Conservation and efficiency: accounting for energy

Student activity • observation and reasoning

YEAR 10 / LESSON 24 / PHYSICS + SCIENCE (DOUBLE AWARD)

The question

Where is the energy when a device is less than 100% efficient?

Use original energy-accounting cards to calculate efficiency and identify incomplete descriptions.

Equipment

- Booklet, calculator and energy-accounting cards

Paper and calculation activity only. No heaters, lamps or electrical supplies are operated in this lesson.

Course coverage: Shared Physics / Double Award: 4.3–4.4. Conservation and efficiency.

Plan, model or apparatus sketch

Draw a labelled setup or force diagram; include the measured quantities.

Method and reasoning

Read the whole sequence before starting

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1. For a model lamp receiving 100 J, label 25 J as useful light output and identify the remaining energy transfer to surroundings.

2. Calculate efficiency as useful output divided by total input × 100%. Check that all values refer to the same operating interval.

3. Repeat for a model motor receiving 240 J and transferring 180 J usefully by mechanical work. Account for the remainder.

4. Analyse a claimed 120 J useful output from 100 J input. Decide whether a store was depleted, an input was omitted or a measurement was wrong.

5. Define useful output for each device before comparing efficiencies. Explain why two devices with different purposes cannot always be ranked by one number.

6. Draw a system boundary and show all energy crossing it or remaining stored. Explain conservation without saying that wasted energy has disappeared.

Cleanup

- Return cards and keep corrected calculations.

Record your evidence

Blank spaces are for your own work

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Reference and task data

All card values are invented practice data. Conservation requires accounting for inputs, outputs and changes in stores over the same interval. Efficiency is a fraction or percentage for a stated useful output. A value above 100% indicates inconsistent accounting or measurements, not energy creation.

Device	Input / J	Useful output / J	Efficiency / %
Lamp	100	25	
Motor	240	180	
Claim to evaluate	100	120	

Show your calculations, labelled model or correction here.

Explain and evaluate

Use evidence and show calculation steps where relevant

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1. Find lamp efficiency.

2. Find its non-useful output.

3. Find motor efficiency.

4. Find motor’s remaining energy transfer.

5. Is wasted energy destroyed?

6. Why use the same time interval for input and output?