

Topic: Photosynthesis Modeling Lab - Ball-and-Stick

Summary: Students will learn about the inputs and outputs of photosynthesis by building ball and stick chemical models. Students will also experience the law of conservation of matter by breaking CO_2 and H_2O into Glucose and O_2 . Students will summarize the activity using a CER paragraph.

NGSS Standards:

HS-LS1-5: Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy.

HS-LS1-6: Construct and revise an explanation based on evidence for how carbon, hydrogen, and oxygen from sugar molecules may combine with other elements to form amino acids and/or other large carbon-based molecules.

Common Core: W 9-10.2.D, 9-10.7

Common Core: RST 9-10.3, 9-10.4, 9-10.7

Time Length: 50 minutes

Prerequisite Knowledge: Students should have already been introduced to the reactants (inputs) and products (outputs) of photosynthesis. Students should have been introduced on how to write a CER paragraph.

Materials:

- 6 carbon atoms (black)
- 18 oxygen atoms (red)
- 12 hydrogen atoms (white)
- 40 bonds (long bendable kind is better, but not required)
- bin or plastic box to hold all of the atoms and bonds

Accommodations: Students with an IEP demonstrate their understanding using a verbal assessment or the use of sentence frames for the CER.

Editable DOCX File and Answer Key:

Available at www.ngsslifescience.com

Name: _____ Row: _____

Date: _____ Period: _____

Photosynthesis Modeling Lab

Ball-&-Stick

Driving Question:

How are the atoms in carbon dioxide and water related to the glucose molecule and oxygen molecules synthesized in photosynthesis?

Atom Color Key:

(B) Black = carbon

(R) Red = oxygen

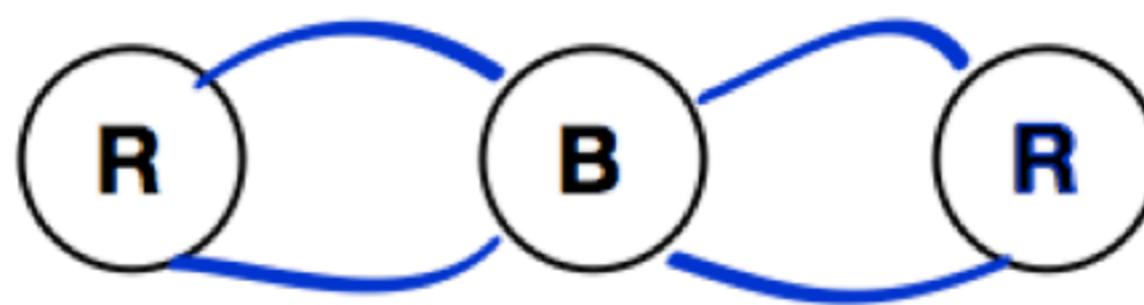
(W) White = hydrogen

Background:

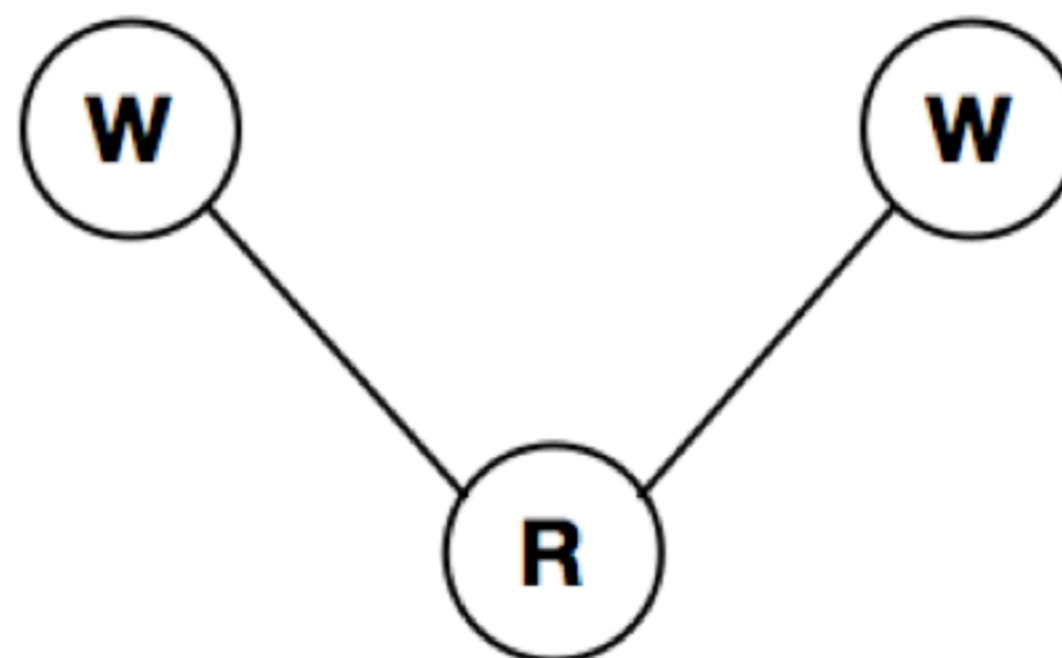
There are many processes involved in order for a plant to grow. Photosynthesis, cellular respiration, and cell division are all required for plants to grow. Photosynthesis demonstrates the law of conservation of matter which states that atoms can not be created nor destroyed, the atoms can only be rearranged into new molecules and ions. Photosynthesis is aided by proteins called enzymes. Enzymes can either cut (break bonds) or glue (form bonds) molecules.

