

Exercise walk-through

4.1

Energy transfers and thermal transfer

Pearson Edexcel · International GCSE · Physics

1

The method

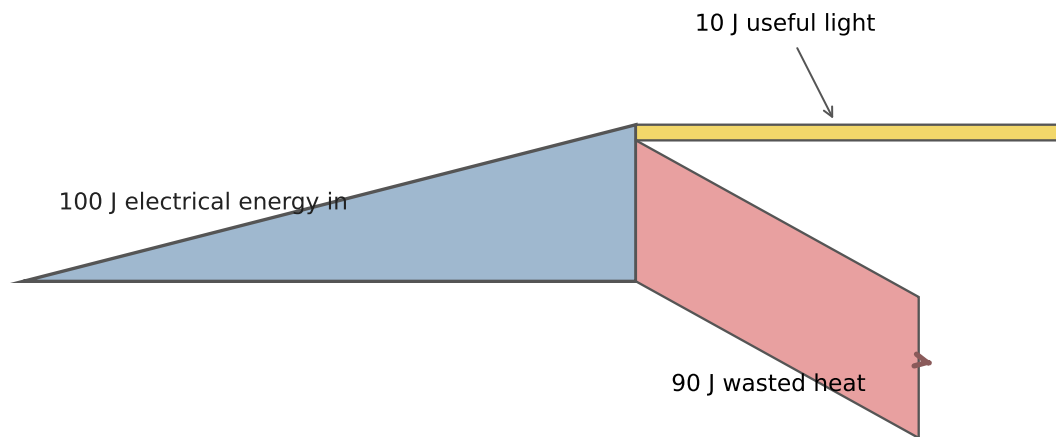
Method — Efficiency from the diagram

$$\text{efficiency} = \frac{\text{useful energy output}}{\text{total energy output}} \times 100\%$$

Worked check. A motor taking 800 J and giving 560 J of useful motion:
 $560/800 \times 100 = 70\%$ – the other 240 J warms the surroundings.

Method — Efficiency from the diagram

[$\text{efficiency} = \frac{\text{useful energy output}}{\text{total energy input}} \times 100\%$] Worked check.



A Sankey diagram: 100 J in, 10 J useful light out, 90 J wasted heat.

Exercises 2.1·2.3

2.1 Name three energy stores and two transfer pathways. [5]

2.2 State the principle of conservation of energy. [1]

2.3 A device uses 2000 J and gives 500 J of useful output. Calculate the efficiency. [2]

Exercises 2.1·2.3

2.1 Name three energy stores and two transfer pathways. [5]

2.1 Any three stores: chemical, kinetic, gravitational, elastic, thermal, magnetic, electrostatic, nuclear; any two pathways: mechanically, electrically, heating, radiation.

2.2 State the principle of conservation of energy. [1]

2.2 Energy cannot be created or destroyed, only transferred between stores – the total is constant.

2.3 A device uses 2000 J and gives 500 J of useful output. Calculate the efficiency. [2]

2.3 $500/2000 \times 100 = 25\%$.

Exercises 2.4·3.1

2.4 Name the thermal transfer that works in a vacuum. [1]

2.5 Which surface absorbs radiation best: matt black or shiny silver? [1]

3.1 Explain how a radiator heats a whole room by convection. [3]

Exercises 2.4·3.1

2.4 Name the thermal transfer that works in a vacuum. [1]

2.4 (Infrared) radiation.

2.5 Which surface absorbs radiation best: matt black or shiny silver? [1]

2.5 Matt black.

3.1 Explain how a radiator heats a whole room by convection. [3]

3.1 Air near the radiator warms and expands, becoming less dense; the warm air rises and cooler air sinks to replace it; a circulating convection current distributes the heat around the room.

Exercises 3.2·3.3

3.2 Explain why a metal spoon in hot soup warms at the far end, naming the transfer process. [3]

3.3 Describe two features of a house that reduce heat loss and name the transfer each reduces. [4]

Exercises 3.2·3.3

3.2 Explain why a metal spoon in hot soup warms at the far end, naming the transfer process. [3]

3.2 Conduction: the hot soup gives energy to the spoon's particles at the end in the soup, which vibrate more; the vibrations pass along the metal to the far end through free-electron and particle collisions, warming it.

3.3 Describe two features of a house that reduce heat loss and name the transfer each reduces. [4]

3.3 Any two with transfers: loft/cavity-wall insulation – reduces conduction (and convection in the cavity); double glazing – the trapped air gap cuts conduction and convection; shiny foil behind radiators – reflects radiation.