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CHIRCHIQ DAVLAT PEDAGOGIKA UNIVERSITETI
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CHEMISTRY

KIMYO YO'NALISHI UCHUN INGLIZ TILI

(Darslik)

O'ZBEKISTON RESPUBLIKASI
OLIY VA O'RTA MAXSUS TA'LIM VAZIRLIGI

TOSHKENT VILOYATI
CHIRCHIQ DAVLAT PEDAGOGIKA INSTITUTI

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ABSTRACT

"English for Chemistry" is a comprehensive textbook designed to help chemistry students, researchers, and professionals improve their English language skills in the context of their chosen field. The textbook is organized into 36 thematic chapters, each focusing on a particular area of chemistry, as well as dedicated sections on grammar, vocabulary, and pronunciation.

The journey begins with an introduction to the basic English language skills and scientific vocabulary necessary for studying chemistry. As students progress through the textbook, they explore a wide range of topics, from the scientific method and laboratory equipment to elements, compounds, and chemical reactions. These foundational chapters are designed to strengthen their understanding of the key concepts and principles in chemistry, while also enabling them to practice and enhance their English language skills in a scientific context.

As students delve deeper into the textbook, they encounter more advanced topics, such as thermochemistry, gases, solutions, acids and bases, and chemical equilibrium. These subjects provide a well-rounded understanding of chemistry and allow them to confidently discuss and explain these concepts in a professional setting.

In addition to these core chemistry topics, the textbook also covers specialized areas of chemistry, including organic chemistry, biochemistry, environmental chemistry, materials science, and analytical chemistry, among others. By examining the diverse applications of chemistry across various industries and fields of research, students gain a deeper appreciation for the importance of effective communication in English for chemistry professionals.

The grammar, vocabulary, and pronunciation sections of the textbook are designed to complement the chemistry content and support the development of students' English language skills. These sections cover essential aspects of English grammar, technical, academic, and general vocabulary. The pronunciation section provides guidance on the pronunciation of technical terms, intonation patterns in scientific communication, and accent reduction strategies.

"English for Chemistry" aims to provide students with a comprehensive, accessible, and engaging resource to support their journey towards mastery of the English language within the field of chemistry. Whether they are a student embarking on their studies, a researcher seeking to expand their knowledge, or a professional looking to enhance their communication skills, this textbook offers a wealth of information, guidance, and practical tools to help them achieve their goals. By developing their English language skills in conjunction with their understanding of chemistry, they will be better equipped to engage with the global scientific community, share their ideas, and contribute to the ongoing advancement of human knowledge.

ANNOTATSIYA

"Kimyo yo'nalishi uchun ingliz tili" - bu kimyo fakulteti talabalari, tadqiqotchilar va mutaxassislarga o'zlari tanlagan yo'nalish bo'yicha ingliz tili ko'nikmalarini oshirishga yordam berish uchun mo'ljallangan keng qamrovli darslikdir. Darslik 36 ta mazvudan iborat bo'lib, ularning har biri kimyoning ma'lum bir sohasiga, shuningdek grammatika, lug'at va talaffuzga bag'ishlangan bo'limlarga qaratilgan.

Darslik asosiy ingliz tili ko'nikmalari va kimyoni o'rganish uchun zarur bo'lgan ilmiy lug'at bilan tanishishdan boshlanadi. O'quvchilar darslik bilan tanishar ekan, ilmiy metod va laboratoriya jihozlaridan tortib elementlar, birikmalar va kimyoviy reaksiyalargacha bo'lgan turli mavzularni o'rganadilar. Mavzular kimyo fanidagi asosiy tushunchalar va tamoyillar haqidagi tushunchalarini mustahkamlash, shu bilan birga ularga ingliz tilini ilmiy kontekstda amaliyotda qo'llash va faollikni oshirishga imkon berish uchun mo'ljallangan.

Talabalar darslikni chuqurroq o'rganish jarayonida termokimyo, gazlar, eritmalar, kislotalar va asoslar, kimyoviy muvozanat kabi ilg'or mavzularga duch kelishadi. Ushbu fanlar kimyo haqida har tomonlama tushuncha beradi va ularga ushbu tushunchalarni professional sharoitda ishonchli tarzda muhokama qilish va tushuntirishga imkon beradi.

Ushbu asosiy kimyo mavzularidan tashqari, darslik kimyoning ixtisoslashgan sohalarini, jumladan, organik kimyo, biokimyo, atrof-muhit kimyosi, materialshunoslik va analitik kimyoni va boshqalarni o'z ichiga oladi. Turli sohalarda va tadqiqot sohalarida kimyoning turli xil qo'llanilishini o'rganib

chiqib, talabalar kimyo bo'yicha mutaxassislar uchun ingliz tilida samarali muloqot qilishning ahamiyatini chuqurroq tushunishadi.

Darslikning grammatika, lug'at va talaffuz bo'limlari kimyo fanining mazmunini to'ldirish hamda talabalarning ingliz tilini o'rganish ko'nikmalarini rivojlantirishga yordam berishga mo'ljallangan. Ushbu bo'limlar ingliz tili grammatikasi, texnik, akademik va umumiy lug'atning muhim jihatlarini qamrab oladi. Talaffuz bo'limida texnik atamalarning talaffuzi, ilmiy muloqotdagi intonatsiya naqshlari va urg'uni kamaytirish strategiyalari bo'yicha ko'rsatmalar berilgan.

"Kimyo yo'nalishi uchun ingliz tili" talabalarga kimyo sohasida ingliz tilini o'zlashtirish yo'lidagi harakatlarini qo'llab-quvvatlash uchun keng qamrovli, mavjud va qiziqarli manba bilan ta'minlashga qaratilgan. Ular o'rganishni endi boshlagan talaba bo'ladimi, o'z bilimini kengaytirishga intilayotgan tadqiqotchi yoki muloqot ko'nikmalarini oshirishga intilayotgan mutaxassis bo'ladimi, bu darslik ularga o'z maqsadlariga erishishda yordam beradigan ko'plab ma'lumotlar, yo'l-yo'riqlar va amaliy vositalarni taqdim etadi. Kimyo haqidagi tushunchalari bilan birgalikda ingliz tili ko'nikmalarini rivojlantirish orqali ular jahon ilmiy hamjamiyati bilan aloqa qilish, o'z g'oyalari bilan o'rtoqlashish va insoniyat bilimlarining doimiy rivojlanishiga hissa qo'shish ko'nikmalariga ega bo'ladilar.

Taqrizchilar:

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PREFACE

Chemistry, often referred to as the "central science," is a subject that bridges multiple scientific disciplines, including physics, biology, and materials science. The study of chemistry allows us to understand the natural world, leading to numerous advances in human knowledge and technology. As a result, chemistry has become an integral part of our everyday lives, shaping the world we live in and the products we consume.

The ability to communicate effectively is paramount for those who study and work in the field of chemistry. With English being the predominant language for scientific communication, it is essential for chemistry students and professionals to develop the necessary language skills to effectively read scientific literature, write reports, and communicate with their peers in the English-speaking world.

This textbook, "English for Chemistry," is designed to provide a comprehensive and accessible guide for chemistry students, researchers, and professionals who seek to improve their English language skills in the context of their chosen field. The content of this book is organized into 36 thematic chapters, each addressing a particular area of chemistry, along with specific sections on grammar, vocabulary, and pronunciation. This structure allows readers to focus on the specific topics that are most relevant to their needs, while also providing a comprehensive overview of the language skills required for success in chemistry.

The first chapter, "Introduction to English for Chemistry," serves as an essential starting point for students who are new to the subject. It introduces the basic English language skills necessary for studying chemistry and familiarizes readers with scientific vocabulary. As the textbook progresses, readers will explore a variety of chemistry topics, such as the scientific method, laboratory equipment and techniques, elements and compounds, and chemical reactions. These chapters provide a solid foundation for understanding key concepts and principles in chemistry, while also enabling readers to practice their English language skills in a scientific context.

Further chapters delve into more advanced topics, including thermochemistry, gases, solutions, acids and bases, and equilibrium. These subjects are essential for a well-rounded understanding of chemistry, and the textbook's focus on English language proficiency ensures that readers can confidently discuss and explain these concepts in a professional setting.

The textbook also covers specialized areas of chemistry, such as organic chemistry, biochemistry, environmental chemistry, materials science, and analytical chemistry, among others. These chapters provide insight into the diverse applications of chemistry in various industries and fields of research, highlighting the importance of effective communication in English for chemistry professionals.

In addition to the core chemistry content, this textbook also emphasizes the development of research and presentation skills, which are crucial for success in academia and industry. The chapters on research skills and presentation skills in chemistry provide practical guidance on conducting research, analyzing data, and presenting findings in a clear and engaging manner.

The grammar, vocabulary, and pronunciation sections of the textbook are designed to support the development of English language skills throughout the course. These sections cover essential aspects of English grammar, such as parts of speech, tenses, articles, passive voice, and conditionals, as well as technical, academic, and general vocabulary. The pronunciation section offers guidance on the pronunciation of technical terms, intonation patterns in scientific communication, and accent reduction strategies.

In conclusion, "English for Chemistry" is a valuable resource for chemistry students and professionals who wish to enhance their English language skills and expand their knowledge of the subject. By providing a comprehensive overview of the key concepts and principles in chemistry, along with targeted guidance on grammar, vocabulary, and pronunciation, this textbook empowers readers to effectively communicate their ideas and findings in the global scientific community.

It is our hope that this textbook will serve as a valuable resource for students, educators, and professionals alike, providing the tools and knowledge necessary for success in the exciting and ever-evolving field of chemistry. As you embark on your journey through the pages of this book, we encourage you to actively engage with the material, ask questions, and strive to apply your newly acquired knowledge and language skills in real-world contexts. This active engagement with the content will not only deepen your understanding of the subject matter but also help you develop essential critical thinking and problem-solving abilities, which are invaluable in both your academic and professional pursuits.

The authors of this textbook have drawn upon their extensive experience in the fields of chemistry and English language education to create a comprehensive and user-friendly guide that is specifically tailored to the needs of chemistry students and professionals. Each chapter has been carefully designed to present complex concepts in a clear and accessible manner, with numerous examples, illustrations, and exercises to reinforce learning and facilitate the application of new knowledge.

Furthermore, this textbook recognizes the importance of collaboration and communication within the scientific community. Throughout the chapters, you will find suggestions for group activities and discussions that encourage you to share your ideas, collaborate with your peers, and develop a deeper understanding of the material through the exchange of diverse perspectives. This collaborative approach not only enhances your learning experience but also fosters the development of essential teamwork and interpersonal skills that will serve you well in your academic and professional endeavors.

As you progress through the chapters, it is important to remember that learning is an ongoing process, and mastery of any subject requires dedication, persistence, and curiosity. It is our hope that this textbook will inspire you to continually challenge yourself, expand your knowledge, and refine your English language skills in the context of chemistry. By doing so, you will be better equipped to engage with the international scientific community, contribute to the advancement of human knowledge, and make a meaningful impact in your chosen field.

In closing, we would like to express our gratitude to the many educators, researchers, and professionals who have contributed their expertise and insights to the development of this textbook. Their dedication to the advancement of chemistry education and the promotion of effective scientific communication has been instrumental in shaping this valuable resource.

As you embark on your journey through "English for Chemistry," we wish you every success in your studies and future endeavors. We hope that this textbook will serve as a trusted companion, providing you with the knowledge, skills, and confidence you need to excel in the dynamic and rewarding field of chemistry. And remember, the pursuit of knowledge and the development of effective communication skills are lifelong endeavors; embrace the journey and continue to grow and evolve as a chemistry student, professional, and global citizen.

INTRODUCTION

Welcome to "English for Chemistry," a comprehensive textbook designed to help chemistry students, researchers, and professionals improve their English language skills in the context of their chosen field. As the global language of science, English plays a crucial role in the dissemination of research, collaboration between scientists, and the exchange of ideas within the scientific community. In this textbook, we provide you with the necessary tools and guidance to effectively read, write, and communicate in English, while simultaneously deepening your understanding of the fascinating world of chemistry.

Chemistry, often called the "central science," connects and underpins various scientific disciplines, such as physics, biology, and materials science. By exploring the composition, structure, and properties of matter, chemistry enables us to understand and harness the natural world. Consequently, the study of chemistry has led to numerous breakthroughs and technological advancements that have shaped our society, from the development of life-saving medications to the creation of innovative materials for sustainable energy sources.

Given the importance of chemistry in our modern world, it is crucial for students and professionals in the field to be able to effectively communicate their ideas, findings, and knowledge with their peers and the broader scientific community. This textbook aims to equip you with the English language skills necessary for success in your academic and professional pursuits, while also providing you with a solid foundation in the key concepts and principles of chemistry.

To help you achieve these goals, "English for Chemistry" is organized into 36 thematic chapters, each focusing on a particular area of chemistry, as well as dedicated sections on grammar, vocabulary, and pronunciation. This structure allows you to tailor your learning experience to your specific needs and interests, while also providing a comprehensive overview of the language skills required for success in the field of chemistry.

The journey begins with an introduction to the basic English language skills and scientific vocabulary necessary for studying chemistry. As you progress through the textbook, you will explore a wide range of topics, from the scientific method and laboratory equipment to elements, compounds, and chemical reactions. These foundational chapters are designed to strengthen your understanding of the

key concepts and principles in chemistry, while also enabling you to practice and enhance your English language skills in a scientific context.

As you delve deeper into the textbook, you will encounter more advanced topics, such as thermochemistry, gases, solutions, acids and bases, and chemical equilibrium. These subjects provide a well-rounded understanding of chemistry and allow you to confidently discuss and explain these concepts in a professional setting.

In addition to these core chemistry topics, the textbook also covers specialized areas of chemistry, including organic chemistry, biochemistry, environmental chemistry, materials science, and analytical chemistry, among others. By examining the diverse applications of chemistry across various industries and fields of research, you will gain a deeper appreciation for the importance of effective communication in English for chemistry professionals.

Research and presentation skills are vital for success in academia and industry. To support the development of these skills, the textbook includes chapters on research skills and presentation skills in chemistry. These chapters offer practical guidance on conducting research, analyzing data, and presenting your findings in a clear and engaging manner.

The grammar, vocabulary, and pronunciation sections of the textbook are designed to complement the chemistry content and support the development of your English language skills. These sections cover essential aspects of English grammar, such as parts of speech, tenses, articles, passive voice, and conditionals, as well as technical, academic, and general vocabulary. The pronunciation section provides guidance on the pronunciation of technical terms, intonation patterns in scientific communication, and accent reduction strategies.

Throughout the textbook, you will find a variety of learning aids, such as examples, exercises, and illustrations, which are designed to facilitate your understanding of the material and reinforce your learning. By actively engaging with the content and applying the language skills and concepts you acquire, you will bewell-prepared for success in your academic and professional endeavors.

In addition to the primary content, this textbook also features supplementary materials that will further enhance your learning experience. These include self-assessment quizzes, additional exercises, and online resources that will help you practice and consolidate the language skills and chemistry concepts covered in

each chapter. By making use of these resources, you can track your progress, identify areas that require further attention, and gain confidence in your ability to communicate effectively in English within the context of chemistry.

As you work through the textbook, we encourage you to approach your studies with curiosity, persistence, and an open mind. Chemistry is a vast and ever-evolving field, and the knowledge and skills you acquire through the study of this subject can open up a world of opportunities for you, both academically and professionally. By developing your English language skills in conjunction with your understanding of chemistry, you will be better equipped to engage with the global scientific community, share your ideas, and contribute to the ongoing advancement of human knowledge.

In conclusion, "English for Chemistry" aims to provide you with a comprehensive, accessible, and engaging resource to support your journey towards mastery of the English language within the field of chemistry. Whether you are a student embarking on your studies, a researcher seeking to expand your knowledge, or a professional looking to enhance your communication skills, this textbook offers a wealth of information, guidance, and practical tools to help you achieve your goals.

As you begin your exploration of the fascinating world of chemistry through the lens of the English language, remember that learning is a lifelong process, and the knowledge and skills you acquire will serve you well in your academic and professional pursuits. We wish you the best of luck on your journey and hope that this textbook will be a valuable companion as you strive for success in the field of chemistry and beyond.

