Particle model and Balancing Equation Notes

Is used to show chemical reactions.

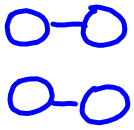
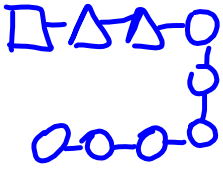
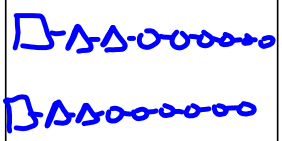
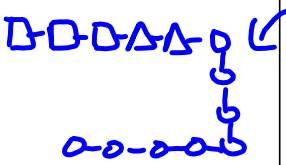
Counting atoms in a molecule

NaCl	3 NaCl	Na_2SO_4	2 Na_2SO_4
1 Na	3 Na	2 · Na	4 · Na
1 Cl	3 Cl	1 · S	2 · S
		4 · O	8 · O

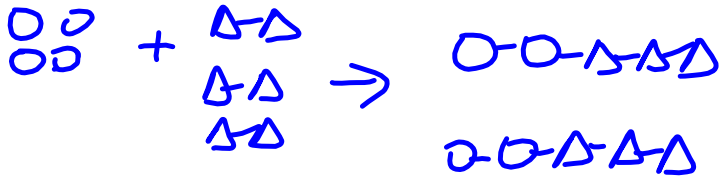
$C_5H_{11}OH$	3 $C_5H_{11}OH$	$Ca_3(PO_4)_2$	3 $Ca_3(PO_4)_2$
5 · C	15 · C	3 Ca	9 · Ca
12 · H	36 · H	2 P	6 · P
1 · O	3 · O	8 · O	24 · O

33 + 3

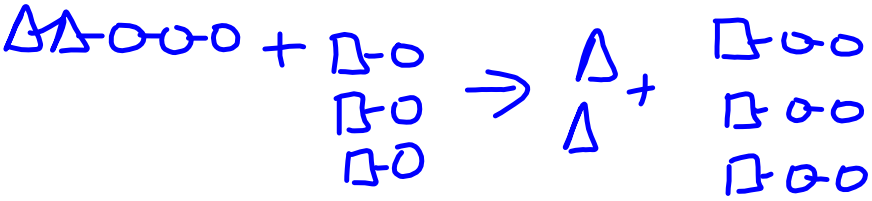
Various symbols are used to show the molecules.

Na	2 Na	2 H_2	H_2SO_4
			
$Cu(NO_3)_2$	2 $Cu(NO_3)_2$	$Ca_3(PO_4)_2$	3 $Ca_3(PO_4)_2$
			

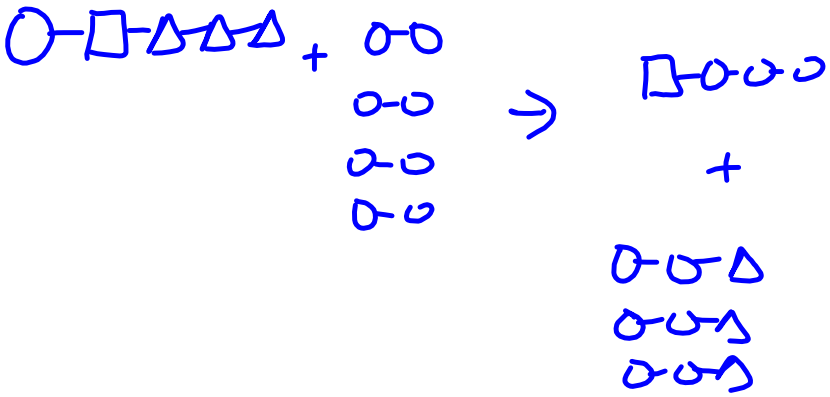
$4\ Al + 3\ O_2 \Rightarrow 2\ Al_2O_3$



$Fe_2O_3 + 3\ CO \Rightarrow 2\ Fe + 3\ CO_2$



$HNO_3 + 4\ H_2 \Rightarrow NH_3 + 3\ H_2O$



Conservation of Matter

Matter is never created or destroyed, it is just changed.

Rules:

1- The type of atoms stay constant before and after the reaction.

2- The number of atoms stay constant before and after the reaction.

3- The mass of the atoms stays the same before and after the reaction.

What is incorrect with the following equation?

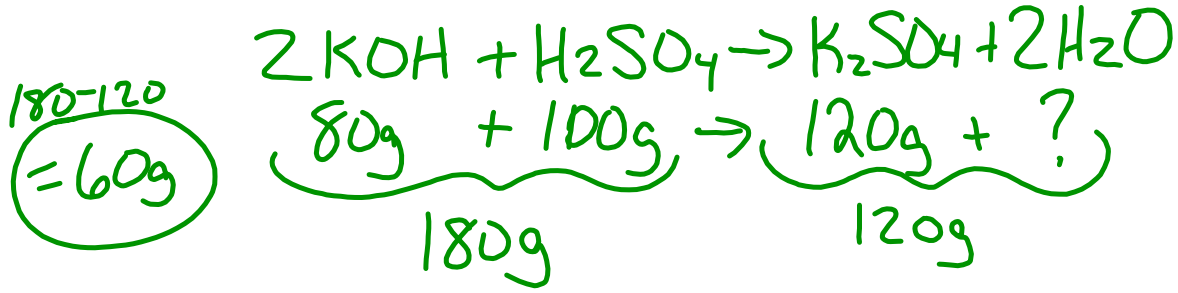
$4Al + 3O_2 \Rightarrow 2 Al_2O_3$ = unbalanced equation

