Physics 1 – 6.1 Energy

Section 1: Energy Stores

Energy Store	Definition / Example
Chemical	Energy in bonds of chemicals
Thermal /Internal	Heat. Increases with as temperature increases
Kinetic	Movement.
Gravitational Potential	Distance from the ground. Increases as height increases
Electrostatic	Attraction or repulsion of charges
Elastic Potential	Stretching / Bending / Moulding
Magnetic	Attraction or repulsion of Magnetic Poles
Nuclear	Within a nucleus

Section 2: Energy Transfers

Energy Transfer: The movement of energy from one store to another.

Energy Transfer	How it transfers
Mechanical Working	Physical movement
Electrical Working	Movement of charge in electrical currents
Heating	Via conduction or convection
Radiation	Light, sound or heat

Section 3: Conservation and Dissipation

Theory	Definition
Conservation of energy	Energy cannot be created or destroyed Energy can only change store within a system
Dissipation of energy	Energy if lost from a system, spreads out, often as heat
System	Is an object or group of objects
Wasted energy	Energy that is not usefully transferred

Section 4: Calculating Energy Stores

Useful Energy output in a system (J) = **Total energy input**(J) – **wasted energy** (J)

Gravitational Potential Energy (J) = **mass** (kg) **x gravitational field strength** (J) **x height** (m)

Kinetic Energy (J) = **0.5 x mass** (kg) **x speed^2** (m/s)

Work Done (J) = **force applied** (N) **x distance in the same direction** (m)

Change in Thermal Energy (J) = **mass** (kg) **x specific heat capacity** (J/Kg°C) **x temperature change** (°C)

Elastic Potential Energy (J) = **0.5 x spring constant** (N/m) **x extension^2** (m) ← You will be given this

Section 5: Electrical Appliances

Power: The rate of energy transfer or rate of work done

Power (W) = $\frac{\textbf{energy transferred (J)}}{\textbf{time (s)}}$

Power (W) = $\frac{\textbf{work done (J)}}{\textbf{time (s)}}$

An energy transfer of 1 joule per second is equal to a power of 1 watt.

Efficiency: The amount of useful energy compared to wasted energy

Efficiency = $\frac{\textbf{Useful output energy transfer}}{\textbf{Total input energy transfer}}$

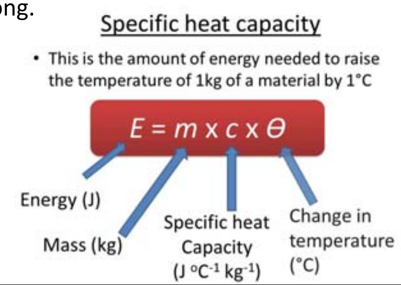
Efficiency = $\frac{\textbf{Useful power output}}{\textbf{Total power input}}$

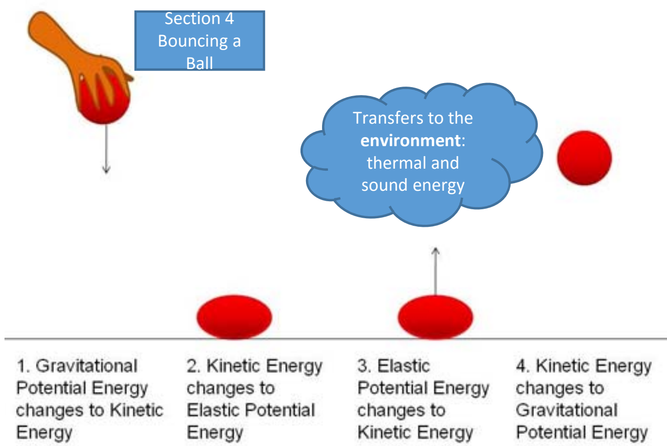
To calculate a percentage efficiency you times by 100