SYLLABUS

Course Overview: This course aims to provide Chemistry students with the necessary language skills to read scientific literature, write reports, and effectively communicate with other scientists in the English-speaking world. The course will cover the following topics:

Level: Elementary to Upper-Intermediate

Lesson Plans: Each lesson will be two hours long, consisting of a mix of themes, grammar, vocabulary, and pronunciation sections. Each week, students will be assigned a set of reading materials, vocabulary lists, and grammar exercises to complete before class. The class will consist of practicals, group discussions, role-plays, and oral presentations. The final project will require students to conduct research on a chemistry-related topic, write a report in English, and present their findings to the class.

Total Hours: 156 (78 practical hours + 78 self-study hours)

Frequency: Three times a week

Duration: 2 hours (80 min.) per lesson.

Theme 1: Introduction to English for Chemistry

Lesson Plan

Level: Elementary Duration: 80 minutes

Activity 1: Icebreaker

Learning Outcome: To introduce students to each other and create a positive learning atmosphere

Time/Duration: 10 minutes

Mode of Interaction: Group work

Material: None

Procedure:

1. Divide the students into groups of four.
2. Ask each student to introduce themselves to their group members and share one interesting fact about themselves.
3. Encourage students to ask questions and engage in conversation with each other.

Activity 2: Video Viewing

Learning Outcome: To introduce students to common laboratory equipment and its English names

Time/Duration: 20 minutes

Mode of Interaction: Individual work

Material: (link to the video)

Procedure:

1. Ask students to watch the video individually.
2. Ask them to make a list of the laboratory equipment shown in the video and its English names.
3. After the video, ask students to share their lists with their partners and check their answers.

Activity 3: Vocabulary Building

Learning Outcome: To build vocabulary related to laboratory equipment and procedures

Time/Duration: 20 minutes

Mode of Interaction: Pair work

Material: PPT slide showing pictures of laboratory equipment and procedures

Procedure:

1. Show pictures of laboratory equipment and procedures on the PPT slide.
2. Ask students to work in pairs and match the picture with the correct English word.
3. After completing the matching activity, ask students to discuss with their partner how the equipment is used.

Activity 4: Grammar Focus - Present Simple Tense

Learning Outcome: To practice the present simple tense in the context of laboratory procedures

Time/Duration: 20 minutes

Mode of Interaction: Group work

Material: PPT slide with examples of present simple tense sentences

Procedure:

1. Explain the present simple tense to the students using the PPT slide.
2. Give examples of present simple tense sentences related to laboratory procedures.
3. Ask students to work in groups and create their own sentences using the present simple tense to describe laboratory procedures.
4. Have groups share their sentences with the class.

Activity 5: Closing Discussion

Learning Outcome: To summarize the key concepts covered in the lesson

Time/Duration: 10 minutes

Mode of Interaction: Whole class discussion Material: None

Procedure:

1. Ask students to share what they learned in the lesson.
2. Summarize the key concepts covered in the lesson.
3. Ask students if they have any questions or concerns.

Theme 2: Scientific Method

Lesson Plan

Level: Elementary Duration: 80 minutes

Activity 1: Brainstorming and Group Discussion

Learning Outcome: Students will be able to identify the scientific method and its steps, and apply it to a chemistry experiment.

Time/Duration: 15 minutes

Mode of Interaction: Groupwork

Materials: Whiteboard and markers

Procedure:

1. Begin the lesson by asking students if they know what the scientific method is, and what its steps are.
2. Write their responses on the whiteboard.
3. Ask students to work in small groups to create a flowchart or diagram of the scientific method and its steps, using the information on the whiteboard and any additional information they can find in their textbook or online.
4. After 10 minutes, ask each group to share their diagram with the class and explain their thought process.
5. Discuss any similarities or differences between the diagrams, and identify the correct steps of the scientific method.
6. Explain to students that they will be applying the scientific method to a chemistry experiment later in the lesson.

Activity 2: Experiment Demonstration

Learning Outcome: Students will be able to apply the scientific method to a chemistry experiment.

Time/Duration: 25 minutes

Mode of Interaction: Individual work

Materials: Beaker, baking soda, vinegar, safety goggles, paper, pencil

Procedure:

1. Demonstrate a simple chemistry experiment, such as the reaction between baking soda and vinegar, to the class.
2. Explain to students that they will be using the scientific method to conduct their own experiment.
3. Hand out safety goggles, beakers, baking soda, vinegar, and paper and pencils to each student.
4. Instruct students to use the scientific method to conduct an experiment of their own choosing. They should write down their hypothesis, materials needed, procedure, results, and conclusion on their paper.

5. After 20 minutes, ask each student to share their experiment with the class and explain their thought process.
6. Discuss any similarities or differences between the experiments, and identify any errors or improvements that could be made.
7. Summarize the steps of the scientific method and how they were applied in the experiment.

Activity 3: Vocabulary Practice

Learning Outcome: Students will be able to use and understand chemistry vocabulary related to the scientific method.

Time/Duration: 20 minutes

Mode of Interaction: Pair work

Materials: Chemistry vocabulary worksheet (provided by the teacher)

Procedure:

1. Hand out the vocabulary worksheet to each pair of students.
2. Instruct students to work together to match the vocabulary words to their definitions.
3. After 10 minutes, ask each pair to share their answers with the class.
4. Review any vocabulary words that were difficult or unfamiliar.
5. Instruct students to write a sentence using each vocabulary word to practice their usage.
6. Collect and grade the vocabulary worksheets.

Activity 4: Pronunciation Practice

Learning Outcome: Students will be able to pronounce chemistry vocabulary related to the scientific method correctly.

Time/Duration: 20 minutes

Mode of Interaction: Individual work

Materials: Pronunciation worksheet (provided by the teacher)

Procedure:

1. Hand out the pronunciation worksheet to each student.
2. Instruct students to practice pronouncing the chemistry vocabulary words related to the scientific method correctly.
3. Provide examples of correct pronunciation and ask students to repeat after you.
4. Give students time to practice on their own.
5. Ask each student to read a vocabulary word aloud and correct any pronunciation errors.
6. Collect and grade the pronunciation worksheets.

Theme 3: Laboratory Equipment and Techniques

Lesson Plan

Level: Elementary

Duration: 80 minutes

Activity 1: Introduction and Vocabulary

Learning outcome: Students will be able to recognize and use basic laboratory equipment and techniques vocabulary.

Time/Duration: 10 minutes

Mode of interaction: Whole group discussion

Material: Picture flashcards of laboratory equipment and techniques

Procedure:

1. Teacher will show flashcards and ask students to name the equipment/techniques and describe their function.
2. Teacher will introduce new vocabulary words and explain their meanings.
3. Students will repeat the new vocabulary words and practice pronunciation.

Activity 2: Reading and Comprehension L

earning outcome: Students will be able to read and comprehend instructions for laboratory equipment and techniques.

Time/Duration: 30 minutes

Mode of interaction: Pair work

Material: Handouts with instructions for laboratory equipment and techniques

Procedure:

1. Students will be divided into pairs and given a handout with instructions for a laboratory procedure.
2. Students will read and discuss the instructions with their partner, making sure they understand the steps.
3. Students will practice pronunciation of difficult words in the instructions.

Activity 3: Role Play

Learning outcome: Students will be able to use laboratory equipment and techniques vocabulary in a role-play scenario.

Time/Duration: 30 minutes

Mode of interaction: Group work

Material: Role-play scenarios and props (e.g. beakers, test tubes, goggles)

Procedure:

1. Students will be divided into small groups and given a role-play scenario.
2. Each group will be given props to use in their scenario.
3. Students will act out the scenario, using appropriate laboratory equipment and techniques vocabulary.

Activity 4: Wrap-Up and Review

Learning outcome: Students will be able to summarize the laboratory equipment and techniques vocabulary and their meanings.

Time/Duration: 10 minutes

Mode of interaction: Whole group discussion

Material: Whiteboard and markers

Procedure:

1. Teacher will write key vocabulary words on the whiteboard.
2. Students will take turns summarizing the meanings of each word.
3. Teacher will clarify any misunderstandings and reinforce correct usage.

Theme 4: Elements, Compounds, and Molecules
Lesson Plan

Level: Elementary
Duration: 80 minutes
Activity 1: Introduction to Elements, Compounds, and Molecules
Learning outcome: Students will be able to differentiate between elements, compounds, and molecules, and identify examples of each.
Time/Duration: 15 minutes
Mode of interaction: Whole class
Material: Presentation slide with definitions of elements, compounds, and molecules
Procedure:
1. Begin the lesson by asking students if they have heard the terms "elements," "compounds," or "molecules" before. Write these terms on the board.
2. Present a slide with definitions of each term, using visuals and simple language to explain each concept.
3. Ask students to give examples of each, and write their answers on the board.
4. Review the definitions and examples with the class, clarifying any misconceptions.
Activity 2: Elements, Compounds, or Molecules?
Learning outcome: Students will be able to identify whether a given substance is an element, compound, or molecule.
Time/Duration: 20 minutes
Mode of interaction: Individual work
Material: Worksheet with examples of substances, labeled as either elements, compounds, or molecules
Procedure:
1. Distribute the worksheet to students and explain that they will need to identify whether each substance is an element, compound, or molecule.
2. Students work on the worksheet independently, with the teacher circulating the room to answer questions and provide support.
3. Once students have completed the worksheet, go over the answers as a class.
Activity 3: Creating Molecules
Learning outcome: Students will be able to use elements to create molecules.
Time/Duration: 30 minutes
Mode of interaction: Pair work
Material: Set of element cards (one per pair), worksheet with instructions and space to draw molecules

Procedure:
1. Divide students into pairs and distribute the element cards.
2. Explain that each pair will be creating their own molecules using the elements on their cards.
3. Instruct students to follow the worksheet, which will guide them through the process of creating their molecules.
4. Students work on their molecules in pairs, with the teacher circulating the room to answer questions and provide support.
5. Once students have completed their molecules, have them share their creations with the class.
Activity 4: Vocabulary Review Game
Learning outcome: Students will be able to identify and define vocabulary related to elements, compounds, and molecules.
Time/Duration: 15 minutes
Mode of interaction: Whole class
Material: Game cards with vocabulary words and definitions
Procedure:
1. Divide the class into two teams.
2. Explain that you will read a vocabulary word or definition, and the first team to correctly identify the corresponding definition or word will earn a point.
3. Read the first word or definition and allow the teams to confer before answering.
4. Continue with the remaining words and definitions, keeping score on the board.
5. At the end of the game, the team with the most points wins.

Theme 5: Stoichiometry
Lesson Plan

Level: Elementary
Duration: 80 minutes
Activity 1: Introduction to Stoichiometry
Learning outcome: Students will understand the concept of stoichiometry and how it is used in chemistry.
Time/Duration: 10 minutes
Mode of interaction: Whole class
Materials: Whiteboard or projector
Procedure:
1. Start by asking students if they have heard the term "stoichiometry" before.
2. Explain that stoichiometry is the calculation of the quantities of reactants and products in a chemical reaction.
3. Draw a simple chemical equation on the board and show students how to balance it.
4. Explain that the coefficients in the balanced equation tell us the mole ratio of reactants and products in the reaction.
5. Show examples of how stoichiometry is used in chemistry, such as calculating how much product can be produced from a given amount of reactant or how much reactant is needed to produce a certain amount of product.
Activity 2: Calculating Stoichiometry Problems
Learning outcome: Students will be able to calculate stoichiometry problems.
Time/Duration: 30 minutes
Mode of interaction: Individual
Materials: Worksheet with stoichiometry problems
Procedure:
1. Distribute the worksheet to students and explain that they will be working on stoichiometry problems individually.
2. Explain the steps involved in solving stoichiometry problems, including identifying the given and desired quantities, converting to moles using molar mass, using mole ratios from the balanced equation to calculate the unknown quantity, and converting back to the desired units.
3. Allow students to work on the problems independently, circulating around the room to answer questions and provide assistance as needed.
4. Review the answers as a class and provide feedback.

Activity 3: Stoichiometry Game
Learning outcome: Students will review stoichiometry concepts in a fun and engaging way.
Time/Duration: 40 minutes
Mode of interaction: Groupwork
Materials: Game board, dice, game pieces, question cards Procedure:
1. Divide students into small groups and provide each group with a game board, dice, game pieces, and question cards.
2. Explain the rules of the game, which involves rolling the dice and moving the game pieces along the board, answering stoichiometry questions on the question cards as they go.
3. Allow students to play the game in their groups, answering questions and providing explanations to each other as needed.
4. Circulate around the room to answer questions and provide assistance as needed.
5. Review the answers and provide feedback as a class.

Theme 6: Chemical Reactions

Lesson Plan

Level: Elementary

Duration: 80 minutes

Activity 1: Vocabulary review

Learning outcome: To review and reinforce the vocabulary related to chemical reactions

Time/Duration: 10 minutes

Mode of interaction: Individual

Material: Whiteboard, markers

Procedure:

1. Teacher writes key vocabulary words related to chemical reactions on the whiteboard (e.g., reactant, product, chemical equation, synthesis, decomposition, combustion)
2. Students individually write the definition of each word on a piece of paper.
3. Students compare their definitions with a partner and discuss any discrepancies.
4. Teacher reviews the correct definitions with the class.

Activity 2: Chemical Reaction Demonstration

Learning outcome: To observe and describe a chemical reaction

Time/Duration: 20 minutes

Mode of interaction: Group work

Material: Materials for a simple chemical reaction demonstration (e.g., baking soda and vinegar)

Procedure:

1. Students are divided into groups of 3-4.
2. Teacher demonstrates a simple chemical reaction (e.g., baking soda and vinegar).
3. Students observe the demonstration and record their observations in their notebooks.
4. Students discuss their observations with their group and come up with a group observation.
5. Each group presents their observation to the class.

Activity 3: Writing chemical equations

Learning outcome: To practice writing chemical equations for different types of reactions

Time/Duration: 30 minutes

Mode of interaction: Individual/Pair work

Material: Worksheets with different types of chemical reactions

Procedure:

1. Students are given worksheets with different types of chemical reactions (e.g., synthesis, decomposition, combustion)
2. Students work individually or in pairs to write the chemical equation for each reaction.
3. After completing the worksheet, students compare their answers with a partner and discuss any discrepancies.
4. Teacher reviews the correct answers with the class.

Activity 4: Roleplay - chemical reactions in everyday life

Learning outcome: To apply knowledge of chemical reactions in a real-life scenario

Time/Duration: 20 minutes

Mode of interaction: Group work

Material: Scenario cards

Procedure:

1. Students are divided into groups of 4-5.
2. Each group is given a scenario card with a real-life situation involving a chemical reaction (e.g., cooking, cleaning, and rusting of metal)
3. Students discuss and come up with a role-play to demonstrate the chemical reaction.
4. Each group presents their role-play to the class.

Activity 5: Pronunciation practice

Learning outcome: To practice the pronunciation of key vocabulary related to chemical reactions

Time/Duration: 10 minutes

Mode of interaction: Individual

Material: Audio or video of a native speaker pronouncing key vocabulary words related to chemical reactions

Procedure:

1. Teacher plays an audio or video of a native speaker pronouncing key vocabulary words related to chemical reactions.
2. Students listen and repeat the words.
3. Teacher provides feedback on pronunciation and intonation.

Theme 7: The Periodic Table

Lesson Plan

Level: Elementary

Duration: 80 minutes

Activity 1: Periodic Table Scavenger Hunt

Learning outcome: Students will be able to locate elements on the periodic table and identify their properties.

Time/Duration: 15 minutes

Mode of interaction: Individual work

Material: Printable periodic table

Procedure:

1. Provide each student with a printed periodic table.
2. Explain that they will have 10 minutes to find and list as many elements as they can that meet certain criteria (e.g. elements with the letter "O" in their name, elements in the same group as nitrogen).
3. After 10 minutes, have students share their lists with a partner and discuss any differences or similarities.
4. As a class, review some of the elements that were found and discuss their properties.

Activity 2: Element Trading Cards

Learning outcome: Students will be able to research and summarize information about a specific element.

