Assessment Schedule – 2013

Physics: Demonstrate understanding of aspects of heat (90939)

Evidence Statement

Q	Achievement	Achievement with Merit	Achievement with Excellence
ONE (a)	Heat transfer methods stated: • conduction • convection • radiation.	• Heat transfer methods stated AND TWO from. • conduction – best in solids • convection – best in liquids / gases. • radiation – no medium required.	
(b)	Mentions black absorbs heat. OR Silver reflects radiation. OR L-shape captures more light.	ONE of: • The shiny surface is a **good reflector** of radiation **so it** reflects **most** of the radiation to the pot. • The black surface is a **good absorber** of heat energy **so** the pot **absorbs most** of the radiation hitting it. • The L-shape means that radiant / light energy from a **wide area** is reflected into the pot, **so** it **increases the amount of radiation** to the pot.	TWO of: • The shiny surface is a **good reflector** of radiation **so it** reflects **most** of the radiation to the pot. • The black surface is a **good absorber** of heat energy **so** the pot **absorbs most** of the radiation hitting it. • The L-shape means that radiant / light energy from a **wide area** is reflected into the pot, **so** it **increases the amount of radiation** to the pot.
(c)	Prevents heat loss by convection. OR Heated **particles** / less dense **particles** can't leave (taking heat with them). OR Black lid absorbs radiation / heat / more heat.	Prevents heat loss by convection AND Heated **particles** / less dense **particles** can't leave (taking heat with them)	
(d)	No conduction / poor conductor / insulator. OR No convection currents.	ONE of: • No conduction **because** (trapped) air is poor conductor / good insulator (trapped air is NOT a vacuum). • No convection (currents) **because** trapped air cannot circulate. • Clear plastic allows **radiation** through so that the heat can get to the pot.	TWO of: • No conduction **because** (trapped) air is poor conductor / good insulator (Trapped air is NOT a vacuum). • No convection (currents) **because** trapped air cannot circulate. • Clear plastic allows **radiation** through so that the heat can get to the pot.

NØ	N1	N2	A3	A4	M5	M6	E7	E8
	1a	2a	3a	4a	2m	3m	1e	2e

Q	Achievement	Achievement with Merit	Achievement with Excellence
TWO (a)	Definition in terms of hotness: Measurement of the **average kinetic energy** of **atoms / molecules / particles** in an object. OR The (degree of intensity of) heat present in a substance or object according to a comparative scale shown by thermometer or touch.		
(b)	Fails to convert mass to kg (answer = 7 980 000 J) OR Correct method for calculation. (units not required)	Correct calculation $Q = mc\Delta T$ $= 0.1 \times 4.2 \times 10^3 \times (42 - 23)$ $= 7980$ J (units not required)	
(c)	Higher temperature causes more heat energy / molecules to vibrate more. OR States that **some of the water** changes state / evaporates / vapourises / boils before the water reaches 100°C.	TWO of: • Higher temperature causes more heat energy / molecules to vibrate more. • States that **as** the water heats up **some of the water** changes state or evaporates or vapourises or boils before the water reaches 100^oC. • Particle motion is fixed inside the pot when liquid but particle motion is free when left the pot as gas / bonds broken between liquid particles to form gas.	THREE of: • Higher temperature causes more heat energy / molecules to vibrate more. • States that **as** the water heats up **some of the water** changes state or evaporates or vapourises or boils before the water reaches 100^oC. • Particle motion is fixed inside the pot when liquid but particle motion is free when left the pot as gas / bonds broken between liquid particles to form gas.
(d)	Correct method for one calculation. $Q_1 = mL$ $Q_2 = mc\Delta T$ $P = E / t$ where $E = Q_1 + Q_2$ (E.g. wrong mass for latent heat, fails to convert g to kg or minutes to seconds). $Q_1 = mL = 29\,900$ $Q_2 = mc\Delta T = 32\,340$ Power calculation: $E = mL + mc\Delta T$ $E = 29900 + 32340 = 62240$ $P = E / (20 \times 60)$ or $E / 1200$	ONE correct calculation AND ONE correct method for one of the other two calculations. $Q_1 = mL$ $Q_2 = mc\Delta T$ $P = E / t$ where $E = Q_1 + Q_2$ (Eg, wrong mass for latent heat, fails to convert g to kg or minutes to seconds). OR All three calculations correct with answer of 52 (with missing or incorrect unit.)	All THREE calculations correct: Total Q: $Q = mL + mc\Delta T$ $= (0.100 - 0.087) \times 2.3 \times 10^6$ $+0.100 \times 4.2 \times 10^3 \times (100 - 23)$ $= 62\,240$ J $P = \frac{E}{t} = \frac{62\,240}{20 \times 60}$ $= 51.867 = 52$ W (Correct units required.)

