

[Question of Term Final Examination]

KHULNA UNIVERSITY

School: Science, Engineering & Technology

Discipline: Chemistry

Program: B. Sc (Hon's)

Year: First

Term: First

Examination Year: 2026

Session: 2025-2026

Course Code: 0531 18 Chem 1101

Course Title: Atomic Structure and Chemical Bonding

Total Marks: 60

Time: 3 hours

Credit: 3.0

- Use separate answer script for each section.
- The figures in the right margin indicate marks. Questions are of equal value.

Section A

There are **Four** questions in this section. Answer any **Three** questions.

Question No.	Question Description	Marks
1.	a) State and explain the Law of definite proportions. [L2; CLO1]	4
	b) Carbon and oxygen are known to form two compounds. The carbon content in one of these compounds is 42.9% (by mass) while in the other, it is 27.3% (by mass). Show that the data are in the agreement with the law of multiple proportions. [L4; CLO1]	4
	c) Find some practical application of chemistry in your everyday life. [L1; CLO1]	2
2.	a) Construct a tabular form, what are the three fundamental particles, their charges and mass. [L6; CLO1]	3
	b) Derive a mathematical expression for the calculation of first Bohr radius. [L3; CLO2]	4
	c) How can you calculate the three lowest energy levels of the hydrogen atom? [L1; CLO2]	3
3.	a) What do you mean by wave mechanical theory and wave mechanics? [L1; CLO2]	2
	b) Discuss the significances of ψ and ψ^2 in Schrödinger's wave equation. [L6; CLO2]	4
	c) You have four orbital's, 1s, 2p, 3d and 4f. List the orbital's in the increasing order of energy and justify your answer. [L4; CLO2]	4
4.	a) Discuss the role of shielding effect on electron affinity when we move down in a group. [L6; CLO3]	3
	b) Classify elements in the periodic table based on the subshell being filled by valence electrons. [L2; CLO3]	4
	c) Assess the position of the element having outer electronic configuration	3×1=3
	(i) ns^2np^4 for $n=3$	
	(ii) $(n-1)d^2ns^2$ for $n=4$, and	
	(iii) $(n-2)f^7(n-1)d^1ns^2$ for $n=6$, in the periodic table. [L5; CLO2]	

Section B

There are **Four** questions in this section. Answer any **Three** questions.

Question No.	Question Description	Marks
5.	a) How poles do forms in a compound? What are the three major conditions to forms a chemical bond? [L1; CLO4]	3
	b) Classify intramolecular chemical bonds based on the difference of electronegativities of elements. [L2; CLO4]	2
	c) Assess the bonding pattern among the compounds of NaCl, CH ₄ and an Al-pot. [L5; CLO4]	5
6.	a) Define the Polarizing power and polarizing capacity of cations and anions? [L1; CLO4].	2
	b) Summarize the Fajan's rule in a table. [L2; CLO4]	2
	c) Applying radius ratio rules, calculate the limiting radius ratio for CsCl (8:8). [L3; CLO5]	4
	d) Analyze the shattering nature of ionic compounds. [L4; CLO4]	2
7.	a) Conclude the key points to predict the stable resonance structure of a covalent compound and show the formal charge on Nitrogen and Hydrogen atom in NH ₄ ⁺ ion. [L3; CLO5]	3
	b) (i) In what conditions Carbon atom shows sp, sp ² , sp ³ hybridization? [L1; CLO4]	2+3=5
	(ii) Predict the hybridization pattern presence in PF ₅ molecule. [L6; CLO5]	
	c) How do you determine the total number of valence electrons in a covalent compound for a simple compound, compound containing lone pairs of electrons and for the ions? [L5; CLO5].	2
8.	a) Make a comparison of crystal structures depending on the coordination number and Atomic Packing Factor. [L2; CLO4]	2
	b) Distinguish between atomic and molecular orbitals. [L4; CLO5]	3
	c) Explain conductivity, luster and malleability of a metal. [L2; CLO4]	2
	d) Construct a figure of molecular orbitals and its energies. corresponding to delocalization of valence electrons over increasing number of Li atom. [L6; CLO5]	3

*Levels of Bloom's cognitive domain:

[L1 = Remember, L2 = Understand, L3 = Apply, L4 = Analyze, L5 = Evaluate, L6 = Create]

[Question of Term Final Examination]

KHULNA UNIVERSITY

School: Science, Engineering & Technology Discipline: Chemistry Program: B. Sc (Hon's)
Year: First Term: First Examination Year: 2026 Session: 2025-2026
Course Code: 0531 18 Chem 1103 Course Title: Introduction to Physical Chemistry
Total Marks: 60 Time: 3 hours Credit: 3.0

- Use separate answer script for each section.
- The figures in the right margin indicate marks. Questions are of equal value.