Time/Duration: 30 minutes

Mode of interaction: Individual work

Material: Printable trading card template, internet access for research

Procedure:

1. Provide each student with a printed trading card template.
2. Assign each student a different element to research.
3. Instruct students to research their element and fill in the trading card template with information such as the element's atomic number, symbol, properties, common uses, and interesting facts.
4. After 20 minutes, have students share their trading cards with a partner and give feedback on each other's work.
5. As a class, have a few students share their trading cards and present their findings about their element.

Activity 3: Element Bingo

Learning outcome: Students will be able to recognize and identify elements on the periodic table.

Time/Duration: 35 minutes

Mode of interaction: Group work

Material: Printable bingo cards with element symbols, periodic table

Procedure:

1. Divide the class into groups of 3-4 students.
2. Provide each group with a printed periodic table and a set of bingo cards.
3. Instruct students to fill in the blank spaces on their bingo cards with the symbols of the elements on the periodic table.
4. Call out random element symbols and have students mark them on their bingo cards.
5. The first group to get five in a row (horizontally, vertically, or diagonally) yells "Bingo!" and wins the game.
6. As a class, review some of the elements that were called out and discuss their properties.

Activity 4: Periodic Table Pictionary

Learning outcome: Students will be able to communicate information about elements using visual representations.

Time/Duration: 20 minutes

Mode of interaction: Group work

Material: Whiteboard, markers

Procedure:

1. Divide the class into groups of 3-4 students.
2. Assign each group a different element on the periodic table.
3. Instruct each group to take turns drawing pictures that represent the properties or common uses of their assigned element.
4. The other groups have 1 minute to guess the element based on the drawings.
5. After each round, have a different group present their drawing and the element it represents.
6. As a class, discuss some of the properties or common uses of the elements that were drawn.

Theme 8: The Periodic Table
Lesson Plan

Level: Elementary
Duration: 80 minutes
Activity 1: Introduction to Chemical Bonding
Learning outcome: Students will be able to understand the concept of chemical bonding and identify different types of chemical bonds.
Time/Duration: 10 minutes
Mode of interaction: Whole class discussion
Material: Whiteboard, markers
Procedure:
1. Begin the lesson by introducing the topic of chemical bonding and its importance in understanding the properties of different substances.
2. Write the definition of chemical bonding on the whiteboard and ask the students to read it out loud.
3. Discuss with the students the different types of chemical bonds such as ionic, covalent, and metallic bonds.
4. Draw diagrams and give examples of each type of bond to help students understand the concept better.
5. Encourage students to ask questions and provide examples of their own.

Activity 2: Identifying Chemical Bonds
Learning outcome: Students will be able to identify different types of chemical bonds in given examples.
Time/Duration: 20 minutes
Mode of interaction: Individual work
Material: Worksheet, periodic table
Procedure:
1. Distribute the worksheet to the students and provide instructions on how to complete it.
2. The worksheet will contain a series of examples where students will be required to identify the type of chemical bond present.
3. Encourage students to use the periodic table to identify the elements present in each example.
4. Allow students to work on the worksheet individually and monitor their progress.
5. After completion, go over the answers as a class to ensure understanding.

Activity 3: Modeling Chemical Bonds
Learning outcome: Students will be able to model different types of chemical bonds using molecular model kits.
Time/Duration: 30 minutes
Mode of interaction: Group work
Material: Molecular model kits, worksheet
Procedure:
1. Divide students into groups of 2-3 and provide each group with a molecular model kit and a worksheet.
2. The worksheet will contain a series of examples where students will be required to model the chemical bond present.
3. Encourage students to work together to create the models and to discuss their thought process.
4. Allow students to experiment with different models to understand how different elements bond together.
5. Monitor progress and provide assistance when necessary.
Activity 4: Chemical Bonding Presentation
Learning outcome: Students will be able to present their understanding of chemical bonding and its different types to the class.
Time/Duration: 20 minutes
Mode of interaction: Group work
Material: PowerPoint, projector
Procedure:
1. Ask each group to create a PowerPoint presentation on chemical bonding and its different types.
2. Encourage students to use visuals and examples to illustrate their understanding of the concept.
3. Allocate 5 minutes for each group to present their presentation to the class.
4. After each presentation, encourage class discussion and ask follow-up questions to ensure understanding.
5. Provide feedback and praise for student efforts.

Theme 9: Thermochemistry
Lesson Plan

Level: Elementary
Duration: 80 minutes
Activity 1: Introduction to Thermochemistry
Learning outcome: Students will be able to define thermochemistry and understand the difference between endothermic and exothermic reactions.
Time/Duration: 10 minutes
Mode of interaction: Whole class discussion
Material: PowerPoint presentation
Procedure:
1. Begin by introducing the concept of thermochemistry and explaining how it relates to the study of chemistry.
2. Show a PowerPoint slide defining thermochemistry and providing examples of endothermic and exothermic reactions.
3. Engage the class in a discussion of the differences between endothermic and exothermic reactions and their importance in chemistry.
4. Use examples to illustrate how endothermic and exothermic reactions occur in everyday life, such as the burning of a match or the melting of ice.
Activity 2: Thermochemistry Experiment
Learning outcome: Students will be able to observe and explain the change in energy that occurs during a chemical reaction.
Time/Duration: 30 minutes
Mode of interaction: Group work
Material: Chemicals (such as baking soda and vinegar), cups, thermometers
Procedure:
1. Divide the class into groups of 3-4 students.
2. Provide each group with the necessary materials to conduct a simple thermochemistry experiment.
3. Instruct the students to mix the chemicals together in a cup and take the temperature of the solution before and after the reaction.
4. Have the students record their results and discuss as a class how the temperature change indicates a change in energy.
5. Encourage the students to think about how this type of experiment is useful in the study of chemistry and other scientific fields.
Activity 3: Thermochemistry Vocabulary Practice
Learning outcome: Students will be able to use appropriate vocabulary to describe thermochemistry concepts.

Time/Duration: 20 minutes
Mode of interaction: Individual work
Material: Vocabulary list, worksheet
Procedure:
1. Provide the students with a list of vocabulary words related to thermochemistry.
2. Instruct the students to complete a worksheet that includes matching definitions to the appropriate vocabulary word and filling in the blank sentences with the correct term.
3. Have the students share their answers with a partner and discuss any questions or areas of confusion.
4. Review the correct answers as a class and provide additional explanations or examples if needed.
Activity 4: Thermochemistry Writing Activity
Learning outcome: Students will be able to apply their understanding of thermochemistry concepts to a real-world scenario.
Time/Duration: 20 minutes
Mode of interaction: Individual work
Material: Writing prompt
Procedure:
1. Provide the students with a writing prompt that asks them to apply their understanding of thermochemistry concepts to a real-world scenario, such as explaining the energy changes that occur during the baking of a cake.
2. Instruct the students to write a short paragraph that clearly explains the thermochemistry concepts at play in their chosen scenario.
3. Have the students share their writing with a partner and provide feedback on clarity and understanding.
4. Collect the writing samples for assessment purposes.

Theme10: Gases

Lesson Plan

Level: Pre-intermediate

Duration: 80 minutes

Activity 1: Introduction to Gases

Learning Outcome: Students will be able to define what gases are and their properties

Time/Duration: 15 minutes

Mode of Interaction: Individual work

Materials: Pictures of gases, whiteboard and markers

Procedure:

1. Begin the lesson by displaying pictures of different gases (e.g., helium, oxygen, nitrogen) on the whiteboard.
2. Ask the students to describe what they see in the pictures.
3. Discuss with the students the different properties of gases, such as they have no definite shape or volume, they are compressible, and they fill any container they are in.
4. Write the definition of gases on the whiteboard and ask students to copy it down.

Activity 2: Gas Laws

Learning Outcome: Students will be able to explain the relationship between pressure, volume, and temperature of gases using gas laws

Time/Duration: 25 minutes

Mode of Interaction: Pair work

Materials: Gas law worksheets (available online), calculators

Procedure:

1. Divide the students into pairs and give them a gas law worksheet.
2. Instruct them to solve the problems on the worksheet using the gas laws they have learned (Boyle's law, Charles' law, Gay-Lussac's law).
3. After 15 minutes, go over the answers to the worksheet with the class, discussing the process for solving the problems.
4. Encourage students to ask questions and clear their doubts.

Activity 3: Gas Demonstration

Learning Outcome: Students will be able to observe the behavior of gases in different situations

Time/Duration: 20 minutes

Mode of Interaction: Group work Materials: Gas cylinders, balloons, air pump, safety goggles

Procedure:

1. Divide students into groups of three to four.
2. Instruct the groups to use the gas cylinders and balloons to demonstrate gas behavior in different situations (e.g., filling balloons with different amounts of gas and observing how their size changes, using an air pump to compress and expand gases).
3. Emphasize safety precautions and give safety goggles to the students.
4. After 15 minutes, each group will present their demonstrations to the class.

Activity 4: Gas Discussion

Learning Outcome: Students will be able to discuss the real-world applications of gases

Time/Duration: 20 minutes

Mode of Interaction: Individual work

Materials: Projector, videos, internet

Procedure:

1. Use a projector to show videos of real-world applications of gases (e.g., airbags in cars, helium balloons, gas-powered vehicles, etc.).
2. Ask the students to take notes and write down any questions they have about these applications.
3. After 10 minutes of watching, have a class discussion on the videos and the real-world applications of gases.
4. Encourage students to ask questions and clear their doubts.

Activity 5: Recap

Learning Outcome: Students will be able to summarize the main points of the lesson

Time/Duration: 5 minutes

Mode of Interaction: Individual work Materials: None

Procedure:

1. Ask students to write a brief summary of the lesson on a piece of paper.
2. Collect the papers and review them to make sure that students have understood the main points of the lesson.
3. Provide feedback on their summaries and address any misconceptions that were observed.

Theme 11: Solutions

Lesson Plan

Level: Pre-intermediate

Duration: 80 minutes

Activity 1: Introduction to Solutions

Learning outcome: Students will be able to define solutions and identify the different types of solutions.

Time/Duration: 10 minutes

Mode of interaction: Individual work

Materials: Whiteboard, marker, handout with definitions of key terms, and pictures of different types of solutions. Procedure:

1. Write the word "solution" on the whiteboard and ask students if they know what it means.
2. Distribute the handout with definitions of key terms related to solutions (e.g., solute, solvent, concentration).
3. Ask students to read the definitions and try to explain them in their own words.
4. Show pictures of different types of solutions (e.g., salt water, soda, vinegar) and ask students to identify the solute and solvent in each one.
5. Review the definitions and examples with the class.

Activity 2: Solubility Rules

Learning outcome: Students will be able to predict whether a given combination of solute and solvent will form a solution.

Time/Duration: 20 minutes

Mode of interaction: Pair work

Materials: Whiteboard, marker, handout with solubility rules, samples of different solutes and solvents (e.g., sugar, salt, water, alcohol).

Procedure:

1. Distribute the handout with solubility rules.
2. Explain the rules to the class and provide examples (e.g., "All salts containing Group 1 elements are soluble in water").
3. Divide the class into pairs and provide each pair with samples of different solutes and solvents.
4. Ask students to predict whether each combination will form a solution based on the solubility rules.
5. Have each pair present their predictions to the class and discuss as a group.

Activity 3: Concentration Calculations

Learning outcome: Students will be able to calculate the concentration of a solution in different units.

Time/Duration: 30 minutes

Mode of interaction: Group work

Materials: Whiteboard, marker, handout with concentration formulas and sample problems.

Procedure:

1. Divide the class into groups of 3-4 students.
2. Distribute the handout with concentration formulas and sample problems.
3. Ask each group to work together to solve the sample problems.
4. Circulate around the room and provide assistance as needed.
5. Have each group present their solutions to the class and discuss any questions or difficulties.

Activity 4: Solution Properties

Learning outcome: Students will be able to describe the physical properties of solutions and how they relate to concentration.

Time/Duration: 20 minutes

Mode of interaction: Individual work

Materials: Whiteboard, marker, handout with questions about solution properties.

Procedure:

1. Distribute the handout with questions about solution properties.
2. Ask students to answer the questions individually.
3. Review the answers with the class and discuss any points of confusion.
4. Show examples of solutions with different concentrations and ask students to describe their physical properties (e.g., color, viscosity, density).
5. Discuss how the physical properties of a solution change as the concentration changes.

Activity 5: Review and Quiz

Learning outcome: Students will be able to demonstrate their understanding of solutions by answering quiz questions.

Time/Duration: 20 minutes

Mode of interaction: Individual work

Materials: Whiteboard, marker, quiz questions.

Procedure:

1. Review key concepts and vocabulary related to solutions with the class.
2. Distribute the quiz questions.
3. Ask students to answer the questions individually.
4. Review the answers as a class and discuss any points of confusion.
5. Provide feedback and encourage students to continue practicing their understanding of solutions.

Theme 12: Acids and Bases

Lesson Plan

Level: Pre-intermediate
Duration: 80 minutes
Activity 1: Acid or Base?
Learning Outcome: Students will be able to distinguish between acids and bases based on their properties.
Time/Duration: 15 minutes
Mode of Interaction: Individual work
Material: Pictures of common household items (vinegar, baking soda, lemon juice, soap, etc.)
Procedure:
1. Begin the class by asking students if they have heard of acids or bases before. Ask if they can name any common household items that are acidic or basic.
2. Show pictures of common household items and ask students to classify each item as an acid or a base. Encourage them to explain why they chose each classification.
3. Discuss the properties of acids and bases, such as taste, texture, and pH level.
4. Have students work in pairs to identify whether several substances are acids or bases based on the properties discussed.
5. Review the correct answers as a class.
Activity 2: pH Scale
Learning Outcome: Students will be able to understand the concept of pH and use the pH scale to identify acidic and basic substances.
Time/Duration: 25 minutes
Mode of Interaction: Individual work
Material: pH scale chart, household substances with varying pH levels (lemon juice, vinegar, baking soda, soap, etc.)
Procedure:
1. Start by reviewing the concept of pH and explaining the pH scale.
2. Hand out the pH scale chart and ask students to identify which substances on the chart are acidic, basic, or neutral.
3. Provide students with several household substances with varying pH levels, and have them use the pH scale chart to identify the pH level of each substance.
4. Discuss the importance of pH in everyday life, such as in swimming pools, soil acidity for gardening, and in our own bodies.
5. Review the correct answers as a class.

Activity 3: Neutralization Reactions
Learning Outcome: Students will be able to understand the concept of neutralization reactions and predict the products of a neutralization reaction.
Time/Duration: 40 minutes
Mode of Interaction: Groupwork
Material: Chemical equation worksheet, pH scale chart, household substances with varying pH levels (vinegar, baking soda, lemon juice, etc.), beakers, droppers, and litmus paper
Procedure:
1. Review the concept of acids and bases and their reactions.
2. Explain the concept of neutralization reactions and how they occur.
3. Hand out the chemical equation worksheet and ask students to predict the products of several neutralization reactions using the pH scale chart and their knowledge of acids and bases.
4. Provide students with beakers, droppers, and household substances with varying pH levels.
5. Have students conduct a neutralization reaction in pairs and test the pH level of the resulting solution using litmus paper.
6. Review the results as a class and compare with the predicted products on the chemical equation worksheet.
Activity 4: Acid Rain
Learning Outcome: Students will be able to understand the concept of acid rain and its effects on the environment.
Time/Duration: 20 minutes
Mode of Interaction: Individual work
Material: Video on acid rain, article on acid rain effects, worksheet with questions
Procedure:
1. Begin by introducing the concept of acid rain and explaining how it is formed.
2. Show a video on acid rain and its effects on the environment.
3. Hand out an article on acid rain effects and ask students to read it and answer questions on a worksheet.
4. Discuss the questions and answers as a class.
5. Conclude by discussing ways that individuals and governments can help prevent acid rain.

