Heaven's Light is Our Guide

DEPARTMENT OF CIVIL ENGINEERING

RAJSHAHI UNIVERSITY OF ENGINEERING & TECHNOLOGY

B.Sc. Engineering **First** Year **Odd Semester** Examination, 2018

Chem 1101
Chemistry-I

Full marks: 72 **Time: 3 Hours**

N.B:- (i) Answer any **SIX** questions, taking **THREE** from each section.
(ii) Figures in the margin indicate full marks.
(iii) Use separate answer script for each section.

SECTION-A

Q.1(a) Briefly outline the engineering materials. 4.50
(b) Differentiate between additives and admixtures of cement. Give suitable example for each. 3.00
(c) Illustrate the reactions of cement with water. Proof that the total amount of water required for hydration of cement is equal to 38% by weight of cement. 4.50

Q.2(a) Explain Zeeman effect as a shortcoming of Boh'r theory. How this can be explained by using quantum number? 4.00
(b) Electronic configuration of two elements is $3d^3 4s^2$ & $3d^5 4s^1$. Predict the position of the elements in the modern periodic table. Explain the deviation of Aufbau principle between the electronic configuration and why. 6.00
(c) Define "node" and "nodal plane". 2.00

Q.3(a) Define electro-negativity. Explain how electro-negativity difference between bonding elements can be used to determine ionic/covalent character of compounds. 3.00
(b) Explain the periodic variations of electron affinity with exceptions. 6.00
(c) Write a short note on "normal elements". 3.00

Q.4(a) Define hydrogen bond. Illustrate on various kinds of hydrogen bond present in molecules. 3.00
(b) Write out the properties of ionic compounds. What are the criteria of formation of ionic bond? 4.00
(c) Sn (II) compounds are strong reducing agents while Pb (II) compounds are weak, although both are in the same group of periodic table- Explain. 3.00
(d) Explain why metallic sulfides are less soluble than the corresponding metal oxides. 2.00

SECTION-B

Q.5(a) Explain the qualitative and quantitative effect of temperature on the value of equilibrium constant for a reversible reaction at equilibrium. 6.00
(b) The industrial production of lime involves the following chemical reaction: $CaCO_3(s) \rightleftharpoons CaO(s) + CO_2(g)$. What type of equilibrium it is? Apply the law of mass action and deduce the equation of equilibrium constant for this reaction. 4.00
(c) Define the term "degree of dissociation". 2.00

Q.6(a) Differentiate between gel and emulsion. Discuss on elastic and non-elastic gel with specific example. 3.00
(b) Explain how positive and negative colloidal particles of AgCl can be obtained? 3.00
(c) Briefly describe on the purification of colloid by dialysis method. 3.00
(d) Explain the mechanism of removal of suspended particles from water. 3.00

Q.7(a) Define colloids and colloidal solution. Write down the properties of colloidal solution. 4.00
(b) Describe at least two methods for colloidal solution preparation. 4.00
(c) State and explain Osmotic pressure of dilute solution. 4.00

Q.8 Write Short Notes: (Any three) 12.00
(a) Bohr's atomic model with limitation.
(b) Electron affinity.
(c) Water as future fuel.
(d) Half-life of 1st order reaction.

****

Heaven's Light is Our Guide

DEPARTMENT OF CIVIL ENGINEERING

RAJSHAHI UNIVERSITY OF ENGINEERING & TECHNOLOGY

B.Sc. Engineering **FIRST** year **ODD SEMESTER** Examination, 2017

Chem 1101

Chemistry -I

Full Marks: 72 **Time: 3 Hours**

N.B.:- (i) Answer SIX questions, taking THREE from each section.
(ii) Figure in the margin indicates full marks.
(iii) Use separate answer script for each section.

