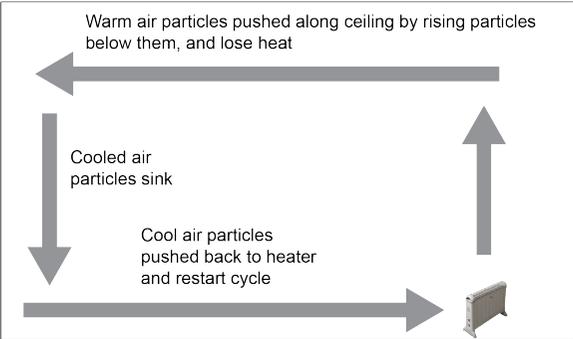# Assessment Schedule – 2025

Physics, Earth and Space Science: Demonstrate understanding of a physical system using energy concepts (92047)

Evidence

Q	Evidence	Achievement	Achievement with Merit	Achievement with Excellence
ONE (a)	**Electrical** energy is transformed into (Gravitational) Potential /Kinetic + (Thermal)	• Correct answer.		
(b)	$E = Pt = 250 \times 35 = 8750$ J $E_p = mgh = 40 \times 10 \times 20 = 8000$ J The difference is the energy lost due to heat and sound to the electric motor. Accept if g = 9.8 used, $E_p = 7840$ J	• Selected the correct equation for either equation and put in some numbers. • Mentions due to energy loss.	• Both calculations with correct equation and working (units NOT required). Consistent marking if g = 9.8 used OR Explained the energy loss as heat or sound.	• Both calculations with correct equation and working. Units required. AND Explained where the loss of energy comes from heat or sound.
(c)	Gravitational potential energy is converted to gravitational energy and kinetic energy with a loss to thermal energy. *This can be shown using words or a diagram.*	• Transfer from E_p to $E_k + E_p$.	• Transfer from E_p to $E_k + E_p + E_{thermal}$.	
(d)	$E_p = mgh = 40 \times 10 \times 20 = 8000$ J (or carried number down from (b)) Assumed $E_p = E_k$ – must be stated not assumed $8000 = \frac{1}{2} mv^2$ $V = \frac{\sqrt{8000 \times 2}}{40}$ $= 20$ m s^{-1} The speed of the paint pot will be less because not all gravitational energy is transformed into kinetic energy. Some is lost to thermal energy due to the air particles hitting the surface of the paint pot.	• Selected correct formulae for kinetic energy and added some values. • Assumed that all E_p is transformed into E_k. • Mentioned that energy is lost due to friction. OR The speed of the pot will be less.	• Started to calculate the velocity that it hits the ground but forgot to take the square root ($v = 400$ m s^{-1}) OR Correct answer but incorrect unit. • Explains that the speed of the paint pot will be less due to air resistance / thermal energy / heat / friction.	• Correct calculation for the velocity with correct unit AND Correct assumption (assuming all $E_p \geq E_k$) OR no energy loss. AND Energy is lost to thermal due to particles of air hitting the surface of the paint pot AND Therefore the paint pot will not hit the ground as fast as the calculated speed.

NØ	N1	N2	A3	A4	M5	M6	E7	E8
No response	1A	2A	3A	4A	2M	3M	1E + 1M	2E

Q	Evidence	Achievement	Achievement with Merit	Achievement with Excellence
TWO (a)	Temperature is the average kinetic energy of the particles, whereas thermal / heat energy is the total kinetic energy of the particles.	• Either definition correct.	• Has explained a difference between temperature and thermal/heat energy.	
(b)	$P = VI$ $I = \dfrac{P}{V}$ $= \dfrac{1000}{240}$ $= 4.17$ A (Accept 4.16 A, 4.2 A 4.15 A)	• Shows correct equation with some numbers.	• Correct answer with working and units (sig figs not important).	
(c)	Current is increased, which causes electrons carrying more energy around the circuit. This results in greater power, and over time, an increase in electrical energy to be transformed into thermal energy. *Candidate uses equations to back up their explanations.*	• Increase in current increases electrical energy. OR Increase in power causes increase in electrical energy. • Electrical energy is transformed into heat energy.	• Increase in current causes increase in power due to $P = VI$ • Increase in power causes increase in energy due to $\Delta E = Pt$	• Increase in current causes increase in power d*ue to* $P = VI$. *Where I increases,* V stays constant so P increases. AND Increase in power causes increase in energy due to $\Delta E = Pt.$. Where P increases, time stays constant so ΔE increases.

