Thermochemistry Enrichment Problems:
Phase Change AND Temperature Change

Starter Level Specific Heat Theory Question

A) Object A specific heat is 2.45 J/g·°C and object B specific heat is 0.82 J/g·°C. Which object will heat up faster if they have the same mass and equal amount of heat is applied? Explain why.

Starter Level Phase Change Problems

Energy required for phase change

q	=	m	ΔH
heat energy		mass	Heat of fusion (ΔH_{fus}) *or* Heat of vaporization (ΔH_{vap})
J *or* cal		g *or* mol (be sure units cancel)	$\frac{J}{g}$ or $\frac{cal}{g}$ $\frac{J}{mol}$ or $\frac{cal}{mol}$

B) If the heat of fusion of water is 80 $\frac{cal}{g}$, what is the amount of heat energy required to change 15.0 g of ice at 0°C to 15.0 g of water at 0°C?

C) Applying 7.80 kJ of heat melts what mass of solid CH_2Cl_2 at its melting point?

Properties of CH_2Cl_2	
Heat of Fusion	**Heat of Vaporization**
4.60 $\frac{kJ}{mol}$	28.06 $\frac{kJ}{mol}$

D) When 92.0 g of ethanol (C_2H_6O) is vaporized at its boiling point of 78.3°C, it requires 78.6 kJ of energy. What is the approximate molar heat of vaporization of ethanol in $\frac{kJ}{mol}$?

IB Preparation Phase Change Problem

Remember from notes…

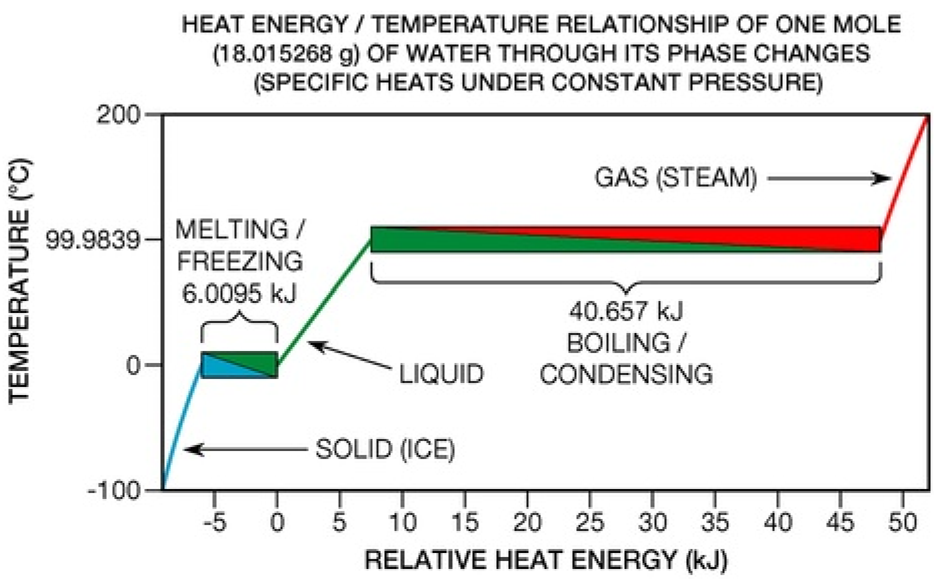
Energy required for temperature change

Specific heat capacity – the amount of energy required to raise 1 g of water by 1°C

- specific heat capacity of water = 1 $\frac{cal}{g\cdot°C}$ or 4.184 $\frac{J}{g\cdot°C}$

q	=	m	c	ΔT
heat energy		mass	specific heat capacity	change in temperature $T_{final} - T_{initial}$
J or cal		g	$\frac{J}{g\cdot°C}$ or $\frac{cal}{g\cdot°C}$	°C

Use the following diagram to answer questions 1 and 2.



Possibly useful information for water:

ΔH_{fus} = 6.0095 $\frac{kJ}{mol}$

ΔH_{vap} = 40.657 $\frac{kJ}{mol}$

Melting point = 0°C

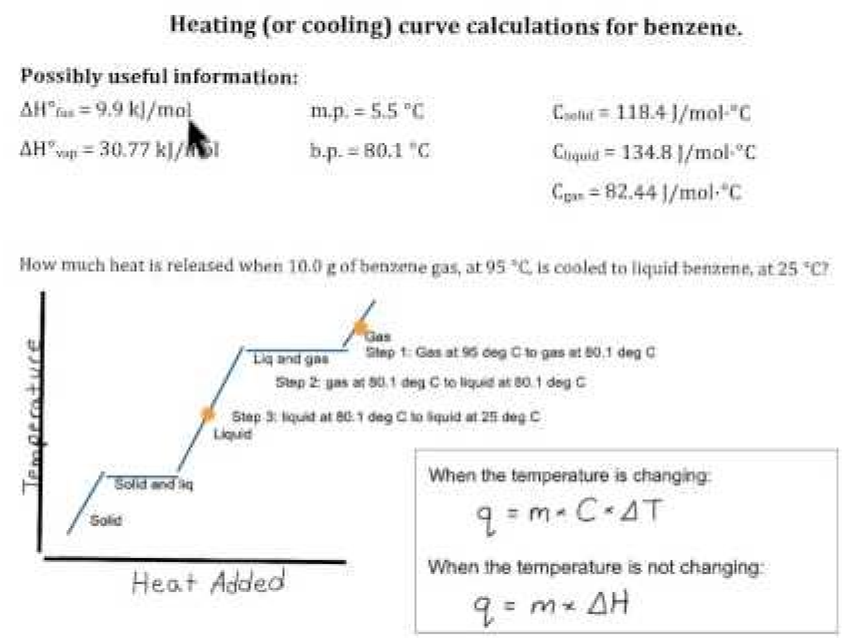
Boiling point = 100°C

Specific heat of liquid water = 4.184 $\frac{J}{g\cdot°C}$

1) **Which requires more energy? Melting 100.0 grams of ice or boiling 100 grams of water?**

2) **How much energy in kJ is required to heat 100.0 g of ice at 0°C to water at room temperature (20°C)?**

Use the following diagram to help you answer question #3.



3) How much heat is released when 10.0 *g* of benzene gas (*C_6H_6*), at 95°C, is cooled to liquid benzene, at 25°C?

Possibly useful information for benzene:

ΔH_{fus} = 9.9 $\frac{kJ}{mol}$

ΔH_{vap} = 30.77 $\frac{kJ}{mol}$

Melting point = 5.5°C

Boiling point = 80.1°C

Specific heat of solid benzene = 118.4 $\frac{J}{mol \cdot ℃}$

Specific heat of liquid benzene = 134.8 $\frac{J}{mol \cdot ℃}$

Specific heat of benzene vapor = 82.44 $\frac{J}{mol \cdot ℃}$