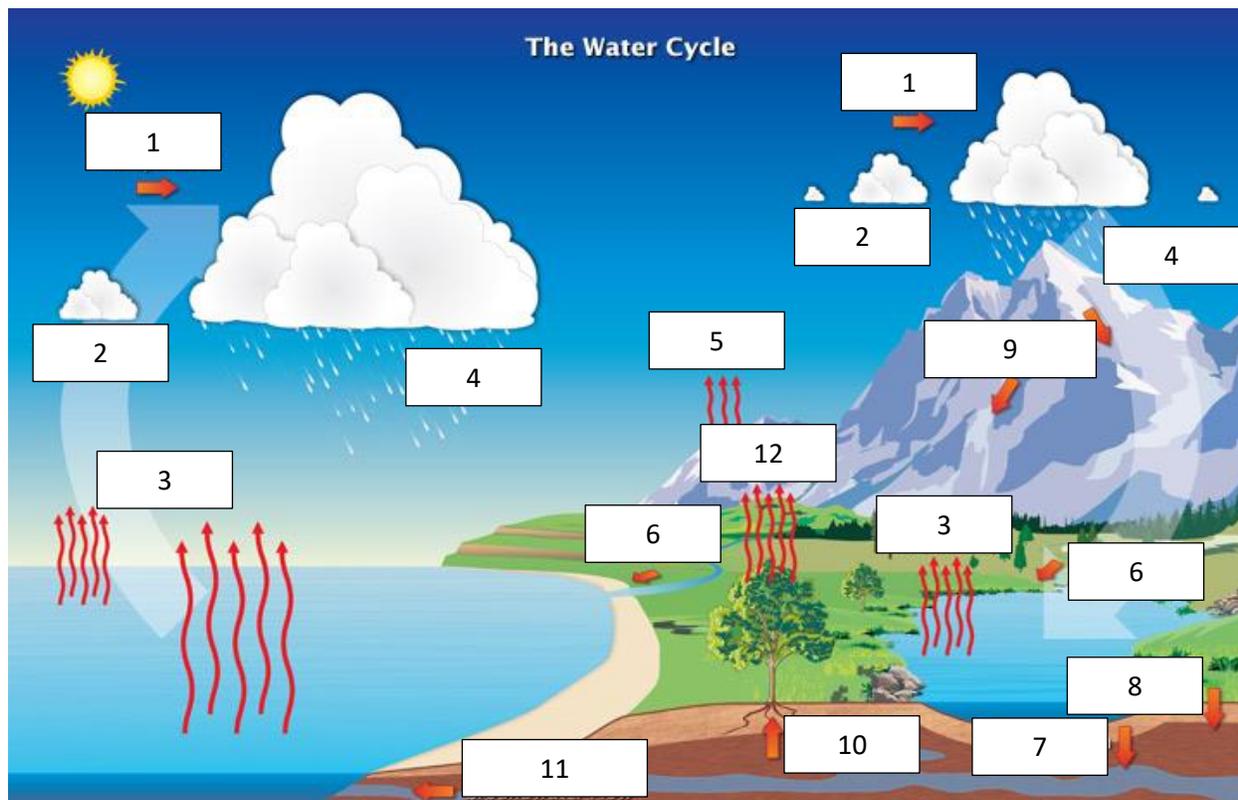


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SECTION I: MARINE AND ESTUARY ECOLOGY (34 pts total)

1. Label the elements of the water cycle (12 pts, 1 pt per number)



- 1: Transportation
- 2: Condensation
- 3: Evaporation
- 4: Precipitation
- 5: Sublimation
- 6: Surface Runoff
- 7: Percolation
- 8: Infiltration
- 9: Snow Melt Runoff
- 10: Plant Uptake
- 11: Groundwater flow
- 12: Transpiration

1 pt per correct answer

2. Describe and explain the purpose of coagulation and flocculation (4 pts):

Coagulation and flocculation is the process of clumping together sediments and other suspended solids from the water to remove them with greater ease. The particles first coagulate, colliding with the coagulant, and then are flocculated, where the particle size grows, and then it proceeded to sedimentation, where the flocs settle to the ground and are removed.

1 pt for coagulation = collisions with coagulant, 1 pt for flocculation = growing particles, 2 pts for removing suspended solids from the water

3. Define nutrient cycling and why it is important to productivity of an ecosystem and understanding how the ecosystem functions (6 points):

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Nutrient cycling is the passing of nutrients among different components of an ecosystem and how they are cycled and reutilized by some of these components. Keeping track of it is important to understanding how an ecosystem responds to alteration of the biotic or physical parameters, and understanding from where nutrients come from and how much must be replenished. To maintain a high level of productivity in a community, there must be a high amount of nutrient conservation and cycling to sustain the flow of energy.

