Part 3: Multiple Choice, or Short Answer – 30 Points

You must show your work on each of these problems to get full credit. This might include things like: equations used, sketches, unit conversions, an explanation of why you chose the answer, etc.

5. Circle which of one in each pair has higher entropy?

Liquid water at 0.0 °C	or	Solid water at 0.0 °C
Brakes on your car before stopping	or	Brakes on your car after stopping
A gas at high temperature	or	Same gas at lower temperature

6. A home freezer is operating with a condenser temperature of 25 °F and an evaporator temperature of 95 °F. What is the maximum theoretical COP for this freezer?
   a) 0.357
   b) 1.36
   c) 6.93
   d) 7.93

7. What is the value of the <u>polytropic exponent</u> for <u>isentropic expansion</u> of water vapor?
   (Assuming constant heat capacities)
   a) 1.00
   b) 1.33
   c) 1.40
   d) 1.67

8. Circle the terms in the First Law of Thermodynamics equation that represent the **<u>transport</u>** of energy across the system boundary?

$$\dot{Q} - \dot{W} + \sum_i \dot{m}_i \left(h_i + \frac{V_i^2}{2g_c} + \frac{g}{g_c} z_i \right) - \sum_e \dot{m}_e \left(h_e + \frac{V_e^2}{2g_c} + \frac{g}{g_c} z_e \right) = \frac{d}{dt}(U + KE + PE)$$

9. If a fluid with a <u>specific volume</u> of 3.0 m³/kg flows at 1.5 kg/s through a 0.20 m diameter pipe, what is its velocity?
   a) 35 m/s
   b) 57 m/s
   c) 143 m/s
   d) 173 m/s

10. Four devices (Carnot heat engine, real heat engine, heat pump, and refrigerator) operate between the same high and low temperature thermal reservoirs. What is the order of the most efficient device to the least efficient device?
    a) Heat pump > Carnot engine > Refrigerator > Real engine
    b) Heat pump > Refrigerator > Carnot engine > Real engine
    c) Carnot engine > Refrigerator > Heat pump > Real engine
    d) Carnot engine > Heat pump > Refrigerator > Real engine

11. What is a reasonable assumption when modeling/analyzing a <u>turbine</u>?
    a) aergonic
    b) isenthalpic
    c) adiabatic
    d) isochoric

12. (Multiple Answer) Of the following answers, circle ones that are a property (intensive or extensive)
    a) dQ (differential heat)
    b) Enthalpy
    c) dW (differential work)
    d) dQ/T (differential heat over boundary temperature)

13. On a T-s diagram, isotherms look like
    a) lines that slope from the upper left to the lower right
    b) lines that slope from the lower left to the upper right
    c) horizontal lines
    d) vertical lines

14. The specific volume of R-134a at 500 psia and 50 °F is most nearly:
    a) 0.0200 ft^3/lbm
    b) 0.0657 ft^3/lbm
    c) 0.7871 ft^3/lbm
    d) 0.0127 ft^3/lbm