



آغا خان یونیورسٹی ایگزامینیشن بورڈ  
AGA KHAN UNIVERSITY EXAMINATION BOARD

## Pacing Guide for Teachers

# CHEMISTRY

Grade X

Theory

Numbers of weeks: 28

Number of periods per week: 5

Key Textbook: Chemistry for Grade 10, National Book Foundation, Islamabad

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Institution(s): P.E.C.H.S Girls Schools, Bai Virbaiji Soparivala Parsi High School and Al-Murtaza School, Karachi

## Topic

9.Chemical Equilibrium

## Total Periods

14

Sub-Topic	Range of SLOs	Periods (40 mins)
9.1 Reversible Reactions and Dynamic Equilibrium	9.1.1-9.1.3	1
	9.1.4 (also introduce 9.3.5)	1
9.2 Law of Mass Action and Thermal Reactions	9.2.1- 9.2.3	1
9.3 Equilibrium Constant Expression and Le Chatelier's Principle	9.3.1-9.3.2	3
	9.3.3	2
	9.3.4	2
	9.3.5-9.3.7	4

## Learning Resources

- Chemistry 10, Caravan Book House, Lahore. Unit 9: Chemical Equilibrium
- Rose Marie Gallagher and Paul Ingram, Complete Chemistry, Oxford University Press. Unit 8: How fast are reactions?
- Chemistry for Class 11. Punjab Textbook Board, Lahore, Chapter 8: Chemical Equilibrium

- Tan Yin Toon, Chen Ling Kwong, John Sadler and Emily Clare, Chemistry Matters G.C.E. 'O' level, Marshall Cavendish Education, Chapter 17: Energy Changes
- Christopher N. Prescott, Chemistry, A Course for 'O' Level, Marshall Cavendish Education, Unit 10: Energy from Chemicals

## Web Resources

<https://www.usetute.com.au/lechatsp.html>

<http://www.chemguide.co.uk/physical/equilibria/lechatelier.html>

<https://www.youtube.com/watch?v=7zuUV455zFs>

## Suggested Activities and/or Formative Assessment

### Activity 1:

An activity related to Le Chatelier's principle could involve conducting an experiment to investigate the effect of changing various factors on the equilibrium position of a chemical reaction.

### Activity 2:

A word bank can be provided to students with examples and ask them to fill the examples in the column of exothermic and endothermic reactions.

Links for worksheets

<https://www.lcps.org/cms/lib/VA01000195/Centricity/Domain/16570/Le%20Chateliers%20Principle%20Worksheet.pdf>

<https://www.liveworksheets.com/nm1284682fx>

## Further Resources

For additional resources related to teaching, learning and formative assessments, please refer to Learn Smart Classroom by Knowledge Platform:

<https://akueb.knowledgeplatform.com/login>



## Topic

10. Acids, Bases and Salts

## Total Periods

22

Sub-Topic	Range of SLOs	Periods (40 mins)
10.1 Concepts of Acids and Bases	10.1.1-10.1.4	3
	10.1.5-10.1.7	1
10.2 Properties of Acids and Bases	10.2.1-10.2.2	3
10.3 Strengths of Acids and Bases	10.3.1-10.3.2	2
10.4 Applications of Acids and Bases	10.4.1-10.4.2	1
10.5 pH Scale	10.5.1-10.5.3	1
	10.5.4	3
10.6 Acid Base Titration	10.6.1-10.6.2	4
10.7 Salts	10.7.1-10.7.2	1

	10.7.3-10.7.5	3
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## Learning Resource

- Chemistry 10, Caravan Book House, Lahore. Unit 10: Acids, Bases and Salts

## Suggested Activities and/or Formative Assessment

**Activity 1:** Chemical properties of acids and bases using kitchen items.

**Activity 2:**

Links for activities

<https://studylib.net/doc/7254164/acids--bases--salts-crossword>

<https://phet.colorado.edu/en/simulations/ph-scale>

<https://phet.colorado.edu/en/simulations/ph-scale-basics>

**Activity 3:** Acid Base Neutralization

[https://phet.colorado.edu/sims/html/acid-base-solutions/latest/acid-base-solutions\\_all.html](https://phet.colorado.edu/sims/html/acid-base-solutions/latest/acid-base-solutions_all.html)

