Biogeochemical Cycles Sketches Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

& Ocean Water Assignment

1. On a separate piece of paper, draw the carbon, water, and nitrogen cycles to satisfy the criteria below:

Atmosphere

1. Title your drawing with the cycle name. EX: “Carbon Cycle”
2. Label reservoirs and draw a box around each reservoir label. 🡪
3. Label arrows showing the mechanisms. (see example)
4. Each sphere should be represented in each sketch.

Photosynthesis

1. To be clear, you should have 3 separate sketches.

1. List 3 properties of ocean water. Evaluate how changing these properties (naturally or artificially) could affect Earth’s spheres.
2. Read the article on the back of this paper and answer the two questions.

**Ocean Acidification – National Geographic**For tens of millions of years, Earth's oceans have maintained a relatively stable acidity level. It's within this steady environment that the rich and varied web of life in today's seas has arisen and flourished. But research shows that this ancient balance is being undone by a recent and rapid drop in surface pH that could have devastating global consequences.

Since the beginning of the industrial revolution in the early 1800s, fossil fuel-powered machines have driven an unprecedented burst of human industry and advancement. The unfortunate consequence, however, has been the emission of billions of tons of carbon dioxide (CO2) and other greenhouse gases into Earth's atmosphere.

Scientists now know that about half of this anthropogenic, or man-made, CO2 has been absorbed over time by the oceans. This has benefited us by slowing the climate change these emissions would have instigated if they had remained in the air. But relatively new research is finding that the introduction of massive amounts of CO2 into the seas is altering water chemistry and affecting the life cycles of many marine organisms, particularly those at the lower end of the food chain.

**Carbonic Acid**   
When carbon dioxide dissolves in this ocean, carbonic acid is formed. This leads to higher acidity, mainly near the surface, which has been proven to inhibit shell growth in marine animals and is suspected as a cause of reproductive disorders in some fish.

On the pH scale, which runs from 0 to 14, solutions with low numbers are considered acidic and those with higher numbers are basic. Seven is neutral. Over the past 300 million years, ocean pH has been slightly basic, averaging about 8.2. Today, it is around 8.1, a drop of 0.1 pH units, representing a 25-percent increase in acidity over the past two centuries.

**Carbon Storehouse**  
The oceans currently absorb about a third of human-created CO2 emissions, roughly 22 million tons a day. Projections based on these numbers show that by the end of this century, continued emissions could reduce ocean pH by another 0.5 units. Shell-forming animals including corals, oysters, shrimp, lobster, many planktonic organisms, and even some fish species could be gravely affected.

Equally worrisome is the fact that as the oceans continue to absorb more CO2, their capacity as a carbon storehouse could diminish. That means more of the carbon dioxide we emit will remain in the atmosphere, further aggravating global climate change.

Scientific awareness of ocean acidification is relatively recent, and researchers are just beginning to study its effects on marine ecosystems. But all signs indicate that unless humans are able to control and eventually eliminate our fossil fuel emissions, ocean organisms will find themselves under increasing pressure to adapt to their habitat's changing chemistry or perish.

1. Describe the change in acidity scientists are concerned about.
2. What affects might this change have?