Procedures:

1. Obtain the necessary atoms and bonds supplies.
2. Create 6 carbon dioxide molecules. Use the diagram below to help build the model. R stands for red the red oxygen atoms and B stand for black carbon atom. *(If you don't have the longer bonds to create a double bond, just attach one bond on each side of the carbon.)*



3. Create 6 water molecules from the remaining atoms and bond sticks. Use the diagram below to help build the model. R stands for the red oxygen atom and H stand for white hydrogen atoms.



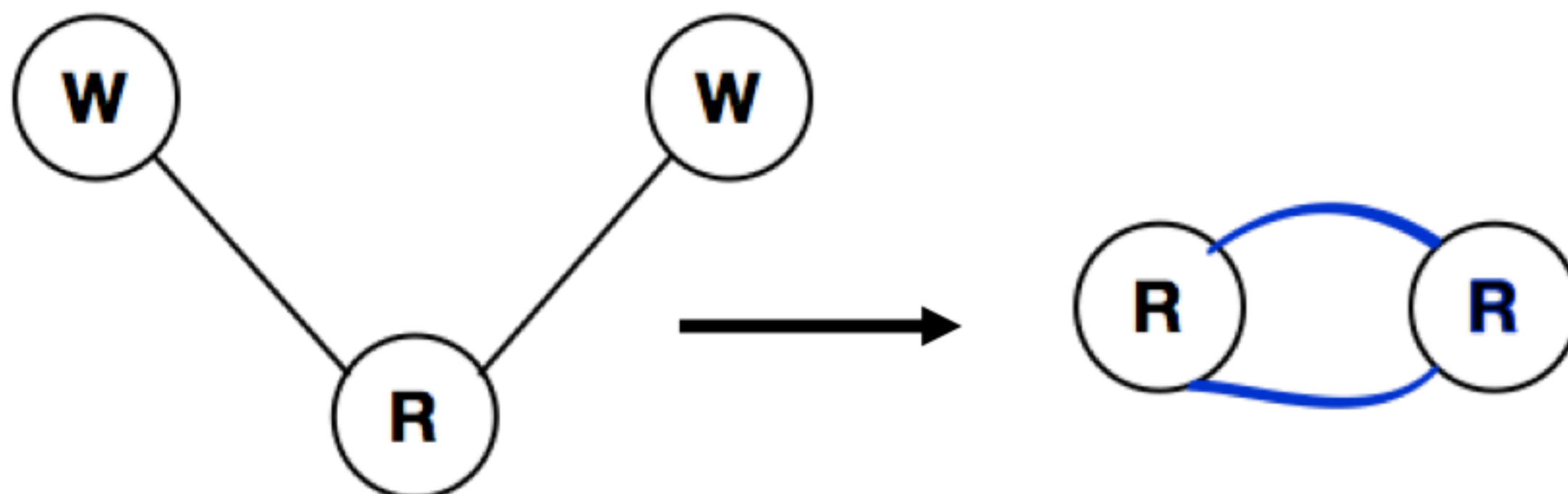
4. **Stop** and show your teacher all 12 molecules.

5. You have not done any photosynthesis as of yet. You have just created the reactants.



You are ready to perform photosynthesis.

