

SECTION – A

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

Symbols used have their usual meaning.

1. (a) A function is defined as (12)

$$f(x) = \begin{cases} 1 + \sin x; & 0 \leq x < \frac{\pi}{2} \\ 2 + \left(x - \frac{1}{2}\pi\right)^2; & \frac{\pi}{2} \leq x < \infty \end{cases}$$

Examine the continuity and differentiability of $f(x)$ at $x = \frac{\pi}{2}$.

- (b) Evaluate $\lim_{x \rightarrow 0} \left(\frac{\tan x}{x}\right)^{1/x}$ (12)

- (c) Find the n th derivate of $y = \sin^5 x \cos^3 x$ (11)

2. (a) If $y = e^{a \sin^{-1} x}$, then prove that $(1 - x^2)y_{n+2} - (2n + 1)xy_{n+1} - (n^2 + a^2)y_n = 0$. Also find $(y_n)_0$. (15)

- (b) Verify Rolle's theorem for the function $f(x) = x^3 - x^2 - 4x + 4$ in the interval $(-2, 2)$. (10)

- (c) Expand $f(x) = e^x \cos x$ in a finite series in powers of x with Lagrange's form of remainder. (10)

3. (a) Using Euler's theorem, find the value of $x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y}$, when $u = \sin^{-1} \frac{x^{3/2} + y^{3/2}}{x^{3/2} - y^{3/2}}$. (13)

- (b) Show that the maximum value of $x + \frac{1}{x}$ is less than its minimum value. (9)

- (c) Verify Mean value theorem for the function $f(x) = x^3 - 2x^2 + 3x - 2$ in the interval $(0, 2)$. (13)

4. (a) Show that for the curve $by^2 = (x + a)^3$, the square of the sub tangent varies as the subnormal. (15)

- (b) Find the condition that the curves $ax^2 + by^2 = 1$ and $a_1x^2 + b_1y^2 = 1$ shall cut orthogonally. (10)

- (c) Find the pedal equation of the curve $r^m = a^m \sin m\theta$. (10)

MATH 181/NAME

SECTION-BThere are **FOUR** questions in this section. Answer any **THREE**.

5. Compute the following:

(a) $\int \frac{dx}{\cos(2x-a)\cos(2x+a)}$ (10)

(b) $\int \frac{dx}{x^6\sqrt{1+x^2}}$ (12)

(c) $\int \sin^2 x \cos^6 x dx$ (13)

6. (a) Obtain a reduction formula for $I_{m,n} = \int \cos^m x \cos nx dx$ and hence find

$\int \cos^3 x \cos 2x dx.$ (12)

(b) Evaluate: $\int_0^{\pi} \frac{x \tan x}{\sec x + \tan x} dx$ (12)

(c) Evaluate: $\lim_{n \rightarrow \infty} \left\{ \left(1 + \frac{1^2}{n^2}\right) \left(1 + \frac{2^2}{n^2}\right) \cdots \left(1 + \frac{n^2}{n^2}\right) \right\}^{1/n}$. (11)

7. (a) Evaluate: (i) $\int_0^{\infty} \frac{x}{(x^2+a^2)(x^2+b^2)} dx$ (11)

(ii) $\int_0^2 x \sqrt[3]{8-x^3} dx$ (11)

(b) Show that $\beta(m,n) = \frac{\Gamma(m)\Gamma(n)}{\Gamma(m+n)}$ (13)

8. (a) Find the area of the region bounded by $a^4 y^2 = x^5(2a-x)$. (11)

(b) Find the perimeter of the cardioid $r = a(1 - \cos \theta)$. (11)

(c) Find the volume of the solid obtained by the revolution of the cissoid $y^2(2a-x) = x^3$ about its asymptotes. (13)

L-1/T-1/NAME

Date : 15/09/2018

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-1/T-1 B.Sc. Engineering Examinations 2017-2018

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

Full Marks: 210

Time : 3 Hours

USE SEPARATE SCRIPTS FOR EACH SECTION

The figures in the margin indicate full marks.