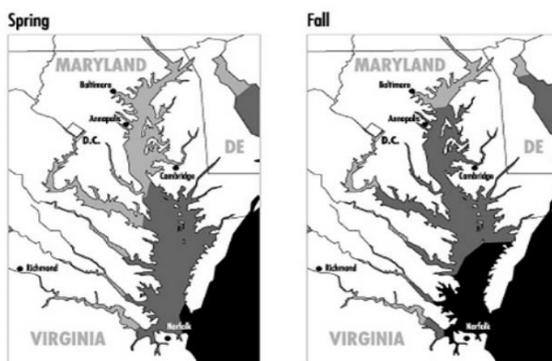
2 pts for definition, 2 pts for reason why it's important, 2 pts for how it relates to productivity

4. Problems sedimentation pollution causes include (3 pts):

- I. Lack of sunlight
- II. Lowered fish resistance to disease
- III. Stripping nutrients from the river
- a. I
- b. I & III
- c. II & III
- d. II
- e. I & II

Salinity: Spring and Fall

KEY: Salt in parts per thousand 0-10 10-20 20-30



5.

The diagram above depicts the change in salinity of different portions of the Chesapeake. Explain why this occurs and what affect it has on 1 (one) organism (4 pts):

In the spring, higher river flows overtake the ocean's influence and the salinity is down for half the Bay, but in the fall, river flow diminishes and the ocean overtakes the rivers.

Organisms:

Striped bass lay eggs in fresh or brackish water and travel up the rivers to spawn and then move downriver as they mature, so they mate in the spring where there is more freshwater.

Blue crabs mate in the months preceding fall, and the females migrate to the lower Bay for the saliter waters, and when the larvae develop, they are released into the more salty mouth of the Bay.

Oysters adopt the salinity of whatever water they filter, so they change in salinity as the seasons change.

2 pts for salinity change/seasons, 2 pts for choosing an organism and explaining the affect

6. **Why is global warming considered a factor in coral death? What is the second greatest threat to coral and what effects does it have(3 pts)?**

Global warming changes the temperatures of the seawater from the ideal temperatures corals prefer and have caused corals to begin dying from stress as seen in the last three bleaching events. The second greatest threat is human pollutants of phosphorus and nitrogen, which cause algae blooms and the failure of coral to absorb enough phosphorus.

1 pt for water temp, 1 pt for naming of threat, 1 pt for naming of at least one effect

7. **When was the last mass bleaching event and what percent of coral died (2 pts)?**

The last mass bleaching event was in 1997-1998 and is currently in the middle of one. 16% of the world's coral died.

1 pt for years, 1 pt for percent

SECTION II: CORAL REEF MACROFLORA AND FAUNA ID (4 points per ID), 34 pts total

1 pt per ID and food, 2 pts for other question



- 1.
- ID:** Parrotfish
 - Food:** Epilithic Algae
 - Importance to the reef:** Has a hard beak, meaning that it can scrape algae off of coral and prevent it from overgrowing the reef



- 2.
- ID:** Triton
 - Food:** Other mollusks and starfish
 - Importance to the reef:** Kills Crown-of-thorns starfish, which consumes a large amount of coral (up to 5 m² annually)

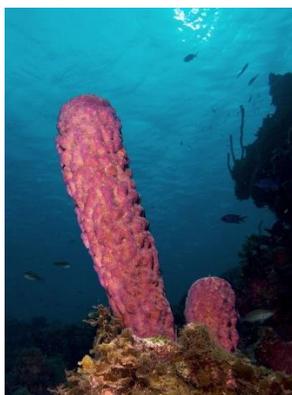
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- 3.
- ID:** Humphead wrasse
 - Food:** Primarily invertebrates and fish
 - Reproduction:** At certain times of the year, wrasses gather together in large mating groups of both genders and pairs form. Males fertilize the eggs that females release into the water.



- 4.
- ID:** Nassau Grouper
 - Significance of reef in reproduction method:** They breed at specific spawning areas in up to tens of thousands in less than 100 sites and females release eggs and males release sperm into the water column above deep reefs at the same time.
 - Location found:** Atlantic



- 5.
- ID:** Sponge
 - Formation and growth:** Fertilized ova develop into larvae and swim off to find an empty cell to house them, often times in a broken fragment. However, when conditions become hard, sometimes survival pods that remain dormant until better conditions occur are dropped and form new sponges.
 - Where do carnivorous sponges tend to exist?** Extremely deep locations where there is a lack of light and plankton
6. **Why are giant clams often used as a measure of water quality in the ocean (3 pts)?**

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Giant clams are extremely sensitive to acidity and temperature of water. Their presence means the pH and temperature of the water is at a good level for the ecosystem, as they die when levels are less than perfect.

1 pt for acidity, 1 pt for temp, 1 pt for how it tells water quality

7. Why is the diet of the parrotfish different than other herbivorous fish in the reef and why is it important (3 pts)?

Parrotfish have a harder beak, and as such can eat harder, calciferous algae which many other species avoid. It is important because the presence of not only Tang and Surgefish but also Parrotfish means that the algae levels of the reef are kept at healthy levels.

1 pt for hard beak + algae, 2 pts for algae levels on reef

8. How can sea urchins be used as indicators of reef health? How does their population affect the reef in larger or smaller numbers (4 pts)?

