PHYS 202 Heat pump, Refrigerator, and Entropy Name:\_\_\_\_\_\_\_\_\_\_\_\_Due 1/30 BB
Q = mc∆T Q = mL For water: c = 4186 J/(kg·C°), Lf = 3.35x105 J/kg, Lv = 2.26 x106 J/kg

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|  | Coefficient of Performance (COP) | Entropy Change |
| Heat Pump | $$COP=\frac{Q\_{H}}{W}$$ | eq15_59 |
| Refrigerator or Air Conditioner | $$COP=\frac{Q\_{C}}{W}$$ |

1. A heat pump removes 2090 J of heat from the outdoors and delivers 3140 J of heat to the inside of a house. (a) How much work does the heat pump need? (b) What is the coefficient of performance of the heat pump?

2. The wattage of a commercial ice maker is 225 W and is the rate at which it does work. The ice maker operates just like a refrigerator and has a coefficient of performance of 3.60. The water going into the unit has a temperature of 15.0°C, and the ice maker produces ice cubes at 0.0°C. Ignoring the work needed to keep stored ice from melting, find the maximum amount (in kg) of ice that the unit can produce in one day of continuous operation.

3. Find the change in entropy of the H2O molecules when (a) three kilograms of ice melts into water at 273 K and (b) three kilograms of water changes into steam at 373 K. (c) On the basis of the answers to parts (a) and (b), discuss which change creates more disorder in the collection of H2O molecules.

4. Find the increase in entropy of 1.00 kg of liquid nitrogen that starts at its boiling temperature, 77.35K and boils. Lv=201x103Kg, for lig.nitrogen.

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