

# CAIE Physics IGCSE

## Topic 1.7 - Energy, Work and Power

### Flashcards

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Give seven examples of the different forms in which energy can be stored?



# Give seven examples of the different forms in which energy can be stored?

- Kinetic
- Gravitational potential
- Chemical
- Elastic (strain)
- Nuclear
- Electrostatic
- Internal (thermal)



What type of energy is stored in a moving object?





What type of energy is stored in a moving object?

Kinetic energy.



What happens, in terms of energy, when an object is lifted?



What happens, in terms of energy, when an object is lifted?

Its gravitational potential energy increases.



Give an equation for kinetic energy  
(supplement)



Give an equation for kinetic energy (**supplement**)

kinetic energy (J) =  $\frac{1}{2}$  x mass (kg) x velocity<sup>2</sup> (m/s)

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



Give an equation for gravitational potential energy (supplement)



Give an equation for gravitational potential energy  
(supplement)

Gravitational potential energy (J) = mass (kg) x  
height (m) x gravitational field strength (N/kg)

$$E = mgh$$



Give an equation for change in  
gravitational potential energy  
(supplement)





Give an equation for change in gravitational potential energy (**supplement**)

change in gravitational potential energy = mass x gravitational field strength x change in height

$$\Delta E_p = mg\Delta h$$



Give four ways through which energy can be transferred.



Give four ways through which energy can be transferred.

- Forces
- Electrical currents
- Heating
- Waves (electromagnetic/ sound)



# What is the law of conservation of energy?



# What is the law of conservation of energy?

- Energy is neither created nor destroyed. During an energy transfer:

Total energy before the event = total energy after the event



# How can energy transfer be shown using diagrams?



# How can energy transfer be shown using diagrams?

Flow diagrams - arrows show the direction of the energy transfer.

Sankey diagrams (**supplement**) - arrows show the direction and amount of energy transferred, as well as differentiating between useful output and wasted energy.



# Define work done.





## Define work done.

- Work is done on an object when energy is transferred (from one form to another)
- Equal to the product of force and distance



Give the equation for work done



Give the equation for work done

work done (J) = force (N) x distance (m)

$$W = Fd$$

(where distance is the distance moved along the line of action of the force)



What are the main energy resources available to humans?



# What are the main energy resources available to humans?

- Fossil fuels
- Nuclear fuels
- Biofuels
- Water (hydroelectricity, tides, and waves)
- Solar energy (solar panels and cells)
- Wind



What factors need to be considered when thinking about the advantages and disadvantages of each energy resource?



What factors need to be considered when thinking about the advantages and disadvantages of each energy resource?

- Renewability
- Availability
- Reliability
- Scale
- Environmental impact



Define renewable energy.





Define renewable energy.

Energy from a source which does not run out, so can be replenished.



Which energy sources are  
non-renewable?



# Which energy sources are non-renewable?

- Fossil fuels
- Nuclear fuel



# Which energy sources are renewable?



## Which energy sources are renewable?

- Biofuels
- Wind
- Hydroelectric and tidal energy
- Geothermal energy
- Solar power



Are non-renewable or renewable energy resources usually better at providing electricity on a large scale?



Are non-renewable or renewable energy resources usually better at providing electricity on a large scale?

Non-renewable - these resources tend to have a larger energy output per kilogram of fuel.



# How can electricity be generated from different energy sources?





# How can electricity be generated from different energy sources?

- A turbine is turned using energy from an energy resource.
- The turbine turns coils, in a magnetic field, in a generator.
- This generates electrical power.



# How are biofuels and fossil fuels used to generate electricity?



# How are biofuels and fossil fuels used to generate electricity?

They are burnt to generate electrical power:

- Their chemical energy is transferred to heat energy.
- The heat energy is used to boil water, creating steam.
- The steam turns the turbine.



# How are nuclear fuels used to generate electricity?



# How are nuclear fuels used to generate electricity?

They undergo nuclear fission to generate electrical power:

- Heat energy is released by nuclear fission.
- The heat energy is used to boil water, creating steam.
- The steam turns a turbine.



# How is water used to generate electricity?



# How is water used to generate electricity?

Water's waves and tides can be used:

- The kinetic energy as waves and tides move is used to turn underwater turbines.

OR hydroelectric dams can be used:

- The water behind the dam is above ground level, so has gravitational potential energy.
- This energy is transferred to kinetic energy when water is released down a slope.
- The flowing water turns the turbine.



# How are radioactive elements used to generate electricity?





# How are radioactive elements used to generate electricity?

- As radioactive elements decay, their geothermal energy heats the surrounding rock.
- Water is poured into shafts in the hot rock.
- The heat energy boils the water, creating steam, which is returned via another shaft.
- Steam turns a turbine.



# How can the sun be used to generate electricity?



# How can the sun be used to generate electricity?

Solar energy from sunlight is turned into an electrical current by solar cells.



# How can the sun be used to heat water?



## How can the sun be used to heat water?

- Infrared waves of the Sun's light heat water, contained within solar panels.
- The water goes to a tank and is stored for later use.
- A boiler may be needed to heat the water further.



# How can the wind be used to generate electricity?



# How can the wind be used to generate electricity?

As the wind blows, it transfers kinetic energy to the blades of wind turbines.



What is the original source of most of the energy on Earth? (supplement)





What is the original source of most of the energy on Earth? (**supplement**)

The sun.



What forms of energy do not ultimately  
come from the sun?  
(supplement)



What forms of energy do not ultimately come from the sun? (supplement)

- Geothermal
- Nuclear
- Tidal



What is the source of the sun's energy?  
(supplement)



What is the source of the sun's energy?  
(supplement)

Nuclear fusion.



# What is efficiency?



## What is efficiency?

The ratio of **useful** work done to energy supplied, often given as a percentage, i.e. the percentage of energy which is converted to a useful form.



Give the equation for efficiency  
(supplement)





Give the equation for efficiency (supplement)

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

You can convert this to a percentage by multiplying the answer by 100.



# Define power.



Define power.

Power is the **rate at which energy is transferred**, or the rate at which work is done.



# Give an equation for power



Give an equation for power

$$\text{power (W)} = \text{energy (J)} \div \text{time (s)}$$

$$\text{power (W)} = \text{work done (J)} \div \text{time (s)}$$

