

## Physics 111 Homework Set #1

- 1) A constant volume gas thermometer is calibrated in dry ice at  $-80^{\circ}\text{C}$  and boiling ethyl alcohol at  $78^{\circ}\text{C}$ . The two pressures are 0.900 atm and 1.635 atm respectively. (a) What value of absolute zero does the calculation yield. (b) What is the pressure at the freezing point of water and the (c) boiling point of water?
- 2) The highest recorded temperature on earth is  $136^{\circ}\text{F}$  and the lowest is  $-127^{\circ}\text{F}$ . What are these temperatures in degree Celsius?
- 3) On a strange temperature scale, the freezing point of water is  $-14^{\circ}\text{S}$  and the boiling point is  $60^{\circ}\text{S}$ . Develop a linear conversion between the Strange and Celsius temperature scales.
- 4) The New River Gorge bridge in West Virginia is a steel arch 518 m in length. How much does its length change between temperature extremes of  $-20^{\circ}\text{C}$  and  $35^{\circ}\text{C}$ ?
- 5) At  $20^{\circ}\text{C}$  an Al ring has a inner diameter of 5.000cm and a brass rod has a diameter of 5.050cm. (a) To what temperature must the ring be heated so that it will just slip over the rod? (b) To what common temperature must both be heated so that the ring just slips over the rod?
- 6) A volumetric flask made of Pyrex is calibrated at  $20^{\circ}\text{C}$ . It is filled to the 100ml level with acetone at  $35^{\circ}\text{C}$ . (a) What is the volume of the acetone when it cools to  $20^{\circ}\text{C}$ . (b) How significant is the change in the volume of the flask?
- 7) A He filled balloon has a volume of  $1\text{m}^3$ . As it rises, its volume expands. What is its final volume if its original temperature is  $20^{\circ}\text{C}$  and original pressure is 1.00 atm and its final temperature is  $-40^{\circ}\text{C}$  and final pressure is 0.10 atm?
- 8) In a state of the art vacuum system, the pressure is  $1 \times 10^{-9}$  Pa. How many particles are in a  $1\text{m}^3$  vessel if the temperature is  $27^{\circ}\text{C}$ ?
- 9) Show that 1mole of any gas at atmospheric pressure ( $1.01 \times 10^5$ Pa) and temperature (273K) occupies 22.4l.
- 10) A pendulum clock with a brass suspension system has a period of 1.000s at  $20^{\circ}\text{C}$ . If the temperature increases to  $30^{\circ}\text{C}$  (a) by how much does the period change, and (b) How much time does the clock gain/lose in 1 week?
- 11) The relationship  $L=L_0(1+\alpha\Delta T)$  is an approximation that works if  $\alpha$  is small. If  $\alpha$  is large, we must use the relation  $dL/dt = \alpha L$  to determine the final length. (a) Assuming that  $\alpha$  is a constant, find the general expression for the final length. (b) Given  $L_0= 1.00\text{m}$  and  $\Delta T = 100^{\circ}\text{C}$ , determine the error caused by the approximation if  $\alpha= 2 \times 10^{-5} (\text{C})^{-1}$  and  $\alpha= 0.02 (\text{C})^{-1}$ .