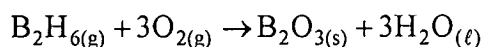
SECTION – A

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

1. (a) What is meant by pseudo-first order reaction? Explain with an example. Write the rate law expression for a pseudo-first order reaction. (8)
(b) Derive the integrated rate law equation of a second order reaction. How is half-life related to the second order reaction kinetics? (15)
(c) Distinguish between equilibrium constant and velocity constant. (5)
(d) Without using a catalyst, the activation energy of a reaction is 367.8 kJ/mol. With a catalyst, the activation energy is found to be 187.2 kJ/mol. Assuming the frequency factor (A) and the initial concentrations of all reactants are the same for each reaction, how many times faster is the initial rate of the catalyzed reaction at 26.88°C? (7)

2. (a) State and explain Raoult's law. Explain how the lowering of vapor pressure of a solvent can be employed to determine the molecular weight of the dissolved solute substance. (8)
(b) How is a true solution differed from suspensions and colloids? Describe the molecular view of the formation of a solution. (8)
(c) What is molal depression constant? Deduce the relationship between the concentration of a solution and the lowering of freezing point. Can you determine the molecular weight of sodium chloride by this method? (14)
(d) A solution containing 0.622 gm of solute in 40 gm of water froze at -0.51°C. What is the molecular weight of the solute? (K_f for water is 18.58 for 100 gms of water) (5)

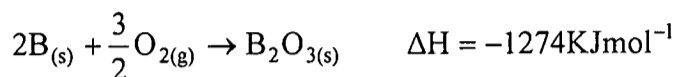
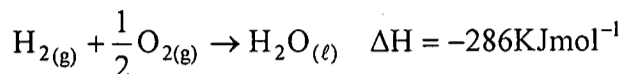
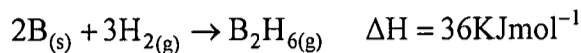
3. (a) What is meant by state function of a chemical system? Explain why Gibbs free energy is considered as a state function? (7)
(b) How does the temperature affect on reaction enthalpies? Derive the kirchhoff's equation for the temperature dependence of reaction enthalpies. (14)
(c) State and explain the second law of thermodynamics. How is entropy related to the reaction spontaneity? (8)
(d) The compound diborane (B_2H_6) is used as a rocket fuel. The equation for the combustion of diborane is shown below: (6)



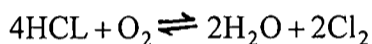
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CHEM 117/NAME**Contd... Q. No. 3(d)**

Calculate the enthalpy of combustion of diborane (B_2H_6) in $KJmol^{-1}$ using the following data:



4. (a) Explain each of the following terms used in the phase rule: (5)
- (i) Components (ii) Degree of freedom
- (b) Draw and discuss the phase diagram for one component system with the application of phase rule. (13)
- (c) State and explain the significance of equilibrium constant of a reversible reaction. (5)
- (d) The gas-phase reaction below has a negative enthalpy of reaction for the forward direction. (12)



Predict the result of each of the following changes to this reaction at equilibrium:

- (i) Temperature increase (ii) Volume decrease
- (iii) Addition of krypton (iv) Addition of a catalyst
- (v) Pressure decrease (vi) Removal of water with a desiccant

SECTION-B

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

5. (a) What are the scientific approaches to understand a matter? (4)
- (b) By which concept you can explain the wave motion of guitar similar to the wave motion of electron? Explain. (6)
- (c) H atom and Be^{3+} ion each have one electron. Would you expect the Bohr model to predict their spectra accurately? Would you expect their spectra to be identical? Explain. (7)
- (d) A hydrogen atom absorbs a photon of UV light and its electron enters the $n = 4$ energy level. Calculate (i) the change in energy of the atom and (ii) the wavelength (in nm) of the photon. (6)
- (e) Derive the Schrödinger wave equation and explain the quantum mechanical model in terms of this equation. (12)

