Name: KEY Official Class: _____ Date: _____

Teacher: _____ Period: _____ Class: _____

Calculating Heat Energy ($q = mH_f$/$q = mH_v$)

YOYO: Manipulate the $q = mc\Delta T$ to solve for the following variables.

Solving for Heat (J)	Solving for Mass (g)	Solving for Specific Heat (J/g•C)	Solving for Temperature (°C)
$q = mc\Delta T$	$m = \frac{q}{c\Delta T}$	$c = \frac{q}{m\Delta T}$	$\Delta T = \frac{q}{mc}$

The Equations

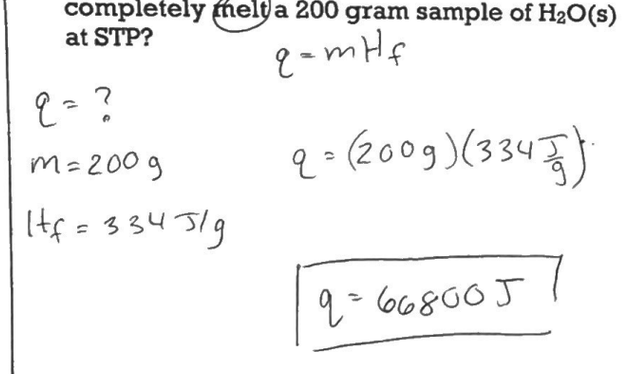
$q = mH_f$

The Symbols

- q = heat
- Hf = heat of fusion
  - On Table B for water
    334 J/g

Relating Back to the Heating/Cooling Curve

- Heat of fusion is used when a substance is either freezing or melting



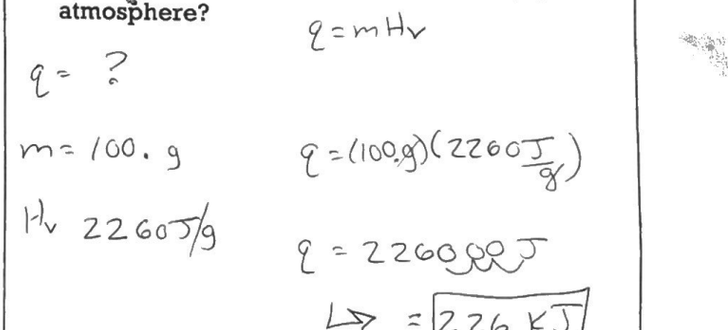
$q = mH_v$

The Symbols

- q = heat
- Hv = heat of vaporization
  - On Table B for water
    2260 J/g

Relating Back to the Heating/Cooling Curve

- Heat of vaporization is used when a substance is either vaporizing or condensing



1. **What is the amount of heat required to completely melt a 200 gram sample of $H_2O(s)$ at STP?**

$q = mH_f$

$q = ?$

$m = 200\ g$

$H_f = 334\ J/g$

$q = (200\ g)(334\ \frac{J}{g})$

$q = 66800\ J$

2. **What is the total number of kiloJoules required to boil 100. grams of water at 100°C and 1 atmosphere?**

$q = mH_v$

$q = ?$

$m = 100.\ g$

$H_v = 2260\ J/g$

$q = (100.\ g)(2260\ \frac{J}{g})$

$q = 226000\ J$

$= 226\ kJ$

3. **The heat of fusion of a compound is 126 Joules per gram. What is the total number of Joules of heat that must be absorbed by a 15.0-gram sample to change the compound from solid to liquid at its melting point?**

$q = mH_f$

$q = ?$

$m = 15.0\ g$

$H_f = 126\ J/g$

$q = (15.0\ g)(126\ \frac{J}{g})$

$q = 1890\ J$

4. **At 1 atmosphere of pressure, 25.0 grams of a compound at its normal boiling point is converted to a gas by the addition of 34,400 Joules. What is the heat of vaporization for this compound, in Joules per gram?**

$q = mH_v$

$q = 34{,}400\ J$

$m = 25.0\ g$

$H_v = ?$

$\frac{34{,}400\ J}{25.0\ g} = \frac{(25.0\ g)\ H_v}{25.0\ g}$

$H_v = 1376\ \frac{J}{g}$

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5. What is the total number of joules released when a 5.00-gram sample of water changes from liquid to solid at 0°C?

$q = mH_f$

$q = ?$

$m = 5.00\,g$

$H_f = 334\,J/g$

$q = (5.00\,g)(334\,J/g)$

$q = 1670\,J$

6. The heat of vaporization of a liquid is 1,340 Joules per gram. What is the minimum number of Joules needed to change 40.0 grams of the liquid to vapor at the boiling point?

$q = mH_v$

$q = ?$

$m = 40.0\,g$

$H_v = 1340\,J/g$

$q = (40.0\,g)(1340\,J/g)$

$q = 53600\,J$

7. What is the minimm amount of heat to completely melt 20.0 grams of icea at its melting points?

$q = mH_f$

$q = ?$

$m = 20.0\,g$

$H_f = 334\,J/g$

$q = (20.0\,g)(334\,J/g)$

$q = 6680\,J$

8. What is the minimum number of kilojoules needed to change 40.0 grams of water at 100 degrees Celcius to steam at the same temperature and pressure?

$q = mH_v$

$q = ?$

$m = 40.0\,g$

$H_v = 2260\,J/g$

$q = (40.0\,g)(2260\,J/g)$

$q = 90400\,J$

$\hookrightarrow 90.4\,kJ$

9. What is the total number of kilojoules to boil 100. grams of water at 100 degrees Celcius and 1 atmosphere?

$q = mH_v$

$q = ?$

$m = 100.\,g$

$H_v = 2260\,J/g$

$q = (100.\,g)(2260\,J/g)$

$q = 226000\,J$

$\hookrightarrow 226\,kJ$

10. What is the total number of joules released when a 15.00-gram sample of water changes from solid to liquid at 0°C?

$q = mH_f$

$q = ?$

$m = 15.00\,g$

$H_f = 334\,J/g$

$q = (15.00\,g)(334\,J/g)$

$q = 5010\,J$