

We will be taking a 1st semester final that will summarize the most important things we have learned from September through January. This review sheet will be your guide to help you review for the exam.

Part 1

Nature of science and engineering.



1. What is science? (textbook definition and in your own words)

Science is empirical, logical, and skeptical.

2. What the heck to those three words mean?

Empirical =

Logical =

Skeptical =

When conducting an experiment a scientist can sometimes have a personal **bias**.

3. What is a bias and how can that influence the experiment?

4. Tell me what bias do you see in the following experiment:

A scientist is conducting an experiment on frogs:

- The scientist yells “JUMP!” at the frog and the frog jumps one meter.
- Then he cuts off one of the frog’s legs, yells “JUMP!” and the frog jumps half a meter.
- He then cuts off the other leg and yells “JUMP!” and the frog does not move.
- “Aha!” he says. “I have my result!”
- So he carefully writes in his lab book: “When two legs are removed, a frog becomes deaf.”

5. Many people have **misconceptions** about how things work. What are misconceptions?

Misconceptions can often be difficult to get rid of. 8th grade students were asked why we have seasonal weather changes here in Minnesota. Sixty-five percent of those asked thought (incorrectly) that it was because the Earth was farther from the sun during the winter and closer during the summer. They were then taught the correct reason for the seasonal change (the tilt of the Earth) and were tested. A month later when the students were asked the same question again 85% reverted back to their old misconception that it was due to the Earth being closer or farther from the sun.

Sometimes in science two similar experiments can give **different** results. The challenge scientists face is determining whether or not the results are **significant**. If they are significant further investigation (experiments) must be needed.

5. We can determine whether or not they are significant by using mathematics. In science we often use Mean, Median, and Range.

Mean =

Median =

Range =

The following data is from 2 experiments that we done on plant growth.

6. All measurements are in cm. In both experiments 28 plants were grown and their heights measured. Calculate the mean, median and range for the 2 experiments.

Experiment 1

12, 14, 11, 4, 2, 13, 7, 16, 13, 22, 3, 3, 6, 5, 8, 9, 19, 4, 5, 7, 14, 15, 14, 13, 21, 1, 7, 11

Mean =

Median =

Mode =

Experiment 2

14, 10, 11, 16, 14, 15, 17, 15, 14, 16, 15, 15, 13, 12, 18, 17, 14, 13, 16, 15, 14, 15, 16, 14, 15, 13, 14, 15

7. Are the results from experiments 1 and 2 significantly different from one another?

In Science we have to be able to distinguish between fact and opinion. Science is only concerned with the facts.

8. What is a fact?

9. What is an opinion?

10. Identify if the following statements are facts or opinions.

_____ Mr. Jones has two sons and one daughter.

_____ That picture is a picasso.

_____ Her house is really beautiful.

_____ The Heat are better than the Knicks.

_____ The group will stop in Denver overnight.

Science Vocab - You must know these words for the Final!!!

Hypothesis - A proposed answer to a question. It isn't just a guess it is an educated guess based on what you already know.

- Example:

If I eat a nutritious breakfast I will have more energy at the end of the day.

If a leopard is confronted by a group of 3 or more hyenas it will protect itself by climbing a nearby tree. If the number is 2 or less it will fight them off.

11. Come up with your own example and write it below.

Variable - Anything that can affect the outcome of an experiment.

Example:

Experiment - Testing the effects of Gatorade on a person's ability to dunk.

Variables - Type of gatorade, what size gatorade, flavor, athletic ability, height, gender, the type of ball used, height of the hoop, surface they are jumping off of.

Experiment - The effects of walking a dog on a dog's bad behavior (peeing on the carpet, tearing up the furniture, knocking things over).

Variables - walking the dog, time spent walking, speed of the walk, type of dog, do other dogs live in the same household.

12. Come up with your own example and write it below.

Controlled Experiment - An experiment in which the relationship between two variables is tested. One is manipulated, the other is measured and recorded. The rest of the variables are controlled which means they are kept the same.

- Example:

13. We want to determine how the amount of sleep a student gets can affect test results.

14. What are all the possible variables in this experiment?

15. What two variables are we examining the relationship between?

16. What is the manipulated variable (aka the independent variable)?

17. What is the variable we are measuring (aka the dependent variable)?

18. Why is it so important to control all the other variables?

Controlled experiments aren't the only way to answer a question in science. To answer questions we can use a variety of different methods. Sometimes we can answer our question by performing a simple controlled experiment. Other times we may need to do a field study, review existing work, or develop a scientific model.

19. Identify how the following questions would be best answered.

_____ How do crocodiles hunt their prey?

_____ Which preservative keeps food from spoiling longer, sodium chloride or sodium nitrate?

_____ What heats up faster sand or water?

_____ What does a newly discovered planet look like?

_____ How much has the average temperature increased in Barnesville since the industrial revolution?

20. What is the **Scientific Method**?

21. What are the steps of the Scientific Method?

22. What do engineers do?

23. What is design?

24. How are science and engineering related to one another?

25. Why is failure important to engineers?

26. Name something that can have many different designs that all have the same purpose.

27. Is there one perfect design?

28. Engineers commonly have to make trade-offs in terms of features, performance, durability and cost. Give me an example of this.