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ET-105(B)(S)

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

00178

Term-End Examination

December, 2016

ET-105(B)(S) : CHEMISTRY

Time : 3 hours *Maximum Marks : 70*

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

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

(a) The indicator used in titration between $KMnO_4$ and Mohr's salt in acidic medium is

(i) $K_4Fe(CN)_6$

(ii) Methyl blue

(iii) Methyl red

(iv) $KMnO_4$ itself

(b) Mond process can be used to purify

(i) Ni

(ii) Cu

(iii) Al

(iv) All the above

(c) The rate constant K, of a reaction has the units sec^{-1}. The order of the reaction is

(i) 0

(ii) 1

(iii) 2

(iv) 3

(d) Which among the following is an electrophile ?

(i) NH_3

(ii) H_2O

(iii) ROH

(iv) BF_3

(e) Green vitriol is

(i) $FeSO_4 . 7H_2O$

(ii) H_2SO_4

(iii) $CuSO_4 . 5H_2O$

(iv) $Na_2S_2O_3 . 5H_2O$

(f) The total number of atoms per unit cell in a primitive cell is

(i) 1

(ii) 2

(iii) 3

(iv) 4

(g) The hybridization in XeF_2 molecule is

(i) sp^2

(ii) sp^3

(iii) sp^3d

(iv) sp^2d

(h) The number of π-electrons in Benzene is

(i) 2

(ii) 1

(iii) 4

(iv) 6

(i) The unit of entropy is

(i) J

(ii) $JK^{-1} L^{-1}$

(iii) JK^{-1}

(iv) $JK^{-1} L$

(j) Which among the following is a tetrabasic acid ?

(i) $H_4P_2O_6$

(ii) $H_4P_2O_7$

(iii) HPO_3

(iv) H_3PO_4

2. (a) What is Phase rule ? Explain with example. *3*

(b) What is Eutectic point ? Explain. *3*

(c) Draw and label the phase diagram of any one component system. *4*

3. (a) Give two main reasons for non-ideal behaviour of gases. *3*

(b) What is Raoult's law ? *2*

(c) The solubility of MgF_2 at room temperature is 0·0012 mol/litre. Calculate the solubility product of MgF_2. Find the solubility of MgF_2 in 0·1 M $MgSO_4$. *5*

4. (a) What is the maximum number of electrons which can possess the following set of quantum numbers ? *3*

(i) $n = 2$

(ii) $n = 4, l = 3$

(iii) $n = 5, l = 3$

(iv) $m_i = +1$

(b) Calculate the velocity of electrons ejected from a platinum surface when a radiation of wavelength 150 nm is incident on it. The work function for platinum is about 5 eV. *4*

(c) Calculate the shortest frequency of radiation in the Paschen series. 3

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

(i) Viscosity

(ii) Weight

(iii) Mass

(iv) Specific gravity

(v) Refractive index

(vi) Volume of a solid

(b) Derive Arrhenius equation showing the effect of temperature on reaction rate. 3

(c) A Carnot engine operating between 480 K and 600 K absorbs 4184 J of heat from the source per cycle. What is the work done per cycle ? Also, find the heat given out to sink. What is the efficiency of the engine ? 4

6. (a) Given the following data :

t/s	$\frac{[\text{ester}]}{10^{-2}\,\text{Mol dm}^{-3}}$
0	5·00
100	3·55
200	2·75
300	2·25
400	1·85
500	1·6
600	1·48
700	1·40
800	1·38

Plot 1/[ester] v/s t and show that it is a second order reaction. Also, determine its rate constant. *5*

(b) Define Le Chatelier's principle and discuss its applications. *5*

7. (a) Write the electronic configuration of any ***two*** of the following elements : *2*

$_{15}P$, $_{23}V$, $_{64}Gd$ (Subscript is At. No)

(b) Which member of each of the following pairs of atoms has greater radius and why ? 6

(i) Li or F

(ii) Se or Ca

(iii) Br or S

(iv) Cu or Ni

(c) Write the balanced equation for the following reactions : 2

(i) Al_2O_3 dissolved in a basic solution (NaOH)

(ii) Addition of NH_4Cl to the solution in (i) above produces white precipitate

8. (a) What are the commercial uses of Ar, Ne and He ? 3

(b) Explain briefly, why most transition metal complexes are paramagnetic. 3

(c) Predict the geometry of complexes formed by transition metal ions using the following hybrid orbitals : 4

(i) d^2sp^3

(ii) dsp^2

9. (a) Show that bond order in unhybridised CO is 2. *3*

(b) The molecule HCN is isoelectronic with N_2. Discuss bonding in HCN. *3*

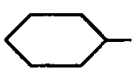
(c) Calculate the packing fraction of a simple cubic lattice. *4*

10. (a) Write the structure of the following : *3*

(i) 2, 2, 4-trimethylhexane

(ii) 2, 3-dimethylbutane

(b) Give the structures and names of the products A and B in the following reactions : *4*

(i)  $\xrightarrow[(ii)\ H^+]{(i)\ CO_2}$ Compound A

(ii) Compound A as in (i) above $\xrightarrow[H^+]{C_2H_5OH}$ Compound B

(c) Explain what is meant by "Coke" and "Coal tar". *3*