| ET-105(B) |

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

Term-End Examination

December, 2018

00393

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 : $10 \times 1 = 10$

   (a) The equilibrium constant for the dissociation of PCl_5 at 250°C and a total pressure of 1 bar is 1·78. Calculate the degree of dissociation.

   $$PCl_5 \rightleftharpoons PCl_3 + Cl_2$$

   (i) 0·8

   (ii) 0·2

   (iii) 0·01

   (iv) 1

   (b) The degree of freedom at triple point is

   (i) 1

   (ii) 2

   (iii) 3

   (iv) zero

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(c) Which one is the more common form of 'Tin' ?

(i) Grey Tin

(ii) White Tin

(iii) Yellow Tin

(iv) Rhombic Tin

(d) Which of the following shows Geometrical Isomerism ?

(i) Dichlorodiammineplatinum

(ii) Glucose

(iii) Tetraamminetrinitrochromium(III)

(iv) None of the above

(e) Which of the following is true for an adiabatic transformation ?

(i) $W = C_v \, dT$ and $q = \Delta S$

(ii) $W = C_p \, dT$ and $q = \Delta S$

(iii) $W = C_p \, dT$ and $q = 0$

(iv) $W = C_v \, dT$ and $q = 0$

(f) A radioactive substance decays with a half-life of 10 minutes. Assuming first order kinetics, the rate constant would be

(i) $0 \cdot 1623$ min^{-1}

(ii) $0 \cdot 0693$ min^{-1}

(iii) $1 \cdot 000$ min^{-1}

(iv) None of the above

(g) Aldehydes and ketones have lower boiling points than the corresponding alcohols due to

    (i) Van der Waals forces

    (ii) Ionization energy

    (iii) H-bonding

    (iv) Dipole-dipole interaction

(h) One of the major constituents of coal-tar is

    (i) Cellulose

    (ii) Citric acid

    (iii) Toluene

    (iv) Ethene

(i) The shape and bond angle of C_2H_4 is

    (i) Trigonal, 120°

    (ii) Linear, 180°

    (iii) Tetrahedral, 109° 28'

    (iv) Angular, 30°

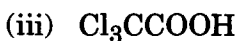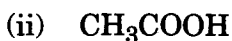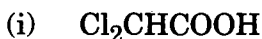(j) What is the maximum number of electrons which can possess the following set of quantum numbers ?

    $n = 5$, $l = 3$, $m = +1$

    (i) 4
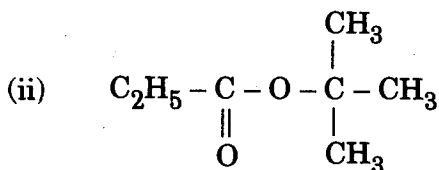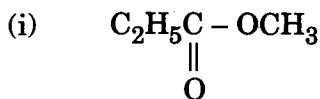
    (ii) 3

    (iii) 2

    (iv) 1

2. (a) Draw the energy level diagram of homonuclear diatomic O_2 and calculate the bond order.   *5*

(b) What do you understand by the term molecular axis ? Identify the molecular axis in H_2, NH_3 and benzene.   *5*

3. (a) Arrange the following acids in the order of increasing acidity, with explanation :   *5*

(i) $Cl_2CHCOOH$

(ii) CH_3COOH

(iii) Cl_3CCOOH

(iv) $ClCH_2COOH$

(b) What products would you expect if an ester is hydrolysed in the presence of hot aqueous sodium hydroxide ? Which of the following would be hydrolysed faster and why ?   *5*

(i)
$$C_2H_5\underset{\underset{O}{\|}}{C} - OCH_3$$

(ii)
$$C_2H_5 - \underset{\underset{O}{\|}}{C} - O - \underset{\underset{CH_3}{|}}{\overset{\overset{CH_3}{|}}{C}} - CH_3$$
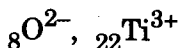
4. (a) Write the mechanism of photosynthesis. *5*

(b) Explain the principle of production of a laser beam. Why is such a beam inherently monochromatic in nature ? *5*

5. (a) What is Collision theory ? Derive an expression for the Collision theory. *5*

(b) The value of k for the reaction $O + CH_4 \rightarrow CH_3 + OH$ varies with temperature as given below :

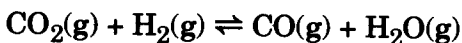| T (K)	$k \, (dm^{-3} \, mol^{-1} \, s^{-1})$
297	$1 \cdot 26 \times 10^7$
363	$9 \cdot 2 \times 10^7$
419	$3 \cdot 4 \times 10^8$
519	$2 \cdot 5 \times 10^9$
605	$1 \cdot 09 \times 10^{10}$
904	$1 \cdot 3 \times 10^{11}$

Calculate the Arrhenius activation energy and the pre-exponential factor for the reaction. *5*

6. (a) Derive $\overline{C}_p - \overline{C}_v = R$. 5

(b) 3 moles of oxygen ($\overline{C}_p = 25.73$ J K^{-1} mol^{-1}) at 30°C and 10 bar pressure expand adiabatically to a pressure of 8·6 bar when the temperature falls to 17°C. Calculate the work done and heat absorbed by the gas. 5

7. (a) Write a short note on 'Chemical Properties of Alkaline Earth Metals'. 5

(b) How can the similarity in the chemical properties of the lanthanides be explained ? 3

(c) Write the electronic configuration of the following ions : 2

$$_8O^{2-}, \ _{22}Ti^{3+}$$

8. (a) The equilibrium constant for the reaction

$$CO_2(g) + H_2(g) \rightleftharpoons CO(g) + H_2O(g)$$

at 959 K is 0·534. The partial pressures of CO_2, H_2, CO and H_2O in a reaction vessel are 0·2, 0·25, 0·3 and 0·25 bar respectively.

(i) In which direction will the reaction proceed at 959 K ?

(ii) What will be the partial pressure at equilibrium ? 5

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(b) What is Le Chatelier's principle ? Discuss it giving the example of formation of ammonia.   5

9. (a) What is a Galvanic cell ? Draw and explain laboratory version of the Daniell cell.   5

(b) Write a short note on protective measures against corrosion.   5

10. (a) Define Faraday's laws of electrolysis and electrolytic conduction. Explain their significance.   5

(b) Distinguish between Primary and Secondary cells.   5