COLLEGE OF SCIENCE, TECHNOLOGY AND APPLIED ARTS OF TRINIDAD AND TOBAGO

School of Nursing, Health and Environmental Sciences
DEPARTMENT OF NATURAL & LIFE SCIENCES

"Transforming Lives, Transforming Communities, Transforming the Nation… One Student at a Time

CHEM 131: GENERAL CHEMISTRY I

VISION:

To be a student-centered, dynamic and innovative, world-class and multi-campus college, promoting excellence in teaching and learning, serving diverse communities and producing lifelong learners who can compete globally.

MISSION:

To be the premier educational institution in: providing high quality, affordable and accessible education programmes serving the needs of business, industry and the diverse campus communities and facilitation the personal and professional development of its students, faculty and staff.

The Institution's motto "Transforming Lives, Transforming Communities, Transforming the Nation… One Student at a Time." is embodied in our Core Curriculum as well as Programme Curriculum through ten competencies which students will understand, practice and demonstrate upon successful completion of their programmes of study at the College. These competencies are as follows:

Programme Curriculum Competencies
KNOWLEDGE
A clear understanding of the principles and concepts of related theories and models of the particular discipline and the relationship to other disciplines through study, education and experience.
EFFECTIVE COMMUNICATION
The ability to accurately transfer thoughts and meaning through interpersonal skills using appropriate registers.
ANALYTICAL ABILITY
The ability to systematically gather relevant data and make appropriate deductions, inferences and connections with a view to judiciously solve problems.
TECHNOLOGICAL EXPERTISE
Utilization of current tools and techniques with the view to achieving efficiency and improving functionality.
COLLABORATION
Proficiency in working cohesively with other stakeholders with the view to achieving common goals.
CREATIVITY
The ability to explore issues and generate solutions from an innovative perspective.
PROFESSIONALISM
A life-long engagement in reflective, moral, ethical and best practices in all spheres.
DIVERSITY
The ability to recognize and respect uniqueness, worth and dignity of others whilst developing one's own belief system.
SOCIAL AND GLOBAL RESPONSIBILITY
A conscientious approach that reflects social and global accountability, commitment, caring and integrity.
ENTREPRENEURSHIP
The ability to recognize and take advantage of legitimate opportunities for innovation and social improvement, whilst accepting the related risks.

Course Code:	**CHEM 131**
Course Title:	General Chemistry I
Number of Credits:	4
Co-requisites:	
Prerequisite:	A Grade of 1, 2, or 3 in CSEC/GCE 'O' Level Chemistry or CHEM 090 and CHEM 092
Prerequisite for:	All advanced Chemistry courses; A minimum C grade is required.
Number of Contact Hours:	90
Delivery:	Blended- face to face classes supported by resources on the e-classroom
Instructor:	
Office:	
Office Hours:	
Telephone:	
Email:	

COURSE DESCRIPTION AND GOAL:

This course focuses on the fundamental principles, theories and laws of chemistry. Topics include atomic theory, and the structure of the atom, nuclear chemistry, periodicity, and chemical bonding. The gas laws are also studied.

The competencies addressed in this course are **Knowledge (K)**, **Analytical Ability (A)**, **Technological Expertise (T)** and **Collaboration (C) and Effective Communication (EC)** at the **Entry** and **Immersion Levels**. The objectives for this course are listed by Competency and Level:

Objectives for General Chemistry I:

KNOWLEDGE (K)

Entry level (E): *understands the content of various disciplines, the generalizations about content and the modes and methods of inquiry.*

Student should be able to:

- **K1.** Discuss the development of the atomic theory.
- **K2.** Describe isotopes and their composition
- **K3.** Describe the make-up of the nucleus, the neutron-proton ratio and the band of stability.
- **K4.** Write and balance equations that describe nuclear reactions
- **K5.** Describe radioactive decay and the methods for detecting radiation.
- **K6.** Describe ionic, polar and non-polar covalent bonding

Immersion level (Im): *Demonstrates comprehension of the relevant and significant ideas across disciplines.*

Student should be able to:

- **K7.** Describe the wave and particle properties of light.
- **K8.** Describe the main features of the quantum mechanical picture of the atom
- **K9.** Describe some nuclear reactions and discuss the pros and cons of their applications.
- **K10.** Describe and explain the periodicity of selected physical properties among elements of the Periodic Table.
- **K11.** Write Lewis formulas for atoms, molecules and polyatomic ions

K12. Describe the basic ideas of the VSEPR and valence bond theories
K13. Describe molecular orbital theory.
K14. Discuss the kinetic theory of matter.

