SATISH SCIENCE ACADEMY

DHANORI PUNE-411015

CHEMISTRY

JEE main - Chemistry

**Time Allowed: 1 hour**   **Maximum Marks: 100**
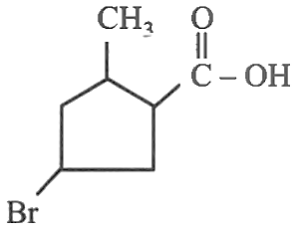
General Instructions:

- All questions are compulsory.

- There are 25 questions where the first 20 questions are MCQs and the next 5 are numerical.

- You will get 4 marks for each correct response and 1 mark will be deducted for an incorrect answer.

CHEMISTRY (Section-A)

1. Which of the following forms of hydrogen emits low energy β^- particles? **[4]**

   a) Deuterium ^2_1H b) Proton H^+

   c) Tritium ^3_1H d) Protium ^1_1H

2. Which of the following elements in considered as a metalloid? **[4]**

   a) Bi   b) Sc

   c) Te   d) Pb

3. Which amongst the following is the strongest acid? **[4]**

   a) $CHCl_3$ b) $CH(CN)_3$

   c) CHI_3 d) $CHBr_3$

4. The intermolecular potential energy for the molecules A, B, C and D given below suggests that: **[4]**
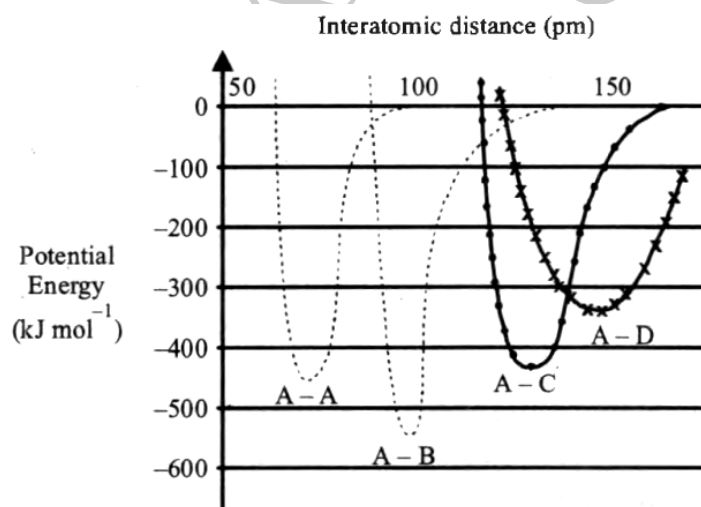

   a) D is more electronegative than other atoms   b) A-B has the stiffest bond

   c) A-A has the largest bond enthalpy   d) A-D has the shortest bond length

5. How many litres of water must be added to 1 L of an aqueous solution of HCl with a pH of 1 to create an aqueous solution with pH of 2? **[4]**

a) 9.0 L   b) 2.0 L

c) 0.1 L   d) 0.9 L

6. In order to oxidise a mixture of one mole of each of FeC_2O_4, $Fe(C_2O_4)_3$, $FeSO_4$ and $Fe_2(SO_4)_3$ in acidic medium, the number of moles of $KMnO_4$ required is: **[4]**

a) 1   b) 1.5

c) 2   d) 3

7. The IUPAC name of the following compound is: **[4]**

a) 5-Bromo-3-methylcyclopentanoic acid   b) 3-Bromo-5-methylcyclopentanoic acid

c) 4-Bromo-2-methylcyclopentane carboxylic acid   d) 3-Bromo-5-methylcyclopentane carboxylic acid

8. Which one of the following cannot function as an oxidising agent? **[4]**

a) I^- b) S (s)

c) $Cr_2O_7^{2-}$ d) NO_3^- (aq)