Theme 13: Equilibrium

Lesson Plan

Level: Pre-intermediate

Duration: 80 minutes

Activity 1: Introduction to Equilibrium

Learning outcome: Students will be able to define equilibrium and understand how it relates to reversible reactions. Time/Duration: 15 minutes

Mode of interaction: Whole class discussion

Material: Whiteboard and marker

Procedure:

1. Introduce the topic of equilibrium by writing the definition on the board: "Equilibrium is a state in which the rate of the forward reaction is equal to the rate of the reverse reaction."
2. Ask students if they have heard of the term "equilibrium" before and if they know what it means.
3. Discuss the concept of reversible reactions and how they are related to equilibrium.
4. Ask students to give examples of reversible reactions they know. Write them on the board.
5. Explain that in a reversible reaction, the reactants can form products, but the products can also reform the reactants. This creates a dynamic balance where the reaction appears to stop changing even though the reactants and products are still reacting.
6. Summarize the key points of the discussion and clarify any questions students may have.

Activity 2: Equilibrium and Le Chatelier's Principle

Learning outcome: Students will be able to apply Le Chatelier's Principle to predict the effect of changing conditions on a chemical reaction at equilibrium.

Time/Duration: 30 minutes

Mode of interaction: Individual/Pair work

Material: Handout with examples of chemical reactions at equilibrium, Le Chatelier's Principle handout, whiteboard and marker

Procedure:

1. Distribute the handout with examples of chemical reactions at equilibrium.
2. Ask students to work individually or in pairs to identify which reactions are at equilibrium and which are not.

3. Once students have identified which reactions are at equilibrium, distribute the handout on Le Chatelier's Principle and explain how it can be used to predict the effect of changing conditions on a chemical reaction at equilibrium.
4. Ask students to work individually or in pairs to predict the effect of changing conditions on the chemical reactions at equilibrium on the handout.
5. After students have completed the handout, ask them to share their answers with the class and discuss any questions or misunderstandings.

Activity 3: Equilibrium Demonstrations

Learning outcome: Students will be able to observe and describe the effects of changing conditions on a chemical reaction at equilibrium. Time/Duration: 35 minutes Mode of interaction: Group work

Material: Chemicals and equipment to demonstrate equilibrium, whiteboard and marker Procedure:

1. Divide the class into small groups and provide each group with the necessary chemicals and equipment to demonstrate an equilibrium reaction. For example, you could provide materials to demonstrate the reaction between iron (III) ions and thiocyanate ions.
2. Ask each group to perform the demonstration and observe the reaction. They should take note of any changes they observe during the reaction.
3. After the demonstration, ask each group to share their observations with the class and discuss the effects of changing conditions on the reaction at equilibrium.
4. Write the key observations and conclusions on the board and summarize the lesson.

Activity 4: Exit Ticket

Learning outcome: Students will be able to demonstrate their understanding of equilibrium by answering questions related to the topic.

Time/Duration: 10 minutes

Mode of interaction: Individual work

Material: Paper and pen

Procedure:

1. Provide each student with a paper and pen and ask them to answer the following questions:
   - Define equilibrium.
   - What is a reversible reaction?
   - How can Le Chatelier's Principle be used to predict the effect of changing conditions on a chemical reaction at equilibrium?
2. Collect the papers and review them to assess the students' understanding of the topic.

Theme 14: Kinetics

Lesson Plan

Level: Pre-intermediate

Duration: 80 minutes

Activity 1: Introduction to Kinetics

Learning outcome: Students will be able to define and explain the concept of kinetics.

Time/Duration: 10 minutes

Mode of interaction: Whole class discussion

Material: Whiteboard and marker

Procedure:

1. Write the word "Kinetics" on the board.
2. Ask the students if they have heard the term before and if they can define it.
3. Explain that kinetics is the study of the rate at which chemical reactions occur.
4. Give some examples of reactions with different rates (e.g. rusting of iron vs. burning of wood).
5. Ask the students why they think it is important to study kinetics.

Activity 2: Reaction Rate Experiment

Learning outcome: Students will be able to observe and compare the rates of two different chemical reactions.

Time/Duration: 30 minutes

Mode of interaction: Group work

Material: Two beakers, 10mL of 0.1M hydrochloric acid, 10mL of 0.1M sodium thiosulfate, stopwatch

Procedure:

1. Divide the students into pairs.
2. Provide each pair with two beakers and the materials listed above.
3. Instruct the students to mix the hydrochloric acid and sodium thiosulfate in one beaker and start the stopwatch.
4. The students should record the time it takes for the mixture to become cloudy (when the reaction has ended).
5. Repeat the experiment with the same amounts of acid and thiosulfate but at a different temperature (e.g. use warm water to heat the beaker).
6. Instruct the students to compare the two reaction times and discuss why the second reaction might have been faster.

Activity 3: Kinetics Vocabulary Match-Up

Learning outcome: Students will be able to identify and match kinetic vocabulary words with their definitions.

Time/Duration: 20 minutes

Mode of interaction: Pair work

Material: Vocabulary cards with words and definitions, worksheet

Procedure:

1. Provide each pair of students with a set of vocabulary cards and a worksheet.
2. Instruct the students to match the vocabulary words with their definitions.
3. Have the students check their answers with another pair.
4. Review the correct answers as a class.

Activity 4: Kinetics Discussion

Learning outcome: Students will be able to discuss the factors that affect reaction rates and explain why they are important.

Time/Duration: 20 minutes

Mode of interaction: Whole class discussion

Material: Whiteboard and marker

Procedure:

1. Write the following question on the board: "What factors affect the rate of a chemical reaction?"
2. Instruct the students to brainstorm possible factors and write them on the board.
3. Have the students discuss why each factor is important and how it affects reaction rates.
4. Summarize the discussion by emphasizing the importance of studying kinetics in understanding how and why reactions occur.

Theme 15: Nuclear Chemistry

Lesson Plan

Level: Pre-intermediate

Duration: 80 minutes

Activity 1: Introduction to Nuclear Chemistry

Learning outcome: Students will be able to define nuclear chemistry and explain the difference between nuclear reactions and chemical reactions.

Time/Duration: 10 minutes

Mode of interaction: Individual

Material: PowerPoint presentation

Procedure:

1. Begin the class by introducing the topic of nuclear chemistry.
2. Ask students if they have heard of nuclear chemistry before and if they know what it is.
3. Show a PowerPoint slide with the definition of nuclear chemistry and briefly explain it to the class.
4. Ask students to brainstorm the differences between nuclear reactions and chemical reactions.
5. Have students share their ideas with the class.
6. Summarize the differences on the board.

Activity 2: Radioactive Decay

Learning outcome: Students will be able to identify the types of radioactive decay and explain how they differ from each other.

Time/Duration: 20 minutes

Mode of interaction: Individual/Pair work

Material: Video on types of radioactive decay worksheet

Procedure:

1. Show the video on types of radioactive decay to the class.
2. Distribute a worksheet with questions related to the video.
3. Have students complete the worksheet individually or in pairs.
4. Review the answers as a class.

Activity 3: Half-Life

Learning outcome: Students will be able to define half-life and calculate the amount of radioactive substance remaining after a given number of half-lives.

Time/Duration: 30 minutes

Mode of interaction: Individual/Pair work

Material: PowerPoint presentation, worksheet

Procedure:

1. Introduce the concept of half-life using a PowerPoint presentation.
2. Provide an example of how to calculate the amount of radioactive substance remaining after a given number of half-lives.
3. Distribute a worksheet with questions related to half-life calculations.
4. Have students complete the worksheet individually or in pairs.
5. Review the answers as a class.

Activity 4: Applications of Nuclear Chemistry

Learning outcome: Students will be able to identify the uses of nuclear chemistry in various fields.

Time/Duration: 20 minutes

Mode of interaction: Groupwork

Material: PowerPoint presentation

Procedure:

1. Divide the class into small groups.
2. Show a PowerPoint presentation on the applications of nuclear chemistry in various fields such as medicine, energy, and agriculture.
3. Have each group discuss and brainstorm the applications of nuclear chemistry in their assigned field.
4. Have each group share their findings with the class.
5. Summarize the applications on the board.

Theme 16: Organic Chemistry
Lesson Plan

Level: Pre-intermediate
Duration: 80 minutes
Activity 1: Brainstorming Organic Chemistry Vocabulary
Learning Outcome: Students will be able to recall and use common organic chemistry vocabulary.
Time/Duration: 10 minutes
Mode of Interaction: Individual work
Material: Whiteboard or blackboard, chalk or marker
Procedure:
1. Start the class by asking the students what they already know about organic chemistry.
2. On the board, write the words "Organic Chemistry" and ask students to brainstorm related vocabulary.
3. Allow 5 minutes for the students to write down as many words as they can think of.
4. When the time is up, ask students to come up to the board and write their words. Encourage discussion and collaboration to expand the list.
5. Go through the list together and explain any vocabulary that is new to the students.
Activity 2: Organic Compound Identification
Learning Outcome: Students will be able to identify common organic compounds based on their functional groups.
Time/Duration: 25 minutes
Mode of Interaction: Pair work
Material: Pictures or diagrams of organic compounds with functional groups labeled, worksheet for recording answers
Procedure:
1. Provide each pair of students with a worksheet and a set of pictures or diagrams of organic compounds with functional groups labeled.
2. Instruct the students to identify the functional groups in each compound and record their answers on the worksheet.
3. After the students have completed the worksheet, go over the answers as a class.
Activity 3: Organic Compound Naming
Learning Outcome: Students will be able to name organic compounds based on their structure.
Time/Duration: 30 minutes

Mode of Interaction: Group work
Material: Worksheet with organic compounds, answer key
Procedure:
1. Divide the students into groups of three or four.
2. Provide each group with a worksheet containing several organic compounds and their structures.
3. Instruct the students to name each compound based on its structure and record their answers on the worksheet.
4. After the students have completed the worksheet, go over the answers as a class.
Activity 4: Organic Reaction Matching
Learning Outcome: Students will be able to match organic reactions with their corresponding products.
Time/Duration: 15 minutes
Mode of Interaction: Individual work
Material: Pictures or diagrams of organic reactions, worksheet for recording answers
Procedure:
1. Provide each student with a worksheet and a set of pictures or diagrams of organic reactions and their corresponding products.
2. Instruct the students to match each reaction with its corresponding product and record their answers on the worksheet.
3. After the students have completed the worksheet, go over the answers as a class.
Activity 5: Organic Chemistry Song
Learning Outcome: Students will be able to sing and understand the lyrics of a song about organic chemistry.
Time/Duration: 20 minutes
Mode of Interaction: Whole class
Material: Organic chemistry song lyrics, music player, speakers
Procedure:
1. Provide the students with the lyrics to an organic chemistry song.
2. Play the song for the class and have them sing along.
3. After the song, ask the students if they have any questions about the lyrics or any words that they didn't understand.
4. Encourage discussion about the song and any related topics.

Theme 17: Biochemistry

Lesson Plan

Level: Pre-intermediate

Duration: 80 minutes

Activity 1: Warm-up discussion

Learning outcome: Students will be able to activate prior knowledge about biochemistry and discuss their personal interests in the topic.

Time/Duration: 10 minutes

Mode of interaction: Groupwork

Material: None

Procedure:

1. Divide the class into groups of 3-4 students.
2. Ask the groups to discuss the following questions:
   - What is biochemistry?
   - Why is it important?
   - What topics in biochemistry interest you the most?
3. Allow the groups 5 minutes to discuss.
4. Ask each group to share one topic they find interesting.

Activity 2: Vocabulary activity

Learning outcome: Students will be able to identify and define key vocabulary related to biochemistry.

Time/Duration: 20 minutes

Mode of interaction: Individual work

Material: Handout with vocabulary words and definitions

Procedure:

1. Distribute the handout with vocabulary words and definitions to each student.
2. Ask students to match the vocabulary words with the correct definitions.
3. Allow students 10-15 minutes to complete the activity.
4. Review the correct answers as a class.

Activity 3: Case study analysis

Learning outcome: Students will be able to apply their understanding of biochemistry concepts to a real-world scenario.

Time/Duration: 30 minutes

Mode of interaction: Groupwork

Material: Case study handout

Procedure:

1. Divide the class into groups of 3-4 students.
2. Distribute the case study handout to each group.

3. Ask the groups to read and discuss the case study, and answer the questions provided.
4. Allow the groups 20 minutes to complete the activity.
5. Ask each group to share their answers to the questions.

Activity 4: Wrap-up discussion

Learning outcome: Students will be able to reflect on the lesson and discuss what they have learned.

Time/Duration: 10 minutes

Mode of interaction: Groupwork

Material: None Procedure:

1. Ask the groups to discuss the following questions:
   - What did you learn about biochemistry in this lesson?
   - What topics or concepts do you still have questions about?
   - How can you apply what you learned to your daily life?
2. Allow the groups 5 minutes to discuss.
3. Ask each group to share one idea from their discussion.

Theme 18: Environmental Chemistry

Lesson Plan

Level: Pre-intermediate

Duration: 80 minutes

Activity 1: Introduction to Environmental Chemistry

Learning outcome: Students will be able to define environmental chemistry and identify its importance in our daily lives.

Time/Duration: 10 minutes

Mode of interaction: Teacher-led discussion

Material: PowerPoint presentation on Environmental Chemistry

Procedure:

1. Teacher will introduce the topic of Environmental Chemistry and its importance in our daily lives.
2. Teacher will display a PowerPoint presentation on Environmental Chemistry, defining the subject and explaining its relevance to the environment and society.
3. Teacher will lead a discussion on the definition and importance of Environmental Chemistry, asking students to provide examples of how it affects our daily lives.

Activity 2: Environmental Pollution Video

Learning outcome: Students will be able to identify the different types of environmental pollution and their impact on the environment and human health.

Time/Duration: 25 minutes

Mode of interaction: Individual work

Material: Video on Environmental Pollution

Procedure:

1. Teacher will show a video on Environmental Pollution, highlighting the different types of pollution and their impact on the environment and human health.
2. Students will watch the video individually, taking notes on the different types of pollution and their impact.
3. After the video, students will discuss with their classmates what they learned and share their notes.

Activity 3: Pollution Prevention

Learning outcome: Students will be able to identify ways to prevent environmental pollution in their daily lives.

Time/Duration: 25 minutes

Mode of interaction: Group work

Material: Handout on Pollution Prevention

Procedure:

1. Teacher will provide a handout on Pollution Prevention, outlining ways that individuals can reduce pollution in their daily lives.
2. Students will work in groups to discuss and identify ways they can prevent pollution in their daily lives, using the handout as a guide.
3. Each group will share their ideas with the class, and the teacher will facilitate a class discussion on pollution prevention.

Activity 4: Environmental Chemistry Quiz

Learning outcome: Students will be able to test their knowledge of environmental chemistry concepts and terminology.

Time/Duration: 20 minutes

Mode of interaction: Individual work

Material: Environmental Chemistry Quiz

Procedure:

1. Teacher will distribute an Environmental Chemistry Quiz to the students.
2. Students will work individually to complete the quiz.
3. Teacher will review the answers with the class, discussing any concepts or terminology that were unclear.

Theme 19: Materials Science
Lesson Plan

Level: Intermediate
Duration: 80 minutes
Activity 1: Introduction to Materials Science
Learning outcome: Students will be able to define materials science, identify the different types of materials, and understand their applications.
Time/Duration: 10 minutes
Mode of interaction: Teacher-led presentation
Material: PowerPoint presentation
Procedure:
1. Introduce the topic of materials science and explain its importance in modern technology.
2. Present a PowerPoint slide showing the different types of materials (metals, polymers, ceramics, and composites) and their applications.
3. Ask students to identify and discuss a material they have interacted with in the past week, for example, their smartphone, clothes, or a kitchen utensil.
Activity 2: Vocabulary Building
Learning outcome: Students will learn new vocabulary related to materials science and their applications.
Time/Duration: 20 minutes
Mode of interaction: Pair work
Material: Vocabulary handout
Procedure:
1. Distribute a vocabulary handout to the students with a list of materials science-related terms.
2. Ask students to work in pairs and match the terms with their definitions.
3. Check the answers as a class.
Activity 3: Materials Identification
Learning outcome: Students will learn how to identify different materials using their physical properties.
Time/Duration: 30 minutes
Mode of interaction: Group work
Material: Samples of different materials, worksheet
Procedure:
1. Divide students into groups of three or four.
2. Provide each group with a sample of a different material, such as metal, plastic, wood, or glass.

