No. of Printed Pages : 8

ET-105(B)

B.Tech. Civil (Construction Management)/ B.Tech. Civil (Water Resources Engineering)

Term-End Examination

June, 2014

01245

ET-105 (B) : CHEMISTRY

Time : 3 hours *Maximum Marks : 70*

Note : *Question no. 1 is* ***compulsory****. Answer any* ***five*** *questions from the remaining. Use of scientific calculator is permitted.*

1. Write the most appropriate answer out of the given alternatives for the following.

(a) Number of nearest neighbours around an atom in SC crystal is *2*

(i) 6

(ii) 8

(iii) 12

(iv) 14

(b) Diamond *2*

(i) contains only covalent bonds

(ii) is a good conductor of electricity

(iii) has a BCC structure

(iv) is a super-cooled liquid

(c) Which one of the following is an electrophile ? 2

(i) BF_3

(ii) H_2O

(iii) CN^-

(iv) NH_3

(d) Heterolytic fission results in the formation of 2

(i) free radical

(ii) two neutral atoms

(iii) carbenes

(iv) carbonium ion

(e) Ethane reacts with bromine to form bromoethane. It is an example of 2

(i) nucleophilic substitution reaction

(ii) electrophilic substitution reaction

(iii) free radical substitution reaction

(iv) S_N2 reaction

(f) For two moles of an ideal gas 2

(i) $C_p - C_v = R$

(ii) $C_p - C_v = R/2$

(iii) $C_p - C_v = -2R$

(iv) $C_p - C_v = 0$

(g) Oil of vitrol is 2

(i) $FeSO_4 . 7H_2O$

(ii) H_2SO_4

(iii) $CuSO_4 . 5H_2O$

(iv) $Na_2S_2O_3 . 5H_2O$

(h) Solvay process is used for prepration of 2

(i) liquid air

(ii) nitric oxide

(iii) Na_2CO_3

(iv) chlorine

(i) In Wurtz reaction, reagent and other condition used are 2

(i) metallic Na and dry ether

(ii) Ag or alc. alkali

(iii) Anhydrous $AlCl_3$

(iv) Br_2 + alkali

(j) Silver is prepared by 2

(i) Deacon's process

(ii) Parkes' process

(iii) Ostwald process

(iv) None of the above

2. (a) How is the efficiency of a heat engine related to temperatures T_2 and T_1 where $T_2 > T_1$? 2

(b) Give an example where Carnot cycle is used to convert heat into work. 2

(c) At what condition can efficiency of a heat engine theoretically be made to 1 ? 2

(d) Give an example where Carnot cycle works in reverse order. 2

(e) Can the efficiency of a heat engine be increased by replacing water by an oil ? 2

3. Fill up the blanks :

(i) Pressure has no effect on the reaction in which $\Delta n =$ _____ . 2

(ii) Sulphur reduces hot conc. H_2SO_4 to _____ and hot conc. HNO_3 to _____ . 2

(iii) Radioactive ^{11}C decays by _____ emission whereas ^{14}C decays by _____ emission. 2

(iv) Conc. HNO_3 on dehydration with P_4O_{10} gives _____ . 2

(v) Ferric ions can be distinguished from ferrous ions by KCNS test in which ferric ions give _____ colour due to the formation of _____ . 2

4. Fill up the blanks :

(i) $Au + 4HCl + 3HNO_3 \rightarrow$ ____ $+ 3NO_2 + 3H_2O$ 2

(ii) $C + 4HNO_3$ (conc.) $\rightarrow CO_2 +$ _____ $+ 2H_2O$ 2

(iii) $Sn + 2KOH$ (hot) $+ 4H_2O \rightarrow$ _____ $+ 2H_2$ 2

(iv) $Cu(OH)_2 + 2NH_4NO_3 + NH_4OH \rightarrow$ ___ $+ 4H_2O$ 2

(v) $2KMnO_4 + H_2SO_4 \rightarrow$ _____ $+ K_2SO_4 + H_2O$ 2

5. (a) The solubility product of Ag_2CrO_4 is $1{\cdot}9 \times 10^{-12}$. Calculate the solubility of Ag_2CrO_4. *3*

(b) The solubility of CaF_2 in pure water is $3{\cdot}5 \times 10^{-4}$ at 25°C. What will be its solubility product ? *3*

(c) In a solution containing 0·01 M $CrO_4^{=}$ and 0·1 M Cl^- ions. Ag^+ ions are added slowly in the solution. Predict which ion will precipitate first ?