CHEM 117/NAME

6. (a) Explain the Z_{eff} value of 1s, 2s and 2p orbitals in terms of penetration effect including diagram. (8)
- (b) Write a set of quantum numbers for the third electron and a set for the eighth electron of the F atom. (6)
- (c) Rank the elements in each set in order of increasing IE1: (6)
- (i) Sb, Sn, I; (ii) Na, Mg, Cs.
- (d) What is hybridized bridge bond? Explain the covalent bonding in diborane. (5)
- (e) Discuss the structure and properties of oxides of nitrogen. (10)
7. (a) For single bonds between similar types of atoms, how does the strength of the bond relate to the sizes of the atoms? Explain. (5)
- (b) Rank the members of each set of compounds in order of decreasing ionic character of their bonds. Use partial charges to indicate the bond polarity of each: (6)
- (i) PCl_3 , PBr_3 , PF_3 (ii) BF_3 , NF_3 , CF_4 .
- (c) Explain the periodic trends in electro-negativity (EN) and the inverse relationship of EN values to atomic sizes. (6)
- (d) Show the diagram for the distribution of electron density in H_2 molecule. (5)
- (e) Discuss the stretching vibrations of CO_2 . Why does asymmetric stretching show peak at higher wave number than symmetric stretching? (6)
- (f) What is natural frequency of vibration? How can you identify 1-octyne and 4-octyne by IR spectroscopy? (7)
8. (a) These species do not obey the octet rule. Draw a Lewis structure for each, and state the type of octet-rule exception: (6)
- (i) O_3 (ii) XeF_2 (iii) SbF_4^-
- (b) Draw the resonance structure of CNS^- ion and select one with the lowest formal charge. (5)
- (c) Draw and explain the shape of ClO_4^- , PF_5 and XeF_2 according to VSEPR theory. (12)
- (d) By MO diagrams calculate bond orders and predict whether He_2^+ and He_2^- exist or not? If either exists, write its electron configuration of the molecules. (6)
- (e) Draw the molecular orbital diagram of NO and HF. (6)
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SECTION – A

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

Assume reasonable value for any missing data.

1. (a) Show that for a wall sided vessel inclined to an angle ‘ θ ’, the righting lever: **(20)**

$$GZ = \sin \theta \left(GM + \frac{1}{2} BM \tan^2 \theta \right)$$
; where, GM and BM refer to the upright condition value. From this expression also find the expression for small angle stability.
 (b) A box shaped vessel having length 65 m, breadth 12m and depth 8m and has a KG 4 m, and is floating in salt water on an even keel at 4 m draft. Calculate the moments of statical stability at (i) 5 degree and (ii) 25 degrees heel. **(15)**

2. (a) Explain launching of a ship. Derive the expression for the drafts forward and aft considering ways with camber during launching of a ship. **(10)**
 (b) Illustrate the launching curves and also list the information that can be extracted from the launching curves. **(10)**
 (c) Write short notes on the following: **(15)**
 - (i) IMO stability requirements
 - (ii) Gross Tonnage and Net Tonnage
 - (iii) Load Line Mark

3. (a) State what is meant by the term floodable length, illustrating your answer by drawing a typical curve of floodable length for a ship. **(15)**
 (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 salt water. It’s 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. **(20)**

4. (a) A cargo carrier has displacement of 35000 tonnes and KG 9 m. Construct the statical stability curve for the following GZ values: **(20)**

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Contd... Q. No. 4(a)

Heel (degrees)	5	10	15	20	30	45	60	75	90
GZ (m)	0.12	0.43	0.87	1.32	2.0	2.39	1.91	0.71	-0.60

Draw the stability curve and also from the curve, find the following:

- (i) The range of stability
- (ii) The angle of vanishing stability,
- (iii) The maximum righting lever and angle of the heel at which it occurs, and
- (iv) The approximate initial metacentric height.

(b) Define dynamical stability of ship. A ship of 10000 tonnes displacement has the following righting levers when inclined: (15)

Heel (degrees)	0	10	20	30	40	50
GZ (m)	0.0	0.2	0.12	0.21	0.30	0.33

Calculate the dynamical stability to 50 degrees heel.

SECTION – B

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

The symbols have their usual meanings.

5. (a) Write short notes on C_b , C_m , C_p , C_w , and C_D . What are the typical values of these for different vessels? (10)

(b) A water-plane of length 270 m and breadth 35.5 m has the following equally spaced breadths: 0.3, 13.5, 27.0, 34.2, 35.5, 35.5, 35.5, 32.0, 23.1 and 7.4 m respectively. (12)

Calculate the water-plane area, water-plane area co-efficient and the TPC in fresh water.

