



آغا خان یونیورسٹی ایگزامینیشن بورڈ
AGA KHAN UNIVERSITY EXAMINATION BOARD

Pacing Guide for Teachers

CHEMISTRY

Grade XI

Theory

Number of weeks: 28

Number of periods per week: 5

Key Textbook: Grade XI Chemistry by Punjab Curriculum and Textbook Board

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Institution(s): Aga Khan Higher Secondary School, Karimabad, Karachi and Habib Public High School, Karachi

Topic

1. Stoichiometry

Total Periods

16

Sub-Topic	Range of SLOs	Periods (40 mins)
1.1 Chemistry as a Quantitative Science	1.1.1, 1.2.1	1
1.2 Mole and Avogadro Number	1.2.2, 1.2.3	3
	1.2.4	2
	1.2.5	2
1.4 Excess and Limiting Reagent	1.4.1, 1.4.2	3
1.3 Formulae & Percentage Composition	1.3.1	1
	1.3.2	2
1.5 Theoretical, Actual and Percentage Yield	1.5.1, 1.15.2	2

Web Resources

<https://bpb-ca-c1.wpmucdn.com/blog44.ca/dist/a/4/files/2011/08/STP-and-RTP-and-Supp-and-KEY-1rxci5.pdf>
[https://chem.libretexts.org/Bookshelves/Introductory_Chemistry/Introductory_Chemistry_\(CK-12\)/12%3A_Stoichiometry/12.02%3A_Mole_Ratios#:~:text=A%20mole%20ratio%2](https://chem.libretexts.org/Bookshelves/Introductory_Chemistry/Introductory_Chemistry_(CK-12)/12%3A_Stoichiometry/12.02%3A_Mole_Ratios#:~:text=A%20mole%20ratio%2)

[0is%20a,of%20the%20balanced%20chemical%20equation. OR
https://chem.libretexts.org/Bookshelves/Introductory_Chemistry/Introductory_Chemistry_\(CK-12\)/12%3A_Stoichiometry/12.02%3A_Mole_Ratios#:~:text=A%20mole%20ratio%20is%20a,of%20the%20balanced%20chemical%20equation.](https://chem.libretexts.org/Bookshelves/Introductory_Chemistry/Introductory_Chemistry_(CK-12)/12%3A_Stoichiometry/12.02%3A_Mole_Ratios#:~:text=A%20mole%20ratio%20is%20a,of%20the%20balanced%20chemical%20equation.)

Suggested Activities and/ or Formative Assessment

Activity 1:

For stoichiometry, it's suggested that teachers make students work in group to solve and practice numerical from the end of exercise questions given in key textbooks as well as from additional resources mentioned.

Activity 2:

Peer to peer assessment: Let students check each other's solutions and grade each other as per the criteria given by the teacher or by the rubric given by teacher.

Activity 3:

Let students solve questions as a team of two or three to make the assessment more engaging and fun. Make teams of students compete with one another to help them achieve results in allotted time to help them time manage their numerical solving.

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

Total Periods

2. Atomic Structure

16

Sub-Topic	Range of SLOs	Periods (40 mins)
2.1 Discharge Tube Experiment	2.1.1-2.1.2	2
2.2 Planck's Quantum Theory	2.2.1	1
2.3 Bohr's Atomic Theory	2.3.1-2.3.2, 2.3.4	3
	2.3.3, 2.3.5	1
2.4 X-Rays and Atomic Numbers	2.4.1 - 2.4.4	2
2.5 Heisenberg's Uncertainty Principle and Quantum Number	2.5.1, 2.5.2	1
	2.5.3	1
	2.5.4	2
2.7 Electronic Configuration	2.7.1- 2.7.2	2
2.6 Dual Nature of Electron	2.6.1	1

Web Resource

<http://misterguch.brinkster.net/PRA014.pdf>

Suggested Activities and/or Formative Assessment

Activity 1:

Ask the following questions:

- 1- What do we know about atoms?
- 2- How has our (scientists') understanding of atoms evolved over time? / Why do you think it was necessary to develop different atomic theories throughout history?

For each question, make a mind map on the board based on all the points generated by the students. Use this activity to generate ideas, interest and clear any misconceptions that the students may have.