3. Ask students to use their senses to identify the material and record their observations on a worksheet.
4. Check the answers as a class.
Activity 4: Materials Testing
Learning outcome: Students will learn how to test different materials for their properties.
Time/Duration: 20 minutes
Mode of interaction: Individual work
Material: Materials testing kit
Procedure:
1. Provide each student with a materials testing kit containing different materials, such as wires, springs, and magnets.
2. Ask students to test the materials and record their observations on a worksheet.
3. Check the answers as a class.
Activity 5: Materials Presentation
Learning outcome: Students will learn how to present information on different materials.
Time/Duration: 20 minutes
Mode of interaction: Individual work
Material: PowerPoint presentation template
Procedure:
1. Ask students to choose a material and research its properties and applications.
2. Provide them with a PowerPoint presentation template.
3. Ask students to create a short presentation on the material, including its properties and applications.
4. Allow students to present their findings to the class.

Theme 20: Analytical Chemistry

Lesson Plan

Level: Intermediate

Duration: 80 minutes

Activity 1: Brainstorming

Learning outcome: Students will be able to generate ideas about the applications of analytical chemistry in their daily life.

Time/Duration: 10 minutes

Mode of interaction: Group work

Materials: Whiteboard and markers

Procedure:

1. Divide the students into groups of 3-4.
2. Ask each group to brainstorm the applications of analytical chemistry in their daily life.
3. Give them 5 minutes to generate as many ideas as possible.
4. Ask each group to present their ideas on the whiteboard.
5. Discuss and clarify any misconceptions and provide examples.

Activity 2: Vocabulary Building

Learning outcome: Students will learn and understand key vocabulary related to analytical chemistry.

Time/Duration: 20 minutes

Mode of interaction: Individual work

Materials: Handout with key vocabulary and definitions

Procedure:

1. Distribute the handout with key vocabulary related to analytical chemistry.
2. Ask the students to read the definitions and underline any unfamiliar words.
3. Instruct the students to use a dictionary to look up the meaning of the unfamiliar words.
4. Ask the students to work in pairs and quiz each other on the vocabulary.
5. Ask the students to use the vocabulary in a sentence to demonstrate their understanding.

Activity 2: Video Analysis

Learning outcome: Students will be able to analyze and understand the use of analytical chemistry in real-life situations.

Time/Duration: 30 minutes

Mode of interaction: Group work

Materials: Video on the use of analytical chemistry

Procedure:

1. Show the students a video on the use of analytical chemistry in real-life situations.
2. Divide the students into groups of 3-4.
3. Ask each group to analyze the video and identify the key concepts related to analytical chemistry.
4. Instruct each group to present their findings to the class.
5. Discuss and clarify any misconceptions and provide examples.

Activity 3: Case Study

Learning outcome: Students will be able to apply their knowledge of analytical chemistry to a real-world problem.

Time/Duration: 20 minutes

Mode of interaction: Pair work

Materials: Case study

Procedure:

1. Distribute a case study to each pair of students.
2. Instruct the students to read the case study and identify the problem.
3. Ask the students to brainstorm possible solutions using their knowledge of analytical chemistry.
4. Ask each pair to present their solutions to the class.
5. Discuss and evaluate each solution and provide feedback.

Activity 4: Reflection

Learning outcome: Students will reflect on their learning and identify areas for improvement.

Time/Duration: 10 minutes

Mode of interaction: Individual work

Materials: Reflection worksheet

Procedure:

1. Distribute a reflection worksheet to each student.
2. Instruct the students to reflect on their learning and identify areas for improvement.
3. Ask the students to write down one thing they learned and one thing they need to work on.
4. Collect the reflection worksheets and review them to identify any common areas of improvement.
5. Provide feedback and encourage students to work on their identified areas of improvement.

Theme 21: Forensic Chemistry
Lesson Plan

Level: Intermediate
Duration: 80 minutes

Name of Activity	Learning Outcome	Time/Duration	Mode of Interaction	Material
Warm-up: Crime Scene Investigation	Students will be able to identify key vocabulary related to forensic chemistry.	10 minutes	Group work	Handout with crime scene scenario
Presentation: Introduction to Forensic Chemistry	Students will be able to understand the role of forensic chemistry in criminal investigations.	10 minutes	Teacher-led	PowerPoint presentation
Reading Activity: Analyzing Evidence	Students will be able to read and comprehend scientific texts related to forensic chemistry.	20 minutes	Individual work	Article on the analysis of forensic evidence
Discussion: The Importance of Accuracy	Students will be able to express their opinions and support their arguments related to the importance of accuracy in forensic chemistry.	15 minutes	Group work	Discussion questions
Case Study: Analyzing a Crime Scene	Students will be able to apply their knowledge of forensic chemistry to analyze a crime scene scenario.	25 minutes	Pair work	Handout with crime scene scenario and analysis questions

Materials:

- Handout with crime scene scenario
- Article on the analysis of forensic evidence

- Discussion questions
- Handout with crime scene scenario and analysis questions

Procedure:

1. Warm-up: Crime Scene Investigation (10 minutes)
- Provide students with a handout describing a crime scene scenario.
- In groups, have students identify and write down key vocabulary related to forensic chemistry that they encounter in the scenario.
- Go over the vocabulary as a class and discuss any questions or confusion.

2. Presentation: Introduction to Forensic Chemistry (10 minutes)
- Use a PowerPoint presentation to provide an introduction to forensic chemistry.
- Discuss the role of forensic chemistry in criminal investigations and provide examples of how it has been used in real cases.

3. Reading Activity: Analyzing Evidence (20 minutes)
- Provide students with an article on the analysis of forensic evidence.
- Have students read the article individually and answer comprehension questions related to the content.

4. Discussion: The Importance of Accuracy (15 minutes)
- In groups, have students discuss the importance of accuracy in forensic chemistry.
- Provide discussion questions to guide the conversation, such as "Why is accuracy important in forensic chemistry?" and "What are some potential consequences of inaccurate analysis in criminal investigations?"

5. Case Study: Analyzing a Crime Scene (25 minutes)
- Provide students with a handout describing a crime scene scenario and analysis questions related to the forensic chemistry involved.
- In pairs, have students analyze the scenario and answer the questions, applying their knowledge of forensic chemistry.
- Go over the answers as a class and discuss any questions or confusion.

By the end of this lesson, students should have a better understanding of the role of forensic chemistry in criminal investigations, the importance of accuracy in forensic analysis, and how to apply their knowledge of forensic chemistry to analyze a crime scene.

Theme 22: Pharmaceutical Chemistry

Lesson Plan

Level: Intermediate

Duration: 80 minutes

Activity 1: Introduction to Pharmaceutical Chemistry

Learning Outcome: Students will be able to define pharmaceutical chemistry and understand its importance in the medical field.

Time/Duration: 10 minutes

Mode of Interaction: Whole class discussion

Material: PowerPoint presentation

Procedure:

1. Start the lesson by asking students if they have ever taken medicine or know anyone who has.
2. Introduce the concept of pharmaceutical chemistry and explain that it is the study of drugs and their properties, including how they are made, their effectiveness, and their safety.
3. Discuss the importance of pharmaceutical chemistry in the medical field, highlighting how it helps researchers and doctors develop new drugs and improve existing ones.
4. Show a PowerPoint presentation with examples of common drugs and explain how pharmaceutical chemistry played a role in their development.
5. End the activity by summarizing the key points and asking if anyone has questions or comments.

Activity 2: Vocabulary Building

Learning Outcome: Students will be able to understand and use common pharmaceutical chemistry vocabulary.

Time/Duration: 20 minutes

Mode of Interaction: Pair work

Material: List of pharmaceutical chemistry terms and definitions

Procedure:

1. Divide students into pairs and distribute a list of pharmaceutical chemistry terms and definitions.
2. Instruct students to work with their partner to match the terms with their correct definitions.
3. Monitor the pairs and answer any questions they may have.
4. After all pairs have finished, review the correct answers as a class and ask students to share any new vocabulary words they learned during the activity.

Activity 3: Drug Classification Game

Learning Outcome: Students will be able to identify different types of drugs and their effects on the body.

Time/Duration: 30 minutes

Mode of Interaction: Group work

Material: Drug classification chart, cards with drug names and descriptions

Procedure:

1. Divide students into small groups and distribute a drug classification chart.
2. Give each group a set of cards with drug names and descriptions. The descriptions should include the drug's classification, its effects on the body, and any potential side effects.
3. Instruct the groups to work together to match each drug card with its correct classification on the chart.
4. Monitor the groups and answer any questions they may have.
5. After all groups have finished, review the correct answers as a class and ask students to share any interesting information they learned about the drugs during the activity.

Activity 4: Case Study Analysis

Learning Outcome: Students will be able to apply their knowledge of pharmaceutical chemistry to a real-life scenario.

Time/Duration: 20 minutes

Mode of Interaction: Individual work

Material: Case study handout

Procedure:

1. Distribute a case study handout to each student. The case study should describe a patient's medical history and symptoms, and ask students to identify the most appropriate drug treatment based on their knowledge of pharmaceutical chemistry.
2. Instruct students to read the case study and answer the questions on their own.
3. Monitor the students and answer any questions they may have.
4. After all students have finished, ask a few volunteers to share their answers and explain their reasoning.

Theme 23: Chemistry of Food and Beverages

Lesson Plan

Level: Intermediate

Duration: 80 minutes

Activity 1: Introduction to Chemistry of Food and Beverages

Learning Outcome: Understand the basic concepts and vocabulary related to chemistry of food and beverages

Time/Duration: 10 minutes

Mode of Interaction: Individual work Materials: Pictures of common food and beverage items, PowerPoint presentation

Procedure:

1. Begin the class by asking students about their favorite food and beverage items and how they think chemistry plays a role in the taste and quality of these items.
2. Introduce the topic of chemistry of food and beverages using a PowerPoint presentation with pictures of common food and beverage items. Define key vocabulary such as flavor, aroma, texture, and preservation.
3. Show pictures of food and beverage items and ask students to identify the chemical components that contribute to their taste, smell, and texture.
4. Assign a short writing task where students write a paragraph about their favorite food or beverage item and describe the chemistry behind its taste and texture.

Activity 2: Food Chemistry Experiment

Learning Outcome: Conduct a simple food chemistry experiment and understand the chemical reactions taking place

Time/Duration: 30 minutes

Mode of Interaction: Group work

Materials: Baking soda, vinegar, food coloring, measuring cups, mixing bowls, spoons, paper cups

Procedure:

1. Divide the students into groups of 3-4.
2. Explain the experiment to the students: mixing baking soda and vinegar to produce a gas (carbon dioxide) and observing the reaction. Add food coloring to see the carbon dioxide bubbles more clearly.
3. Give each group the necessary materials and have them follow the instructions to conduct the experiment. Encourage them to make observations and record their findings.
4. After the experiment, have the groups share their observations and discuss the chemical reactions that occurred. Ask them to identify any similarities to reactions that take place in the preparation of food.

Activity 3: Vocabulary Review

Learning Outcome: Review key vocabulary related to chemistry of food and beverages

Time/Duration: 10 minutes

Mode of Interaction: Individual work

Materials: List of key vocabulary words

Procedure:

1. Distribute a list of key vocabulary words related to chemistry of food and beverages to each student.
2. Have students match the word with its definition, either individually or in pairs.
3. Review the correct answers with the class and provide further explanation as needed.

Activity 4: Food Label Analysis

Learning Outcome: Understand how to read and interpret food labels using chemical terminology

Time/Duration: 30 minutes

Mode of Interaction: Individual work

Materials: Food labels from common food items

Procedure:

1. Provide students with food labels from common food items.
2. Explain the significance of each component of the label, such as serving size, calories, and nutrient content.
3. Have students identify any chemical ingredients on the label and explain their function in the food item.
4. Discuss any trends or patterns that students notice across different food labels, such as the prevalence of preservatives or artificial flavors.

Activity 5: Food Chemistry Presentation

Learning Outcome: Develop presentation skills while presenting on a topic related to chemistry of food and beverages

Time/Duration: 20 minutes

Mode of Interaction: Group work

Materials: Research materials, PowerPoint presentation software

Procedure:

1. Divide the students into groups of 3-4.
2. Assign each group a specific topic related to chemistry of food and beverages, such as the chemistry of taste or the role of additives in food preservation.

3. Have each group conduct research and prepare a PowerPoint presentation on their assigned topic.
4. Each group will present their PowerPoint presentation to the class, practicing their presentation skills and communicating the key concepts and vocabulary related to their topic.

Theme 24: Green Chemistry

Lesson Plan

Level: Intermediate
Duration: 80 minutes
Activity 1: Brainstorming and Vocabulary Building
Learning Outcome: Students will be able to brainstorm and generate ideas related to green chemistry and develop their vocabulary related to the theme.
Time/Duration: 15 minutes
Mode of Interaction: Group work
Material: Whiteboard and marker
Procedure:
1. Divide the class into groups of 3-4 students.
2. Ask each group to brainstorm and generate a list of words and ideas related to green chemistry.
3. Encourage the students to think creatively and come up with as many ideas as possible.
4. After 5-7 minutes, ask each group to share their ideas with the class and write them on the board.
5. Discuss the ideas and ask students to define any unfamiliar words related to green chemistry.

Activity 2: Reading and Comprehension
Learning Outcome: Students will be able to read and comprehend an article related to green chemistry.
Time/Duration: 25 minutes
Mode of Interaction: Individual work
Material: Article (provide a link), worksheet (questions related to the article)
Procedure:
1. Provide each student with a copy of the article related to green chemistry.
2. Ask students to read the article individually and answer the questions related to the article on the worksheet.
3. Encourage the students to use their own words when answering the questions.
4. After 15 minutes, ask students to exchange their worksheet with a partner to check their answers.
5. Discuss the article and ask students to share their answers with the class.

Activity 3: Group Discussion
Learning Outcome: Students will be able to discuss the importance of green chemistry and its impact on the environment.
Time/Duration: 30 minutes
Mode of Interaction: Group work
Material: Whiteboard and marker
Procedure:
1. Divide the class into groups of 3-4 students.
2. Ask each group to discuss the importance of green chemistry and its impact on the environment.
3. Encourage the students to share their ideas and opinions with each other.
4. After 15 minutes, ask each group to present their ideas to the class.
5. Write the main points of each presentation on the board and discuss them with the class.

Activity 4: Presentation
Learning Outcome: Students will be able to present a project related to green chemistry.
Time/Duration: 20 minutes
Mode of Interaction: Individual work
Material: PowerPoint presentation, handouts
Procedure:
1. Ask students to work on a project related to green chemistry.
2. The project can be related to any aspect of green chemistry, such as the use of renewable energy sources or the development of eco-friendly products.
3. Encourage the students to use PowerPoint to create their presentation and provide handouts to the class.
4. After 15 minutes, ask each student to present their project to the class.
5. Encourage the class to ask questions and provide feedback to each presenter.

Theme 25: Petrochemistry
Lesson Plan

Level: Intermediate
Duration: 80 minutes
Activity 1: Introduction to Petrochemistry
Learning outcome: Students will be able to describe the importance of petrochemistry in our daily lives and explain the basic concepts related to petrochemicals.
Time/Duration: 10 minutes
Mode of interaction: Whole class discussion
Material: PowerPoint presentation
Procedure:
1. The teacher will introduce the topic of petrochemistry and ask the students what they know about it.
2. The teacher will provide a PowerPoint presentation to the class explaining what petrochemistry is, the different petrochemical products, and their uses.
3. The teacher will ask the students to give examples of petrochemical products they use in their daily lives.
4. The teacher will facilitate a whole class discussion about the importance of petrochemistry in our daily lives.

Activity 2: Vocabulary Practice
Learning outcome: Students will be able to use petrochemical-related vocabulary in sentences.
Time/Duration: 20 minutes
Mode of interaction: Individual work
Material: Handout with petrochemical-related vocabulary
Procedure:
1. The teacher will give the students a handout with petrochemical-related vocabulary.
2. The teacher will explain the meaning of each word and ask the students to write a sentence for each word using the correct form of the word.
3. The teacher will ask the students to share their sentences with a partner and provide feedback.

Activity 2: Reading Comprehension
Learning outcome: Students will be able to read and understand a text about petrochemicals.

