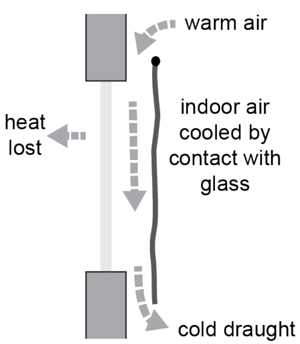
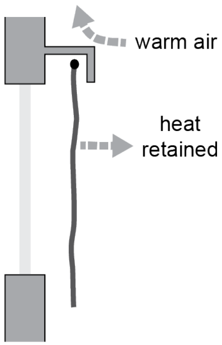
Assessment Schedule – 2019

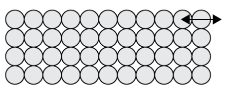
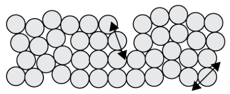
Physics: Demonstrate understanding of aspects of heat (90939)

Evidence

Q	Evidence	Achievement	Merit	Excellence
ONE (a)	4200 J of energy is required to raise the temperature of 1 kg of water by 1°C.	• **4200 J** to raise **1 kg** of **water** by **1°C**.		
(b)	$Q = mc\Delta T$ $= 600 \times 1006 \times 5$ $= 3\,018\,000 \text{ J}$	• Correctly uses equation with incorrect temperature. (E.g. uses 16°C to get 9 657 600 J or 21°C to get 12 675 600 J).	• Correct answer.	
(c)	The specific heat capacity of water is higher than that of air. This means more energy is required to heat moist air, as the water contained in the air requires more energy (per kilogram) to increase the temperature by the same amount.	• Identifies that specific heat capacity of water is more than air, and m oist air has water in it.	• Specific heat capacity of water is greater than that of air, and moist air contains water, so moist air requires more energy.	
(d)(i)	$P_{\text{output}} = \frac{Q}{t} = \frac{150\,000}{5 \times 60} = 500 \text{ W}$ $= P_{\text{total}} \times Efficiency$ $P_{\text{total}} = \frac{P_{\text{output}}}{Efficiency} = \frac{500}{0.85} = 588 \text{ W}$	• Uses power formula correctly but makes one unit error (e.g. forgets to convert kJ to J or min to s). OR Temperature increases when insulation is installed. OR Calculates P = 500 W.	• Calculates P_{total} = 588 W. OR Divides incorrect P by 0.85. OR Insulation reduces rate of heat loss so energy retained in air increases so temperature increases.	• Calculates P_{total} = 588 W. AND Insulation reduces rate of heat loss so energy retained in air increases so temperature increases.
(ii)	Insulation would reduce the rate of heat loss from the house, but the power of the heater is the same so the amount of heat in the air in the house would increase so the temperature in the house would increase. *(Power of heat loss would increase with temperature difference, so eventually the power of heat loss would again equal the power of the heater and equilibrium would again be reached, but at a higher temperature than before insulation was installed.)*			

Q	Evidence	Achievement	Merit	Excellence
TWO (a)	A convection current is caused by the warmer, less dense material rising while the cooler, more dense material sinks, creating circulation / convection current.	• Warm / less dense air rises OR cool / denser air sinks.		
(b)	Air against the window cools, making it more dense, so it sinks. Without the pelmet warm air is easily drawn in from above to replace the sinking cool air and then cooled itself. This creates a convection current and cools the air in the room. The pelmet creates a barrier disrupting the warm air from being drawn down behind the curtain as easily and reduces the effect of convection. **Without pelmet**  **With pelmet** 	• Identifies that without a pelmet a convection current occurs (words or diagram). OR Identifies that a pelmet prevents a convection current from occurring. OR Cool air sinks behind curtain and loses heat to window (words or diagram).	• Cool air sinks behind curtain and warm air is drawn in from above to replace it (words or diagram). AND Pelmet disrupts flow of warm air down from above reducing convection.	
(c)	The honeycomb style would be more effective at reducing heat loss than the venetian blind. The honeycomb has a middle that is filled with air. Since air is a poor conductor of heat it reduces the loss of heat by conduction. As the air is in different cells heat loss by convection is reduced.	• Identifies honeycomb style is better. AND - Air is an insulator / poor conductor of heat. OR - Cells reduce heat loss by convection.	• Identifies honeycomb style is better. AND Air is an insulator / poor conductor of heat. AND Cells reduce heat loss by convection.	

