|  |
| --- |
| **Date**: September 19-23, 2025 |
| **Subject**: Chemistry |
| **Grade**: 12 |
| **Duration**: 80 Minutes |
| **Topic**: Atomic Structure and the Periodic Table |
| **Subtopic:** Radioactivity and Band of Stability |
| **Number of Students**: 12 [Girls: 10] [Boys: 2] |
| **General Objectives**:  *On Completion of this lesson, students will be able to*:   * Understand the theory of atoms as a useful construct that explains the impact of nuclear chemistry on society.   **Specific Objectives**:  *By the end of the lesson, students will be able to:*   1. Explain the phenomenon of radioactivity and write balanced nuclear equations for alpha, beta, and gamma emissions, including calculations with neutron/proton ratios. 2. Explain the band of stability and describe how unstable nuclides move toward stability through different modes of emission. 3. Cite at least three uses of radioisotopes. |
| **Key Scientific Attitudes:**  Critical thinking, communication, collaboration, cooperation, open-mindedness |
| **Content**   * ***Radioactivity:* spontaneous emission of radiation from unstable nuclei.**   + Alpha: decrease of 2 protons, 2 neutrons.   + Beta: neutron transforms into proton + electron.   + Gamma: energy release, no change in mass or atomic number. |
| **Instructional Sequence**  ***Engage:***   * **Demonstration / Hook**: Show a short video clip or animation of a Geiger counter detecting radiation from a radioactive source. * **Prompt**: Ask students: *“If atoms are considered stable building blocks of matter, why do some atoms spontaneously change into other atoms?”* * Purpose: Generate curiosity and link atomic structure to nuclear instability.   ***Explore:***   * **Activity**: Students are given cards showing nuclear reactions with missing particles.   Example:    * Students deduce the daughter nuclide (Ba-222). * Groups then calculate n/p ratios for parent and daughter nuclides to observe the change.   ***Explain:***   * Teacher leads a structured discussion:   1. ***Definition of radioactivity***: spontaneous emission of radiation from unstable nuclei.   2. Types of emissions:      + **Alpha (α)**: decrease of 2 protons, 2 neutrons.      + **Beta (β−)**: neutron → proton + electron.      + **Gamma (γ)**: energy release, no change in mass or atomic   3. ***Writing nuclear equations*** with examples:      * 1. Band of Stability: plot Z vs N diagram showing stable nuclides along a curve. * Too many neutrons 🡪 beta emission or neutron emission. * Too many protons 🡪 positron emission or electron capture. * Too many of both 🡪 alpha emission.   ***Elaborate:***   * **Case Study and Application**:   + Provide isotopes (e.g. C-14, Ra-223, Na-22, Cs-137).   + Students determine:     - n/p ratio.     - whether isotope is stable or unstable.     - likely decay mode to move toward the band of stability. * **Discussion**: Uses of radioisotopes.   + Medicine: cancer treatment (Co-60), medical tracers (I-131).   + Industry: radiography to test welds (Ir-192).   + Archaeology: carbon dating (C-14).   ***Evaluate:***   * Exit Ticket / Quiz:   + Write the balanced nuclear equation for the alpha decay of uranium-238.   + A nuclide has Z = 50 and N = 82. Calculate its n/p ratio. Is it above, below, or within the band of stability?   + Name one medical, one industrial, and one archaeological use of radioisotopes. * Teacher collects for formative assessment. |