Sea urchins can be both beneficial and detrimental to a reef depending on their numbers, so a reasonable number would indicate a healthy reef. Too many, and they eliminate all algae and fish and mollusks have no food, destroying a reef. Too few, and there is uncontrolled algae growth and lack of space for slow growing corals to compete for reef space.

2 pts for explanation fo too many, 2 pts for explanation of too few

9. What would an abundance of fleshy macroalgae indicate about the reef (list 2) (4 points)?

An abundance of fleshy macroalgae could indicate decreased grazing pressure from fish, mollusks, urchins, etc. or an increase of nutrient availability (ex. runoff)

2 pts for herbivory intensity, 2 pts for nutrient availability

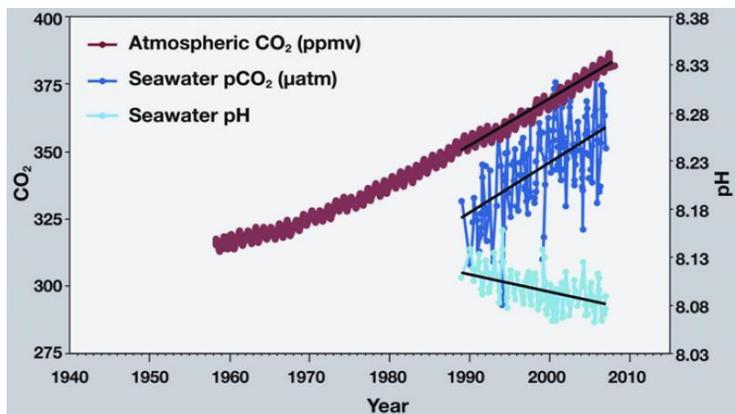
SECTION III: WATER MONITORING AND ANALYSIS (32 pts)

1. Why is aragonite used as an indicator of ocean acidification (4 pts)?

Aragonite is used as an indicator of ocean acidification because aragonite is a crystalline form of calcium carbonate that is more readily soluble than calcite and used in building the shells of many crustations. As such, by testing saturation at the surface of the ocean can be used to quantify calcium carbonite in the water. The lower these values go, the less free carbon there is floating around and the more carbonic acid there is, as the carbon goes towards more acid as opposed to forming compounds organisms use to build shells.

1 pt for of calcium carbonate, 2 pts relating lower values to more ocean acidification, 1 pt organism usage in shell building

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2.

What does this graph show about the effect of carbon emissions on the ocean? What affect does this have on shelled organisms and coral development (6 pts)?

This graph shows that in the last ten years, concentrations of CO₂ in both oceans and the atmosphere have increased by about .15 ppmv/µatm, and pH has dropped ~0.05. This implies a corroboration between ocean acidification and the higher amounts of CO₂ in the water/atmosphere. This would prevent crustations from forming strong shells and erode away at corals.

2 pts relationship shown in graph, 2 pts correlation, 2 pts effect on organisms

3. Water is tested at a location and the salinity is measured to be 20 ppt. What type of water was this sample taken from, and what is an example of a body of water of this type (2 pts)?

The sample was taken from brackish water. An example of a body of water of this type would include any estuary, including the Chesapeake or any other one.

1 pt for brackish, 1 pt for estuary

4. Match the data type to the testing method (6 pts):

1. Dissolved Oxygen C	A. Spectrophotometry
2. pH E	B. CTD Instrument
3. Nitrates A	C. (RDO) Luminescence Quenching
4. Salinity B	D. Membrane Filter Method
5. Phosphates F	E. Potentiometry
6. Fecal Coliform D	F. Ascorbic Acid Method

5. Which two units do we use to measure turbidity (2 pts)?

Nephelometric turbidity units (NTU) and Jackson turbidity units (JTU)

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1 pt per each

6. What is the measurement of total solids composed of, and what is an example of each (4 pts)?

Total solids are composed of both total dissolved solids and total suspended solids in a liquid.

Examples of dissolved solids: calcium, chlorides, nitrate, phosphorus, iron, sulfur (particles that will pass through a filter with pores of around 2 microns (0.002 cm) in size)

Examples of suspended solids: silt and clay particles, plankton, algae, fine organic debris, and other particulate matter (won't pass through the filter)

2 pts for listing both types of solids, 2 points for one correct example of each

7. If there is an abnormally high concentration of nitrates, which of the following could occur (pick 2) (2 pts):

- a. Fish death
- b. Algal bloom
- c. Purple water
- d. Increased biodiversity

8. If the shells of crustations are extremely thin and underdeveloped in a region, what problem might the water have (2 pts)?

High acidity caused by large amounts of carbon dioxide forming carbonic acid

1 pt for high acidity, 1 pt for carbonic acid/carbon dioxide

9. What would an excess amount of phosphates in water cause (list 2) (4 pts)?

Cloudy water, low oxygen, massive growth of algae, death of other organisms from lack of DO (dissolved oxygen), eutrophication

2 pts per each answer, give points if any two correct answers are chosen