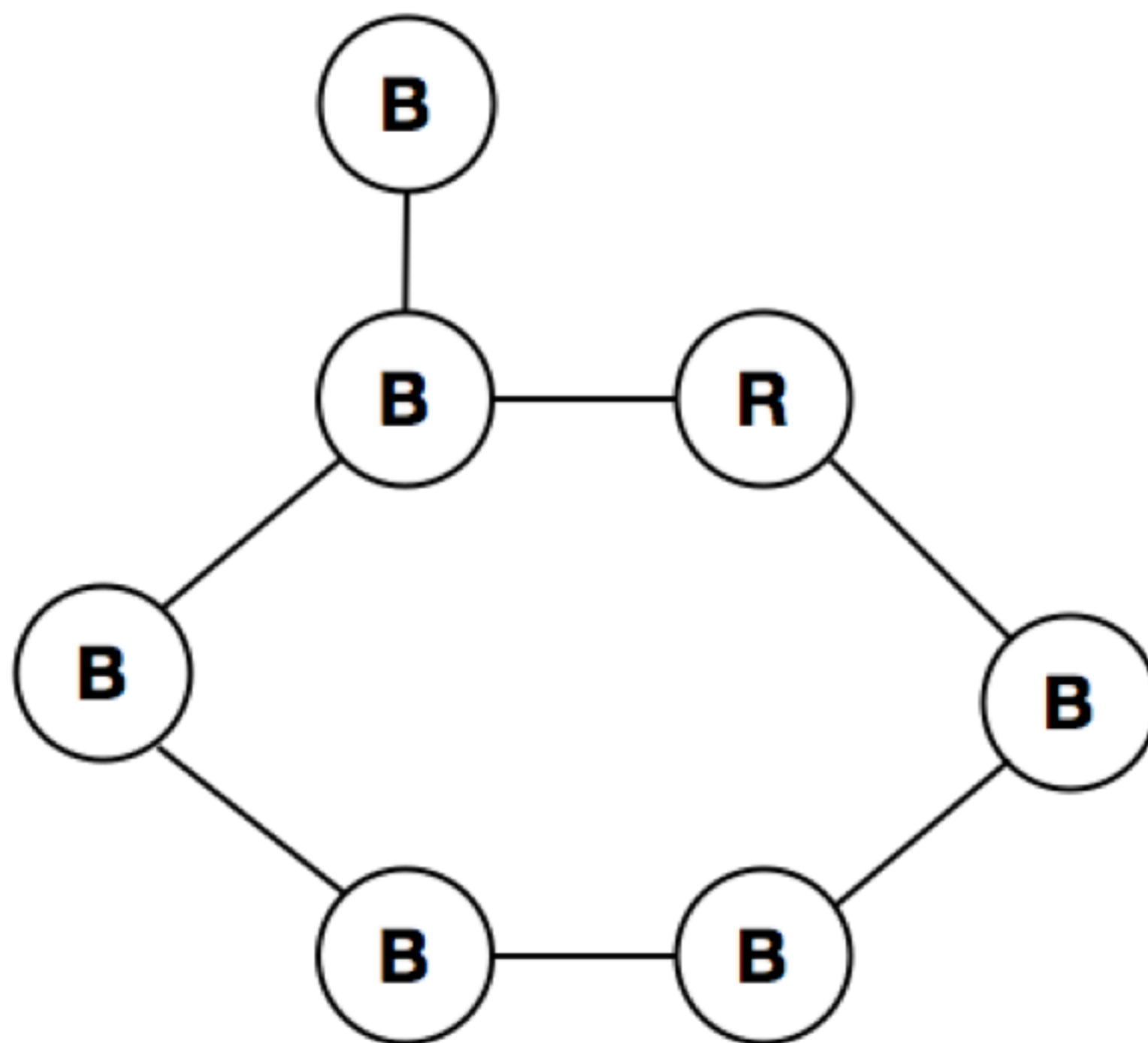
6. Create 6 oxygen gas molecules by breaking apart the water molecules. Use the diagram below to help build the model. *(If you don't have the longer bonds to create a double bond, just attach one bond to attached the oxygen atoms.)*



