Lesson Title: Water Quality lesson, day 1

Objectives/ SWBAT:
List contaminants of concern to water quality. State how these contaminants may have entered the aquatic system. Explain how organisms associated with the contaminated water source will be affected. Understand global water circulation patterns and the nitrogen cycle.

Lesson duration: 50 mins

Aim: What parameters are important to water quality?

Do Now:
List as many contaminants found in water as you can think of.

Materials:
Powerpoint presentation

Procedure:
The powerpoint will address the following topics:

1. The water cycle (terrestrial evaporation, eventual precipitation), global quantities of water

2. The nitrogen cycle

3. The parameters covered are:
    -acidity
    -alkalinity
    -carbon dioxide
    -density
    -dissolved oxygen
    -ammonia
    - nitrite
    - nitrate
    - pH
    - phosphate
    - salinity
    - dissolved solids
    -temperature
    - turbidity

For each parameter, background information will be provided for full understanding of what the parameter is measuring, and potential sources of the contaminant.

On day 2 of this lesson, students will be divided into groups, and practice utilizing water quality test kits in order to quantify contaminant levels in a water source.

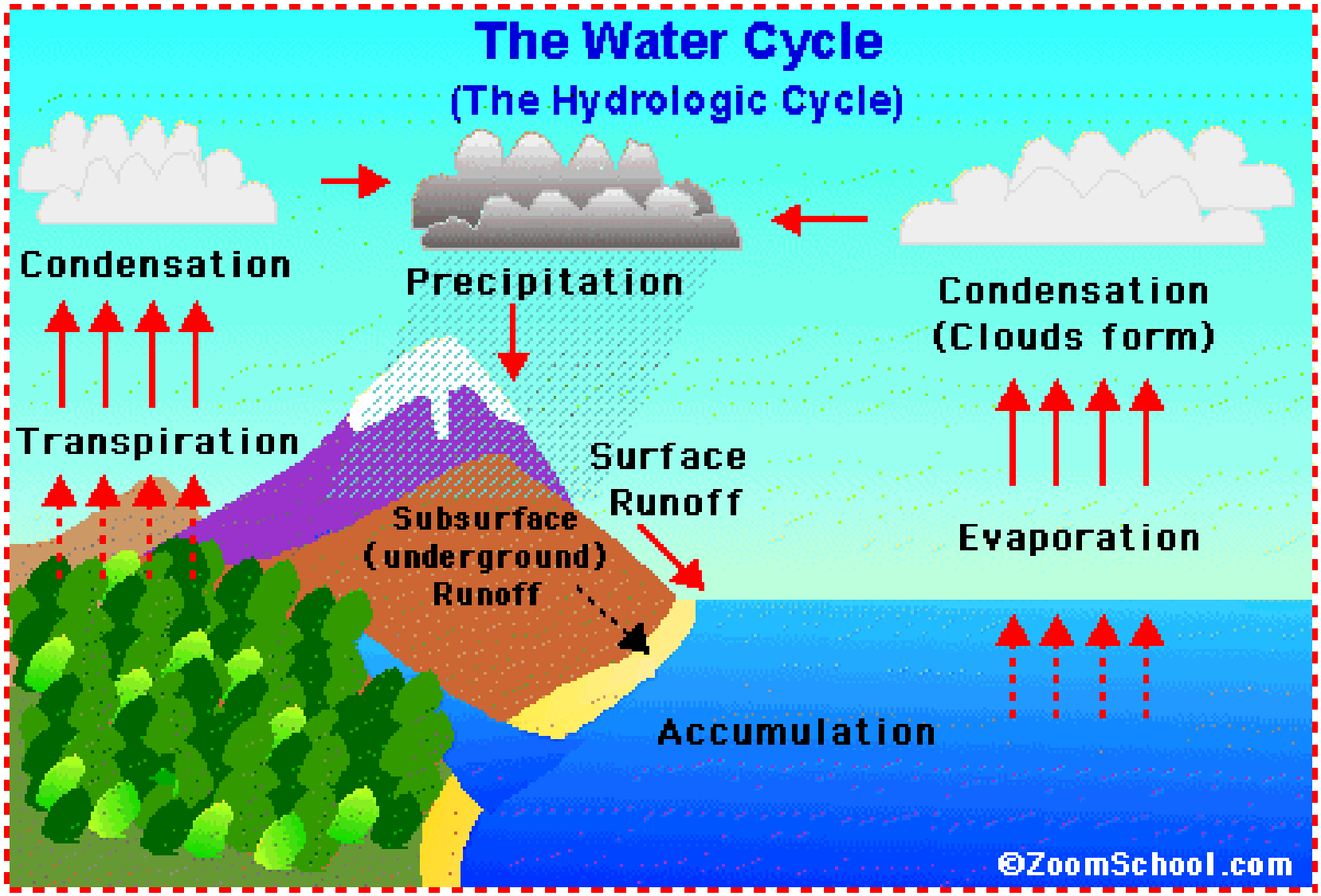
Homework:

