

Internal Energy Latent Heat

GCSE Physics · Written to the shared content for AQA, Edexcel and OCR

Name _____ Class _____ Date _____

1. Worked example

Calculate the energy needed to melt 2.0 kg of ice at 0 °C. Specific latent heat of fusion of water = 334 000 J/kg. (2 marks)

Step 1 · Write the equation

energy for a change of state = mass × specific latent heat, $E = m L$

Step 2 · Substitute and calculate

$$E = 2.0 \times 334\,000 = 668\,000 \text{ J (668 kJ)}$$

Answer: 668 000 J

Check: No temperature change appears in $E = m L$.

2. Now try one with the steps

113 000 J of energy boils away 0.050 kg of water at 100 °C. Calculate the specific latent heat of vaporisation. (3 marks)

Step 1 · Rearrange

Step 2 · Substitute

Step 3 · Calculate

Answer:

3. Practice

Show your working. The marks tell you how much is expected.

1. Define the internal energy of a system. [2]

2. State what happens to the temperature of ice while it is melting. [1]

3. Define specific latent heat. [2]

4. State the difference between specific latent heat of fusion and specific latent heat of vaporisation. [2]

5. A cooling curve for wax has a flat section at $54\text{ }^{\circ}\text{C}$. State what this temperature is. [1]

6. Calculate the energy needed to melt 0.50 kg of ice at $0\text{ }^{\circ}\text{C}$. $L_f = 334\text{ }000\text{ J/kg}$. Give your answer in joules. [2]

7. Calculate the energy needed to boil away 0.20 kg of water at $100\text{ }^{\circ}\text{C}$. $L_v = 2\text{ }260\text{ }000\text{ J/kg}$. Give your answer in joules. [2]

8. Explain why the temperature of water stays at $100\text{ }^{\circ}\text{C}$ while it boils. [2]

9. It takes $210\text{ }000\text{ J}$ to melt 1.5 kg of a wax at its melting point. Calculate the specific latent heat of fusion of the wax in J/kg . [3]

10. $66\text{ }800\text{ J}$ of energy is supplied to ice at $0\text{ }^{\circ}\text{C}$. Calculate the mass of ice that melts. $L_f = 334\text{ }000\text{ J/kg}$. [2]

11. Explain why a scald from steam at $100\text{ }^{\circ}\text{C}$ is usually worse than one from boiling water at $100\text{ }^{\circ}\text{C}$. [2]

12. Calculate the energy needed to turn 0.40 kg of ice at $0\text{ }^{\circ}\text{C}$ into water at $20\text{ }^{\circ}\text{C}$. $L_f = 334\text{ }000\text{ J/kg}$; $c = 4200\text{ J/kg }^{\circ}\text{C}$. Give your answer in kJ to 3 significant figures. [4]

13. Explain how sweating helps to cool the body. [2]

14. A 2.0 kW kettle keeps boiling for 60 s after the water reaches 100 °C. Calculate the mass of water boiled away, in grams to 2 significant figures. $L_v = 2\,260\,000 \text{ J/kg}$. [3]

4. Before you hand it in

Using $\Delta E = m c \Delta \theta$ while water boils

Use $E = m L$ for a change of state and $\Delta E = m c \Delta \theta$ for a temperature change. Multi-stage questions need both.

"During melting no energy is being absorbed."

Energy is still absorbed: it increases the potential energy of the particles (internal energy rises).

Using L_f for boiling

Fusion = solid $\leftrightarrow$ liquid. Vaporisation = liquid $\leftrightarrow$ gas. Check which change of state the question describes.

"Temperature and internal energy are the same thing."

Temperature relates to the average kinetic energy of particles; internal energy is the total kinetic + potential energy of all of them.