Student Journal: Measuring water quality to study human impact

Date:
Team/Name:
Period:

Part 1: Prior knowledge

Complete questions 1-3 individually then discuss with your team and share responses with the class.

1. What is meant by the terms conductor and insulator as they relate to electricity?

2. Can water conduct electricity? Explain your reasoning.

3. What are some causes of water pollution?

Part 2: Analog data

Welcome young scientists and engineers! You are about to participate in an important ecological investigation. Fish populations in a local watershed have been declining. You have been hired to study the watershed and determine the source site of the pollution. Before you begin, you will need some background knowledge on the science behind a data collection instrument you will be building and using.

Electrical conductivity of dry materials

Use the materials provided by your teacher to build the analog EC sensor for testing the conductivity of dry materials.
List the name of the item you are testing in the left column and place a check in the appropriate category based on your data.

Item	Conductor	Insulator	Description of Brightness (Draw a light bulb and color in brightness observed for each condition.)
Soda Can			
Paper Clip			
Leather			
Plastic Cup			
Pile of Dry Salt			
Pin Wire			

4. Look back at the materials that were able to conduct electricity. What do you think enables these materials to conduct electricity while the other materials could not?

Electrical conductivity of liquids

Use the materials provided by your teacher to build the analog EC sensor for testing the conductivity of liquids.
Record qualitative data related to the brightness of the bulb.

Stir stick scoops of baking soda added to solution	Description of Brightness (Draw a light bulb and color in brightness observed for each condition.)
0	
1	

2	
3	
4	
5	

5. Can water conduct electricity? If so, provide evidence.

6. What is the relationship between the amount of baking soda added to the solution and the conductivity of the solution? Provide evidence.

7. Watch the video: Dissociation of Salt. Describe the interaction between salt and water when salt is placed in water. How does this influence the conductivity of water?

Part 3: Digital data

Congratulations! Your successful testing of electrical conductivity has impressed your supervisor. You will receive additional funding to build a digital EC sensor that will enable you to make more precise measurements for your study.

Build your digital EC sensor

Collaborate with your team to build an electrical conductivity (EC) sensor using the Instructions.

9. Describe an engineering problem your group experienced while building the sensor. (Your teacher may ask you to carry out one or more components of the Design loop.)

10. Draw a diagram of the innovation or modification you used to solve the problem. Annotate your diagram with descriptive explanations.

Calibration of your digital EC sensor

Collaborate with your team to calibrate your EC sensor using the Instructions.

11. What does it mean to calibrate something?

12. Were the voltage readings from your digital EC sensor proportional to the measurement of dissolved solutes in PPM? Use the graph you made in Part 3 to explain your reasoning.

13. Why is calibration important?

Observations and data

Well done! You now have your digital EC sensor built, calibrated and ready to use in the field!

Excel watershed simulation data

Use your digital EC sensor to measure the water quality from the five different zones represented in the Excel EC watershed worksheet. Be sure to save your data to the worksheet. A reminder on saving data can be found in the instructions.

Zone	Concentration of Dissolved Salts (PPM)	Assessment: Is the measurement within the acceptable range? If not, what might be the cause of the readings outside this range?
1		
2		
3		
4		
5		

Field Data (Optional)

Your teacher may choose to have you bring in your own water samples to analyze. Use the Excel EC Water Sample worksheet to record your data. You may choose to bring in samples from different commercially packaged beverages

14. Report your findings to the class. Record ideas and insights from other teams in your classroom. Include the following in your report:
    - What was the source of the pollution?
    - What are the next steps that need to be taken?

Part 4: Reflection

1. Can water conduct electricity? Explain your reasoning.

2. Explain how the conductivity of a water sample is related to the quality of the water sample.

3. What kind of pollutants will this sensor NOT detect? Why?

4. What are some sources of pollutants that might increase the electrical conductivity of water?

5. Describe how you could be a good steward of our natural waterways.

Amazing work!
You should be very proud of your efforts in protecting native ecosystems. The world will be a better place if you and others like you continue to be good stewards of this wonderful fragile planet.