(c) From the following information, calculate the vessels deadweight, the fully loaded displacement and C_D . (13)

Light draft 8m, WPA = 9750 m².

Medium ballast draft 10 m, WPA = 11278 m²

Heavy ballast draft 12 m, WPA = 12600 m²

Fully-loaded draft 14 m, WPA = 13925 m²

Light weight at 8 m draft is 18231 tonnes.

6. (a) Derive Morrish's formula for depth of centre of buoyancy below the load water-line. (15)

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Contd... Q. No. 6

(b) An athwart ship coal-bunker is 6 ft. long in fore and aft direction. It is bounded at sides by two longitudinal bulkheads 34 ft apart, and by a horizontal deck at the top. The bottom is formed by the inner bottom of the ship and is in the form of a curve having vertical ordinates measured from the top of 12.5, 15.0, 16.0, 16.3, 16.4, 16.3, 16.0, 15.0 and 12.5 respectively, the first and last ordinates being on the bulkheads.

Find:

(20)

(i) The number of tons coal the bunker will hold.

(ii) The distance of the centre of gravity of the coal from the top

Assume density of coal 0.4 ton per cubic ft.

7. (a) Define transverse metacentre of a ship with figure and discuss its effect on the ships' stability.

(8)

(b) Derive the expression of transverse BM.

(12)

(c) Prove that a homogeneous log of timber of square section and specific gravity 0.5 cannot float in fresh water with one of its faces horizontal. How will it float?

(15)

8. (a) Discuss the effect of free surface of liquids on the stability of a ship.

(10)

(b) Define angle of the loll. Explain the procedure of correcting it.

(10)

(c) A vessel whose TPC is 12.3 has draft 4 m. A rectangular midship cargo compartment 12 m long, 10 m breadth and 6 m depth has a permeability of 60%. What will be the mean draft if the compartment was bilged?

(15)



L-1/T-1/NAME

Date : 25/09/2018

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-1/T-1 B.Sc. Engineering Examinations 2017-2018

Sub : **HUM 111** (English)

Full Marks: 140

Time : 3 Hours

USE SEPARATE SCRIPTS FOR EACH SECTION

The figures in the margin indicate full marks.

SECTION – A

There are **FOUR** questions in this section. Answer any **THREE**. Answer any **THREE** questions including Question No. 1 as compulsory.

Symbols indicate their usual meaning.

1. (a) Explain with reference to the context any one of the following: (8)
- (i) "There is nothing more humiliating than to have a shabby air in the midst of rich women."
- (ii) "And I despise your books, I despise wisdom and blessing of this world."
- (b) Answer any one of the following: (10)
- (i) Describe Laura's ambivalence over her class consciousness in reference to the story "The Garden Party".
- (ii) Analyze "The Bet" as a manifestation of two opposing goals of life – the life of worldly pursuits and the life of renunciation.
- (c) Answer any three of the following: (12)
- (i) "Mine were false. They were not worth over five hundred francs!" Describe this climactic statement in reference to the story of 'The Diamond Necklace'.
- (ii) How did Matilda and her husband suffer to repay the loan?
- (iii) Why did Mrs. Loisel suffer from the poverty of her apartment?
- (iv) Give a brief description of the party arranged by the banker?
- (v) How did the banker try to justify the concept of capital punishment?
2. Recast and correct any ten of the following sentences: (20)
- (i) Neither of the traffic lights are working.
- (ii) The mayor, with his councilors, was present.
- (iii) Laura is an alumnus of the Oxford.
- (iv) I method him sometimes in last summer.
- (v) Hasan is not as tall as his father.
- (vi) I have other books beside this.
- (vii) Young men dream glory and riches.
- (viii) The music created an allusion that it was coming from the next room.
- (ix) Rabindranath occupies a most unique place in literature.
- (x) The story has no morale.
- (xi) Fifteen minutes are allowed to each speaker.
- (xii) The committee is divided in their opinions.
3. (a) Write down meaning of **any ten** of the following words: (10)
- Affluent, Brittle, Cataclysm, Deride, Flip, Germinate, Jeopardy, Indictment, Limpid, Menace, Ordeal, Tranquil.