Activity 2:

Give students time to research orbit and orbital as homework. In class, ask them to compare the two. Instead of telling them, ask them what they have found out about it. Correct misconceptions where needed.

Activity 3:

Conduct a quiz based on questions from the following link:

<https://quizizz.com/admin/quiz/589b08c4fc7d61dc55b85b3b/quantum-numbers>

Further Resources

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



Topic

Total Periods

3. Theories of Covalent Bonding
and Shape of Molecules

11

Sub-Topic	Range of SLOs	Periods (40 mins)
3.1 Bond Characteristics	3.1.1- 3.1.3 3.1.6	1
	3.1.4, 3.1.5	1
	3.1.7, 3.1.8	1
3.2 Shape of Molecules using VSEPR Theory	3.2.1, 3.2.2	1
3.3.VBT, MOT and Hybridization	3.3.1, 3.3.2	1
	3.3.3, 3.3.4	2
	3.3.5, 3.3.7	1
	3.3.6	2
3.4 Effect of Bonding on Physical and Chemical Properties	3.4.1 -3.4.3	1

Web Resources

<https://phet.colorado.edu/en/simulations/molecule-polarity>

<https://phet.colorado.edu/en/simulations/molecule-shapes>

[https://chem.libretexts.org/Courses/Sacramento_City_College/SCC%3A_CHEM_330_Adventures_in_Chemistry_\(AlviarAgnew\)/04%3A_Chemical_Bonds/4.12%3A_Shapes_and_Properties-Polar_and_Nonpolar_Molecules](https://chem.libretexts.org/Courses/Sacramento_City_College/SCC%3A_CHEM_330_Adventures_in_Chemistry_(AlviarAgnew)/04%3A_Chemical_Bonds/4.12%3A_Shapes_and_Properties-Polar_and_Nonpolar_Molecules)

Suggested Activities and/or Formative Assessment

Activity 1:

Make students work in groups and explore the simulation on the given link:

<https://phet.colorado.edu/en/simulations/molecule-polarity>

(You can provide them with questions to explore or ask them to explore freely and then discuss their findings in class.)

Activity 2:

Explore molecules and bonding using DIY models of plaster of Paris/ plasticine & Toothpicks.

Activity 3:

Use presentation to deliver the lesson along with 3D models for better understanding and engagement of class.

Further Resources

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Topic

4. Gases

Total Periods

11

Sub-Topic	Range of SLOs	Periods (40 mins)
4.1 Kinetic Molecular Interpretation of gases	4.1.1, 4.1.2	1
	4.1.2	1
	4.1.3	1
	4.1.4	1
4.2 Absolute Temperature	4.2.1-4.2.2	1
4.3 Ideal Gas Equation	4.3.1-4.3.2	1
	4.3.3 - 4.3.5	1
4.4 Deviation from Ideal Behaviour	4.4.1	1
4.5 Vander Waal Equation	4.5.1, 4.5.2	1
4.6 Liquefaction of Gases	4.6.1, 4.6.2	1
4.7 Plasma	4.7.1- 4.7.3	1

Web Resources

<https://www.chemteam.info/GasLaw/Gas-Ideal-Prob1-10.html>

http://chemsite.lsrhs.net/gasses/handouts/Ideal_Problems.pdf

Suggested Activities and/or Formative Assessment

Activity 1:

In pairs or groups, ask students to solve the problems given in key textbooks and additional resource links.

Activity 2:

Divide students into groups and assign one of the following to each group: Boyle's law, Charles's law, Avogadro's law, Dalton's law of partial pressure, Graham's law of diffusion/effusion. Ask each group to research about it and present their findings to class with the help of models and/ or diagrams.

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

5. Liquids

Total Periods

5

Sub-Topic	Range of SLOs	Periods (40 mins)
5.1 Kinetic Molecular Interpretation of Liquid	5.1.1 (relate it to 6.1.1)	1
5.2 Intermolecular forces	5.2.1- 5.2.2	1
	5.2.3 - 5.2.4	1
5.3 Phase change	5.3.1- 5.3.3	1
5.4 Liquid Crystals	5.4.1- 5.4.4	1

Suggested Activities and/or Formative Assessment

Activity 1

Students can be given SLOs for presentation as group work. Students will demonstrate the topic to the rest of their peers. Teachers can facilitate them in their research and assess their presentation.

