GREATER ATLANTA CHRISTIAN SCHOOL

# Summer Review
# CP Chemistry

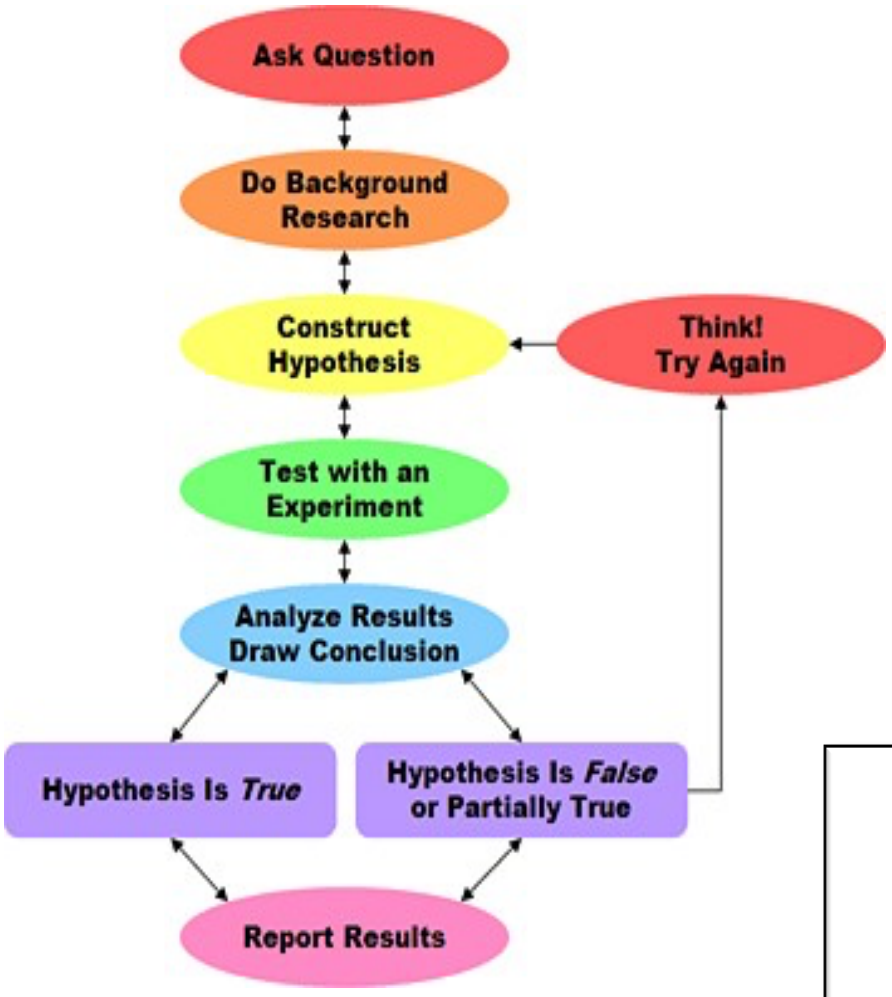
# 2024

This packet is a set of activities designed to review some basic skills and content needed for 10th grade science. Students enrolled in CP Chemistry for the Fall should thoroughly complete this review over the summer and be prepared to submit it on the first day of school.

# Experimental design

**Terminology Review**

**Hypothesis:** Tentative explanation of observations, may or may not be supported by experimental data




**Experiment:** a procedure used to test a hypothesis

**Constants:** the factors in the experiment that stay the same

**Variables:** the factors in the experiment that change

- **Independent Variable (IV):** the variable that the experimenter changes
- **Dependent Variable (DV):** the variable that changes as a result of the experiment (usually what is measured)

**Control:** standard used as a comparison

**Observation:** information obtained during an experiment
**Qualitative Data:** collected using 4 senses
**Quantitative Data:** collected using scientific instruments; numbers

**Graph:** a diagram showing the relation between variable quantities, typically of two variables, each measured along one of a pair of axes at right angles.