SECTION-A

Q.1(a) Describe the wave mechanical concept of atom. 5.00

(b) Explain how the energy of an electron can be determined. 7.00

Q.2(a) Write a short note on normal elements and transition elements. 4.00

(b) Describe a suitable method for the determination of ionic radius in crystals. 5.00

(c) Define ionization potential. Explain how ionization potential can be applied to determine the metallic and non-metallic character of elements in the periodic table. 3.00

Q.3(a) Discuss about the structure based classification of silicates. 6.00

(b) Define density and specific gravity of solution. Under what condition both will be equal? 3.00

(c) A commercial sulfuric acid reagent is labeled as 96%, with specific gravity of 1.48. Calculate the amount of the commercial reagent required to prepare 6M solution in 100ml volumetric flask. 3.00

Q.4(a) Briefly describe the composition, property and applications of rapid hardening and extra rapid hardening cement. 5.00

(b) Point out the features of field test of cement. 2.50

(c) Describe the construction of rotary kiln. Assign the chemical changes that take part during the burning of raw materials in rotary kiln. 4.50

SECTION-B

Q.5(a) Explain why - chemical equilibrium is a dynamic state, mathematically. 2.00

(b) For the following reaction 7.00

$$2SO_2 + O_2 \rightleftharpoons 2SO_3 \qquad \Delta H = -96.23 \text{ kj mol}^{-1}$$

Derive the equation for K_p and K_c and also find the effect of temperature and pressure on the reaction.

(c) Write down the properties of chemical equilibrium. 3.00

Q.6(a) Explain why – water is a polar compound. How can water be used as a "fuel for future"? 5.00

(b) Define capillarity of water. Derive the equation of capillarity. How can capillarity of water affect civil engineering structure? 7.00

Q.7(a) Explain what happens when 3.00

(i) a solution of $FeCl_3$ is added to a precipitate of $Fe(OH)_3$.

(ii) a solution of excess $AgNO_3$ is added to a solution of NaCl

Draw the electrical double layer formed in each case.

(b) Explain how electric potential can be applied (i) for identification of charge of colloids and (ii) for purification of colloids. 4.00

(c) Differentiate between lyophillic and lyohpobic colloids. 5.00

Q.8 Write short notes on the followings: 12.0

(i) Henry's equation (ii) Zero order reaction (iii) Properties if ideal colloidal solution (iv) Sols and Gel preparation

Heaven's Light is Our Guide

DEPARTMENT OF CIVIL ENGINEERING

RAJSHAHI UNIVERSITY OF ENGINEERING & TECHNOLOGY

B.Sc. Engineering **First Year Odd Semester Examination, 2016**

Chem 1101
Chemistry-I

Full marks: 72 **Time: 3 Hours**

N.B:- (i) Answer any **SIX** questions, taking **THREE** from each section.
(ii) Figures in the margin indicate full marks.
(iii) Use separate answer script for each section.
(iv) Assume reasonable value for any data missing.

SECTION-A

Q.1	(a)	Discuss Rutherford's α-particle experiment. What kinds of information can you get from it?	5.0
	(b)	State and explain Hund's principle with example.	3.0
	(c)	From electronic configuration, find the positions of following elements in periodic table. As, Se, Sr, Ba	4.0
Q.2	(a)	State and explain the rules of filling up of orbitals with electrons.	6.0
	(b)	Prove that the total number of electrons in a main energy shell is equal to $2n^2$.	4.0
	(c)	Explain the origin of fine structure in the structure of hydrogen atom by using Bohr-Sommerfeld's atomic model.	2.0
Q.3	(a)	Define variable electrovalency. Explain why some transition and non-transition metals show variable electrovalency.	6.0
	(b)	Based on hybridization, explain the structure of the followings (i) SO_4^{2-}, (ii) NH_3	4.0
	(c)	Point out some important characteristics of coordinate compounds.	2.0
Q.4	(a)	Discuss the function of additives used in the manufacture of cement with examples for each.	4.0
	(b)	Point out the approximate oxide composition limits of ordinary portland cement. Explain how they affect the qualities of cement.	4.0
	(c)	Explain how sulphate attack affects the durability of concrete mass. Point out the criteria of sulphate resisting cement.	4.0

