

Subject Spotlight Lesson Plan

Title of Session	Subject Spotlight: Material Science - Neutrons, Crystals and Nuclear Fusion
Description:	When solid materials are needed to build nuclear reactors, a simple way to assess their suitability is by inspecting the arrangement of atoms within them. In this workshop, we'll discuss the holy grail of electricity production, nuclear fusion, the need to develop suitable materials for fusion reactors, and some tricks for testing their viability. In the main activity, we'll simulate neutron irradiation of different crystal systems (solid materials) by bowling neutrons (balls) at atoms (skittles).

Duration of session:	~45 mins	Target Audience:	Y12/13
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Regional Progression Framework - Learning Outcomes:
LO1 - Awareness of HE and the different opportunities available. Be able to challenge any myths relating to HE.
LO2 - Identify the link between GCSE attainment and progression opportunities and how these can support life or career goals
LO5 - Learner knows how to research different routes into HE and how to make an application
Gatsby Benchmarks:
7. Encounters with Further and Higher Education - All students should understand the full range of learning opportunities that are available to them. This includes both academic and vocational routes and learning in schools, colleges, universities and in the workplace.

Timings:	Activity/Task/Information:	Instructions for teacher:	Resources needed:
0:00-04:35	<ul style="list-style-type: none"> Introduction 	Pause the video at 3:43 and allow students for 1 minute, to quickly write down their thoughts on what 'irradiation-tolerant materials for nuclear fusion'. No expectation of 'correct' answer.	
04:36-12:39	<ul style="list-style-type: none"> Nuclear Fusion 	Ask students to take notes in order to further their understanding and in preparation of returning to their understanding of the definition at the end of the workshop .	
12:40-19:06	<ul style="list-style-type: none"> Crystallography - Question 	Pause video at 15:43 to allow students to work out calculation on the screen. Allow students 5 minutes to complete this question, they may use a calculator. Answers are provided at 15:58	Calculator
19:07 – 25:30	<ul style="list-style-type: none"> Activity 	<p>Simulation of irradiation damage of different metals by placing skittles on colour-coded positions of handout. Learners will need at least one member of the group to count and note the number of pins that fall for each structure and calculate an average for each of bcc, fcc or hcp. Split learners in to as many groups as possible (as limited by resources) and help to complete the activity. The handout only need be used as a guide for the arrangement of the atoms, so the activity can be scaled up or down where necessary.</p> <p>Once the activity is complete, allow students to answer the questions in the video that appear from 21:005. Pause the Video at 22:14 and give students 5 minutes to complete all post-activity questions.</p>	Activity handout
25:31-29:24	<ul style="list-style-type: none"> Debrief 	Allow students to take 1 minute at the end to come back have ago at explaining the title 'Irradiation-	

		tolerant materials for nuclear fusion'. Develop discussion if time permits!	
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Overview of all resources:	
Calculator (optional)	
Pen or pencil	
1 ball (perhaps tennis ball), 9 or 10 objects that can serve as bowling pins (perhaps glue sticks).	
Activity handout	
Bonus for students that are interested in Fusion	https://ippex.pppl.gov/#vt
Resources to share	Materials at Uni of Manchester: https://www.materials.manchester.ac.uk/ What can you do with Materials? https://www.prospects.ac.uk/careers-advice/what-can-i-do-with-my-degree/materials-science-and-engineering