Cellular Respiration Candy Modeling

(similar approach can be used with photosynthesis)

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Materials List (per person): (can cut this down if they work in pairs after glycolysis)

- 1 package Smarties
  - Need at least 15 pieces of candy
- 12 Skittles
  - 2 of one color
  - 6 of a second color
  - 4 of a third color
- 14 Twizzlers bites
- 8 Werther's Originals
- 16 Mini M&Ms
- 1 Snack sized baggie

Each candy piece represents a molecule involved in cellular respiration/photosynthesis.

Students receive a baggie with all components (*candy*), and a white piece of paper.

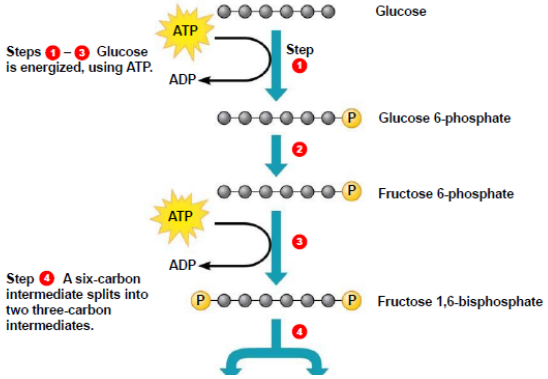
It helps to have an input and output area to keep up with the accounting of the components

Components:

Smarties	Carbon molecules
Skittles	2:CoA 4:CO_2 6:H_2O
Twizzlers bites	NAD^+/NAPDH and FAD/$FADH_2$
Werther's Originals	ATP/ADP/Pi
Mini M&Ms	Electrons

Glycolysis – Energy Investment Phase

For glycolysis you will start with glucose, 6 Smarties (carbons), then you have a Werther's Original (ATP) come in and then remove unwrapped (ADP). Leave the wrapper with the Smarties – donated a phosphate. Then you repeat a second Werther's Original – leaving the phosphate on the other end of the Smarties. Then split into two 3 carbon/Smarties molecules (G3P).

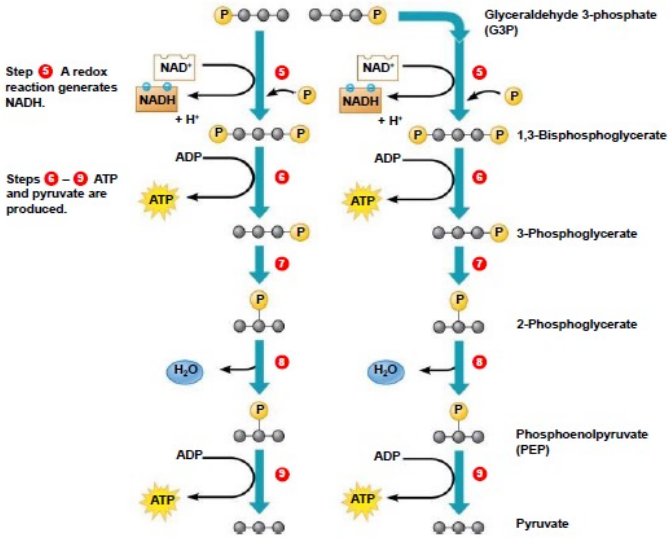


Glycolysis – Energy Payoff Phase

Take the two 3-Smarties molecules (G3P) and bring in two Twizzlers bites and add two mini M&Ms to each while adding another wrapper (P) to each molecule.

Remove a wrapper from each 3-Smarties molecule and wrap it around a Werther's Original (ADP to ATP).

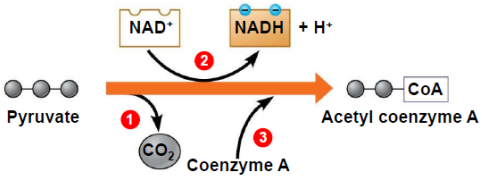
Rearrange your molecules. Take two Skittles (H_2O) and put in the output pile. The remove the remaining wrapper and put on a Werther's Original to convert ADP into ATP. You are left with a 3 Smarties (carbon) molecule, pyruvate.



Do the accounting to see what your output is. Compare that to the input. This way you can see the products of glycolysis.

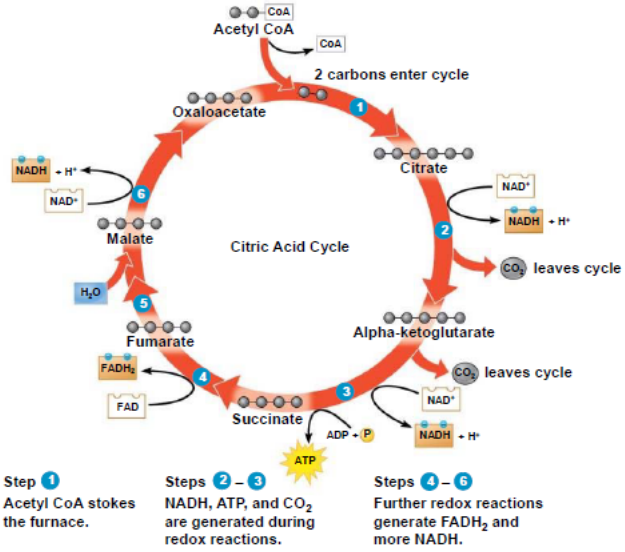
Pyruvate Oxidization

Take each 3 Smarties molecule and remove a Smarties from each and remove it out on top of a Skittles into the output pile. Bring in a Twizzlers Bites for each pyruvate and add two mini M&Ms to each. Then bring in another Skittles and attach to the end of the 2 Smarties molecule, this is Acetyl CoA.



Citric Acid Cycle – you will complete two turns

Start with your two Smarties/Skittles (Acetyl CoA) molecule as well as a four Smarties, Oxaloacetate. Combine these molecules into citrate – six Smarties. Then bring in a Twizzlers bite and add two mini M&Ms to it to make NADH and remove a Smarties with a Skittles (CO_2) into the output pile.



This leaves a five Smarties molecule from which you remove another Smarties that leaves with a Skittles to the output pile and then reduce a Twizzlers bite with 2 mini M&Ms. Then bring in another Werther's Original and place in the output pile and there is now a 4 Smarties molecule of succinate. Next bring in a Twizzlers bite and reduce it with two mini M&Ms. From there you go from fumarate to malate by bringing back in a Skittles (H_2O). Then bring in a Twizzlers bite and reduce it with two mini M&Ms as you convert malate to oxaloacetate.

Do the accounting to see what your output is. Compare that to the input. This way you can see the products of the citric acid cycle is.

Students can take the candy bags home and practice the processes and track the input and outputs of each step or use to model photosynthesis as well.