

# Worksheet: Specific Latent Heat Calculations ( $E = m L$ ) PhysicsSheets

Specification: GCSE Physics (AQA / Edexcel / OCR Gateway)

**Core Equation:**  $E = m \times L$

**Rearrangements:**  $m = E/L$  |  $L = E/m$

**Units:**

- $E$ : Thermal energy for state change (**Joule, J**)
- $m$ : Mass (**kilogram, kg**)
- $L$ : Specific Latent Heat (**Joule per kilogram, J/kg**)

**Key Concept:** During a change of state (melting, freezing, boiling, condensing), the temperature of the substance remains constant. The energy supplied or removed is used to change the potential energy of the particles, not their kinetic energy.

## Section A: Units, Conversions & Equation Rearrangement

1. State the correct SI unit and symbol for each variable in the equation  $E = m \times L$ :

- Thermal energy ( $E$ ): \_\_\_\_\_
- Mass ( $m$ ): \_\_\_\_\_
- Specific Latent Heat ( $L$ ): \_\_\_\_\_

2. Rearrange the equation  $E = m \times L$  to make the specified variable the subject:

- Make  $m$  the subject: \_\_\_\_\_
- Make  $L$  the subject: \_\_\_\_\_

3. Convert the following values into the required SI units:

- 250 g = \_\_\_\_\_ kg
- 1.5 kJ = \_\_\_\_\_ J
- 30 minutes = \_\_\_\_\_ s
- 0.005 kg = \_\_\_\_\_ g
- 2.4 MJ = \_\_\_\_\_ J

## Section B: Specific Latent Heat Calculations

1. Answer the following questions, showing your working clearly and stating the correct units.

- Calculate the thermal energy required to melt 0.5 kg of ice at  $0^\circ\text{C}$ . The specific latent heat of fusion of ice is  $3.34 \times 10^5 \text{ J/kg}$ .

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- A kettle boils 0.2 kg of water at  $100^\circ\text{C}$  into steam. The specific latent heat of vaporisation of water is  $2.26 \times 10^6 \text{ J/kg}$ . Calculate the energy transferred to the water.

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- 120 kJ of thermal energy is supplied to melt a substance. If the specific latent heat of fusion of the substance is  $1.5 \times 10^5 \text{ J/kg}$ , calculate the mass of the substance that melts.

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- d) 50 000 J of thermal energy is required to boil 20 g of a liquid at its boiling point. Calculate the specific latent heat of vaporisation of this liquid.

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### Section C: Multi-step & Conceptual Challenges

2. A student uses an electric heater to melt a block of ice. The heater has a power output of 50 W and is switched on for 5 minutes. Assume all the energy from the heater is transferred to the ice. The specific latent heat of fusion of ice is  $3.34 \times 10^5$  J/kg.

- a) Calculate the mass of ice that melts during this time. Give your answer to an appropriate number of significant figures.

- b) Explain, in terms of the kinetic and potential energy of the particles, what happens to the energy supplied to the ice during the melting process.