Time/Duration: 30 minutes
Mode of interaction: Individual work
Material: Text about petrochemicals, handout with comprehension questions
Procedure:
1. The teacher will provide a text about petrochemicals to the students and ask them to read it.
2. The teacher will provide a handout with comprehension questions related to the text.
3. The students will answer the questions on the handout individually.
4. The teacher will facilitate a class discussion to check the answers and address any questions.

Activity 3: Group Discussion
Learning outcome: Students will be able to discuss the advantages and disadvantages of petrochemicals.
Time/Duration: 20 minutes
Mode of interaction: Group work
Material: Handout with discussion questions
Procedure:
1. The teacher will divide the class into small groups.
2. The teacher will provide a handout with discussion questions related to the advantages and disadvantages of petrochemicals.
3. The students will discuss the questions in their groups.
4. The teacher will facilitate a whole class discussion about the different perspectives and opinions presented in the group discussions.

Theme 26: Polymer Chemistry
Lesson Plan

Level: Intermediate
Duration: 80 minutes
Name of activity: Introduction to Polymer Chemistry Learning outcome: Students will be able to define the term "polymer" and understand the difference between monomers and polymers. Time/Duration: 10 minutes Mode of interaction: Whole class discussion Material: PowerPoint presentation, whiteboard, markers
Procedure:

1. Start the class by asking the students if they know what a polymer is.
2. Define the term "polymer" using the PowerPoint presentation.
3. Discuss the difference between monomers and polymers.
4. Ask the students to provide examples of monomers and polymers.
5. Write down the examples on the whiteboard and ask the students to classify them as monomers or polymers.

Name of activity: Polymerization Process Learning outcome: Students will be able to explain the process of polymerization and identify the types of polymerization. Time/Duration: 20 minutes Mode of interaction: Individual work Material: Handout on types of polymerization
Procedure:

1. Distribute the handout on types of polymerization.
2. Ask the students to read the handout and write down a short summary of the process of polymerization.
3. After a few minutes, ask the students to share their summaries with a partner.
4. Ask the students to identify the types of polymerization mentioned in the handout.
5. Discuss the different types of polymerization with the whole class.

Name of activity: Polymer Properties Learning outcome: Students will be able to identify the properties of different polymers and understand the impact of polymer properties on their applications. Time/Duration: 30 minutes Mode of interaction: Group work Material: Sample polymers, worksheet on polymer properties
Procedure:

1. Divide the students into groups of three or four.
2. Provide each group with a sample polymer and the worksheet on polymer properties.
3. Ask the students to research the properties of the polymer and fill out the worksheet.

4. After a few minutes, ask the groups to share their findings with the rest of the class.
5. Discuss the different properties of the polymers and their impact on their applications.

Name of activity: Polymer Synthesis Learning outcome: Students will be able to understand the different methods of synthesizing polymers and their applications. Time/Duration: 20 minutes Mode of interaction: Whole class discussion Material: PowerPoint presentation on polymer synthesis

Procedure:

1. Use the PowerPoint presentation to discuss the different methods of synthesizing polymers.
2. Ask the students to identify the applications of the different methods of polymer synthesis.
3. Discuss the advantages and disadvantages of each method with the class.
4. Ask the students to provide examples of polymers that are synthesized using each method.

Name of activity: Wrap-up Learning outcome: Students will be able to summarize what they have learned about polymer chemistry. Time/Duration: 10 minutes Mode of interaction: Whole class discussion Material: None

Procedure:

1. Ask the students to share one thing they learned about polymer chemistry during the lesson.
2. Summarize the key points of the lesson and ask the students if they have any questions.
3. Provide feedback on their performance and encourage them to continue learning about polymer chemistry.

Theme 27: Surface Chemistry

Lesson Plan

Level: Intermediate

Duration: 80 minutes

Name of activity: Introduction to Surface Chemistry Learning outcome: Students will be able to define and explain the basic concepts of surface chemistry Time/Duration: 10 minutes Mode of interaction: Whole-class discussion Material: PowerPoint presentation

Procedure:

1. Begin the lesson by asking the students if they know what surface chemistry is and what they know about it. Write their answers on the board.
2. Introduce the topic by showing a PowerPoint presentation that defines surface chemistry and its basic concepts such as surface tension, adsorption, and surface energy.
3. Use examples and animations to help students understand the concepts better.
4. Ask students to take notes during the presentation and to ask questions if they don't understand something.

Name of activity: Surface Tension Experiment Learning outcome: Students will be able to observe and measure surface tension of liquids Time/Duration: 20 minutes Mode of interaction: Group work Material: Glass slides, beakers, droppers, water, alcohol, PowerPoint presentation

Procedure:

1. Divide the class into small groups.
2. Show a PowerPoint presentation that explains the concept of surface tension and how it can be measured.
3. Provide each group with a glass slide and ask them to clean it thoroughly.
4. Ask each group to fill a beaker with water and another with alcohol.
5. Ask each group to use a dropper to drop water and alcohol on the glass slide and observe the shape of the drops.
6. Ask the groups to measure the diameter of the drops and calculate the surface tension of the liquids.
7. Ask each group to present their results to the class.

Name of activity: Adsorption Experiment Learning outcome: Students will be able to observe and explain the process of adsorption Time/Duration: 30 minutes Mode of interaction: Individual work Material: Activated charcoal, beakers, methylene blue solution, glass slides, microscope

Procedure:

1. Provide each student with a glass slide and a dropper.
2. Ask each student to place a drop of methylene blue solution on the glass slide.
3. Ask each student to add a small amount of activated charcoal to the drop and mix it well.
4. Ask each student to observe the slide under a microscope and describe what they see.
5. Explain to the students how adsorption works and how activated charcoal can be used to adsorb harmful substances from the environment.
6. Ask the students to write a short paragraph explaining the process of adsorption and its applications.

Name of activity: Discussion on Applications of Surface Chemistry Learning outcome: Students will be able to identify and discuss the applications of surface chemistry in everyday life and industry Time/Duration: 20 minutes Mode of interaction: Whole-class discussion Material: PowerPoint presentation

Procedure:

1. Show a PowerPoint presentation that highlights the various applications of surface chemistry in everyday life and industry, such as detergents, paints, and coatings.
2. Ask the students to share their observations and experiences with the products mentioned in the presentation.
3. Discuss how the principles of surface chemistry are applied in the development of these products.
4. Encourage the students to share any other examples of the applications of surface chemistry that they are aware of.

Theme 28: Electrochemistry

Lesson Plan

Level: Intermediate

Duration: 80 minutes

Name of activity: Introduction to Electrochemistry Learning outcome: Students will be able to understand the basic concepts of electrochemistry and identify the difference between oxidation and reduction reactions. Time/Duration: 10 minutes Mode of interaction: Teacher-led discussion Material: PowerPoint slides

Procedure:

1. The teacher will begin the lesson by asking students what they know about electrochemistry and how it relates to their daily lives.
2. The teacher will present a PowerPoint slide on the basic concepts of electrochemistry, including the definition of an electrochemical cell and the difference between oxidation and reduction reactions.
3. The teacher will give examples of electrochemical cells and ask the students to identify the oxidizing and reducing agents in each cell.
4. The teacher will ask students to summarize what they have learned so far.

Name of activity: Half-Cell and Electrode Potential Learning outcome: Students will be able to describe the difference between half-cell and electrode potential and identify the factors that affect electrode potential. Time/Duration: 20 minutes Mode of interaction: Groupwork Material: Worksheet

Procedure:

1. The teacher will divide students into groups of three or four.
2. Each group will be given a worksheet that contains questions related to half-cell and electrode potential.
3. The groups will work together to answer the questions on the worksheet.
4. The teacher will monitor the groups and provide assistance as needed.
5. After 20 minutes, the teacher will ask each group to share their answers with the class.

Name of activity: Applications of Electrochemistry Learning outcome: Students will be able to describe the applications of electrochemistry in industry and everyday life. Time/Duration: 25 minutes Mode of interaction: Individual work Material: Video

Procedure:

1. The teacher will play a video that explains the applications of electrochemistry in industry and everyday life.
2. Each student will be given a sheet of paper to write down at least three applications of electrochemistry that they learned from the video.

3. After the video, students will share their answers with a partner.
4. The teacher will ask a few students to share their answers with the class.

Name of activity: Electroplating Experiment Learning outcome: Students will be able to explain the process of electroplating and identify the materials used in the experiment. Time/Duration: 25 minutes Mode of interaction: Pair work Material: Electroplating kit

Procedure:

1. The teacher will provide each pair of students with an electroplating kit.
2. Each pair will follow the instructions to conduct the electroplating experiment.
3. While the experiment is going on, the teacher will ask students to explain the process of electroplating and identify the materials used in the experiment.
4. After the experiment, the teacher will ask each pair of students to share their experience and explain the process of electroplating.

Theme 29: Computational Chemistry

Lesson Plan

Level: Upper-Intermediate

Duration: 80 minutes

Name of Activity: Introduction to Computational Chemistry

Learning Outcome: By the end of the lesson, students will be able to understand the basics of computational chemistry, including its applications and benefits.

Time/Duration: 10 minutes

Mode of Interaction: Whole Class

Material: PowerPoint Presentation

Procedure:

1. Begin the class by introducing the topic of computational chemistry and asking the students if they have any prior knowledge of the subject.
2. Display the PowerPoint presentation, which includes definitions of computational chemistry, its applications in the field of chemistry, and benefits of using computational chemistry.
3. After discussing the presentation, provide some examples of how computational chemistry is used in real-world applications, such as drug discovery and materials science.
4. Encourage the students to ask questions and clarify any points that are unclear.

Name of Activity: Discussion on Molecular Modeling

Learning Outcome: By the end of the lesson, students will be able to describe how molecular modeling is used in computational chemistry.

Time/Duration: 20 minutes

Mode of Interaction: Group work

Material: Articles on Molecular Modeling

Procedure:

1. Divide the students into small groups.
2. Provide the groups with an article on molecular modeling, which they will read and discuss amongst themselves.
3. Ask the groups to share their thoughts on the article and summarize its contents in a brief presentation to the class.
4. As the groups present, encourage other students to ask questions and provide feedback.

Name of Activity: Hands-on Exercise

Learning Outcome: By the end of the lesson, students will be able to demonstrate their understanding of computational chemistry by using molecular modeling software to visualize and manipulate molecules.
Time/Duration: 50 minutes
Mode of Interaction: Individual/Pair work
Material: Molecular modeling software (e.g. Avogadro), computers
Procedure:

1. Provide each student or pair of students with a computer and molecular modeling software.
2. Instruct the students to use the software to visualize and manipulate a molecule of their choice.
3. Encourage the students to experiment with different features of the software and observe how they affect the appearance of the molecule.
4. Ask the students to explain the features they used and what they observed during the exercise.

Name of Activity: Reflection and Summary
Learning Outcome: By the end of the lesson, students will be able to summarize the main concepts of computational chemistry and reflect on what they have learned.
Time/Duration: 10 minutes
Mode of Interaction: Whole Class
Material: None
Procedure:

1. Ask the students to briefly summarize the main concepts they have learned during the lesson.
2. Encourage the students to reflect on what they have learned and how it might be useful to them in the future.
3. Provide an opportunity for students to ask any final questions or make any additional comments.

Theme 30: Quantum Chemistry
Lesson Plan

Level: Upper-Intermediate
Duration: 80 minutes
Name of Activity: Brainstorming Learning Outcome: Students will be able to list the fundamental principles of quantum mechanics that are applied in quantum chemistry. Time/Duration: 10 minutes Mode of Interaction: Individual Material: Whiteboard, markers
Procedure:

1. The teacher writes the term "Quantum Chemistry" on the whiteboard and asks the students if they have any idea what it means.
2. The teacher explains that quantum chemistry is the study of the behavior of atoms and molecules using the principles of quantum mechanics.
3. The teacher asks the students to individually brainstorm and write down as many fundamental principles of quantum mechanics as they can think of on the whiteboard.
4. The teacher collects the responses and goes over them with the class, adding any missing principles to the list.
5. The teacher leads a class discussion on how these principles are applied in quantum chemistry.

Name of Activity: Video Watching Learning Outcome: Students will be able to understand the basic principles of quantum mechanics applied in quantum chemistry through a visual representation. Time/Duration: 20 minutes Mode of Interaction: Individual Material: Video
Procedure:

1. The teacher provides the video link to the students and asks them to watch the video individually.
2. The students take notes during the video to identify the basic principles of quantum mechanics applied in quantum chemistry.
3. After the video is finished, the teacher leads a class discussion on the video and asks students to share their notes and what they learned from the video.

Name of Activity: Group Discussion Learning Outcome: Students will be able to explain the Schrodinger equation and how it is used in quantum chemistry. Time/Duration: 30 minutes Mode of Interaction: Groupwork Material: Handouts with Schrodinger equation information
Procedure:

1. The teacher divides the students into small groups.

2. The teacher distributes handouts with information about the Schrodinger equation and its application in quantum chemistry.
3. The students discuss the handouts in their groups and create a summary of the key points.
4. Each group presents their summary to the class, with the teacher leading a discussion on the topic.

Name of Activity: Writing Activity Learning Outcome: Students will be able to write a short essay on the importance of quantum chemistry in modern science. Time/Duration: 20 minutes Mode of Interaction: Individual Material: Writing paper, pens

Procedure:

1. The teacher asks the students to write a short essay on the importance of quantum chemistry in modern science.
2. The teacher provides a list of guiding questions for students to consider while writing, such as "What is the significance of quantum chemistry in the development of new materials?" and "What are the practical applications of quantum chemistry in industry and medicine?"
3. After the students have finished writing, they share their essays with the class and the teacher leads a discussion on the topic.

Name of Activity: Vocabulary Review Learning Outcome: Students will be able to identify and use vocabulary related to quantum chemistry. Time/Duration: 10 minutes Mode of Interaction: Individual Material: Vocabulary list

Procedure:

1. The teacher provides a list of vocabulary related to quantum chemistry.
2. The students individually review the vocabulary and try to define each term in their own words.
3. The teacher randomly selects a few terms and asks students to provide definitions and use them in a sentence.

Theme 31: Industrial Chemistry

Lesson Plan

Level: Upper-Intermediate

Duration: 80 minutes

Name of activity: Introduction to Industrial Chemistry Learning outcome: Students will be able to describe the role of industrial chemistry in society and explain the importance of industrial chemistry in our daily lives. Time/Duration: 10 minutes Mode of interaction: Individual Material: PowerPoint presentation

Procedure:

1. Begin the lesson by showing a PowerPoint presentation on industrial chemistry.
2. Explain that industrial chemistry is the application of chemistry principles to develop new products and processes to improve human life.
3. Ask students to discuss in pairs the importance of industrial chemistry in our daily lives.
4. Ask a few students to share their answers with the class.

Name of activity: Case study analysis Learning outcome: Students will be able to analyze a case study related to industrial chemistry and discuss the ethical implications of the case study. Time/Duration: 30 minutes Mode of interaction: Group work Material: Case study handout

Procedure:

1. Divide the class into small groups.
2. Provide each group with a case study handout related to industrial chemistry.
3. Ask the groups to read and analyze the case study, and discuss the ethical implications of the case study.
4. Ask each group to present their analysis and discussion to the class.

Name of activity: Vocabulary building Learning outcome: Students will be able to expand their vocabulary related to industrial chemistry. Time/Duration: 20 minutes Mode of interaction: Individual Material: Vocabulary handout

Procedure:

1. Provide students with a handout of industrial chemistry related vocabulary words and definitions.
2. Ask students to match the words with their definitions.
3. Review the answers with the class and discuss the meaning of the words.

Name of activity: Video analysis Learning outcome: Students will be able to explain the industrial chemistry processes involved in the production of a product. Time/Duration: 20 minutes Mode of interaction: Individual Material: Video clip

Procedure:

1. Show a video clip on the industrial chemistry processes involved in the production of a product.
2. Ask students to take notes on the chemistry principles and processes involved in the production of the product.
3. Discuss the video with the class and ask students to share their notes.

