

Name: _____

Unit 1: Quantitative Skills and Biochemistry

Dual Enrollment Biology

Ms. Grapes

Part I. Quantitative Skills

1. Define the following terms:

a. Observation:

b. Inference:

c. Independent Variable:

d. Dependent Variable:

e. Control Group:

2. What's the difference between a hypothesis, a theory and a law in scientific terms?

3. Controls and Variable. Identify them in the space provided after reading each scenario.

a. Smithers thinks that a special juice will increase the productivity of workers. He creates two groups of 50 workers each and assigns each group the same task (in this case, they're supposed to staple a set of papers). Group A is given the special juice to drink while they work. Group B is not given the special juice. After an hour, Smithers counts how many stacks of papers each group has made. Group A made 1,587 stacks, Group B made 2,113 stacks.

Control Group:

Dependent Variable:

The Right Conclusion:

Independent Variable:

How could this be improved?



b. Krusty was told that a certain itching powder was the newest best thing on the market, it even claims to cause 50% longer lasting itches. Interested in this product, he buys the itching powder and compares it to his usual product. One test subject (A) is sprinkled with the original itching powder, and another test subject (B) was sprinkled with the Experimental itching powder. Subject A reported having itches for 30 minutes. Subject B reported to have itches for 45 minutes

Control Group:

Dependent Variable:

Independent Variable:

Do you think the advertisement is right? Why or why not?

How could you improve this experiment?

Chi Square

The following are the approximate percentages for the different blood types among white Americans: A: 40%; B: 11%; AB: 4%; O: 45%. A random sample of 1000 black Americans yielded the following blood type data: A: 270; B: 200; AB: 40; O: 490. Does this sample provide evidence that the distribution of blood types among black Americans differs from that of white Americans or could the sample values simply be due to sampling variation?

- Write what the null and alternative hypothesis would be for this experiment.
H₀: _____
H_A: _____
- What are the degree of freedom for this experiment? _____
- Fill in the table below.

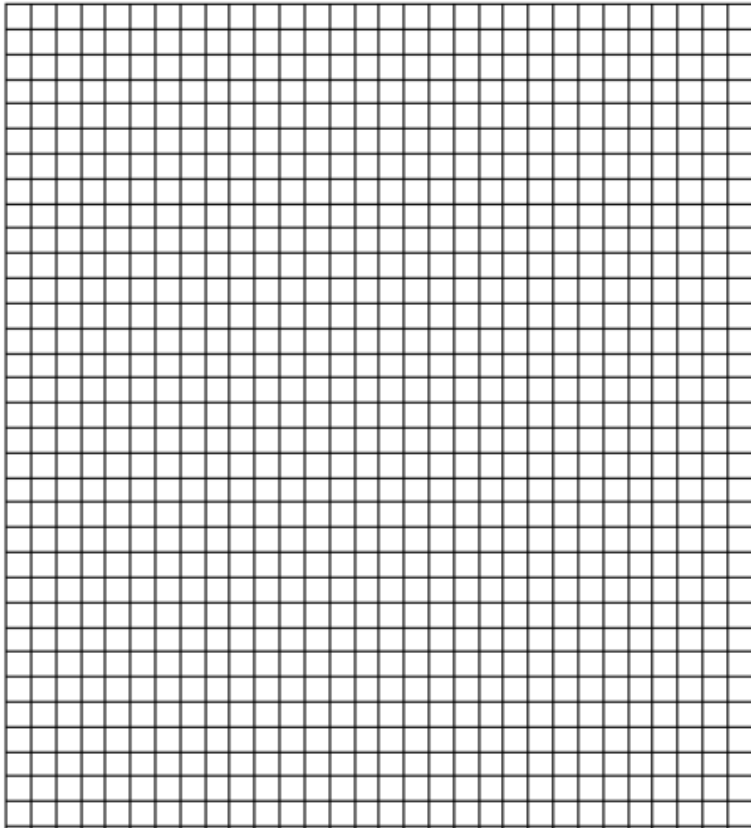
| Blood Type | Observed | Expected (with math) | X ² Formula | X ² |
|------------|----------|----------------------|------------------------|----------------|
| A | | | | |
| B | | | | |
| AB | | | | |
| O | | | | |
| | | | | SUM |

- Using the table provided, what is the critical value? _____
- What can you conclude? _____