**Activity 4:** Molarity

<https://phet.colorado.edu/en/simulations/molarity>

**Activity 5:** Precipitation of salts

<https://www.labxchange.org/library/items/lb:LabXchange:d42e577a:video:1>

<https://www.labxchange.org/library/items/lb:LabXchange:11237604:video:1>

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**Topic**

11.Organic Chemistry

**Total Periods**

21

Sub-Topic	Range of SLOs	Periods (40 mins)
11.1 Organic Compounds	11.1.1,11.1.4	2
	11.1.2-11.1.3	2
11.2 Classification of Organic Compounds	11.2.1	2
11.2 Classification of Organic Compounds 11.3 Alkanes and Alkyl Groups	11.2.2-11.3.1	1
11.3 Alkanes and Alkyl Groups	11.3.2	1
11.4 Homologous Series and Isomerism	11.4.1	1
	11.4.2	1
	11.4.3-11.4.4	2
11.5 Functional Groups	11.5.1-11.5.2	3

	11.5.3	2
	11.5.4	4

## Learning Resources

- Chemistry 10, Caravan Book House, Lahore. Unit 11: Organic Chemistry
- Chemistry for XII, Sindh Textbook Board, Jamshoro. Chapter 6: Introduction to Organic Chemistry

## Suggested Activities and/or Formative Assessment

### Activity 1:

One hands-on activity to introduce hydrocarbons is the "Modelling Hydrocarbons with Molecular Kits."

Here's a step-by-step guide:

#### Materials needed:

- Molecular modelling kit (available in educational or science supply stores)
- Instruction booklet or reference materials (if included with the kit)

#### Instructions:

Familiarize yourself with the molecular modelling kit components and their functions. The kit typically includes plastic atoms representing carbon (C) and hydrogen (H) and connectors representing chemical bonds. (Magnetic kit can be used)

Explain the basic concepts of hydrocarbons to the participants, including the definition of hydrocarbons as organic compounds composed solely of carbon and hydrogen atoms.

Divide the participants into small groups and distribute the molecular modelling kits to each group.

Instruct the participants to use the atoms and connectors in the kit to build various hydrocarbon molecules.

Start with simple hydrocarbons such as methane ( $\text{CH}_4$ ), ethane ( $\text{C}_2\text{H}_6$ ), and propane ( $\text{C}_3\text{H}_8$ ).

Encourage the participants to explore different arrangements of atoms and bond angles to create different hydrocarbons.

Allow the participants time to experiment and build different hydrocarbon molecules using the modelling kits.

Ask the participants to share and discuss the hydrocarbons they have built, explaining the number of carbon and hydrogen atoms in each molecule.

Facilitate a group discussion to reinforce the key characteristics of hydrocarbons, such as their carbon and hydrogen composition, the role of chemical bonds, and the diversity of hydrocarbon structures.

Optionally, you can provide real-life examples of hydrocarbons, such as methane (natural gas), ethane (used in fuel), or longer-chain hydrocarbons found in petroleum products.

This hands-on activity allows participants to physically build and manipulate hydrocarbon models, promoting a better understanding of their composition and structure. It encourages exploration and creativity while reinforcing the fundamental concepts of hydrocarbons in a tangible way.

## Activity 2:

Conduct hands-on activities like molecular modelling and organic compound sorting using cards based on functional groups.

