L-1/T-1/NAME Date : 27/06/2015

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-1/T-1 B. Sc. Engineering Examinations 2014-2015

Sub : **PHY 113** (Structure of Matter, Electricity and Magnetism and Modern Physics)

Full Marks : 210 Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

There are **FOUR** questions in this section. Answer any **THREE**.

1. (a) Distinguish between crystalline and amorphous solids. What is polymorphism, explain it with some examples. What is graphene? **(11)**

   (b) What are the lattice parameters of orthorhombic and cubic crystal systems? Draw the unit cells of various space lattices in orthorhombic and cubic crystal systems. **(14)**

   (c) What is coordination number? What are the co-ordination numbers of (i) simple cubic, (ii) body centered cubic, and (iii) face centered cubic crystals; explain with the help of neat sketches. **(10)**

2. (a) Define packing factor for a crystal system. Calculate packing factor for FCC crystal. **(8)**

   (b) Draw a typical unit cell of NaCl crystal. Describe its crystal structure. Calculate packing factor for NaCl crystal if R_{Cl} = 0.187 nm and R_{Na} = 0.097 nm. Why packing factor for NaCl crystal is different from an ideal FCC crystal. **(18)**

   (c) What is X-ray diffraction? Deduce Bragg's law of X-ray diffraction. **(9)**

3. (a) Why real crystals are never perfect? Explain. **(9)**

   (b) Describe briefly various types of defects that exist in solids. **(11)**

   (c) Derive an expression for lattice energy of KCl crystal. **(15)**

4. (a) Write down the four Maxwell's equations of electromagnetism. Explain the physical significance of them. **(12)**

   (b) State Biot-Savart law. Using Biot-Savart law calculate the magnetic field **B** at the centre of a current loop. **(16)**

   (c) Schematically show that if you place a paramagnetic atom in a magnetic field (i.e. in front of a bar magnet), a magnetic force will be acted toward the magnetic field and thus will be attractive. **(7)**

Contd P/2

PHY 113 (NAME)

SECTION – B

There are **FOUR** questions in this section. Answer any **THREE**.

5. (a)

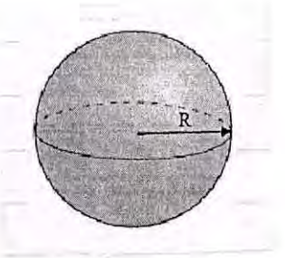

Figure 1

Figure 1 shows a non-conducting (insulating) sphere of radius R having + Q charges which are uniformly distributed from the center to the surface of the sphere. Using Gauss's law obtain expressions for magnitude of electric field E at a point at a distance r from the center of the sphere shown in figure 1 when the point is at **(15)**

(i) Outside (r > R)

(ii) Surface (r = R) and

(iii) Inside (r < R) of the sphere

Also draw schematically E(r) as a function of distance r.

(b) Define capacitance of a capacitor. A spherical capacitor consists of two concentric conducting sphere of radii a and b (b > a). Consider the inner sphere is positively charged where the outer one is negatively charged. Show that the capacitance of this device is $4\pi \in_o \frac{ab}{b-a}$. **(15)**

(c) Sketch qualitatively the electric lines of forces associated with + 3Q and – Q charges by considering the limiting cases points very close to – Q charge and very far from it. **(5)**

6. (a) What is a dielectric material? Mention some examples of them. Show that when the space between the plates of a parallel plate capacitor is filled with a material of dielectric constant κ, capacitor's capacitance increases. **(12)**

(b) The charged particle originated from solar wind deflected by earth's magnetic field and produce "Aurora". Explain briefly about Aurora. **(13)**

(c) Find the magnetic field B that is set up in a solenoid of length L having N number of turns and carrying a current I. **(10)**

Contd P/3

PHY 113 (NAME)

7. (a) State the basic postulates of the special theory of relativity. **(7)**

   (b) Obtain the Lorentz Space-Time transformation formulae. **(20)**

   (c) A beam of muons-unstable particles with a proper lifetime of 2.2×10^{-6} s are measured to move with a speed of 0.99 c. Muons are created at an altitude of 6000 m. Despite their short lifetime, is it possible for the muons to reach the ground from the altitude at which they are usually formed? **(8)**

8. (a) Define Compton effect. **(5)**

   (b) Derive the expression of Compton shift and hence find the maximum Compton shift. **(20)**

   (c) A surface having work function 1.51 eV is illuminated by light of wavelength 4000 Å. Calculate **(10)**

   (i) The maximum kinetic energy of the ejected electrons and

   (ii) The stopping potential.