Activity 2

Ask the following questions:

- 1- Which physical properties of liquids make them unique (different from solids and gases)?
- 2- How do hydrogen bonds contribute to some of the identified properties?

For each question, make a mind map on the board based on all the points generated by the students. Use this activity to generate ideas, interest and clear any misconceptions that the students may have.

Further Resources

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FOR ACADEMIC YEAR 2023 AND ONWARDS

Topic

6. Solids

Total Periods

5

Sub-Topic	Range of SLOs	Periods (40 mins)
6.1 Kinetic Molecular Interpretation of Solids	6.1.1	Done with 5.1.1
6.2 Types and Properties of Solid	6.2.1- 6.2.5	2
6.3 Crystal Lattice	6.3.1, 6.3.2	1
	6.3.3	1
6.4 Types of Crystalline Solid	6.4.1, 6.4.2	1

Suggested Activities and/or Formative Assessment

Activity 1:

Ask students to identify key ideas of KMT they remember from previous lessons.

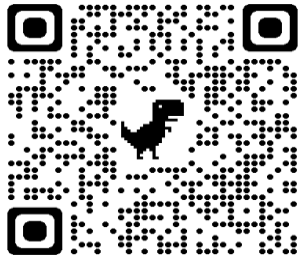
Activity 2:

Students can be given SLOs for presentation as group work. Students will demonstrate the topic to the rest of their peers. Teachers can facilitate them in their research and assess their presentation.

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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FOR ACADEMIC YEAR 2023 AND ONWARDS

Topic

Total Periods

7. Chemical Equilibrium

11

Sub-Topic	Range of SLOs	Periods (40 mins)
7.1 Reversible Reaction and Dynamic Eq.	7.1.1-7.1.3	1
	7.1.4	2
	7.1.5-7.1.7	2
7.2 Le-Chatelier's Principle and its Application	7.2.1-7.2.2	2
7.3 Solubility Product and Precipitation Reactions	7.3.1-7.3.3	1
	7.3.4	1
	7.3.5	1
7.4 Common Ion Effect	7.4.1- 7.4.2	1

Web Resource

<https://christou.chem.ufl.edu/wp-content/uploads/sites/62/2017/01/Chapter-19-Ionic-Equilibria-Week-1.pdf>

Suggested Activities and/or Formative Assessment

Activity 1:

Ask students to watch the given videos on Le-Chatelier's principle as homework. Discuss the key learnings in class. Use the end of exercise questions and additional resource link to solve problems and better understanding.

Temperature:

https://www.youtube.com/watch?v=j7FOzKIDrg8&ab_channel=KhanAcademy

Volume:

https://www.youtube.com/watch?v=FmqyKCQo7Tk&ab_channel=KhanAcademy

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

Total Periods

8. Acids, Bases and Salts

18

Sub-Topic	Range of SLOs	Periods (40 mins)
8.1 Acids, Bases and Amphoteric Substances	8.1.2-8.1.3	1
	8.1.4	2
8.2 Conjugate Acids and Bases	8.1.1, 8.2.1- 8.2.2	2
8.3 Strengths of Acids and Bases	8.3.2-8.3.3	2
	8.3.1, 8.3.4-8.3.5	1
	8.3.6	2
	8.3.7	1
8.4 Lewis Concept of Acids & Bases	8.4.1-8.4.2	1
8.5 Buffer Solution	8.5.1-8.5.3	1
	8.5.4	1
	8.5.5	2
8.6 Hydrolysis and Hydration	8.6.1, 8.6.3	1
	8.6.2	1

Web Resources

<https://web.mnstate.edu/jasperse/Chem210/Extra%20Practice%20Sets%20Chem%20210/Test2%20ch17a%20Acid-Base%20%20Practice%20Problems.pdf>

<https://christou.chem.ufl.edu/wp-content/uploads/sites/62/2017/01/Chapter-19-Ionic-Equilibria-Week-1.pdf>

Suggested Activities and/or Formative Assessment

Activity 1:

Ask students to bring items of daily use that are acidic or basic in nature. Test the items using litmus paper.

