

Radioactive Dating Game

Spoken Tutorial Project

<http://spoken-tutorial.org>

National Mission on Education through ICT

<http://sakshat.ac.in>

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Learning Objectives



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We will demonstrate,



Learning Objectives

We will demonstrate,

- ▶ **Radioactive Dating Game PhET simulation**



System Requirement



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- ▶ **Ubuntu Linux OS v 16.04**



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- ▶ **Java v 1.8.0**



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- ▶ **Ubuntu Linux OS v 16.04**
- ▶ **Java v 1.8.0**
- ▶ **Firefox Web Browser v 60.0.2**



Pre-requisites



Pre-requisites

- ▶ **Learners should be familiar with high school physics and chemistry**



Learning Goals



Learning Goals

- ▶ **Radioactive decay and half-life**



Learning Goals

- ▶ Radioactive decay and half-life
- ▶ Decay rates



Learning Goals

- ▶ Radioactive decay and half-life
- ▶ Decay rates
- ▶ Measurement of radioactivity



Learning Goals

- ▶ Radioactive decay and half-life
- ▶ Decay rates
- ▶ Measurement of radioactivity
- ▶ **Radioactive dating**



Link for PhET Simulation



Link for PhET Simulation

<http://phet.colorado.edu>



Stable and Unstable Nuclei



Stable and Unstable Nuclei

- ▶ **Electrostatic repulsion between protons in nucleus**



Stable and Unstable Nuclei

- ▶ **Electrostatic repulsion between protons in nucleus**
- ▶ **Strong nuclear force is associated with binding energy**



Stable and Unstable Nuclei

- ▶ **Electrostatic repulsion between protons in nucleus**
- ▶ **Strong nuclear force is associated with binding energy**
- ▶ **If binding energy is low, the nucleus is unstable and is radioactive**



Radioactive Decay



Radioactive Decay

- ▶ **Radioactive decay**



Radioactive Decay

- ▶ **Radioactive decay**
- ▶ **i) Alpha decay**



Radioactive Decay

- ▶ Radioactive decay
 - ▶ i) Alpha decay
 - ▶ ii) Beta decay



Radioactive Decay

- ▶ **Radioactive decay**
- ▶ **i) Alpha decay**
- ▶ **ii) Beta decay**
- ▶ **iii) Gamma decay**



Half-Life



Half-Life

- ▶ **Half-life is the time taken for half of the nuclei in a radioactive material to decay**



Radioactive Dating



Radioactive Dating

- ▶ Two isotopes of C: ^{12}C and ^{14}C



Radioactive Dating

- ▶ **Two isotopes of C: ^{12}C and ^{14}C**
- ▶ **Both isotopes $\rightarrow \text{CO}_2$, living organisms**



Radioactive Dating

- ▶ **Two isotopes of C: ^{12}C and ^{14}C**
- ▶ **Both isotopes \rightarrow CO_2 , living organisms**
- ▶ **Death of organism: ratio and ^{14}C fall**



Radioactive Dating-Cont'd



Radioactive Dating-Cont'd

- ▶ **Radioactive dating, $^{14}\text{C}:$ ^{12}C of sample vs recently dead specimens**



Radioactive Dating-Cont'd

- ▶ **Radioactive dating, $^{14}\text{C}:$ ^{12}C of sample vs recently dead specimens**
- ▶ **Ur-Pb dating for rocks, artefacts etc**



Assignment



Assignment

- ▶ Estimate ages of all objects in Dating Game screen



Assignment

- ▶ Estimate ages of all objects in Dating Game screen
- ▶ Correlate age (yrs) with percent unstable nucleus



Assignment

- ▶ Estimate ages of all objects in Dating Game screen
- ▶ Correlate age (yrs) with percent unstable nucleus
- ▶ Correlate age (yrs) with depth at which object found



Assignment

- ▶ Estimate ages of all objects in Dating Game screen
- ▶ Correlate age (yrs) with percent unstable nucleus
- ▶ Correlate age (yrs) with depth at which object found
- ▶ **C-14: animal; U-238: rocks, objects**



Summary



Summary

We have demonstrated,



Summary

We have demonstrated,

- ▶ **Radioactive Dating Game PhET simulation**



Summary



Summary

- ▶ **Radioactive decay and half-life**
- ▶ **Decay rates**
- ▶ **Measurement of radioactivity**
- ▶ **Radioactive dating**



About the Spoken Tutorial Project

- ▶ Watch the video available at http://spoken-tutorial.org/What_is_a_Spoken_Tutorial
- ▶ It summarises the Spoken Tutorial project
- ▶ If you do not have good bandwidth, you can download and watch it



Spoken Tutorial Workshops

The Spoken Tutorial Project Team

- ▶ Conducts workshops using spoken tutorials
- ▶ Gives certificates to those who pass an online test
- ▶ For more details, please write to contact@spoken-tutorial.org



Forum for specific questions

- ▶ Do you have questions in **THIS Spoken Tutorial?**
- ▶ Please visit
<http://forums.spoken-tutorial.org>
- ▶ Choose the minute and second where you have the question
- ▶ Explain your question briefly
- ▶ Someone from our team will answer them



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Acknowledgements

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- ▶ It is supported by the National Mission on Education through ICT, MHRD, Government of India
- ▶ More information on this Mission is available at

<http://spoken-tutorial.org/NMEICT-Intro>

