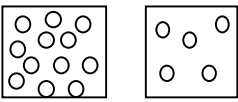


Assessment Schedule – 2012: Physics: Demonstrate understanding of aspects of heat (90939)

Assessment Criteria

Question	Achievement	Merit	Excellence					
ONE (a)(i) (ii)	States the term condensation.	States the term condensation. AND When the water vapour / humid air touches the cold glass (surface) , and becomes liquid / water. (not accepting: steam)	States the term condensation. AND When the water vapour / humid air touches the cold glass (surface) , heat / energy is lost / removed and water vapour becomes liquid / water. (not accepting: steam)					
(b)	$Q = mc\Delta T$ $= 696 \times 1006 \times (21 - 8.0)$ $= 9\,102\,288\text{ J}$ or 9102 kJ							
(c)	Mentions that humid air contains water / water vapour, so more heat energy is required to heat it.	Water / water vapour has a large heat capacity compared with dry air. Humid air contains water and so more heat energy is required to heat humid air than dry air. OR Attempts to calculate energy required for humid air but fails to realise mass of dry air is not 696 kg, obtaining an answer of 9862.32 kJ	Shows that humid air contains water / water vapour and hence more heat energy is required to heat humid air than dry air by correct calculation. Humid air requires 9 680.27 kJ compared to dry air; correctly subtracting water vapour mass from total mass of humid air.					
(d)(i)	Both diagrams are correct (NOT accepting significantly different sized particles AND neither must have the regular arrangement associated with a solid.) 							
(ii) (iii)	Calculation is correct and answer is given in joules but quotes as kJ. $Q_{\text{liquid}} = mL$ $= 12 \times 168\,000$ $= 2\,016\,000\text{ kJ}$	Calculation is correct including conversion to kJ. $Q_{\text{liquid}} = mL$ $= 12 \times 168\,000$ $= 2\,016\,000\text{ J}$ $= 2016\text{ kJ}$	Calculation is correct including conversion to kJ. $Q_{\text{liquid}} = mL$ $= 12 \times 168\,000$ $= 2\,016\,000\text{ J}$ $= 2016\text{ kJ}$ AND Heat loss to the surroundings / air / pipes OR a mechanism is stated, eg conduction to pipes, or states that the heat loss accounts for the difference.					
NØ	N1	N2	A3	A4	M5	M6	E7	E8
No evidence	1a	2a	3a	4a	2m	3m	1e	2e

Question	Achievement	Merit	Excellence
<p>TWO (a)</p> <p>(b)</p>	<p>Any ONE of:</p> <p><u>Floor</u></p> <ul style="list-style-type: none"> • Aluminium is a (good) reflector of heat energy, reflecting the heat (energy) back to the house. • Aluminium is a poor emitter / radiator of heat / energy, so less energy is lost by radiation. • The air between the floor board and the foil reduces heat loss as it is a poor conductor / good insulator. • The air between the floor board and the foil is trapped and prevents heat loss by convection. <p>Any ONE of:</p> <p><u>Window</u></p> <ul style="list-style-type: none"> • Trapped air reduces heat loss by convection. • Two layers of glass reduce heat loss by conduction because glass is a poor conductor / insulator. • The air between the glass reduces heat loss as it is a poor conductor / good insulator. • Two layers of glass reduce heat loss by conduction because the (trapped) air is a poor conductor. <p>(Do NOT accept vacuum.)</p>	<p>Any TWO of:</p> <p><u>Floor</u></p> <ul style="list-style-type: none"> • Aluminium is a (good) reflector of heat energy, reflecting the heat (energy) back to the house. • Aluminium is a poor emitter / radiator of heat / energy, so less energy is lost by radiation. • The air between the floor board and the foil reduces heat loss as it is a poor conductor / good insulator. • The air between the floor board and the foil is trapped and prevents heat loss by convection. <p><u>Window</u></p> <ul style="list-style-type: none"> • Trapped air reduces heat loss by convection. • Two layers of glass reduce heat loss by conduction because glass is a poor conductor / insulator. • The air between the glass reduces heat loss as it is a poor conductor / good insulator. • Two layers of glass reduce heat loss by conduction because the (trapped) air is a poor conductor. • (Do NOT accept vacuum.) 	<p>Any THREE of:</p> <p><u>Floor</u></p> <ul style="list-style-type: none"> • Aluminium is a (good) reflector of heat energy, reflecting the heat (energy) back to the house. • Aluminium is a poor emitter / radiator of heat / energy, so less energy is lost by radiation. • The air between the floor board and the foil reduces heat loss as it is a poor conductor / good insulator. • The air between the floor board and the foil is trapped and prevents heat loss by convection. <p><u>Window</u></p> <ul style="list-style-type: none"> • Trapped air reduces heat loss by convection. • Two layers of glass reduce heat loss by conduction because glass is a poor conductor / insulator. • The air between the glass reduces heat loss as it is a poor conductor / good insulator. • Two layers of glass reduce heat loss by conduction because the (trapped) air is a poor conductor. <p>(Do NOT accept vacuum.)</p>
(c)	<p>Method: By filling the cavity of the wall with pink batts or any non-conducting materials / cotton / insulation.</p>	<p>Method: By filling the cavity of the wall with pink batts or any non-conducting materials / cotton / insulation.</p> <p>AND</p> <p>Reason: trapped air / pockets of air reduces heat loss.</p>	<p>Method: By filling the cavity of the wall with pink batts or any non-conducting materials / cotton / insulation.</p> <p>AND</p> <p>Reason: trapped air / pockets of air reduces heat loss.</p> <p>AND</p> <p>This will reduce the heat loss by conduction / convection.</p>

