YEAR 9 PHYSICS, AQA GCSE, UNIT 2, UNIT REVIEW

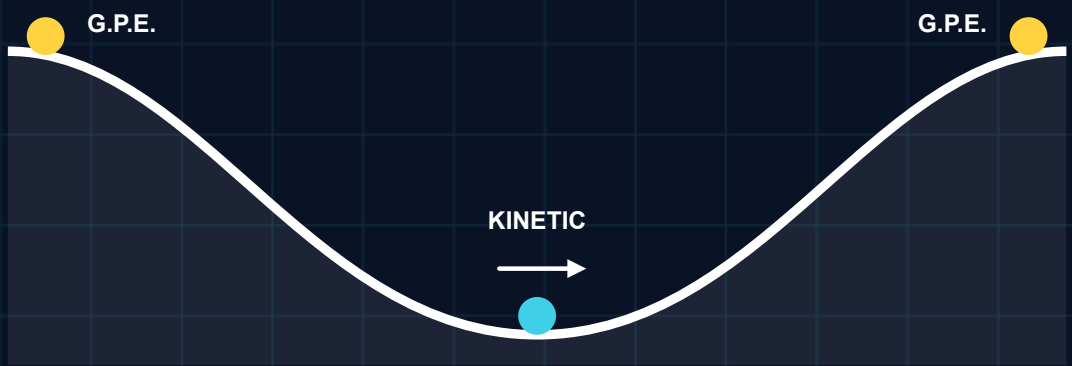
ENERGY STORES AND TRANSFERS

UNIT REVIEW

AFTER LESSON 9

Mixed exam-style questions from the whole unit, a fix-it log and the equation toolkit.

ANSWER EDITION FOR TEACHERS AND SELF-MARKING



NAME _____ CLASS _____

TEACHER _____ TARGET GRADE _____

AFTER LESSON 9, AT HOME OR IN CLASS

UNIT REVIEW

Mixed questions from the whole unit, like a real exam. Try each question without looking back. The equation toolkit is on the last page. Then mark your answers with your teacher and fill in the “fix it” log.

AQA-STYLE

MIXED EXAM PRACTICE

40 marks, about 45 minutes

1 Draw **one** line from each object to the energy store that is filling up. **[3 marks]**

a book being lifted onto a shelf	elastic potential store
a bow being pulled back	thermal store
a cup of tea being heated	gravitational potential store

All three correct (3); two correct (2); one correct (1).

2 A battery-powered fan is switched on. Describe the useful energy transfer. **[2 marks]**

Energy is transferred electrically from the chemical store of the battery (1) to the kinetic store of the fan blades (1).

3 A car of mass 1200 kg travels at 15 m/s. Calculate the energy in the kinetic store of the car. Use $E_k = \frac{1}{2} m v^2$ **[3 marks]**

EQUATION	$E_k = \frac{1}{2} m v^2$ **(1)**
SUBSTITUTE	$E_k = \frac{1}{2} \times 1200 \times 15^2$ **(1)**
ANSWER	**135 000 J (1)** unit:

4 A climber of mass 60 kg climbs 12 m up a rock face. Calculate the energy transferred to the climber's gravitational potential store. Gravitational field strength = 9.8 N/kg **[3 marks]**

EQUATION	$E_p = m g h$ **(1)**
SUBSTITUTE	$E_p = 60 \times 9.8 \times 12$ **(1)**
ANSWER	**7056 J (accept 7100 J) (1)** unit:

5 A student hangs weights on a spring and measures its extension. **[6 marks]**

Force / N	0	1.0	2.0	3.0	4.0	5.0
Extension / cm	0	2.0	4.0	6.0	8.0	10.9

(a) Calculate the spring constant. Use the reading at 2.0 N, and $F = k\,e$

EQUATION	$F = k\,e$
REARRANGE	$k = \frac{F}{e}$ **(1)**
SUBSTITUTE	$k = \frac{2.0}{0.040}$ **(extension in metres) (1)**
ANSWER	**50 N/m (1)** unit:

(b) Calculate the energy in the elastic potential store when the extension is 0.060 m. Use $E_e = \frac{1}{2}\,k\,e^2$

EQUATION	$E_e = \frac{1}{2}\,k\,e^2$
SUBSTITUTE	$E_e = \frac{1}{2} \times 50 \times 0.060^2$ **(1)**
ANSWER	**0.09 J (1)** unit:

(c) Explain what the result at 5.0 N shows.

The extension is no longer proportional to the force (it should be 10.0 cm): the limit of proportionality has been exceeded (1).

6 A ball of mass 0.50 kg is dropped from a height of 3.2 m. Gravitational field strength = 9.8 N/kg **[6 marks]**

(a) Calculate the energy in the ball's gravitational potential store before it is dropped.

EQUATION	$E_p = m\,g\,h$
SUBSTITUTE	$E_p = 0.50 \times 9.8 \times 3.2$ **(1)**
ANSWER	**15.68 J (15.7 J) (1)** unit:

(b) Ignoring air resistance, how much energy is in the ball's kinetic store just before it hits the ground?

15.7 J (the same as the gravitational potential energy lost) (1)

(c) The ball bounces back to a height of only 2.4 m. Explain why, using the idea of conservation of energy.

Energy is not destroyed, but some is dissipated (1) to the thermal store of the ball and surroundings / transferred by sound when it hits the ground (1).

