

# Science Starter

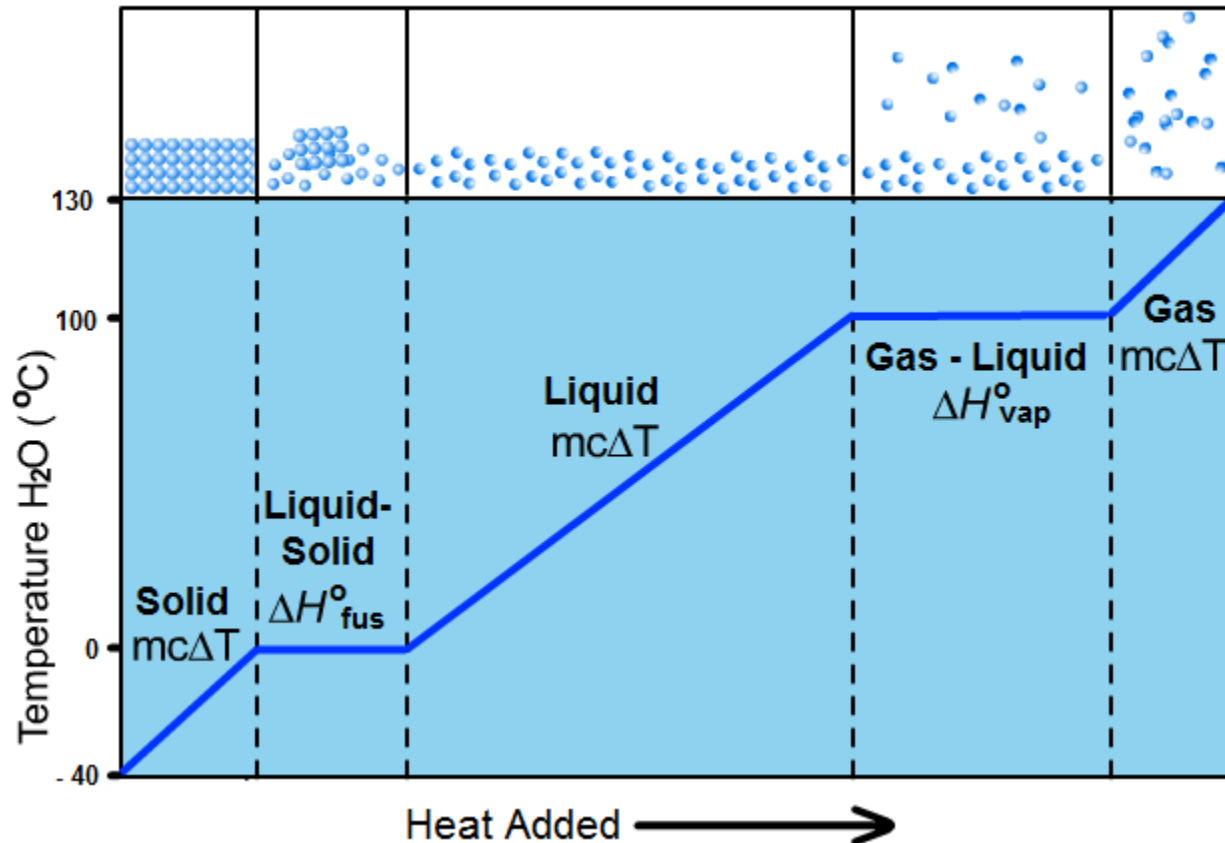
Convert 2260 J/g H<sub>2</sub>O into kJ/mol.

