CHURCH STRETTON SCHOOL

Triple Science - Physics

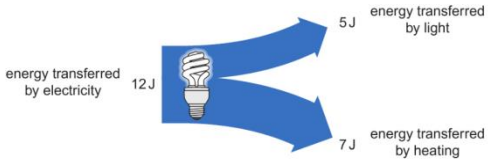
SP3 Knowledge organiser

P3: Energy

Lesson sequence

1. Storing and transferring energy
2. Energy efficiency
3. Insulation
4. Stored energy
5. Non-renewable energy resources
6. Renewable energy resources

1. Storing and transferring energy	
Energy	The capacity to do work.
Joules	The units of energy, symbol = J.
Kilojoules	1000 J, symbol = kJ.
Thermal energy	Energy stored on hot objects.
Kinetic energy	Energy stored in moving objects.
Chemical energy	Energy stored in chemicals such as fuels.
Nuclear energy	Aka atomic energy. Energy stored in the nucleus of atoms.
Gravitational potential energy	Energy stored in objects based on how high they are.
Elastic potential energy	Aka strain energy. Energy stored in bent or stretched objects.
Other forms of energy	Light, sound, electrical.
First law of thermodynamics	Energy cannot be created or destroyed, just transferred from one form to another.
Energy transfers	Say what form the energy starts as *and* what it becomes.
Sankey diagram	Shows energy transfers. The thickness of the arrow relates to the amount of energy.



2. Energy efficiency	
Dissipation	The way energy spreads out, becoming less useful as it does.
Wasted energy	Energy that is transferred into forms that can't be used.
Friction	Causes energy loss as heat when two surfaces rub together.
Lubrication	Allows surfaces to move smoothly, reduces energy loss from friction.
Electrical resistance	Causes wires to heat up, wasting electrical energy.
Calculating efficiency	$Efficiency = \frac{useful\ energy\ transferred}{total\ energy\ transferred}$
Energy efficiency numbers	Efficiency is between 0 and 1. 1 = no energy wasted, 0 = all energy wasted.

Worked example

Calculate the efficiency of the old-style bulb shown in diagram D.

efficiency = (useful energy transferred by the device) / (total energy supplied to the device)

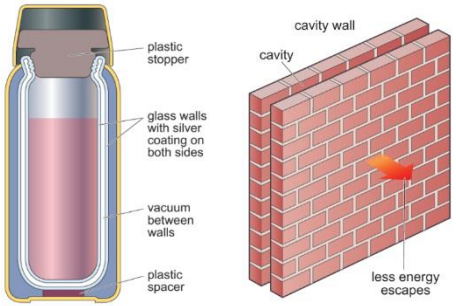
$= \frac{9\ J}{100\ J}$

$= 0.09$

The efficiency is a ratio so there are no units.

3. Insulation	
Convection	Heat transfer caused when hot fluids (gas or liquid) rise because they are less dense.
Conduction	Heat transfer through solids caused by vibrating particles bumping into each other.
Radiation	Heat transfer by infrared radiation which heats objects up when they absorb it.
Insulation	Materials that contain lots of tiny air pockets that prevent heat loss by conduction.
Thermal conductivity	A measure of how well a material conducts heat.
Draught-proofing	Sealing gaps around doors and windows to prevent heat loss by convection.

4. Stored energy	
Calculating kinetic energy	$KE = \frac{1}{2}mv^2$ Where 'KE' is kinetic energy in J, 'm' is mass in kg, 'v' is velocity in m/s.
Calculating v from KE	$v = \sqrt{\frac{2KE}{m}}$
Gravitational field strength	The strength of gravity. Different on different planets. On earth: 10 N/kg.
Calculating gravitational potential energy	$\boldsymbol{GPE = mgh}$ Where 'GPE' is gravitational potential energy in J, 'm' is mass in kg, 'g' is gravitational field strength in N/kg, 'h' is height change in m.



5. Non-renewable energy resources	
Fossil fuels	Coal, oil, natural gas. All are non-renewable.
Non-renewable resource	A resource that will one day run out because it is being used faster than it is being made.
Harm from burning fossil fuels	Carbon dioxide gas is released which causes global warming. Sulfur dioxide is released which causes acid rain.
Renewable resource	A resource will not run out.
Nuclear power	Electricity generated from nuclear fuels such as uranium.
Nuclear power pros and cons	😊 Lasts a long time, releases no carbon dioxide ☹ Produces very harmful waste, expensive to decommission, although rare, accidents are very dangerous.

6. Renewable energy resources	
Wind power	Large turbines spun by the wind. 😊 No CO_2 ☹ Lots needed, ugly?, no wind no power
Solar power	Solar cells turn sunlight to electricity. 😊 No CO_2 ☹ No sun no power, need lots of space, not suitable for all countries
Tidal power	Uses water movement from tides to spin turbines
Tidal barrage	A damn built across an estuary that fills up when tide goes in. 😊 Huge amounts of energy, no CO_2 ☹ Destroys important mudflat habitats
Hydroelectricity	A damn is built across a river valley, water released from the damn spins turbines. 😊 Lots of energy, no CO_2 ☹ Destroys habitat by flooding
Biofuels	Fuels made from recently plant or animal matter, often waste. 😊 Carbon neutral ☹ Needs a lot of land, increases food prices

Carbon neutral	When burning a fuel releases the same CO_2 it absorbed when it was growing, so there is no CO_2 increase.