SECTION-B

Q.5	(a)	Name the dispersion methods used for the preparation of hyophobic sols. Describe the Bredig's arc method for the preparation of sols of noble metals.	5.0
	(b)	Describe how the charge bearing the colloidal particles can be determined. Explain the origin of electrical charge on the colloidal particles.	5.0
	(c)	Define 'gold number'.	2.0
Q.6	(a)	Define chemical equilibrium	2.0
	(b)	For the following reaction $aA + bB + \ldots\ldots \Leftrightarrow mM + nN + \ldots\ldots$ Derive the equations for K_p, K_c and K_x and what is the reaction between them?	7.0
	(c)	Find the effect of pressure and volume for the following chemical reaction $PCl_5 \Leftrightarrow PCl_3 + Cl_2$	3.0
Q.7	(a)	Define colloidal solution and properties of a ideal colloidal solution.	4.0
	(b)	Define heat of solution and how can you determine heat of solution experimentally?	5.0
	(c)	Find the mathematical relationship between molarity, molality and normality.	3.0
Q.8	(a)	Differentiate between order and molecularity of a reaction. Discuss the importance of study of chemical kinetics.	4.0
	(b)	Describe the characteristics of first order kinetics. Illustrate a suitable method for the test of first order reaction.	4.0
	(c)	Benzene diazonium chloride decomposes in the presence of water according to the first order kinetics. If the velocity constant at 25°C is 2.8×10^{-3} min^{-1}, and the activation energy is 11.9kcalmol^{-1}, find the velocity constant at 35°C.	4.0

****

Heaven's Light is Our Guide

DEPARTMENT OF CIVIL ENGINEERING

RAJSHAHI UNIVERSITY OF ENGINEERING & TECHNOLOGY

B.Sc. Engineering **First Year Odd** Semester Examination, 2015

Chem- 1101

Chemistry -I

Full marks: 72 **Time: 3 Hours**

N.B:-
(i) Answer any **SIX** questions, taking **THREE** from each section.
(ii) Figures in the margin indicate full marks.
(iii) Use separate answer script for each section.
(iv) Assume reasonable value for any data missing.

SECTION-A

Q.1(a) Explain (n + l) rule. 3.00

(b) Find the value of radius and energy for hydrogen atom when N = 4 6.00

(c) Deduce De-broglie's equation. 3.00

Q.2 (a) Briefly Describe the long form of periodic table. What are the shortcomings if long form of periodic table? 8.00

(b) Define electron affinity. Explain the period variations of this property of atoms. 4.00

Q.3 (a) Define the followings with their function : (i) Mortar (iii) Concrete (iii) Reinforced concrete 4.00

(b) Briefly describe the water requirements for hydration of cement. What happens if the amount of water is more or less than the specified amount? 3.00

(c) Describe the specifications of rapid hardening cement and sulphate resisting cement. Point out the specified applications of each. 4.00

(d) Define the soundness test of cement 1.00

Q.4 (a) Briefly describe the inert pair effect when we move from top to bottom in a periodic table. 3.00

(b) Define covalent bond. Explain why covalent bonds are called non-polar bond 4.00

(c) Based on variable covalency- show that SF_6 exits but OF_6 does not exit. 3.00

(d) H_2O is liquid but H_2S is gas-why. 2.00

SECTION-B

Q.5(a) Define rate and order of reaction 2.00

(b) How can you determine the order of a reaction by half-life method? 5.00

(c) For $2A \rightarrow$ Product, Find the equation for rate constant and show that half-life is inversely proportional to the initial concentration of reactant. 5.00

Q.6(a) Define molarity, normality and molality. 3.00

(b) Classify solution with examples. 3.00

(c) Discuss the properties of colloidal solution. 4.00

(d) State Henry's law. 2.00

Q.7(a) Name the methods applied for the preparation of colloids. Describe the electro dialysis method of purification of colloids. 4.00

(b) Define flocculation value and gold number. Explain the following properties of gel: (i) Thixotropy (ii) Syneresis (iii) Imbibition 5.00

(c) Mention some important applications of colloids. 3.00

Q.8 Short note: (Any three) 3x4 12.0

(a) Bohr's atomic model (b) Hydrogen bonding

(c) Zero order reaction (d) Properties of water.

