Explanation time!
Water at constant pressure boils at constant temperature. Outline, in terms of the energy of the molecules, the reason for this. [2 marks]
Water at constant pressure boils at constant temperature.
Outline, in terms of the energy of the molecules, the reason for this. 

Markscheme

Temperature is a measure of the (average) kinetic energy of the molecules; at the boiling point, energy supplied (does not increase the kinetic energy) but (only) increases the potential energy of the molecules/goes into increasing the separation of the molecules/breaking one molecule from another / OWTTE;
3b. In an experiment to measure the specific latent heat of vaporization of water, steam at 100°C was passed into water in an insulated container. The following data are available.

- Initial mass of water in container = 0.300kg
- Final mass of water in container = 0.312kg
- Initial temperature of water in container = 15.2°C
- Final temperature of water in container = 34.6°C
- Specific heat capacity of water = 4.18×10^3 Jkg⁻¹K⁻¹

Show that the data give a value of about 1.8×10⁶ Jkg⁻¹ for the specific latent heat of vaporization \( L \) of water.

**Markscheme**

(energy gained by cold water is) \( 0.300 \times 4180 \times [34.6-15.2] / 24327 \);
(energy lost by cooling water is) \( 0.012 \times 4180 \times [100-34.6] / 3280 \);
(energy lost by condensing steam is) \( 0.012 L \);
\[ 1.75 \times 10^6 (\text{Jkg}^{-1}) / \left( \frac{\text{energy gained by cold water} - \text{energy lost by cooling water}}{0.012} \right) \];

Award [4] for \( 1.75 \times 10^6 (\text{Jkg}^{-1}) \).

Award [2 max] for an answer that ignores cooling of condensed steam.

3c. Explain why, other than measurement or calculation error, the accepted value of \( L \) is greater than that given in (h).
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**Markscheme**

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(energy lost by cooling water is) \( 0.012\times4180\times[100-34.6] \) / 3280;
(energy lost by condensing steam is) \( 0.012L \);
\[ \frac{1.75\times10^6 (Jkg^{-1})}{1.75\times10^6 (Jkg^{-1})} - \text{the energy lost by cooling water} \]
\( \frac{0.012}{0.012} \);

Award [4] for 1.75×10⁶(Jkg⁻¹).
Award [2 max] for an answer that ignores cooling of condensed steam.

3c. Explain why, other than measurement or calculation error, the accepted value of \( L \) is greater than that given in (h).

**Markscheme**

some of the energy (of the condensing steam) is lost to the surroundings;
so less energy available to be absorbed by water / rise in temperature of the water would be greater if no energy lost;
7a. Describe, with reference to molecular behaviour, the process of melting ice. [2 marks]
Describe, with reference to molecular behaviour, the process of melting ice.

Markscheme

in ice, molecules vibrate about a fixed point;
as their total energy increases, the molecules (partly) overcome the attractive force between them;
in liquid water the molecules are able to migrate/change position;
11a. Explain, in terms of the energy of its molecules, why the temperature of a pure substance does not change during melting.
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[3 marks]

Markscheme

energy supplied/bonds broken/heat absorbed;
increases potential energy;
no change in kinetic energy (so no change in temperature);
(ii) Explain, in terms of the molecular model of matter, the relative magnitudes of the specific latent heat of vaporization of water and the specific latent heat of fusion of water.
(ii) Explain, in terms of the molecular model of matter, the relative magnitudes of the specific latent heat of vaporization of water and the specific latent heat of fusion of water. [3 marks]

(ii) potential energy changes during changes of state / bonds are weakened/broken during changes of state; potential energy change is greater for vaporization than fusion / more energy is required to break bonds than to weaken them; SLH vaporization is greater than SLH fusion;

*Only award third marking point if first marking point or second marking point is awarded.*
Outline why a given mass of molten zinc has a greater internal energy than the same mass of solid zinc at the same temperature.
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Markscheme

same temperature so (average) kinetic energy (of atoms/molecules) the same;
(interatomic) potential energy of atoms is greater for liquid / energy is needed to separate the atoms; } (do not allow “forces are weaker” arguments)

internal energy = potential energy + kinetic energy; (allow BOD for clear algebra)

(so internal energy is greater)