

# Chapter M - Problems

Blinn College - Physics 2425 - Terry Honan

## Problem M.1

A constant volume gas thermometer is calibrated using dry ice (at  $T = -80.0\text{ }^{\circ}\text{C}$ ) and boiling water (at  $T = 100\text{ }^{\circ}\text{C}$ ). The pressure with dry ice is 1.81 atm and with boiling water is 3.49 atm.

- With this calibration, what is the value of absolute zero given by the thermometer?
- What is the pressure at  $0\text{ }^{\circ}\text{C}$ ?

## Problem M.2

At what temperature are the numerical values of the Fahrenheit and Celsius scales the same?

## Problem M.3

Liquid nitrogen is at 77 K. What is this in Celsius and in Fahrenheit?

## Problem M.4

The total vertical fall of Niagara Falls is about 55 m. If the water temperature at the top of the Falls is  $15\text{ }^{\circ}\text{C}$  then what is the temperature at the bottom? Assume all of the potential energy goes into heat in the water and also assume there is no evaporation, which would tend to decrease the temperature.

## Problem M.5

The temperature of a 2 kg mass of an unknown substance increases by  $15\text{ }^{\circ}\text{C}$  when 8400 J of heat is added to it. What is the specific heat of the unknown?

## Problem M.6

A 4 kg chunk of iron at  $500\text{ }^{\circ}\text{C}$  is dropped into a bucket with 25 kg of water that is initially at  $20\text{ }^{\circ}\text{C}$ . Assuming no heat loss to the environment or bucket then what is the equilibrium temperature of the water and iron?

## Problem M.7

How much heat must be added to completely melt 2 kg of lead at  $20\text{ }^{\circ}\text{C}$  ?

## Problem M.8

A quantity of mass  $m$  of water at  $20\text{ }^{\circ}\text{C}$  is added to 2 kg of ice at  $-10\text{ }^{\circ}\text{C}$ . There are three possible final states: all ice at a temperature less than  $0\text{ }^{\circ}\text{C}$ , ice-water at  $0\text{ }^{\circ}\text{C}$  or all water at some temperature greater than  $0\text{ }^{\circ}\text{C}$ . What values of  $m$  will give each of the three possibilities?