

# Lesson Plan

# Forces



## KS2 Lesson Plan Forces On the Canal

NB: This lesson would make an ideal complement to the practical workshop offered by the Museum on 'Floating & Sinking'

### Introduction

This lesson introduces the concept of forces in the canal environment, and how they were, and are, used to move boats, and operate locks. It explains the concept of opposing forces (such as buoyancy & gravity).

### Learning objectives.

- To understand the meaning of the word force.
- To discover some of the commonest examples of forces that may be found in the canal environment.
- To learn about the opposition of forces in the canal environment.

### National curriculum & QCA Schemes of Work

Science SC1 Scientific Enquiry Ideas and evidence in science 1a&b, SC4 Physical Processes Forces and motion 2d&e

QCA Schemes of Work Science Unit 2E Forces & Movement

### Differentiation

- All children will learn that the two basic forces are push and pull.
- Most children will be able to identify some of the forces at work around the canal.
- Some children will understand the concept of opposing forces.

### Resources

1. Copies of 'Forces on the Canal' sheet for each child.
2. Clipboards & pencils
3. Bowl of water
4. Model boat, or floating waterproof container, such as margarine tub
5. Small weights, to act as loads on the 'boat' eg stones or coins

### Key vocabulary

- force
- push
- pull
- gravity
- upthrust
- lever



## Lesson Plan

- 1) Arrange for the class to visit a canal, (if possible one where there is some movement of people, and boats taking place, and a lock). Ensure that you make a preliminary visit, arrange enough adult supervision, and have completed all necessary risk assessments.
- 2) At the site, ask the children to stand and watch what is going on for a minute in silence, and count how many different things they can see moving. Then get them to report what they saw back to the group, using as many appropriate words as possible eg swing, turn, go faster, go round, go slower.
- 3) Give each child a 'Forces on the Canal' sheet. Review what their understanding of everyday forces is, by asking them to write down four push movements and four pull movements they make every day eg opening door, putting on socks etc.
- 4) Some children may think that pushes and pulls can only be created by humans. Discuss what other things may move objects, such as wind, water, animals, engines & magnets.
- 5) Discuss the three main forces acting on a canal boat in the water the downward pull of gravity, the upward push of the buoyancy of the water, and the push of the engine/pull of a horse. Get children to draw in the direction of the forces on the diagrams.
- 6) Every force has an opposing force. The level at which a boat floats on the water depends on the balance between the pull of gravity and the buoyancy of the water. The more loaded a boat is, the greater the pull of gravity over the push of buoyancy, and the lower it rests in the water. Demonstrate this with a model boat or floating container, such as a margarine or ice cream tub. Place it on the water, and carefully 'load' it with 'cargo'. Ask children what is happening and why, and get the children to fill in the diagram on the fourth page of this plan.
- 7) If possible, get children to look at the gauging rod in the museum, and find out how it was used to judge how heavily loaded the boats were.

