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

Term-End Examination

□□952 **June, 2018**

ET-105(B) : CHEMISTRY

Time : 3 hours   *Maximum Marks : 70*

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

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

   (a) What is the maximum number of electrons which can possess the following set of quantum numbers :

   $n = 4, l = 3$

   (i) 8

   (ii) 10

   (iii) 14

   (iv) 18

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(b)   What is the formula for the total force on particle j ?

(i) $$j = -\sum_{\substack{i=1 \\ (i \neq j)}}^{N} \frac{\partial U_{ij}}{\partial \vec{r}_j}$$

(ii) $$j = -\sum_{\substack{i=1 \\ (i = j)}}^{N} \frac{\partial U_{ij}}{\partial \vec{r}_j}$$

(iii) $$j = \sum_{\substack{i=1 \\ (j = 0)}}^{N} \frac{\partial U r_{ij}}{\partial \vec{r}_j}$$

(iv)   None of the above

(c)   Nitrogen and hydrogen react to form ammonia in a sealed steel tube. This is a/an

(i)   closed system

(ii)   open system

(iii)   isolated system

(iv)   None of the above

(d)   The first order rate constant for the decomposition of N_2O_5 is $6 \cdot 2 \times 10^{-4}$ s^{-1}. What is the half-life for this decomposition ?

(i)   1120·7 s

(ii)   1117·7 s

(iii)   2222·8 s

(iv)   1007·7 s

(e) Consider the system consisting of the three solids Fe_3O_4, FeO and Fe_2O_3. How many components are there?
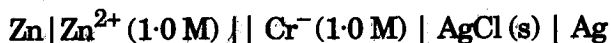
    (i)   3

    (ii) 4

    (iii) 1

    (iv) 2

(f) For the galvanic cell

$Zn \mid Zn^{2+}$ (1·0 M) $\mid\mid$ Cr^- (1·0 M) $\mid$ $AgCl$ (s) $\mid$ Ag

the EMF at 298 K is 0·985 V. Identify the *ANODE*.

    (i)   LHS electrode viz. Zn is the anode

    (ii) RHS electrode viz. Ag is the cathode

    (iii) The Ag electrode is the positive electrode

    (iv) The Zn electrode is the negative electrode

(g) Predict the geometry of complexes formed by transition metal ions using the hybrid orbitals d^2sp^3.

    (i)   Tetrahedral

    (ii) Octahedral

    (iii) Square planar

    (iv) Trigonal bipyramidal

(h) Which has higher electron affinity, $_6C$ or $_9F$?

(i) $_6C$

(ii) $_9F$

(iii) Both $_6C$ and $_9F$

(iv) None of the above

(i) Arrange the following hydrocarbons in the order of increasing boiling point :

1. 2, 3-dimethyl butane

2. n-hexane

3. 2, 2-dimethyl butane

4. 2-methyl pentane

(i) $1 > 2 > 3 > 4$

(ii) $4 > 3 > 2 > 1$

(iii) $3 < 1 < 4 < 2$

(iv) $1 < 2 < 4 < 3$

(j) The distance of the Sun from the Earth is

(i) 120×10^6 km

(ii) 180×10^6 km

(iii) 150×10^6 km

(iv) 100×10^6 km

2. (a) How would you convert (i) propene to 2-chloropropane, (ii) 1-bromopropene to propene ?   4

(b) Which of the following is/are aromatic and why ?   3

(i)

(ii)

(c) Write the reaction for preparing ethylene glycol from ethylene.   3

3. (a) Explain copolymerisation with the help of an example.   5

(b) Explain photosynthesis.   5

4. (a) Write a short note on the Carnot cycle.   5

(b) Three moles of water are heated at atmospheric pressure from 270 K to 400 K. Calculate the entropy change accompanying the process. Ice melts at 273 K and water boils at 373 K. The latent heat of fusion of ice is 333.19 J/g and the latent heat of vapourisation of water is 2255·32 J/g. The specific heat of ice and water are $4·22 \, J/K^{-1} \, g^{-1}$ and the specific heat of steam is $2·01 \, J/K^{-1} \, g^{-1}$. The molecular weight of water is 18.   5

5. (a) 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.   *5*

(b) For the reaction $A + B \rightarrow$ Products

at $A_0 = 1 \cdot 0$ M, 'B' varied with 't' as follows :

t(min)	$\dfrac{[B]}{10^{-3}M}$
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 with respect to B and determine k.   *5*

6. (a) Write orbital energy correlation diagram of 'CO'

(i) without hybridization, and

(ii) with hybridization on 'C' and 'O'.   *5*

(b) Calculate the packing fraction in a FCC lattice of NaCl.   *5*

7. (a) What is the difference between eutectic and triple point ? Explain one of these with a diagram. **4**

(b) Define Degrees of Freedom. **2**

(c) Define Raoult's law. Relate it with azeotropic mixture. **4**

8. (a) Define Nernst Equation. **5**

(b) The standard electrode potential of Ag-AgCl electrode on the hydrogen scale is + 0·222 V, at 298 K. For the cell

$$Fe\,|\,Fe^{2+}(1·0\ M)\ \|\ Cl^-\,(1·0\ M)\,|\,AgCl(s)\,|\,Ag,$$

the EMF was found to be + 0·663 V at 298 K. What is the standard electrode potential of Fe^{2+}/Fe on the hydrogen scale ? **5**

9. (a) Crystal Field Theory has three assumptions. Explain and draw the figure of the splitting of d-level in an octahedral field. **5**

(b) Write a short note on blast furnace in the formation of molten iron. **5**

10. (a) What are the commercially important compounds of alkali metals ? Discuss any two. **5**

(b) Write a short note on chemical properties of boron. **5**