ANALYTICAL ABILITY (A)

Entry Level: *observes accurately and draws reasonable inferences from observations*

Student should be able to:

A1. Calculate relative atomic mass based on isotopic abundance data.
A2. Differentiate between paramagnetic and diamagnetic substances
A3. Differentiate among ionic, non-polar and polar covalent compounds.

Immersion level: *Analyses structures and organizations and perceives and makes relationships*

Student should be able to:
A4. Perform calculations involving wavelength, frequency and energy of light.
A5. Relate the electron configuration of an atom to its position in the periodic table.
A6. Carry out calculations associated with nuclear chemistry
A7. Predict the shape and polarities of molecules and polyatomic ions
A8. Predict bond order, bond stability and magnetic properties using molecular orbital theory.
A9. Perform calculations involving gas laws and the ideal gas equation

TECHNOLOGICAL EXPERTISE (T)

Entry Level: *uses basic technology proficiently and understands its potential as a learning tool*

Student should be able to:
T1. Investigate the properties of electromagnetic radiation using a spectroscope.
T2. Predict the identity of metal ions using flame tests.

Immersion Level: *uses technology to gain knowledge of various techniques and demonstrates a sound understanding of the nature and functioning of technology systems in problem solving, gathering, organizing and analyzing information.*

Student should be able to:
T3. Correctly use the UV-Visible Spectrophotometer to test the linearity of Beer-Lambert's Law.
T4. Use simple laboratory tests to distinguish among ionic, non-polar and polar covalent compounds.
T5. Plan, design and perform simple experiments to differentiate between ionic, non-polar and polar covalent substances.
T6. Plan and design experiments to test the gas laws.

COLLABORATION (C)

Entry Level: *Engages in collaboration when learning across disciplines.*

Student should be able to:
C1. Work in a group to solve calculation type problems

Immersion Level: *Initiates cooperative learning activities by seeking out other for assistance and for building projects together and acts as an active facilitator.*

Student should be able to:

C2. Work in groups to gather, present and explain material pertaining to specific course topics.

EFFECTIVE COMMUNICATION (EC)

Immersion Level: *Uses communication process purposefully to make meaning in different disciplinary contexts.*

Student should be able to:

EC 1. Use Standard English to write logical and concise essays in General Chemistry topics using appropriate chemical jargon.

Key:

Competency	Levels
K= Knowledge	Im = Immersion
A = Analytical Ability	It = Intermediate
T= Technological Expertise	Ad = Advanced
C= Collaboration	

WEEKLY CLASS SCHEDULE AND TEACHING OBJECTIVES

Week	Content	Specific Objectives and Activities	Competency	Level
1	**UNIT 1: ATOMIC STRUCTURE** • Dalton's Atomic theory • Discovery and properties of subatomic particles • Definitions: atom and subatomic particles • The atomic theory: Discuss how the work of Rutherford, Moseley, Thompson and Chadwick that led to changes of Dalton theory. • Standard Notation for describing the particles in a given atom: ${}^{A}_{z}X$ • Nucleon number (formerly mass number) and isotopes • Mass Spectrometry & Isotopic abundance • Relative Atomic Mass (A_r) based on carbon–14 scale	❑ Discuss Dalton's atomic theory ❑ Define atom and subatomic particles ❑ Describe the discovery and properties of the three fundamental sub-atomic particles ❑ Describe the arrangement of the particles in atoms ❑ Write the Standard Notation for describing the particles in a given atom: ${}^{A}_{z}X$ ❑ Define and discuss mass number and isotopes ❑ Briefly outline how the mass spectrometer works to help determine the isotopic abundance and isotopic mass. ❑ Calculate relative atomic mass based on isotopic abundance data **Activities:** Formative Assessment - Problem Sheet on problems involving calculations on mass number, atomic number, charge, and relative atomic mass based on isotopic data.	K1 K1 K1 K1 K1 K2 K2 A1 K1, K2, A1	E E E E E E E E E