No homework is due.

Water Quality

October 25, 2011

How much of our planet is water?


The Water Cycle
(The Hydrologic Cycle)
Condensation
Precipitation
Condensation
(Clouds form)
Transpiration
Surface
Runoff
Subsurface
(underground)
Runoff
Evaporation
Accumulation
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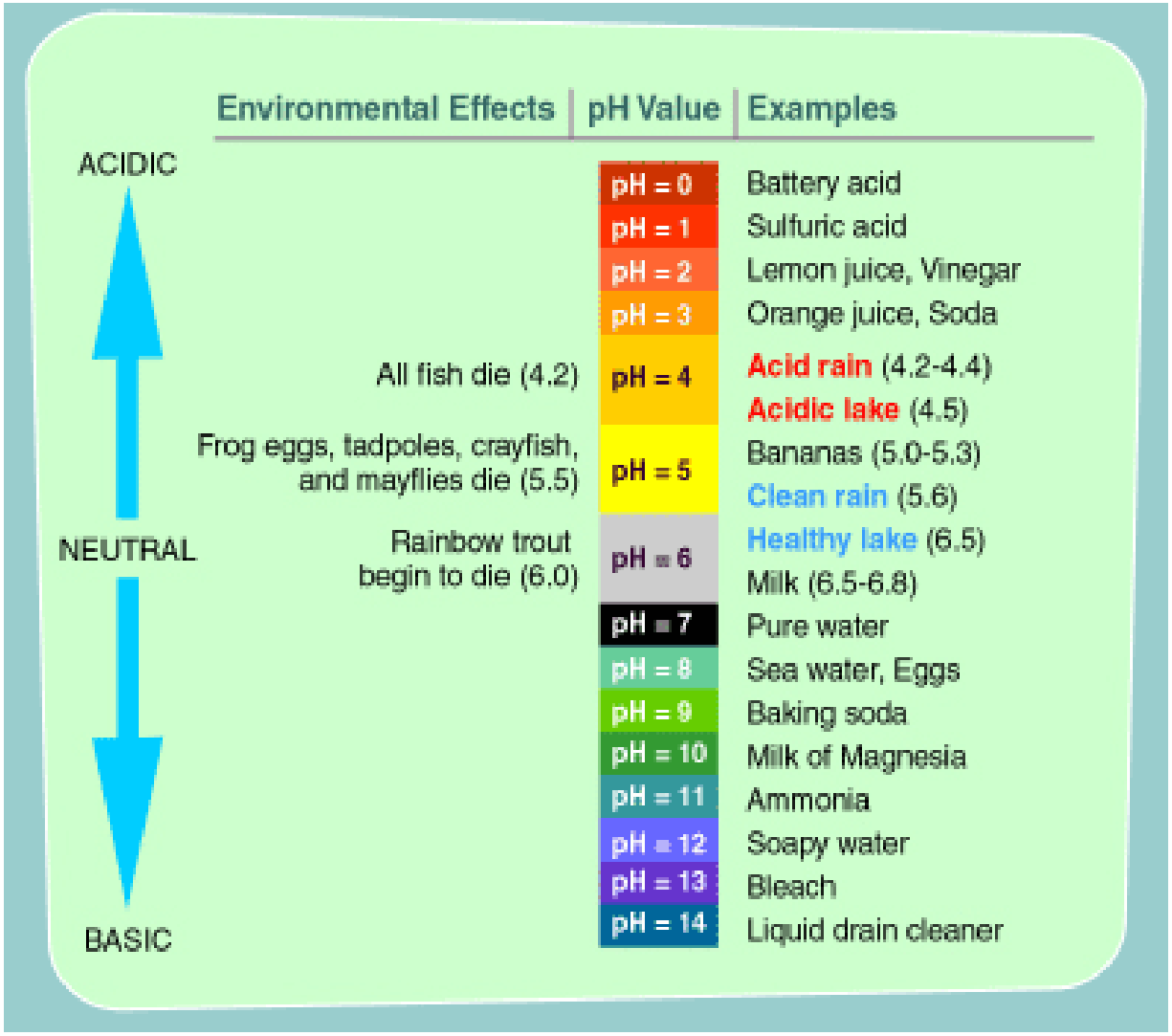
Parameters Affecting Water Quality