## Activity 3:

Links for worksheet

[https://www.liveworksheets.com/worksheets/en/Chemistry/Organic/Nomenclature\\_of\\_organic\\_compounds\\_bs2834334xf](https://www.liveworksheets.com/worksheets/en/Chemistry/Organic/Nomenclature_of_organic_compounds_bs2834334xf)

<https://www.chemguide.co.uk/basicorg/questions/q-names1.pdf>

<https://studylib.net/doc/25671005/nomenclature-isomerism-worksheet>

<https://www.dimanregional.org/site/handlers/filedownload.ashx?moduleinstanceid=7855&dataid=2294&FileName=Functional%20Groups%20and%20Structure%20Drawing%20WS.pdf>

## Further Resources

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<https://akueb.knowledgeplatform.com/login>





## Topic

12. Hydrocarbons

## Total Periods

26

Sub-Topic	Range of SLOs	Periods (40 mins)
12.1 Nomenclature	12.1.1	2
	12.1.2	2
12.2 Saturated and Unsaturated Hydrocarbons	12.2.1-12.2.3	4
12.3 Structural and Electronic Formulae	12.3.1	1
12.4 Uses of Hydrocarbons	12.4.1	1
12.5 Alkanes	12.5.1	2
	12.5.2	2
	12.5.3-12.5.4	2
12.6 Alkenes	12.6.1	1
	12.6.2-12.6.3	2

12.7 Alkynes	12.7.1-12.7.2	3
	12.7.3	1
12.8 Reactions of Alkanes, Alkenes and Alkynes	12.8.1	1
	12.8.2	1
	12.8.3	1

## Learning Resources

- Chemistry 10, Caravan Book House, Lahore. Unit 12: Hydrocarbons
- Chemistry for XII, Sindh Textbook Board, Jamshoro. Chapter 7: Chemistry of Hydrocarbons
- Chemistry for Class 10. Punjab Textbook Board, Lahore. Chapter 17: Organic Chemistry
- Dr Rex M. Heyworth and J. G. R. Briggs, All About Chemistry 'O' Level, Hodder Education Singapore. Chapter 25: Alkanes and Alkenes

## Suggested Activities and/or Formative Assessment

Links for worksheets

<https://www.claytonschoools.net/cms/lib/MO01000419/Centricity/Domain/244/organicnomenclature%20wksht%20key.pdf>

<https://www.pw.live/worksheet-class-10/icse-class-10-science-chemistry/chapter-12-organic>

<https://www.helpsteaching.com/search/hydrocarbons>

## Activity 1:

Introducing nomenclature, the system of naming compounds, can be done using a structured approach that combines theory and practical examples. Here's a suggested method:

**Start with the basics:** Explain the importance of nomenclature in chemistry, which allows scientists to communicate and identify compounds accurately. Emphasize the need for a systematic and standardized approach to naming compounds.

**Discuss the two main types of compounds:** Introduce participants to inorganic and organic compounds. Explain that inorganic compounds are typically composed of elements other than carbon, while organic compounds contain carbon atoms bonded to hydrogen and possibly other elements.

**Focus on inorganic compound nomenclature:** Provide an overview of the naming conventions for inorganic compounds, including ionic compounds and covalent compounds. Emphasize the use of oxidation numbers for transition metals in ionic compounds and the use of prefixes to indicate the number of atoms in covalent compounds.

**Explain organic compound nomenclature:** Introduce the IUPAC (International Union of Pure and Applied Chemistry) system for naming organic compounds. Highlight the importance of the parent chain, functional groups, and substituents in organic compound names.

**Break down the components of organic compound names:**

**Parent chain:** Explain how the longest continuous carbon chain serves as the parent chain, and its name is derived from the number of carbon atoms (meth-, eth-, prop-, but-, etc.).

**Functional groups:** Discuss common functional groups in organic compounds and their naming conventions.

**Substituents:** Explain how substituents, which are smaller groups attached to the parent chain, are named as prefixes and positioned with locants (numbers) to indicate their locations on the parent chain.

**Provide practical examples:** Use specific examples to illustrate the naming process. Choose representative compounds from different functional groups and complexity levels. Walk participants through the step-by-step process of identifying the parent chain, functional groups, and substituents to arrive at the correct systematic name.