2 & 3	**UNIT 2 –ELECTRONIC STRUCTURE OF ATOMS** • Electromagnetic radiation • The photoelectric effect • Atomic spectra and the Bohr atom • The wave nature of the electron • The quantum mechanical picture of the atom • Quantum numbers • Atomic orbitals • Electronic Configurations • Paramagnetism and diamagnetism • The periodic table and electronic configuration	❑ Describe electromagnetic radiation ❑ Calculate wavelength, speed, frequency, energy of light ❑ Discuss the photoelectric effect ❑ Differentiate the particle and wave nature of the electron ❑ Explain atomic spectra and the Bohr Atom ❑ Describe the quantum mechanical picture of the atom ❑ Define quantum numbers ❑ Explain atomic orbitals ❑ Determine electronic configuration of atoms ❑ Differentiate between paramagnetic and diamagnetic substances ❑ Discuss the arrangement of the atoms in the periodic table based of electronic configuration of atoms **Activities:** Formative Assessment -Worksheet on topic containing exam type questions as well as questions from the recommended text.	K7 A4 K7 K7 K7 K8 K8 K8 K8 A2 A5 A4, A2, A5, K8	Im Im Im Im Im Im Im Im Im E Im Im
4 ,5, 6	**UNIT 3 – NUCLEAR CHEMISTRY** • The Nucleus • Neutron-Proton Ratio and Nuclear Stability • Nuclear Stability and Binding Energy • Radioactive Decay • Equations for Nuclear Reactions • Neutron-Rich Nuclei (Above the Band of Stability) • Neutron-Poor Nuclei (Below the Band of	❑ Describe the makeup of the nucleus ❑ Describe the relationships between neutron-proton ratio and nuclear stability ❑ Discuss what is meant by the band of stability ❑ Calculate mass deficiency and nuclear binding energy ❑ Describe the common types of radiation emitted when nuclei undergo radioactivity decay ❑ Write and balance equations that describe nuclear reactions ❑ Predict the different kinds of nuclear reactions undergone	K3 K3 K3 A6 K9 K5 K9	E E E Im Im E Im

	Stability) • Nuclei with Atomic Number greater than 83 • Detection of radiation • Rates of decay and half-life • Decay series • Uses of radionuclides • Artificial Transmutations of elements • Nuclear fission • Nuclear fission reactors • Nuclear fusion	by nuclei, depending on their positions relative to the band of stability ❑ Describe methods for detecting radiation ❑ Understand half-lives of radioactive elements ❑ Carry out calculations associated with radioactive decay ❑ Interpret decay series ❑ Discuss some uses of radionuclides, including the use of radioactive elements for dating objects ❑ Describe some nuclear reactions that are induced by bombardment of nuclei with particles ❑ Discuss nuclear fission and some of its applications including nuclear reactors ❑ Discuss nuclear fusion and some prospects for and barriers to its use for the production of energy **Activities:** 1. Debate on the pros and cons of nuclear energy as an alternative source of energy Or 2. Flip Chart presentation: Groups present in class on issues surrounding nuclear waste disposal e.g. sources of nuclear waste, methods of disposal and political issues, site suitability, groundwater contamination, long-term effects, etc. 3. Formative Assessment -Worksheet on topic containing exam type questions as well as questions from the recommended text.	K9 K4 A6 K4 K9 K9 K9 K9, EC1 K9, EC1 A5, A6, K5, C1	Im E Im E Im Im Im Im Im Im
7	**EXAM 1: UNITS 1 -3 (15%)**			

