**1.** (a) the amount of energy / heat required to raise the temperature of a substance / object through 1K / °C; 1

(b) (i) to ensure that the temperature of the metal does not change during the transfer / negligible thermal energy / heat is lost during the transfer; 1

*Do not accept metal and water at same temperature.*

(ii) to ensure that all parts of the water reach the same temperature; 1

(c) energy lost by metal $= 82.7 \times (T - 353)$ J;
energy gained by water $= 5.46 \times 10^2 \times 65$ J;
energy gained by calorimeter $= 54.6 \times 65$ J;
equate energy lost to energy gained to get $T = 825$ K; 4

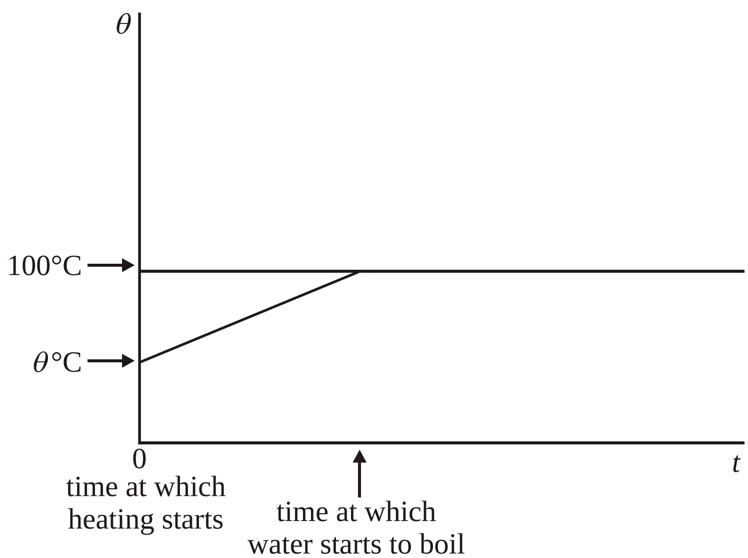
*Award* ***[2 max]*** *if any energy term is missed.*

**[7]**

**2.** (a) specific heat capacity is the amount of energy required to raise the temperature of unit mass through 1 K; 1

(b) raising the temperature means increasing the KE of the molecules; there are different numbers of molecules of different mass in unit mass of aluminium and water (accept different densities) and therefore different amounts of energy will be needed / *OWTTE*; 2

(c) (i)




general shape (but constant $\theta$ range must be clear); 1

(ii) $\theta \rightarrow 100$ °C:
the KE of the molecules is increasing;

100 °C:
when the water starts to change phase, there is no further increase in KE;
the energy goes into increasing the PE of the molecules;
so increasing their separation;
until they are far enough apart to become gas / their molecular bonds are broken / until they are effectively an infinite distance apart / *OWTTE*; 5

(d) (i) total energy supplied = 400 × 600 = $2.4 \times 10^5$ J; 1

(ii) energy required to raise temperature of water = $0.30 \times 80 \times 4.2 \times 10^3$

$= 1.0 \times 10^5$ J;

energy available to convert water to steam = $(2.4 - 1.0) \times 10^5 = 1.4 \times 10^5$ J;

mass of water converted to steam $= \dfrac{(1.4 \times 10^5)}{2.3 \times 10^6} \approx 60$ g; 3

(iii) energy is lost to the surroundings *(must specify where the energy is lost) /* water might bubble out of pan whilst boiling / anything sensible; 1 max

**[14]**

**3.** (a) bubbles rise at constant rate / constant temperature using a thermometer; 1

(b) can check that rate of boiling is constant;
because the two masses should be equal; 2

(c) (i) reasonable line drawn; 1

(ii) triangle for gradient with hypotenuse at least half length of line;
some working shown (*e.g.* coordinates used made clear);
answer 12 (W $g^{-1}$) ± 1; 3

(d) gradient = $\dfrac{L}{200}$;

$L = 2400$ *allow ecf from (c)(ii)*;
correct unit J $g^{-1}$; 3

(e) heat energy losses / systematic error;
to the atmosphere / any other detail; 2

**[12]**