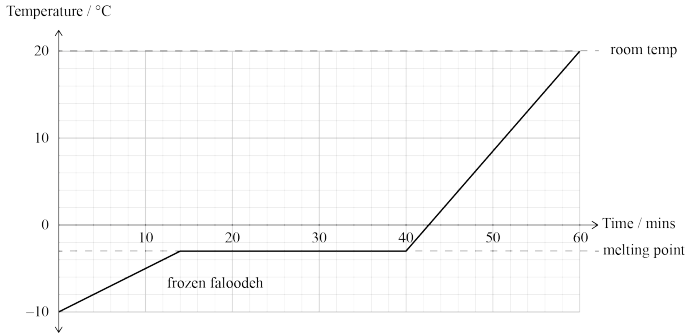
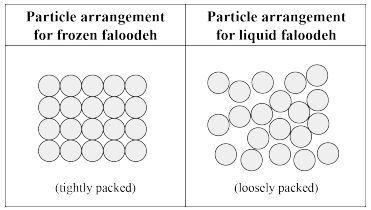
Assessment Schedule – 2017

Physics: Demonstrate understanding of aspects of heat (90939)

Evidence Statement

Q	Evidence	Achievement	Merit	Excellence
ONE (a)	Conduction, convection, radiation.	All three correct		
(b)	The ice in the pit cools the air around it. Cold air is more dense than warm air, so it sinks into the pit where it cannot escape, preventing warm air from reaching the ice to heat it. If the ice was on flat ground, the cold air would flow away across the ground, allowing warm air to reach the ice and heat it up.	Cold air sinks / is denser than warm air (or vice versa).	Cold air sinks into the pit preventing warm air from heating the ice.	
(c)(i) (ii)	Thickness of the walls helps reduce heat transfer through conduction. **Lime:** The white colour of the lime reflects heat energy from the sun so less radiant heat energy / radiation is absorbed. **Goat hair:** The coarse fibres trap small air pockets. The air and / or hair is a poor conductor / good insulator, so less heat is conducted through the wall. OR The coarse fibres trap small air pockets which reduce heat transfer by convection. **Sand:** Silicon dioxide / glass is a poor conductor / good insulator, so less heat is conducted through the wall.	Thickness reduces heat transfer through conduction. OR One of the components partially explained.	Thickness reduces heat transfer through conduction. AND One of the components explained with reference to a relevant heat transfer method.	

(d)(i)	As the water is at a lower temperature than the air, heat will flow from the air to the water. Because water has a higher specific heat capacity (and density) than air, the temperature of the water rises only a little bit for a significant drop in air temperature. This leaves the air cooler than it was when it entered the qanat. Could also explain the evaporation of water requiring latent heat, which is absorbed from the air, cooling the air.	Qanat helps cool the air, as the water source absorbs the heat from the air. OR Attempt calculations but make a calculation error. E.g. Uses wrong temp.	Qanat helps cool the air, as the water source absorbs the heat from the air because water is at a lower temperature than air OR latent heat / evaporation explained. OR Correct calculation.	Qanat helps cool the air, as the water source absorbs the heat from the air. Water has a higher specific heat capacity than air, so the water will not rise as much in temperature as the air will fall in temperature, leaving the air cooler. AND Correct calculation.
(ii)	$Q = mC\Delta T$ $Q = 6500 \times 1006 \times 5$ $Q = 32\ 695\ 000$ J			

Q	Evidence	Achievement	Merit	Excellence
TWO (a)		Correct shape (increases then flat then increases).	Correct graph drawn. Starts at –10°C at t = 0 min, flat at –3°C, ends at 20°C at 60 min. Specific shape of temperature increasing sections not important (straight lines, curved lines ok).	
(b)		Both diagrams correct. Solid must have the regular arrangement, while liquid particles are more loosely attached (consistent particle size not required).		
(c)	The energy gained as the sugar water melts goes into breaking the bonds between the molecules that held them in a solid structure. The amount of energy required to break these bonds (for a kg of material) is called the latent heat.	Defines latent heat as the amount of energy required for phase change. OR As sugar water melts, the particles gain more energy (from surroundings) and break bonds.	Complete answer.	
(d)(i)	$Q = mL = 0.138 \times 3.3 \times 10^5 = 45\,540$ J $E = Pt$ $t = \frac{E}{P} = \frac{45\,540}{98.5} = 462.3$ s $t = \frac{462.3}{60} = 7.7$ min ≈ 8 min	Correctly finds Q. OR Uses correct method to find t but uses wrong Q value. OR Adding lid stops heat loss due to convection / conduction	Correctly finds time, but forgets to convert to min. or rounding error. OR Adding lid stops heat loss due to convection, as air inside is trapped. / Adding lid stops heat loss due to conduction, as trapped air inside acts as an insulator.	Correct time. AND Adding lid stops heat loss due to convection, as air inside is trapped. / Adding lid stops heat loss due to conduction, as trapped air inside acts as an insulator.
(ii)	Adding lid stops heat loss due to convection, as air trapped inside acts as an insulator, as it is a poor conductor of heat.			

Q	Evidence	Achievement	Merit	Excellence
THREE (a)	When heated, the kinetic energy of the material increases and its atoms vibrate with larger and larger amplitudes, and hence take up more space.	Particles vibrate more when heated so take up more space.		
(b)	The modification of holes allows air to be trapped inside. This reduces the amount of heat transfer, as air is a good insulator, as it does not conduct heat well. Trapping air inside the honeycomb prevents it from circulating much, which reduces heat transfer by convection.	The modification of holes allows air to be trapped inside. OR Trapped air cannot transfer much heat through convection currents. OR Air is a good insulator as it does not conduct heat well.	One of conduction OR convection explained correctly.	
(c)	White reflects some of the radiation from the sun. This reduces the amount of heat being transferred into the building, which helps keep it cool.	White reflects heat.	White reflects some of the **radiation** / less **radiation** absorbed, which keeps the building cool.	
(d)(i)	• Low ceilings – Less air to heat, and hot air rises so if ceilings are low they will be warmer to live in. • Small openings – Reduce heat loss to environment via radiation and convection. • Partially built underground, less surface area for heat to escape from. • Earth heaped up against walls act as insulation to reduce heat loss as thick earth walls reduce conduction.	One bullet point from (i) partially explained. OR Calculates the heat energy (60 kJ).	One bullet points from (i). explained fully. OR Calculates heat energy OR calculates ΔT using full amount of energy (150 kJ $\rightarrow$ 9.93°C).	One bullet points from (i). AND Correct change in temp calculated.
(d)(ii)	40% of 150 kJ = 60 kJ $Q = mC\Delta T$ $\Delta T = \frac{Q}{mC} = \frac{60}{15 \times 1.006} = 3.97°C \approx 4°C$			

Question Sufficiency – All Questions

NØ	N1	N2	A3	A4	M5	M6	E7	E8
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 1 × A + 1 × E	1 × A + 2 × M OR 1 × M + 1 × E *(must have >1 M to get above A4)*	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 – 14	15 – 18	19 – 24