****

Heaven's Light is Our Guide

DEPARTMENT OF CIVIL ENGINEERING

RAJSHAHI UNIVERSITY OF ENGINEERING & TECHNOLOGY

B.Sc. Engineering **First Year Odd Semester Examination, 2014**

Chem 1101

Chemistry-I

Full marks: 70 **Time: 3 Hours**

N.B:- (i) Answer any SIX questions, taking THREE from each section.
(ii) Figure in the margin indicate full marks.
(iii) Use separate answer script for each section.

SECTION-A

Q.1(a)	Explain the uncertainty principle. How does it limit the description of the location of electrons in an atom?	3.67
(b)	Write down the electronic configuration of the following elements in their ground state and exited state: Ni^{2+}, Cr, Cu.	3.00
(c)	Explain how the following rules affect the filling up of orbitals with electrons: (i) Aufbau principle, (ii) Hund's rule of maximum multiplicity.	5.00
Q.2(a)	Explain why the long form of periodic table is more clear than the Mendeleef's periodic table.	5.67
(b)	Define ionic radii. Arrange the following ions in the increasing order of their ionic radii: Fe^{2+}, Mn^{2+}, Co^{3+}.	4.00
(c)	Define ionization potential. Explain which one has larger ionization energy: Be, B.	2.00
Q.3(a)	Define chemical bonding.	1.00
(b)	Explain molecular orbital theory and draw the molecular orbitals of NO and CO and also find the bond order and magnetic property for these molecule.	6.00
(c)	Find the limitations of octet rule for co-valent bonding with examples.	4.67
Q.4(a)	Define dielectric constant of water.	1.00
(b)	Define surface tension and capillarity of water.	3.00
(c)	Derive an equation of surface tension for a capillary tube.	5.00
(d)	What is the civil engineering aspect of ground water capillarity?	2.67

SECTION-B

Q.5(a)	Define order and molecularity of a chemical reaction.	3.00
(b)	How can you determine the order of a chemical reaction by half-life method?	4.00
(c)	Define 2nd order reaction with example and derive the equation of rate constant for single component. ($2A \rightarrow$ product)	4.67
Q.6(a)	Describe the chemical method of preparation of colloids.	4.00
(b)	Explain the optical property of colloids. Why the property is not observed in true solutions?	4.67
(c)	Explain the Hardy-Schulze rule for precipitation of colloids.	3.00
Q.7(a)	Define cement.	1.67
(b)	Write a short note on setting and hardening of cement.	4.00
(c)	With flow-diagram, describe the industrial manufacture of cement.	6.00
Q.8(a)	Define chemical equilibrium.	1.00
(b)	What is relation between Kp and Kx?	1.00
(c)	Derive an equation showing the influence of temperature on equilibrium constant.	6.00
(d)	Calculate Kp and Kc for the following reaction- $N_2 + 3H_2 \rightleftharpoons 2NH_3$	3.67

***

Heaven's Light is Our Guide

DEPARTMENT OF CIVIL ENGINEERING

RAJSHAHI UNIVERSITY OF ENGINEERING & TECHNOLOGY

B.Sc. Engineering First year First semester Examination, 2013

Chem 101

Chemistry-I

Time: 3 Hours **Full Marks: 70**

N.B.:-
(i) Answer SIX questions, taking THREE from each section.
(ii) Figure in the margin indicates full marks.
(iii) Use separate answer script for each section.
(iv) Assume reasonable value for any data not given.