Section A

There are **Four** questions in this section. Answer any **Three** questions.

Question No.	Question Description	Marks
1.	a) Define melting and sublimation. [L1; CLO1]	2
	b) Analyze the relationship between intermolecular forces and physical state. [L4; CLO1]	4
	c) Evaluate the statement: "Hydrogen bonding is stronger than other van der Waals forces." [L5; CLO1]	4
2.	a) Why does the total pressure of a gas mixture equal the sum of individual partial pressures? [L2; CLO1]	3
	b) Compare the Maxwell velocity distribution curves at low and high temperatures. [L6; CLO2]	4
	c) A sample of oxygen is collected by the downward displacement of water from an inverted bottle. The water level inside the bottle is equalized with that in the trough. Barometric pressure is found to be 757 mm Hg, and the temperature of water is 23 °C. What is the partial pressure of O ₂ ? Vapour pressure of H ₂ O at 23 °C = 19.8 mm Hg. [L3; CLO2]	3
3.	a) Develop a relationship between C _p and C _v for an ideal gas. [L5; CLO3]	4
	b) Define collision frequency. Describe the effect of temperature and pressure on collision frequency. [L1; CLO2]	3
	c) Calculate the RMS velocity of chlorine molecules at 12 °C and 78 cm pressure. [L1; CLO3]	3
4.	a) Explain why equal volumes of gases at the same temperature and pressure contain equal numbers of molecules. [L2; CLO2]	4
	b) Analyze the P–V isotherms of carbon dioxide studied by Thomas Andrews. [L4; CLO2]	6

Section B

There are **Four** questions in this section. Answer any **Three** questions.

Question No.	Question Description	Marks
5.	a) Explain the following intermolecular interactions with example: [L2; CLO4] (i) Cation- π (ii) π -stack (iii) Hydrophobic interaction	6
	b) Arrange <i>n</i> -butane, propane, 2-methylpropane, and <i>n</i> -pentane in order of increasing boiling points. [L6; CLO4]	4
6.	a) When two liquids having viscosity η_1, η_2 and density ρ_1, ρ_2 passes through a viscometer in time t_1, t_2 , justify that- $\eta_1/\eta_2 = \rho_1 t_1 / \rho_2 t_2$. [L5; CLO6]	5
	b) The vapor pressure of a liquid at the temperatures 110 °C and 150 °C is 22.8 Pa and 238.8 Pa respectively. Calculate the enthalpy of vaporization of that liquid. [L3; CLO5]	5
7.	a) At 800 °C, the pressure of CO ₂ is 0.236 atm. Calculate (a) K_P and (b) K_c for the reaction at this temperature. [L3; CLO3]	5
	b) Explain the buffer effect of both acidic and basic buffer with example. [L2; CLO6]	5
8.	a) Apply Le-Chatelier's principle to predict the effect of increasing pressure on the synthesis of ammonia. [L3; CLO5]	5
	b) What are the criteria for chemical equilibrium? [L1; CLO3]	2
	c) Justify why catalysts are essential in industrial equilibrium reactions even though they do not change K_c . [L5; CLO6]	3

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[L1 = Remember, L2 = Understand, L3 = Apply, L4 = Analyze, L5 = Evaluate, L6 = Create]

[Question of Term Final Examination]
KHULNA UNIVERSITY

School: Science, Engineering & Technology **Discipline:** Chemistry **Program:** B. Sc (Hon's)
Year: First **Term:** First **Examination Year:** 2026 **Session:** 2025-2026
Course Code: 0541 18 Math 1151 **Course Title:** Differential and Integral Calculus
Total Marks: 60 **Time:** 3 hours **Credit:** 3.0

- Use separate answer script for each section.
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Section A

There are **Four** questions in this section. Answer any **Three** questions.

