Name _____

More HEAT/THERMAL Problems:

1. A 500 $cm^3$ container is filled with $Cl_2$ gas. How many moles of the gas are the in the container at STP? (remember to convert $cm^3$ to $m^3$)
2. A gas occupies 4.5 L at STP. What new volume will the gas occupy if its temperature is raised to 53°C and the pressure changes to 1.75 atm?

3a. How much heat is required to change the temperature of 500 g of water from 10°C to 50°C? (sketch the heating curve)

3b. How much heat is required to change the temperature of 500 g of iron from 10°C to 50°C? (sketch the heating curve)

4. How much heat is required to change the temperature of 500. g of water from 10°C to steam at 110°C? (sketch the heating curve)
5. How much heat must be removed to cool 1.5 kg of water at 20°C to ice at –10°C? (sketch the cooling curve)
6. 12,500 Joules of heat energy is added to 300.g of water initially at 20.00°C. What is the final temperature?

1. $PV = nRT$ $\quad P = 1\ atm = 101\ kPa$

$n = \frac{PV}{RT} = \frac{(101\times10^3 Pa)(500\times10^{-6}\ m^3)}{(8.31\ \frac{J}{mol\,K})(273\ K)}$

$n = 0.022$ moles

2. $4.5\ L$, STP, $P_1 = 1\ atm$, $T = 273\ K$ $\rightarrow$ $T_2 = 53°C = 326\ K$, $P_2 = 1.75\ atm$

$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$

$\frac{(1\ atm)(4.5\ L)}{273\ K} = \frac{(1.75\ atm)\ V_2}{326\ K}$

$V_2 = 3.1\ L$

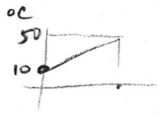
3a.


$Q = mc\Delta T$

$= (.5kg)(4186\ \frac{J}{kg°C})(40°C)$

$= 8.37\times10^4\ J$

3b.

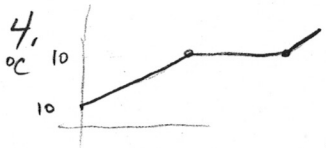



$Q = mc\Delta T$

$= (.5kg)(450\ \frac{J}{kg°C})(40°C)$

$= 9000\ J$

4.



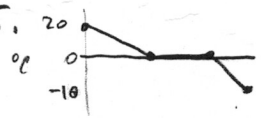

$Q = (mc\Delta T)_{liq} + mH_f + (mc\Delta T)_{gas}$

$= (.5)(4186)(90°C) + (.5)(22.6\times10^5\ \frac{J}{kg}) + (.5)(2010)(10°C)$

$= 1.88\times10^5\ J + 1.13\times10^6\ J + 1.0\times10^4\ J$

$Q = 1.33\times10^6\ J$

5.




$Q = (mc\Delta T)_w + mH_f + (mc\Delta T)_s$

$= (1.5)(4186)(20) + (1.5)(3.33\times10^5) + (1.5)(2100)(10)$

$= 125580\ J + 499500\ J + 31500\ J$

$Q = 6.6\times10^5\ J$

1. 0.022 moles 2. 3a. ~~83,680~~ 83600 J 3b. ~~9200~~ 9000 J $C_{iron} = 450\ \frac{J}{kg°C}$ 4. 5 6. 29.96°C

6. $Q = 12{,}500\ J$, $m = 300g = .3\ kg$, $T_i = 20.00°C$

$Q = mc\Delta T$

$12{,}500 = (.3kg)(4180\ \frac{J}{kg°C})(T_f - 20°)$

$9.97 = T_f - 20$

$T_f = 29.97°C$