**Model:** visual, verbal, mathematical explanation of experimental data

**Scientific Theory**: a well-tested explanation for a broad set of observations but often is eventually modified

**Scientific Law:** a concise statement about a relationship in nature that is supported by many experiments and generally accepted to be true

**Using only the Terminology Review on the page above and your general knowledge from previous science courses, answer these questions <u>using complete sentences</u>.**

1. How does a hypothesis differ from a theory?

2. Describe what is needed for a hypothesis to develop into a theory.

3. Can a hypothesis that has been rejected be of any value to a scientist? Why or why not?

4. What is a scientific law, and how does it differ from a theory?

5. What are the parts of “the scientific method”?

6. Why is there actually no single order of steps in the scientific method?

7. Why does a scientist include a control in the design of an experiment?

8. How would a control group be set up to test the effectiveness of a new drug in treating a disease?

9. Why is it important for a scientist to control the variables in an experiment?

10. What is the difference between an independent and a dependent variable in an experiment?

11. Why should an experiment be repeated?

**Consider the following experiment:**

Isabella wanted to test what would happen when she added various amounts of Chemical X to water.

She set up 3 test tubes in a test tube rack.

Isabella placed 5 mL of distilled water in each test tube. The temperature of the water in each test tube was 23ºC at the start of the experiment. The test tubes were the same size and made of Pyrex.

To the first test tube, she added no Chemical X.
To the second test tube, she added 2.5 grams of Chemical X.
To the third test tube, she added 5.0 grams of Chemical X.

She recorded both quantitative and qualitative data.

**Isabella's Data Table**

| Test Tube # | Initial Temperature | Final Temperature | Temperature Change | Initial Color | Final Color |
|---|---|---|---|---|---|
| 1 | 23 | 23 | 0 | Clear | Clear |
| 2 | 23 | 23 | 0 | Clear | Purple |
| 3 | 23 | 23 | 0 | Clear | Green |

1. What is Isabella's independent variable?

2. What is Isabella's dependent variable(s)?

3. What is Isabella's control?

4. What are the constants in Isabella's experiment?

5. What data would be classified as qualitative?

6. What data would be classified as quantitative?

**Identify the parts of the following 2 experiments:**

1. Marie decides to design an experiment to evaluate the effectiveness of a "new and improved" chemical fertilizer on her bean plants. She places 5 bean plants in pots, using the same type of soil and the same size and type of pots. She labels them 1 through 5. Each week, for 6 weeks, she waters and fertilizes the plants as follows:

- Pot #1: 1 ml fertilizer mixed in 1 gallon of water
- Pot #2: 2 ml fertilizer mixed in 1 gallon of water
- Pot #3: 3 ml fertilizer mixed in 1 gallon of water
- Pot #4: 8 ml fertilizer mixed in 2 gallons of water
- Pot #5: 1 gallon of water only

As a result of their care over 6 weeks, the bean plants grow as follows:

- Pot #1: 5 inches of vine with 2 bean sprouts
- Pot #2: 8 inches of vine with 4 bean sprouts
- Pot #3: 16 inches of vine with 8 bean sprouts
- Pot #4: 12 inches of vine with 8 bean sprouts
- Pot #5: 5 inches of vine with 3 bean sprouts

**Independent Variable:**

**Dependent Variable:**

**Control group(s):**

**Experimental group(s):**

**3 constants:**

2. Pierre is in a hardware store and notices fertilizers have three main ingredients: nitrogen, phosphorus and potassium. He wonders if increasing the initial amount of fertilizer given to his beloved cherry tomato plants will affect the production and size of tomatoes. He thinks that tomato plants with the highest initial amount of fertilizer will result in the greatest production.

Pierre begins by growing forty cherry tomato plants and divides them equally into four groups: A, B, C, and D. He then adds no fertilizer to group A, 1.0 g to group B, 1.5 g to group C and 2.0 g to group D. He gives all groups the same amount of sunlight and water. He massed each mature tomato to determine the total production. He also finds the average mass of the cherry tomatoes for each group. Data is shown in the table below.

| | Group A | Group B | Group C | Group D |
|---|---|---|---|---|
| Total production mass | **300.0 g** | **350.2 g** | **455.0 g** | **400.2 g** |
| Average mass of cherry tomato | **5.0 g** | **3.2 g** | **7.0 g** | **5.0 g** |