Question No.	Question Description	Marks
1. a)	Illustrate the graph of the function $y = e^{(1-2x)}$, also find the domain and range of the function from the graph. [L1&2; CLO1]	5
b)	Determine the value of a , so that the function $f(x)$ defined by $f(x) = \begin{cases} (a - \sin^2 x) & ; \quad x \neq 0 \\ 5 & ; \quad x = 0 \end{cases}$ will be continuous. [L5; CLO1]	5
2. a)	If $y = \cos(m \sin^{-1} x)$ prove that $(1-x^2)y_{n+2} - (2n+1)xy_{n+1} + (m^2 - n^2)y = 0$. [L5; CLO5]	5
b)	If $u = \ln\left(\frac{x^2+y^2}{x+y}\right)$, prove that $x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y} = 1$. [L5; CLO5]	5
3. a)	It is given that the Rolle's theorem holds good for the function $f(x) = x^3 + ax^2 + bx$, where $x \in [1, 2]$ at the point $x = \frac{4}{3}$. Determine the values of a and b . [L5; CLO2]	6
b)	Examine the validity and conclusion of Mean Value Theorem for the function $f(x) = \sin x - \sin 2x$ defined in the interval $[0, \pi]$. [L4; CLO2]	4
4. a)	Find maximum and minimum values of the given function, $f(x) = 6x^3 - 45x^2 - 108x + 1$ [L1; CLO2]	4
b)	A square sheet of cardboard with each side 50 centimeters is to be used to make an open top box by cutting a small square of cardboard from each of the corners and bending up the sides. Determine the side length of the small squares if the box is to have as large a volume as possible? [L5; CLO 2]	6

Section B

There are **Four** questions in this section. Answer any **Three** questions.

Question No.	Question Description	Marks
5.	Evaluate the following integrals, [L1; CLO1&3]	
i.	$\int \sin^{-1} x dx$	2.5 × 4 = 10
ii.	$\int \frac{dx}{1 + \tan x}$	
iii.	$\int \frac{dx}{x\sqrt{x-4}}$	
iv.	$\int \frac{1+x^2\sqrt{x}+x}{x} dx$	
6.	a) Define antiderivative with examples. Also define integral, integration and integrand. [L1; CLO5]	3
	b) Suppose $f(x) = x^2$ in the interval $[0,1]$. Divide this interval into 10 equal parts and find the area by evaluating left, right and middle point approximation method. [L4; CLO5]	5
	c) Explain why constant is added after integration. [L2; CLO5]	2
7.	Evaluate the following integrals, [L5; CLO2]	
i.	$\int_{-\frac{\pi}{2}}^{\frac{\pi}{2}} \cos^5 \theta (1 + \sin \theta)^2 d\theta$	5 × 2 = 10
ii.	$\int_0^{\infty} \frac{x^7}{(1+x^2)^{\frac{11}{2}}} dx$	
8.	a) Find the area enclosed between the graphs of $y = \sin x$ and $y = 1 - \sin x$ for $0 < x < \pi$. [L1; CLO3]	5
	b) Find the area between the curves $xy = 1$ and $y = \sin x$ in the region $0 < x < \pi$. [L1; CLO3]	5

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KHULNA UNIVERSITY

School: Science, Engineering & Technology Discipline: Chemistry Program: B. Sc (Hon's)
Year: First Term: First Examination Year: 2026 Session: 2025-2026
Course Code: 0533 18 Phy 1153 Course Title: Properties of Matter
Total Marks: 60 Time: 3 hours Credit: 3.0

- Use separate answer script for each section.
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Section A

There are **Four** questions in this section. Answer any **Three** questions.

Question No.	Question Description	Marks
1.	a) Define gradient, divergence and curl of a vector. [L1; CLO1]	3
	b) In a two dimensional coordinates construct the position vectors for the points P(2,-1,3) and Q(3,2,-4) and estimate the distance between this two points. [L5; CLO1]	3
	c) Show that $A = (2x^2 + 8xy^2z)i + (3x^3y - 3xy)j - (4y^2z^2 + 2x^3z)k$ is not solenoidal but $B = xyz^2A$ is solenoidal. [L2; CLO1]	4
2.	a) If ω is a constant vector and $A = \omega \times r$, show that $\nabla \cdot A = 0$. [L2; CLO1]	3
	b) Explain collision in one dimension and give the statement when – (i) $m_1 = m_2$ and (ii) m_2 is initially at rest or stationary. [L2; CLO3]	6
	c) Under which condition, conservation of linear momentum violates? [L1; CLO2]	1
3.	a) Define torque and angular momentum and show that the time rate of change of angular momentum of a particle is equal to the torque acting on it. [L1; CLO5]	5
	b) Distinguish between conservative and non-conservative force. [L2; CLO4]	2
	c) Show that the rotational kinetic energy of a rigid body is $K = \frac{1}{2}I\omega^2$. [L3; CLO4]	3
4.	a) Illustrate the stress-strain curve for a ductile material. [L4; CLO5]	2
	b) Develop the relation connecting the elastic constants and show that $\frac{9}{\gamma} = \frac{3}{\eta} + \frac{1}{K}$, where the symbols have their usual meaning. [L6; CLO6]	5
	c) A wire of length 2m and diameter 1mm is increased by 0.05cm in length. What will be the decrease of its diameter? [L1; CLO6]	3

Section B

There are **Four** questions in this section. Answer any **Three** questions.