# Energy and Phase Changes

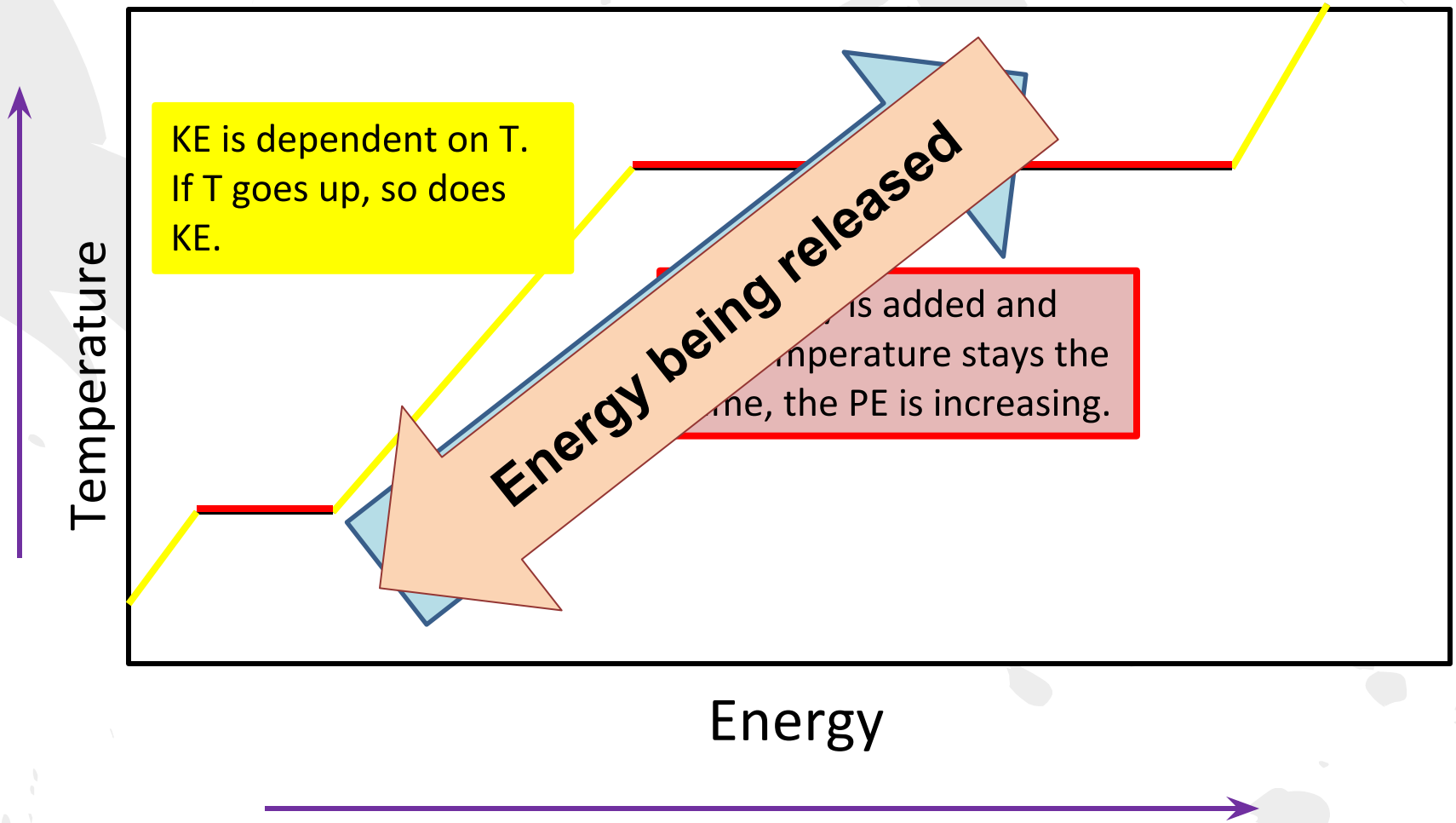
Arbor Prep Chemistry

# Phase Changes

What happens to the temperature of a block of ice when you put a Bunsen burner underneath it? You might think that the temperature goes up smoothly, but that's not what happens. The graph of temperature against time is called a heating curve. Let's look at the heating curve for water.



