Answer on Question #53092 - Chemistry - Analytical Chemistry

a) Calculate the work when 617 grams of solid CO_2 sublimes at 221.5K.

b) Calculate the work when 1 mole of solid CO_2 sublimes at 221.5K

a) CO2(s) → CO2(g)

617 grams/ 44 gram/moles = 14 moles of CO_2

Work done = - pressure·volume·amount of moles of CO_2 at 221.5K [this is the change in volume when 14 moles solid CO_2 changes to 14 moles CO_2 gas at 221.5K]

1 mole CO_2 occupies volume V_1 = 22.4L at STP , P_1= 1 atm and T_1= 273K

At T_2= 221.5K pressure remains 1 atm, the gas occupies volumer V_2

$P_1V_1/T_1=P_2V_2/T_2$

$V_2= P_1V_1T_2/T_1P_2 = (1·22.4·221.5)/(273·1)=18.2$ L

Work done = 1 atm · 18.2L (system volume change)·14 moles of CO_2 = 254.8 L-atm or 25811.24 J

1 L-atm = 101.3 J

Answer: 25811.24 J

b) CO2(s) → CO2(g)

Work done = - pressure·volume of 1 mole CO_2 at 221.5 k [this is the change in volume when 1 mole solid CO_2 changes to 1 mole CO_2 gas at 221.5 k]

1 mole CO_2 occupies volume V_1 = 22.4L at STP , P_1= 1 atm and T_1= 273 K

At T_2= 221.5 K pressure remains 1 atm , the gas occupies volumer V2

$P_1V_1/T_1=P_2V_2/T_2$

$V_2= P_1V_1T_2/T_1P_2 = (1·22.4·221.5)/(273·1)=18.2$L

Work done = 1 atm · 18.2L (system volume change) = 18.2 L-atm or 1844 j

1 L-atm = 101.3J

Answer: 1844J