8	**UNIT 4 – CHEMICAL PERIODICITY** • Atomic Radii • Ionization Energy • Electron Affinity • Ionic Radii • Electronegativity • Hydrogen and the Hydrides • Reactions of Hydrogen and the Hydrides • Oxygen and the Oxides • Oxygen and Ozone • Reactions of Oxygen and the Oxides • Combustion Reactions: Combustion of Fossil Fuels and Air Pollution	❑ Understand and effectively use the periodic table ❑ Discuss chemical periodicity of the following physical properties: a. Atomic radii b. Ionization energy c. Electron affinity d. Ionic radii e. Electronegativity ❑ Describe chemical periodicity in the reactions of a. Hydrogen b. Oxygen ❑ Describe chemical periodicity in the compounds of a. Hydrogen b. Oxygen **Activities:** Formative Assessment -Worksheet on topic containing exam type questions as well as questions from the recommended text.	K10 K10 K10 K10 K10, EC1	Im Im Im Im Im

9 & 10	**UNIT 5 – CHEMICAL BONDING** • Lewis dot formulas of atoms • Formation of Ionic compounds • Formation of Covalent bonds • Bond lengths and bond energies • Lewis formulas for molecules and polyatomic ions • Writing Lewis formulas: The Octet Rule • Formal charges • Writing Lewis formulas: Limitations of the Octet Rule • Resonance • Polar and nonpolar covalent bonds • Dipole moments • The continuous range of bonding types	❑ Write Lewis dot representations of atoms ❑ Predict whether bonding between specified elements will be primarily ionic, covalent or polar covalent ❑ Compare and contrast characteristics of ionic and covalent compounds ❑ Describe how the properties of compounds depend on their bonding ❑ Describe how the elements bond by electron transfer (ionic bonding) ❑ Describe energy relationships in ionic compounds ❑ Predict the formulas of ionic compounds ❑ Describe how elements bond by sharing electrons (covalent bonding) ❑ Write Lewis dot and dash formulas for molecules and polyatomic ions ❑ Recognize exceptions to the octet rule ❑ Write formal charges for atoms in covalent structures ❑ Describe resonance, and know when to write resonance structures and how to do so ❑ Relate the nature of bonding to electronegativity differences **Activities:** Formative Assessment -Worksheet on topic containing exam type questions as well as questions from the recommended text.	K11 K6, A3 A3 A3 K6 K6 K6 K11 K11 K11 K11 K11 A3, K11	Im E E E E E E Im Im Im Im Im E, Im

11	**UNIT 6 – MOLECULAR STRUCTURE AND COVALENT BONDING THEORIES** • Valence shell electron pair repulsion theory • Polar molecules: The influence of molecular geometry • Valence bond theory • Linear electronic geometry: AB_2 Species (No lone pairs of electrons on A) • Trigonal planar electronic geometry: AB_3 Species (No lone pairs of electrons on A) • Tetrahedral electronic geometry: o AB_4 Species (no lone pairs of electrons on A) o AB_3U Species (one lone pair of electrons on A) o AB_2U_2 Species (two lone pairs of electrons on A) o ABU_3 Species (three lone pairs of electrons on A) • Trigonal Bipyramidal electronic geometry: AB_5,AB_4U, AB_3U_2 and AB_2U_3 • Octahedral electronic geometry: AB_6, AB_5U and AB_4U_2 • Compounds containing double bonds • Compounds containing triple bonds • A summary of electronic molecular geometries	❑ Describe the basic ideas of the valence shell electron pair repulsion (VSEPR) theory ❑ Describe the basic ideas of the Valence bond theory ❑ Use the VSEPR theory to predict the electronic geometry and the molecular geometry of polyatomic molecules and ions ❑ Describe the relationships between molecular shapes and polarities ❑ Predict whether a molecule is polar or nonpolar **Activities:** use molecular models to illustrate the shapes of molecules and to predict polarity.	K12 K12 A7 K12 A7 A7	Im Im Im Im Im Im
12	**EXAM 2: UNITS 4 -6 (15%)**			

13	**UNIT 7 – MOLECULAR ORBITALS IN CHEMICAL BONDING** • Molecular orbitals • Molecular orbital energy • Bond order and bond stability • Homonuclear diatomic molecules • Heteronuclear diatomic molecules • Delocalization and the shapes of molecular orbitals	❑ Describe the basic concepts of molecular orbital theory ❑ Relate the shapes and overlap of atomic orbitals to the shapes and energies of the resulting molecular orbitals ❑ Distinguish among bonding, antibonding, and non bonding orbitals ❑ Apply the Aufbau Principle to find molecular orbital descriptions for homonuclear diatomic molecules and ions ❑ Apply the Aufbau Principle to find molecular orbital descriptions for heteronuclear diatomic molecules and ions with small Δ(EN) values ❑ Find the bond order in diatomic molecules and ions ❑ Relate bond order to bond stability ❑ Use the MO concept of delocalization for molecules in which valence bond theory would postulate resonance **Activities:** Formative Assessment -Worksheet on topic containing exam type questions as well as questions from the recommended text.	K13 K13 K13 K13 A8 A8 K13 A8	Im Im Im Im Im Im Im Im

