No. of Printed Pages : 7

ET-105(B)

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

Term-End Examination

December, 2017

00547

ET-105(B) : CHEMISTRY

Time : 3 hours *Maximum Marks : 70*

Note : *Attempt **seven** questions in all. Question no. 1 is **compulsory**. Use of calculator is allowed.*

1. Choose the most appropriate option/answer for the following questions : *10×1=10*

(a) The equivalent weight of $KMnO_4$ in aqueous solution is

(i) $\frac{\text{mol. wt}}{6}$

(ii) $\frac{\text{mol. wt}}{3}$

(iii) $\frac{\text{mol. wt}}{4}$

(iv) $\frac{\text{mol. wt}}{1}$

(b) Which of the following has the least ionic radius ?

(i) N^{3-}

(ii) Mg^{2+}

(iii) Na^{+}

(iv) F^{-}

(c) An element has atomic number 52. It is an element of

(i) s-block

(ii) p-block

(iii) d-block

(iv) f-block

(d) Homolytic fission results in the formation of

(i) Free radicals

(ii) Carbonium ions

(iii) Carbenes

(iv) Carbanions

(e) Total σ and π bonds in ethyne are

(i) $3\sigma, 2\pi$

(ii) $2\sigma, 3\pi$

(iii) $2\sigma, 2\pi$

(iv) $1\sigma, 3\pi$

(f) Gibbs-Helmholtz equation is

(i) $\Delta G = \Delta H - T\Delta S$

(ii) $\Delta G = T\Delta S - \Delta H$

(iii) $-\Delta G = \Delta H + T\Delta S$

(iv) $\Delta G = \Delta H + T\Delta S$

(g) In d^2sp^3 hybridization, the geometry of complexes formed by transition metal ions is

(i) Tetrahedral

(ii) Octahedral

(iii) Square Planar

(iv) Trigonal

(h) Acidic strength among halo acids is

(i) HF < HCl < HBr < HI

(ii) HI < HBr < HCl < HF

(iii) HBr < HI < HF < HCl

(iv) HCl < HF < HI < HBr

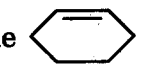
(i) The total number of atoms per unit cell in BCC structure is

(i) 2

(ii) 3

(iii) 4

(iv) 1

(j) The molecule  is called

(i) 1,2-cyclobenzene

(ii) cyclohexene

(iii) cyclohexyne

(iv) cyclohexadiene

2. (a) Define Degree of Freedom and give an example. $2\frac{1}{2}$

(b) What is Eutectic Mixture ? Explain. $2\frac{1}{2}$

(c) Draw and label a phase diagram of the H_2O system. 5

3. (a) Explain Common Ion effect. $2\frac{1}{2}$

(b) What is meant by Solubility Product ? $2\frac{1}{2}$

(c) The solubility product of lead chloride ($PbCl_2$) is $1{\cdot}6 \times 10^{-5}$. If 500 ml of 0·03 M NaCl is mixed with 500 ml of 0·3 M lead nitrate, will there be precipitation of $PbCl_2$? Explain. 5

4. (a) Calculate the velocity of an electron having a de Broglie wavelength of 0·15 nm. 3

(b) If the position of a dust particle of mass 1·5 μg is within 10^{-3} mm, what is the minimum uncertainty in its velocity ? 5

(c) What are the dihedral angles in a planar molecule ? 2

5. (a) In PH_3 , the P – H bond length is 1·42 Å and in AsH_3 , the As – H bond length is 1·52 Å. What are expected H – P – H and H – As – H bond angles ? Explain. 4

(b) The molecule SO_3 is isoelectronic with NO_3^- and CO_3^{2-}. What are the expected structures of these ions ? What is the bond order of the N – O and C – O bonds ? 4

(c) How many electrons, protons and neutrons are there in Fluorine (At. no. 9) and Bismuth (At. no. 83) atoms ? 2

6. (a) Which of the following are extensive and which are intensive properties ? 3

(i) Temperature

(ii) Surface tension

(iii) Volume of a gas

(iv) Volume of a given mass of a gas at a definite pressure

(v) Pressure of a given mass of a gas at a definite volume

(vi) Pressure of a gas

(b) Calculate the entropy of fusion of one mole of ice if its heat of fusion is 6·0 kJ mol^{-1} at its melting point. 3

(c) What are Biological Catalysts ? Derive an expression for rate of reaction catalysed by a biological catalyst in terms of its concentration and concentration of the substrate. 4

7. (a) For the reaction

$A + B \rightarrow$ Products

at A_0 = 1·0 M, B varies with t as follows :

t(min)	$\frac{[B]}{10^{-3}M}$
0	100
1·23	95
2·60	90
5·17	80
8·93	70
17·33	50
19·95	45
57·50	10

Show that the reaction order is 1 w.r.t. B and determine K. 5

(b) Derive an expression of the Nernst equation for galvanic cell at 25° C. 5

8. (a) Write the electronic configurations of the following : 3

(i) $_8O^{2-}$

(ii) $_{29}Cu^{2+}$

(iii) $_{22}Ti^{3+}$

(b) Which member of the following pairs of ions has greater radius ? Also give reason(s). 4

(i) S^{2-} or S^{6+}

(ii) Na^+ or Al^{3+}

(iii) Na^+ or F^-

(iv) Fe^{2+} or Fe^{3+}

(c) Explain why diamond is an insulator through which graphite conducts electricity. 3

9. (a) Of all the inert gases, only Xenon forms compounds with Fluorine. Explain. 3

(b) Explain why $CuSO_4.5H_2O$ is blue whereas $ZnSO_4.H_2O$ is colourless. 3

(c) Write the IUPAC names of the following complexes : 4

(i) $[Cr(NH_3)_3(NO_2)_3]$

(ii) $[Cr(H_2O)_4Cl_2]Cl$

(iii) $[Co(NH_3)_5(H_2O)]Cl_3$

(iv) $K_4[Fe(CN)_6]$

10. (a) Arrange the following hydrocarbons in the order of their increasing boiling points : *2*

(i) 2,3-dimethylbutane

(ii) n-hexane

(iii) 2,2-dimethylbutane

(iv) 2-methylpentane

(b) Describe two reactions for preparing ethylene glycol from ethylene. What are the uses of ethylene glycol ? *4*

(c) How would you carry out any ***two*** of the following conversions ? *2+2=4*

(i) 2-Propanol to Propene

(ii) Propyne to 2-Butene

(iii) 2-Butene to Butane