CALCULATING ENTHALPY CHANGES FOR WARMING SUBSTANCES AND FOR CHANGES OF STATE

1.a) 135 g sample of water was warmed. Calculate the amount of heat absorbed by the water if its temperature rose from 25.0°C to 75.0°C. The specific heat capacity of water is 4.18 J/g°C

b) Assuming constant pressure, what is the enthalpy change, expressed in kJ, for the water, due to the warming process in 1 (a)? Include the sign for ΔH.

2. a) Calculate the amount of energy absorbed by 135 g of water at 25 ^{O}C in order t evaporate it all into water vapour at 25 ^{O}C. The heat of vaporisation of water, ΔH_{vap} , is 2.26 kJ/g. Assume the pressure stays constant.

b) What is the enthalpy change, in kJ for 135 g of water changing to water vapour at 25 ^{O}C ? Include the sign for ΔH ?

3. A 135 g sample of ice is in a freezer at - 21 ^{O}C. It is removed from the freezer and allowed to melt and the resulting water warms up to the room temperature, 23 ^{O}C. How much energy is absorbed by the135 g sample? The specific heat capacity of ice is 2.0 J g^{-1} $^{O}C^{-1}$ and the heat of fusion of ice is 0.33 kJ g^{-1}.

4. An unknown substance was heated from 23.3 ^{O}C to 27.5 ^{O}C by the addition of 7.50 J of energy. If the mass of the material was 7.6 g, identify the material. (Use Table 7.1 in Harwood and Petrucci, page 210)

5. To change the temperature of 6.70 g of copper from 21.0 ^{O}C to 26.8 ^{O}C. 15.1 J of energy was required. Calculate the specific heat capacity of copper.

6. A piece of lead having a mass of 200.0 g and a temperature of 100.0 ^{O}C is placed in an amount of water initially at 22.1 ^{O}C. After stirring, the final temperature of the water and the lead is 25.4 ^{O}C. Assume that all the energy from the lead is transferred to the water, calculate the heat energy lost by the lead to the water. Calculate also the amount of water used. (See Harwood and Petrucci, Table 7.1 page 210 for specific heat capacities required.)

7. A gold ring is heated to 216.2 ^{O}C then dropped into a tiny cup of water. The mass of water in the cup was 55.7 g. The temperature of the water rose from 23.0 ^{O}C to 27.6 ^{O}C. Calculate the mass of the ring.

8. A mixture is made of 120.0 g of water at a temperature of 81.5 ^{O}C and 75.0 g of methanol at a temperature of 23.3 ^{O}C. Determine the final temperature of the mixture. The specific heat capacity of methanol is 2.55 J/g ^{O}C.

Answers

1.(a) q = 28.2 kJ (b) ΔH = + 28.2 kJ
2. (a) q = 305 kJ, (b) ΔH = + 305 kJ
3. + 63 kJ
4. silver
5. 0.389 J/g ^{O}C
6. 1.91 kJ, 138 mL
7. 44.0 g
8. 65.5 ^{O}C