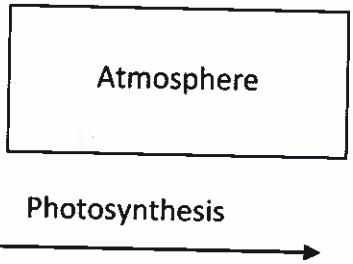
Biogeochemical Cycles Sketches
& Ocean Water Assignment

Name Key 2018

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

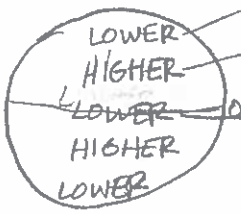


a. Title your drawing with the cycle name. EX: "Carbon Cycle"
b. Label reservoirs and draw a box around each reservoir label. →
c. Label arrows showing the mechanisms. (see example)
d. Each sphere should be represented in each sketch.
e. To be clear, you should have 3 separate sketches.

℗ Describe cycles.
℗ How do humans impact the cycle?

2. List 3 properties of ocean water. Evaluate how changing these properties (naturally or artificially) could affect Earth's spheres.

SALINITY



poles
subtropics
tropics

a. Salinity (saltiness of water) - INC SAL: freezing of sea ice; -high evap
DEC SAL: -melt of sea ice (Natural & art. influ); -river runoff; -high precip
↳ migration patterns affect biosphere
↳ thermohaline circulation affects weather (atmosphere)

b. Temp - ↑CO_2 in atm traps Earth's heat causing sea ice to melt (hydrosphere) & habitat loss (biosphere), sea levels rise (geosphere) flooding/erosion, ↑ evaporation (atmosphere), severe weather (all!), ↑absorption of CO_2 in oceans ↴

↑CO_2 = ↑acidity (today ~ 8.1)

c. Acidity - ↑ absorption of CO_2 in oceans increases acidity by making carbonic acid. ↓pH inhibits growth of shells & causes reproductive disorders in fish (biosphere). Could also decrease the ocean's ability to store carbon, leaving more in atm. (atmosphere)

3. 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.

increasing acidity (↓ pH): ↑ burning of f.f. = ↑ CO_2 in atm = ↑ CO_2 absorbed by oceans = CO_2 → carbonic acid

2. What affects might this change have?

↓pH (↑acidity) inhibits growth of shells & causes reproductive disorders in fish.... Could also decrease the ocean capacity to store carbon leaving more in atm.