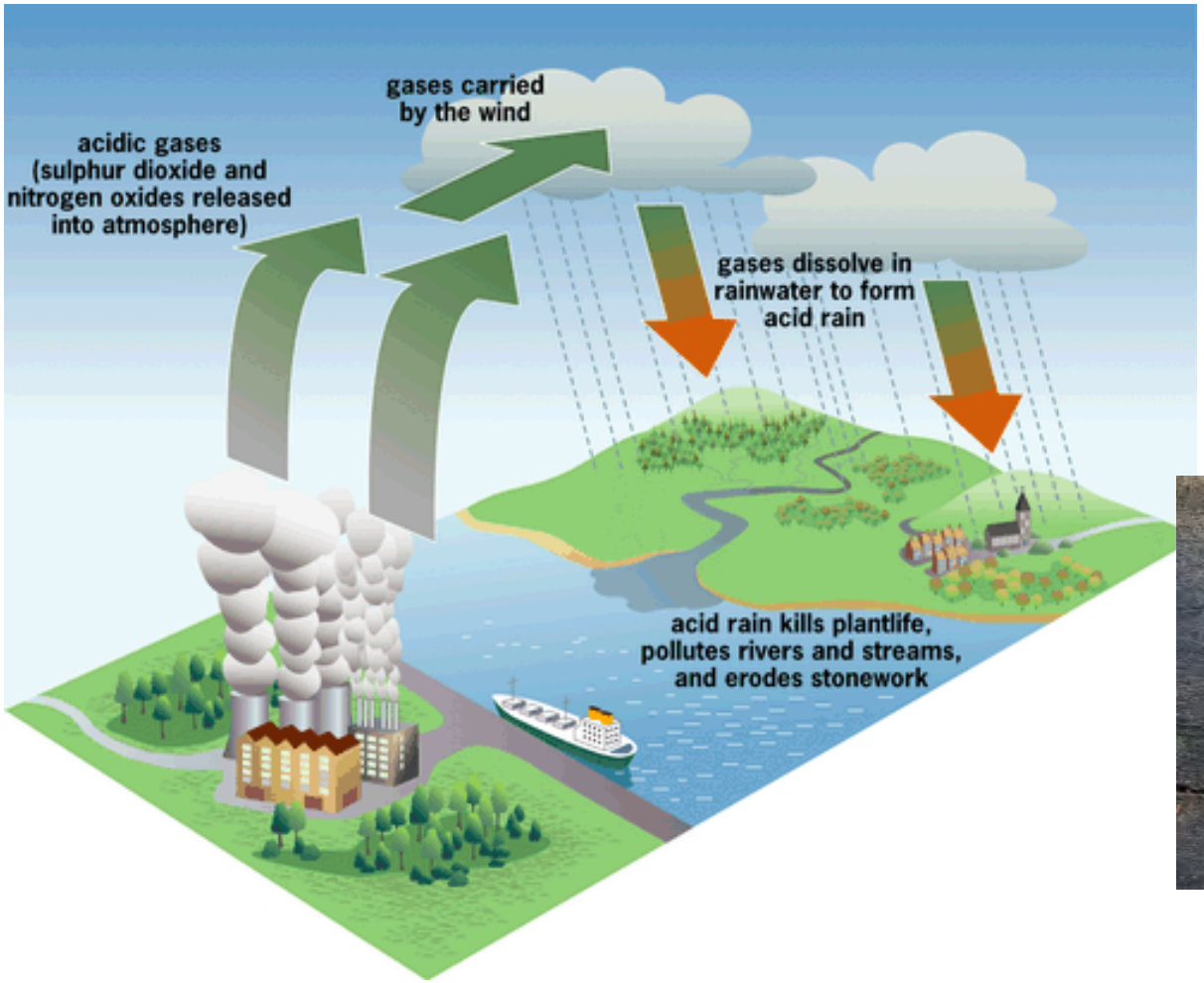
- Acidity
- Alkalinity
- Carbon dioxide
- Density
- Dissolved Oxygen
- Ammonia
- Nitrite
- Nitrate
- pH
- Phosphate
- Salinity
- Total dissolved solids
- Temperature
- Turbidity

