

HOVERCRAFT

A. OVERVIEWS

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| Subject | Physics |
| Age | 6-10 |
| Duration | 60 minutes |
| Focus | A difference in air pressure causes lift. Air cushion reduces friction between two objects, and allows faster motion. |
| Goals | Students will learn: 1. How a hovercraft moves on an air cushion to overcome friction. 2. How Newton's laws of motion are applied in the working of a hovercraft. 3. How air pressure helps to lift a hovercraft off the ground. |
| Objectives | After completing this section, students will understand how a hovercraft works and the laws of physics involved. |
| Materials | Hovercraft kit and lesson plan 4 X AAA, 1.5 volt batteries Small cross-head screwdriver |
| Introduction | Background reading – hovercraft Class discussion: different principles of physics |
| Practical | Students will assemble hovercrafts |
| Extensions | Investigation and discussion points |

B. BACKGROUND READING

Set the background reading as a homework assignment the day before the planned hovercraft lesson. This lesson will cover 'hovercraft' and provide a springboard for discussion on the working of a hovercraft.

Review

Start the lesson by reviewing the reading.

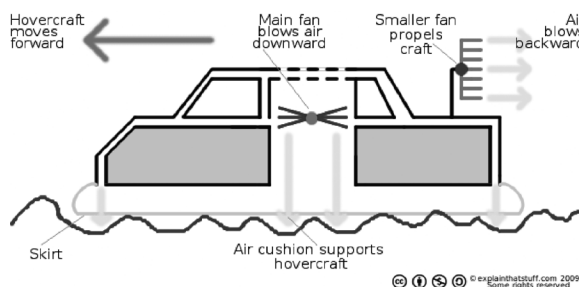
Important points students should understand:

- Energy is stored in a spring
- Energy can be transformed from one form into another

Reading material

A hovercraft is a vehicle that floats over the ground or water by means of an air cushion. A propeller installed on the hovercraft forces the air above and around the hovercraft to go down below the vehicle, forming an air cushion which is trapped in the 'skirt' of the vehicle. The air pressure above the hovercraft becomes lower whilst the air pressure below the craft becomes higher. This difference in pressure causes a lift which elevates the craft. A fan pushes air out from the back of the craft, which propels the vehicle forward. This is a result of Newton's Third Law which states that for every action there is an equal and opposite reaction.

When an object is placed on a surface, there is friction which opposes movement. Energy, or force, needs to be applied in order to overcome friction and move the object. To reduce friction, the area of contact between the object and the surface should be minimised. In a hovercraft, this is achieved by the air cushion which lifts the craft off the ground, thus minimising friction. Since friction is reduced, less energy is required to move the craft forward.



Newton's First Law states that an object at rest will remain at rest, and an object that is in motion continues to stay in motion, unless it is acted on by an external force. Since a hovercraft does not make any contact with the ground, it does not come to a stop like other road vehicles (caused by friction). The only force acting on it to slow it down is wind resistance. The only way to stop a hovercraft is to reverse the air flow from the propeller which causes a braking action.

C. CLASS DISCUSSION

Identify the principles of physics involved in each of these situations

| Situation | Principle of Physics |
|---|--|
| The hovercraft is lifted off the ground by the air cushion. | A difference in air pressure above and below the hovercraft creates a lifting force. |
| As air blows out of the back of the hovercraft, the vehicle moves forward | Newton's Third Law |
| A ball rolling on the ground will eventually come to rest. | Friction |
| A ball will not move unless it is kicked. | Newton's Third Law |

Lift – Where else is lift applied in everyday life?

- Aeroplanes
- Kites

Friction – How is friction involved in road safety?

• Vehicles can be brought to rest because of the friction between the tyres and the road. If there was no friction, then more road accidents will occur.

D. PRACTICAL

Each group of students requires 1 kit and 1 instruction sheet. Select the relevant information from the instructions if necessary. Go through the safety warnings given in the instructions with the class before assembly.

Check each group's finished model and supervise the test runs.

E. EXTENSIONS

- Which part of the hovercraft generates air flow?
- How can you modify the skirt to make the hovercraft move better?
- How do you stop a real-life hovercraft?
- What other objects use air cushions to make them move?
- What are the advantages and disadvantages of using hovercrafts?
- Try to construct your own hovercraft using materials around the house, e.g. balloons, used CDs, bottle tops and cardboard.
- Find out about other air-cushion vehicles (ACV).

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