L-1/T-1/NAME Date : 04/07/2015

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-1/T-1 B. Sc. Engineering Examinations 2014-2015

Sub : **NAME 117** (Hydrostatics and Stability)

Full Marks : 210 Time : 3 Hours

The figures in the margin indicate full marks.

Assume reasonable value for missing data if any.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

There are **FOUR** questions in this section. Answer any **THREE**.

Question No. 4 is compulsory to answer.

1. (a) Show how the lost buoyancy and position of the centroid of the lost buoyancy can be obtained from first principles for a ship which is bilged and floats at a waterline tangent to the margin line. **(10)**

   (b) The immersed cross-sectional areas, at sections spaced 12.20 m apart of a ship floating at a waterline tangent to the margin line are as follows, estimating from the after perpendicular: **(25)**

   0 46.95 87.33 121.70 147.72 159.79 167.23 168.15 141.21 91.04 and 0 square meter

   Find the buoyancy the ship can lose, and the centroid of the lost buoyancy, if the original displacement was 11,700 tons and the center of buoyancy 0.70 m forward of amidships.

2. (a) State what is meant by the term floodable length, illustrating your answer by drawing a typical curve of floodable length for a ship. **(10)**

   (b) A vessel of constant rectangular cross-section is 106.71 m long and 15.24 m beam and floats at an even-keel draft of 6.10 m in slat water. Its center of gravity is at amidships and 5.49 m above the base. There is a compartment forward formed by two transverse watertight bulkheads which are respectively 30.49 m and 41.16 m forward of amidships. This compartment contains cargo having a permeability of 70 percent. Determine the draughts of the vessel when the compartment is open to the sea. **(25)**

3. (a) Describe the IMO stability criteria of intact stability for passenger and cargo ships. **(8)**

   (b) A ship 150 m long arrives at the mouth of a river with drafts 5.50 m F and 6.30 m A, MCT 1 cm 200 tonnes-m, TPC 15 tonnes. Center of flotation is 1.5 m aft of amidships. The ship has then to proceed up the river where the maximum permissible drafts is 6.20 m. It is decided that salt water ballast will be run into the forepeak tank to reduce the draft aft to 6.20 m. If the center of gravity of the forepeak tank is 60 m forward of the center of floatation, find: **(27)**

   (i) the minimum amount of water, which must be run in and

   (ii) the final draft forward.

Contd P/2

NAME 117

4. A vessel has a launching weight of 5800 tons, the center of gravity being 7.93 m abaft the mid-length and the fore poppet 70.12 m before the mid-length. Construct a launching diagram from the following data: **(35)**

Mid-length abaft A.E. of ground ways	0	6.10	12.20	18.29	24.39	[m]
Buoyancy	2560	3190	3840	4530	5330	[tons]
Center of buoyancy A.E. of ground ways	39.94	43.60	48.17	52.74	56.40	[m]

State:

(i) Distance of mid-length abaft the after end of the ground ways when stern lifts

(ii) Force on fore poppets when the stern lifts

(iii) Reserve moment against tipping.

SECTION – B

There are **FOUR** questions in this section. Answer any **THREE**.

5. (a) Show that, when a vessel passes from salt water to fresh water, the mean draft changes by $\frac{1}{4}\cdot\frac{\Delta}{T}$, where Δ is the displacement in tonnes and T is the tonnes per centimeter immersion when in the salt water. **(10)**

(b) A ship 150 m long has half-ordinates of water plane commencing from aft as follows: **(25)**

0, 5, 9, 9, 7 and 0 m respectively.

Find the followings:

(i) The area of the water plane

(ii) The tonnes per centimeter immersion.

(iii) The water-plane area coefficient.

(iv) The distance of the centre of flotation abaft amidships.

(v) The position of the transverse metacentre above centre of buoyancy.