1. Acidity



- Acids have a pH less than 7
- Acidity is the amount of base that needs to be added to neutralize the pH

Acid Rain


gases carried
by the wind
acidic gases
(sulphur dioxide and
nitrogen oxides released
into atmosphere)
gases dissolve in
rainwater to form
acid rain
acid rain kills plantlife,
pollutes rivers and streams,
and erodes stonework

2. Alkalinity

- Alkalinity is the ability to buffer against a pH change

3. Carbon Dioxide

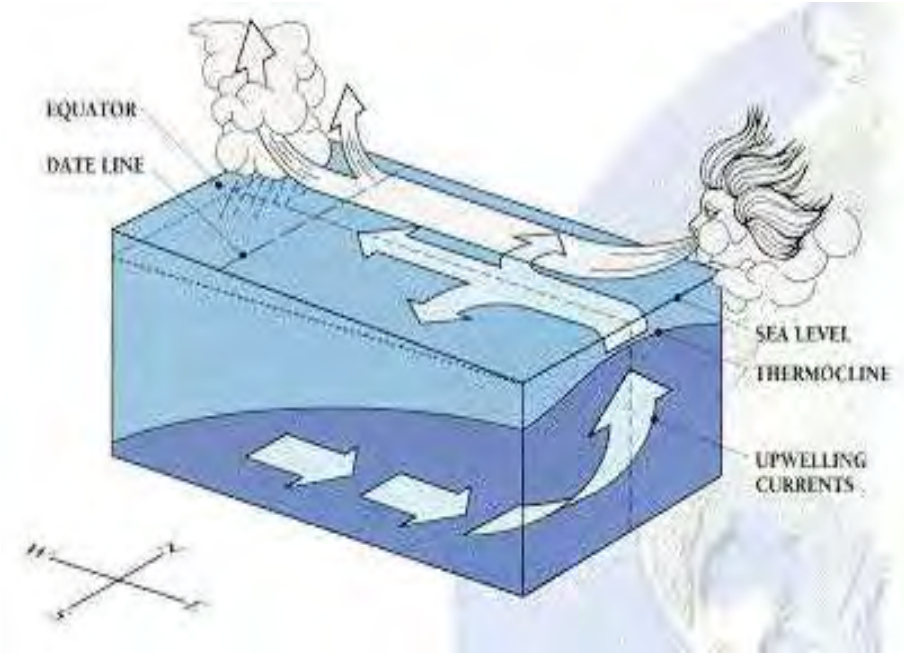
- Necessary for photosynthesis
- Excess lowers the pH of water

4. Density

- Density = mass/volume

Thermocline: Transition between surface and deep water, based on temperature.

Halocline: Transition layer between surface and deep water, based on salinity.