Balancing equations

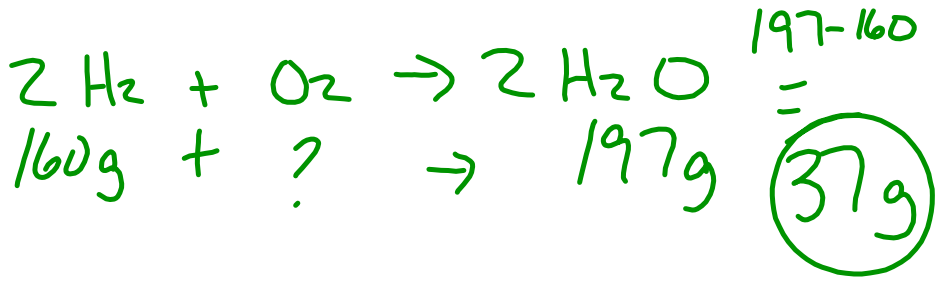
1. $4P + 5O_2 \rightarrow 2P_2O_5$
2. $2H_2 + O_2 \rightarrow 2H_2O$
3. $2P + 3Cl_2 \rightarrow 2PCl_3$
4. $2N_2 + 5O_2 \rightarrow 2N_2O_5$
5. $Fe_2O_3 + CO \rightarrow Fe + CO_2$
6. $2KOH + H_2SO_4 \rightarrow K_2SO_4 + 2H_2O$
7. $2NH_3 + 3Cl_2 \rightarrow 6HCl + N_2$
8. $4NaOH \rightarrow 4Na + O_2 + 2H_2O$
9. $4FeS + 7O_2 \rightarrow 2Fe_2O_3 + 4SO_2$
10. $2HCl + Fe \rightarrow FeCl_2 + H_2$
11. $2Na + 2H_2O \rightarrow 2NaOH + H_2$
12. $2C_8H_{18} + 25O_2 \rightarrow 16CO_2 + 18H_2O$
13. $HNO_3 + 4H_2 \rightarrow NH_3 + 3H_2O$
14. $FeCl_3 + 3NH_4OH \rightarrow Fe(OH)_3 + 3NH_4Cl$
15. $2H_2SO_4 + C \rightarrow CO_2 + 2H_2O + 2SO_2$

Mass of Equations

1. You combined 80 g of 2 KOH with 100 g of H_2SO_4 to produce 120 g of K_2SO_4 and 2 H_2O. How much water was produced?



2. You combined 160 g of 2 H_2 with O_2 and produced 197 g of 2 H_2O. How much O_2 was produced?

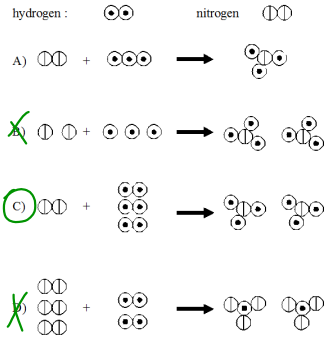


Past Exam Questions

1. One litre of nitrogen (N_2) reacts with three litres of hydrogen (H_2) to produce two litres of ammonia, according to the following equation :

$$N_{2(g)} + 3\ H_{2(g)} \rightarrow 2\ NH_{3(g)}$$

Which of the following models best describes the chemical change that occurs?



2. Which of the following chemical equations are correctly balanced?

1. $4\ Bi_{(s)} + 3\ O_{2(g)} \rightarrow 2\ Bi_2O_{3(s)}$
2. $2\ Bi_{(s)} + Cl_{2(g)} \rightarrow 2\ BiCl_{3(s)}$
3. $2\ Bi_2S_{3(s)} + 9\ O_{2(g)} \rightarrow 2\ BiO_{3(s)} + 6\ SO_{2(g)}$
4. $Bi_2O_{3(s)} + 3\ C_{(s)} \rightarrow 2\ Bi_{(s)} + 3\ CO_{(g)}$
5. $As_2O_{3(s)} + 6\ H_{2(g)} \rightarrow 2\ AsH_{3(s)} + 3\ H_2O_{(g)}$

A) 1, 3 and 4 C) 3, 4 and 5
B) 1, 4 and 5 D) 2 and 3

3. One of the causes of acid rain is the sulfur released when fossil fuels such as coal and oil are burned. The following two reactions take place when these fuels are burned:

128 sulfur dioxide	+	32 oxygen	→	160 sulfur trioxide
160 sulfur trioxide	+	36 water	→	sulfuric acid 196g

With the above reactions in mind, a student combined 128 g of sulfur dioxide with 32 g of oxygen to produce sulfur trioxide. He then combined all the resulting sulfur trioxide with 36 g of water to produce sulfuric acid. What mass of sulfuric acid did he produce?

4. The Iron and Steel Company uses a chemical reaction to transform ferric oxide (rust) into iron. The balanced equation for this reaction is as follows:

$$2\ Fe_2O_{3(s)} + 3\ C_{(s)} + \text{energy} \rightarrow 4\ Fe_{(s)} + 3\ CO_{2(g)}$$

(80) (9) (55) (?)

To determine how much CO_2 it emits, the company took a sample and obtained the data presented in the table below

89-55= 34g

Masses of the four Substances before and after the reaction

Substance	Initial Mass (g)	Final Mass (g)
Fe_2O_3	80	0
C	9	0
Fe	0	55
CO_2	0	?

Using the law of conservation of matter, calculate the mass of CO_2 emitted during this reaction.