Science KS3 **Forces and motion**

Glossary:

- **Acceleration**
  Speeding up.
- **Deceleration**
  Slowing down.
- **Density**
  A measure of how close the particles are packed together.
- **Displaced**
  Moved from its position and replaced
- **Force**
  Push, pull or twist an object, changing their motion or shape.
- **Gravity**
  The universal attraction between objects.
- **Inertia**
  Object continues its existing state or motion unless the state is changed by a force.
- **Irregular**
  Not regular, object has different sized sides.
- **Magnitude**
  Size
- **Mass**
  Amount of matter something contains, kilograms.
- **Moment**
  Turning effect of a force.
- **Motion**
  movement
- **Newton** Unit of force.
- **Particle**
  Atom or molecule.
- **Pivot**
  Central point where something turns.
- **Speed**
  Energy
- **Stationary**
  Not moving.
- **Weight**
  Force caused by the effect of gravity on a mass, newton.

Activities

- Describe the forces acting on a stationary object.

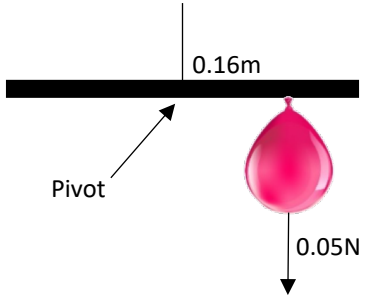
- Look at this diagram of a stationary boat floating on water. The boat is made of metal and is heavy.

  a) Draw and label the forces acting on the boat.
  b) Explain why the boat floats even though it is made of a heavy metal.

- Draw and label the forces acting on this plane as it travels at a steady speed.

- Calculate the density of the following blocks in g/cm^3
  a) 1Kg block with a volume of $100cm^3$
  b) 0.5Kg block with a volume of $20cm^3$.

- Calculate the moment the balloon produces about the pivot in the following diagram.



QUICK QUESTIONS:

1. State the equation linking distance, time and speed.
2. State the equation linking force, moment and distance.
3. State the equation linking density, volume and mass.
4. What is the unit for force? What is the unit for weight?
5. What is the unit for mass?
6. What is a moment?

1. Speed

- **Speed (m/s) = distance (m) ÷ time (s)**
- The **speed** of a moving object is a measure of how far it will travel in a certain time.
- How quickly an object travels depends on its **mass** and the **force** acting on it.
- The greater the mass of an object the longer it takes to speed up or slow down, a property of mass called **inertia**.

2. Gravitational forces

- All objects on Earth are affected by **gravitational forces**. An object which stays at rest on the surface of the Earth has one or more forces acting on it, thus balancing the force of gravity.
- A book lying on a table does not fall because the atoms in the table are pushing upwards on the book with a force **equal** to the force of gravity.

3. Force diagrams

- We can show the **forces** acting on an object using **force arrows**.
- These arrows show the **size** (**magnitude**) and **direction** of the force.

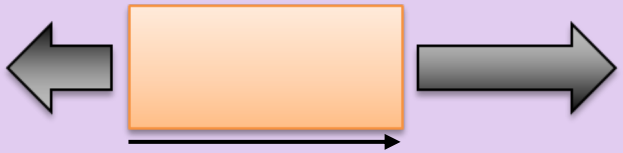
PiXL Science

KS3 Spine

Forces and motion

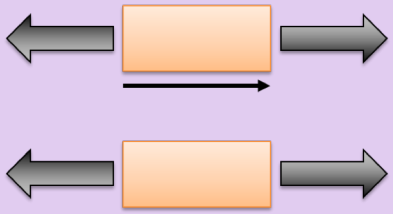
4. Unbalanced forces

- If the forces acting on an object are **unbalanced** the object will either **speed up (acceleration)**, **slow down (deceleration)** or **change direction**.
- **Unbalanced forces cause change.**



5. Balanced forces

- **Equal** and **opposite forces** are found **on stationary objects** and those travelling at a **steady speed**.
- An object with equal and opposite forces acting on it will carry on doing what it is already doing.
- **Balanced forces cause no change**.

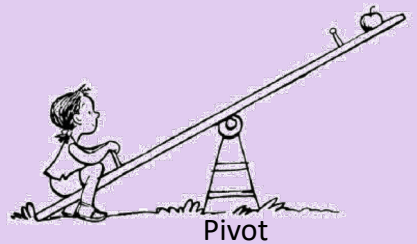


6. Floating

- Objects **float** on water because they are **less dense** than the water.
- An object **floating** on a **liquid**, or in **air**, does not move because there is an **upward force balancing** the **downward force of gravity**.
- The **upward force** is **equal** to the **weight** of the fluid **displaced**. So heavy objects can float if they are hollowed out to displace a large weight of water.

7. Moments

- **Moment (Nm) = force (N) x distance (m)**
- A **moment** is the **turning effect of a force** around a **pivot**.



8. Density

- **Density = mass ÷ volume**
- Density is a measure of how **closely the particles are packed** together in a particular space. The **closer** the particles are packed together, the **heavier** the object feels for its **size**.
- The **volume** of an **irregular shaped object**, like a stone, can be found by measuring the volume of the water **displaced** by the object.