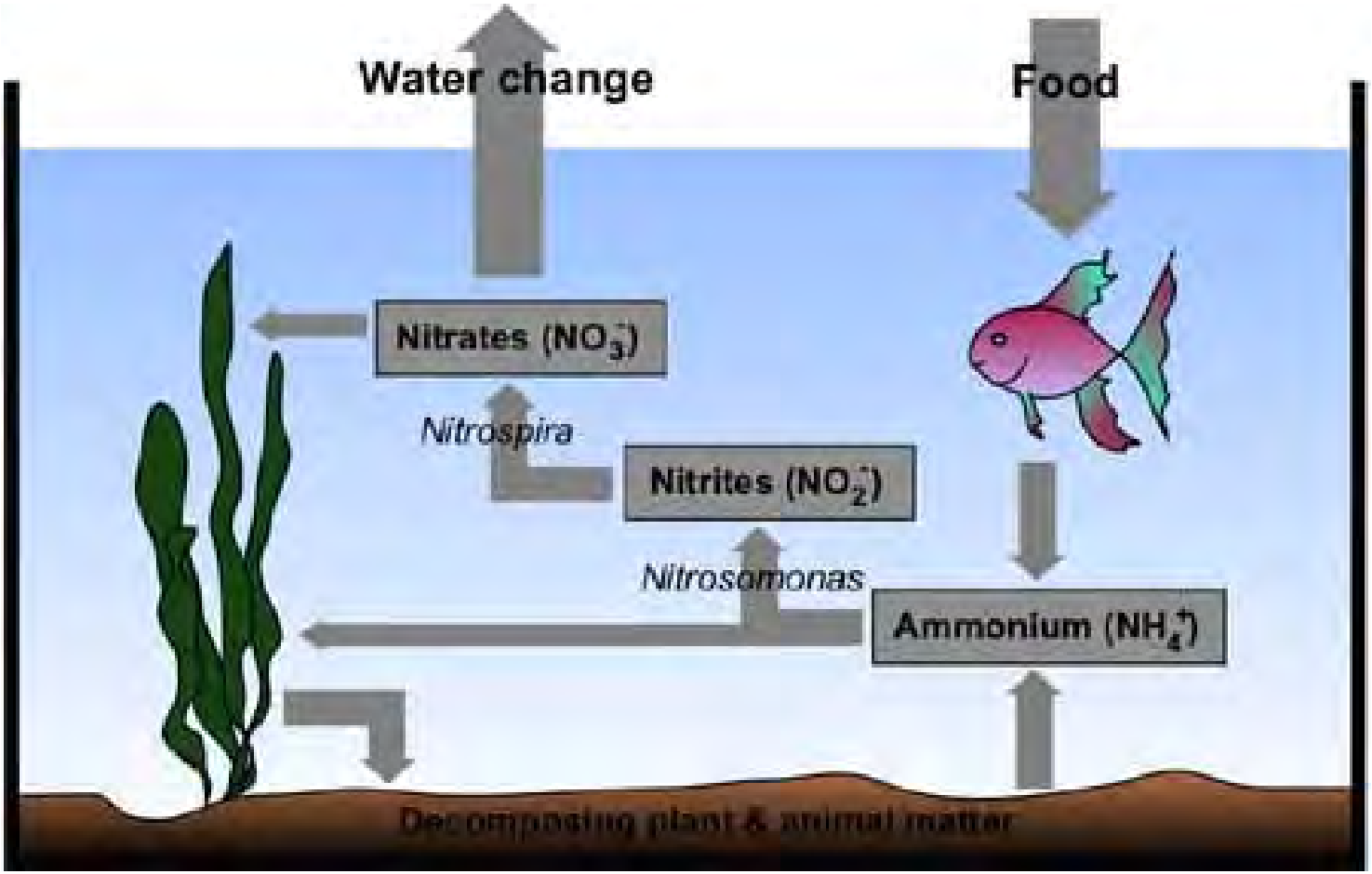


Upwelling: transport of deep water to the surface.

5. Dissolved Oxygen

- Dissolved oxygen is the amount of oxygen in water.

Nitrogen Cycle

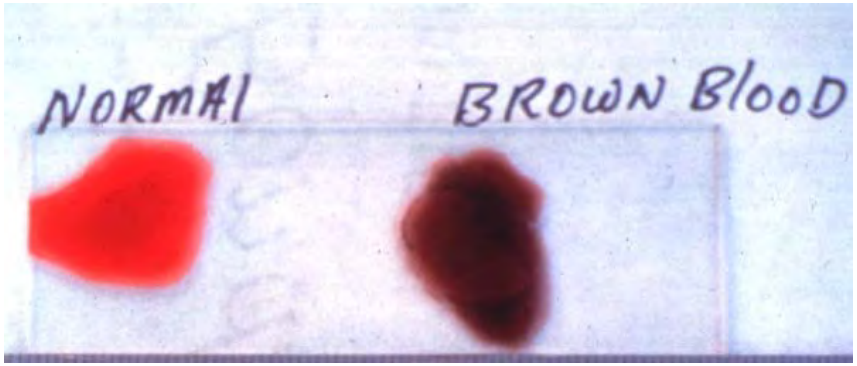


6. Ammonia

- Is converted to nitrite
- Too high a dose is toxic

7. Nitrite

- Intermediate stage between ammonia and nitrate
- Can cause “brown blood disease” in fish.



