Into the belly of the ship:
Teacher's Notes

inspiringseas

oceans of teaching resources

Preface:

Into the belly of the ship is an activity designed to apply the principles of energy transfer and heat exchange to the internal workings of a ship, highlighting how one of the principal forms of wasted energy, heat, is conserved and used for other useful processes. The lesson begins with a game, entitled *particle people*, where pupils put their knowledge about the particle model and energy transfer to the test, considering how energy is transferred in each state of matter.

The *into the belly of the ship slideshow* applies this theory to the internal workings of a ship, illustrating the relevance of physics to the real world. The session ends with a *plenary revision worksheet*, allowing pupils to consolidate knowledge gained from the *into the belly of the ship slideshow*.

Audience: Key Stage 3 pupils – Year 9

Length: 1 hour

Learning Objectives:

- To enable pupils to apply theory regarding energy transfer and heat exchange to the internal workings of a ship.
- To allow pupils to see the relevance of physics to the real world.
- To encourage pupils to consider how heat energy might be conserved and used for other useful processes on ships, applying the theory of heat transfer by conduction, convection and radiation.

Running the activity:

Starter* – 15 minutes*: Tell pupils they are going to be playing a game called *particle people*. Divide your class into three equal groups. Put the first group of pupils in a line and hand a tennis ball to a pupil at the end of the line. This tennis ball represents heat energy.

Tell the first group of pupils that they represent particles in a solid and their job is to transfer the heat energy from one end of the line to the other. Ask the rest of the class to decide how they should do it. Pupils should pass the tennis ball along the line so represent conduction in a solid and the transfer of heat energy through the vibration of particles.

Bring up the second group of pupils and say that they represent particles in a fluid, but still need to line up fairly close together. Give the tennis ball to a pupil at the end of the line. Ask the rest of the

class to decide how heat energy is transferred in a fluid. The pupil at the end of the line should take the tennis ball to the person at the other end of the line. At the same time, the person who has just been handed the tennis ball should then walk back and hand the tennis ball to the new person at the end of the line. Pupils move up the line to take their turn, symbolising a convection current taking place.

Bring up the last group of pupils and say that they represent particles in a gas, but still need to line up fairly close together, but further apart than the second group. Give the tennis ball to a pupil at the end of the line. Ask the rest of the class to decide how heat energy in transferred in a gas/vacuum. The pupil at the end of the line should throw the tennis ball to the person at the other end of the line, symbolising radiation. Emphasise that radiation can also occur through a vacuum.

***Main* – 25 minutes:** Go through the *into the belly of the ship slideshow* with pupils using the guidance notes provided at the bottom of each slide.

***Plenary – 20* minutes:** Provide pupils each with a copy of the *plenary revision sheet* in the plenary activity folder in this resource packs and ask pupils to answer the questions for the rest of the session and as homework.

Where it fits in:

Module-based curriculum

1. Unit 8I – Heating and cooling
- Energy transfer results from a difference in temperature
- Describe good conductors and insulators
- Apply the particle model to explain why metals are good conductors
- The expansion of a material will reduce its density
- Convection in fluids
- Radiation energy can travel through a vacuum
- Insulation can reduce unwanted energy transfer

2. Unit 9H – Using chemistry
- When fuels burn they release energy

3 – Unit 9I –Energy and electricity
- Range of useful energy transfers and transformations
- Dissipation of waste energy and the conservation of energy

Enquiry-based curriculum

3.1 – Energy, electricity and forces
3.1a - Energy can be transferred usefully, stored or dissipated , but cannot be created or destroyed

3.2 – Chemical and material behaviour
3.1a - 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