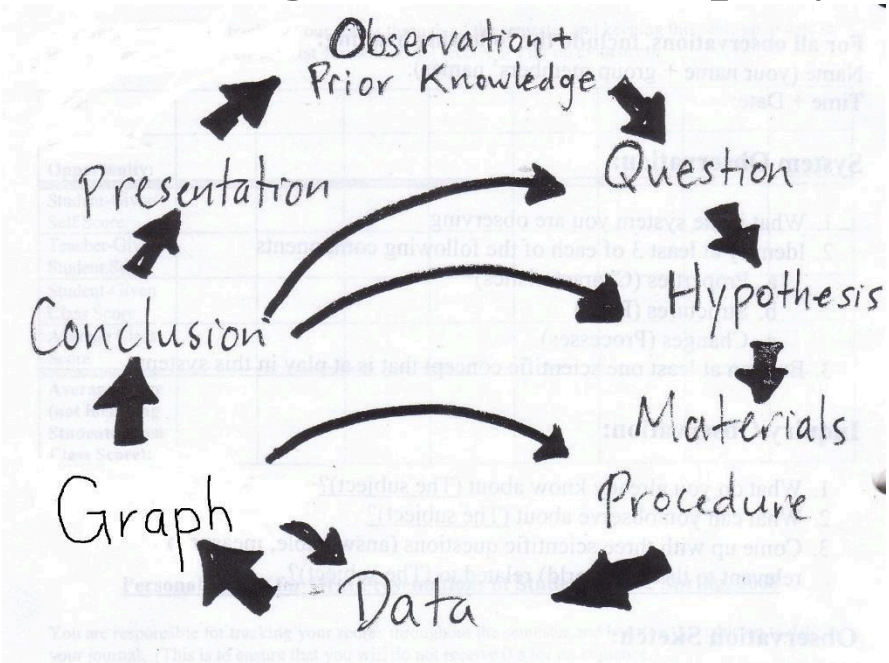
# Scientific Investigations: The Inquiry Process




| Inquiry Step | Expectation |
|---|---|
| **Observation / Prior Knowledge** | • What do you observe and know about the subject?<br>• Include sensory observations and facts. |
| **Question** | How does the ***independent*** variable affect the ***dependent*** variable?<br>***Independent variable***=Factor you are testing/changing<br>***Dependent variable***=Results that are observed/measured/recorded |
| **Hypothesis** | **If:** What will you actually be doing/measuring?<br>**Then:** What actual results do you predict you will find?<br>**Because:** What is the scientific reason behind your prediction? |
| **Materials / Procedure** | **M** = Bulleted supply list including tool to measure dependent variable<br>**P** = Numbered steps including all 3 variables (***controlled variables*** stay the same), how often to measure and record, and repeated trials.<br>• **C**hoose your first item to test and explain rules for the test<br>• **O**bserve, measure and record your outcome (dependent variable)<br>• **R**epeat steps 1-2 two more times<br>• **R**epeat steps 1-3 with the other items to test (name them)<br>• **T**able (blank table with independent on left and dependent on right) |
| **Data** | Numbers in a table with independent variable on the left and dependent variable on the right. Include a column for averages on the far right. |
| **Graph** | Graph data with proper **T**itle (independent vs. dependent), **A**xis (independent on X, dependent on Y), **I**ntervals (start at 0, even jumps), **L**abels (units on Y, tested items on X), **S**cale (data fills most of graph) |
| **Conclusion/CER (Claim, Evidence Reasoning)** | **1. Claim:** Answer question (make a **claim** about the actual results)<br>**2. Evidence:** Cite **evidence** (report and label averages)<br>**3. Evidence:** Cite more **evidence** (compare data – subtract/manipulate)<br>**4. Reasoning:** Explain with **reasoning** (state a science concept and explain how your results compare to the science concept) |
| **Presentation** | Include all steps of the inquiry process; Be professional |

SAMPLE INVESTIGATION WRITE:UP:

# Location vs. Turbidity in Tumwater Creek

**Observation/Prior Knowledge:** At the downstream sites we heard cars and saw tracks from trucks near the creek. At the upstream sites we heard birds chirping and saw ferns next to the creek. We know Tumwater goes through Port Angeles and the bridge over the creek was replaced in 2008.

**Question:** What is the effect of location (river mile) on turbidity (cloudiness) of Tumwater Creek?

**Hypothesis:** If we test turbidity at different river miles, then lower river miles (downstream) will have higher turbidity levels because the creek gets bigger and stirs up more sediment downstream.