Name of activity: Reflection Learning outcome: Students will be able to reflect on what they have learned in the lesson and how it relates to their future careers. Time/Duration: 10 minutes Mode of interaction: Individual Material: None

Procedure:

1. Ask students to reflect on what they have learned in the lesson.
2. Ask students to write down how industrial chemistry relates to their future careers.
3. Ask a few students to share their answers with the class.

Theme 32: Historical Developments in Chemistry

Lesson Plan

Level: Upper-Intermediate

Duration: 80 minutes

Name of activity: Warm-up Quiz Learning outcome: Assess students' prior knowledge of historical developments in chemistry Time/Duration: 10 minutes Mode of interaction: Individual Materials: Quiz questions, paper, pen

Procedure:

1. Give students a quiz with multiple choice and short answer questions related to historical developments in chemistry.
2. Allow students to complete the quiz individually within the time frame provided.
3. Collect the quiz and grade it to assess students' prior knowledge.

Name of activity: Lecture on Historical Developments in Chemistry Learning outcome: Students will understand the key historical developments in chemistry and their significance Time/Duration: 30 minutes Mode of interaction: Teacher-led lecture Materials: PowerPoint presentation

Procedure:

1. Introduce the topic of historical developments in chemistry.
2. Use a PowerPoint presentation to deliver a lecture on key historical developments in chemistry such as the discovery of oxygen, atomic theory, and the periodic table.
3. Discuss the significance of these developments in the context of modern chemistry.

Name of activity: Group Discussion Learning outcome: Students will be able to analyze and interpret the impact of historical developments in chemistry Time/Duration: 20 minutes Mode of interaction: Small group discussion Materials: Handouts on specific historical developments

Procedure:

1. Divide the class into small groups.
2. Assign each group a specific historical development to analyze and interpret.
3. Provide handouts with information and guiding questions for each development.
4. Allow groups time to discuss and analyze the significance of their assigned historical development.
5. Ask each group to present their findings to the class.

Name of activity: Simulation Activity Learning outcome: Students will understand the process of scientific discovery and experimentation Time/Duration: 20 minutes

Mode of interaction: Individual/Pair work Materials: Simulation software, computers

Procedure:

1. Introduce a simulation software that models the process of scientific discovery and experimentation.
2. Allow students to work individually or in pairs to use the simulation to discover and analyze a chemical phenomenon.
3. Encourage students to think critically about the process of discovery and experimentation, and to consider how it relates to historical developments in chemistry.
4. Ask students to present their findings and discuss the implications of their experiment.

Name of activity: Reflection and Discussion Learning outcome: Students will reflect on their learning and discuss the relevance of historical developments in chemistry to their current understanding of the subject. Time/Duration: 10 minutes Mode of interaction: Class discussion Materials: None

Procedure:

1. Ask students to reflect on what they have learned about historical developments in chemistry.
2. Encourage students to discuss how their understanding of these developments relates to their current understanding of the subject.
3. Facilitate a class discussion to share insights and opinions on the relevance of historical developments in chemistry to modern chemistry.

Theme 33: Current Issues in Chemistry

Lesson Plan

Level: Upper-Intermediate

Duration: 80 minutes

Name of activity: Brainstorming current issues in chemistry

Learning outcome: By the end of this activity, students will be able to identify and discuss current issues and challenges in the field of chemistry.

Time/Duration: 15 minutes

Mode of interaction: Groupwork

Materials: Whiteboard, markers

Procedure:

1. Divide the class into groups of 4-5 students.
2. Assign each group a current issue or challenge in chemistry (e.g. climate change, renewable energy, antibiotic resistance).
3. Instruct the groups to brainstorm and write down as many ideas as possible related to the assigned issue or challenge on the whiteboard.
4. Encourage the groups to discuss and debate the different ideas presented, and to add or modify ideas as they see fit.
5. After 10-15 minutes, bring the class back together and have each group present their ideas and discuss the different perspectives and approaches.

Name of activity: Debate on controversial chemical technologies

Learning outcome: By the end of this activity, students will be able to argue for or against the use of controversial chemical technologies and to express their opinions and reasoning in a structured debate.

Time/Duration: 30 minutes

Mode of interaction: Individual/Pair work

Materials: Articles or news stories related to controversial chemical technologies (e.g. fracking, genetically modified organisms, nanotechnology)

Procedure:

1. Provide each student with an article or news story related to a controversial chemical technology, and give them time to read and take notes.
2. Instruct the students to form pairs, with one student arguing for the use of the technology and the other arguing against it.
3. Give the pairs time to prepare their arguments and counterarguments, and to gather supporting evidence from their article or news story.
4. Facilitate a structured debate, with each pair presenting their arguments and responding to each other's points.

5. Encourage the students to express their opinions and reasoning, while also being respectful of differing viewpoints.

Name of activity: Current issues in chemistry research presentation
Learning outcome: By the end of this activity, students will be able to research and present on a current issue or topic in chemistry, and to communicate their findings effectively to the class.
Time/Duration: 35 minutes
Mode of interaction: Individual work
Materials: Access to online chemistry journals and databases, presentation software (e.g. PowerPoint, Prezi)
Procedure:

1. Assign each student a current issue or topic in chemistry research (e.g. new developments in cancer treatment, green chemistry initiatives, advances in materials science).
2. Instruct the students to research their assigned topic using online chemistry journals and databases, and to take notes on key findings and relevant research papers.
3. Give the students time to prepare a 5-7 minute presentation on their topic, using presentation software and incorporating relevant visuals (e.g. graphs, charts, images).
4. Have the students present their findings to the class, with time for questions and discussion at the end.
5. Encourage the students to engage with each other's presentations and to ask thoughtful questions about the different topics.

Theme 34: Chemistry and Society

Lesson Plan

Level: Upper-Intermediate
Duration: 80 minutes
Name of activity: Warm-up Discussion Learning outcome: Students will be able to brainstorm and discuss the role of chemistry in society and the impact of chemistry on daily life. Time/Duration: 10 minutes Mode of interaction: Groupwork Material: None Procedure:

1. Divide students into small groups.
2. Ask them to brainstorm and discuss the role of chemistry in society and the impact of chemistry on daily life.
3. Give them 5-7 minutes to discuss and come up with their ideas.
4. Ask each group to share their ideas with the class.

Name of activity: Video and Vocabulary Learning outcome: Students will be able to watch a video and learn new vocabulary related to chemistry and society. Time/Duration: 20 minutes Mode of interaction: Individual work Material: Video, handout with vocabulary list Procedure:

1. Show the video to the students.
2. Distribute the handout with the list of vocabulary words related to chemistry and society.
3. Ask students to watch the video and circle the vocabulary words they hear.
4. After the video, ask students to share the words they circled and write them on the board.
5. Review the definitions of the words and ask students to use them in a sentence.

Name of activity: Debate Learning outcome: Students will be able to form and present arguments about a current issue in chemistry and society. Time/Duration: 30 minutes Mode of interaction: Groupwork Material: Articles about current issues in chemistry and society Procedure:

1. Divide students into groups.
2. Provide each group with an article about a current issue in chemistry and society (e.g., climate change, plastic waste, energy storage).
3. Ask each group to read the article and discuss it.
4. Ask each group to prepare a short presentation with arguments for or against the issue presented in the article.
5. Give each group 5-7 minutes to present their arguments.
6. After all groups have presented, ask students to vote for the most convincing argument.

Name of activity: Reflection Learning outcome: Students will be able to reflect on what they have learned in the lesson and their personal views on chemistry and society. Time/Duration: 10 minutes Mode of interaction: Individual work Material: None Procedure:

1. Ask students to take a moment to reflect on what they have learned in the lesson.
2. Ask students to write down their personal views on the role of chemistry in society and the impact of chemistry on daily life.
3. After 5-7 minutes, ask students to share their thoughts with the class.

Theme 35: Research Skills

Lesson Plan

Level: Upper-Intermediate

Duration: 80 minutes

Name of Activity: Brainstorming Research Topics

Learning Outcome: By the end of this activity, students will be able to generate a list of potential research topics related to chemistry.

Time/Duration: 10 minutes

Mode of Interaction: Groupwork

Materials: Whiteboard or flip chart, markers

Procedure:

1. Divide students into groups of 4-5.
2. Give each group a whiteboard or flip chart and markers.
3. Instruct students to brainstorm potential research topics related to chemistry that they find interesting or important.
4. Encourage students to write down as many topics as possible in 5 minutes.
5. After 5 minutes, have each group present their list of research topics to the class.
6. Write all the research topics on the whiteboard or flip chart for everyone to see.
7. Discuss the topics as a class and choose one topic to focus on for the next activity.

Name of Activity: Research Plan

Learning Outcome: By the end of this activity, students will be able to create a research plan for a chemistry project.

Time/Duration: 30 minutes

Mode of Interaction: Individual/Pair work

Materials: Handout with research plan template

Procedure:

1. Provide students with a handout that includes a research plan template.
2. Instruct students to choose the research topic that the class decided on in the previous activity.
3. Have students work individually or in pairs to fill out the research plan template for their chosen topic.
4. Encourage students to think about the purpose, objectives, research questions, methodology, and expected outcomes of their research project.
5. After 20-25 minutes, have students share their research plan with a partner and give feedback.

6. Ask for volunteers to share their research plan with the class and give feedback.

Name of Activity: Literature Review

Learning Outcome: By the end of this activity, students will be able to conduct a literature review related to their research topic.

Time/Duration: 30 minutes

Mode of Interaction: Individual work

Materials: Access to academic databases, handout with literature review template

Procedure:

1. Provide students with access to academic databases such as Scopus or Web of Science.
2. Instruct students to search for relevant articles and resources related to their research topic.
3. Provide students with a handout that includes a literature review template.
4. Have students work individually to read and summarize 2-3 articles related to their research topic using the literature review template.
5. After 20-25 minutes, have students share their literature review summaries with a partner and give feedback.
6. Ask for volunteers to share their literature review summaries with the class and give feedback.

Name of Activity: Presentation of Research Plan

Learning Outcome: By the end of this activity, students will be able to present their research plan and literature review related to their research topic.

Time/Duration: 10-15 minutes per student/pair

Mode of Interaction: Individual/Pair work

Materials: PowerPoint or poster board

Procedure:

1. Instruct students to create a PowerPoint or poster board presentation of their research plan and literature review.
2. Encourage students to include the purpose, objectives, research questions, methodology, expected outcomes, and literature review summaries in their presentation.
3. Provide students with 10-15 minutes to present their research to the class.
4. After each presentation, have students ask questions and give feedback to the presenter.
5. Encourage students to take notes on each presentation for future reference.

Theme 36: Presentation Skills

Lesson Plan

Level: Upper-Intermediate

Duration: 80 minutes

Name of activity: Introduction to Presentation Skills Learning outcome: Students will be able to understand the importance of presentation skills and their application in the field of Chemistry. Time/Duration: 10 minutes Mode of interaction: Whole class discussion Material: PowerPoint presentation

Procedure:

1. Start the class by introducing the topic of presentation skills and their relevance in the field of chemistry.
2. Ask students if they have ever given a presentation related to chemistry and if they have any difficulties in doing so.
3. Introduce the key skills required for an effective presentation, such as audience engagement, clear delivery, and appropriate use of visuals.
4. Show a PowerPoint presentation to the class to demonstrate the importance of effective visual aids in a presentation.
5. Encourage students to ask questions or share their own experiences with presentations.

Name of activity: Analyzing Presentations Learning outcome: Students will be able to analyze and evaluate effective presentations and identify areas for improvement. Time/Duration: 30 minutes Mode of interaction: Pair work Material: Video recording of a chemistry presentation (provide the link)

Procedure:

1. Divide students into pairs and provide them with a video recording of a chemistry presentation.
2. Ask each pair to analyze the presentation and identify the strengths and weaknesses of the presenter's delivery, visual aids, and overall message.
3. Encourage students to take notes and provide specific examples to support their observations.
4. After 15 minutes, ask each pair to share their analysis with the class, focusing on common themes and areas for improvement.

Name of activity: Creating a Chemistry Presentation Learning outcome: Students will be able to plan and create an effective chemistry presentation. Time/Duration: 40 minutes Mode of interaction: Group work Material: Presentation guidelines and template (provided by the teacher)

Procedure:

1. Divide students into groups of three or four.

2. Provide each group with a set of presentation guidelines and a template.
3. Ask each group to choose a chemistry topic and create a presentation using the provided template.
4. Encourage students to incorporate the presentation skills discussed earlier in the lesson, such as audience engagement and appropriate use of visuals.
5. After 30 minutes, ask each group to present their presentation to the class.
6. Provide feedback and encourage constructive criticism from other groups.

Name of activity: Reflection Learning outcome: Students will be able to reflect on their own presentation skills and identify areas for improvement. Time/Duration: 10 minutes Mode of interaction: Individual work Material: Reflection sheet

Procedure:

1. Distribute a reflection sheet to each student and ask them to reflect on their own presentation skills.
2. Encourage students to identify areas where they have improved and areas where they can continue to develop their skills.
3. Ask each student to share their reflections with the class (optional).

GRAMMAR

Parts of speech

Exercise 1: Identify the part of speech for the underlined word in the following sentences.

1. The chemist mixed the solution carefully. (noun)
2. He was able to calculate the concentration of the acid. (verb)
3. The reaction was highly exothermic. (adjective)
4. She always wears a lab coat in the laboratory. (noun)
5. The experiment yielded unexpected results. (verb)
6. Tenses: Exercise 1: Fill in the blanks with the appropriate verb tense.
7. I _____ (study) chemistry for five years. (present perfect)
8. The experiment _____ (take place) yesterday. (simple past)
9. By next year, he _____ (complete) his PhD. (future perfect)
10. She _____ (be) a chemist for ten years. (present perfect continuous)
11. If we _____ (increase) the temperature, the reaction will speed up. (simple future)

Articles

Exercise 2: Fill in the blanks with "a", "an" or "the".

1. He added _____ acid to the solution. (the)
2. She used _____ burette to measure the volume. (a)
3. _____ elements in the periodic table are arranged according to their atomic number. (the)
4. _____ reaction occurred when the two chemicals were mixed. (an)
5. He needed _____ assistance with the experiment. (some)

Passive voice

Exercise 3: Rewrite the following sentences in the passive voice.

1. The chemist conducted the experiment carefully. (The experiment was conducted carefully by the chemist.)
2. They will analyze the results tomorrow. (The results will be analyzed tomorrow.)
3. We cannot identify the unknown compound. (The unknown compound cannot be identified.)
4. She had finished the experiment before the deadline. (The experiment had been finished before the deadline by her.)
5. The professor will grade the lab reports. (The lab reports will be graded by the professor.)

Conditionals:

Exercise 4: Complete the following sentences with the correct conditional.

1. If she _____ (have) more time, she would have repeated the experiment. (had)
2. If the temperature _____ (increase), the reaction will speed up. (increases)
3. She would have passed the exam if she _____ (study) harder. (had studied)
4. If he _____ (understand) the concept, he would explain it to us. (understood)
5. If we _____ (run) out of chemicals, we won't be able to complete the experiment. (run)

Modals:

Exercise 5: Choose the correct modal verb to complete the sentence.

1. You _____ add more acid to the solution. (should)
2. He _____ calculate the pH of the solution. (can)
3. She _____ wear safety goggles in the laboratory. (must)
4. We _____ have finished the experiment by now. (should)
5. They _____ not mix the chemicals together. (should)

Relative clauses:

Exercise 6: Add a relative clause to the following sentences.

1. The experiment was successful. The chemist conducted it. (The experiment that the chemist conducted was successful.)
2. The student is studying organic chemistry. The student wants to become a biochemist. (The student who wants to become a biochemist is studying organic chemistry.)
3. The compound is highly reactive. The chemist needs to handle it carefully. (The compound that the chemist needs to handle

VOCABULARY

Terminology Exercise 1

Instructions: Match the chemistry term on the left with its definition on the right.