14, 15	**UNIT 8 – KINETIC THEORY** • Understanding the particulate nature of matter • Solids liquids and gases • The gas laws. • The molecular formula of gaseous substances. • The Kinetic Molecular Theory of matter. • Ideal vs real gases	❑ Compare solid, liquids and gases. ❑ Use the ideal gas equation as well the following gas laws:- a. Boyle's law. b. Charles's law. c. Avogadro's law d. The combined gas law. e. Dalton's law of partial pressures ❑ Discuss and use standard temperature and pressure (STP). ❑ Determine the molecular weights and the molecular formulas of gaseous substances. ❑ Define and apply Daltons Law of Partial pressures. ❑ Determine Mass-volume relationships in reactions involving gases. ❑ State the kinetic theory of matter. ❑ Explain Brownian motion in term of the kinetic theory of matter. ❑ Identify the assumptions of the kinetic theory with regards to ideal gases. ❑ Explain the differences between real and ideal gases. **Activities:** Formative Assessment -Worksheet on topic containing exam type questions as well as questions from the recommended text.	K14 A9 A9 A9 A9 A9 K14 K14 K14 K14, EC 1 A9, K14	Im Im Im Im Im Im Im Im Im Im
16	**FINAL EXAM (40 %)**			

Laboratory Exercises

There are 10 compulsory laboratory sessions associated with this course. The specific dates for these lab sessions would be given by your class lecturer in the first week of class or posted on E-classroom.

Lab #	Lab Title	Competency	Level
1.	Lab Safety & Lab Techniques	K	Im
2.	Flame Tests	C2, T2	Im
3.	Electromagnetic Spectrum	A4, C2,T1	Im
4.	UV- VIS Spectroscopy and Beer-Lambert's Law	C2, T3	Im
5.	Spectroscopy: How effective is your sunscreen?	C2, T3	Im
6.	Planning & Design: Chemical Periodicity	C2, T5	Im
7.	Distinguishing between covalent and polar covalent bonding	A3, C2, T4	Im
8.	Molecular Modeling #1	A7, C2,	Im
9.	Molecular Modeling #2	A7, C2,	Im
10.	Planning & Design: Kinetic Theory	C2, T5	Im

For this course, the following grading scheme will be used:

Grading system used in AAS for Chemistry			
Mark Range	**Definitions**	**Grade**	**GPA**
90 – 100	Excellent	A	4.0
85 - 89	Very good	B+	3.5
80 - 84	Good	B	3.0
75 – 79	Satisfactory	C+	2.5
70 - 74	Average	C	2.0
65 - 69	Below average	D+	1.5
60 - 64	Minimum passing grade	D	1.0
0 - 59	Fail	F	0.0

The mark allocation for this course will be broken down as follows:

Mark Allocation system used for AAS in Chemistry	
2 In-course exams at 15% each	30 %
These two examinations will consist of multiple choice and/ or structured short- answer questions. You will be informed by your lecturer about the topics to be covered in each test before the exam	
In-class and take-home assignments	10%
The class assignment/s chosen to be graded for CHEM132 may differ by semester in terms of their number and type as directed by the lecturer. The mark schemes for these assignments will be made available upon distribution of the assignments.	
Laboratory performance and Reporting	20 %
An 80% attendance of Labs is expected for all Science courses. Students are expected to adhere to safety precautions outlined in the Laboratory manual, with special attention to appropriate lab wear (Lab coats and covered shoes.) Students are further expected to be cognizant of the mark penalty for late submission of lab reports and exercises, where two (2) marks per day will be deducted for late assignments. Students are required to submit an explanatory letter and a medical certificate should illness prevent timely completion of an assignment. Please refer to lab manual for Rubric.	
Final Examination	40 %
See Appendix I for Table of Specification	

Please note: Any late assignments that are not delivered directly to the lecturer must be deposited with the Programme Assistant and signed for in the register. Assignments that are not submitted in the format designated by the lecturer will not be graded.