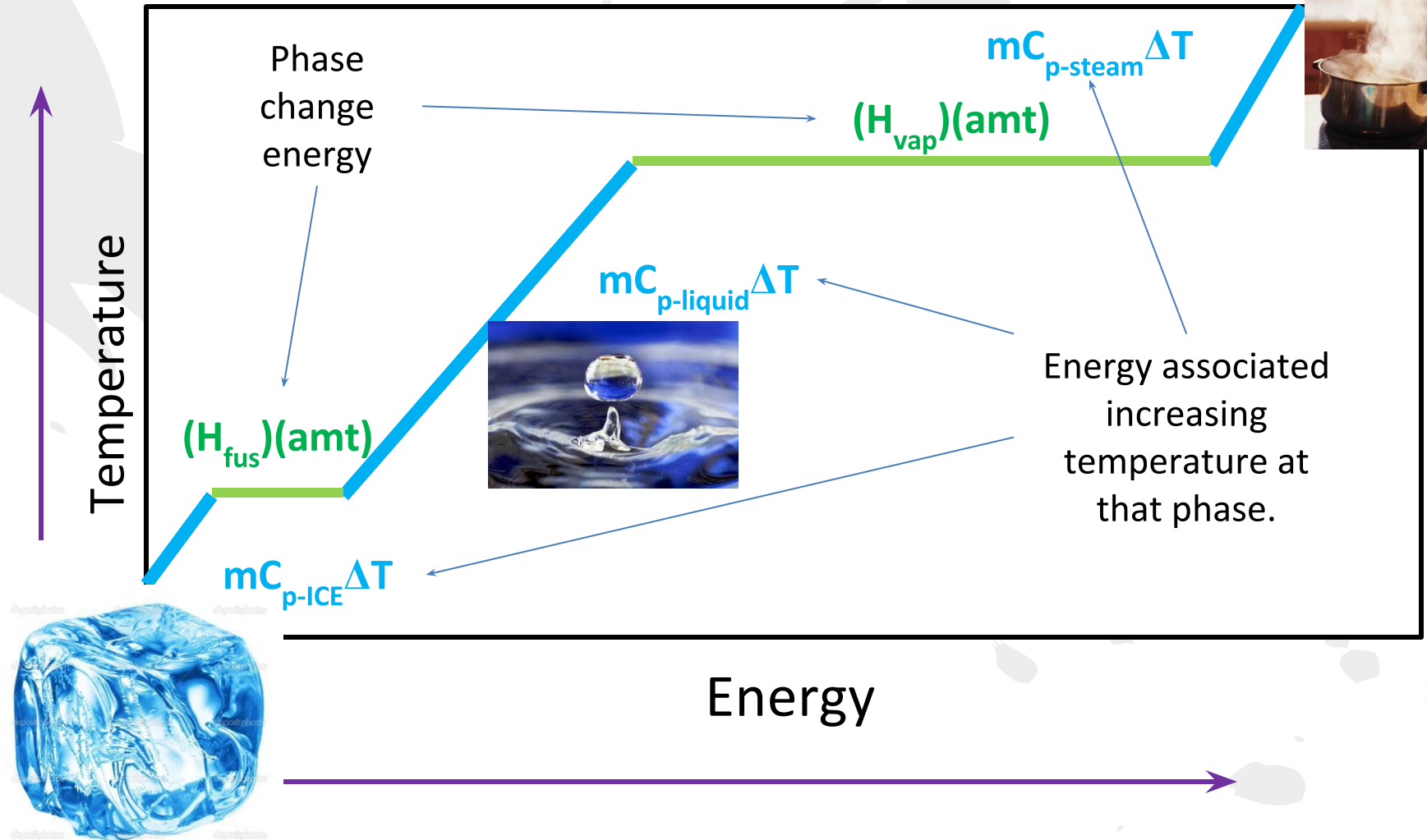
# Energy Changes



# Phase Changes

- In the graph, the flat areas are the areas that are undergoing the phase changes.
  - The  $H_{\text{fus}}$  is the energy needed to either melt or freeze water. Water needs 334 J to melt one gram of ice.
  - The  $H_{\text{vap}}$  is the energy needed to either vaporize or condense water. Water needs 2260 J to vaporize one gram of ice.
- Liquid water has a specific heat of  $4.184\text{J/g}^{\circ}\text{C}$ .
- Steam has a specific heat of  $2.00\text{J/g}^{\circ}\text{C}$
- Solid Ice has a specific heat of  $2.06\text{J/g}^{\circ}\text{C}$