6. (a) Will a homogeneous log of square cross-section and relative density 0.5 have a positive initial Metacentric Height when floating in fresh water with one side parallel to the waterline? Verify your answer by means of a calculation. **(15)**

(b) A pontoon of constant rectangular cross-section is 140 ft long, 25 ft beam, 14 ft depth and floats in salt water at a draft of 5 ft with its centre of gravity 6.5 ft above the base. Determine the greatest load which can be added at height of 14 ft above the base, without causing the pontoon to become unstable. **(15)**

(c) Define Reserve Buoyancy. **(5)**

Contd P/3

NAME 117

7. (a) Verify that, for a box-shaped vessel, the minimum KM and the draft at which it occurs are both given by the expression $B/\sqrt{6}$, when B is equal to vessel's beam. **(13)**

(b) Captain Han Solo is currently sailing on the Planet Earth, where the density of water is 1.025 t/m^3. The displacement of his vessel is 18932 tonnes and KM is 10.93 m. The metacentric height is 1.95 m. The ship floats upright; there is no heel angle. The double bottom amidship is divided into 3 compartments, each size 30 × 6 × 1.5 m. The central compartment is filled with fresh water and two side compartments are empty. Due to maintenance Captain Solo needs to empty the centre compartment completely. He has two options: **(22)**

(i) Move all the water from the centre compartment to one to the side compartments.

(ii) Move half of the water to the port compartment and half to the starboard compartment.

Assume KM is constant during the operation. Find for both cases, the resulting heel angle and corrected meta-centric height.

(For simplicity ship cross-section can be assumed to be rectangular).

8. (a) Derive an expression of the righting lever (GZ) in terms of GM and BM for a wall-sided vessel inclined at an angle 'θ'. **(15)**

(b) From the ship's cross curves of stability, the GZ ordinates of a vessel of displacement 20550 tonnes are as follows: **(15)**

Angle of heel (θ)	0	15	30	45	60	75	90
GZ ordinate (m)	0	0.71	1.46	1.53	0.89	–0.21	–1.16

Using this information, construct the ship's statical stability curve for this condition of loading and determine the following:

(i) Maximum righting lever GZ.

(ii) Angle of heel at which the maximum GZ occurs.

(iii) Angle of vanishing stability.

(iv) Range of stability.

(v) The approximate initial metacentric height.

(c) With the aid of suitable sketch, show the effect of slack tanks on a ship's stability. **(5)**

L-1/T-1/NAME Date : 30/07/2015

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-1/T-1 B. Sc. Engineering Examinations 2014-2015

Sub : **MATH 181** (Differential and Integral Calculus)

Full Marks : 210 Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

There are **FOUR** questions in this section. Answer any **THREE**.

1. (a) Test the continuity and differentiability of the function **(15)**

$$f(x)=\begin{cases} x+x^{4/3}\sin\left(\frac{1}{x}\right), & x\neq 0 \\ 0, & x=0 \end{cases}$$

at $x = 0$.

(b) Evaluate: (i) $\lim\limits_{x\to 0}\dfrac{e^x+\ln\left(\frac{1-x}{e}\right)}{\tan x - x}$. **(10)**

(ii) $\lim\limits_{x\to 0}\left(\dfrac{1}{x}\right)^{\sin x}$. **(10)**

2. (a) If $y = e^{k\sin^{-1}x}$, prove that $(1-x^2)\,y_{n+2} - (2n+1)\,xy_{n+1} - (n^2+k^2)\,y_n = 0$.

Hence find the value of $(y_n)_{x=0}$. **(20)**

(b) Find the Pedal equation of the curve $r^n = a^n \sin n\theta$. **(15)**

3. (a) Expand the function $y = \tan^{-1} x$ in powers of x in infinite series, stating the condition under which the expansion is valid. **(15)**

(b) If $u = \tan^{-1}\left(\dfrac{x^2+y^2+z^2}{x+y+z}\right)$ then find the value of $x\dfrac{\partial u}{\partial x} + y\dfrac{\partial u}{\partial y} + z\dfrac{\partial u}{\partial z}$. **(10)**

(c) Find the equation of the circle of curvature at the point (3, 1) on the curve $y = x^2 - 6x + 10$. **(10)**

4. (a) Find all the asymptotes of the curve $x^2(x-y)^2 - a^2(x^2+y^2) = 0$. **(17)**

(b) Find the height and radius of the least expensive closed cylinder which has a volume of 1000 cubic inches. Assume that the only cost for this cylinder is the cost of the materials; the material for the top and bottom costs 5 cents per square inch, and the material for the sides costs 3 cents per square inch. **(18)**

Contd P/2

MATH 181/NAME

SECTION – B

There are **FOUR** questions in this section. Answer any **THREE**.