(d)	Calculates total amount of heat in J or kJ. Total heat loss for 2 minutes $= 46 + 68 + 34 + 24$ $= 172 \text{ kJ (172 000 J)}$			The process is correct, but used 2 minutes instead of 120 s and got an answer of 86 kW or 86 000 W. (Unit required.) Accept J s^{-1} or kJ s^{-1} The process is correct, but answer has wrong units e.g. 1.4 W not 1.4 kW.			Total heat loss for 2 minutes $= 46 + 68 + 34 + 24$ $= 172 \text{ kJ (172 000 J)}$ $P = \frac{E}{t}$ $t = 2 \times 60 = 120 \text{ s}$ $P = \frac{172 \text{ kJ}}{120} = 1.43 = 1.4 \text{ kW}$ OR $P = \frac{172\,000}{120} = 1430 \text{ W} = 1.4 \text{ kW}$ $P = 1433$ Accept J s^{-1} or kJ s^{-1}		
NØ	N1	N2	A3	A4	M5	M6	E7	E8	
No evidence	1a	2a	3a	4a	2m	3m	2e	3e	

Question	Achievement	Merit	Excellence					
THREE (a)	The specific heat capacity of a material is the amount of heat energy required to raise 1.0 kg / unit mass of substance by one degree of temperature.							
(b)	It heats up faster / water boils quicker / less fuel needed / less energy needed.	Requires less heat (energy) to heat the metal so the water boils quicker / the thermette requires less fuel.	Because less heat (energy) is required to heat up the metal more of the heat (energy) will be transferred to the water and so the water boils quicker / requires less fuel.					
(c)	$c = \frac{Q}{m\Delta T} = \frac{45\,885}{1.05 \times 115}$ $= 380$ OR Correct working shown, but wrong answer.		BOTH CORRECT $c = \frac{Q}{m\Delta T} = \frac{45\,885}{1.05 \times 115}$ $= 380 \text{ J kg}^{-1}\text{C}^{-1}$ (units required) $Q = m L$ $345\,000 = m \times 2\,300\,000$ $m = \frac{345\,000}{2\,300\,000} = 0.15 \text{ kg}$ $m = 150 \text{ g}$					
(d)(i)	Answer of 0.15 without correct conversion to g.	$Q = m L$ $345\,000 = m \times 2\,300\,000$ $m = \frac{345\,000}{2\,300\,000} = 0.15 \text{ kg}$ $m = 150 \text{ g}$						
(ii)	Latent heat is needed / causes (phase) change from liquid to gas / water to steam.	The water absorbs the latent heat of vaporisation when changing from liquid phase to gas phase / water to steam. OR The vapour contains more heat energy than the liquid at the same temperature because it contains latent heat of vaporisation as well as the heat energy due to its temperature.	The water absorbs the latent heat of vaporisation when changing from liquid phase to gas phase / water to steam. AND (The latent heat is required because) water molecules in the steam are more spread out than in the water / the energy went into separating the water molecules / the bond breaking allows the molecules to move farther apart in the gaseous state. (Any mention on increased E_K negates.)					
(e)	Radiation. Radiation is the method of heat transfer that does not require a medium / involves IR radiation / involves heat / electromagnetic waves.							
NØ	N1	N2	A3	A4	M5	M6	E7	E8
No evidence	1a	2a	3a	4a	2 m	3m	2e	3e

Question	Achievement		Merit			Excellence		
FOUR (a)(i) (ii)	Conduction.		Conduction. AND Atoms / particles (gain heat energy and) begin to vibrate. They transfer heat energy to neighbouring atoms / particles (by vibration).					
(b)(i) (ii)	Insulator / poor conductor / high SHC. AND So it can be held safely / doesn't burn hand.		Insulator / poor conductor / high SHC. AND It reduces heat conduction from the thermette / metal to the person's hand, so the thermette can be handled safely when it is hot / so the person doesn't burn their hand.					
(c)	Mentions that hot water rises. AND Cold / colder water sinks without any reference to density.		The water being heated gets warmer and it rises to the top, because it is less dense AND Cold / colder water, being denser, sinks to the bottom.			The water being heated gets warmer and it rises to the top, because it is less dense. AND Cold / colder water, being denser, sinks to the bottom. AND The idea that this occurs because the water is not being evenly heated / heated in a specific part of the thermette (e.g. bottom) by description of where heated. (Consistent mention of expanding particles negates as does more or less dense particles.)		
(d)	Gives any ONE of the features correctly linked to the appropriate heat transfer mechanism.		The narrow chimney top reduces the amount hot air / flame loss and hence heat loss by convection through the chimney. (Alternatively: The tapered chimney causes convection currents in the air and smoke, which rapidly draw in air to fuel the flames and create a lot of heat energy.) OR The surrounding water jacket minimises the heat loss by radiation from the chimney because it is not exposed to air outside / is surrounded by the water.			Convection: The narrow chimney top reduces the amount hot air / flame loss and hence heat loss by convection through the chimney. (Alternatively: The tapered chimney causes convection currents in the air and smoke, which rapidly draw in air to fuel the flames and create a lot of heat energy.) AND Radiation: The surrounding water jacket minimises the heat loss by radiation from the chimney because it is not exposed to air outside / is surrounded by the water.		
NØ	N1	N2	A3	A4	M5	M6	E7	E8
No evidence	1a	2a	3a	4a	2m	3m	1e	2 e

Judgement Statement

	Not Achieved	Achievement	Achievement with Merit	Achievement with Excellence
Score range	0 – 10	11 – 16	17 – 24	25 – 32