STATEMENT ON ACADEMIC DISHONESTY

"Academic dishonesty is unacceptable and will not be tolerated. Cheating, forgery, plagiarism and collusion in dishonest acts undermine the College's educational mission and the student's personal and intellectual growth. COSTATT students are expected to bear individual responsibility for their work and to uphold the ideal of academic Integrity. Anu Student who attempts to compromise the academic process will be sanctioned."
– COSTAATT Academic, Integrity and Honesty Policies and Procedures Handbook.

A QUICK NOTE ON CITATION

Plagiarism is the representation of someone else's ideas or words as one's own. It is a serious academic offence that includes:

- Presenting another person's paper or ideas as original, submitting borrowed, purchased, ghost-written papers and documents downloaded from internet sites.
- Extensive paraphrasing
- Flagrant failure to properly cite sources. This includes uncited ideas, quotations and/ or words.

Students are expected to implement the methods taught in COMM117, COMM118 and LIBS130 and should be cognizant of the fact that credit will not be given for work found to be plagiarized. Repeated incidents of plagiarism will result in a failing grade and/or academic sanction.

COSTAATT requires students to adhere to the APA (American Psychology Association) citation standards that require in text citation and a reference list. Details of these requirements are as follows:

- In text citation (Quotes/Paraphrasing)
  - Direct quotation
    - Use quotation marks and include page numbers (when quoting books, journals and periodicals) or paragraph number (para. when quoting online sources.
    - A quotation of 40 or more words should be formatted as a freestanding, indented block of text without quotation marks.
  - Indirect quotation/paraphrasing
  - Citations from a secondary source
- References list
  - At the end of an assignment, the full bibliographic information for each source cited in text should be provided. *Do not use footnotes*
  - References must be listed in alphabetical order by author and should use the hanging indent format.
  - Books / Reports / DVDs
    - Each reference should include four elements:
      - Author/Editor/Producer
      - Date
      - Title
      - Publication Information
- Periodicals -Serials or periodicals are resources published on a regular basis, such as journals, magazines and newspapers. The elements to be included are:
  - Author(s)
  - Date
  - Title of article
  - Title of Periodical
  - Volume, Issue and Page numbers
- Webpages (unpublished and informally published work) Reference to web page should include the following elements :
  - Author
  - Date
  - Title
  - Retrieval statement (URL)

THE TEACHING TEAM FOR THIS COURSE:

In addition to the lecturer, several people are responsible for the smooth and efficient running of this course. From time to time, a student will interact with one of the following people:

- **The Programme Assistants:** Students may leave messages for their lecturer with the Programme Assistant, including late lab submissions. The Programme Assistant also sets up appointments should a student wish to see the Department Chair.

- **Lab Lecturer:** In some courses, team teaching is performed where one lecturer is in charge of the theory component of the course and another, highly qualified lecturer teaches the laboratory component. This lecturer is additionally responsible for collecting and grading lab reports.
- **Lab Technicians:** The Lab Technicians are highly capable individuals who are responsible for setting up labs, assisting with handling samples and equipment during labs and responsible for lab safety procedures and protocols. In case of an emergency, the Lab Technician and Lab Lecturer are responsible for your safety in the lab.
- **IT Support:** Should you experience issues with access, please contact the IT Helpdesk

ESSENTIAL SUPPLIES

- Text books – students should walk with their text books to class and to labs.
- Lab manual – to be provided at the start of the lab component of each course.
- Appropriate Lab wear – slippers, flip-flops and open toed footwear are strictly prohibited in the Labs. Students are also expected to wear protective clothing in labs, for example a lab coat. For the safety of all concerned, the Lab Technician has the responsibility to deny a student access to the lab if they are improperly attired.

