

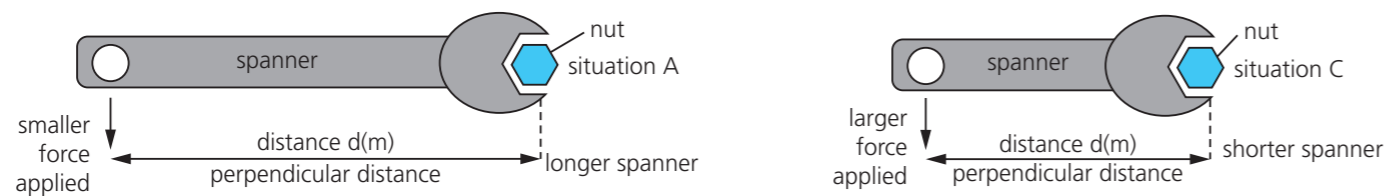
Work

- In physics, **work done** is the energy transferred when a force is used to move an object a certain distance
- Like energy, work is measured in **Joules (J)**
- Work can be done in a range of situations e.g. lifting a book work is done against gravity, when you slide a book along a table work is done against friction
- We calculate work with the equation:

$$\text{work done (J)} = \text{force (N)} \times \text{distance moved (m)}$$

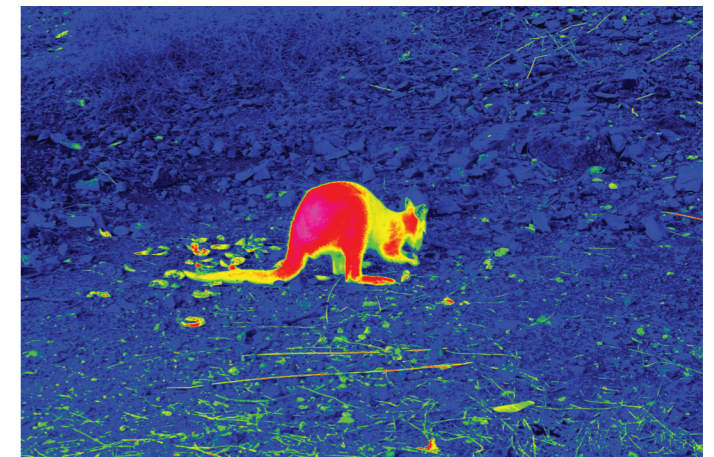
- A **simple machine** makes it easier to lift things, they reduce the force needed
- A **force multiplier** uses a smaller **input force** (what you apply) to generate a larger **output force** (what is created)
- If you increase the distance from the pivot, less input force is needed to be used for the same output force as before
- A **lever** is an example of a force multiplier, a longer lever will require a less input force than a shorter lever to produce the same output force

The physics of unscrewing a tight nut with a spanner



Radiation

- Radiation** is a method of transferring energy without the need for particles
- An example of radiation is thermal energy being transferred from the Sun to us through space (where there are no particles)
- This type of radiation is known as **infrared radiation**, it is a type of wave just like light
- The hotter an object is the more infrared radiation it will emit (give out)
- The amount of radiation emitted and absorbed depends on the surface of the object:
 - Darker matte surfaces absorb and emit more infrared radiation
 - Shiny and smooth surfaces absorb and emit less infrared radiation, instead reflecting this
- The amount of infrared radiation being emitted can be viewed on a **thermal imaging camera**

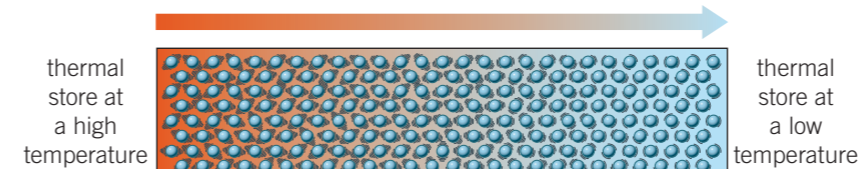


Energy and temperature

- The **temperature** of a substance is a measure of how hot or cold it is
- Temperature is measured with a **thermometer**, it has the units of degrees Celsius (°C)
- The **thermal energy** of a substance depends on the individual energy of all of the particles, it is measured in Joules (J)
- As all particles are taken into account, a bath of water at 30 °C would have more thermal energy than a cup of tea at 90 °C as there are many more particles
- The faster the particles are moving, the more thermal energy they will have
- When particles are heated they begin to move more quickly
- The energy needed to increase the temperature of a substance depends on:
 - the mass of the substance
 - what the substance is made of
 - how much you want to increase the temperature by

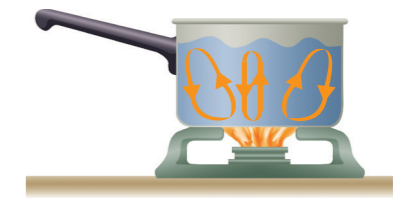
Conduction

- Conduction** is the transfer of thermal energy by the vibration of particles, it cannot happen without particles
- This means that every time particles collide they transfer thermal energy
- Conduction happens effectively in solids as their particles are close together and can collide often as they vibrate around a fixed point
- Metals are also good **thermal conductors** as they contain electrons which are free to move
- In conduction the thermal energy will be transferred from an area which has a high **thermal energy store** (high temperature) to an area where there is a low thermal energy store (low temperature)
- Gases and liquids are poor conductors as their particles are spread out and so do not collide often, we call these **insulators**



Convection

- Convection** is the transfer of thermal energy in a liquid or a gas, it cannot happen without particles
- As the particles near the heat source are heated they spread out and become less dense, this means that they will rise
- More dense particles will take their place at the bottom nearest the heat source creating a constant flow of particles
- This is known as a **convection current**
- Convection cannot happen in a solid as the particles cannot flow, they can only move around a fixed point



Key terms

Make sure you can write definitions for these key terms.

conduction convection convection current force multiplier input force insulator infrared radiation lever output force simple machine temperature
thermometer thermal conductor thermal energy store thermal imaging camera work done