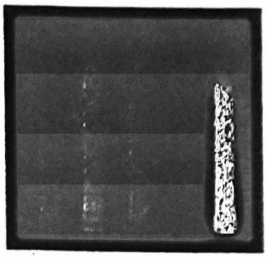
Changes to Matter CER Name:_____

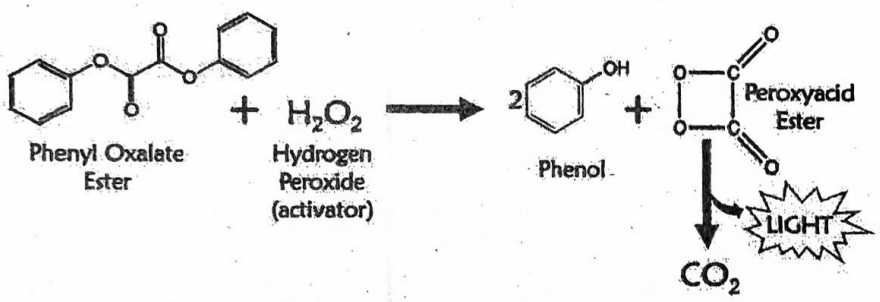
Directions: Read each passage and answer the questions that follow.

Passage One: Glowstick Click



You may have noticed that you have to crack or snap a light stick to make it work. Why would cracking something make it glow? And without batteries, where does the light energy come from?

Before you activate the light stick, different substances are kept in separate chambers within the light stick. Phenyl oxalate ester and a dye (color) fill most of the plastic stick. A second substance, hydrogen peroxide, is in a small fragile container in the middle of the stick. When you bend the stick, the smaller container pops open (which is why you hear a crack) and the materials mix together. As they mix, phenol and peroxyacid ester are created. Peroxyacid is very unstable, so it quickly breaks down into carbon dioxide (CO_2). As this happens, light is released. Because this process releases light, it is considered exergonic, or energy-releasing. After all the materials have finished this process, no more light is emitted and the stick stops glowing.



1. Use the Claims-Evidence-Reasoning grid below to answer the following question:
   Does a glowing light stick represent a chemical or a physical change?

My Claim	My Evidence (Provide 2 Points)	My Reasoning
A glowing light stick represents...	Evidence #1: Evidence #2:	

2. Why would the materials in a glow stick need to be kept in separate containers within the stick?

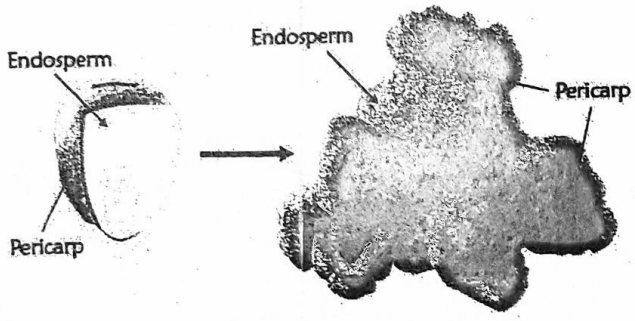
3. What does *exergonic* mean? Is a light stick always exergonic? Explain.

Passage Two: What's Poppin'?

Popcorn dates back thousands of years and is believed to be the first way people ate corn at all, starting about 4000 years ago. In the early 1500s, the Spanish explorer Cortes observed that popcorn, which he described a small white flower, was an important food for the Aztec Indians. They also used popcorn as decoration for ceremonial headdresses, necklaces, and ornaments on statues of their gods. Another Spanish explorer, Cobo, observed Peruvian Indians in 1650, saying "They toast a certain kind of corn until it bursts. They call it *pisancalla."*

In recent times, popcorn is usually thought of as a snack food, but it was once a popular breakfast food. During the late nineteenth and early twentieth centuries, popcorn was eaten like we eat cereal today – including the milk! Also popular was the "popcorn ball" snack, which was a treat that nearly everyone could afford. Popcorn began being served at movies in the 1920s, and microwave popcorn was developed in the early 1980s. Today Americans eat 14 billion quarts of popcorn a year.

A corn kernel is actually the seed of the corn plant. It has a hard outer coating called the pericarp, made of cellulose, and a white inside called the endosperm. There is also a small amount of moisture (water) within the kernel. To "pop" popcorn, heat must be added. This heats the water inside the kernel, changing its state from a liquid to a gas (steam). Pressure from the expanding steam builds up inside the kernel. When the pressure reaches a certain point, the kernel pops turning itself inside out. The endosperm expands and is now on the outside. The pericarp is still there, but less visible.

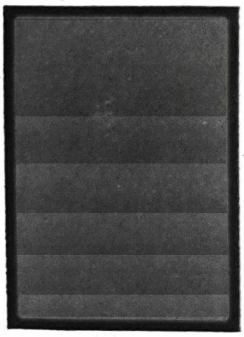


4. Use the Claims-Evidence-Reasoning grid below to answer the following question:
   Does popping popcorn represent a chemical or a physical change?