TEXTBOOKS:

Recommended Text:
Chemistry (latest Edition) by Kenneth W. Whitten, Raymond E. Davis, M. Larry Peck, George G. Stanley

ISBN- 10: 0495111309
ISBN- 13: 9780495111306

Reference Text:
Chemistry Principles & Practice (2nd Edition) by Reger, Goode & Mercer

ISBN-13: 9780030733338

AUDIO-VISUAL RESOURCES:

Multimedia Projector, Laptop with Microsoft Office Word, PowerPoint, Excel, Multimedia Player DVD drive, USB ports and Speakers, Molecular Models.

COURSE COORDINATOR:

Ms. Risha Kalloo
Senior Lecturer
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DEPARTMENT CHAIR:

Ms. Delamae Wilson
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Appendix I-
Tables of Specification for CHEM131 Midterms and Final Examinations

Table of Specification for CHEM 131 Midterm I- 15%

Item type	Competency tested	Level	Percentage Weighting
MCQ/ T&F/Matching	Knowledge	Im	30%
	Analytical Ability	Im	20%
Short answer/ data analysis/ calculations	Knowledge	Im	30%
	Analytical Ability	Im	20%

Table of Specification for CHEM 131 Midterm II- 15%

Item type	Competency tested	Level	Percentage Weighting
MCQ/ T&F/Matching	Knowledge	Im	20%
	Analytical Ability	Im	20%
Short answer/ data analysis/ calculations	Knowledge	Im	30%
	Analytical Ability	Im	20%
Essay	Effective Communication	Im	5%
	Analytical Ability	Im	5%

Table of Specification for CHEM 131 Final Examination- 40%

Section	Item Type	Competency	% Weighting	Comments
A	MCQ, True/False, Diagram labeling, Matching, Short Answer	Knowledge	30	
B	MCQ, T/F, Diagram labeling, Matching, Short Answer	Analysis	40	
C	Essay	Analysis	10	A rubric is provided in the course outline to guide marking in this section.
		Effective Communication	10	
D	Diagram labeling, short answer, matching	Technical Expertise	10	This question must test, at the appropriate level, topics related to those covered in the laboratory aspect of the course.

Appendix II-
Rubric for grading Class Assignments

Assignment Description:

The class assignment/s chosen to be graded for CHEM 131 may differ by semester in terms of their number and type as directed by the lecturer. The following rubric, however, should be used to guide grading.

Rubric for CHEM 131 Class Assignments

COMPETENCY	PERFORMANCE RANKING		
	EXCELLENT (8-10)	**AVERAGE (5-7)**	**POOR (0-4)**
KNOWLEDGE (70%)	Students display a high level of knowledge as evidenced by accurate answers to most questions.	Students display a moderate level of knowledge as evidenced by accurate answers to some questions.	Students display a low level of knowledge as evidenced by accurate answers to few questions.
COLLABORATION (30%)	The student is an active part of the class group and participates fully in class discussions and activities as directed by the lecturer.	The student is a fairly active part of the class group and participates in class discussions and activities as directed by the lecturer.	The student is not an active part of the class group and does not participate in class discussions and activities as directed by the lecturer.

Appendix III –
Rubric for Grading of the Final Examination Essay (20%)

COMPETENCY	PERFORMANCE RANKING		
	EXCELLENT (8-10)	**AVERAGE (5-7)**	**POOR (0-4)**
EFFECTIVE COMMUNICATION (10%) *Sentence Structure, Grammar, Mechanics, & Spelling*	The essay contains the following elements: 1. Sentences which are all well constructed, with variation in structure and length. 2. No grammatical and/or spelling errors 3. Legible handwriting 4. Correct use of paragraphs 5. Correct use of relevant jargon	The essay contains three - four of the required elements.	The essay contains less than three of the required elements.
ANALYTICAL ABILITY (10%) *Interpretation of question and use of scientific jargon*	The essay contains the following elements: 1. The question is accurately interpreted. 2. Main ideas are appropriately emphasized, and are well supported by detailed and accurate information and appropriate jargon. 3. The introduction is inviting, states the main topic, and provides an overview of the paper. 4. Information is relevant and presented in a logical order. 5. The conclusion is strong and supported by the main points of the essay.	The essay contains three - four of the required elements.	The essay contains less than three of the required elements.