(d)	$Q_{\text{heating}} = mc\Delta T$ $= 0.200 \times 4\,200 \times 80$ $= 67\,200$ J $Q_{\text{boiling}} = mL$ $= 0.200 \times 2.3 \times 10^6$ $= 460\,000$ J $Q_{\text{total}} = Q_{\text{heating}} + Q_{\text{boiling}}$ $= 67\,200 + 460\,000 = 527\,200$ J	• Either energy calculation correct (67 200 J or 460 000 J). OR Understanding that you needed to add both energies.	• Correct working but with minor error (e.g. uses 200 g in calculation to get 527 200 000 J).	• Correct answer.

<table>
<tr><th>Q</th><th>Evidence</th><th>Achievement</th><th>Merit</th><th>Excellence</th></tr>
<tr><td>THREE
(a)</td><td>1500 °C – Melting
2850 °C – Boiling</td><td>• Both correct.</td><td></td><td></td></tr>
<tr><td>(b)</td><td>The latent heat of vaporisation of iron is greater than the latent heat of fusion. For a fixed mass of iron changing from liquid to gas requires more energy than changing from solid to liquid. So, for constant power input, it will take more time for the iron to change from liquid to gas than from solid to liquid.</td><td>• Changing from liquid to gas requires more energy.</td><td>• As $L_{\text{vaporisation}} > L_{\text{fusion}}$ changing from liquid to gas requires more energy so it will take longer.</td><td></td></tr>
<tr><td>(c)(i)</td><td><table><tr><th>Arrangement of iron particles at 1000°C</th><th>Arrangement of iron particles at 2000°C</th></tr><tr><td></td><td></td></tr></table>1000 °C Solid – regular particle arrangement, particles close.
2000 °C Liquid – irregular particle arrangement, particles further apart.
Particles touching ok.</td><td rowspan="2">• At 1000 °C arrangement regular, at 2000 °C arrangement irregular.
OR
At 1000 °C particles close, at 2000°C particles further apart.
OR
Particles at 1000 °C oscillate / vibrate, particles at 2000 °C move.</td><td rowspan="2">• At 1000 °C, arrangement regular and particles close, at 2000 °C, arrangement irregular and particles further apart.
AND
Particles at 1000 °C oscillate / vibrate, particles at 2000 °C move.</td><td rowspan="2"></td></tr>
<tr><td>(ii)</td><td>Iron particles at 1000 °C are in the solid state. They have no net movement (average position does not change), but they can vibrate / oscillate.
Iron particles at 2000 °C are in the liquid state. The particles are able to move past each other.</td></tr>
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(d)	When heated, the particles inside the metal gain more energy and vibrate / oscillate faster. As a result, particles also move further apart, and this causes the metal to expand. If the ends of a section of track are fixed in place and the track expands, the track must bend to allow the increased track length to fit between the fixed end points. Including a gap between each section allows the track to expand without pushing against the next section so it does not have to bend to account for the increased length.	• Increased temperature causes particles to vibrate faster / move further apart / metal to expand. OR Expansion makes the track bend. OR Gap allows track to expand without bending.	• Increased temperature causes particles to vibrate faster / move further apart, so metal expands. AND ONE OF Expansion [with fixed ends] makes the track bend. OR Gap allows track to expand.	• Increased temperature causes particles to vibrate faster and move further apart, so metal expands. AND Expansion [with fixed ends] makes the track bend AND Gap allows track to expand without pushing against next section so does not bend.

Judgement Statement

NØ	N1	N2	A3	A4	M5	M6	E7	E8
No relevant evidence.	Very little evidence at the Achievement level. Most evidence is at the Not Achieved level.	Some evidence at the Achievement level; partial explanations.	Most evidence provided is at the Achievement level, while some is at the Not Achieved level.	Nearly all evidence provided is at the Achievement level.	Some evidence is at the Merit level with some at the Achievement level.	Most evidence is at the Merit level, with some at the Achievement level.	Evidence is provided for most tasks, with evidence at the Excellence level weak or with minor errors / omissions.	Evidence provided for all tasks. Evidence at the Excellence level accurate and full.
No evidence	1 × A	2 × A OR 1 × M	3 × A OR 1 × A + 1 × M OR 1 × E	4 × A OR 2 × A + 1 × M OR 2 × M OR 1A (or more) + 1E	1 × A + 2 × M OR 1 × M + 1 × E	2 × A + 2 × M OR 3 × M	1 × A + 1 × M + 1 × E	2 × M + 1 × E

Cut Scores

Not Achieved	Achievement	Achievement with Merit	Achievement with Excellence
0 – 7	8 – 13	14 – 18	19 – 24