- How did you decide this conclusion? _____

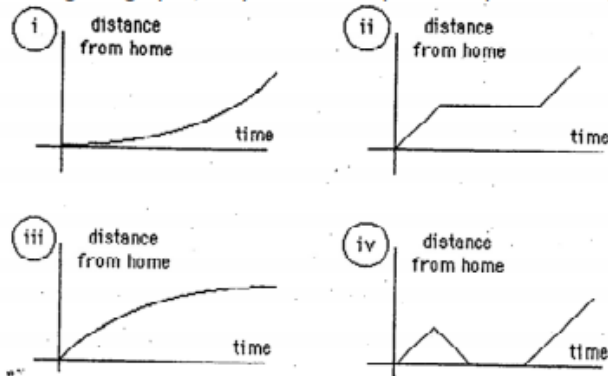
Experiment #1: Use the following data to create an appropriate graph and answer the questions. (graph paper on next page).

| Depth (meters) | Bubbles per minute Plant A | Bubbles per minute Plant B |
|----------------|----------------------------|----------------------------|
| 2 | 29 | 21 |
| 5 | 36 | 27 |
| 10 | 45 | 40 |
| 16 | 32 | 50 |
| 25 | 20 | 34 |
| 30 | 10 | 20 |



Interpreting Graphs

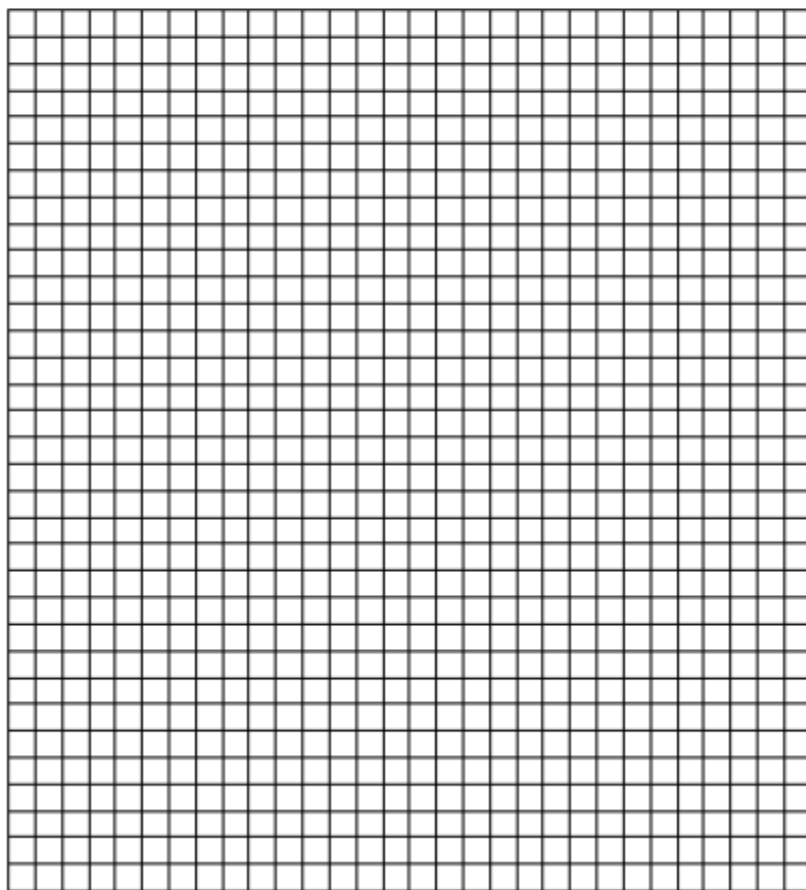
In addition to being able to draw a graph based on data collected, you will also need to interpret data given to you in graph form. Answer the following questions based on the graphs presented. NOTE: Most of these are NOT examples of great graphs, they are for interpretation practice only.



Identify the graph that matches each of the following stories:

18. _____ I had just left home when I realized I had forgotten my books so I went back to pick them up.
19. _____ Things went fine until I had a flat tire.
20. _____ I started out calmly, but sped up when I realized I was going to be late.

10. In 1989, the US Department of the Interior reported that there were 360 endangered species of plants and animals in the United States. These endangered organisms included 32 species of mammals, 61 species of birds, 8 species of reptiles, 5 species of amphibians, 45 species of fishes, 3 species of snails, 32 species of clams, 8 species of crustaceans, 10 species of insects, 3 species of spiders, and 153 species of plants. Construct a bar graph of the total number of endangered plants and animals in 1989.