9. Which of the following compounds will exhibit geometrical isomerism? **[4]**

a) 1-phenyl-2-butene   b) 2-phenyl-1-butene

c) 3-phenyl-1-butene   d) 1, 1-diphenyl-1-propane

10. A solution at 20 °C is composed of 1.5 mol of benzene and 3.5 mol of toluene. If the vapour pressure of pure benzene and pure toluene at this temperature are 74.7 torr and 22.3 torr, respectively, then the total vapour pressure of the solution and the benzene mole fraction in equilibrium with it will be, respectively: **[4]**

a) 35.8 torr and 0.280   b) 38.0 torr and 0.589

c) 30.5 torr and 0.389   d) 30.5 torr and 0.480

11. What would be the molality of 20% (mass/mass) aqueous solution of KI? (Molar mass of KI = 166 g mol^{-1}) **[4]**

a) 1.48   b) 1.08

c) 1.51   d) 1.35

12. For the given cell; **[4]**

$Cu(s)|Cu^{2+}(C_1M)||Cu^{2+}(C_2M)|Cu(s)$

change in Gibbs energy (ΔG) is negative, if:

a) $C_1 = C_2$ b) $C_1 = 2C_2$

c) $C_2 = \frac{C_1}{\sqrt{2}}$ d) $C_2 = \sqrt{2}C_1$

13. In the reaction, $P + Q \rightarrow R + S$, the time taken for 75% reaction of P is twice the time taken for 50% reaction of P. The concentration of Q varies with reaction time as shown in the figure. The overall order of the reaction is **[4]**
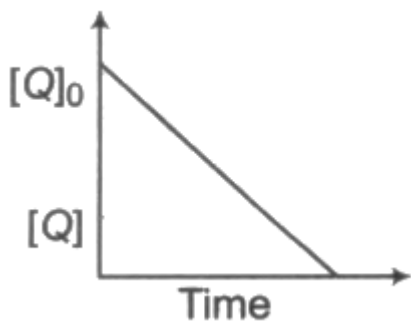
a) 2

b) 3

c) 1

d) 0

14. Given below are the half-cell reactions: **[4]**

$Mn^{2+} + 2e^- \longrightarrow Mn$; $E^o = -1.18$ V

$2(Mn^{3+} + e^- \longrightarrow Mn^{2+})$; $E^o = +1.51$ V
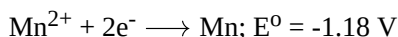
The E^o for $3Mn^{2+} \longrightarrow Mn + 2Mn^{3+}$ will be:

a) -2.69 V; the reaction will not occur

b) -2.69 V; the reaction will occur

c) -0.33 V; the reaction will occur

d) -0.33 V; the reaction will not occur

15. In KO_2, the nature of oxygen species and the oxidation state of oxygen atom are, respectively: **[4]**

a) Superoxide and -1

b) Oxide and -2

c) Superoxide and $-\frac{1}{2}$
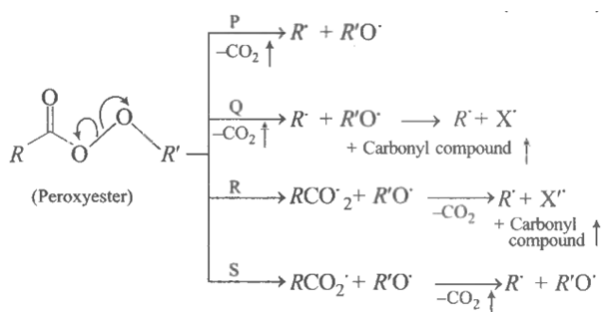
d) Peroxide and $-\frac{1}{2}$

16. On the treatment of 100 mL of 0.1 M solution of $CoCl_3 \cdot 6H_2O$ with an excess of $AgNO_3$; 1.2×10^{22} ions are precipitated. The complex is **[4]**

a) $[Co(H_2O)_6]Cl_3$

b) $[Co(H_2O)_5Cl] Cl_2 \cdot H_2O$

c) $[Co(H_2O)_3Cl_3] \cdot 3H_2O$

d) $[Co(H_2O)_4Cl_2] Cl \cdot 2H_2O$

17. The optically inactive compound from the following is: **[4]**

a) 2-chloro-2-methylbutane

b) 2-chloropentane

c) 2-chlorobutane

d) 2-chloropropanal

18. Different possible thermal decomposition pathways for peroxyesters are shown below. Match each pathway from Column **I** with an appropriate structure from Column II and select the correct answer using the code given below the lists. **[4]**

