

Knowledge organiser – 3 Energy - Work and Heating and cooling

WORK AND ENERGY

- When a force causes a body to move (or deform), work is being done on the object by the force.
- The amount of work depends on the size of the force and the distance the object moves (displacement).
- Work done = energy transferred



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

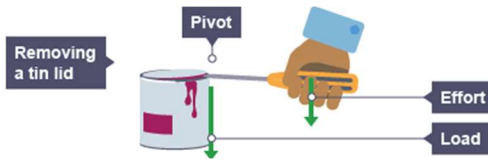
$$= 10 \text{ N} \times 2 \text{ m} = 20 \text{ J}$$

MACHINES

- Simple machines make it easier to lift, move or turn things. It reduces the force or increases the distance something moves when you apply a force.
- They give a bigger force but with a smaller movement.
- A wheel is an example of a simple machine.

LEVERS

- A lever is a simple machine that makes work easier to do.
- It is a force multiplier (something that increases the effect of a force). The force applied by the lever is bigger than the force that you apply with just your hand.
- Examples of simple levers include cutting with scissors, or lifting the lid on a tin of paint with a screwdriver.



PULLEYS

- A pulley is used to lift (or lower) heavy objects. They are wheel shaped with a groove that allows a cord to sit inside the groove.
- A single pulley changes the direction of force, making pulling down easier than lifting up (adjusting window blinds). Using two pulleys together means you need half the force to lift.

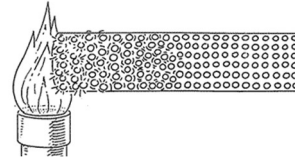


ENERGY AND TEMPERATURE (°C)

- The temperature of an object is to do with how hot or cold it is.
- When an object is heated, its particles move or vibrate faster.
- The hotter the substance, the more its particles vibrate, and therefore the higher its thermal energy.
- The energy you need to increase the temperature of a material depends on: the mass, the material it is made of and the temperature rise you want.
- Energy only transfers from a hot object to a cooler object.

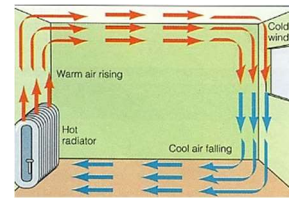
CONDUCTION

- Particles transfer energy by colliding with other particles when they vibrate.
- Wood and many non-metals are poor thermal conductors. Energy is transferred, but very slowly.
- Liquids are also poor thermal conductors. Gases do not conduct well at all because their particles are much further apart than particles in a solid.



CONVECTION

- The particles in liquids and gases can move from place to place.
- Convection happens when particles with a lot of thermal energy in a liquid or gas move, and take the place of particles with less thermal energy.
- Thermal energy is transferred from hot places to cold places by convection.



RADIATION

- All objects transfer energy to their surroundings by infrared radiation.
- The hotter the object, the more infrared radiation it gives off.
- No particles are involved; infrared radiation travels as a wave. Energy transfer by radiation can work when objects are not touching, even in space.

Absorbing infrared radiation

- Your skin detects infrared – this is why your skin feels hot when its sunny.
- Thermal imaging cameras absorb the radiation and produce an image. Hot areas are red in the image.
- Remote thermometers contain sensors to detect radiation and work out temperature.
- Dark colours absorb radiation and light / shiny surfaces reflect infrared.

INSULATION: you can use insulation to slow down energy transfer by conduction, convection or radiation. They do this by removing particles, trapping particles so they cannot move (cavity wall insulation) or using reflecting surfaces (foil blanket / foil packs for food).

KEYWORD	DEFINITION
Conduction	Transfer of thermal energy by the vibration of particles.
Convection	Transfer of thermal energy when particles in a heated fluid rise.
Convection current	The movement of heated fluids where hot fluid moves upwards and cold fluid moves downwards.
Deform	When an object is stretched or squashed, which required work.
Displacement	The distance an object moves from its original position.
Input force	The force you apply to a machine.
Lever	A type of machine which is a rigid bar that pivots about a point.
Output force	The force that is applied to the object moved by the machine.
Radiation	The transfer of energy as a wave.
Simple machine	A machine such as a lever or pulley system which changes the size of the force by moving a force over a bigger or smaller distance.
Temperature	A measure of the motion and energy of particles.
Thermal conductor	Material that allows heat to
Thermal energy store	The store containing energy due to the vibration or movement of particles of a substance.
Thermal insulator	Material that only allows heat to travel slowly through it.
Thermometer	Instrument used to measure temperature.
Work	The transfer of energy when a force moves an object through a distance, in joules.