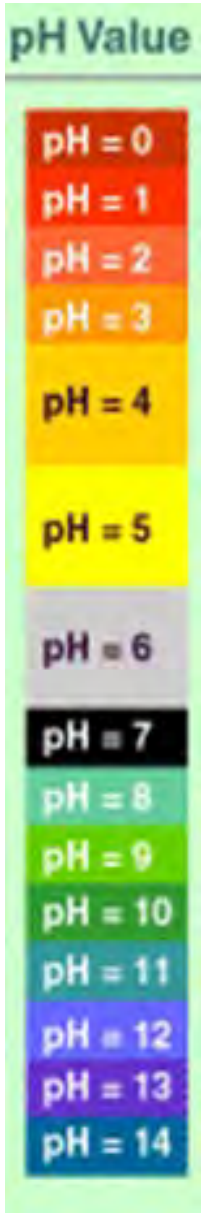
8. Nitrate

- Necessary for photosynthesis
- Excess amounts are toxic

Eutrophication: Excess nutrients cause excessive plant growth

9. pH

- pHis how acidic or basic something is.



10. Phosphate

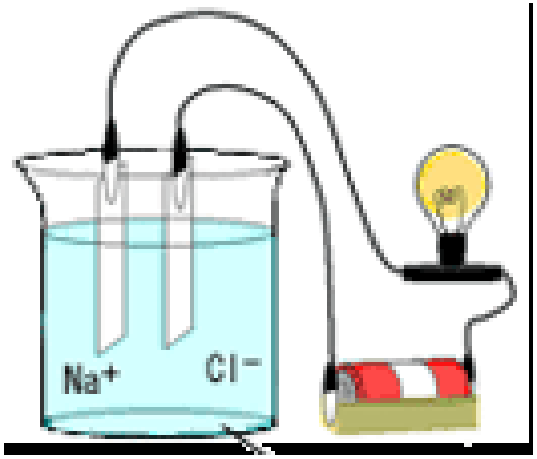
- Stimulates marine plant growth
- Can cause eutrophication

11. Salinity

- Salinity is the mount of salt in water
- The salinity affects the density and pH

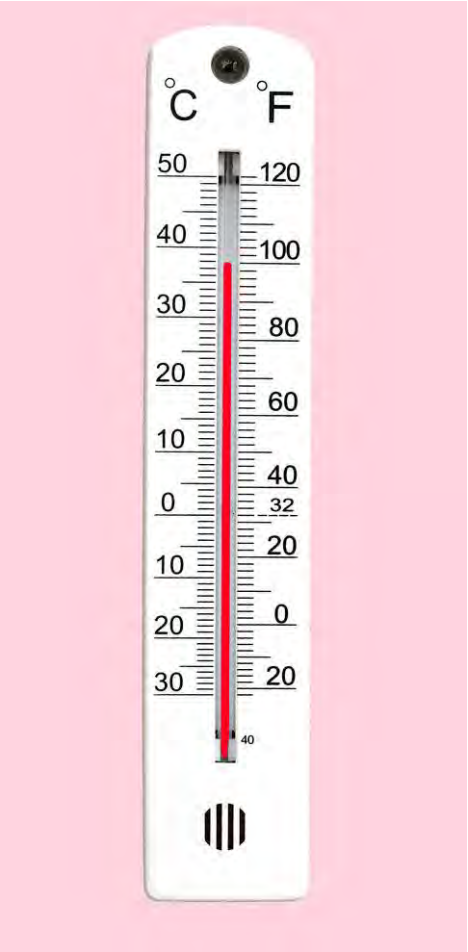
12. Total Dissolved Solids/Conductivity

- Conductivity is the capacity of a substance to carry an electrical current
- Indicative of the presence of pollutants



