m_\ell = +2$ in n = 5 are:

Ans. (3)

Sol. n = 5

$\ell = 0, 1, 2, 3, 4$

$\ell = 2 \rightarrow m = -2, -1, 0, +1, +2$

$\ell = 3 \rightarrow m = -3, -2, -1, 0, +1, +2, +3$

$\ell = 4 \rightarrow m = -4, -3, -2, -1, 0, +1, +2, +3, +4$

24. Incorrect statement regarding C_{60} is:

(1) It has 24 6-membered rings & 12 5-membered rings.

(2) It has 5-membered rings only attached to 6-membered rings.

(3) It has 6-membered rings attached to both 5 & 6-membered rings.

(4) Each Carbon is attached to 3 C-atoms.

Ans. (1)

25. The number of mol of $PbSO_4$ obtained on reacting 35 ml of 0.15M $Pb(NO_3)_2$ with 50 ml, 0.2M $Cr_2(SO_4)_3$ is $x \times 10^{-5}$. Find x.

Ans. (525)

Sol. $3Pb(NO_3)_2 + Cr_2(SO_4)_3 \longrightarrow 3PbSO_4 + 2Cr(NO_3)_3$

m.mol. 5.25 (L.R.) 10

0 5.25 m.mol formed

$\Rightarrow$ i.e. $= 525 \times 10^{-5}$

$\therefore$ x = 525

26. Determine pH of 0.588 M H_2SO_3 solution given $K_{a_1} = 1.7 \times 10^{-2}$ $K_{a_2} = 10^{-8}$

Ans. (1)

Sol. $\frac{0.588\alpha^2}{1-\alpha} = 1.7 \times 10^{-2}$

$\frac{\alpha^2}{1-\alpha} = 0.029$ $\quad \therefore \alpha^2 + 0.029\alpha - 0.029 = 0$

$\alpha = \frac{-0.029 + \sqrt{(0.029)^2 + 4(1)(0.029)}}{2}$

$= 0.1564$

$[H^+] = 0.588 \times 0.1564 = 0.092$ M

$pH = 2 - \log 9.2 = 2 - 0.964 = 1.036 \approx 1$