**Practice exercises:** Engage participants in naming exercises to reinforce learning. Provide a set of organic compounds and ask participants to determine their systematic names, or vice versa.

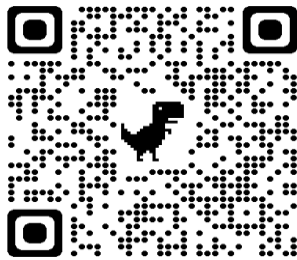
**Offer resources and references:** Provide participants with reliable resources, such as nomenclature guidelines, textbooks, or online tools, to help them practice and expand their understanding of nomenclature.

Encourage active participation, ask questions to assess comprehension, and provide ample opportunities for practice. Nomenclature can be complex, so it's important to ensure participants understand the underlying principles before moving on to more advanced topics.

## Further Resources

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FOR ACADEMIC YEAR 2023 AND ONWARDS

## Topic

## Total Periods

13. Biochemistry

18

Sub-Topic	Range of SLOs	Periods (40 mins)
13.1 Carbohydrates 13.8 Sources and Uses	13.1.1-13.1.4 13.8.1-13.8.2	3
13.2 Proteins	13.2.1-13.2.2	2
13.2 Proteins 13.8 Sources and Uses	13.2.3-13.2.4 13.8.1-13.8.2	3
13.3 Enzymes	13.3.1-13.3.2	1
13.4 Lipids 13.8 Sources and Uses	13.4.1-13.4.3 13.8.1-13.8.2	2
13.5 Nucleic Acids 13.8 Sources and Uses	13.5.1-15.5.3 13.8.1-13.8.2	2
13.6 Vitamins	13.6.1-13.6.3	2
13.7 Biologically Important Minerals	13.7.1-13.7.2	1
13.8 Sources and Uses	13.8.1-13.8.2	1
	13.8.3	1

## Learning Resources

- Chemistry 10, Caravan Book House, Lahore. Unit 13: Biochemistry
- Chemistry for Grade 12, National Book Foundation, Islamabad. Chapter 21: Biochemistry
- Rose Marie Gallagher and Paul Ingram, Complete Chemistry, Oxford University Press. Unit 8: How fast are reactions? Unit 20: Further Topics

## Web Resources

[http://glencoe.mheducation.com/sites/9834092339/student\\_view0/chapter3/protein\\_denaturation.html](http://glencoe.mheducation.com/sites/9834092339/student_view0/chapter3/protein_denaturation.html)

<https://www.youtube.com/watch?v=O5uqdxQyJj8>

<https://www.britannica.com/science/nutrition>

<https://mcqlearn.com/grade10/chemistry/biochemistry-multiple-choice-questions-answers.php?page=28>

<https://www.britannica.com/science/agricultural-sciences>

## Suggested Activities and/or Formative Assessment

### Activity 1:

Provide students a tabular sheet with rows for elements, complex forms, simple forms, use in the body, and foods with respect to carbohydrates, lipids, and proteins, and ask them to fill the sheet.

Links for worksheets

<https://mcqlearn.com/grade10/chemistry/biochemistry-multiple-choice-questions-answers.php?page=28>

### Activity 2:

Check the solubility of mono and disaccharide with hot and cold water.

### Activity 3:

To introduce the peptide linkage between amino acids in a polypeptide chain, you can follow these steps:

Define amino acids: Start by explaining that amino acids are the building blocks of proteins. Mention that amino acids consist of an amino group ( $-NH_2$ ), a carboxyl group ( $-COOH$ ), a hydrogen atom (H), and a variable side chain ( $-R$  group).

Discuss polypeptides: Explain that polypeptides are chains of amino acids linked together through peptide bonds. Emphasize that peptide bonds are covalent bonds formed between the carboxyl group of one amino acid and the amino group of another amino acid, resulting in the release of a water molecule (dehydration synthesis or condensation reaction).