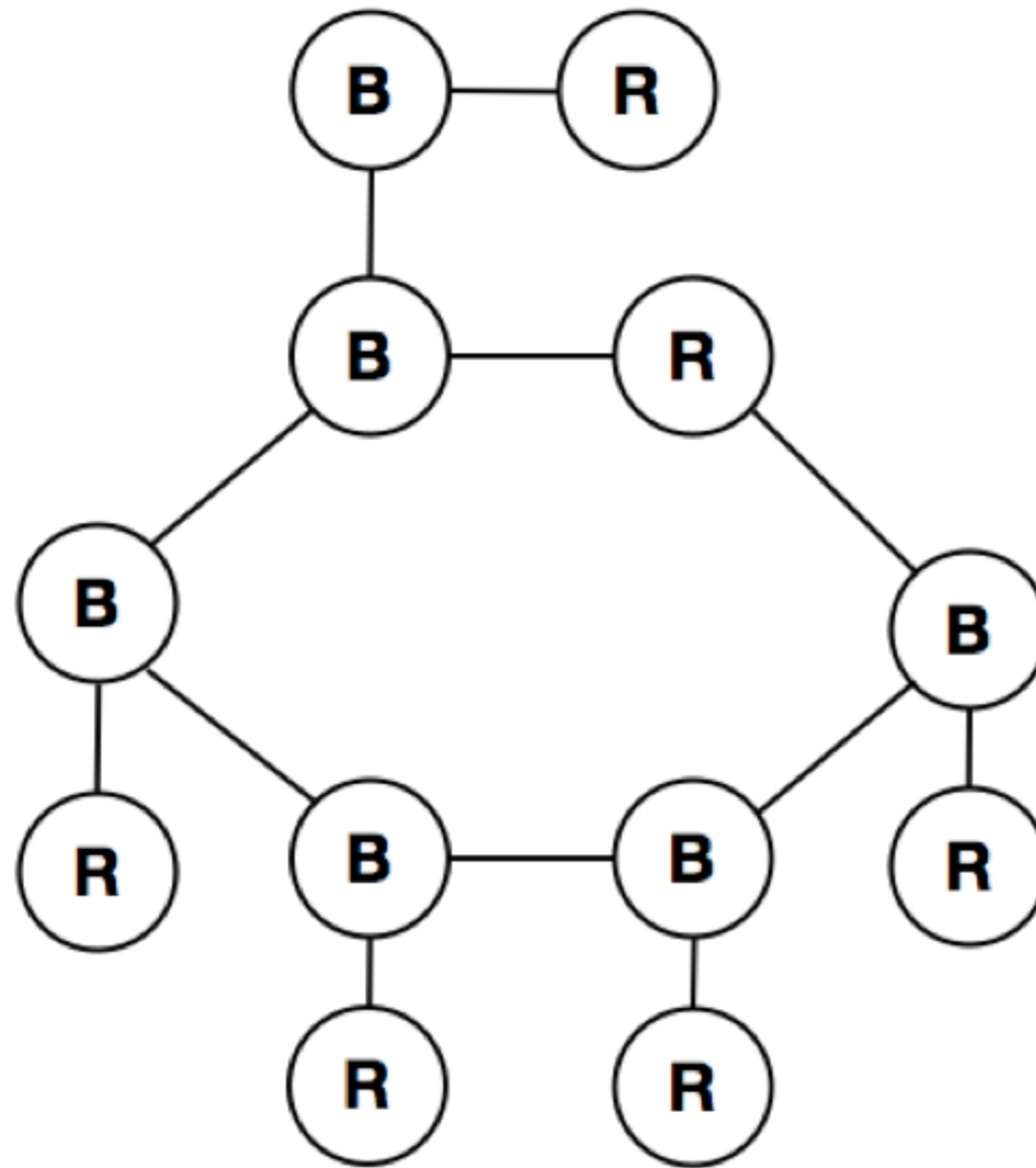
7. Place the 6 oxygen molecules to the side and **DO NOT break them apart for steps 9 - 11.**

These are the oxygen gas molecules that plants release into the air.