My Claim	My Evidence (Provide 2 Points)	My Reasoning
Popping popcorn represents...	Evidence #1: Evidence #2:	

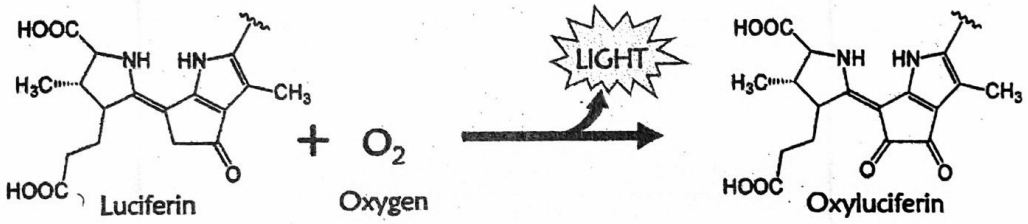
5. Why is heat necessary to "pop" popcorn?

Passage Three: Shining Seas



On a 5-year sailing trip around the world, naturalist Charles Darwin (1809-1892) studied plants and animals from all over the world, many of which had never been documented before. Darwin wrote about one peculiar observation in his diary: "While sailing a little south of the Plata on one very dark night, the sea presented a wonderful and most beautiful spectacle. There was a fresh breeze and every part of the surface which during the day is seen as foam, now glowed with a pale light. The vessel drove before her bows two billows of liquid phosphorus (substance that glows in the dark), and in the trail left by the boat she was followed by a milky train. As far as the eye reached, the crest of every wave was bright [with] pale white flames." What Darwin was describing was a glow-in-the-dark ocean! This phenomenon is caused by one-celled organisms called dinoflagellates that swim near the surface of the ocean water. The light they give off is an example of bioluminescence - light produced by a living organism. Scientists think that these animals use bioluminescence to either distract a predator, attract prey, or maybe even to attract the predators of their predators.

Dinoflagellates make light inside their cells by releasing a substance called luciferin. When luciferin is mixed with oxygen it gives off light. Most of the time dinoflagellates keep the luciferin packaged up, separate from oxygen. However, when the dinoflagellates are disturbed, they release luciferin and the light-producing process begins, resulting in the molecule oxyluciferin being produced.

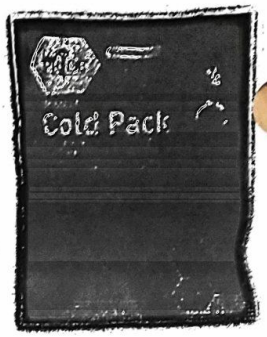


6. Use the Claims-Evidence-Reasoning grid below to answer the following question:
   Does bioluminescence represent a chemical or a physical change?

My Claim	My Evidence (Provide 2 Points)	My Reasoning
Bioluminescence represents...	Evidence #1: Evidence #2:	

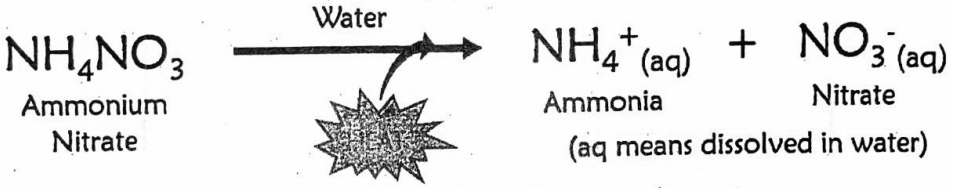
7. Look at the diagram. Carefully examine the luciferin molecule to the left of the arrow and compare it to the oxyluciferin molecule to the right of the arrow. Describe how they are different.

Passage Four: Cold Pack Whack



You're in gym class about to kick a soccer ball when it happens - you turn your ankle and grimace in pain. The gym teacher sends you to the nurse, who pulls a plastic pouch out from a drawer. The pouch is room temperature. You are startled as the nurse gives the pouch a quick whack. She hands it to you, and motions to put it on your ankle. You feel the pouch becoming as cold as ice. As your ankle feels the relief from the cold, you are left wondering how the pouch got cold even though it wasn't in a freezer. You're also wondering when the nurse started smacking medical supplies.

A cold pack contains granules of a solid substance called ammonium nitrate and a small bag of water. The water bag is made of thin, weak plastic. When this bag of water is broken by the whack, the water mixes with the ammonium nitrate. The bonds holding together the ammonium nitrate molecule are broken, and the separate parts (ammonia and nitrate) are dissolved in the water. This process is endothermic – it absorbs heat from the surroundings. Heat from around the cold pack is absorbed into the substances, so the area surrounding the cold pack loses heat energy. This is why it feels cold – your skin is losing heat to it. In fact, after they are activated, the temperature of a cold pack will fall about 35 degrees Fahrenheit for about 15 minutes.



Cold packs are important because when your body gets hurt, inflammation occurs. Part of the inflammation process makes the local area of the injury get warmer. When you put a cold pack on t warmer area, the cold pack absorbs heat from your skin, keeping it from getting too inflamed. This reduces swelling and pain.

8. Use the Claims-Evidence-Reasoning grid below to answer the following question:
   Do instant cold packs represent a chemical or a physical change?

My Claim	My Evidence (Provide 2 Points)	My Reasoning
Instant cold packs represent...	Evidence #1: Evidence #2:	

9. Instant cold packs are labeled as "Single Use Only". Why do you think they cannot be reused?

10. What does endothermic mean? Explain how a cold pack is endothermic.