

Exercise walk-through

2.2

Dissipation efficiency and resources

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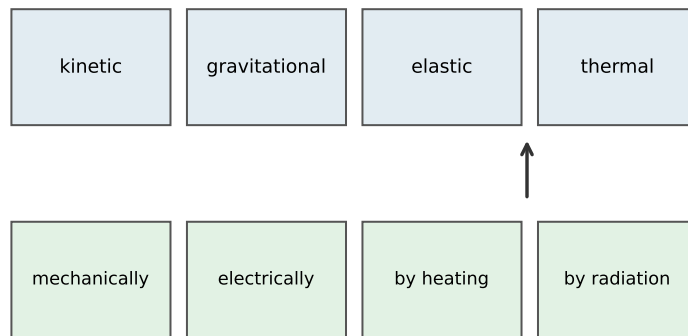
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The method

Method — Conservation with dissipation

Energy is transferred usefully, stored or dissipated – never created or destroyed.
Friction and air resistance are the great dissipaters, heating the surroundings.

energy STORES (left) are moved by TRANSFER PATHWAYS (right)

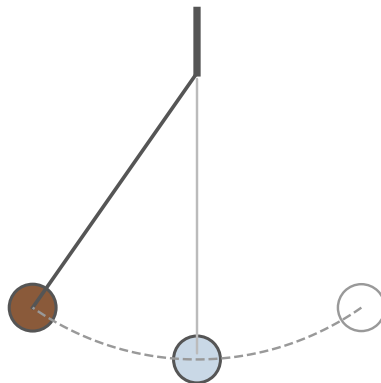


a system change moves energy between stores along the pathways

Energy stores above, transfer pathways below.

Method — (P) The pendulum and the Sankey

Sankey arrow width $\propto$ energy flow; total in = total out always.



highest points: all GPE

lowest point: all KE

A pendulum: all GPE at the top, all KE at the bottom.

Exercises 2.1·2.3

2.1 What is meant by a “system” in energy accounting? [1]

2.2 Name the two forces that most commonly dissipate energy. [2]

2.3 A device takes 500 J and gives 150 J usefully. Calculate the efficiency as a percentage. [2]

Exercises 2.1·2.3

2.1 What is meant by a “system” in energy accounting? [1]

2.1 An object or group of objects whose energy changes we track.

2.2 Name the two forces that most commonly dissipate energy. [2]

2.2 Friction and air resistance.

2.3 A device takes 500 J and gives 150 J usefully. Calculate the efficiency as a percentage. [2]

2.3 $150/500 \times 100 = 30\%$.

Exercises 2.4·3.1

2.4 (P) Describe the energy changes over one full swing of a pendulum. [2]

2.5 Give one advantage and one drawback of geothermal power. [2]

3.1 A motor takes 240 W of electrical power and delivers 180 W of mechanical power. Calculate the efficiency and the power dissipated, and name the store the dissipated energy reaches. [4]

Exercises 2.4·3.1

2.4 (P) Describe the energy changes over one full swing of a pendulum. [2]

2.4 (P) GPE at the top $\rightarrow$ KE at the bottom $\rightarrow$ GPE again at the other top; the total (GPE + KE) stays constant in an ideal pendulum.

2.5 Give one advantage and one drawback of geothermal power. [2]

2.5 Steady, reliable output; very few suitable geological sites.

3.1 A motor takes 240 W of electrical power and delivers 180 W of mechanical power. Calculate the efficiency and the power dissipated, and name the store the dissipated energy reaches. [4]

3.1 Efficiency = $180/240 = 0.75 = 75\%$; dissipated power = $240 - 180 = 60$ W; it reaches a thermal store – the motor warms.

Exercises 3.2·3.3

3.2 (P) Explain why a real pendulum eventually stops, and where its energy has gone.[3]

3.3 Draw or describe the Sankey diagram for a 100 J lamp giving 15 J of light, labelling the arrow widths. [3]

Exercises 3.2·3.3

3.2 (P) Explain why a real pendulum eventually stops, and where its energy has gone.[3]

3.2 (P) Air resistance and friction at the pivot dissipate energy by heating; each swing carries slightly less mechanical energy until the pendulum rests – the energy is in the warmed surroundings.

3.3 Draw or describe the Sankey diagram for a 100 J lamp giving 15 J of light, labelling the arrow widths. [3]

3.3 One input arrow 100 J wide splits at a junction; a useful branch 15 J wide to the lamp (light); a dissipated branch 85 J wide to thermal energy of the surroundings – widths drawn to scale.