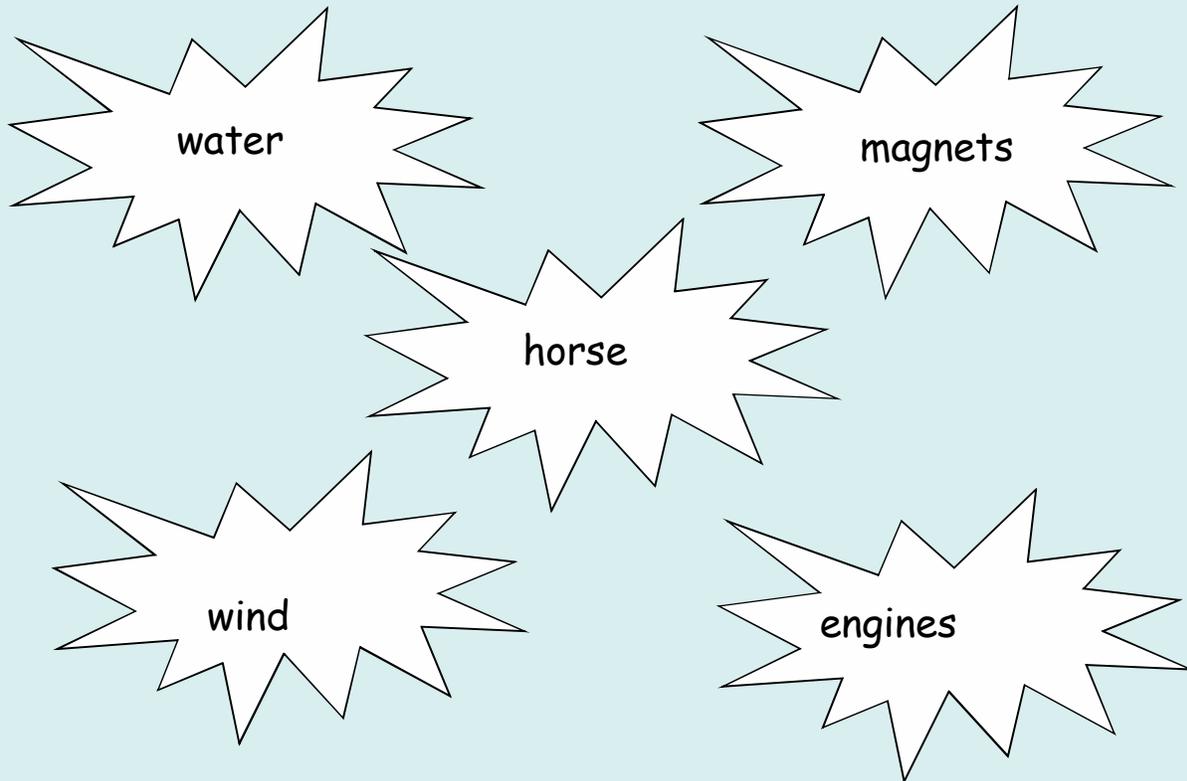


## Forces On the Canal

There are two types of forces pushing and pulling. Make a list of four things you push every day and five things you pull. Here are two ideas to start you off

| I push                    | I pull                   |
|---------------------------|--------------------------|
| 1. my classroom door open | 1. my socks onto my feet |
| 2.                        | 2.                       |
| 3.                        | 3.                       |
| 4.                        | 4.                       |
| 5.                        | 5.                       |

Not all pushes and pulls are made by people. All of these can make things move with a push or a pull:



There are three forces that affect canal boats - the GRAVITY of the earth, the UPTHrust OF the water, and the PUSH or PULL that makes them move.

Here is a modern narrow boat. It has an engine at the back. Does the engine PUSH or PULL the boat along? Draw the side of the canal and arrows to show the direction of the three forces working on the boat.



Front ----- Back

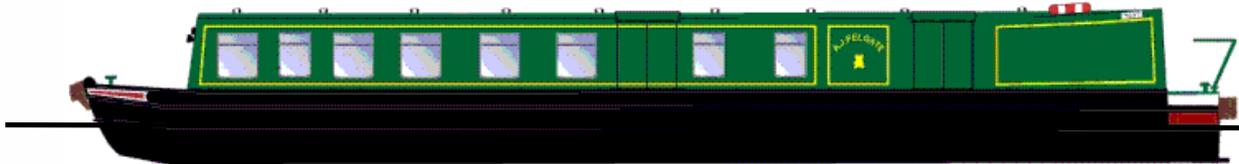


Here is an old fashioned narrow boat. It has a horse at the front. Does the horse PUSH or PULL the boat along? Draw the side of the canal, the rope linking the horse and boat, and arrows to show the direction of the three forces working on the boat.



GRAVITY & UPTHURST oppose each other when a boat floats. GRAVITY pulls down, and UPTHURST pushes up. The greater the mass of an object, the stronger the pull of gravity. When a boat is empty, it floats high in the water, because the two forces are roughly equal. When a boat is loaded with people or cargo, it floats low in the water, because the pull of gravity is stronger than the upthrust of the water.

One of these two boats is empty, and the other has 10 people in it. Can you tell which is which by looking at the pictures? (Clue: Look at where the level of the water line is on the side of the boat)



I think this boat is \_\_\_\_\_ because \_\_\_\_\_

I think this boat is \_\_\_\_\_ because \_\_\_\_\_

