Assessment Schedule – 2018

Physics: Demonstrate understanding of aspects of heat (90939)

Evidence Statement

<table>
<tr><th>Q</th><th>Evidence</th><th>Achievement</th><th>Merit</th><th>Excellence</th></tr>
<tr><td>ONE
(a)</td><td>X = 100°C
Y = 0°C</td><td>Either X or Y correct (units not needed).</td><td></td><td></td></tr>
<tr><td>(b)</td><td>
<table>
<tr><td></td><td>(i) Process</td><td>(ii) Phase / s</td></tr>
<tr><td>Section B</td><td>Melting / phase change</td><td>Solid and liquid</td></tr>
<tr><td>Section C</td><td>Heating / temp increase</td><td>Liquid</td></tr>
</table>
</td><td>One column correct.
OR
One row correct.</td><td>All correct.</td><td></td></tr>
<tr><td>(c)</td><td>During section D, the water is changing phase (from liquid to gas / steam).
The energy being added from the cooker breaks bonds between the particles, allowing them to change phase [from liquid to gas].
The (average) kinetic energy of the particles does not change during this process, so the temperature does not change.</td><td>Change in phase.
OR
Bonds between particles broken.
OR
No change in kinetic energy.</td><td>Energy breaks bonds between particles.
AND
No change in kinetic energy so no change in temperature.</td><td></td></tr>
<tr><td>(d)</td><td><u>Section D: Boiling</u>
$L = 2\,300\,000 \text{ J kg}^{-1}$
$Q = mL = 0.35 \times 2\,300\,000 = 805\,000 \ J$
$t = \frac{E}{P} = \frac{805\,000}{930} = 865.59 = 870 \text{ s (2 s.f.)}$
As the mass of water is the same for both processes, but the latent heat of vaporisation is higher than the latent heat of fusion, boiling will require more energy than melting.
Because the power provided is constant and boiling requires more energy, the time taken for boiling will be longer than the time taken for melting.</td><td>Correct Q.
OR
Incorrect Q used to correctly calculate t.
OR
More energy for boiling / less energy for melting.</td><td>Correct time.
OR
Boiling requires more energy because the latent heat is larger (or vice versa).
OR
Boiling will take more time because it requires more energy (or vice versa).
OR
One of: constant / same mass or constant / same power.</td><td>Correct time and unit.
(2 s.f. not required)
AND
Section D requires more energy because the latent heat is larger (or vice versa).
AND
Section D will take more time because it requires more energy (or vice versa).
AND
One of: constant / same mass or constant / same power.</td></tr>
</table>

Q	Evidence	Achievement	Merit	Excellence
TWO (a)	One of: Air pockets / traps air / poor conductor (of heat) / insulator /light colour or reflects heat (only if related to appropriate surface i.e. inside)	One property stated.		
(b)	Air gets trapped between each layer of clothing. Having more layers will trap more air. Because air is a poor conductor / good insulator of heat, having more air trapped between the layers of clothing will reduce the amount of heat lost to the environment, keeping the person warm.	Traps more air. OR Air is a poor conductor / good insulator.	Air is a poor conductor / good insulator. AND Less heat lost to environment.	
(c)	Water near the skin will evaporate. To do this the water needs to gain energy to break bonds with adjacent particles / gain latent heat. It absorbs this energy from the skin of the person, cooling the person down. *More accurate answer: The highest energy water particles have enough energy to change phase so evaporate. As the highest energy particles have been removed, the average kinetic energy / temperature of the remaining water decreases. As the water is now at a lower temperature than the skin, heat will flow from the person to the water until it is at the same temperature as the skin.*	Evaporation or latent heat described. (NOT "increasing temperature of water" or "boiling".)	Water gaining energy / latent heat to evaporate linked to heat loss and cooling of person.	
(d)(i)	The thick rubber soles reduce heat loss by **conduction/less heat conducted out**, as the heat has a large amount of **insulating / poorly conducting** material to pass through.	Appropriate heat-transfer methods stated for two layers. OR Relevant features of two layers described.	Appropriate heat-transfer methods stated for all three layers. OR Relevant feature linked to appropriate heat-transfer method for one layer.	Relevant features linked to appropriate heat-transfer methods for all three layers.
(ii)	The thin aluminium membrane reduces heat loss by **radiation/ emits less radiant heat**, as it is shiny and **reflects heat / radiation** back in towards the feet.			
(iii)	The polyester / wool layer reduces heat loss by **convection**, as it **traps air** in tiny pockets and doesn't allow it to circulate. OR The polyester / wool layer reduces heat loss by **conduction**, as it traps air, which is an **insulator / poor conductor** of heat. OR The polyester/wool layer reduces heat by **conduction** as it is an **insulator/ poor conductor**			

Q	Evidence	Achievement	Merit	Excellence
THREE (a)	Heat is transferred from the warm water to the cold ice. This decreases the temperature of the water and increases the temperature of the ice. *(The heat lost is then replaced by heat from the steam, maintaining the temperature of the water.)*	Heat transferred from water to ice. OR Temperature of water decreases / temperature of ice increases.	Heat transferred from water to ice. AND Temperature of water decreases and temperature of ice increases.	
(b)	$Q = mc\Delta T = 260\,000 \times 4\,200 \times 5.6 = 6.1 \times 10^9$ J	Q correct.		
(c)	The narrow opening reduces heat loss by convection. The narrow opening limits the flow of warm air up out of the well and cold air down into the well. (Also reduces heat loss by evaporation.)	Convection.	Convection. AND Describes limiting either warm air rising or cold air sinking.	
(d)(i)	$Q = P \times t = 220\,000 \times 60 = 1.32 \times 10^7$ J $m = \frac{Q}{L} = \frac{1.32 \times 10^7}{2\,300\,000} = 5.739 = 5.7$ kg (2 s.f.)	Q correct. OR Correct working for m with one minor error (eg incorrect Q or uses fusion L value). OR One mechanism described.	Correct m. OR One correct mechanism used to explain why less steam is produced than expected.	Correct m. AND One correct mechanism used to explain why less steam is produced than expected.
(d)(ii)	Less water than calculated will gain enough energy to change phase / boil and less than 5.7 kg of steam will be produced because: • The system is not 100% efficient, not all of the energy will go into 5.7 kg of water. • Some energy will be lost into the surroundings / steam will be heated to more than 100°C / etc…			

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 OR 1 × E	3 × A OR 1 × A + 1 × M	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