Your notes

GCSE Physics: revision notes

Power and efficiency

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Power

- **Power** is the rate at which energy is transferred, or the rate at which work is done.
- P = E ÷ t and P = W ÷ t, where P is in **watts** (W), E and W in joules (J) and t in seconds (s).
- An energy transfer of 1 joule per second is a **power** of 1 **watt**. 1 kW = 1000 W.
- Two motors lifting the same load the same height: the one that does it faster has the higher **power**.

Efficiency

- **Efficiency** = useful output energy transfer ÷ total input energy transfer.
- **Efficiency** = useful **power** output ÷ total **power** input.
- **Efficiency** can be given as a decimal (such as 0.75) or a percentage (75%). It can never be more than 1 (100%), because energy cannot be created.

Wasted energy

- In any energy transfer, some energy is dissipated, usually as thermal energy to the surroundings. This is **wasted energy**.
- **Wasted energy** = total input – useful output.
- Ways to reduce waste: lubricating moving parts to reduce friction, using thermal insulation, and streamlining vehicles to reduce air resistance.

Sankey diagrams

- A **Sankey diagram** shows energy transfers. The width of each arrow is proportional to the amount of energy.
- The input arrow splits into useful output and **wasted energy** arrows, which add up to the input.

Worked examples

A motor is given 500 J of energy and does 150 J of useful work. Find its efficiency.

Use efficiency = useful output ÷ total input. **150 ÷ 500**

Work it out. **0.3**

Multiply by 100 for a percentage. **0.3 × 100 = 30**

Answer: 0.3, or 30%

Key terms

Power	The rate at which energy is transferred or work is done.
Watt	The unit of power: 1 W = 1 J/s.
Efficiency	The proportion of the input energy that is transferred usefully.
Useful energy	Energy transferred to the store where it is wanted.
Wasted energy	Energy that is dissipated and not useful, usually as thermal energy.
Sankey diagram	A diagram with arrows whose widths show amounts of energy transferred.
Kilowatt	1000 watts.

Quick questions

Cover the answers and test yourself: remembering is what makes it stick.

1. What is power?
2. What is the unit of power?
3. A motor transfers 3000 J in 60 s. What is its power?
4. How much energy does a 60 W lamp transfer in 10 minutes?
5. A machine uses 200 J and transfers 50 J usefully. What is its efficiency?
6. A motor has an input power of 800 W and a useful output of 600 W. What is its efficiency?
7. A device is 40% efficient and is supplied with 500 J. How much energy is transferred usefully?
8. Why can efficiency never be more than 100%?

Answers

1. The rate at which energy is transferred
2. Watt (W)
3. 50 W
4. 36 000 J
5. 25%

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6. 75%
7. 200 J
8. Energy cannot be created

What to do next

Practise 11 questions on this topic

Try 7 exam questions, with mark schemes

Read the lesson, one step at a time

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