Activity 2:

Use additional resource links for classwork and assessment. Students can solve worksheets from the resource.

<https://web.mnstate.edu/jasperse/Chem210/Extra%20Practice%20Sets%20Chem%20210/Test2%20ch17a%20Acid-Base%20%20Practice%20Problems.pdf>

Activity 3:

Ask students to research about the importance of buffer solutions in daily life (SLOs 8.5.2) and share their findings in class.

Activity 4:

Give end of exercise questions from key textbooks and past paper questions as practice questions. Additional Resource link can also be used for assessment worksheet or Q/A.

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

Total Periods

9. Chemical Kinetics

7

Sub-Topic	Range of SLOs	Periods (40 mins)
9.1 Chemical Kinetics	9.1.1, 9.1.2	1
9.2 Rate and Order of Reaction	9.2.3, 9.2.4, 9.3.2	2
9.3 Collision Theory, Transition State and Activation Energy	9.3.4	1
	9.3.5	1
9.4 Catalysis	9.3.3 9.4.1- 9.4.3	1
	9.2.2 - 9.3.1	1

Web Resources

[https://chem.libretexts.org/Bookshelves/Physical_and_Theoretical_Chemistry_Textbook_Maps/Supplemental_Modules_\(Physical_and_Theoretical_Chemistry\)/Kinetics/05%3A_Experimental_Methods/5.01%3A_Determining_Reaction_Order](https://chem.libretexts.org/Bookshelves/Physical_and_Theoretical_Chemistry_Textbook_Maps/Supplemental_Modules_(Physical_and_Theoretical_Chemistry)/Kinetics/05%3A_Experimental_Methods/5.01%3A_Determining_Reaction_Order)

<https://www.khanacademy.org/science/ap-chemistry-beta/x2eef969c74e0d802:kinetics/x2eef969c74e0d802:introduction-to-rate-law/v/experimental-determination-of-rate-laws>

[https://chem.libretexts.org/Bookshelves/General_Chemistry/Chemistry_1e_\(OpenS_TAX\)/12%3A_Kinetics/12.7%3A_Catalysis](https://chem.libretexts.org/Bookshelves/General_Chemistry/Chemistry_1e_(OpenS_TAX)/12%3A_Kinetics/12.7%3A_Catalysis)

Suggested Activities and/or Formative Assessment

Activity 1

Students can be given SLOs for presentation as group work. Students will demonstrate the topic to the rest of their peers. Teachers can facilitate them in their research and assess their presentation.

Activity 2

Ask the questions:

- 1- What do you know about the rate of reaction?
- 2- How does a catalyst affect the rate of reaction?

For each question, make a mind map/ write key points on the board based on all the points generated by the students. Use this activity to generate ideas, interest and clear any misconceptions that the students may have.

Further Resources

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Topic

Total Periods

10. Solution & Colloids

11

Sub-Topic	Range of SLOs	Periods (40 mins)
10.1 Colloid, Suspension and Solution	10.1.1-10.1.4	2
10.2 Concentration Unit	10.2.1	2
10.3 General Properties of Solution & Solubility	10.3.1-10.3.2	1
	10.3.3	1
10.4 Raoult's Law	10.4.1-10.4.3	2
10.5 Colligative Properties	10.5.1-10.5.2	2
	10.5.3	1

Web Resource

[https://chem.libretexts.org/Bookshelves/Physical_and_Theoretical_Chemistry_Textbook_Maps/Supplemental_Modules_\(Physical_and_Theoretical_Chemistry\)/Physical_Properties_of_Matter/Solutions_and_Mixtures/Solution_Basics/Units_Of_Concentration](https://chem.libretexts.org/Bookshelves/Physical_and_Theoretical_Chemistry_Textbook_Maps/Supplemental_Modules_(Physical_and_Theoretical_Chemistry)/Physical_Properties_of_Matter/Solutions_and_Mixtures/Solution_Basics/Units_Of_Concentration)

Suggested Activities and/or Formative Assessment

Activity 1:

Ask students to solve the questions on the given link in class. Facilitate and clear misconceptions where needed.

http://msdilalloscience.weebly.com/uploads/6/9/6/2/6962884/concentrations_worksheet_with_main_formulas_on_top.pdf

Activity 2:

Make a worksheet with questions relating to the graph for deeper understanding. Give student time to reflect on the graph before attempting worksheet. Use HOT questions to assess students. Ask them to predict the solubility of various solutions on graph and why would it be such a case. Use same method as above in graph for Raoult's law.

