

Results are due in class Monday April 7 – no exceptions.

Show all or your work, be neat, be organized and please avoid writing a book answering the questions – of course the answers need to be complete and accurate to the best of your ability.

1. Two concrete slabs are laid end to end between rigid end abutments on a standard day. If the environmental temperature increases from the standard day (15C) to a very hot day (50C) find the thermal stress within the slabs. Will this stress exceed the concrete's strength? What clearance or gap should be allowed between the slabs to avoid buckling up to the 50C? (Assume the slab length is 12 meters.)
2. Sometimes during the design of a machine operating at elevated temperatures it is necessary to connect parts made of dissimilar metals. Why must great care be taken when doing this? There are two answers: one answer is related to chemistry and the other is related to mechanics.
3. Why is it never a good idea to fill fuel tanks to the very top when filling these tanks during the summer months?
4. If two bodies are at the same temperature as a third body, what can you say about these bodies?
5. Why is the equation of state for a perfect gas a significant equation in the field of thermodynamics? What are the limitations that are applied to the Perfect Gas Law (also known as the Ideal Gas Law?)
6. Name five thermodynamic properties for a gas (not including mass.)
7. Given a volume of gas at a specific temperature and pressure, and you compress this gas by doing work on it; what can you say about this process? You should address gas properties and the First Law of Thermodynamics.
8. You are familiar with the Kinetic Theory of Gases. What explanation might you give to explain the differences for specific heats of monatomic, diatomic and triatomic gases?
9. What is the primary conclusion drawn from the Kinetic Theory of Gases?
10. Given a heat engine using two moles of air as its working fluid that completes a thermodynamic cycle using three processes. Process AB is a constant volume process, process BC is an isothermal process and process CA is a constant pressure process. Initial conditions at point A are 22C and one atmosphere and the maximum cycle temperature is 475 Kelvin. Calculate the following:

- a) The molecular weight of air.
  - b) Draw the cycle ABC on a PV plot.
  - c) What is the Carnot efficiency for this cycle?
  - d) Write the First Law for each of the three processes.
  - e) What is the change in internal energy for process AB?
  - f) What is the fluid volume at point C?
  - g) How much work is done in process BC?
  - h) What is the change in internal energy for process BC?
  - i) What is the total heat supplied to this engine?
  - j) What is the net work done by this engine?
  - k) What is the actual efficiency for this engine?
11. Explain what the Second Law of Thermodynamics means to you and use some examples.
12. What is the purpose of a reversible adiabatic process?
13. If you expand a monatomic gas adiabatically from initial conditions of one liter, 100C and 3 atmospheres to two liters, what is the final temperature and pressure?