NØ	N1	N2	A3	A4	M5	M6	E7	E8
	1a	2a	3a	4a	2m	3m	1e	2e

Q	Achievement	Achievement with Merit	Achievement with Excellence
THREE (a)	Metal is a better conductor than fabric. OR Metal is conductor and fabric is an insulator OR Hot or cold is sensed by the direction of heat (flow), in this case heat is into the metal so she feels cold.	Metal is a better conductor than the fabric. When Sonya touches the metal, heat is conducted **away** from her body / **more quickly** causing her to feel cold. OR Sonya, at 37°C is warmer than the metal and fabric, which are both at the same temperature. This means since heat move from hot to cold. Sonya will transfer heat energy to the objects. Since metal is a better conductor of heat energy this heat transfer happens quicker when she touches the metal, so she loses heat energy quicker so she feels that the metal is colder.	
(b)	States that twigs and logs are made up of same material / have same specific heat capacity OR states that twigs have a smaller heat capacity than the logs (without explanation that this is due to smaller mass). OR Defines the heat capacity *C* of a substance is the amount of heat required to change its temperature by one degree, and has units of energy per degree OR defines the specific heat capacity, is the amount of heat required to change the temperature of one kg of mass of a substance by one degree. OR Explanation that smaller mass / heat capacity results in quicker heating and therefore easier to light.	TWO of: • States that twigs and logs are made up of same material / have same specific heat capacity. • States that twigs have a smaller heat capacity than the logs due to smaller mass. • Defines the heat capacity *C* of a substance is the amount of heat required to change its temperature by one degree, and has units of energy per degree OR defines the specific heat capacity, is the amount of heat required to change the temperature of one kg of mass of a substance by one degree. • Explanation that smaller mass / heat capacity results in quicker heating and therefore easier to light.	States that twigs and logs are made up of same material / have same specific heat capacity OR States that twigs have a smaller heat capacity than the logs due to smaller mass. AND Defines the heat capacity *C* of a substance is the amount of heat required to change its temperature by one degree, and has units of energy per degree OR defines the specific heat capacity, is the amount of heat required to change the temperature of one kg of mass of a substance by one degree. AND Explanation correctly links difference in mass / heat capacity to total amount of heat energy required to reach required temperature.

(c)	Energy / heat is taken from her body. OR Water / sweat evaporates.	Energy / heat is taken from her body AND Water / sweat evaporates. OR When water / sweat evaporates, the required (latent) heat energy is taken from the body (cooling the body down).	When water / sweat evaporates, the required (latent) heat energy is taken from the body cooling the body down. AND When water evaporates, the remaining liquid is cooler so feels colder on the skin.
(d)	Correct method for one calculation. $Q = mL$ $t = Q / P$	ONE correct calculation AND ONE correct method. OR Calculations correct with answer of 220 (with no or incorrect unit).	BOTH calculations correct: $Q = mL = 0.1 \times 3.3 \times 10^5$ $= 33\ 000$ J $t = E / P = 33\ 000 / 150 = 220$ s (Correct units required).

NØ	N1	N2	A3	A4	M5	M6	E7	E8
	1a	2a	3a	4a	2m	3m	1e	2e

Judgement Statement

	Not Achieved	Achievement	Achievement with Merit	Achievement with Excellence
Score range	0 – 7	8 – 14	15 – 19	20 – 24