Question No.	Question Description	Marks
5.	<p>a) Define surface tension and surface energy. Show that the surface tension is numerically equal to the surface energy per unit area. [L2; CLO6]</p> <p>b) Differentiate between adhesive force and cohesive force with examples. [L2; CLO6]</p> <p>c) Derive an expression for excess pressure inside a soap bubble. [L2; CLO6]</p> <p>d) The rise of water in a capillary tube is 3.0 cm. Find the radius of the tube if surface tension is 0.075 N/m and contact angle is 0°. (Take $\rho = 1000 \text{ kg/m}^3$, $g = 9.8 \text{ m/s}^2$). [L2&3; CLO6]</p>	<p>3</p> <p>3</p> <p>2</p> <p>2</p>
6.	<p>a) State and derive Poiseuille's equation for the flow of liquid through a horizontal capillary tube. [L2&4; CLO7]</p> <p>b) Explain Bernoulli's theorem and mention two applications of it. [L2&4; CLO7]</p> <p>c) Define the coefficient of velocity and write its SI unit and dimensional formula. [L2; CLO7]</p>	<p>3</p> <p>5</p> <p>2</p>
7.	<p>a) Define streaming flow. Derive the expression for the terminal velocity of a small sphere falling through a viscous liquid using Stoke's law. [L2; CLO8]</p> <p>b) Define simple harmonic motion. Obtain the differential equation of SHM. [L2; CLO8]</p> <p>c) Distinguish between free, damped, and forced oscillations. [L2&3; CLO8]</p>	<p>5</p> <p>3</p> <p>2</p>
8.	<p>a) Define phase velocity and group velocity. [L2; CLO9]</p> <p>b) Define the Doppler effect. Show that the apparent pitch of sound is given by $n' = \frac{v}{v-v_s} n$, when the listener is at rest but the source is in motion towards the observers. [L2; CLO9]</p> <p>c) Differentiate between traveling and stationary waves. A wave propagating in a medium is $y = 0.02 \sin(30t - 4x)$, where 'x' is in meters and t in seconds. Calculate the velocity of the wave. [L2&3; CLO9]</p>	<p>2</p> <p>4</p> <p>4</p>

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KHULNA UNIVERSITY

School: Science, Engineering & Technology **Discipline:** Chemistry **Program:** B. Sc (Hon's)
Year: First **Term:** First **Examination Year:** 2026 **Session:** 2025-2026
Course Code: 0231 18 Eng 1155 **Course Title:** Communicative English
Total Marks: 60 **Time:** 3 hours **Credit:** 3.0

- Use separate answer script for each section.
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Section A

There are **Four** questions in this section. Answer any **Three** questions.

Question No.	Question Description	Marks
1. a)	Change the word class as directed and make sentences with new words: [L1,2&3; CLO1&2] i) Beauty (adjectives) ii) Structure (adjective) iii) Comprehend (noun) iv) Water (verb) v) Select (noun)	5 × 1 = 5
b)	Fill in the blanks with the right form of verbs: [L1,2 & 3; CLO3] One day, Hazrat Ali's (R) favorite shield (a) (steal). After a long search, it (b) (find) with a Jew. He (c) (ask) him to return the shield. But the Jew (d) (refuse) to return it. He (e) (say) that the shield was his.	5 × 1 = 5
2. a)	Make sentences with simple sentence structures: [L6; CLO3] i) Subject (Tom) + Transitive Verb + Object ii) Subject + Be Verb + Adverbial iii) There + Verb + Subject (Three cats) iv) Subject + Linking Verb (taste) + Adjective Complement v) Subject + Intransitive Verb	5 × 2 = 10
3. a)	Differentiate between skimming and scanning with examples. [L1&2; CLO4,5&6]	5
b)	Transform simple sentences into complex sentences: [L1&2; CLO3] (i) This is a pen. (ii) Jolly is a writer. (iii) The house is beautiful. (iv) The road is repaired. (v) Her cousin has come home.	5 × 1 = 5

Question No.	Question Description	Marks
4 a)	Make a sentence using following directives: [L3; CLO7&8]	5×1=5
	i) Make a polite request	
	ii) Accept an invitation	
	iii) Reject a proposal	
	iv) Seeking permission	
	v) Agree with someone	
b)	Join the following pairs of sentences: [L3; CLO3]	5×1=5
	(i) Dhaka is a capital of Bangladesh. It is a very noisy city.	
	(ii) He belongs to some place. You know it.	
	(iii) He was strong. He failed to win.	
	(iv) He was not a student. He did not work there.	
	(v) I left the meeting. It was awfully noisy.	