# Phase Changes with Energy

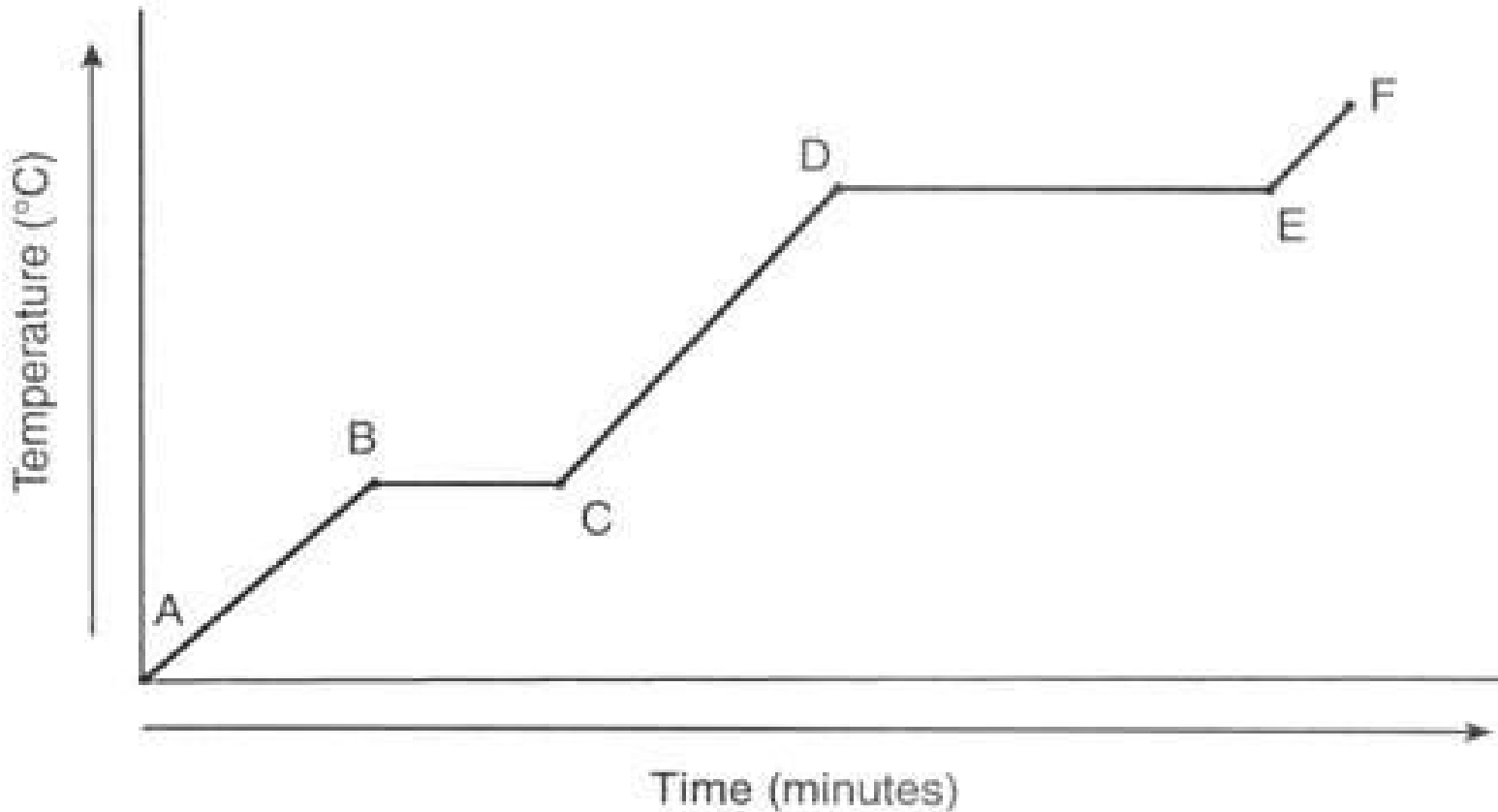


# Review

- ReCAP!!!
  - $q = mC_p\Delta T$  when there is NO phase change (slanted line)
    - BE SURE TO USE THE CORRECT  $C_p$  !!!
  - $q = \Delta H(\text{amount})$  for phase changes
    - BE SURE TO USE THE CORRECT  $\Delta H$  !!!
- Slanted lines indicate a change in the KE.
  - Increase to the right and Decrease to the left
- Phase changes indicate a change in PE.
  - Increase to the right and Decrease to the left

# Practice #1

Calculate how many Joules of energy would be required to change 32.9 g of water at 35°C to steam at 120°C. You will need to break this problem into four steps. Use the diagram to assist you.





## Practice #2

How much heat energy would be required to change the temperature of 125g of ice from  $-32.9^{\circ}\text{C}$  to liquid water at  $75^{\circ}\text{C}$ ?

## Practice #3

How much energy (in kJ) is required to melt 150.0 g of  $-18.00^{\circ}\text{C}$  ice, and bring the resulting liquid water up to  $25.00^{\circ}\text{C}$ ?

# STAMP IT!!!

How much energy is required or released to ...

- Melt 15 g of ice at  $0^{\circ}\text{C}$  and heat the water to  $22^{\circ}\text{C}$ ?
- Cool and freeze 5150 kg of water from  $25.0^{\circ}\text{C}$  to  **$-4.00^{\circ}\text{C}$**