(d) Calculate the efficiency of the bounce. Use $\textbf{efficiency} = \dfrac{\textbf{bounce height}}{\textbf{drop height}}$

$\dfrac{2.4}{3.2} = 0.75$ **(75%) (1)**

7 A motor lifts a load. It transfers 4800 J to the load in 12 s. **[4 marks]**

(a) Calculate the power of the motor. Use $P = \dfrac{E}{t}$

EQUATION	$P = \dfrac{E}{t}$
SUBSTITUTE	$P = \dfrac{4800}{12}$ **(1)**
ANSWER	**400 W (1)** unit:

(b) A 600 W motor transfers the same 4800 J. Calculate how long it takes.

EQUATION	$P = \dfrac{E}{t}$
REARRANGE	$t = \dfrac{E}{P}$ **(1)**
SUBSTITUTE	$t = \dfrac{4800}{600}$
ANSWER	**8.0 s (1)** unit:

8 Efficiency. **[4 marks]**

(a) A kettle is supplied with 2000 J. It transfers 1700 J to the thermal store of the water. Calculate its efficiency.

EQUATION	$\text{efficiency} = \frac{\text{useful output}}{\text{total input}}$
SUBSTITUTE	$\text{efficiency} = \frac{1700}{2000}$ **(1)**
ANSWER	**0.85 or 85% (1)** unit:

(b) A lamp is 20% efficient. Its useful power output is 6.0 W. Calculate its total power input.

EQUATION	$\text{efficiency} = \frac{\text{useful}}{\text{total}}$
REARRANGE	$\text{total} = \frac{\text{useful}}{\text{efficiency}}$ **(1)**
SUBSTITUTE	$\text{total} = \frac{6.0}{0.20}$
ANSWER	**30 W (1)** unit:

9 **6-MARK QUESTION** A family wants to waste less energy heating their house. **[6 marks]**
Describe how energy is transferred out of the house, and explain **three** ways to reduce the energy wasted.

Level 3 (5–6): a clear description of how energy leaves, and three ways, each linked to how it reduces the rate of transfer. Level 2 (3–4): two ways with some explanation. Level 1 (1–2): ways listed with little or no explanation. Points: energy is transferred by heating from the warm house to the colder surroundings (through walls, roof, windows, gaps); it is dissipated to the thermal store of the surroundings; loft insulation / cavity-wall insulation / double glazing use materials with low thermal conductivity (or trapped air), so the rate of energy transfer is lower; thicker walls or insulation reduce the rate further; draught excluders stop warm air escaping; thermostats or lower settings mean less energy is needed.

10 Draw a ring around the correct unit in each box. **[3 marks]**

The unit of power is **J** (**W**) **N**

The unit of spring constant is (**N/m**) **N** **J/s**

The unit of energy is **W** **kg** (**J**)

REVIEW LATER

FIX-IT LOG

Turn every lost mark into a target.

Q	What went wrong?	The correct physics (or method) is…	Lesson to revisit

REFERENCE

EQUATION TOOLKIT

Every equation in the unit. AQA prints all of them on the equation sheet in the exam, but you still need to know what each symbol means, its unit, and how to use it. Use $g = 9.8\ \text{N/kg}$.

1. Cover the quantity you want to find.
2. What is left side by side? **Multiply**.
3. One above the other? **Divide** the top by the bottom.

Example: to find h from $E_p = m\,g\,h$, cover h. E_p is above m and g, so $h = \dfrac{E_p}{m\,g}$. Kinetic and elastic potential energy have no triangle: in this unit you only use them to calculate the energy.

$E_k = \frac{1}{2}\,m\,v^2$

Lesson 2

kinetic energy = 0.5 × mass × (speed)²

J, kg, m/s

Use it to calculate the energy. Only the speed is squared.

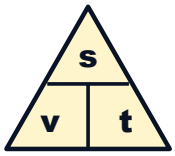
$s = v\,t$

Lesson 2

distance travelled = speed × time

m, m/s, s

$v = \dfrac{s}{t}$ and $t = \dfrac{s}{v}$



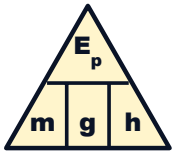
$E_p = m\,g\,h$

Lesson 3

gravitational potential energy = mass × gravitational field strength × height

J, kg, N/kg, m

$h = \dfrac{E_p}{m\,g}$ and $m = \dfrac{E_p}{g\,h}$



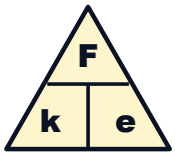
$F = k\,e$

Lesson 4

force = spring constant × extension

N, N/m, m

$k = \dfrac{F}{e}$ and $e = \dfrac{F}{k}$



$E_e = \frac{1}{2}\,k\,e^2$

Lesson 5

elastic potential energy = 0.5 × spring constant × (extension)²

J, N/m, m

Use it to calculate the energy. Only the extension is squared.

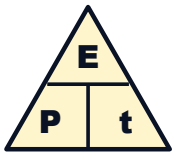
$P = \dfrac{E}{t}$

Lesson 7

power = energy transferred ÷ time

W, J, s

$E = P\,t$ and $t = \dfrac{E}{P}$



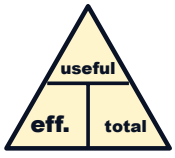
$\text{eff.} = \dfrac{\text{useful output}}{\text{total input}}$

Lesson 9

efficiency = useful output ÷ total input, using energy (J) or power (W)

no unit: a decimal up to 1, or × 100 for a percentage

useful = eff. × total; $\text{total} = \dfrac{\text{useful}}{\text{eff.}}$



1

Write what you know. Convert first: g → kg, cm → m, kJ → J, min → s, % → decimal.

2

Write the equation in symbols.

3

Rearrange if you need to, then substitute the numbers.

4

Give the answer with a unit. Ask: is it sensible?