Great Quantum World

How does the environment affect how a paper spinner falls?

AGE RANGE: 7–11 years

OVERVIEW

Using 'Izzy Jones's Quantum World' pupils meet the character of Izzy - a young girl trying to find her place in the world. In her search for finding the place that allows her to be her best, the story subtly illustrates how important it is for quantum researchers to control the variables in the environment around the atoms they are working with. This is so that they can get the best performance to create new materials. In this enquiry, pupils investigate ways that they can control environmental variables and how this can affect the performance of paper spinners whilst also reinforcing their understanding of independent and dependent variables.

LEARNING OBJECTIVES

- Explain that unsupported objects fall towards the Earth because of the force of gravity acting between the Earth and the falling object
- Identify the effects of air resistance that can act between moving surfaces

WORKING SCIENTIFICALLY

- Set up a simple practical comparative enquiry
- Report and present findings, including conclusions, causal relationships and explanations of and degree of trust in results, in oral and written forms.
- Identify differences, similarities or changes related to simple scientific ideas and processes

RESOURCES (groups of 3–4)

- paper spinner templates
- different materials to make spinner from e.g. paper, card, tracing paper etc.
- scissors
- paper clips
- metre ruler
- hairdryer/fan (dependent on variable selected by the class)

TO SUPPORT TEACHING

- 7-11 Great Quantum World video
- Book: 'Izzy Jones's Great Quantum World', by Jules Pottle, ISBN:9781739939939 (optional)
- Izzy Jones story read video
- Brian Cox video

KEY WORDS

- variables
- independent
- dependent
- control

The Careers Chat resources give pupils time to learn more about research scientists, Maddy and Jess, as well as author Jules Pottle!

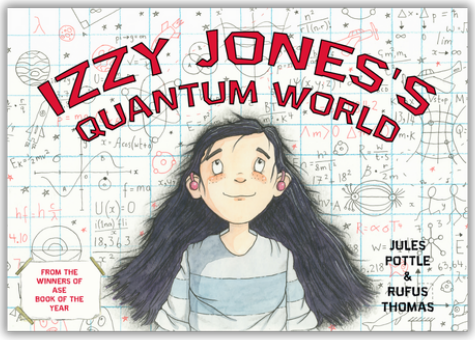
Maddy's Video Chat

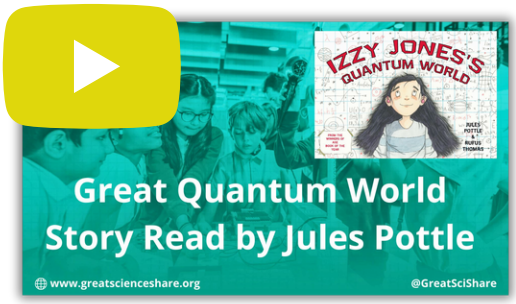
Jess's Video Chat

Jules's Video Chat

Step-by-step guide

Read Jules Pottle's story *Izzy Jones's Quantum World* or watch the **story read video**.





Questioning

1.Play the 7-11 Great Quantum World video with Maddy, Jess and Jules to introduce the enquiry. Provide a variety of different sized templates and materials for each pupil to make one paper spinner - give them free choice over which material/size they use. In groups of 3-4, give pupils 10 mins 'exploring' time to drop their spinners, trying to get them to land on a marked spot on the floor.

Gathering evidence

2. Engage in a class discussion about what they noticed.

- *Did the paper spinners always land on the marked spot?*
- *Did they always land in the same place?*
- *Did everyone's spinners take the same amount of time to fall?*

1 2 3 Planning

3. Pupils to list as many **independent variables** and **dependent variables** as they can. Ask pupils if they have identified any environmental factors that are difficult to control on their list. *(for example, where they conduct the investigation)*

Independent variable

The one you choose to change

- size of spinner
- material it's made from

Dependent variable

The one you choose to measure

- distance from landing spot
- time taken to fall

NB: Pupils will find it easier to list variables linked to the properties of the spinner. However, in science, there are also environmental factors which can affect results. Support pupils to consider these, identifying the environmental factors that affect the spinner, mainly air movement.

Questioning

4. By watching the Brian Cox video, where he explains the affect of limiting air movement, ask the pupils to identify the independent variable. Develop understanding of this key word.

Note: In the video the environment that the experiment was done in had the air removed, hence creating a vacuum. This affected how quickly the bowling ball and feathers fell.

Brian Cox Video

1 2 3 Planning

5. Brainstorm ideas of environmental factors that could affect the results of dropping their spinners and how you could change these e.g. air flow, location (inside/outside), room temperature etc. As a class/in groups, decide which environmental variable the pupils will choose to investigate. The Question Wonder resource from the Great Science Toolkit can support pupils to form an enquiry question.

Step-by-step guide cont...

Pupils investigate whatever environmental variable they choose but for the purposes of this enquiry. Below are some suggestions where the air flow is controlled using a hairdryer or fan.

Gathering evidence

6. Choose one spinner type for all groups to use. Pupils drop the spinner three times from the same height, trying to land it on a marked cross on the floor. Measure the distance from the cross to the where the spinner landed (cm). Record results in an appropriate table. Repeat the investigation a second time but this time with a hairdryer directed at the drop zone. Pictures of the landing points could be marked with chalk and an aerial photograph taken.

If time allows you could investigate different options here e.g. move the hairdryer further away from the drop zone etc. Alternatively, pupils could carry out the investigation in different places/spaces e.g. inside and outside.

Analyse and interpret

7. Collate class results. Through discussion compare what happened in the two different environments by analysing the results. Use the 7-11 interpreting data skills starter video to support.

Drawing conclusions

8. What do pupils notice? Is the spread of data different in the two tests? What does this tell you about the importance of controlling the environment?
Link what the pupils have discovered (environmental variables) back to the book and work of quantum scientists who are also trying to control the environment to ensure it does not affect the results of their investigations.

Share with us

9. Pupils could create a poster to share with others to explain how they have worked like quantum scientists and how they now know why controlling the environment is important when carrying out investigations. Share on social media by tagging us on X @GreatSciShare.

EXTEND THE LEARNING!

Use the Talk Prompts in the quantum-linked **Great Question Ponder** as part of science and oracy development.

Spinner template

Instructions: cut the solid lines, fold the dotted lines