SECTION-A

Q.1(a) Define colloidal solution. Discuss the characteristics of lyophobic and lyophillic colloids. 4.67
(b) Explain how colloids act in purification of water and air. 5.00
(c) What is electro-osmosis? 2.00

Q.2(a) A two component solution 'AB' was prepared by dissolving component B in A, where both A & B may be solid, liquid or gas. Discuss the methods of expressing the composition of B in AB. 7.67
(b) Describe the preparation of 100 ml of approx. 6.0 M HCl from the commercial concentrated reagent. The label on the bottle states that the reagent is 37% HCl and has a specific gravity of 1.18. 4.00

Q.3(a) What is meant by rate equation? Mention the significance of rate equation. 3.00
(b) Give a suitable example of pseudo-unimolecular reaction. Why it is so called? 2.00
(c) Deduced the rate equation of a first order reaction: $2N_2O_5(g) \xrightarrow[\Delta]{CCl_4} 4NO_2(g)+O_2(g)$ 4.00
(d) Mention different methods of sampling in the study of chemical kinetics. 2.67

Q.4(a) What is chemical equilibrium? Point out the characteristics of chemical equilibrium. 4.67
(b) State law of mass action. Derive the expressions for K_p and K_c for the following reactions: 7.00
i) $PCl_5 \Leftrightarrow PCl_3 + Cl_2$
ii) $N_2 + O_2 \Leftrightarrow 2NO$

SECTION-B

Q.5(a) What is emission spectra? Explain why a hot body emits radiant energy not as continous waves but as small packets? 4.00
(b) What is azimuthal quantum number? Point out the information's obtained from this quantum number. 4.67
(c) State Pauli's exclusion principle and show that maximum number of electrons in a given orbital is 2. 3.00

Q.6(a) What is modern periodic law? Give a brief account of modern periodic table. 4.00
(b) Explain the terms 'Shielding effect' and 'effective nuclear charge'. 4.67
(c) A neutral atom of an element has two K, eight L and five M electrons. Give the following informations: (i) Total number of S-orbitals, (ii) Total number of P-electrons, (iii) Total number of d-electrons, (iv) Total number of paired electrons, (v) Total number of un-paired electrons, (vi) Position in the periodic table. 3.00

Q.7(a) What do you understand by 'stable configuration'? What are the ways by which an atom can attain stable configuration? 3.67
(b) Explain the followings: 6.00
i) Ionic solids are highly brittle
ii) Water has maximum density at 4°C
iii) Metals are opaque and have lustre or color. 2.00
(c) What is hydrgen bond? 4.00

Q.8(a) What is meant by sulphate attack in cement? How does it occur in concrete structures? Mention some applications of sulphate resisting cement. 5.67
(b) What are the raw materials for the manufacturing of cement? Discuss critically the reactions take place inside the rotary kiln at different temperatures during cement manufacturing. 2.00
(c) What do you mean by unsound cement?

The End

DEPARTMENT OF CIVIL ENGINEERING
RAJSHAHI UNIVERSITY OF ENGINEERING & TECHNOLOGY
B.Sc. Engineering First year First Semester Examination, 2012

CH 101
Chemistry - I

Full Marks: 70 Time: 3 Hours

N.B.:- (i) Answer SIX questions, taking THREE from each section.
(ii) Figure in the margin indicates full marks.
(iii) Use separate answer script for each section.
(iv) Assume reasonable value for any data not given.

SECTION-A

Q.1 (a) What is meant by zero order reaction? Deduce the rate equation of zero order reaction. 3.00

(b) Derive a second order rate equation for the reaction $2A \rightarrow$ product. Explain that half-life period of a second order reaction is inversely proportional to the initial concentration. 5.67

(c) 50% of a first order reaction is complete in 23 minutes. Calculate the time required to complete 90% of the reaction. 3.00

Q.2 (a) Derive an equation that describes the quantitative effect of variation of temperature on equilibrium constant. 4.67

(b) State Le chatelier principle and apply it to the following reaction: 4.00

(i) $N_2 + 3H_2 \rightleftharpoons 2NH_3$; $\Delta H = -22.08$ Kcal

(c) Phosphorous pentachloride when heated in a closed vessel dissociates into PCl_3 and Cl_2. The gaseous mixture is found to have density of 75.5 at 200°C. Calculate the degree of dissociation of PCl_5 at the same temperature. 3.00