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**

11. Thermochemistry

13

Sub-Topic	Range of SLOs	Periods (40 mins)
11.1 Thermodynamics	11.1.1-11.1.2	1
11.2 First Law of Thermodynamics	11.2.1-11.2.2	1
	11.2.3	1
11.3 Hess's Law	11.3.1-11.3.2	1
	11.3.3	2
11.4 Measurement of Enthalpy of a reaction	11.4.1	1
	11.4.2	2
11.5 Born-Haber Cycle	11.5.1,11.5.2	1
	11.5.3	2
11.6 Heat Capacity	11.6.1	1

Web Resources

http://butane.chem.illinois.edu/cyerkes/102_F_11/Worksheets/Worksheet-First%20Law.pdf

[https://www.hartismere.com/PNEQ53T9G10.pdf/Hess%20Law%20Problems%20\(with%20ans\)](https://www.hartismere.com/PNEQ53T9G10.pdf/Hess%20Law%20Problems%20(with%20ans))

https://www.cerritos.edu/chemistry/_includes/docs/Chem_111/Others/Worksheets/Answers/Worksheet%20Born-Haber%20Cycle%20Answer%20Key%20PDF.pdf

Suggested Activities and/or Formative Assessment

Activity 1:

Ask the students to watch the given video:

<https://www.khanacademy.org/science/chemistry/thermodynamics-chemistry/internal-energy-sal/v/first-law-of-thermodynamics-introduction>

Conduct a whole class discussion on key ideas from the video. Clear misconceptions if needed.

Activity 3:

Ask students to recall their practical of calorimetry done as Lab practical for glass calorimeter.

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**

12. Electrochemistry

16

Sub-Topic	Range of SLOs	Periods (40 mins)
12.1 Oxidation and Reduction	12.1.1 -12.1.2	1
	12.1.3 - 12.1.4	2
	12.1.5 - 12.1.6	3
	12.1.7 - 12.1.8	1
12.2 Electrode, Electrode potential and electrochemical series	12.2.1	1
	12.2.2	1
12.3 Types of Electrochemical cells	12.3.1,12.3.2	1
	12.3.3	1
	12.3.4	1
12.4 Faraday's Law	12.4.1	1
	12.4.3	2

Web Resources

<https://chemistrytalk.org/understanding-oxidation-states/>

<https://www.livingston.org/cms/lib4/NJ01000562/Centricity/Domain/826/more%20practice%20balancing%20redox.pdf>

<https://www.westminsterpublicschools.org/cms/lib/CO01001133/Centricity/Domain/398/RedOx%20Reaction%20Practice.pdf>

[https://chem.libretexts.org/Bookshelves/Introductory_Chemistry/Introductory_Chemistry_\(CK-12\)/23%3A_Electrochemistry/23.06%3A_Calculating_Standard_Cell_Potentials#:~:text=The%20silver%20half%2Dcell%20will,0red%E2%88%92E0oxid.](https://chem.libretexts.org/Bookshelves/Introductory_Chemistry/Introductory_Chemistry_(CK-12)/23%3A_Electrochemistry/23.06%3A_Calculating_Standard_Cell_Potentials#:~:text=The%20silver%20half%2Dcell%20will,0red%E2%88%92E0oxid.)

<https://youtu.be/PQ48N5jaG2w>

[AP Chemistry Help \(varsitytutors.com\)](#)

Suggested Activities and/or Formative Assessment

Activity 1:

Discuss the rules of finding oxidation state and practice different scenarios with students.

Activity 2:

Solve questions as an example and use the reduction potential table and emphasis on redox equation to determine cell potential.

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>



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 for an alternative or search material via any search engine.

FOR ACADEMIC YEAR 2023 AND ONWARDS