5. Carryout the following integration: **(10+12+13)**

(a) $\int \frac{\cos x + 4\sin x}{3\cos x + 2\sin x}\,dx$ (b) $\int \frac{x^2 - x + 1}{x^2 + x + 1}\,dx$

(c) $\int (x-3)\sqrt{\frac{2x^3 - 3x + 1}{x - 1}}\,dx$

6. (a) Find a reduction formula for $I_{m,n} = \int \sin^m x \cos^n x\,dx$ and hence find $\int \sin^4 x \cos^3 x\,dx$. **(12)**

(b) Evaluate: $\lim_{n\to\infty}\left[\frac{n^2}{(n^2+1)^{3/2}} + \frac{n^2}{(n^2+2^2)^{3/2}} + \frac{n^2}{(n^2+3^2)^{3/2}} + \ldots + \frac{n^2}{\{n^2+(n+1)^2\}^{3/2}}\right]$. **(12)**

(c) Evaluate: $\int_0^{\pi/2} \frac{\sin x \cos x}{a^2\sin^2 x + b^2\cos^2 x}\,dx$. **(11)**

7. (a) Evaluate: $\int_0^{\infty} \frac{\log(1+x^2)}{1+x^2}\,dx$. **(11)**

(b) Prove that $\left(\frac{1}{2}\right) = \sqrt{\pi}$. **(12)**

(c) Find the area between the curve $y^2(2a - x) = x^3$ and its asymptote. **(12)**

8. (a) Determine the perimeter of the loop of the curve $3ay^2 = x^2(a - x)$. **(15)**

(b) Find the volume and surface area of the solid formed by the revolution of the curve $x^{2/3} + y^{2/3} = a^{2/3}$ about the x-axis. **(20)**

L-1/T-1/NAME **Date : 04/08/2015**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-1/T-1 B. Sc. Engineering Examinations 2014-2015

Sub : **HUM 111** (English)

Full Marks : 140 Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

There are **FOUR** questions in this section. Answer **Q. No. 1** and any other **TWO** from the rest.

1. (a) Read the following passage carefully and answer the questions that follow: **(30)**

Great books do not spring from something accidental in the great men who wrote them. They are the affluence of their very core, the expression of the life itself of the authors. And literature cannot be said to have served its true purpose until it has been translated into the actual life of him who reads. It does not succeed until it becomes the vehicle of the vitals. Progress is the gradual result of the unending battle between human reason and human instinct, in which it forms slowly but surely wins. The most powerful engine in this battle is literature. It is the vast reservoir of true ideas and high emotions and life is constituted of ideas and emotions. In a world deprived of literature, the intellectual and emotional activity of all but a few exceptionally gifted men would quickly sink and retract to a narrow circle. The broad, the noble, the generous would tend to disappear for want of accessible storage. And life would be correspondingly degraded, because the fallacious idea and the pretty emotion would never feel the upward pull of the ideas and emotions of genius. Only by conceiving a society without literature can it be clearly realized that the function of literature is to raise the plain towards the top level of the peaks. Literature exists so that where one man has lived finely, ten thousand may after wards live finely. It is a means of life, it concerns the living essence.

Questions:

(i) What, according to the author, is the source of a great book?

(ii) When does literature serve its true purpose?

(iii) What is the most important function of literature?

(iv) What happens in a world deprived of literature?

(v) 'Literature is a means of life'. Explain this idea in brief.

(vi) Give the meanings of the following words as used in the passage:

affluence, instinct, retract, fallacious, essence.

Contd P/2

HUM 111/NAME

2. (a) As an Assistant Engineer of a company you have recently bought some electrical appliances for your organization. But after the delivery the appliances are found to be sub-standard. Now write a letter of complaint for the replacement of those products. **(10)**

   (b) Write phonetic transcriptions of the following words: (Any five) **(10)**

   among, teach, shame, thought, finger, pair

3. (a) Write a dialogue between two friends on the massive failure of the examinees in the recent university admission tests. **(10)**

   (b) Write a short essay on one of the following topics: **(10)**

   (i) Bangladesh at a Glance

   (ii) Changing trends of Pastimes

   (iii) Universal Brotherhood.