Acid
Base
Catalyst
Compound
Element
Molecule
Ion
Isotope
Oxidation
Reduction

a. A substance that donates hydrogen ions (H+) in a chemical reaction
b. A substance that accepts hydrogen ions (H+) in a chemical reaction
c. A substance that speeds up a chemical reaction without undergoing any permanent chemical change
d. A substance composed of two or more elements that are chemically combined in a fixed ratio
e. A pure substance that cannot be broken down into simpler substances by chemical means
f. A group of two or more atoms held together by chemical bonds
g. An atom or molecule that has an electric charge due to the gain or loss of one or more electrons
h. Atoms of the same element that have different numbers of neutrons in their nuclei
i. A chemical reaction involving the loss of electrons by a molecule, atom or ion
j. A chemical reaction involving the gain of electrons by a molecule, atom or ion

Terminology Exercise 2

Match the term with its definition:

Terms:

1. Atom
2. Molecule
3. Ion
4. Isotope

5. Covalent bond
6. Ionic bond
7. Element
8. Compound
9. Acid
10. Base

Definitions:

a. A substance that contains two or more different elements chemically combined.
b. An atom or group of atoms that has lost or gained one or more electrons, giving it a positive or negative charge.
c. A substance that contains only one type of atom.
d. A bond formed by the sharing of electrons between atoms.
e. A bond formed by the transfer of electrons from one atom to another.
f. A substance that produces hydrogen ions (H+) when dissolved in water.
g. A substance that produces hydroxide ions (OH-) when dissolved in water.
h. The smallest unit of a chemical element that retains its chemical properties.
i. Two or more atoms chemically combined.
j. An atom that has the same number of protons but a different number of neutrons.

Technical Vocabulary

Exercise 1: Matching

Instructions: Match the technical terms in Column A with their corresponding meanings in Column B.

Column A	Column B
Alloy	A substance made up of two or more metals or a metal and another element.
Biochemistry	The study of chemical processes within and relating to living organisms.
Catalyst	A substance that increases the rate of a chemical reaction without itself undergoing any permanent chemical change.
Enzyme	A biological catalyst that speeds up chemical reactions in living cells.
Isomer	Two or more compounds that have the same chemical formula but a different arrangement of atoms.
Polymer	A substance made up of many repeating units (monomers) that are chemically bonded together.
Titration	A laboratory technique used to determine the concentration of a solution by adding a solution of known concentration until the reaction is complete.

Exercise 2: Fill in the Blanks

Instructions: Fill in the blanks with the appropriate technical terms from the word bank.

Word bank: activation energy, anode, cathode, chromatography, distillation, electrolysis, oxidation, reduction, stoichiometry, viscosity

1. The process of separating components of a mixture based on their different affinities for a stationary phase and a mobile phase is called _____.
2. The measure of a fluid's resistance to flow is called _____.
3. In a voltaic cell, the electrode where oxidation occurs is called the _____, while the electrode where reduction occurs is called the _____.
4. The process of breaking down a compound by passing an electric current through it is called _____.
5. The minimum energy required for a chemical reaction to occur is called the _____.
6. The calculation of the quantities of reactants and products involved in a chemical reaction is called _____.
7. The process of separating components of a mixture based on differences in boiling points is called _____.
8. The loss of electrons during a chemical reaction is called _____.
9. The gain of electrons during a chemical reaction is called _____.
10. The study of the relationship between chemical reactions and electrical energy is called _____.

Academic Vocabulary

Exercise 1: Match the terms

Match the terms on the left with their definitions on the right.

Terms	Definitions
1. hypothesis	B. a statement of what you think will happen in an experiment
2. empirical formula	F. a formula that shows the smallest whole number ratio of atoms in a compound
3. isotope	I. atoms of the same element with different numbers of

	neutrons
4. stoichiometry	D. a series of procedures that scientists use to answer questions and solve problems
5. synthesis reaction	A. a substance composed of two or more elements chemically combined in a fixed proportion
6. organic chemistry	E. the study of carbon compounds
7. combustion reaction	G. a type of chemical reaction that occurs when a compound reacts with oxygen to form water and carbon dioxide
8. empirical evidence	J. information gathered from observations and experiments
9. scientific method	D. a series of procedures that scientists use to answer questions and solve problems
10. binary compound	H. a chemical compound that contains only two elements

Exercise 2: Complete the sentence

Choose the appropriate academic term from the word bank to complete each sentence.

Word bank: hypothesis, theory, empirical, experiment, principle, data, analysis, phenomenon, conclusion, model

1. A _____ is a well-tested explanation that unifies a broad range of observations and hypotheses.
2. In science, an _____ is a collection of data taken from observations and experiments.
3. A _____ is a tentative explanation for an observation, phenomenon, or scientific problem that can be tested through experimentation.
4. In scientific research, _____ refers to the systematic process of collecting and analyzing data in order to answer research questions or test hypotheses.
5. An _____ is a physical or chemical event or process that can be observed and studied.
6. A _____ is a generalization or principle that is based on empirical evidence and can be used to explain natural phenomena.
7. A _____ is a detailed examination or interpretation of scientific data in order to identify patterns or relationships and draw conclusions.
8. A _____ is a simplified representation of a complex system or process that is used to explain or predict behavior.

9. _____ is the process of using evidence to support or refute a scientific claim or hypothesis.
10. A _____ is a final decision or judgment that is based on the results of an experiment or scientific investigation.

General Vocabulary

Exercise 1: *Complete the sentences with the correct word from the word bank*

Word bank:

1. density
2. reactants
3. products
4. combustion
5. electrolysis
6. exothermic
7. endothermic
8. catalyst
9. ionization
10. concentration

a) The _____ of a substance is defined as its mass per unit volume.
b) In a chemical reaction, the starting materials are called _____.
c) The substances that are formed as a result of a chemical reaction are called _____.
d) _____ reactions are those that involve the burning of a substance in the presence of oxygen.
e) The process of using electricity to break down a compound into its constituent elements is called _____.
f) _____ reactions release energy in the form of heat.
g) _____ reactions absorb energy in the form of heat.
h) A _____ is a substance that speeds up a chemical reaction without being consumed in the reaction.
i) The process of converting a neutral atom into an ion is called _____.
j) The _____ of a solution is the amount of solute present in a given amount of solvent.

Exercise 2:*Choose the correct word to complete the sentence*

1. The _____ in a chemical reaction are the starting materials.
   a) products b) reactants

2. A substance that speeds up a chemical reaction without being consumed in the reaction is called a _____.
   a) product b) catalyst
3. An _____ is a substance that contains only two elements.
   a) element b) compound c) mixture
4. _____ is the study of the properties and behavior of matter.
   a) Chemistry b) Physics c) Biology
5. The process of breaking down a compound into its constituent elements using heat is called _____.
   a) electrolysis b) synthesis c) combustion
6. A _____ is a substance that can neither be created nor destroyed in a chemical reaction.
   a) reactant b) product c) element
7. The _____ of a substance is defined as its mass per unit volume.
   a) density b) concentration c) molarity
8. A _____ reaction occurs when a compound reacts with oxygen to form water and carbon dioxide.
   a) combustion b) synthesis c) decomposition
9. The _____ of a solution is the amount of solute present in a given amount of solvent.
   a) concentration b) molarity c) density
10. The process of using electricity to break down a compound into its constituent elements is called _____.
    a) combustion b) electrolysis c) decomposition

PRONUNCIATION

Pronunciation of technical terms

Exercise 1: *Listen and repeat Listen to the audio and repeat the following technical terms:*

1. Acid-base titration
2. Chemical equilibrium
3. Electrolysis
4. Exothermic reaction
5. Hydrocarbon
6. Isomerism
7. Oxidation-reduction reaction
8. Periodic table
9. Polymerization
10. Solubility

Exercise 2: Pronunciation drill

Divide the class into pairs. One student reads the technical term, and the other student pronounces it correctly. Then, the roles are reversed. After a few minutes, switch partners and continue practicing. Some technical terms you can use for this exercise are:

1. Aqueous solution
2. Carboxylic acid
3. Chiral center
4. Covalent bond
5. Enzyme catalysis
6. Free radical
7. Isotonic solution
8. Molecular formula
9. Nuclear reaction
10. Sublimation

Exercise 3: *Fill in the blanks Listen to the audio and fill in the blanks with the correct technical terms:*

1. The process of converting a solid directly to a gas is called _____.
2. A substance that has a pH of less than 7 is called an _____.
3. The study of the rates and mechanisms of chemical reactions is called _____.

4. An organic compound that contains a hydroxyl group (-OH) is called a _____.
5. The force that holds two atoms together in a molecule is called a _____.
6. A substance that speeds up a chemical reaction without being consumed in the reaction is called a _____.
7. The study of the properties and behavior of matter at the atomic and molecular level is called _____.
8. The process of breaking down a compound using electricity is called _____.
9. A compound that has the same molecular formula as another compound but a different structure is called an _____.
10. A substance that contains only one type of atom is called an _____.

Answers:

1. Sublimation
2. Acid
3. Chemical kinetics
4. Alcohol
5. Covalent bond
6. Catalyst
7. Physical chemistry
8. Electrolysis
9. Isomer
10. Element

Intonation patterns in scientific communication

Intonation patterns play an important role in scientific communication as they can convey different meanings and emphasize key information. In Chemistry, intonation patterns can help to clarify the purpose and results of experiments, as well as explain complex concepts and theories. Here are some exercises to practice intonation patterns in scientific communication in Chemistry:

Exercise 1: *Rising and falling intonation Listen to the following sentences and decide whether the speaker is using rising or falling intonation.*

1. The melting point of water is 0 degrees Celsius.
2. The pH of the solution decreased after adding the acid.
3. The experiment was designed to test the effect of temperature on reaction rate.
4. The titration curve shows the pH changes during the titration process.
5. The molecular structure of the compound can be determined by X-ray crystallography.

Exercise 2: *Emphasis and contrast Listen to the following sentences and decide which word or phrase is emphasized or contrasted.*

1. The reaction rate increased when the temperature was raised.
2. The product yield was higher than expected.
3. The solvent used in the experiment was acetone.
4. The compound was synthesized using a modified procedure.
5. The sample was contaminated with impurities from the reaction.

Exercise 3: *Pitch range Listen to the following sentences and identify the pitch range used by the speaker.*

1. The absorbance of the solution was measured at different wavelengths.
2. The reaction mechanism involves a series of intermediate steps.
3. The spectroscopic technique allows for the detection of trace amounts of analyte.
4. The compound exhibited interesting properties in the solid state.
5. The titration was performed using a standardized solution.

Note: It is recommended to practice these exercises with the guidance of a teacher or a tutor who can provide feedback and help with pronunciation.

Accent reduction strategies

Here are some accent reduction strategies for Chemistry students:

1. Listen to native speakers: Listen to recordings or videos of native English speakers pronouncing technical terms in Chemistry. Pay attention to their intonation, stress, and rhythm.
2. Record yourself: Record yourself pronouncing technical terms and compare it to the native speaker's pronunciation. Listen carefully to the differences and work to correct them.
3. Practice stress and intonation: Focus on the stress and intonation patterns of technical terms in Chemistry. Emphasize the correct syllables and use the appropriate pitch and tone for the term.
4. Break down complex terms: If a term is particularly difficult to pronounce, try breaking it down into smaller parts and practice each part separately.
5. Use visual aids: Use diagrams and visual aids to help you associate the sound of a word with its meaning. This can also help you remember the correct pronunciation.

6. Ask for feedback: Ask a native speaker or your English teacher for feedback on your pronunciation. They can provide guidance on areas that need improvement and help you practice.

Remember, improving your accent takes time and practice. Be patient with yourself and keep working on your pronunciation skills.

SELF-STUDY PLAN

Week	Topics to Study	Grammar Focus	Vocabulary Focus	Pronunciation Focus
1	Introduction to English for Chemistry	Parts of Speech	Terminology	Pronunciation of technical terms
	Scientific Method	Present Simple	Technical Vocabulary	Intonation patterns in scientific communication
	Laboratory Equipment and Techniques	Articles	Academic Vocabulary	Accent reduction strategies
2	Elements, Compounds, and Molecules	Present Continuous	Technical Vocabulary	Pronunciation of technical terms
	Stoichiometry	Present Perfect	Academic Vocabulary	Intonation patterns in scientific communication
	Chemical Reactions	Past Simple	General Vocabulary	Accent reduction strategies
3	The Periodic Table	Past Continuous	Technical Vocabulary	Pronunciation of technical terms
	Chemical Bonding	Past Perfect	Academic Vocabulary	Intonation patterns in scientific communication
	Thermochemistry	Future Simple	Technical Vocabulary	Accent reduction strategies
4	Gases	Future Continuous	Technical Vocabulary	Pronunciation of technical terms
	Solutions	Future Perfect	Academic	Intonation patterns

			Vocabulary	in scientific communication
	Acids and Bases	Modal Verbs	Technical Vocabulary	Accent reduction strategies
5	Equilibrium	Passive Voice	Technical Vocabulary	Pronunciation of technical terms
	Kinetics	Conditionals	Academic Vocabulary	Intonation patterns in scientific communication
	Nuclear Chemistry	Gerunds and Infinitives	Technical Vocabulary	Accent reduction strategies
6	Organic Chemistry	Reported Speech	Technical Vocabulary	Pronunciation of technical terms
	Biochemistry	Relative Clauses	Academic Vocabulary	Intonation patterns in scientific communication
	Environmental Chemistry	Adverbial Clauses	Technical Vocabulary	Accent reduction strategies
7	Materials Science	Review of all Tenses	Technical Vocabulary	Pronunciation of technical terms
	Analytical Chemistry	Review of all Grammar	Academic Vocabulary	Intonation patterns in scientific communication
	Forensic Chemistry	Review of all Vocabulary	Technical Vocabulary	Accent reduction strategies
8	Pharmaceutical Chemistry	Review of Pronunciation	Academic Vocabulary	Pronunciation of technical terms
	Chemistry of Food and Beverages	Review of Intonation	Technical Vocabulary	Intonation patterns in scientific communication
	Green Chemistry	Review of Accent Reduction	Technical Vocabulary	Accent reduction strategies
9	Petrochemistry	Research Skills	Academic Vocabulary	Pronunciation of technical terms
	Polymer Chemistry	Presentation Skills	Technical Vocabulary	Intonation patterns in scientific

				communication
	Surface Chemistry	Review of Reported Speech	Technical Vocabulary	Accent reduction strategies
10	Electrochemistry	Review of Relative Clauses	Academic Vocabulary	Pronunciation of technical terms
	Computational Chemistry	Review of Adverbial Clauses	Technical Vocabulary	Intonation patterns in scientific communication
	Quantum Chemistry	Review of Gerunds and Infinitives	Technical Vocabulary	Accent reduction strategies
11	Industrial Chemistry	Review of Conditionals	Academic Vocabulary	Pronunciation of technical terms
	Historical Developments in Chemistry	Review of Modals	Technical Vocabulary	Intonation patterns in scientific communication
	Current Issues in Chemistry	Review of Passive Voice	Technical Vocabulary	Accent reduction strategies
12	Chemistry and Society	Review of Articles	Academic Vocabulary	Pronunciation of technical terms
	Final Project Preparation	Review of Parts of Speech	Technical Vocabulary	Intonation patterns in scientific

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Online Resources:

19. American Chemical Society: https://www.acs.org/

20. Breaking the Barrier of Language for Science: https://www.nature.com/scitable/blog/student-voices/breaking_the_barrier_of_language/
21. ChemEnglish: https://chemenglish.com/
22. Chemguide: https://www.chemguide.co.uk/
23. Chemistry LibreTexts: https://chem.libretexts.org/
24. Collins English for Life: Skills - Writing (for Chemistry students): https://www.collinsdictionary.com/dictionary/english/english-for-life-skills-writing
25. Coursera (Chemistry courses): https://www.coursera.org/courses?query=chemistry
26. English for Chemistry (Listening and Speaking): https://www.englishforchemistry.com/
27. English for Science and Technology resources: https://www.usingenglish.com/links/English-for-Science-and-Technology/
28. EnglishClub - Technical English: https://www.englishclub.com/english-for-work/technical.htm
29. IUPAC (International Union of Pure and Applied Chemistry): https://iupac.org/
30. Khan Academy (Chemistry): https://www.khanacademy.org/science/chemistry
31. Purdue OWL (Online Writing Lab): https://owl.purdue.edu/owl/research_and_citation/acs_style/index.html
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