2.2 Dissipation efficiency and resources

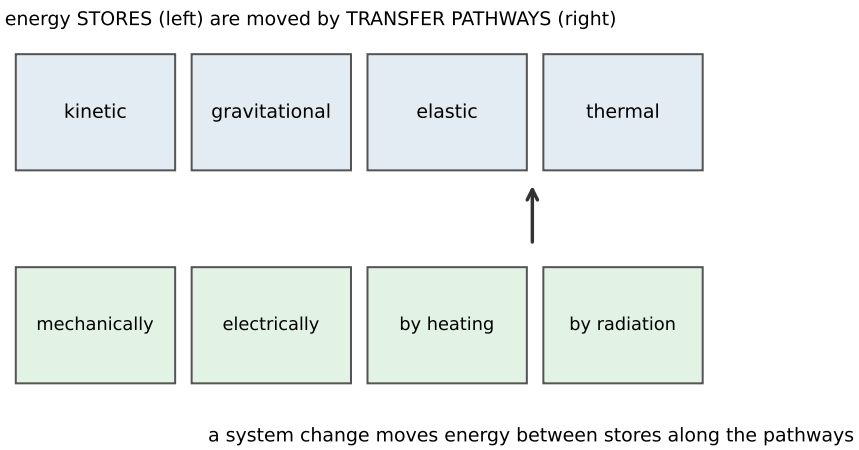
Name: _____ Class: _____ Date: _____ **Total: 19 marks**

Objective

Cover energy transfers, dissipation and resources (3.2.2–3.2.3): system energy transfers, the pendulum (P), conservation, efficiency by energy or power, Sankey diagrams, and renewable versus non-renewable resources. Original OxfordAQA practice.

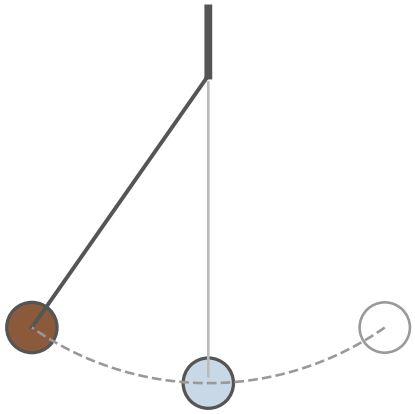
1 Key knowledge and worked examples

■ 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.

(P) The pendulum and the Sankey



highest points: all GPE

lowest point: all KE

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

Resource choices

solar	+ renewable; no fuel cost	- night and cloud dependent
wind	+ renewable; no emissions	- unreliable; visual impact
geothermal	+ steady output	- few suitable sites
wave/tidal	+ predictable tides	- harsh marine environment

2 Practice

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]

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 Exam-style questions

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]

3.2 (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]

Solutions

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

2.2 Friction and air resistance.

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

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

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

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

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 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.