Friday worksheet 2 – Latent heat

$$q = n \times L$$

q = energy (kJ)
n = mol
L = latent heat (kJ/mol)

1. Consider the table on the right.
   it shows the latent heat of fusion and evaporation of a number of substances.
   According to the table the latent heat of fusion for water is 6.01 kJ/mol.
   That is, for every mol of ice 6.01 kJ is needed to disrupt the bonds between water molecules in the ice lattice to turn it into liquid water.

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

   a. Ethanol has a boiling temperature of 78°C.
      Calculate the amount of energy, in kJ, required to completely evaporate 4.5 mol of liquid ethanol at 78°C.
      => Energy = 4.5 X 4.60 = 20.7 kJ
   b. The melting point of ethanol is -114°C. Calculate the amount of energy, in kJ, required to completely melt 88.0 grams of ethanol.
      Step 1 find the mol of ethanol
      => 88 / 46 = 1.913 mol
      Step 2 find the energy required
      => Energy =1.913 X 4.60 = 8.8 kJ
   c. 63.0 grams of water at 100°C is supplied with just enough energy to completely evaporate. Calculate the amount of energy supplied in kJ.
      Step 1 Find the mol of water
      => 63.0 / 18 = 3.5
      Step 2 Find the energy required
      => Energy = 3.5 X 40.7 = 142.5 kJ

2. Geothermal energy can be harnessed from hot springs.
   i. What is the relationship between the latent heat of evaporation and the latent heat of condensation?

   The magnitude of the latent heat of evaporation is equal to the magnitude of the latent heat of evaporation, however, latent heat of evaporation must be supplied whereas the latent heat of condensation is given out.

   d. ii. Calculate the amount of energy released when 12.0 kg of steam at 100°C is captured and condensed back into water at 100°C.
      Step 1 Find the mol of water
      => 12000 / 18 = 666.7
      Step 2 Find the energy required
      => Energy = 666.7 X 40.7 = 27133 kJ