Powering ships:
Teacher's Notes

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Preface:

Powering ships is an activity designed to introduce pupils to the physics of propulsion and how propellers are maximised for efficiency in the world of ship design. The idea of 'cavitation' is introduced as an application of the principles behind pressure. The relationship between pressure and boiling points are also covered.

Audience: Year 9

Length: 1 hour

Learning Objectives:

- To highlight the importance of shipping and the need to understand the physics behind shipping for the industry to remain efficient.
- To introduce pupils to the physics of propulsion and the link between pressure and propeller efficiency.

Running the activity:

Starter – 10 minutes: Using whole class discussion, ask pupils how they think ships move through the water and what is important when considering the efficiency of ships.

***Main* – 30 minutes:** Present the *powering ships slideshow* using the notes provided on each slide.

***Plenary – 20* minutes:** Divide the class into two and ask pupils to design and make propellers that are optimised for high and low pitch based on what they now understand by the terms.

Small foil pie case dishes flattened out are a good material to carry out this practical. The theory behind propeller pitch can then be tested by threading a piece of string through the centre of each propeller and attaching a weight to the underside.

Drop the propellers in a wide measuring cylinder full of water and count the number of turns each propeller makes. Record the data on the white board under 'high pitch propellers' and 'low pitch propellers'.

Average the class data and ask pupils to draw a bar chart to see if the theory behind propeller pitch, as presented in the slideshow, is correct. Low pitch propellers should have a higher number of turns than high pitch propellers and fall quicker to the base of the measuring cylinder than high pitch

propellers. Both of these theories can be tested by both counting the number of turns and measuring the drop time.

Where it fits in:

Module-based curriculum

1 – Unit 9G – Environmental chemistry
- Ways fuel consumption can be usefully limited

2 – Unit 9I – Energy and electricity
- Range of useful energy transfers and formations
- The dissipation of waste energy and the conservation of energy

3 – Unit 9L – Pressure and moments
- Ideas about pressure, force and area
- Use of pressure to generate controlled movement

Enquiry-based curriculum

1.1 – Scientific thinking
1.1a – Using scientific ideas and models to explain phenomena and developing them creatively to generate and test theories
1.1b – Critically analysing and evaluating evidence from observations and experiments

3.1 – Energy, electricity and forces
3.1b – Forces are interactions between objects and can affect their shape and motion

3.2 – Chemical and material behaviour
3.2a – The particle model provides explanations for the different physical properties and behaviour of matter

4 - Curriculum opportunities
4c - Use real life examples as a basis for finding out about science