Assess Quizzes from the o-book – Explanations for the answers.

Chapter 2 Review – Support

Q	Reason
1	The answer has to be an energy unit, and so does its unit symbol. Only *joule (J)* meets these criteria.
2	Specific heat capacity should remain fairly constant while it is in one phase. The c_{water} is usually measured at 25°C and 1 atm pressure because it does vary a little (between a low of 4179.6 at 40°C and 4215.7 at 100°C). So, the graph will be linear but constant. We can say "specific heat capacity" is "independent" of temperature in the range 0-100°C. Thanks for asking.
3	Latent heat means 'hidden' heat because a substance uses heat energy to melt even though its temperature doesn't rise. The thermal energy goes into disrupting the intermolecular bonds as it changes phase. The word 'specific' means that it is for a standard mass unit (kilograms) of the substance.
4	$Q = mc\Delta T$ $= \frac{10}{1000} \times 4180 \times (35-25)$ $= 418\,J$
5	250 mL of water has a mass of 250 g (0.250 kg) as the density of water is 1 g/mL or 1 kg/L $Q = mc\Delta T$ $= 0.250 \times 4100 \times (25-50)$ $= 25.6\,J$
6	'Latent' heat means the heat energy involved in a phase change, in this case for liquid to gas (vaporisation). As the question refers to a mass of 1 kg of the substance it would be better to call it 'specific latent heat of vaporisation' (but that is not one of the options and 'latent heat of vaporisation' is the closest. See page 101 for the definition.
7	Thermal equilibrium means no heat flow, which means the temperatures are equal. This is a statement of the Zeroth Law of Thermodynamics. See page 90.
8	All three changes will help correct the inaccuracies. If you don't take the temperature as soon as the power supply is turned off the water will start to cool. If you don't cover the cup with a lid, thermal energy escapes into the atmosphere. If you don't totally immerse the heating element, some of the heating element will lose its heat to the air.
9	By definition. Unit mass means a 1 kilogram 'unit' of mass. A temperature rise of 1 K is equal to a rise of 1°C.
10	Internal energy increases when the microscopic KE and microscopic PE increases. When there is a temperature rise (stages P and R) the KE is increasing; when the substance is absorbing heat energy but the temperature is not rising (stage Q) then the substance is melting and just the PE is increasing.

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Chapter 2 Review – Consolidate

Q	Reason
1	The Zeroth Law of Thermodynamics says that there will be a transfer of energy from a system with higher temperature to a system with lower temperature until thermal equilibrium is reached. See dot point 1 in summary page 106. There are several ways of stating the Zeroth Law and in the text. I state two of them (pages 90 and 106). They both are getting at the same point but from different angles.
2	$-Q_{lost}(object\,1) = Q_{gained}(object\,2)$ $-m_1 c_{iron}(T_f - T_i)_1 = m_2 c_{iron}(T_f - T_i)_2$ $-20\times(T_f - 70) = 10\times(T_f - 10)$ [eliminate the c_{iron}] $-20T_f + 1400 = 10T_f - 100$ $1500 = 30T_f$ $T_f = \frac{1500}{30} = 50^\circ C$
3	10 g of water has a mass of 10/1000 = 0.010 kg $Q = mc\Delta T$ $= 0.010\times 4180\times(300-285)$ $= 627\,J$
4	$Q = mc\Delta T$ $= \frac{5}{1000}\times 900\times(20)$ $= 90\,J$
5	$Q = mc\Delta T$ $= 0.100\times 4180\times(60-20)$ $= 1.672\times 10^4\,J$ $P = \frac{W}{t}$ $t = \frac{W}{P} = \frac{1.672\times 10^4}{700} = 24\,s$

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Chapter 2 Review – Extend

Q	Reason
1	$$-Q_{lost} = Q_{gained}$$ $$-m_m c_m (T_f - T_i)_m = m_w c_w (T_f - T_i)_w$$ $$-\cancel{50} c_m (30-95)_m = \cancel{50} c_w (30-25)_w$$ $$65c_m = 5c_w$$ $$c_m = \frac{5}{65} c_w = \frac{c_w}{13}$$ That is, the specific heat (capacity) of the metal is <u>less</u> than the specific heat (capacity) of the water. In other words: the specific heat of the water is <u>greater</u> than the specific heat of the metal.
2	$$-Q_{lost} = Q_{gained}$$ $$-m_{iron} c_{iron} (T_f - T_i)_{iron} = m_w c_w (T_f - T_i)_w$$ $$-\frac{140}{\cancel{1000}} \times 444 (T_f - 120) = \frac{500}{\cancel{1000}} \times 4180 (T_f - 30)$$ $$-6.216\times10^4 T_f + 7.549\times10^6 = 2.090\times10^6 T_f - 6.270\times10^7$$ $$2.152\times10^6 T_f = 7.0249\times10^7$$ $$T_f = 32.6^\circ C$$ Closest is 32.71°C. I should change the correct option to 32.6°C hey.
3	$$-Q_{lost} = Q_{gained}$$ $$-m_w c_w (T_f - T_i)_w = m_e c_e (T_f - T_i)_e$$ $$-\frac{120}{\cancel{1000}} \times 4180 (T_f - 343) = \frac{40}{\cancel{1000}} \times 2450 (T_f - 296)$$ $$-5.016\times10^3 T_f + 1.7205\times10^6 = 980 T_f - 2.90\times10^5$$ $$5.996\times10^3 T_f = 2.0105\times10^6$$ $$= 335.3\,K$$ $$= 62.3^\circ C \; [= 335.3 - 273]$$

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4	$$-Q_{lost} = Q_{gained}$$ $$-m_m c_m (T_f - T_i)_m = m_w c_w (T_f - T_i)_w$$ $$-\frac{100}{\cancel{1000}} \times c_m (28.6 - 99.5) = \frac{50}{\cancel{1000}} \times 4180 (28.6 - 15.5)$$ $$7090 c_m = 2.7379 \times 10^6$$ $$c_m = \frac{2.7379 \times 10^6}{7090} = 386$$
5	Total thermal energy = thermal energy to heat solid to melting point + thermal energy to just melt solid $Q = Q_{temp\ increase} + Q_{melt}$ $Q = mc\Delta T + mL_f$