

15 marks · one mark for each correct letter

The reason given for each answer is for learning: it is not needed in the exam.

Q	Answer	Why
1	C	Correct. In kelvin, $300\text{ K} \rightarrow 600\text{ K}$: the average kinetic energy is proportional to the kelvin temperature, so it doubles.
2	A	Correct. Internal energy is the total of both kinds of energy of all the molecules.
3	D	Correct. The temperature is constant, so the average kinetic energy is constant; the molecules move apart, so the potential energy increases.
4	B	Correct. $c = Q/(m\Delta T) = 8400/(0.20 \times 10) = 4200\text{ J kg}^{-1}\text{ K}^{-1}$.
5	C	Correct. $0.10 \times (80 - \theta) = 0.30 \times (\theta - 20)$ gives $\theta = 35\text{ }^{\circ}\text{C}$.
6	D	Correct. $Q = mc\Delta T$ with the same Q and m , so $c \propto 1/\Delta T$: $c_X/c_Y = 1/3$.
7	A	Correct. Energy supplied $Pt = mL$, so $L = Pt/m$.
8	B	Correct. Condensing releases mL_v (a lot of energy) before the water even starts to cool.
9	D	Correct. Melting: $0.50 \times 334\,000 = 167\,000\text{ J}$; warming: $0.50 \times 4200 \times 20 = 42\,000\text{ J}$; total $2.1 \times 10^5\text{ J}$.
10	C	Correct. Warm air is less dense, so it rises and cooler, denser air takes its place: a convection current.
11	A	Correct. $\Delta Q/\Delta t = kA\Delta T/\Delta x$: the area increases by $2^2 = 4$ and the length doubles, so the rate is $4/2 = 2$ times larger.
12	B	Correct. $\Delta Q/\Delta t = kA\Delta T/\Delta x = 0.80 \times 2.0 \times 10/0.0040 = 4000\text{ W}$.
13	D	Correct. $P \propto r^2T^4$: $(1/2)^2 \times 2^4 = 16/4 = 4$.
14	C	Correct. The peak is at 580 nm : $T = 2.9 \times 10^{-3}/(580 \times 10^{-9}) = 5.0 \times 10^3\text{ K}$.
15	B	Correct. $b \propto L/d^2$: $9/3^2 = 1$, so Y has the same apparent brightness.