Lab #1-Part 1 (Group Project) - The Scientific Method

Part 1A: Harold and the Purple Lake

The following exercise is designed to give you some practice in determining what appropriate scientific questions to ask are, and proper hypotheses to propose when faced with a problem in the natural world.

Here’s the situation. Driving across the I-90 bridge Harold comes out of the tunnel and notices that Lake Washington has turned bright purple. Several thoughts run through his mind. Some of these thoughts may be valid steps in initiating the scientific method to solve this mystery, and some may not. Each may be classified as one of the following:

A. a subjective observation: An observation that may differ among observers = a personal opinion or feeling.
B. objective observation: An observation of a physical property that different observations will all agree on.
C. irrelevant question or statement that has no bearing on the scientific problem.
D. valid question or statement that is not a proper hypothesis
E. valid hypothesis = a testable statement or question that explains what happened that caused the lake change color.

Remember: A valid hypothesis must 1) be testable and 2) it must explain an aspect of the natural world (in terms of “how, when, where, or what”).

The following thoughts that run through Harold’s mind and are listed below. You should

1) Specify (in the blank) which of the above (a-e) best describes the statement.
2) For each valid hypothesis – list a possible way to test the hypothesis.

1. ______ “What made the lake turn purple?”
2. ______ “It’s an ugly color purple.”
3. ______ “Nothing else looks different.”
4. ______ “Is the water warmer than it was yesterday?”
5. ______ “When did the lake turn purple?”
6. ______ “Would this be a good color to paint my car?”
7. ______ “Maybe the lake turned purple because someone spilled a batch of experimental, radioactive Kool-Aid into the lake that turned the water purple.”
8. ______ “Maybe the lake is a magic lake and it turned purple by magic.”
9. ______ “Maybe my eyeballs have turned purple because I’ve been drinking too much grape juice and now everything will start to look purple to me.”
10. ______ “Maybe Mayor Greg Nickels (of Seattle) thought that turning the lake purple would decrease the amount of snow that will fall during winter months.”
11. ______ “Maybe a purple-people-eating space aliens landed on the bottom of lake and their purple spaceship is making the water look purple.”
12. ______ “Did the lake turn purple because UW fans have been throwing their team shirts into the lake when the Huskies lost their last game.”
1B) If you determined that any of the above were scientifically *improper hypotheses* (that is are they not testable), explain why you thought so.

1C) Is it possible for a hypothesis to be judged scientifically proper and yet turn out to be ultimately untrue?

1D) Is it possible for a hypothesis to be judged as a scientifically improper hypothesis, yet turn out to be ultimately true? Why or why not?

1E) Suggest at least one additional valid hypothesis (testable) for why the lake has turned purple and list at least one way that this hypothesis could be tested.

Hypothesis:

Test of hypothesis:
Part 2 – Plants and Salt (a little more realistic scenario)
In this part, you will be given the initial observations, and asked to propose a question, hypothesis, and experimental design to address the problem.

Here’s the situation: On a walk down to the beach, you observe that the plants change as you get closer to the ocean and finally no plants grow when you get to the beach itself. You also observe that there are salt crystals in the soil close to the beach, but not farther away from it.

2A) Formulate a valid question based on the observations listed above.

2B) State a proper scientific hypothesis based on your observations and the question you asked above. Remember that it must be testable.

2C) Propose an experiment that would test your hypothesis. What sort of data would you collect, and how would you analyze it? Would you gather data in the field, or would you conduct a laboratory experiment, or both? Remember that a valid experiment should be free from any bias (should not be set up to favor any particular outcome). Also such an experiment must be repeatable (by you and by others).