Part II. Chemistry

Important Terms to Know, Define, Describe, or Give Examples of:

- | | | |
|---------------------|------------------------|------------------------------------|
| 1. Potential energy | 7. Atomic weight | 13. Polar |
| 2. Kinetic energy | 8. Isotope | 14. Nonpolar |
| 3. Neutrons | 9. Valence | 15. Cations |
| 4. Protons | 10. Structural formula | 16. Anions |
| 5. Electrons | 11. Molecular formula | 17. Hydrogen bond |
| 6. Atomic number | 12. Covalent bond | 18. How to read the periodic table |

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1. Define both potential energy and kinetic energy and give an example of each.

2. How do elements differ from compounds?
3. Name and define the subatomic particles that are part of an atom. How do they differ from each other? How do these differences contribute to the properties of atoms and molecules?
4. What is an atom? Give an example.
5. What is the difference between atomic number and atomic weight?
6. Determine the atomic number and atomic weight of the following:
 - a. Carbon
 - b. Oxygen
 - c. Nitrogen
 - d. Phosphorus
 - e. Calcium
 - f. Hydrogen
 - g. Selenium
 - h. Manganese
7. Where is the mass number put with respect to an element's symbol?
8. What does the subscript number to the left of an element's symbol indicate?
9. What is the difference between ^{12}C and ^{14}C ?
10. What is a valence electron? Why are they important?

11. Which of the structures in #12 above are:

a. Polar? Why are they polar?

b. Nonpolar? Why?

12. The atom is the building block of all matter, but even atoms are made up of three subatomic particles: the electron, the proton, and the neutron. Specify which of the three subatomic particles each statement is describing by putting an "E," a "P" or a "N" in the blanks.

a. Is positively charged _____

b. Neutral/no charge _____

c. Flying around the nucleus _____

d. Both weigh one amu _____ & _____

e. Determines the atomic # _____

f. Negatively charged _____

g. In the nucleus _____ & _____

h. Important in bonding characteristics _____

i. Practically weightless _____

j. Differs in isotopes _____

Part III. Water

For the situations listed below, determine which property (or properties) of water are being described.

Properties of Water:

A. Adhesion

B. Cohesion

C. Expansion at freezing

D. High heat of fusion

E. High heat of vaporization

F. High specific heat

G. Solvent

H. Surface tension

1. _____ Gradual transition from September to November temperatures

2. _____ Caused by hydrogen bonding of water

3. _____ Most chemical reactions occur in the cytoplasm of the cell (a watery environment), rather than inside a membrane (which is composed of lipid or fat)

4. _____ Capillary action

5. _____ A dog panting

6. _____ Life can survive the winter in northern lakes

7. _____ Climate in Baltimore, MD is milder and less variable than it is 100 miles inland, due west of the city

8. _____ Water rises from roots to leaves of plants

9. _____ A desert hare has huge ears, with many capillaries carrying blood

10. _____ Water striders "walk" on water

11. _____ Seeds germinate

12. _____ Ocean/large lake temperatures are relatively constant

13. _____ Water comprises 70-90% of cells

14. In the space provided, draw two water molecules, making sure to show their polarity. Draw a hydrogen bond between them. How are hydrogen bonds different from covalent bonds?

Part IV. Macromolecules

1. Fill in the table below

| Macromolecule | Monomer | Elements it Contains | Examples |
|---------------|---------|----------------------|----------|
| | | | |
| | | | |
| | | | |
| | | | |

2. Draw a diagram showing how monomers are put together via dehydration synthesis.
3. Draw a diagram showing how a polymer is broken apart via hydrolysis.
4. What are the main functions of carbohydrates? Give examples of each.
5. Distinguish between monosaccharides, disaccharides, and polysaccharides.
6. Describe the role of symbiosis in cellulose digestion.

7. Describe the building-block molecules, structure, and biological importance of fats, phospholipids, and steroids.

8. Name the principal energy storage molecules of plants and animals.

9. List four conditions under which proteins may be denatured.

10. What determines the primary (sequence of amino acids) of a protein?

11. What are the three parts of a nucleotide, the monomer of nucleic acids?

12. Draw the sugar molecules in DNA and RNA. What's the difference between them?

13. Briefly describe the three-dimensional structure of DNA.

14. What is the importance of DNA?