Illustrate the formation of a peptide bond: Use diagrams or models to visually demonstrate how a peptide bond is formed between two amino acids. Show the carboxyl group of one amino acid bonding with the amino group of another amino acid, resulting in the formation of a peptide linkage (-CO-NH-). Highlight that this process is repeated sequentially to form a polypeptide chain.

## Further Resources

For additional resources related to teaching, learning and formative assessments, please refer to **Learn Smart Classroom by Knowledge Platform**:

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## Topic

## Total Periods

14. Environmental Chemistry I:

8

Atmosphere

Sub-Topic	Range of SLOs	Periods (40 mins)
14.1 Environmental Spheres	14.11-14.12	1
14.2 Layers of Atmosphere	14.2.1-14.2.2	1
	14.2.3	1
14.3 Air Pollutants	14.3.1-14.3.2	1
	14.3.3-14.3.4	1
14.4 Acid Rain and its Effects	14.4.1	1
14.5 Ozone Depletion and its Effects	14.5.1-14.5.3	1
14.6 Global Warming and its Effects	14.6.1-14.6.2	1



## Learning Resources

- Chemistry 10, Caravan Book House, Lahore. Unit 14: The Atmosphere
- Chemistry for Grade 12, National Book Foundation, Islamabad. Chapter 23: Environmental Chemistry

## Suggested Activities and/or Formative Assessment

### Activity 1:

Worksheets can be provided to students to identify the layers of the atmosphere.

### Activity 2:

Assign groups of students to different areas of the school or community to measure air quality. Provide them with air quality monitoring devices or DIY air quality testing kits. Instruct students to collect data on parameters like particulate matter (PM), carbon dioxide (CO<sub>2</sub>), or ozone (O<sub>3</sub>). After collecting data, analyse the results, identify sources of pollution, and discuss ways to improve air quality.

### Activity 3:

Create a model environment using plants, soil, and water. Introduce a simulated acid rain solution (a dilute solution of vinegar or sulfuric acid) and observe the changes in the plants and soil over time. Discuss the causes, consequences, and potential solutions for acid rain.

### Activity 4:

Provide materials for a hands-on activity where students create a model of the ozone layer using balloons or plastic wrap. Use a UV lamp or sunlight to simulate the sun's rays and show how the ozone layer protects against harmful UV radiation.

### Activity 5:

Use a clear plastic container to represent the Earth's atmosphere. Place a heat source (such as a lamp) inside the container and cover it with another clear container or plastic wrap. Observe the temperature inside the container over time and discuss the greenhouse effect, global warming, and climate change.

## Activity 6:

### Links for activities

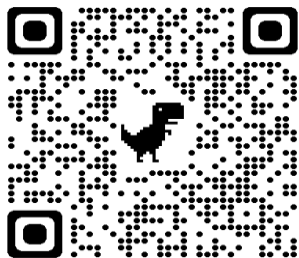
<https://www.legendsoflearning.com/wp-content/uploads/2020/04/Earths-Atmosphere.pdf>

[https://www.labxchange.org/library/items/lb:LabXchange:247ae1c9:lx\\_simulation:1](https://www.labxchange.org/library/items/lb:LabXchange:247ae1c9:lx_simulation:1)

## Further Resources

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FOR ACADEMIC YEAR 2023 AND ONWARDS

**Topic****Total Periods**

15.Environmental Chemistry II: Water

11

Sub-Topic	Range of SLOs	Periods (40 mins)
15.1 Properties of Water	15.1.1	1
	15.1.2-15.1.3	1
15.2 Water as Solvent	15.2.1	1
15.3 Soft and Hard Water	15.3.1-15.3.2	2
	15.3.3	1
15.4 Water Pollution	15.4.1-15.4.2	2
	15.4.3-15.4.5	2
15.5 Water Borne Diseases	15.5.1	1

## Learning Resources

- Chemistry 10, Caravan Book House, Lahore. Unit 15: Water
- Chemistry for Class 10. Punjab Textbook Board, Lahore. Chapter 11: Hydrogen and Water
- Chemistry for IX & X, Sindh Textbook Board, Jamshoro. Chapter 11: Hydrogen and Water
- Rose Marie Gallagher and Paul Ingram, Complete Chemistry, Oxford University Press. Unit 11: Air and Water

## Suggested Activities and/or Formative Assessment

### Activity 1:

Water Testing activity can be performed in the classroom where students can use test strips for water hardness and water samples labelled as soft and hard water and make the response sheet to record their observations and findings for analysis.