4. (a) Transform the following sentences as directed. (Any five) **(10)**

   (i) He succeeded unexpectedly. (Complex)

   (ii) We are all born with a divine fire in us. (Complex)

   (iii) It is difficult to explain, but it exists. (Simple)

   (iv) He will not go unless he is compelled. (Simple)

   (v) To our utter disappoinment he failed to carry out the purpose. (Compound)

   (vi) Hearing the teacher's footsteps, the children kept silent. (Compound)

   (b) Write short notes on any two of the following: **(10)**

   (i) Barriers to Communication

   (ii) The Diphthongs

   (iii) Annual Confidential Report

SECTION – B

There are **FOUR** questions in this section. Answer any **THREE** questions including **Q. No. 5** as compulsory.

5. (a) Explain with reference to the context any **one** of the following: **(8)**

   (i) "... How singular is life, and how full of changes! How small thing will ruin or save one!.."

   (ii) "... I am indebted to you for the happiness of my life, let me help you!" No, it is too much!..."

   (b) Answer any **one** of the following: **(10)**

   (i) How does the story of "Circe's Garden" deal with the concept of struggle between the good and the evil?

   (ii) "The story of "The Diamond Necklace" reflects the contemporary society". Elucidate.

Contd P/3

HUM 111/NAME

Contd ... Q. No. 5

(c) Answer any **three** of the following questions: **(12)**

(i) What is the difference between capital punishment and life long imprisonment?

(ii) Why did Mrs. Loisel throw the invitation card spitefully upon the table?

(iii) How did Matilda and her husband suffer for repaying the loan?

(vi) How did Hermes, the messenger god, help Odysseus to save himself from disaster?

(v) Why did Circe fall at Odysseus' knees and burst into tears?

6. Recast and correct any **ten** of the following sentences: **(20)**

(i) Mrs. Matilda, along with her husband, have attended the party.

(ii) He was used to play cricket.

(iii) Driving recklessly, an accident was caused.

(iv) I am afraid the soup is fairly cold.

(v) Liza was an alumnus of BUET.

(vi) If I know the matter before, I could have helped you.

(vii) It is long since we have met each other.

(viii) The audience implied that the speaker was a Republican.

(ix) Providing that he is not tired, he will address the meeting.

(x) We have less staff members than we had last year.

(xi) The month proceeding June is, of course, May.

(xii) The patient suffered from the illusion that he was a king.

7. (a) Give the meanings of any **ten** of the following words: **(10)**

Adroitly, Ominously, Gypsy, Icon, Obligation, Nestle, Prodigious, Scatter, Scope-goat, Wax, Necromancy, Nepotism.

(b) Make sentences with any **ten** of the following words: **(10)**

Akin to, Emerge, Dilemma, Bunch, Proclaim, Subterfuge, Regret, Inflict, Conch, Inedible, Jurisdiction, Heritage.

8. (a) Write a précis of the following passage with a suitable title: **(20)**

It is much better to give hope and strength and courage than money. The best help is, not to bear the troubles of others for them, but to inspire them with courage and energy to bear their own burdens for themselves, and meet the difficulties of life bravely. So we must be careful not to destroy independence in our anxiety to relieve distress. There is always the danger lest whatever is done for men should make them more dependent instead of more independent. It is important, therefore, not so much to give a man bread, as to put him in the way of earning it for himself, not to give direct aid, but to help others to help themselves.

L-1/T-1/NAME Date : 08/08/2015

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-1/T-1 B. Sc. Engineering Examinations 2014-2015

Sub : **CHEM 117** (Chemistry I)

Full Marks : 210 Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

There are **FOUR** questions in this section. Answer any **THREE**.

1. (a) Write the Schrodinger wave equation. Discuss the meaning and significance of ψ and ψ^2 with reference to this equation. **(2+8=10)**

   (b) What do you understand by the quantisation of angular momentum of an electron? Derive an expression for it, using wave nature of electron. **(3+7=10)**

   (c) In your words, explain the photoelectric effect. How does the photon concept explain this effect? **(5+5=10)**

   (d) What is the frequency of photons emitted during a transition from n = 5 state to the n = 2 state in the hydrogen atom? Also calculate the energy difference between these two states. **(5)**

2. (a) The N_2^+ molecule can be prepared by bombarding the N_2 molecule with fast moving electrons. What are its electronic configuration and bond order? Would you expect the bond length of N_2^+ to be shorter or longer than that of N_2? **(4+3=7)**

   (b) Which of the following ions is planar and why: ClO_3^-, ClO_4^- and NO_3^-? **(6)**

   (c) What do you understand by the term "periodic properties"? Distinguish between electron affinity and electronegativity. Flourine is more electronegative than chlorine although its electron affinity is less than that of chlorine. Explain. **(3+6+6=15)**

