IIT-JEE-2003

CHEMISTRY

Mains

Note : Question number 1 to 10 caries 2 marks each and 11 to 20 carries 4 marks each.

1. Calculate the molarity of water if its density is $1000^{3}\ kg/m$

2. The average velocity of gas molecules is $400\,m/sec$. Calculate its rms velocity at the same temperature.

3. Write down the heterogeneous catalyst involved in the polymerization of ethylene.

4. Which one is more soluble in diethyl ether anhydrous $AICI_3$? Explain in terms of bonding.

5. Using VSEPR theory, draw the shape of PCI5 and BrF5.

6. A racemic mixture of $(+)$ 2 -phenyl propanoic acid on esterification with $(+)$ 2 -butanol gives two esters. Mention the stereochemistry of the two esters produced.

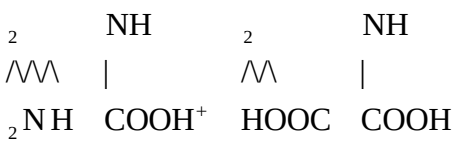
7. Wavelengths of high energy transition-of H at 0.1ms is 91.2nm. Calculate the corresponding wavelength of He atoms.

8. Match the following

	K_a
(a) Benzoic acid	3.3×10^{-5}
(b) O_2N-  -COOH	6.3×10^{-5}
(c) Cl-  -COOH	30.6×10^{-5}
(d) H_3CO-  -COOH	6.4×10^{-5}
(e) H_3C-  -COOH	4.2×10^{-5}

9. Write down reactions involved in the extraction of Pb. What is the oxidation number of lead in litharge?

10. Following two aminoacids liosine and glutamine form dipeptide linkage. What are two possible dipeptides?



11. (a) You are given marbles of diameter $10\,\text{mm}$. They are to be placed such that their centres are lying in a square bound by four lines each of length $40\,\text{mm}$. What will be the arrangements of marbles in a plane so that maximum number of marbles can be placed inside the area? Sketch the diagram and derive expression for the number of molecules per unit area.

(b) $1\,\text{gm}$ of charcoal adsorbs $100\,\text{ml}\,0.5_3\text{COOH}$ to form a monolayer, and thereby the molarity of CH_3COOH reduces to 0.49. Calculate the surface area of the charcoal adsorbed by each molecule of acetic acid. Surface area of charcoal $= 3.01\times10^2\ \text{m}^2/\text{gm}$.

12. (a) Will the pH of water be same at $4°C$ and $25°C$? Explain.

(b) Two students use same stock solution of and $ZaSO_4$ a solution of $CuSO_4$. The emf of one cell is $0.03\,V$ higher than the other. The conc. of $CuSO_4$ in the cell with higher emf value is $0.5\,M$. Find out the conc. of $CuSO_4$ in the other cell $(2.203\ RT/F = 0.06)$.

13. Convert

(a)

F

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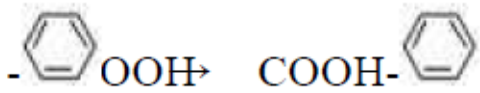
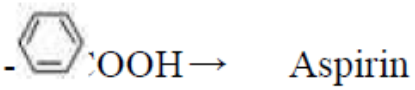


(in not more than 3 steps)

(b)  Aspirin

14. There is a solution of odroxy benzoic acid and p-amino benzoic acid. Discuss one method by which we can separate them and also write down the confirmatory tests of the functional groups present.

$A_6(H_{12})\text{--HCl--}>(B+C)$

15. $_6H_{13}CI)(C$

$\text{--aldBKOH--}>D(\text{isomer of } A)$

$\text{--ozonolysis--}>E$ (it gives negative test with Fehling solution but responds to idoform test)

$\text{--ozonolysis--}>F+G$ (both gives positive Tollen's test but do not give idoform test)

$\text{--conc. NaOH--}>$ HCOONa + a primary alcohol

Identify to A to G.

16. Identify the following :

$CO_3\text{--}>SO_2\text{--}>A\text{--}Na_2CO_2\text{--}>B\text{--}\text{Elemental S}/\Delta\text{-->}C\text{--}I_2\text{--}>D$

Also mention the oxidation state of S in all the compounds.

17. Write the IUPAC nomenclature of the given complex along with its hybridization and structure. $K_2\left[Cr(NO)(NH_3)(CN)^4\right]$, $m=1.73BM$.

18. A mixture consists A (yellow solid) and B (colourless solid) which gives lilac colour in flame

(a) Mixture gives black precipitate C on passing H

(b) C is soluble in aqua-regia and on evaporation of aqua-regia and adding $SnCI_2$ gives grayish black precipitate D.

The salt solution with NH_4OH gives a brown precipitate.

(i) The sodium extract of the salt with $_4/FCCI_3$ gives a violet layer.

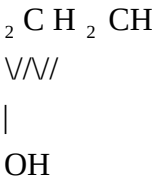
(ii) The sodium extract gives yellow precipitate with $A_3g\,NO$ solution which is insoluble in NH_3. Identify A and B, and the precipitates C and D.

19. (a) Match the following if the molecule weights of X, Y and Z are same

	Boiling Point	**Kb**
X	100	0.68
Y	27	0.53
Z	253	0.98

(b) C_u value of He is always $3R/2$ but C_u value fo H2 is at low temperature and $5R/2$ at moderate temperature and more than $5R/2$ at higher temperature explain in two to three lines.

20. (a)



Write resonance structure of the given compound.

(b) Compound A of molecular formula $C_9H_7O_2CI$ exists in ketoform and predominantly in enolic form ' B '. On oxidation with $KMnO4$, ' A ' gives m-chlorobenzoic acid. Identify ' A ' and ' B '.