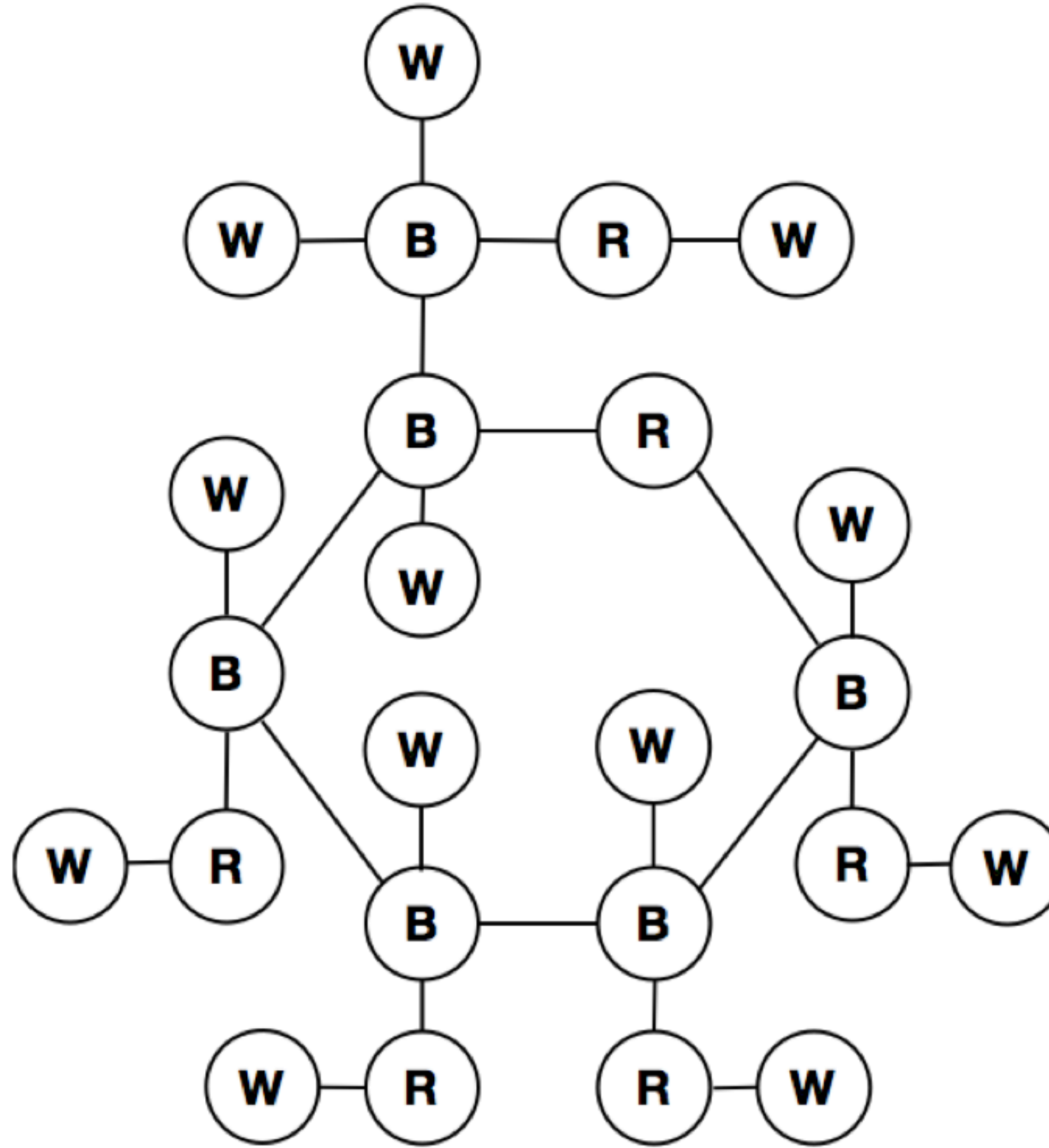
8. You will start to create one glucose molecule in steps 9, 10 and 11. Break apart the carbon dioxide molecules and use all the atoms from the carbon dioxide and the left over atoms from water to do the next steps.
9. Use the diagram below to help build the model. Attach the 6 black carbon atoms and one red oxygen atom to form this ring like structure.



10. Continue adding onto the glucose model from step 9. You will attach the remaining red oxygen atoms that came from the broken apart carbon dioxide. Use the diagram below to help build the model.



11. Continue adding onto the glucose molecule from step 10. You will attach the white hydrogen atoms from the broken water molecules to form the complete glucose molecule. Use the diagram below to build the model.

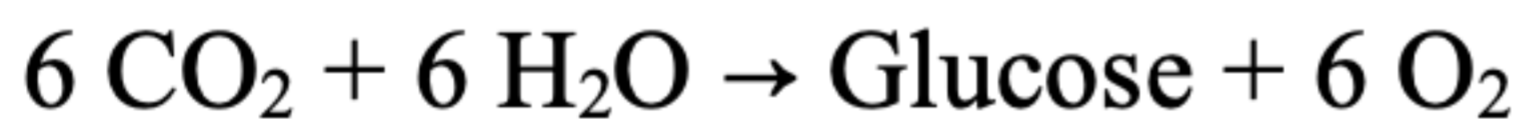


You have now created glucose.



12. **Stop** and show your teacher the 7 molecules.
13. **Break apart all of the molecules**, disconnecting the bonds, and return all of the materials to where you started the activity.

Photosynthesis Equation:



14. What were the two reactants of photosynthesis? _____
15. What were the two products of photosynthesis? _____
16. What is the energy source for photosynthesis? _____
17. Predict what molecule stored that energy? _____

Driving Question:

How are the atoms in carbon dioxide and water related to the glucose molecule and oxygen molecules synthesized in photosynthesis?

Claim Evidence Reasoning:

Write a 3 to 5 sentence paragraph answering the driving question using evidence from the model you just built and explain the science behind what happened.