Q.3 (a) Discuss how electrodialysis is employed to purify colloidal solution. 4.67

(b) Briefly describe the chemical method of preparation of colloids. Give suitable applications of this method. 3.00

(c) Discuss the following properties of colloids: (i) Tyndal effect (ii) Electrophoresis (iii) Brownian movement. 4.00

Q.4 (a) Explain the effect of pressure on the solubility of gas in liquid. Deduce the equations that describe the alternative expression of Henry law. 4.00

(b) Explain the factors that affect the solubility of solids in liquid. 6.67

(c) Differentiate between true solution and coarse suspension 1.00

SECTION-B

Q.5 (a) Explain the following: 5.67
(i) First ionization potential of B is less than that of Be.
(ii) An orbital contains not more than two electrons.

(b) Explain the followings: 6.00
(i) The atomic radius decreases from left to right in the periodic table.
(ii) The ionization potential tends to decrease from top to bottom in the periodic table.
(iii) The stability of H-X bond decreases in the order H-F > H-Cl > H-Br > H-I.

Q.6(a) Explain the free electron theory of metallic bonding. Based on it explain why metals are: 6.67
(i) Malleable and ductile
(ii) Good conductor of electricity.

(b) What are the factors to explain the formation of a covalent bond between two atoms A and B against ionic bond? 3.00

(c) Explain why PCl_5 exist but NCl_5 does not why covalent bonds are called non polar bond? 2.00

Q.7 (a) What is Zeeman effect? How does it explain the origin magnetic quantum number of elements? 3.00

(b) Derive an expression for the energy and radius of an electron in the n^{th} orbit of H-atom. 4.00

(c) What is hydrogen spectrum? Explain how Bohr's theory accounts for the line spectrum of H-atom? 4.67

Q.8(a) Mention the properties and applications of silicates. Explain why silicates have high melting point. 5.67

(b) Explain the mechanism of hydration of cement. 4.00

(c) Why gypsum is added to the cement clinker? 2.00

Heaven's Light is Our Guide
DEPARTMENT OF CIVIL ENGINEERING
RAJSHAHI UNIVERSITY OF ENGINEERING & TECHNOLOGY
B.Sc. Engineering First year First Semester Examination, 2011
Chem 101
Chemistry – I

Full marks: 70 **Time: 3 Hours**

N.B.:- (i) Answer any SIX questions, taking THREE from each section.
(ii) Figure in the margin indicate full marks.
(iii) Use separate answer script for each section.
(iv) Assume reasonable value for any data missing.

SECTION-A

Q.1(a) Give a brief account of Bohr's model of hydrogen atom covering the following points: (i) postulates, (ii) energy and radius, (iii) limitations — 8.67
(b) Find out the energy of emitted photon when an electron in Li^{2+} ion returns to its ground state from n = 3 level. — 3.00

Q.2(a) Differentiate between orbit and orbital. — 3.00
(b) Briefly describe the subsidiary quantum number. What types of information can be obtained from it? — 5.67
(c) Illustrate Pauli's exclusion principle with suitable examples. — 3.00

Q.3(a) What is periodic law? Give a brief account of modern periodic table. — 4.67
(b) An electron is in 4f orbit. What are the values of n,l,m and s it can have? — 4.00
(c) An element M^{2+} has the atomic number 26. Give the information regarding (i) electronic configuration, (ii) Total number of s orbital, (iii) total number of d electron, (iv) number of paired electron, (v) number of unpaired electron (vi) position in the periodic table. — 3.00

Q.4(a) What is electrovalent bond? Point out the properties of electrovalent compound. — 4.67
(b) Explain the following: (i) Solid NaCl does not conduct electricity whereas molten NaCl does, (ii) Density of water is maximum at 4°C — 5.00
(c) What is meant by co – ordinate bond? — 2.00

