WILLIAMSBURG HIGH SCHOOL
for
ARCHITECTURE AND DESIGN

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Welcome Scholars!

Congratulations on joining the Advanced Science program. I understand it is hard to study during the summer. However, in preparation for an academically successful year, you will need to keep your brain active this summer. This summer while you are lazing around a pool, hiking through the mountain or gaming in your living room, take some time out of each day and develop and practice the following skills:

- Math/Algebra
- Significant Figures
- Reading Comprehension

By mastering these skills, you will be more successful. I look forward to meeting you this fall.

Sincerely,

Buihonghanh

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LESSON 1 – QUANTITATIVE MEASUREMENT

PART: MATH/ALGEBRA

Name_____

A quantitative measurement has 2 components: 1. Numerical value 2. Unit	**EXAMPLE 1:** 12 inches Numerical value = 12 Unit = inches **EXAMPLE 1:** 28 km Numerical value = 28 Unit = km

INSTRUCTIONS: **Complete the blanks**

1. 10 km
    a. Numerical value = _____
    b. Unit = _____
2. 21.2 K
    a. Numerical value = _____
    b. Unit = _____
3. 125 J
    a. Numerical value = _____
    b. Unit = _____
4. 17 m
    a. Numerical value = _____
    b. Unit = _____

5. 24 L
    a. Numerical value = _____
    b. Unit = _____
6. 7 atm
    a. Numerical value = _____
    b. Unit = _____
7. 89 g
    a. Numerical value = _____
    b. Unit = _____
8. 2 u
    a. Numerical value = _____
    b. Unit = _____
9. 273 K
    a. Numerical value = _____
    b. Unit = _____
10. 53 g
    a. Numerical value = _____
    b. Unit = _____

LESSON 2 – ALGEBRA BASIC
PART: MATH/ALGEBRA

Name_____

EXAMPLE 1: Given the following equation: 2b + 3c Where b = 4 and c = 2 SOLUTION: 2b + 3c 2(4) + 3(2) 8 + 6 **14**	**EXAMPLE 2:** Given the following equation: 2b + 3c =35 Where b = 4 SOLUTION: 2b + 3c = 35 2(4) + 3c = 35 8 + 3c = 35 8 -8 + 3c = 35 – 8 3c = 27 3c/3 = 27/3 **c=9**

INSTRUCTIONS: Show all work and box the answer

For all problems:
a = 3 , b = 4, c = 5

1. 7a + 3b	2. 8b + 2c
3. 9a + 3c	4. 10a + 3b + 6c
5. 9a + 4b + 7c	6. 12a - 4b
7. 2a + 4d = 42	8. 3a + 2b + 3d = 30
9. 4a + 5c + 3d = 50	10. 6a + 5b + 3d = 48
11. 8a + 2c + 2d = 100	12. 4b + 5c + 4d = 68

LESSON 3 – FORMULA
PART: MATH/ALGEBRA

Name_____
_____

DENSITY FORMULA: **D =** $\frac{M}{V}$ D = Density M =Mass V = Volume	EXAMPLE 1 What is the density of carbon dioxide gas if 0.196 g occupies a volume of 100 ml? Solution: **D =** $\frac{M}{V}$ **D =** $\frac{0.196g}{100ml}$ **D =** $\mathbf{00.196\ g/ml}$

INSTRUCTIONS: Show all work and box the answer

1. What is the density of oxygen gas if 1 g occupies a volume of 20 ml?

2. What is the density of nitrogen gas if 15 g occupies a volume of 150 ml?

3. What is the density of a can of soda if 394 g occupies a volume of 355 ml?

4. What is the density of a diet can of soda if 355 g occupies a volume of 355 ml?

5. 5.0 mL of ethanol has a mass of 3.9 g, and 5.0 mL of benzene has a mass of 44 g. Which liquid is denser?

LESSON 1 – RULES
PART: SIGNIFICANT FIGURES

Name_____
Date: _____

RULES:

- Nonzero digits are always significant
  - example: 46.3 m has 3 significant figures
  - example: 6.295 g has 4 significant figures
- Zeros between nonzero digits are significant
  - example: 40.7 m has 3 significant figures
  - example: 87,009 m has 5 significant figures
- Zeroes in front of nonzero digit are not significant
  - example: 0.009587 m has 4 significant figures
  - example: 0.0009 g has 1 significant figure
- Zeroes after whole number are not significant
  - example: 850 g has 2 significant figures
  - example: 190,700 has 4 significant figures
- Zeroes to the right of a decimal point are significant
  - example: 85.00 g has 4 significant figures
  - example: 9.0700 has 5 significant figures

