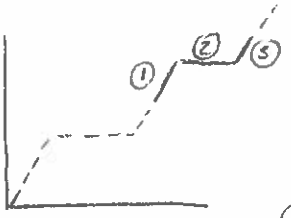
Energy Transfer #2 **Due:** **Name:** Ans

1. What energy is required to change 75.0 g of water at 45°C to steam at 110°C? (4)



① $Q = mc\Delta t$
$= (75.0)(4.19)(100-45)$
$= 17\,283.8\text{ J}$ 2SF
$Q = 17.2838\text{ kJ}$

② $\frac{40.66\text{ kJ}}{18.02\text{ g}} = \frac{x}{75.0\text{ g}}$ $x = 169.229\text{ kJ}$ 3SF

or $1\text{ mol } H_2O = \frac{18.02\text{ g}}{75.0\text{ g}}$ $x = 4.162\text{ mol} \times \frac{40.66\text{ kJ}}{1\text{ mol}} = 169.229\text{ kJ}$

③ $Q = mc\Delta T$
$= (75.0)(1.41)(110-100)$
$= 1057.5\text{ J}$ 2SF
$Q = 1.0575\text{ kJ}$

Total = 187.570 kJ
↓ 3 sig. fig
188 kJ

169.2 ← not sig
+ 17.3
+ 1.1
187.6
188

10

2. Calculate the joules of thermal energy involved in condensing steam at 100°C to 500g of water at 23°C? (please indicate the sign as well) (4)

(27.75 moles)

$\frac{40.66\text{ kJ}}{18.02\text{ g}} = \frac{x}{500}$ $x = 1128.19\text{ kJ}$ released! → -1128.19 kJ

$Q = mc\Delta T$
$= 500\,(4.19)(23-100)$
$Q = -161.315\text{ J}$ → 2 SF
$= -161.315\text{ kJ}$

Total -1128.19
$+ -161.315$
-1289.516 kJ
$-1.29 \times 10^3\text{ kJ}$

-1

-1

3. ~~X~~ ugg! Used on last sheet!! Burning 2.55 g of iron in the presence of oxygen in the rxn chamber of a colorimeter causes 765 mL of water initially at 19.4°C to rise to 27.0°C. SF 0.5. Calculate ΔH. (Assume all the energy went into the water!) (3)

$Q = mc\Delta T$
$= 765\,(4.19)(27.0-19.4)$
$= 765\,(4.19)(7.6$
$= 24\,360.66\text{ J}$
$Q = 24.36066\text{ kJ}$ 2SF

$1\text{ mol Fe} = \frac{55.85\text{ g}}{2.55}$ $x = 0.045658\text{ mol}$ 3SF

$\Delta H = \frac{Q}{n} = \frac{24.36066\text{ kJ}}{0.045658\text{ mol}}$ 3SF
$= 533.546\text{ kJ/mol}$ 2SF

$\Delta H = 5.3 \times 10^2\ \frac{\text{kJ}}{\text{mol}}$

4. A 4.00×10^2 g piece of iron at 22.0°C is heated in a bomb calorimeter until the temperature is 250.0°C. If the iron absorbs 41.04 kJ of heat energy, what is the specific heat capacity of the iron? (2)

$Q = mc\Delta T$
$41040\text{ J} = (400)c(250.0-22.0)$
$41040\text{ J} = 400(c)(228.0)$
$41040\text{ J} = 91200c$
$c = 0.450\ \frac{\text{J}}{\text{g°C}}$