Column I	Column II
P. Pathway P	

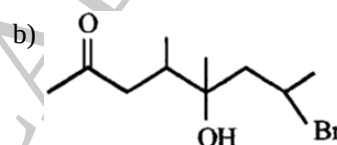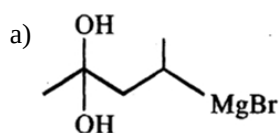|	
	1. $C_6H_5CH_2\overset{\overset{\displaystyle O}{\|}}{C}-O-O-CH_3$
Q. pathway Q	2. $C_6H_5\overset{\overset{\displaystyle O}{\|}}{C}-O-O-CH_3$
R. pathway R	3. $C_6H_5CH_2\overset{\overset{\displaystyle O}{\|}}{C}-O-O-\underset{\underset{\displaystyle CH_2C_6H_5}{\overset{\displaystyle |}{C}}}{\overset{\displaystyle CH_3}{\underset{|}{\overset{|}{C}}}}CH_3$
S. Pathway S	4. $C_6H_5\overset{\overset{\displaystyle O}{\|}}{C}-O-O-\underset{\underset{\displaystyle C_6H_5}{\overset{\displaystyle |}{C}}}{\overset{\displaystyle CH_3}{\underset{|}{\overset{|}{C}}}}CH_3$

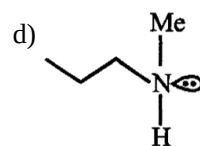a) (P) - (4), (Q) - (1), (R) - (2), (S) - (3)   b) (P) - (3), (Q) - (2), (R) - (1), (S) - (4)
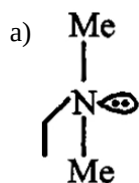
c) (P) - (2), (Q) - (4), (R) - (3), (S) - (1)   d) (P) - (1), (Q) - (3), (R) - (4), (S) - (2)

19. $\xrightarrow[\text{(ii) H}_2\text{O}]{\text{(i) Mg}}$ **A** (Major Product) A is **[4]**

a)

b)

c)

d)
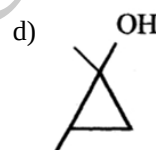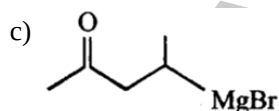
20. An organic compound [A]($C_4H_{11}N$), shows optical activity and gives N_2 gas on treatment with HNO_2. The compound [A] reacts with $PhSO_2Cl$ producing a compound which is soluble in KOH. The structure of A is: **[4]**

a)

b)

c)

d)
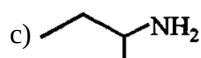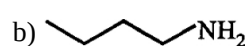
CHEMISTRY (Section-B)

21. Assume that the radius of the first Bohr orbit of hydrogen atom is 0.6 $\overset{o}{A}$. The radius of the third Bohr orbit of **[4]**

He$^+$ is picometer. (Nearest Integer)

22. An organic compound undergoes first order decomposition. If the time taken for the 60% decomposition is 540 s, then the time required for 90% decomposition will be is _____ s. (Nearest integer). Given: In 10 = 2.3; log 2 = 0.3 **[4]**

23. The sum of oxidation states of two silver ions in [Ag(NH$_3$)$_2$] [Ag(CN)$_2$] complex is _____. **[4]**

24. If the value of Avogadro number is 6.023×10^{23} mol^{-1} and the value of Boltzmann constant is 1.380×10^{-23} J K^{-1}, then the number of significant digits in the calculated value of the universal gas constant is **[4]**

25. The logarithm of equilibrium constant for the reaction Pd^{2+}4Cl$^-$ $\rightleftharpoons$ PdCl$_4^{2-}$ is _____ (Nearest integer) **[4]**

Given: $\frac{2.303RT}{F}$ = 0.65 V

Pd^{2+} (aq) + 2e$^-$ $\rightleftharpoons$ pd(s); E^o = 0.83 V

PdCl$_4^{2-}$ (aq) + 2e$^-$ $\rightleftharpoons$ Pd(s) + 4Cl$^-$ (aq)

E^o = 0.65 V