

# Problems - Chapter M

## Physics 2425 - Dr. Terry Honan

### ■ Problem M.1

30 g of water is placed in a 2.5 liter pressure cooker and heated up to 350 °C. What is the pressure inside the cooker assuming no gas escapes and neglecting the gas that was initially inside it?

### ■ Problem M.2

A spherical weather balloon can expand to a volume with radius 25 m when it is at the extreme height where the pressure is 0.04 atm and where the temperature is  $-70$  °C. What is its radius when it is near the ground at 1 atm and 25 °C?

### ■ Problem M.3

A tank contains some unknown gas that may be treated as ideal. When the tank contains 8 kg of gas, the pressure gauge on the tank reads 30 atm. After gas is let out of the tank and the temperature is allowed to return to its earlier value the gauge reads 12 atm. What is the mass of gas left in the tank? Note that a pressure gauge reads the pressure difference between the internal pressure and 1 atm so a gauge pressure of 30 atm means the absolute pressure inside is 31 atm.

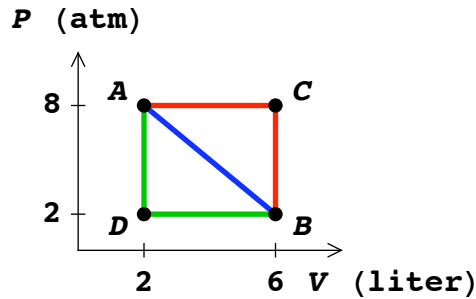
### ■ Problem M.4

In a laboratory pressures as low as  $10^{-9}$  Pa can be reached. For such a vacuum how many molecules are in a  $\text{cm}^3$  at 20 °C?

### ■ Problem M.5

STP, standard temperature and pressure, refers to a pressure of 1 atm and a temperature of 0 °C. How many liters does one mole of an ideal gas at STP occupy?

### ■ Problem M.6



Use the  $PV$ -diagram above to answer the following.

- What is  $W_{ACB}$ , the work from  $A$  to  $C$  to  $B$ ?
- What is  $W_{ADB}$ , the work from  $A$  to  $D$  to  $B$ ?
- What is  $W_{AB}$ , the work from  $A$  to  $B$  along the direct path?
- What is  $W_{BA}$ , the work from  $B$  to  $A$  along the direct path?
- What is  $W_{ABDA}$ , the work for a cycle?
- What is  $W_{ABCA}$ , the work for a cycle?

### ■ Problem M.7

An ideal gas is compressed from 5 liter to 2 liter at a constant pressure of 12 atm. If the internal energy of the gas decreases by 2000 J then what is the heat added to the gas during this process?

### ■ Problem M.8

Referring to the diagram for **Problem M.6**. What is the heat added to the system for the  $ABDA$  cycle, for the  $ABCA$  cycle?

### ■ Problem M.9

Some quantity of an ideal gas does 6000 J of work as expands isothermally at  $20^\circ\text{C}$  to a final pressure and volume of 1.2 atm and 40 liter.

- What are the initial values of the pressure and volume?
- How many moles are in the gas?