

Ideal Gas Law Worksheet 2

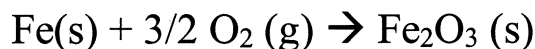
Gas Stoichiometry and Molecular Formula Determination

Methane, the principal component of natural gas, is used for heating and cooking.

- Write a balanced chemical equation for the combustion of methane.
- If 15 moles of methane are reacted, what is the volume of carbon dioxide (in liters) produced at at 23.0°C and 0.985 atm? (Chang #52)

370L

2004 Exam Question 2



Iron reacts with oxygen to produce iron (III) oxide, as represented by the equation above. A 75.0 g sample of Fe(s) is mixed with 11.5 L of O₂ (g) at 2.66 atm and 298 K.

- calculate the number of moles of each of the following before the reaction begins.
 - Fe (s)
 - O₂(g)
- Identify your limiting reactant when the mixture is heated to produce solid iron (III) oxide.
- Calculate the number of moles of iron (III) oxide produced when the reaction proceeds to completion.

ice
table

$$a) \frac{75.0 \text{ g Fe}}{55.85} = 1.34 \text{ mol Fe}$$

$$PV = nRT$$

$$n = \frac{PV}{RT} = \frac{(2.66)(11.5)}{(0.0821)(298)}$$

$$1.25 \text{ mol O}_2$$

$\text{Fe} + \frac{3}{2} \text{O}_2 \rightarrow \text{Fe}_2\text{O}_3$		
$4 \text{Fe} + 3 \text{O}_2 \rightarrow 2 \text{Fe}_2\text{O}_3$		
1.34	1.25	0
-1.34	-1.005	+0.67
0	0.245 mol O ₂	1.67 mol Fe ₂ O ₃ c

$$1.25 \text{ mol O}_2 \times \frac{4 \text{ Fe}}{3 \text{ O}_2} = 1.66 \text{ mol Fe}$$

$$1.34 \text{ mol Fe} \times \frac{3 \text{ O}_2}{4 \text{ Fe}} = 1.005 \text{ mol O}_2$$

1998 AP exam

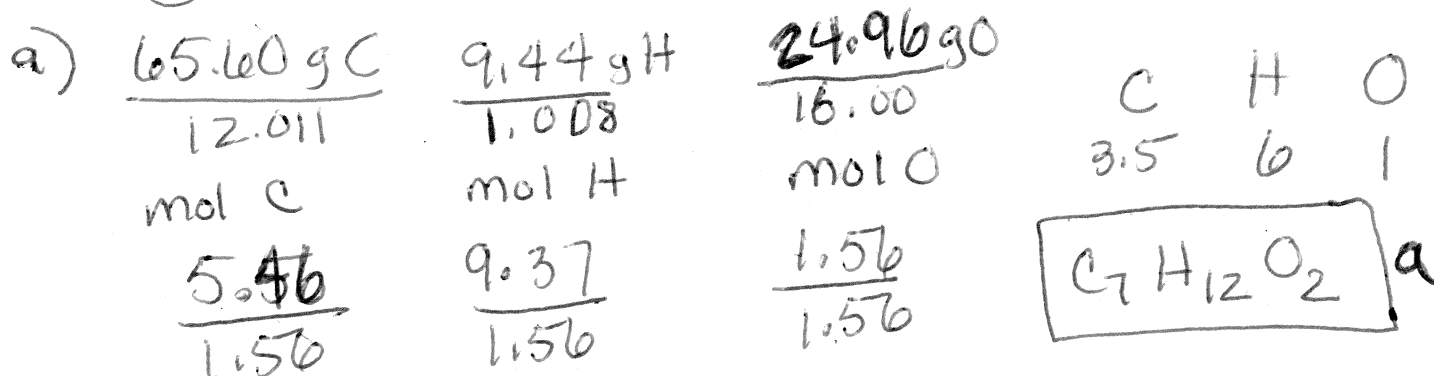
An unknown compound contains only the three elements C, H, and O. A pure sample of the compound is analyzed and found to be 65.60 percent C and 9.44 percent H by mass.

(a) Determine the empirical formula of the compound.

(b) When 1.570 grams of the compound is vaporized at 300 °C and 1.00 atmosphere, the gas occupies a volume of 577 milliliters. What is the molar mass of the compound based on this result?

$$MM = \frac{mRT}{PV} = \frac{(1.570 \text{ g})(0.0821 \text{ L}\cdot\text{atm}/\text{mol}\cdot\text{K})(573 \text{ K})}{(1.00 \text{ atm})(0.577 \text{ L})} = 128.00 \text{ g/mol}$$

(c) Determine the molecular formula of the compound.



2003 Exam B

In an experiment, a sample of an unknown, pure gaseous hydrocarbon was analyzed. Results showed the sample contained 6.000 g of carbon and 1.344 g of hydrogen.

a) determine the empirical formula of the hydrocarbon.

b) The density of hydrocarbon at 25°C and 1.09 atm is 1.96 g/L.

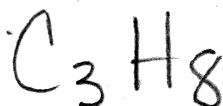
i) Calculate the molar mass of the hydrocarbon

ii) Determine the molecular formula of the hydrocarbon

$$\begin{array}{r} 25 \\ 273 \\ \hline 298 \end{array}$$

$\frac{6.000 \text{ g C}}{12.0}$	$\frac{1.344}{1.0}$
.5 mol C	1.344
$\frac{.5}{.5}$	$\frac{1.344}{.5}$

1 : 2.7



$$36 + 8 = 44 \text{ g/mol}$$

$$MM = \frac{DRT}{P}$$

$$= \frac{1.96 \text{ g/L} \cdot (0.0821 \text{ L}\cdot\text{atm}/\text{mol}\cdot\text{K}) \cdot (298 \text{ K})}{1.09 \text{ atm}}$$

$$= 43.99 \text{ g/mol}$$

SAME