## ChEn 273 - Fall 2018 Special Problem 2

Name: \_\_\_\_\_

1. (Estimation) Using the constants in the front of your book, <u>estimate</u> (without using a calculator) the quantities below in the requested units. Then do the actual calculation. Also, state how many significant figures should be used. (a) 600 L/min = 222 hp

(a) 600. $3/11111 - 222 \text{ mp}$	Estimated.
	Calculated:
(b) 3.0 weeks = ??? ms	Estimated:
	Calculated:
(c) $300 \text{ m}^3 = ??? \text{ ft}^3$	Estimated:
	Calculated:

2. (Units) The units of moles is most related to:(a) mass(b) volume(c) number of molecules(d) weight(e) furry animals

3. (Units) Molecular oxygen has a molecular mass of 32 gm/mol (or 32 gm/gmol).(a) What is the mass (in grams) of 2 gram-moles of O<sub>2</sub>?

A lbmol is a convenient AES unit that is defined by using the molecular mass in lb<sub>m</sub>. Thus, the molecular mass of oxygen is also 32 lb<sub>m</sub>/lbmol. (b) How many lbmol are there in 16 lb<sub>m</sub> of oxygen?

(c) Finish the conversion: 1 lbmol = ???? gmol.

(d) How many lbmol are there in 2 grams of  $O_2$ ?

4. (Mass vs Weight) If I weigh 180 lb<sub>f</sub> in the doctor's office in Salt Lake City, what will I weigh (in lb<sub>f</sub>) on the moon where the force of gravity is only 1.6 m/s<sup>2</sup>? (Start with the definition of weight in terms of gravity).

Remember that the acceleration due to gravity (on earth) is 9.807 m/s<sup>2</sup> or 32.17 ft/s<sup>2</sup>.

5. (Mass vs Weight) (a) What is the weight (in N) of a 10 kg object at sea level?

(b) What is the weight (in  $lb_f$ ) of a 10  $lb_m$  object at sea level?

(c) Which is more massive, the 10 kg or 10 lb<sub>m</sub> object?

6. (Archimedes principle) Archimedes found that the mass of a floating object  $(m_{obj})$  is equal to the mass of the fluid displaced by the object  $(m_{fluid displaced})$ .



- (a) Describe the Archimedes principle in an equation, using (i) mass, and (ii) densities and volumes.
- (b) The density of water is 1 g/cm<sup>3</sup>. A wooden cylinder floats vertically in water. The cylinder is 25 cm high, but 13 cm of the cylinder are below the water line. Calculate the density of the wood.
- (c) The same cylinder of wood is placed in a tub filled with a different liquid. This time, 18 cm of the wood cylinder are below the liquid line. What is the density of the liquid?

7. Make a flow chart of the combustor (also called the furnace or boiler) in the case study problem introduction, labeling all of the flows into and out of the combustor, along with any pertinent information of flow rates, temperatures, composition, etc., pertaining to those flows. The case study problem statement is on Learning Suite for this class. Just make the flow chart for the combustor; we will add the other systems to this flow chart later. Please do this in a drawing program such as powerpoint. Try to do this with at least 2 other people as a group, and turn in one printout with 3 names.