

Year 11 Physics - Worksheet 2

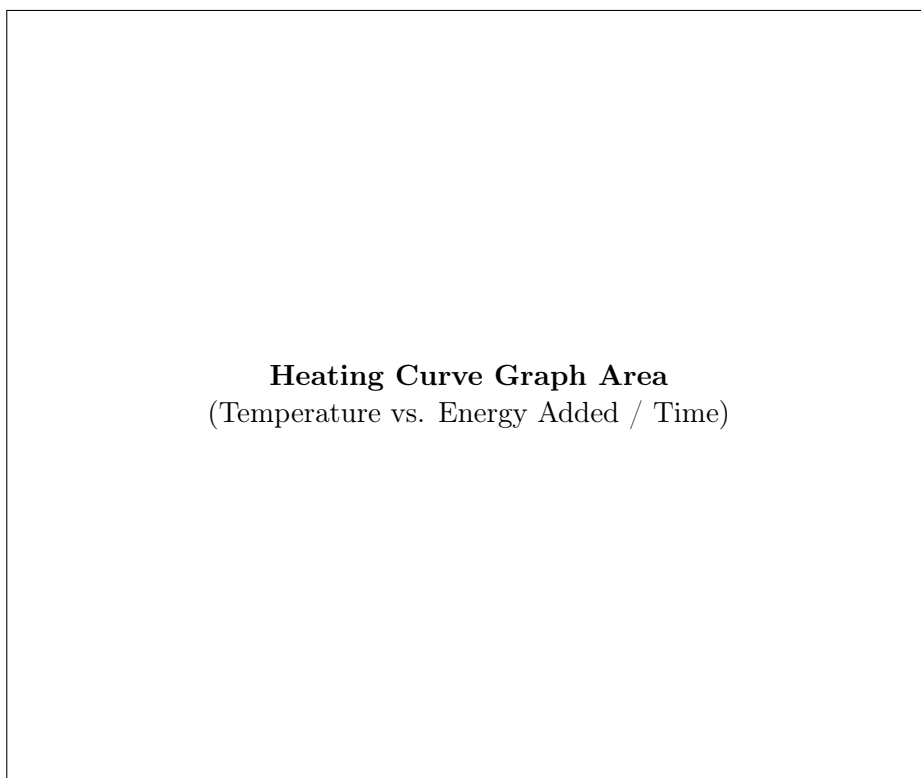
Thermodynamics: Quantifying Heat Phase Change

Student Name: _____ ID: _____

Module 3

Part 1: Heating Curve Analysis (Knowledge Node N5 Analyse)

1. The graph below shows a typical heating curve for water, starting as ice below 0°C and ending as steam above 100°C. Energy is added at a constant rate.



- (a) On the graph above, clearly **label** the 5 sections corresponding to: Heating Ice, Melting Ice, Heating Water, Boiling Water, Heating Steam.
- (b) In which section(s) is the added energy increasing the *kinetic energy* of the particles the most? **Explain** your reasoning.
- (c) In which section(s) is the added energy primarily increasing the *potential energy* (overcoming bonds) of the particles? **Explain** your reasoning. [Literacy N5]
- (d) Indicate on the graph where the formula $Q=mcT$ would be used to calculate energy added, and where $Q=mL$ would be used.

[Numeracy Focus: Graph interpretation - N5]

2. **Define** the following terms:

- Specific Heat Capacity (c):
- Latent Heat of Fusion (L_f):
- Latent Heat of Vaporization (L_v):

[Literacy N3, N5]

Part 2: Calculations (Knowledge Nodes N3 Apply, N5 Apply)

(Use the provided data table for c and L values)

Worked Example 1 ($Q=mc\Delta T$): Calculate heat needed to warm 200g (0.2kg) water from 20°C to 50°C. ($c_{water} = 4186 \text{ J kg}^{-1} \text{ K}^{-1}$) $Q = mc\Delta T = (0.2 \text{ kg})(4186 \text{ J kg}^{-1} \text{ K}^{-1})(50 - 20 \text{ K}) = 25116 \text{ J}$

Worked Example 2 ($Q=mL$): Calculate heat needed to melt 50g (0.05kg) of ice at 0°C. ($L_{f,water} = 3.34 \times 10^5 \text{ J kg}^{-1}$) $Q = mL_f = (0.05 \text{ kg})(3.34 \times 10^5 \text{ J kg}^{-1}) = 16700 \text{ J}$

Practice Problems: Show your working clearly.

1. How much energy is released when 100g (0.1kg) of steam at 100°C condenses to water at 100°C? ($L_{v,water} = 2.26 \times 10^6 \text{ J kg}^{-1}$) [N5 Apply]

2. Calculate the total heat required to change 30g (0.03kg) of ice at -15°C to water at 40°C. ($c_{ice} = 2100 \text{ J kg}^{-1} \text{ K}^{-1}$, $L_{f,water} = 3.34 \times 10^5 \text{ J kg}^{-1}$, $c_{water} = 4186 \text{ J kg}^{-1} \text{ K}^{-1}$) [N3 Apply, N5 Apply]
(Hint: This requires three steps: heating ice, melting ice, heating water). [Numeracy Focus: Formula

application, multi-step calculations - N3, N5]

#MarkSense Quiz 2

Instructions: Choose the best answer for multiple choice questions. Show working for calculations.

Student Name: _____ ID: _____

1. During boiling, the energy added is primarily used to: [N5]

- A. Increase particle kinetic energy
- B. Increase Temperature
- C. Break intermolecular bonds / Increase potential energy
- D. Decrease volume

Answer: _____

2. Substance A has a specific heat capacity of $900 \text{ J/kg}^\circ\text{C}$ and substance B has $c=450 \text{ J/kg}^\circ\text{C}$. If 1kg of each substance absorbs 900J of heat, which statement is true? [N3]

- A. Temp of A increases by 1°C , Temp of B increases by 2°C .
- B. Temp of A increases by 2°C , Temp of B increases by 1°C .
- C. Both increase temperature by 1°C .
- D. Both increase temperature by 2°C .

Answer: _____

3. Calculate the heat energy needed to raise the temperature of 500g (0.5kg) of water from 20°C to 60°C . ($c_{\text{water}} = 4186 \text{ J kg}^{-1} \text{ K}^{-1}$). Show working. [N3 Apply] (2 marks)