

# Homework 6

October 6, 2022

Weekly homework assignments are posted approximately one week prior to the due date. Collaborations are encouraged and students must report all collaborators in writing on each assignment. All external sources (websites, books) must be properly cited. Additional problems are listed at the end of each assignment. This week's assignment is due *Friday, Oct 14th at 11:59pm*.

1) The combustion of gasoline produces carbon dioxide and water. Assume gasoline to be pure octane ( $\text{C}_8\text{H}_{18}$ ) and calculate the mass (in kg) of carbon dioxide that is added to the atmosphere per 1.0 kg of octane burned. Report to (Hint: Begin by writing a balanced equation for the combustion reaction.) (2 pts)

2) A mixture of  $\text{C}_3\text{H}_8$  and  $\text{C}_2\text{H}_2$  has a mass of 2.0 g. It is burned in excess  $\text{O}_2$  to form a mixture of water and carbon dioxide that contains 1.5 times as many moles of  $\text{CO}_2$  as of water. Find the mass of  $\text{C}_2\text{H}_2$  in the original mixture. (2 pts)

3) The reaction of  $\text{NH}_3$  and  $\text{O}_2$  forms  $\text{NO}$  and  $\text{H}_2\text{O}$ . The  $\text{NO}$  can be used to convert  $\text{P}_4$  to  $\text{P}_4\text{O}_6$ , forming  $\text{N}_2$  in the process. The  $\text{P}_4\text{O}_6$  can be treated with water to form  $\text{H}_3\text{PO}_3$ , which forms  $\text{PH}_3$  and  $\text{H}_3\text{PO}_4$  when heated. Write all chemical equations including states. Find the mass of  $\text{PH}_3$  that forms from the reaction of 1.50 g  $\text{NH}_3$ . Report to 3 significant figures. (3 pts)

4) Metallic aluminum reacts with  $\text{MnO}_2$  at elevated temperatures to form manganese metal and aluminum oxide. A mixture of the two reactants is 47.2% mass percent  $\text{Al}$ . Determine the theoretical yield (in grams) of manganese from the reaction of 250g of this mixture. Report to 3 significant figures. (3 pts)

**Optional Textbook Problems:** Ch. 5 - 5.55 – 5.73 odd; 5.101 – 105 odd; 5.113, 5.115