Practice Heating and Cooling Curve Problems

1. The following table shows the thermal properties of ethanol, $C_2H_5OH(l)$.

$12 \times 2 = 24$
$1 \times 5 = 5$
16
$46g$
$1 mol$

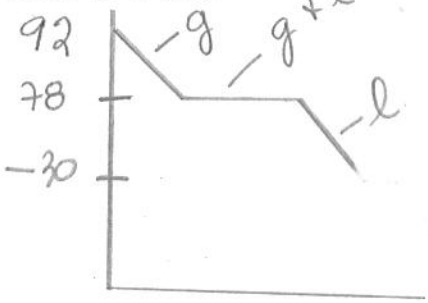
Thermal Properties of Ethanol

Melting point	**-114.0 °C**
Boiling point	**78.0 °C**
Specific Heat Capacity as a solid	**0.97 J/g°C**
Specific Heat Capacity as a liquid	**2.46 J/g°C**
Specific Heat Capacity as a gas	**1.42 J/g°C**
Heat of fusion	**5.02 kJ/mol**
Heat of vaporization	**38.56 kJ/mol**

never given as a neg. – it is your job to turn it into a neg. cooling! HE being released (–)

taken

If a 69.0 g sample of ethanol is from 92.0 °C to – 30.0 °C then how many kJ of heat energy must be released from the ethanol?



Sketch!!!!!!! Just like math class!!!!!

1) $Q = mc\Delta T$
$= (69.0g)(1.42 J/g \cdot °C)(78.0°C - 92.0°C)$
$= -1370 J \times \frac{1 kJ}{1000 J} = -1.37 kJ$

2) $Q = n\Delta H = 69.0g \times \frac{1 mol}{46g} \times \frac{38.56 kJ}{1 mol} = 57.8 kJ$

3) $Q = mc\Delta T$
$= 69.0g \times (2.46 \frac{J}{g \cdot °C})(-30.0°C - 78.0°C)$
$= -18300 J \times \frac{1 kJ}{1000 J} = -18.3 kJ$

ANS

4) $-1.37 kJ + (-57.8 kJ) + (-18.3 kJ) = -77.5 kJ$

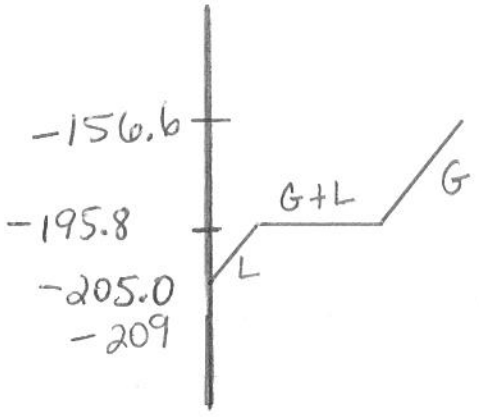
2. Use the information given below to find the total amount of energy required to heat 56.0 g of nitrogen from - 205.0 °C to – 156.6 °C.

N_2!

Boiling point of nitrogen	- 195.8 °C
Melting point of nitrogen	- 209.9 °C
Heat of vaporization of nitrogen	5.58 kJ/mol
Heat of fusion of nitrogen	0.71 kJ/mol
Specific heat capacity of liquid nitrogen	2.04 J/g°C
Specific heat capacity of nitrogen vapour	1.04 J/g°C

Sketch!!!!

ANS $Q_T = 14.5$ kJ



1) $Q = mc\Delta T$

$= 56.0\,g \times \left(2.04\ \frac{J}{g \cdot C}\right)(-195.8\ ^\circ C - (-205.0\ ^\circ C))$

$= 1.05$ kJ

2) $Q = n\Delta H$

$= 56.0\,g\,N_2 \times \frac{1\,mol\,N_2}{28\,g} \times \frac{5.58\ kJ}{1\,mol}$

$= 11.2$ kJ

3) $Q = mc\Delta T$

$= (56.0\,g)\left(1.04\ \frac{J}{g \cdot C}\right)(-156.6\ ^\circ C - (-195.8\ ^\circ C))$

$= 2.28$ kJ