INSTRUCTIONS: Identify the number of significant figures

1) 89.53 = _____

2) 989.53 = _____

3) 1520 = _____

4) 1025 = _____

5) 0.002553 = _____

6) 125.250 = _____

7) 0.0212500 = _____

8) 5 = _____

9) 50 = _____

10) 785.2500 = _____

11)28532 = _____

12)0.002514 = _____

13)7589 = _____

14)3200 = _____

15)1002510 = _____

16)2001 = _____

17)300 = _____

18)3120 = _____

19)0.002 = _____

20)45.236 = _____

21)45.2500 = _____

22)0.00120 = _____

23)1001 = _____

24)56.020 = _____

25)1111 = _____

LESSON 2 – ADDING/SUBTRACTION
PART: SIGNIFICANT FIGURES

Name_____
_____

RULES:	**EXAMPLE:**
1) Count the number of significant figures in the decimal portion of each number in the problem. (The digits to the left of the decimal place are not used to determine the number of decimal places in the final answer.) 2) Add or subtract in the normal fashion. 3) Round the answer to the LEAST number of places in the decimal portion of any number in the problem.	2.5 + 3.42 5.92 **5.9** **note:** 2.5 = 1 significant figure (after the decimal) 3.42 = 2 significant figures (after the decimal) So the answer has to be 1 significant figure

INSTRUCTIONS: Show work and box the answer

$+\begin{array}{r}3.50\\0.01\\\hline\end{array}$	$+\begin{array}{r}3.050\\100.01\\\hline\end{array}$
$+\begin{array}{r}31.50\\20.101\\\hline\end{array}$	$+\begin{array}{r}2.80\\0.21\\\hline\end{array}$
$+\begin{array}{r}0.050\\1.01\\\hline\end{array}$	$+\begin{array}{r}34.650\\0.101\\\hline\end{array}$

$+\begin{matrix}9.50\\10.01\end{matrix}$ _____	$+\begin{matrix}31.050\\21.01\end{matrix}$ _____
$+\begin{matrix}38.210\\100.01\end{matrix}$ _____	$+\begin{matrix}12.50\\0.0251\end{matrix}$ _____
$+\begin{matrix}4.50\\0.1\end{matrix}$ _____	$+\begin{matrix}123.50\\120.001\end{matrix}$ _____

LESSON 3 – MULTIPLICATION/DIVISION
PART: SIGNIFICANT FIGURES

Name_____

RULES:	**EXAMPLE:**
1) Count the number of significant figures in for each number in the problem 2) Multiple or divide in the normal fashion. 3) Round the answer to the LEAST number of places	2.5 x 3.42 8.55 **8.6** **note:** 2.5 = 2 significant figures 3.42 = 3 significant figures So the answer has to be 2 significant figures

INSTRUCTIONS: Show work and box the answer

$\frac{3.5}{0.1}$	$\frac{3.050}{10.01}$
$\frac{31.50}{20.101}$	$\frac{2.80}{0.21}$
$\frac{0.050}{1.01}$	$\frac{34.650}{0.101}$

$\boldsymbol{x}^{\mathbf{9.50}}_{\mathbf{10.01}}$ **_____**	$\boldsymbol{x}^{\mathbf{31.050}}_{\mathbf{21.01}}$ **_____**
$\boldsymbol{x}^{\mathbf{38.210}}_{\mathbf{100.01}}$ **_____**	$\boldsymbol{x}^{\mathbf{12.50}}_{\mathbf{0.0251}}$ **_____**
$\boldsymbol{x}^{\mathbf{4.50}}_{\mathbf{0.1}}$ **_____**	$\boldsymbol{x}^{\mathbf{123.50}}_{\mathbf{120.001}}$ **_____**

LESSON 1 – THE SCIENTIFIC METHOD
PART: READING COMPREHENSION

Name_____

_____

The basic **scientific method** includes the steps scientists use and follow when trying to solve a problem or prove or disprove a theory. The methods are used by scientists all over the world. This is done so scientists can work together to solve some of the same problems.

There are usually five steps which are a part of the scientific method. The steps can occur in any order, but the first step is usually **observation**. An observation is the use of one or more of the five senses, which include seeing, hearing, feeling, smelling, and tasting. The five senses are used to learn about or identify an event or object the scientist wants to study. For example, while observing a spider a scientist may observe the pattern or size of the spider's web.

The second step of the scientific method is the question being researched, the **hypothesis**. It is the question that is turned into a statement about an event or object the scientist would like to research. A good hypothesis includes three things: The explanation for the observations, it is able to be tested by other scientists, and it will usually predict new outcomes or conclusions. The scientist observing the spider building the web may have a question about the strength of the web. An example of the hypothesis might be: The larger the spider, the stronger the web. This hypothesis includes the explanation for the observation, it can be tested, and new conclusions may be reached.