Section 6: Transfers by Heat

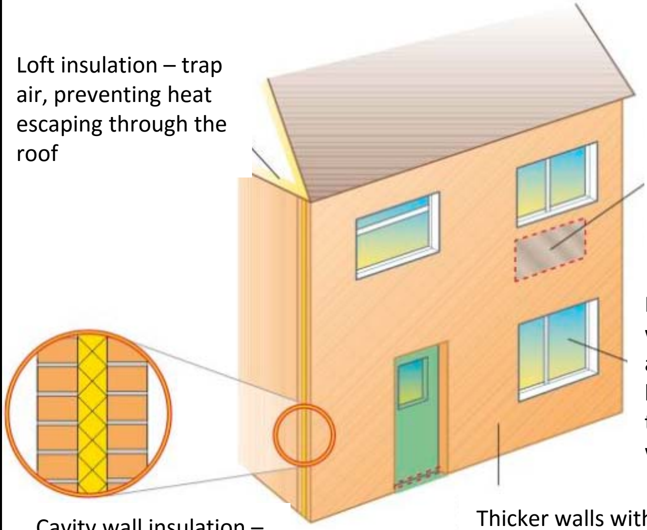
Thermal conductivity: the higher the thermal conductivity, the higher the rate of energy transfer.

Conduction: When particles vibrate in a solid, they bump into one another passing the kinetic/internal energy along.





Section 7: Heating in the Home



Loft insulation – trap air, preventing heat escaping through the roof

Aluminium foil between the wall and the radiator – reflects radiated heat back into the room.

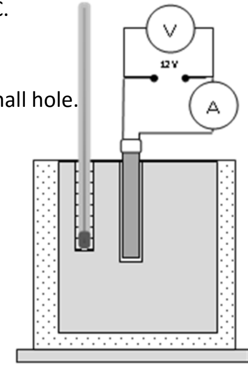
Double glazed windows– trap air, preventing heat escaping through the windows

Cavity wall insulation – traps air, preventing heat leaving through the wall.

Thicker walls with higher thermal conductivity
Makes it harder for thermal energy to transfer

Section 8 : Required Practical: Specific Heat Capacity

Specific heat capacity – the amount of energy required to raise the temperature of 1kg of the substance by 1°C.



Required Practical Method:

1. Measure and record the mass of the copper block in kg.
2. Place a heater in the larger hole in the block and thermometer with a pipette drop of water, in the small hole.
3. Connect the ammeter, power pack and heater in series and the voltmeter across the power pack.
4. Switch the power pack to 12 V. Switch it on.
5. Record the ammeter and voltmeter readings. These shouldn't change during the experiment.
6. Measure the temperature and switch on the stop clock every minute for 10 minutes.
7. Calculate work done and power.
8. Plot a graph of work done against temperature, draw a line of best fit.
9. Calculate the gradient of the line
10. The heat capacity of the block = 1 ÷ gradient
11. The specific capacity of the block = the heat capacity ÷ the mass of the block

Why is expected specific heat capacity always higher than the actual specific heat capacity in this experiment?

As thermal stores of energy can dissipate into the surroundings.

Why do we use an insulation during the practical?

To minimise the amount of energy escaping the system.

Renewable

Renewable energy resources – is being (or can be) replenished as it is used.

Every resource can generate electricity.

Advantages: Replenishable, don't damage environment

Disadvantages: expensive to set up and maintain, less efficient, wastes space, eyesores,

Section 9: Energy Resources

Non- Renewable

The non-renewable fossil-fuels are:

- Coal
- Gas
- Oil

Non-renewable: they cannot be replenished
Fossil Fuels: Fuel from dead animals and plants which have been crushed together. They are burnt to release their energy store.
Advantages: Cheap, no start-up costs, easy to work with, efficient
Disadvantage: Pollution, contribute to global warming, limited supply,

Energy Resource	Definition / Example	Reliable?	Use
Nuclear	Energy released due to nuclear fission in a nuclear reactor.	Yes – as long as there is a supply of uranium or plutonium	
Biofuel	Any fuel taken from living, or recently living, materials. E.g. Animal Waste, vegetable oil.	Yes – sources can regrow (vegetation) or is continually produced (sewage and rubbish)	As a fuel
Wind	Force of the wind drives a turbine around.	No – dependent on wind amount and speed	
Hydro-electricity	Rainwater that is collected, flows downhill driving a turbine.	No – dependent on rain volume	
Geothermal	Energy is released by radioactive substances deep within the earth, heating the surrounding rock and Earth's surface.	Yes – consistent heating of rocks via radioactive substances	Heats water and houses
Tidal	Traps water from tides which can be released into the sea via turbines	No – dependent on high tides	
Solar	Solar radiation heats water in solar panels or generates electricity in solar cells	No – dependent on radiation from the sun	Heats water
Wave	Waves make a floating generator move up or down	No – depends on wave levels and has to withstand storms.	