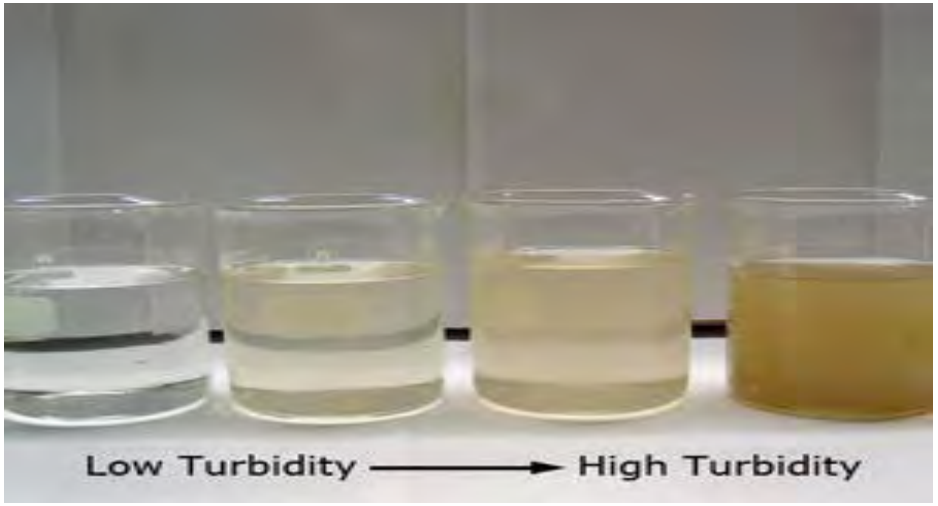
13. Temperature

- Temperature is a determination of heat transfer.
- The temperature determines the types of organisms that can inhabit a location.
- Forms thermocline.



Turbidity

- Turbidity is a measure of the clearness of the water.
- Clear water is important for photosynthesis.
- Cloudy water usually indicates a problem (algal bloom, industrial spill).



Review of Parameters

- Acidity
- Alkalinity
- Carbon dioxide
- Density
- Dissolved Oxygen
- Ammonia
- Nitrite
- Nitrate
- pH
- Phosphate
- Salinity
- Total dissolved solids
- Temperature
- Turbidity

Lesson Title: Water Quality (practical)

Objectives: SWBATS…

Students will know common water quality parameters and how to test water samples for each parameter. Students will be able to perform common laboratory techniques such as titrations.

Lesson duration: 50 mins

Aim: To learn how to conduct water quality tests

Do Now: List as many of the water quality parameters discussed on the previous day.

Materials:

- Hanna or LaMotte water quality testing kits
- Stopwatches
- Gloves
- Saline water
- Chart listing normal range for the various contaminants

Procedure:

- List the tests that the class will be using
- Review vocabulary and techniques from previous day
  - Reagent, titration, meniscus, refractometer, secchi disc, color cube, hydrometer
- Divide into groups
  - Group A: Methyl acidity, nitrate, pH (shake)
  - Group B: Alkalinity, nitrite, salinity (refractometer)
  - Group C: CO2, salinity (hydrometer), Ammonia, TDS
  - Group D: DO, PO4, temperature, secchi disc
- Run trials
- Go over data
- Review Questions:
  - What is the meniscus?
  - What are you doing when you are performing a titration?
  - What are two methods to check the salinity level?

Homework:

None

Lesson Title: Plankton Identification

Objectives/ SWBAT:
Define phytoplankton and zooplankton. Refresh knowledge of microscope usage. Classify various types of plankton using a microscope. Understand what the water chemistry results indicate about the health of the Marine Park Estuary system.

Lesson duration: 50 mins

Aim: What types of plankton can be found in the Marine Park Estuary?

Do Now:
Define 'plankton'.

Materials:
Microscopes, water sample collected at Marine Nature Center day prior, plankton identification cards, sketch pads, previous days' water chemistry data

Procedure:
1. Go over 'do now' by defining plankton, with focus on difference between phytoplankton and zooplankton.

2. Review aquatic food chain: bacteria, phytoplankton, zooplankton, fish. Note which of the water chemistry parameters tested during the lesson prior can have an impact on this cycle.

3. Review basic microscope usage

4. Indicate the difference between diatoms and dinoflagellates. Use the ID cards to indicate species commonly found in this area.

