Sankey diagrams: drawing energy flows to scale

Student activity • observation and reasoning

YEAR 10 / LESSON 25 / PHYSICS + SCIENCE (DOUBLE AWARD)

The question

How can arrow widths communicate energy conservation?

Draw scaled Sankey diagrams from explicit practice values and diagnose misleading diagrams.

Equipment

- Booklet, squared paper, ruler and coloured pencils

Drawing and calculation activity only. No practical apparatus or electrical circuits are used.

Course coverage: Shared Physics / Double Award: 4.3–4.5. Energy transfers and Sankey diagrams.

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. Use a model device receiving 200 J, with 120 J useful output and 80 J transferred to surroundings. Choose a width scale of 1 mm per 10 J.

2. Draw the input arrow 20 mm wide, then split it into the useful and non-useful outputs. Label every arrow with an energy value and pathway.

3. Check that the output widths add to the input width. Keep width, rather than arrow length, proportional to energy.

4. Calculate the device's efficiency. Repeat for a 100 J input with 35 J useful output using a suitable scale that allows accurate widths.

5. Diagnose a diagram whose output widths sum to more than its input. State what additional input or store change would be needed to make the account valid.

6. Explain why a Sankey diagram alone does not reveal operating time or power unless those data are supplied.

Cleanup

- Return pencils and keep corrected diagrams.

Record your evidence

Blank spaces are for your own work

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Reference and task data

These diagrams use invented examples, not measured device efficiencies. In a steady-state account with no net store change, total input energy equals total output energy. Arrow width carries the numerical information; arrow length does not. Efficiency refers to the designated useful branch.

Model	Input / J	Useful / J	Other output / J
A	200	120	
B	100	35	
Own checked example			

Show your calculations, labelled model or correction here.

Explain and evaluate

Use evidence and show calculation steps where relevant

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1. What width represents 120 J at the first scale?

2. What width represents 80 J?

3. Find the first device’s efficiency.

4. What is the second device’s non-useful output?

5. Does a longer arrow necessarily mean more energy?

6. Can power be calculated without a time interval?