

ME/CH EN 2300
Homework #10
Due March 28,2007

#1 (6-37) A refrigerator has a COP of 1.5. That is, the refrigerator removes 1.5 kWh of energy from a refrigerated space for each 1 kWh of electricity it consumes. Is this a violation of the 1st law of thermodynamics? Explain.

#2 (6-42) The coefficient of performance of a residential heat pump is 1.6. Calculate the heating, in KL/sec, this heat pump will produce when it consumes 2 kW of electrical power.

#3 (6-43) A refrigerator used for cooling food in a grocery store is to produce 10,000 kJ/h cooling effect, and it has a coefficient of performance of 1.35. How many kilowatts of power will the refrigerator require to operate?

#4 (6-56) Consider a building whose annual air conditioning load is estimated to be 120,000 kWh in an area where the unit cost of electricity is \$0.10/kWh. Two air conditioners are considered for the building. Air conditioner A has a seasonal average COP of 3.2 and costs \$5,500 to purchase and install. Air conditioner B has a seasonal average COP of 5.0 and costs \$7000 to purchase and install. All else being equal, determine which air conditioner is a better buy.

#5 (6-78) You are an engineer in an electric generation station. You know that the flames in the boiler reach a temperature of 1200 K and that cooling water at 300 K is available from a nearby river. What is the maximum efficiency your plant will ever achieve?

#6 (6-86) An inventor claims to have developed a heat engine that receives 700 kJ of heat from a source at 500 K and produces 300 kJ of net work while rejecting the waste heat to a sink at 290 K. Is this a reasonable claim? Why?