teacher guide

Nuclear reactions 5: Fission and fusion

Components

	NAME	DESCRIPTION	AUDIENCE
	*Fission and fusion* teachers guide	The guide describes how to use two worksheets to explain mass defect calculations.	teachers
	*The ITER project* fact sheet	This fact sheet contains general information about the ITER fusion project, and a schematic diagram of the ITER reactor.	students
	*Fission* worksheet	This worksheet contains questions relating to calculation of mass defect and binding energy.	students
	*Fusion* worksheet	This worksheet contains questions relating to calculation of energy from the fusion process. Questions relating to the experimental ITER fusion reactor are included.	students

Purpose

To provide understanding of fission and fusion processes, including quantitative examples of how energy is calculated.

Outcomes

Students:

- understand fission, including how to calculate energy produced in a nuclear fission reaction;
- understand fusion, including how to calculate energy produced in a fusion reaction.;
- describe how nuclear fusion can produce energy, both in the Sun and in a fusion reactor; and
- describe how a major international research program is in place to demonstrate viable commercial production of power by nuclear fusion.

Activity summary

ACTIVITY	POSSIBLE STRATEGY
Students read through the worked example on the worksheet, *Fission*, with the help of their teacher.	teacher-led discussion
Students then attempt questions on the rest of the worksheet, *Fission*.	student work
Students attempt part 1 of the worksheet, *Fusion*.	student work
Students read fact sheet, *The ITER project*.	individual
Students complete part 2 of the worksheet, *Fusion*.	student work

Technical requirements

The teacher guide, fact sheet and worksheets require Adobe Reader (version 5 or later), which is a free download from www.adobe.com. The worksheets are also provided in Microsoft Word format.

Teacher notes

The worksheets, *Fission* and *Fusion*, contain worked examples of calculation of mass defect and binding energy. Both worksheets contain problems for students to attempt. As the values of unified atomic masses vary from source to source, data for use in calculations is included.

As the treatment of electrons is not always clear, the worksheets assume that neutral atoms are used when calculating mass defect. Therefore electrons need to be included as fundamental particles in calculations. In cases where only the mass of nuclei are used, electrons should not be included as fundamental particles.

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banner image: 'Picture of Cerenkov Radiation Effect in the Reed Research Reactor' by United States Nuclear Regulatory Commission, PD-USGOV, commons.wikimedia.org/wiki/File:Cerenkov_Effect.jpg

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Associated SPICE resources

Nuclear reactions 5: Fission and fusion may be used in conjunction with related SPICE resources to address the broader topic of nuclear physics.

DESCRIPTION	LEARNING PURPOSE
Nuclear reactions This learning pathway shows how a number of SPICE resources can be combined to teach the topic of ionising radiation and nuclear reactions.	
Nuclear reactions 1: Mines to medicine Students express their opinions on a moral issue after viewing a film of demonstrators at a uranium mine and after a medical physicist explains why nuclear medicine is so important to diagnostic and therapeutic procedures.	**Engage**
Nuclear reactions 2: Nuclear radiation Students investigate types and properties of radiation with particular attention to penetrative characteristics.	**Explore 1**
Nuclear reactions 3: Nuclear decay Students manipulate variables in an interactive simulation to investigate connections between decay and half-life. An alternative procedure using dice is provided.	**Explore 2**
Nuclear reactions 4: Decay chains In three separate interactive simulations, students experience modelling as an alternative way of exploring nuclear decay and half-life.	**Explore 3**
Nuclear reactions 5: Fission and fusion Worked examples explain how to calculate mass defect and binding energy for fission and fusion reactions. The experimental ITER fusion reactor is also discussed.	**Explain**
Nuclear reactions 6: Nuclear medicine Students explore applications of radioisotopes in medicine.	**Elaborate 1**
Nuclear reactions 7: Radioisotopes in research Fact sheets illustrate the use of radioisotopes in research being undertaken at The University of Western Australia.	**Elaborate 2**