**Independent Variable:**

**Dependent Variable:**

**Control group(s):**

**Experimental group(s):**

**3 constants:**

## Graphing to communicate data:

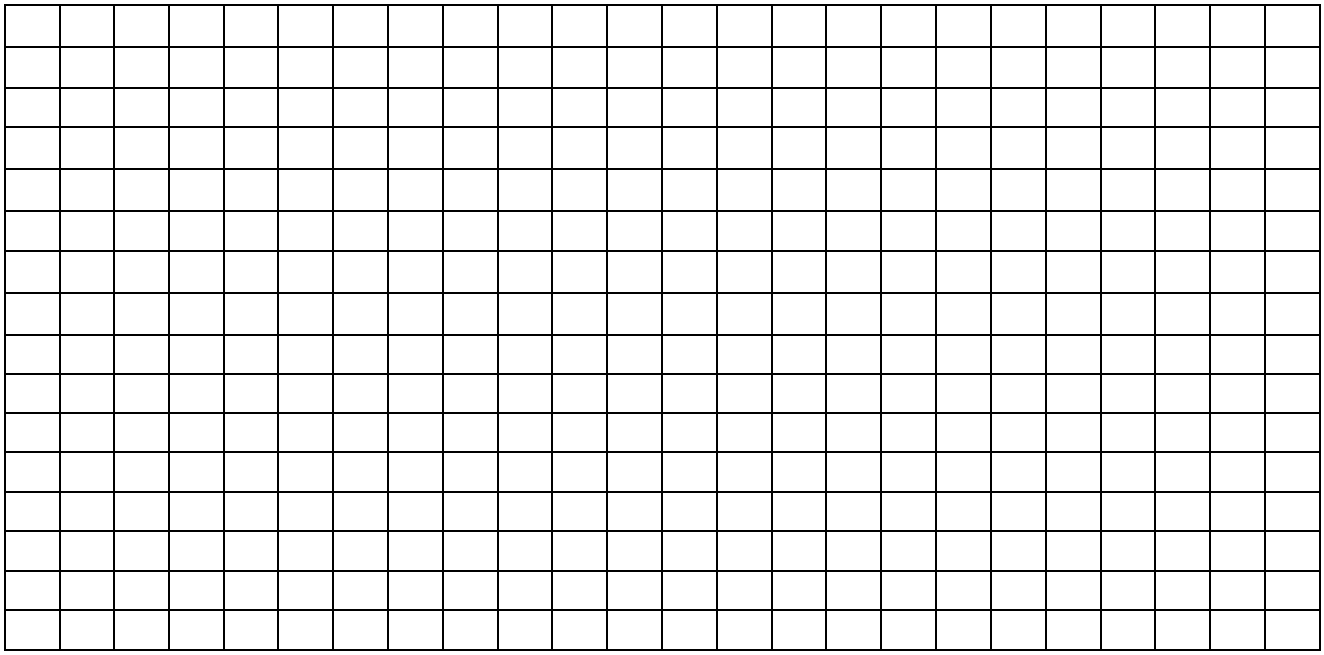
**INTRODUCTION:**

Fish, crabs, oysters and other aquatic animals must have sufficient levels of dissolved oxygen (DO) in their water to survive. The amount of dissolved oxygen in an aquatic ecosystem is a major factor that determines the type and abundance of organisms that can live there.

Magnesium chloride in seawater is about 3.7% of the total mineral content. This compound is essential for the growth of corals, clams, and invertebrates. $MgCl_2$ can be depleted by mangrove plants in aquatic environments.

| Temperature of seawater ($^oC$) | Milligrams of $MgCl_2$/100 ml of water | Milligrams of $O_2$/100 ml of water |
|---|---|---|
| 0 | 52.9 | 44.8 |
| 5 | 53.6 | 39 |
| 10 | 54.6 | 35.2 |
| 15 | 55.8 | 31.7 |
| 20 | 57.5 | 28.8 |
| 25 | 58.0 | 26.4 |
| 30 | 61.0 | 24.4 |
| 35 | 64.6 | 22.6 |
| 40 | 66.1 | 21.6 |
| 45 | 69.5 | 19.7 |
| 50 | 73.3 | 18.6 |

1. Plot the data as a line graph using the graph below. Make sure to include all necessary components for the graph.



2. Describe the relationship between the temperature of the seawater and the dissolved oxygen.

3. Describe the relationship between the temperature of the seawater and the magnesium chloride.