SECTION-B

Q.5(a) What is Portland Cement? Mention the raw materials used in cement manufacturing. — 3.67
(b) Sketch the diagram of a rotary Kiln used in the industrial production of cement. Mention the chemical changes take place in side rotary Kiln. — 6.00
(c) What is unsound cement? — 2.00

Q.6(a) Discuss the classification of sieve based on mesh size. "The particle size of a material is described as – 4 +40 mesh" – what does it mean? — 3.00
(b) What is meant by sulphate attack? Describe how to remedy sulphate attack. Mention the uses of sulphate resisting cement. — 3.00
(c) Discuss the classification of limes with their composition, properties and applications in civil engineering. — 5.67

Q.7(a) Discuss the significance of rate law and chemical kinetics. — 3.00
(b) The composition of a liquid phase reaction $2A \longrightarrow B$ was followed by spectrophotometric method with the following results: — 4.00

t min	0	10	20	30	40	∞
[B] mol/L	0	0.089	0.153	0.200	0.23	0.312

Determine the order of the reaction and its rate constant.
(c) A reversible reaction is as follows: — 4.67
$PCl_5 \rightleftharpoons PCl_3 + Cl_2$
Explain the effect of further addition of pressure on the equilibrium constant at equilibrium and mathematically prove it.

Q.8.(a) Explain why, (i) A colloidal solution is not precipitated on the addition of an electrolyte in the presence of gelatin (ii) Alum is used in town water supply. — 3.00
(b) Write short notes on the followings: (i) Gold number (ii) Cottrel smoke precipitator. — 5.00
(c) Describe the electrical method for the preparation of lyophobic colloids. — 3.67

Heaven's Light is Our Guide

DEPARTMENT OF CIVIL ENGINEERING

RAJSHAHI UNIVERSITY OF ENGINEERING & TECHNOLOGY

B.Sc. Engineering FIRST Year FIRST SEMESTER Examination 2010

Chem-101

Chemistry-I

Full Marks: 70 Time: 3 Hours

N.B:

(i) Answer Six questions, taking Three from each Section

(ii) Figures in the margin indicate full marks

(iii) Use separate answer script for each section

SECTION-A

Q.1 (a) What do you mean by modern periodic law? Why the long form of periodic table is more clear than that of Mendeleef's periodic table? 6.67

(b) Define 'Successive ionization potential' and 'electron affinity'? Why ionization potential increases left to right in a period of periodic table? 5.00

Q.2 (a) What are fundamental partical? Why they are so called? State and explain the postulates of Bolu's theory. 6.67

(b) How does Bohr's explain the spectrum of H atom? Find the Wavelength in A° of the line in Balmer series that is associated with drop of the electron. 5.00

Q.3 (a) What do you mean by polar covalent bond? Discuss metallic bond, based on it explain why metals are: 6.67

(i) Good conductor of electricity

(ii) Malleable and ductile

(b) Explain the condition of formation of ionic bond. Compare the properties of ionic and covalent compounds. 5.00

Q.4 Write short notes on any two of the following:- 11.67

a) Heisenberg's uncertainty principle

b) Quantum numbers

c) Chemical kinetics.

SECTION-B

Q.5 (a) Ionic crystals are brittle but metals are malleable – Explain. 3.00

(b) Discuss the stability of the following ions: Ge^{2+}, Sn^{2+} & Pb^{2+} 3.00

(c) Explain the followings: – 5.67

a) AlF_3 is ionic while $AlCl_3$ is covalent,

b) LiCl is insoluble in water

c) NaCl is soluble in water but not in chloroform.

Q.6 (a) Mention the properties and applications of silicates. 3.00

(b) What is meant by hydraulic lime? Mention its composition and application 3.00

(c) Discuss the effect of the followings on the quality of cement: 5.67

i) Oxide composition of clay

ii) Particle size of cement

iii) Amount of water for hydration.

