Physics Unit 1 - Energy

Key term	Definition
Kinetic energy	Energy stored in a moving object
Gravitational potential energy	Energy stored when an object is raised in a gravitational field
Elastic potential energy	Energy stored in a stretched or compressed object
Specific heat capacity	Energy needed to raise temperature of 1kg of a substance by 1°C
Power	Rate at which energy is transferred
Efficiency	Proportion of supplied energy which is transferred usefully (carries out intended task)
Work done	A measure of energy when a force moves an object through a distance
System	A group of objects which interact
Renewable	A resource which can be replenished as it is being used
Thermal conductivity	A measure of how fast heat can transfer through a material
Insulator	A material with a low thermal conductivity

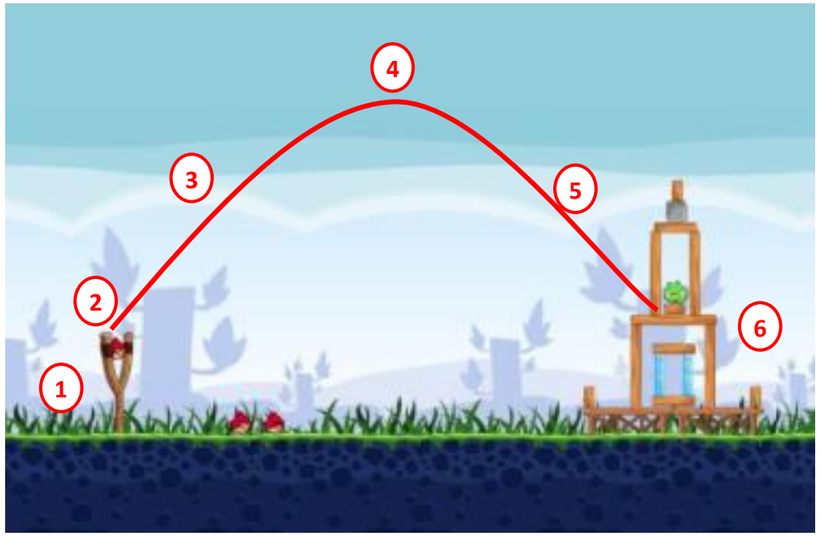
En01

A

B

En02 & 03

Changes in stores example



In this case the system is the catapult, the angry bird projectile and the target blocks. The energy stored in the stretched catapult is the maximum amount of energy available.

1) Elastic potential energy is stored in the stretched catapult
2) The elastic store decreases and is transferred to a kinetic store in the bird
3) As the height increases the gravitational store increases and the kinetic store is decreasing
4) At the top of the trajectory the GPE is at a maximum and the KE is at a minimum
5) As the projectile falls the GPE store will decrease and the KE will increase again
6) The bird is back to the original height, so the GPE has reduced to zero and the KE is back at a maximum

For calculations we assume perfect energy transfers, however no energy transfer is perfect in reality and some energy will be transferred to the surroundings (dissipated). When producing a physics model for a game such as angry birds only perfect energy transfers will be considered.

A

B

En02, 03, 04, 09

Equations to know

$$E_k = \frac{1}{2}mv^2$$

Kinetic Energy = ½ x mass x speed^2
(J) (kg) (m/s)

$$E_g = mgh$$

Gravitational = mass x gravitational x height
Energy field strength change
(J) (kg) (N/kg) (m)

$$P = \frac{E}{t} \text{ or } P = \frac{W}{t}$$

Power = Energy transfer / time **or** Work done / time
(W) (J) (s) (J) (s)

C

$$efficiency = \frac{useful\ power\ output\ (W)}{total\ power\ input\ (W)}$$

$$efficiency = \frac{useful\ output\ energy\ transfer\ (J)}{total\ input\ energy\ transfer\ (J)}$$

Equations to use

$$E_e = \frac{1}{2}ke^2$$

Elastic Energy = ½ x spring constant x extension^2
(J) (N/m) (m)

$$E = \boldsymbol{mc}\Delta\theta$$

Thermal energy = mass x specific heat x temperature
Change capacity change
(J) (kg) (J/kg°C) (°C)

En06

Specific Heat Capacity

This is a way of comparing how much energy it takes to change the temperature of similar masses of different materials. It relates to both increasing or decreasing the temperature.

Copper has a SHC of 385 J/kg°C, water has a SHC of 4200 J/kg°C

This means it takes more energy to increase the temperature of water than copper.

If you put a 100g copper block at 80°C into 100g of water at 20°C the temperature will not even out halfway between the two (50°C) but at 25°C. The same amount of energy has been transferred between the same mass of materials, but as the water has a much higher SHC it will only increase temperature by 5°C as the copper block decreases temperature by 55°C.

B

Energy Resources	Renewable	Transport	Electricity generation	Heating	Reliable	Produces CO_2	Environmental impact
Fossil fuels		✓	✓	✓	✓	✓	Greenhouse effect, pollutant gases
Nuclear fuel			✓		✓		Waste storage, accidents have long lasting effect
Biofuel	✓	✓	✓	✓	✓	✓	Farmland could be used for food
Wind	✓	✓	✓				Some think wind farms are ugly
Hydro-electricity	✓		✓		✓		Dams flood farmland, loss of habitat
Geothermal	✓		✓	✓	✓		Large ugly buildings, loss of habitat
Tidal	✓		✓				Can affect life in estuaries, change/affect habitat
Solar	✓		✓	✓			Mining of rare metals for solar cells
Wave	✓		✓				Can affect sea life

D

En10

Thermal conductivity

Thermal conductivity describes how well a material allows heat to travel through it. Insulating materials still conduct heat, however they do it at a much slower rate than materials which have a high thermal conductivity. The rate at which heat can move through a material depends both on the type of material and how thick the material is. Thermal energy always transfers from a warmer material to a cooler material. The greater the difference in temperature between the objects the greater the rate of energy transfer regardless of material type or thickness.

B

En05 & 07

Required Practicals

1. Specific Heat Capacity – determine the specific heat capacity of one or more materials
2. (P Only) Insulation – investigate the effectiveness of different materials as thermal insulators and the factors that may affect the thermal insulation properties of a material.