## Materials:

- Turbidity meter (including sample vials and wipes)
- Waterproof boots and gloves
- Data sheets and pencils

HINT:
Choose 1st item and state rules
Observe/ measure/record
Repeat steps 1-2 two times
Repeat steps 1-3 with other items

## Procedure:

1) Choose the downstream site (river mile 0.1) and without stirring up the bottom collect a full vial of creek water. Wipe the vial to clean and dry the vial, then put it in the turbidity meter.
2) Observe, measure and record the turbidity level in Nephelometric Turbidity Units (NTU).
3) Repeat steps 1-2 two more times.
4) Repeat steps 1-3 upstream at three different sites (river miles 0.6, 4.0 and 4.4).
5) Repeat steps 1-4 every year starting in 2006.

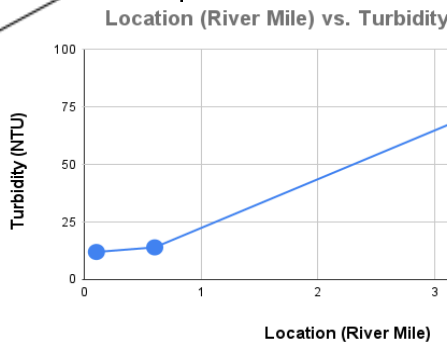
## Data:

HINT: The independent variable goes here

HINT: The dependent variable goes here (results)

Location (River Mile) vs. Turbidity level (NTU)

| Location (River Mile) | Turbidity level (NTU) | | | |
|---|---|---|---|---|
| | Trial 1 | Trial 2 | Trial 3 | |
| **0.1** | 90 | 87 | 93 | |
| **0.6** | 79 | 86 | 93 | |
| **4.0** | 12 | 12 | 18 | |
| **4.4** | 11 | 12 | 13 | |




## Graph:

## Conclusion:

Downstream locations have higher turbidity levels than upstream locations on Tuwater Creek. The furthest downstream sites at river miles 0.1 and 0.6 had average turbidity of 90 and 86 NTU and the furthest upstream sites at river miles 4.0 and 4.4 had average turbidity of 14 and 12 NTU. The average of the 2 downstream sites, 88 NTU, was 75 NTU higher than the average of the 2 upstream sites, 13 NTU. Sediment raises the turbidity (cloudiness) of a stream, and downstream sites on Tumwater Creek are surrounded by the city of Port Angeles, so the sediment running into the stream from city streets causes higher turbidity downstream as compared to upstream where the creek is surrounded by forest.

**OBSERVATION/PRIOR KNOWLEDGE (O/PK):** Strong observation/background

| | | | | |
|---|---|---|---|---|
| Extremely perceptive + thoughtful work | Observation and prior knowledge present | Observation or prior knowledge present | Observation or prior knowledge lacking thought | No evidence |
| **4** | **3** | **2** | **1** | **0** |

**QUESTION (Q):** Answerable, measurable, and relevant

| | | | | |
|---|---|---|---|---|
| All elements + two or more variables present | All elements present | One of three elements incorrect/missing | Two of three elements incorrect/missing | No evidence |
| **4** | **3** | **2** | **1** | **0** |

**HYPOTHESIS (H):** Use the proper format and include thoughtful content

| | | | | |
|---|---|---|---|---|
| Format + content very thoughtful | Format correct and content plausible | Format incorrect or content implausible | Format incorrect or content implausible | No evidence |
| **4** | **3** | **2** | **1** | **0** |

**MATERIALS/PROCEDURE (M/P):** Bulleted list + easy to follow steps-use CORRT on p.1

| | | | | |
|---|---|---|---|---|
| Comprehensive list and specific steps w/CORRT | Bulleted list and numbered steps are clear w/CORR | Bulleted list or numbered steps are lacking two items | Bulleted list and numbered steps are lacking four items | No evidence |
| **4** | **3** | **2** | **1** | **0** |

**DATA (D):** Organized in a table with independent on left and dependent on right

| | | | | |
|---|---|---|---|---|
| All data present and very clearly organized | All data present and clearly organized | Some data not present or poor organization | Some data not present and poor organization | No evidence |
| **4** | **3** | **2** | **1** | **0** |

**GRAPH (G):** Include: Title (independent vs. dependent), Axis (independent on X, dependent on Y), Intervals (start at 0, even jumps), Labels (units on Y, tested items on X), Scale (data fills most of graph)

| | | | | |
|---|---|---|---|---|
| T.A.I.L.S. all present | One element missing | Two elements missing | Three or more elements missing | No evidence |
| **4** | **3** | **2** | **1** | **0** |

**CONCLUSION (C):** Claim (answer question), Evidence (cite data + compare data) Reasoning (explain with scientific concepts)

| | | | | |
|---|---|---|---|---|
| Four elements present + strong | Three elements present | Two elements present | One element present | No evidence |
| **4** | **3** | **2** | **1** | **0** |

**PRESENTATION (P):** Include all steps of inquiry method and be professional

| | | | | |
|---|---|---|---|---|
| All elements present + strong | All elements present | Could be more professional | Missing pieces or unprofessional | No evidence |

| 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|