N27 - Real Life Stoichiometry Examples

Target: I can apply stoichiometry to real life examples that have context/stories behind them.

Example #1 – AIR BAGS

Exact quantity of nitrogen gas must be produced in an instant.



2 NaN₃(s) $\rightarrow 2$ Na(s) + 3 N₂(g)

$2 \text{ NaN}_3(s) \rightarrow 2 \text{ Na}(s) + 3 \text{ N}_2(g)$ If an airbag is made with 90 grams of NaN₃ will it be safe? Assume that 65.1 L of N₂ gas are needed to

inflate an air bag to the proper size to protect you during an accident.

(<u>Hints:</u> Make NaN₃ your A value. The density of N₂ gas at this temperature is about 0.916 g/L).

 $\frac{a}{2}NaN_3 \rightarrow 2Na + \frac{b}{3}N_2$

Density 0.9169/L

63.52 L N₂ gas NOT SAFE! The air bag will not inflate all the way which would be dangerous.

Example #2 – ROCKET FUEL

In 1967 the Saturn V Rocket did an unmanned test flight to the moon. It used kerosene fuel to get through the atmosphere into outer space. The kerosene $(C_{12}H_{26})$ combusts with liquid oxygen (O_2) on board the rocket to form carbon dioxide and



water. $24 k^2$ $24 k^2$ $26 k^1$ $26 k^1$ $26 k^2$ $26 k^2$ $26 k^2$

Example #2 – ROCKET FUEL

2 $C_{12}H_{26}$ + 37 $O_2 \rightarrow$ 24 CO_2 + 26 H_2O If the Saturn V rocket was loaded with 770,886 Liters of kerosene fuel and 890,650 Liters of liquid oxygen, would it have enough liquid oxygen on board to use up all the kerosene in order to get out of the atmosphere?

(<u>Hints:</u> Make kerosene your A value. The density of kerosene is 749g/L, and the density of liquid oxygen is 1141 g/L)



 $+ 370_2 \rightarrow 2400_2 + 26 HaO$ 2 C12 H26 ter density glime only gA ->moifi >> molB >> gB -> density B to mom orize m.m M.R Densityp $m \cdot m$ Density B A \underline{B} = 170.33 A 37molB749gA/ILA 32gB 11419BSA/IMOLA Imore ILB 758,801 ZmolA 770886 LA 7499A 1 mo/A 37molB 328B 170.339 x 2mol A (mol B) 1 LA 11419



 NOT ENOUGH liquid O₂ on board to burn all the kerosene! Uh oh...

Example#3 - HYDROGEN POWERED BICYCLES

Electric Bicycles are becoming very popular these days. They typically have a rechargeable battery pack and electric hub motor.

A new electricity source combines a hydrogen fuel cell with a *"sodium silicide"* fuel cartridge (winner of a "Green Chemistry Challenge Award)



Example#3 – H₂ POWERED BICYCLES

The sodium silicide reacts with water to make the hydrogen fuel to run the bicycle.

2 NaSi_(s) + $5H_2O_{(l)} \rightarrow Na_2Si_2O_{5(s)} + <math>5H_{2(g)}$ If you start with 1Kg of sodium silicide, and your tank can hold 500mL of water, will you have

enough water to use up the battery?

(<u>Hints</u>: Use 1kg of sodium silicide as your A value. The Density of water is 1g/mL) Memory

(A) ANasi+ (B)H20 -> Na2SizOs +5HZ Density doesn't alwargs have the Same units!

KgA > gA > molA > molB > gB > mLB m.R m.m m.m Density metric conversion! BIA A B/A B 51.089A <u>5molB</u> <u>5molB</u> <u>18.029B</u> <u>1mLB</u> 1molA <u>2molA</u> <u>1molB</u> <u>19B</u> King henry ... 62 10003/1Kg 1mo/A 1KgA 100034 Imold 5mold 18.0238 IALB = 1KgA 51.08gr 2mold Irol 8 19 B 881.95 MLH20

 881.95 mL of H2O needed to use up all the NaSi in the battery.



NOT ENOUGH water in the water tank to use up the entire battery.

holds 500 mL H2O Need 881.95 mL

- · Answer the Story Question Also!
- · Box your ans.
- · Final Ans. W/ units AND formula
- concel units
- Units (AEB OR formulas)
- · Dimensional Analysis LINE METHOD
- · label pathway
- · pathway
- · Balanced EQ

YouTube Link to Presentation

<u>https://youtu.be/DK2MEqz9fFs</u>