(d)	Diagram showing convection currents. Hot air labelled going up. Cold air going down either side of room.	• Arrows drawn and labelled (warm OR cold air).	• Labelled arrows are drawn AND Full description of particles getting further apart, so are less dense and rise OR Labelled arrows are drawn AND When it cools, it becomes closer together, more dense, and sink.	• Labelled arrows are drawn AND Full description of particles getting faster and further apart, so are less dense and rise AND When it cools, the particles move slower become closer together, more dense, and sink.
	Warm air particles pushed along ceiling by rising particles below them, and lose heat / Cooled air particles sink / Cool air particles pushed back to heater and restart cycle	• States convection current. • States that warm air rises OR cold air sinks. A7 • States warm air is less dense OR cold air is more dense.	• Labelled arrows AND Particles getting faster so are less dense and rise. When it cools, they slow down become more dense, and sink.	
	Explanation: My diagram shows the heater warming the air above it, increasing the kinetic energy of the particles and causing them to move further apart, resulting in less dense air. The less dense air rises up. In the cold regions, the particles have less kinetic energy, losing energy to the surroundings and moving closer together. This makes the air heavier and this air sinks. This causes a current. where the cold air is heated by the heater causing the upward movement.			

NØ	N1	N2	A3	A4	M5	M6	E7	E8
No response	1A	2A	3A	4A	2M	3M	1E + 1M	2E

Q	Evidence	Achievement	Achievement with Merit	Achievement with Excellence
THREE (a)	The energy required to heat one kilogram of water one degree centigrade without changing its state.	• Correct definition.		
(b)	$P = VI = 24 \times 5.0 = 120$ W $E = Pt = 120 \times 600 = 72\ 000$ J Students may do this in one line. $E = VIt = 24 \times 5.0 \times 600 = 72\ 000$ J **NOTE: This is a show question.**	• One correct equation and adds some numbers.	• Correct answer (units not required).	
(c)(i)	$E_{\text{thermal}} = mc\Delta T$ Therefore $c = \dfrac{Q}{m\Delta T}$ $= \dfrac{72\ 000}{0.5 \times 40}$ $= 3600$ J kg^{-1} °C^{-1}	• Selects correct equation. • Has ΔT as 40 °C.	• Calculates a value for c with a minor error (incorrect ΔT / Q /mass) OR Correct answer but incorrect unit. • **Link to Experiment** Some energy is not transferred to the water, but is transferred into the glass. lost to the atmosphere/not transferred to beaker. OR This could be due to the thermometer being at a hot spot (due to convection currents). OR This means an incorrect reading.	• Correct calculation with correct unit. AND
(ii)	Cecelia's value will be different because some of the energy from the hotplate goes to heat other things and not the water (e.g. the glass). OR Because the water was not stirred, the thermometer was at a hot spot and caused a larger increase in temperature. OR There is an error in some of the measuring devices or equipment. E g Thermometer gave an incorrect reading She did not read the voltage or current of	• **Statement** Mentions why the value is different, e.g. the hot plate heats up the glass or thermometer. OR The water has increased temperature too much. OR A piece of equipment is faulty.		**Link to heat transfer.** Some energy is not transferred to the water, but is transferred into the glass/lost to the atmosphere/not transferred to beaker OR Due to a lack of stirring of the water. OR Mentions consequence of this.

	hotplate correctly.			
(d)	Cecelia could (there are other examples): • enclose experiment in non-conductive material • put a heater element inside the beaker • reduce the size of the hotplate. *Evidence could come from diagram or words.* A link to how this improves accuracy of result, e.g.: • non-conductive material limits heat loss • conductive metal beaker • reduced size of hotplate means only water is being heated. A further link is given to heat loss through conduction, convection, or radiation to a particle / wave level.	• Describes / draws a relevant improvement. • Links improvement to a method of heat transfer.	• Describes / draws a method to improve the accuracy of this experiment. AND Explains how this method helps with heat loss. • This method is linked to heat transfer (ie conduction, convection or radiation).	• Describes / draws a method to improve the accuracy of this experiment. AND Explains how this method helps with heat loss. AND Then links this method to heat transfer. (ie conduction, convection or radiation).

NØ	N1	N2	A3	A4	M5	M6	E7	E8
No response	1A	2A	3A	4A	2M	3M	1E + 1M	2E

Cut Scores

Not Achieved	Achievement	Achievement with Merit	Achievement with Excellence
0 – 6	7 – 12	13 – 18	19 – 24