Contd P/2

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Contd... Q. No. 3

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

(10)

Arduous, Confiscate, Clemency, Diffidence, Elusive, Flicker, Incisive, Loot, Mundane, Oblivious, Perennial, Ratify.

4. Write a précis of the following passage with a suitable title:

(20)

Trees give shade for the benefit of others and while they themselves stand in sun and endure scorching heat, they produce the fruit by which others profit. The character of good Mention is like that of trees. What is the use of this perishable body, if no use of it made for the benefit of mankind? Sandalwood – the more it is rubbed, the more scent does it yield. Sugarcane - the more it is peeled and cut into pieces, the more juice it does produce. Gold - the more it is burnt, the more brightly it does shine. The men who are noble at heart do not lose these even in losing their lives. What does it matter whether men praise them or not? What difference does it make whether riches abide with them or not? What does it signify whether they die at this moment or whether their lives are prolonged? Happen what may, those who tread in the right path will not set foot in any other. Life itself is unprofitable to a man who does not live for others. To live for the mere sake of living one's life is to live the life of dogs and cows. Those who lay down their lives for the sake of friends, or even for the sake of a stranger, will assuredly dwell in a world of bliss.

SECTION-B

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

5. (a) Read the following passage carefully and answer the questions that follow:

(30)

Like other tyrannies, the tyranny of the majority was first, and is still vulgarly, held in dread, chiefly as operating through the acts of the public authorities. But reflecting persons perceived that when society is itself the tyrant—society collectively, over the separate individuals who compose it – its means of tyrannazing are not restricted to the acts which it may do by the hands of its political functionaries. Society can and does execute its own mandates: and if it issues wrong mandates instead of right, or any mandates at all in things with which it ought not to meddle, it practices a social tyranny more formidable than many kinds of political oppression, since though not usually upheld by such extreme penalties, it leaves fewer means of escape, penetrating much more deeply into the details of life, and enslaving the soul itself. Protection, therefore, against the tyranny of the magistrate is not enough: there needs protection also against

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Contd... Q. No. 5(a)

the tyranny of the prevailing opinion and feelings: against the tendency of society to impose, by other means than civil penalties, its own ideas and practices as rules of conduct on those who dissent from them; to fetter the development, and if possible, prevent the formation, of any individuality not in harmony with its ways, and compel all characters to fashion themselves upon the model of its own. There is a limit to the legitimate interference of collective opinion with individual independence: and to find that limit, and maintain it against encroachment, is as indispensable to a good condition of human affairs, as protection against political despotism.

Questions:

- (i) What does "the tyranny of the majority" mean?
 - (ii) When does a society practice social tyranny?
 - (iii) How is social tyranny different from political oppression?
 - (iv) In a society what sort of protection does an individual require?
 - (v) What is essential for nurturing individualism?
 - (vi) Give the meanings of the following words as used in the passage: Vulgar, mandate, meddle, legitimate, despotism.
6. (a) Write a letter to a firm complaining against the supply of damaged and defective goods. (Provide necessary details from your own). **(10)**
- (b) Write phonetic transcriptions of the following words. (Any five). **(10)**
Mother, enrich, among, son, wonder, chair.
7. (a) Write a dialogue between two friends about their plan after the term final examination. **(10)**
- (b) Write a short essay on any ONE of the following topics: **(10)**
- (i) Depression: A Psychic Enemy
 - (ii) Environmental Disaster
 - (iii) Online Education
8. (a) Transform the following sentences as directed. (Any five) **(10)**
- (i) The war is over and silence prevails. (make it simple).
 - (ii) Make haste or else you will be late. (Simple).
 - (iii) What he has said is true. (Compound)
 - (iv) If you speak the truth, I shall pardon you. (Compound)
 - (v) There is no admission without permission. (Complex)
 - (vi) Stay in your place (Complex).
- (b) Write short notes on any TWO of the following: **(10)**
- (i) Components of formal report
 - (ii) The Diphthongs
 - (iii) Parts of a paragraph.
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