### Activity 2:

Provide students with real or hypothetical case studies related to water pollution and waterborne diseases. Ask them to analyse the situation, identify the sources of pollution, and describe the potential health impacts.

### Activity 3:

Assign small groups of students to research and prepare short presentations on specific waterborne diseases or pollution prevention measures. Each group will then teach their findings to the rest of the class.

## Further Resources

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## Topic

## Total Periods

16. Chemical Industries

21

Sub-Topic	Range of SLOs	Periods (40 mins)
16.1 Industries and Basic Metallurgical Operations	16.1.1-16.1.2	3
16.2 Extraction of Metals	16.2.1-16.2.2	3
	16.2.3	2
	16.2.4	1
16.3 Manufacturing of Mineral Acids	16.3.1-16.3.2	2
16.4 Solvay Process	16.4.1-16.4.2	2
16.5 Ammonia and its Uses	16.5.1-16.5.4	4
16.6 Petroleum Industry	16.6.1-16.6.3	1
	16.6.4	2
	16.6.5	1

## Learning Resources

- Chemistry 10, Caravan Book House, Lahore. Unit 16: Chemical Industries
- Chemistry for IX & X, Sindh Textbook Board, Jamshoro. Chapter 13: Nitrogen and Oxygen Chapter 16: Metals and Their Extraction
- Rose Marie Gallagher and Paul Ingram, Complete Chemistry, Oxford University Press. Unit 13: Making Use of Metals Unit 14: Non-metals: Hydrogen and Nitrogen Unit 15: Non-Metals: Oxygen, Sulphur And The Halogens
- Tan Yin Toon, Chen Ling Kwong, John Sadler and Emily Clare, Chemistry Matters G.C.E. 'O' level, Marshall Cavendish Education. Chapter 19: Ammonia
- Christopher N. Prescott, Chemistry, A Course for 'O' Level, Marshall Cavendish Education. Unit 15: Ammonia and its Uses

## Web Resources

<http://www.chemguide.co.uk/inorganic/extraction/aluminium.html>

<http://www.chemguide.co.uk/physical/equilibria/contact.html>

<https://www.youtube.com/watch?v=KBpv2p7T1wo>

<https://www.bbc.co.uk/bitesize/guides/zcc6dxs/revision/1>

<http://www.chemguide.co.uk/physical/equilibria/haber.html>

<https://www.youtube.com/watch?v=NWhZ77Qm5y4>

## Suggested Activities and/or Formative Assessment

### Activity 1:

Draw flow charts for the steps of extraction of metals.

### Activity 2:

Match the columns to identify the names of metals with their name of processes.

## Further Resources

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FOR ACADEMIC YEAR 2023 AND ONWARDS

**Note:** This teacher-led pacing guide has been developed for AKU-EB affiliated schools to facilitate them by

- ensuring smooth transition of a school's academic year.
- ensuring curricular continuity in schools.
- predicting the time and pace of syllabi implementation.

This document also contains **suggested activities and/or formative assessments** that may enhance the learning experience. Please note that these activities are meant to serve as suggestions. As educators, you have the flexibility and autonomy to adapt and modify them to best suit the needs of your students and the dynamics of your classroom.

You are advised to use an ad-blocker while accessing the websites and web resources. In case any website is not functional for any reason, you may inform us at [examination.board@aku.edu](mailto:examination.board@aku.edu) for an alternative or search material via any search engine.

FOR ACADEMIC YEAR 2023 AND ONWARDS