Section B

There are **Four** questions in this section. Answer any **Three** questions.

Question No.	Question Description	Marks
5. a)	Discuss how to develop speaking skills. [L6; CLO7&8]	5
b)	Make sentences using notions/functions as directed: [L6; CLO7&8]	5×1=5
	(i) Express an idea [notion] in a sentence.	
	(ii) Express a concept [notion]	
	(iii) Introduce [function] yourself in a sentence.	
	(iv) Invite [function] someone in a sentence.	
	(v) Apologize [function] to someone.	
6.	Write a conversation between a course coordinator and a student about the student's mistake in course registration. [L2&6; CLO9&10]	10
7.	Write a paragraph on "The value of English in Daily Life". [L5; CLO9&10]	10
8.	Write an application to the Head of your Discipline seeking permission for an Industrial tour. [L6; CLO10]	10

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[Question of Term Final Examination]

KHULNA UNIVERSITY

School: Science, Engineering & Technology Discipline: Chemistry Program: B. Sc (Hon's)

Year: First Term: First Examination Year: 2026 Session: 2025-2026

Course Code: 0611 18 CSE 1157 Course Title: Computer Fundamentals

Total Marks: 60

Time: 3 hours

Credit: 3.0

- Use separate answer script for each section.
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Section A

There are **Four** questions in this section. Answer any **Three** questions.

Question No.	Question Description	Marks
1.	a) What is computer? Write down the key features of a computer. [L1; CLO1]	3
	b) Describe different types of computers based on size and purpose. [L2; CLO1]	3
	c) Discuss the advantages and disadvantages of computers in modern society. [L4; CLO1]	4
2.	a) Explain the basic organization of a computer system with a block diagram. [L2; CLO1&2]	3
	b) Define cache memory. How is it different from primary memory? [L2; CLO2]	4
	c) Write short notes on any THREE: [L2; CLO1&2]	3
	(i) ALU	
	(ii) Register	
	(iii) Processor	
	(iv) System bus	
	(v) Cloud storage	
3.	a) Convert the number $(5D)_{16}$ into <i>Binary</i> and <i>Decimal</i> . Show all steps clearly. [L3; CLO3]	3
	b) Perform the following binary arithmetic operations by showing all steps: [L3; CLO3]	3
	(i) $101101_2 + 11011_2$	
	(ii) $11010_2 - 1011_2$	
	c) Compare <i>ASCII</i> and <i>Unicode</i> encoding schemes. Analyze why <i>Unicode</i> is more suitable for multilingual systems like Bangla computing. [L4; CLO3]	4
4.	a) What is multimedia? Explain its role in communication and entertainment. [L2, CLO4]	3
	b) Analyze how different multimedia elements (audio, video, animation) impact user understanding differently. [L4; CLO4]	3
	c) Evaluate different input/output devices for a smart classroom setup. [L5; CLO1&2]	4

Section B

There are **Four** questions in this section. Answer any **Three** questions.

Question No.	Question Description	Marks
5.	a) Define computer network. Explain LAN, MAN, and WAN with examples. [L2; CLO5]	4
	b) What is network topology? Discuss Bus and Star topologies. [L4; CLO5]	4
	c) What are the different data transmission modes? Explain briefly. [L2; CLO5]	2
6.	a) What is Internet? Explain its major services. [L2; CLO5]	4
	b) Define IP address. Explain classes of IPv4 and basic structure of IPv6. [L2; CLO5]	4
	c) Why is HTTPS preferred over HTTP? [L2; CLO5]	2
7.	a) What is an operating system? Explain its main functions. [L2; CLO4]	4
	b) Classify software and explain system and application software with examples. [L2; CLO4]	4
	c) What is open-source software? Give examples. [L1; CLO4]	2
8.	a) Design a professional email for a job application and explain the purpose of each field used. [L3; CLO6]	4
	b) In real-life email usage, describe the roles of SMTP, POP3, and IMAP. [L3; CLO6]	3
	c) Evaluate strategies to protect against spam, phishing, and spoofing. [L5; CLO6]	3

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