

[TP] What does the following chemical equation tell us?

$$Cu(s) + 2\ Ag^+(aq) \rightleftharpoons Cu^{2+}(aq) + 2\ Ag(s)$$

14% 1. If 0.731 mol Cu reacts, then 0.731 mol Cu^{2+} will be formed
14% 2. 2 mol of Ag^+ will form 1 mol Cu^{2+}
14% 3. 10 g Cu will form 10 g Cu^{2+}
14% 4. 1 and 3
14% 5. 2 and 3
14% 6. All of the above
14% 7. None of the above

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Lecture 11 CH101 A1 (MWF 9:05 am)

Friday, September 29, 2017

For today ...

Begin ch5: Chemical reaction, chemical equations
- What a chemical equation tells us
- Balancing chemical equations
- Stoichiometry: Amounts in chemical transformations
- Limiting reagent percent yield

Next lecture: Complete ch5: Limiting reagent and percent yield

Ch5: Chemical reaction, chemical equations

A chemical equation tells us …

$$Cu(s) + 2\ Ag^+(aq) \rightleftharpoons Cu^{2+}(aq) + 2\ Ag(s)$$

- Relative amounts (in mol) of species that are needed to react and that could be formed

A chemical equation cannot tell us …

$$Cu(s) + 2\ Ag^+(aq) \rightleftharpoons Cu^{2+}(aq) + 2\ Ag(s)$$

- How much of each species reacts
- How much reactants are present
- Which direction is spontaneous
- Whether energy is released or absorbed
- How fast a reaction proceeds
- The microscopic mechanism of the reaction

All of these are goals of the remainder of CH101 and CH102

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Balancing chemical equations (by inspection)

Balancing chemical equations (by inspection)

$$C_6H_{12}O_6(s) + O_2(g) \rightarrow CO_2(g) + H_2O(l)$$

- Adjust coefficients (but never change subscripts)
- Coefficients are molar amounts, so fractions OK
- Set coefficient of most complicated molecule to 1
- Save elements for last
- Don't forget about states (s, l, g, and aq)
- Check your final result (never partial credit!)

Practice

$$C_6H_{12}O_6(s) + O_2(g) \rightarrow CO_2(g) + H_2O(l)$$

$$C_6H_{12}O_6(s) + O_2(g) \rightarrow 6\ CO_2(g) + H_2O(l)$$

$$C_6H_{12}O_6(s) + O_2(g) \rightarrow 6\ CO_2(g) + 6\ H_2O(l)$$

$$C_6H_{12}O_6(s) + 6\ O_2(g) \rightarrow 6\ CO_2(g) + 6\ H_2O(l)$$

Stoichiometry: Amounts in chemical transformations

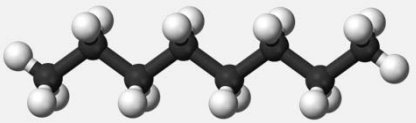
[TP] Intense exercise uses lactic acid,
$CH_3CH(OH)C(O)OH$ and shown at below,
as a combustion fuel. How many moles of carbon dioxide are formed for each mole of lactic acid "burned" completely in the oxygen of air, forming CO_2 and water?

20% 1. 3 mol CO_2
20% 2. 6 mol CO_2
20% 3. 9 mol CO_2
20% 4. 12 mol CO_2
20% 5. None of the above

Lactic Acid

[Quiz] A primary component of gasoline is octane, C_8H_{18}, shown in the figure. How many moles of water are formed for each mole of octane "burned" completely in the oxygen of air?

20% 1. 3 mol water
20% 2. 6 mol water
20% 3. 9 mol water
20% 4. 12 mol water
20% 5. None of the above



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Limiting reagent

Our Learning Assistants are starting a sandwich making business.

Unfortunately, they will offer only a single option …

- A cheese club sandwich on Wonder bread.
- With 15 slices of bread and 6 slices of cheese, …
  - How many sandwiches can they make?
  - How much of each ingredient will be left over?
  - Let's see…

Limiting reagent

3 Bread + 2 Cheese → 1 Sandwich

Balanced chemical equation is the "recipe"

Amounts of reactants is how much can be made

Limiting is which reactant makes the least

Limiting reagent

3 Bread + 2 Cheese → 1 Sandwich

The limiting reagent is the one that form the least product.

- With 15 slices of bread and 6 slices of cheese, …
  - How many sandwiches can they make?
  - How much of each ingredient will be left over?

[TP] Substances A and B combine to form substance C in the balanced chemical equation

$$3\ A + 2\ B \rightarrow 4\ C$$

If 12 mol A and 6 mol B react completely, how many moles of C are formed?

25% 1. 16 mol C
25% 2. 12 mol C
25% 3. 6 mol C
25% 4. None of the above

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[TP] Substances A and B combine to form substance C in the balanced chemical equation

$$3\ A + 2\ B \rightarrow 4\ C$$

If 12 mol A and 6 mol B react completely, how many moles of A remain unreacted?

25% 1. 0 mol A
25% 2. 3 mol A
25% 3. 6 mol A
25% 4. None of the above

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