   (d) What is effective nuclear charge? What relation does it have with shielding phenomenon? **(3+4=7)**

3. (a) Derive Henry's law equation. What are its important applications? **(5+2=7)**

   (b) Mention the limitations of Nernst's distribution law. **(3)**

   (c) State and explain the Vant's Hoff laws of osmotic pressure. Can you see any similarities between the ideal gas equation and osmotic pressure equation? **(8+2=10)**

   (d) State Raoult's law of vapour pressure lowering. What are its limitations? **(5+3=8)**

   (e) What is triple point? Explain it with the help of phase diagram. **(2+5=7)**

Contd P/2

CHEM 117/NAME

4. (a) Describe the one component system water with the help of the phase diagram. Show the various zones in the diagram. **(8+2=10)**

   (b) What is an azeotropic mixture? Explain with a t-c diagram. **(3+5=8)**

   (c) What is internal energy of a system? Show that $\Delta H = \Delta E + RT\,\Delta n$ for a chemical reaction. **(2+8=10)**

   (d) Draw and explain the Bozn-Haber cycle for the formation of RbCl (s) to determine the lattice enthalpy. **(7)**

SECTION – B

There are **FOUR** questions in this section. Answer any **THREE**.

5. (a) A cell consists of a zinc electrode and a hydrogen electron and another cell consists of a copper electrode and a hydrogen electrode. Both cells are operating under standard state conditions. Draw a sketch of the cells. Label the anode and cathode, showing the corresponding half reactions at these electrode and write the complete cell reactions and cell notations for these cells. **(7+4+4=15)**

   (b) Copper (I) ion can act as both an oxidizing agent and a reducing agent. Hence, it can react with itself: **(10)**

   $2\,Cu^{+}\,(aq) \rightarrow Cu\,(s) + Cu^{2+}\,(aq)$

   Calculate the E^{0}_{cell} and equilibrium constant (K_c) at 25°C for this reaction. Given that $E^{0}_{Cu^{2+}/Cu^{+}} = +0.16\ V$ and $E^{0}_{Cu^{+}/Cu} = +0.52\ V$.

   (c) Construct and describe the working principle of hydrogen-oxygen fuel cell. **(10)**

6. (a) Write equilibrium constant expression for k_c and k_p, if applicable, for the following reactions: **(5×2=10)**

   (i) $H_2O\,(g) + C\,(s) \rightleftharpoons CO\,(g) + H_2\,(g)$

   (ii) $NaHCO_3\,(s) \rightleftharpoons Na_2CO_3\,(s) + CO_2\,(g) + H_2O\,(g)$

   (iii) $CH_3COOH\,(l) + H_2O\,(l) \rightleftharpoons CH_3COO^{-}\,(aq) + H_3O^{+}\,(aq)$

   (iv) $CaO\,(s) + CO_2\,(g) \rightleftharpoons CaCO_3\,(s)$

   (v) $2\,NO_2\,(g) + 7\,H_2\,(g) \rightleftharpoons 2\,NH_3\,(g) + 4\,H_2O\,(l)$

   (b) Derive the integral form of Van't Hoff equation and show the graphical representation of that equation for exothermic reaction and endo-thermic reaction. **(10+4)**

   (c) Define solubility product and molar solubility. Calculate the solubility of silver chloride (in g/L) in a 7.5×10^{-3} M silver nitrate solution. The solubility product of AgCl is 1.6×10^{-10} and molar mass is 143.4. **(4+7=11)**

Contd P/3

CHEM 117/NAME

7. (a) What is an opposing reaction? Derive the rate constant equation of an opposing reaction. How can the rate constants of this reaction be determined? **(2+8+4=14)**

   (b) Show the linear graphical representation of zero order, first order and second order reactions with proper notation. **(4×3=12)**

   (c) Show that the half life of zero order reactions is proportional to the initial concentration of reactants. **(9)**

8. (a) Why is H_2O a good solvent for many covalent substances? Discuss the effects of temperature and pressure on solubility of solutes. **(2+8=10)**

   (b) Write down the Nernst's distribution law. How is distribution law modified by change in molecular state in terms of association and dissociation? **(2+8=10)**

   (c) What are the colligative properties and why are they so called? **(5)**

   (d) Deduce from Raoult's law an expression relating the molecular mass of a solute with lowering of vapour pressure of a solvent on the addition of a solute. **(10)**