The third step of the scientific method is the **experiment.** An experiment is a test which will either challenge or support the hypothesis. The hypothesis will then be true or false. Using the spider hypothesis, a scientist may experiment by measuring spider webs in relation to a spider's size. Often, even when a hypothesis is disproved much can still be learned during the experiment. For example, while measuring the strength of spider webs the scientist may discover something new about them.

The final step in the scientific method is the **conclusion**. The conclusion will either clearly support the hypothesis or it will not. If the results support the hypothesis a conclusion can be written. If it does not support the hypothesis, the scientist may choose to change the hypothesis or write a new one based on what was learned during the experiment. In the example, if the scientist proves that larger spiders build stronger webs, then that is the conclusion. If it was not proven, the scientist may change the hypothesis to: The size of a spider does has no bearing on the strength of its web.

The scientific method is used for simple experiments students may do in the classroom or very complex or difficult experiments being done all over the world. The spider experiment may be done by any scientist in the world.

In summary, the **scientific method** includes the steps scientists use to solve a problem or to prove or disprove a theory. There are four basic steps involved with the scientific method. The usual steps include **observation, hypothesis, experiment,** and **conclusion.** The steps may not always be completed in the same order. Following the four steps, the results of the experiment will either support the hypothesis or will not support the hypothesis. Scientists are always free to change or write a new hypothesis and start the four steps all over again. The scientific method is used for simple experiments or for more difficult experiments.

1. Which of the following is the best definition of the scientific method?
   a. A method used by scientists to try and find the answers to questions.
   b. Used by scientists only throughout the world.
   c. A method to prove the right answer to a question by a scientist.
   d. The steps scientists use and follow when trying to solve a problem or to prove or disprove a theory.
2. Which of the steps in the scientific method would a scientist use for seeing, hearing, feeling, smelling, and tasting?
   a. Conclusion
   b. Observation
   c. Experiment
   d. Hypothesis
3. Which of the following is the best example of a hypothesis?
   a. Do hamsters live longer than birds?
   b. Cars and trucks usually use the same amount of gasoline.
   c. I think dogs make better pets for everyone.
   d. Brand B lightbulb will burn longer in a lamp than Brand X lightbulb.
4. Which statement is true?
   a. An experiment is a test which will either challenge or support a hypothesis
   b. An experiment is a test which must always prove the hypothesis
   c. An experiment is only used when trying to prove a hypothesis
   d. An experiment does not have to be part of the scientific method
5. Fill in the blank with one of the choices. If the results of an experiment support the hypothesis a(n) _____ can be written.
   a. Observation
   b. New hypothesis
   c. Conclusion
   d. Experiment
6. The scientific method
   a. Can be used for simple experiments or more difficult experiments
   b. Can be used only for simple experiments at home or in the classroom
   c. Can be used for experiments carried out by scientists.
   d. Can only be used for very difficult experiments

LESSON 2 – DON'T RIDE THE LIGHTNING
PART: READING COMPREHENSION

Name_____
_____

Next time you're planning to go out for a leisurely walk with your MP3 player, be sure to check the weather forecast first. Summer is the prime time for lightning strikes, a fact that Jason Bunch, a teen from Castle Rock, Colo., learned the hard way. A couple of summers ago, he was mowing grass while rocking out to some Metallica on his iPod. Although there wasn't any rain falling on Bunch, he did hear distant thunder. Bunch was then struck by lightning, which seemed to travel through his music player, blowing out his eardrums and leaving him with nasty burns where the device and its cords were close to his body.

Devices such as MP3 players don't attract lightning, says Dr. Mary Ann Cooper, an emergency room physician at the University of Illinois Medical Center in Chicago. However, they may change the pathway that lightning's energy follows in the human body. Lightning that might have passed rather harmlessly over the skin may react differently to the metal of these devices and cause damage.

Rather than leaving your tunes at home, your best bet is watching out for lightning before it hits. Though people have been injured while using MP3 players in storms, Cooper says the devices' main risk "is keeping you from paying attention to thunder and the sky." If you're caught in a storm, seek shelter. For more tips, visit www.lightningsafety.noaa.gov.

1) Which season is the "prime time" for lightning strikes?
   a. Winter
   b. Fall
   c. Summer spring
2) Lightning struck Jason Bunch while he was listening to his iPod. What was the effect of this lightning strike?
   a. The lightning burned Bunch and blew out his eardrums
   b. The lightning passed harmlessly over Bunch's skin
   c. Bunch fell to the ground and lost his ability to move his upper body
   d. Bunch was fine, but his iPod was burned by the lightning
3) What was the primary purpose of this text?
   a. To describe the joy that Jason felt after he survived a lightning strike
   b. To describe the risks of wearing an MP3 player during lightning strikes
   c. To describe the challenges that emergency room physician Dr. Cooper faces at work
   d. To describe the reason that MP3 were once so popular among teenagers