5. Use microscope to identify and quantify various species of plankton in the water sample from Marine Park Estuary.

6. Groups share their water chemistry (from day prior) up on the board. Followed by a discussion of what the parameters indicate about the site, how the test results may differ from what was expected, and possible explanations of why they differed.

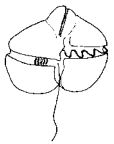
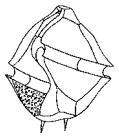
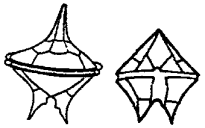
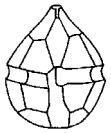
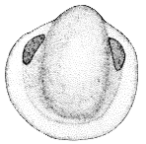
Homework:

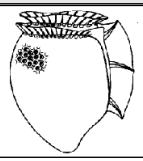
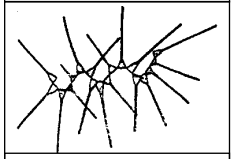
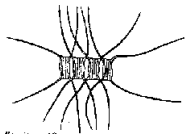
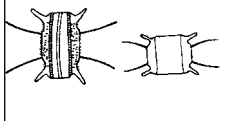
Students will write a report profiling the health of the aquatic system based on plankton counts and water chemistry data.

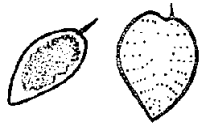
COMMON PHYTOPLANKTON KEY

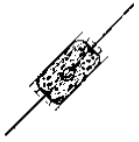
Target Species

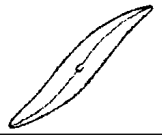
OTHER COMMON PLANKTON (non-phyto)

Alexandrium spp. **AL**	*Gymnodinium spp.* **GY**	*Gonyaulax spinifera* **GS**	*Protoperidinium spp.* **PT**	*Scripsiella spp.* **SC**	*Cocinodiscus spp.* **CO**	*Odontella spp.* **OD**	*Larval Clam* **LC**
							
25-46 µm	**24-50 µm**	**25-50 µm**	**50-95 µm**	**20-37 µm**	**40-500 µm**	**45-70 µm**	**Generally Large**

Dinophysis norvegica **DN**	*Dinophysis acuminata* **DA**	*Dinophysis tripos* **DT**	*Asterionellopsis spp.* **AS**	*Chaetoceros spp.* **CH**	*Chaetoceros socialis* **CS**	*Biddulphia spp.* **BD**	*Rotifer spp.* **RO**
							
48-80 µm	**40 - 50 µm**	**40 - 120 µm**	**30-150 µm**	**10 - 53 µm**	**3-15 µm**	**60 - 160 µm**	**Generally Large**

Prorocentrum lima **PL**	*Prorocentrum micans* **PM**	*Ceratium fusus* **CF**	*Ceratium lineatum* **CL**	*Ceratium longipes* **CP**	*Dictyocha spp.* **DO**	*Fragilaria spp.* **FR**	*Pollen Grain* **PG**
							
31-47 µm	**35-70 µm**	**200-540 µm**	**100-130 µm**	**150-250 µm**	**10-45 µm**	**10 - 70 µm**	**Generally Large**

Pseudonitzschia **PS**	*Thalassionema spp.* **TA**	*Thalassiosira spp.* **TL**	*Nitzschia spp.* **NZ**	*Skeletonema spp.* **SK**	*Ditylum spp.* **DM**	*Leptocylindrus spp.* **LP**	*Crab Zoea* **CZ**
							
64-117 µm	**16 - 90 µm**	**12-39 µm**	**60 - 125 µm**	**2-21 µm**	**80 - 130 µm**	**30 - 75 µm**	**Generally Large**

Species Name **CODE**	*Rhizosolenia spp.* **RH**	*Gyrosigma spp.* **GY**	*Navicula spp.* **NV**	*Melosira spp.* **ML**	*Guinardia spp.* **GN**	*Eucampia spp.* **EU**	*Tintinnid spp.* **TN**
(Guide to using key) *illustration of organism*							
Size Range (in µm)	**25-57 µm**	**110 - 175 µm**	**32-49 µm**	**10-50 µm**	**60 - 160 µm**	**10-33 µm**	**Generally Large**

REFERENCES USED

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http://www.marbot.gu.s/SSS/SSSHome.htm