Q.7 (a) Discuss the origin of electrical charge on the colloidal particles. How the charge of a colloid can be determined? 5.67

(b) What is meant by electron double layer? How electrical double layers are formed on colloidal particles? Give suitable example. 3.00

(c) Describe the chemical method of preparation of colloids. 3.00

Q.8 (a) Define retrograde solubility with examples. A sample of spirit contains 95% ethanol by weight, the rest being water. What is the mole fraction of its constituents? 3.67

(b) State Henry's law. Show that the volume of a gas dissolved in a given volume of solvent at a constant temperature is independent of pressure. 4.00

(c) Discuss the temperature dependent concentration units of a solution. 4.00

DEPARTMENT OF CIVIL ENGINEERING
RAJSHAHI UNIVERSITY OF ENGINEERING & TECHNOLOGY
B. Sc. Engineering First Year First Semester Examination, 2009

Chem 101

Chemistry-I

Full Marks: 70 Time: 3 Hours

N.B.: (i) Answer SIX questions, taking THREE from each section.
(ii) Figures in the margin indicate the full marks.
(iii) Use separate answer script for each section.
(iv) Assume reasonable value for any data missing.

SECTION -A

Q.1.(a) What are fundamental particles? State and explain Heisenberg's uncertainty principle. 4.00
(b) What is atomic spectra? Derive the following equation for hydrogen atom 4.00

$$E = -\frac{2\pi^2 me^4}{n^2 h^2}$$

(c) Using Born-Habber cycle, how can you determine the formation enthalpy of $MgCl_2$. 3.67

Q.2.(a) Describe and sketch the flow diagram for manufacture of Portland Cement. 5.67
(b) Write down the chemical composition of Portland cement and Bogue's compound. 3.00
(c) Prove that cement with higher percentage of di-calcium silicate is better than that of tri-calcium silicate. 3.00

Q.3.(a) What are *s*, *p*, *d* and *f*-block elements? Discuss their main characteristics? 4.00
(b) State, giving reasons, which of the following has smallest radius: 4.67
(i) O, F, Ne, (ii) Na, Al, (iii) Na^+, Mg^{2+}, Al^{3+}.
(c) What is meant by electronegativity? How does it depend on ionization potential and electron affinity? 3.00

Q.4.(a) How covalent character is introduced in ionic compounds? Discuss the factors responsible for it. 5.67
(b) Ethanol is a covalent compound but it is soluble in water – How? 2.00
(c) PCl_5 is stable while NCl_5 can't be prepared – Why? 2.00
(d) Metals are good conductors of electricity while non-metals do not are not – Why? 2.00

SECTION-B

Q.5.(a) Define chemical equilibrium. Why is it called dynamic equilibrium? 4.00
(b) State and explain Le-Chatelier principle. 4.00
(c) A mixture containing 25 moles of H_2 and 18 moles of I_2 was heated in a sealed tube at 256°C till equilibrium, when 30.8 moles of HI was obtained. Calculate the equilibrium constant K_c. 3.67

Q.6.(a) What is meant by crystalloids? Mention some important application of colloids. 4.67
(b) State 'Hardy-Schulze' rule and explain the origin of electric charge on the colloidal particles. 4.00
(c) Write short note on Brownian movement. 3.00

Q.7.(a) Deduce an equation for the dissociation of weak electrolyte. Point out the limitations of Ostwald's dilution law. 4.00
(b) Calculate the pH of a solution made by mixing 0.10 mole of HCl and 0.10 mole of Lithium acetone in enough water to make 1.0 litre of solution. 4.00
(c) Explain the temperature dependent concentration units of a solution. 3.67

Q.8.(a) Define the order and molecularity of a reaction. How do they differ from each other? 3.00
(b) The dimerization reaction, $2AlCl_3 \rightarrow Al_2Cl_6$ is said to be a first order. Deduce the rate equation for this reaction and hence the value of half life and time constant. 5.00
(c) A first order reaction is 40% completed at the end of 50 minutes. What is the value of the rate constant? In how many minutes, will the reaction be 80% completed? 3.67