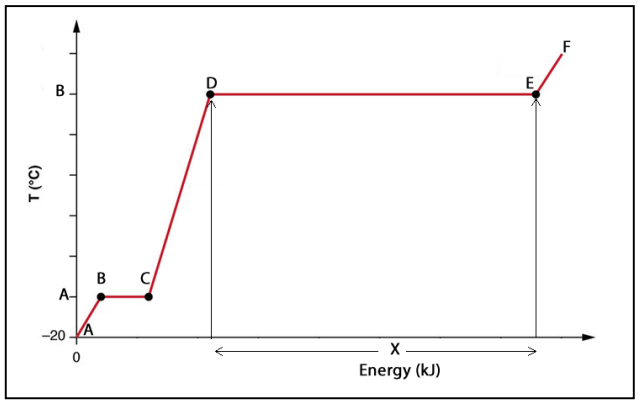
Friday worksheet 3 – Latent heat

1. Consider the graph of temperature versus energy added to a 36.0 gram sample of pure ice.



a. What is the state of the sample during the following segments along the graph.

i. A-B *ice (solid state)*
ii. B-C *liquid + solid states*
iii. C-D *liquid state*
iv. D-E *liquid + gaseous states*

b. During which segment/s along the graph is the speed of the molecules increasing? *A-B, C-D, E-F*

c. What is the value of temperature

i. A = 0°C
ii. B = 100 °C

d) Refer to the information included in the table on the right.

Latent Heats of Fusion and Vaporization

Substance	ΔH_{fus} (kJ/mol)	ΔH_{vap} (kJ/mol)
Ammonia (NH_3)	5.65	23.4
Ethanol (C_2H_5OH)	4.60	43.5
Methanol (CH_3OH)	3.16	35.3
Oxygen (O_2)	0.44	6.82
Water (H_2O)	6.01	40.7

Table 1

i. Calculate the amount of energy, in kJ, required during segment B-C .

Step 1 find the mol of water in the 36.0 g of ice.
=> n_{water} = 36.0 /18.0 = 2.0
Step 2 find the energy needed
Energy = 6.01 X 2.0 = 12.02 kJ.

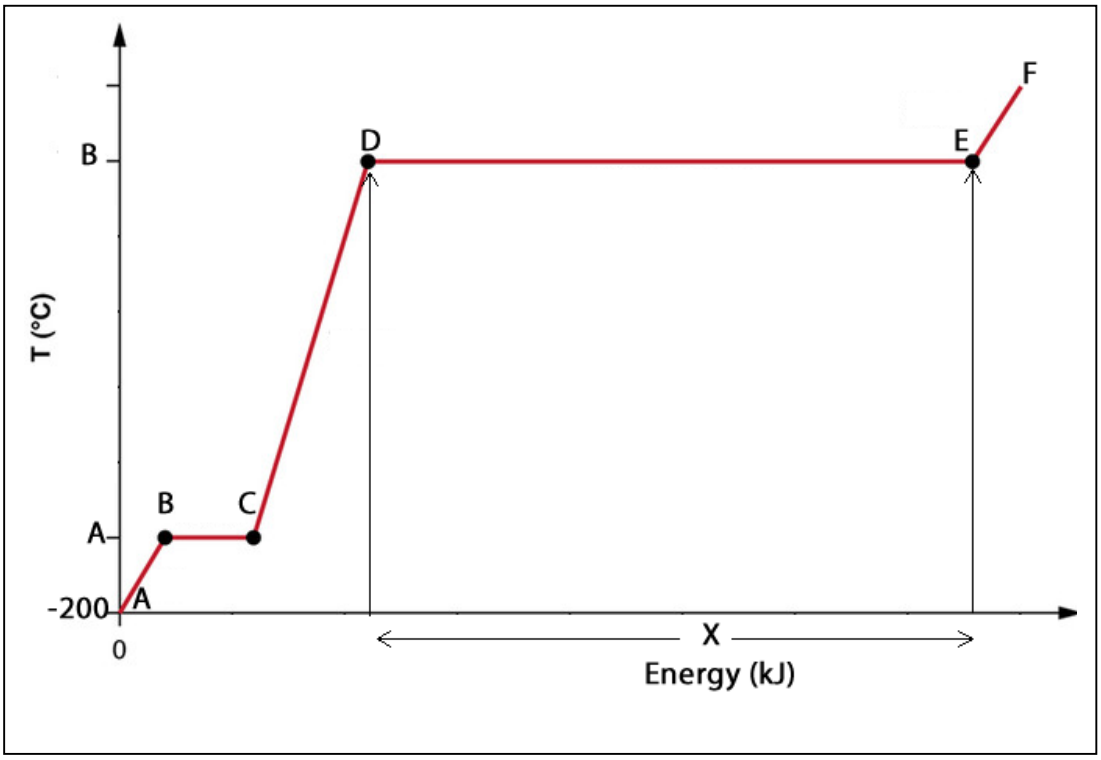
ii. Calculate the value of X on the graph.
X represents the amount of energy needed to vaporise 2.0 mol of liquid water at 100°C.
=> Energy = 40.7 X 2.0 = 81.4 kJ

iii. Sweating is nature's way of cooling the body down. What amount of energy, in kJ, is removed from body if 35.0 grams of water evaporates from the surface of the skin during a game of soccer.

Calculate the amount of energy, in kJ, removed from the body.
Step 1 find the mol of water
=> 35.0 / 18.0 = 1.94

Step 2 find the energy required to vaporise 1.94 mol of water.
=> 40.7kJ/mol X 1.94 mol = 79.1kJ

2. Below is a graph of the temperature vs energy input of a 34.0 grams of solid ammonia. The melting temperature of ammonia is -77°C while its boiling temperature is -33°C. Use the data from table 1 above to answer the following.



a. Calculate the mol of ammonia. *34.0 /14.0 = 2.0 mol*
b. Give the value of A *-77°C*
c. Give the value of B *-33°C*
d. Calculate the value of X, in kj. *23.4 X 2.0 = 46.8 kJ*

e. Explain how this graph would be different if 88.0 grams of frozen ethanol is used. Given the melting point of ethanol is -114 °C while its boiling point is 78°C.

88.0 g of ethanol represents 1.91 mol of ethanol (Fm = 46.0g/mol)
Section B-C will occur at -114°C and stretch for (1.91 X 4.6) 8.79 kJ
Section D-E will occur at 78°C and continue for (1.91 X 43.5) 83.1 kJ.