

151-Tutorial Assignment #5 (Fall 2009)
Gas Laws Save Lives: The Chemistry Behind Airbags

Name _____
Last first

Chem ID _____

TA _____

Neatly write the answers to the following questions. Submit the document to the Green locker in the hallway of the 3rd floor in Laboratory Science Building before 5 pm 11/16/09 (Monday).

Given: $1 \text{ atm} = 1.013 \times 10^5 \text{ Pa}$
 $\text{Gas Constant, } R = 0.08206 \text{ atm}\cdot\text{L/mol}\cdot\text{K} = 8.314 \text{ Joule/mol}\cdot\text{K}$

(4)1. Circle **all** the correct statement(s) of the following:

- a. One mole of NaN_3 decomposes to produce 3 moles of nitrogen gas.
- b. Potassium silicate is an ingredient of glass.
- c. In order for the airbag to cushion the driver for maximum protection, it must be still inflating when the driver hits it during a collision.
- d. Airbags help reduce injuries by increasing the time interval over which the impact force is applied.
- e. When a force exerts on an object, the greater the contact area, the greater the pressure.

(6)2a. Lead(II) azide is an unstable compound which decomposes to form nitrogen gas with slight agitation. Enter a balanced equation in the box below to illustrate the decomposition of lead(II) azide.

b. Is this reaction a redox reaction? Circle your answer. (YES / NO)

c. Enter a balanced equation in the box below to illustrate the reaction of sodium metal with potassium nitrate in an automobile airbag as it deploys.

(5)3. The calculations in Equations (1) to (5) in the tutorial show that the net force exerting on the front face of an airbag must be $3.33 \times 10^4 \text{ N}$ to make the front face accelerate at $1.33 \times 10^4 \text{ m/s}^2$.

- a) If the surface area of the front face of the airbag is 0.250 m^2 , calculate the gauge pressure exerting on the front face. Show your calculation in the space below and enter your answer in the box.

Pa

- b) If the atmospheric pressure is 0.987 atm , what is the absolute pressure inside the airbag (in atm)? Show your calculation in the space below and enter your answer in the box with correct number of significant figures.

atm

(5)4. When fully inflated, the volume of an airbag is 15 L at 25°C and 1.00 atm .

- a. How many moles of gases are trapped inside this airbag. Show work in the space below and enter your answer in the box.

mol

- b. As this airbag is deflated to 1 L , how many moles of gases must have escaped. Show work in the space below and enter your answer in the box with correct number of significant figures.

mol