Given : $[Ag^+][Cl^-] = 2{\cdot}8 \times 10^{-10}$;

$[Ag^+]^2\,[CrO_4^{=}] = 1{\cdot}9 \times 10^{-12}$. *4*

6. (a) What is Dalton's law ? *2*

(b) Suppose n_A moles of a gas A and n_B moles of a gas B are mixed in a volume V at a temperature T. Express the total pressure in terms of n_A, n_B, R, T and V. *2*

(c) A sample of PCl_5 weighing 2·69 gm was placed in a 1 litre flask and completely vaporized at a temperature of 250°C. The pressure observed at this temperature was 1·00 atm. What are the partial pressures of PCl_5, PCl_3 and Cl_2 under these experimental conditions ?

Given : Mol. wt. of $PCl_5 = 208$

$R = 0{\cdot}082\ l - atm / k - mole$ *6*

7. (a) Describe how molecular weight of a solute is determined by freezing point depression method. 4

(b) The freezing point of a solution containing 50 cm^3 of ethylene glycol in 50 g of water is found to be $-34°C$. Assuming ideal behaviour, calculate the density of ethylene glycol. (K_f for water = 1·86 K kg mol^{-1}) 6

8. (a) What is pH ? How is the pH of a solution determined ? 4

(b) Two buffers, (X) and (Y), of pH 4·0 and 6·0 respectively are prepared from a weak acid HA and the salt NaA. Both the buffers are 0·50 M in HA. What would be the pH of the solution obtained by mixing equal volume of the two buffers ? ($K_{HA} = 1·0 \times 10^{-5}$) 6

9. (a) Define differential rate law and integrated rate law. 2

(b) What is the difference between molecularity and order of reaction ? 2

(c) What is half life relation for a zero order reaction of a substance having initial concentration a ? 3

(d) The rate of a reaction is doubled for every 10° rise in temperature. Determine the increase in reaction rate for the temperature rise from 10° to 100°C. 3

10. (a) Give one example for each of the following : *4*

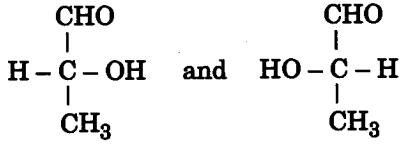
(i) Chain isomerism

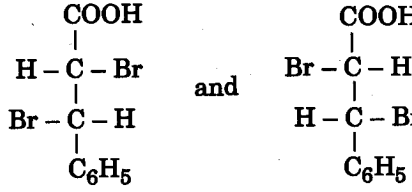
(ii) Enantiomerism

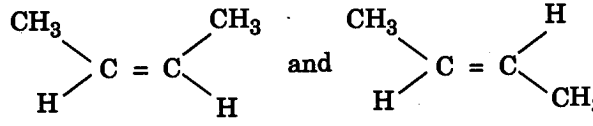
(iii) Tautomerism

(iv) Geometrical isomerism

(b) Which of the following pairs are diastereomers *3*

(i) 

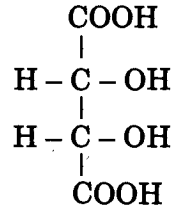
(ii) 

(iii) 

(iv) All of these

(c) Which of the following formulas represent meso compounds ? *3*

(i)



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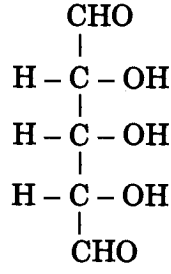

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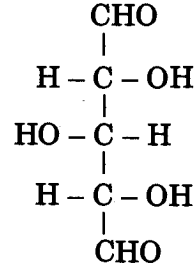

(iv) All of these