NAME: 0.1 GUIDED NOTES (COMPLETE)

Nature of Science

Important Terms to know

Fact - _____

Hypothesis - _____

Law/Principle - _____

Quantitative - _____

Qualitative - _____

Theory - _____

Speculation - _____

Test - _____

Conclusion - _____

Inference - _____

Scientific Method - _____

FILE INCLUDED

I. What is Science?
   a. Defined as: the intellectual and practical activity encompassing the systematic study of the structure and behavior of the physical and natural world through observation and experiment
   b. Interesting Perspectives
      i. "Our brains have evolved to help us survive within the orders of magnitude of size and speed at which our bodies operate."
         1. - Richard Dawkins
      ii. "Science is a way of knowing"
         1. - Dr. John Armstrong WSU

II. What it means to KNOW.
   a. TO KNOW IS TO BE AWARE OF THROUGH OBSERVATION, INQUIRY OR INFORMATION

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b. When curiosity is emphasized and encouraged the discovery process continues throughout life.

CURIOSITY	Results in	EXPLORATION
EXPLORATION	Results in	DISCOVERY
DISCOVERY	Results in	PLEASURE
PLEASURE	Results in	REPETITION
REPETITION	Results in	MASTERY
MASTERY	Results in	NEW SKILLS
NEW SKILLS	Results in	CONFIDENCE
CONFIDENCE	Results in	SELF ESTEEM
SELF ESTEEM	Results in	SECURITY
SECURITY	Results in	MORE EXPLORATION

III. A More Specific Method

a. Science today = "NATURAL PHILOSOPHY"

i. The study of unanswered questions about nature.

b. Branches of Science

i. Living-things

1. BIOLOGY
2. BOTANY
3. ZOOLOGY

ii. Non-Living

1. PHYSICS - THE MOST BASIC SCIENCE
2. CHEMISTRY
3. GEOLOGY
4. ASTRONOMY

iii. THE LANGUAGE OF SCIENCE - MATHEMATICS

IV. The Scientific Method

a. RECOGNIZE A PROBLEM
b. HYPOTHESIS
c. PREDICT
d. EXPERIMENT
e. CONCLUSION

i. INFERENCE -

A MORE INFORMAL OR PASSIVE TYPE OF CONCLUSION BASED ON EVIDENCE AND REASONING.

V. Important Terms and Distinctions

a. FACTS – a close agreement by ***competent*** observers who make a series of observations of the same phenomenon.

b. LAWS / PRINCIPLES – When hypotheses are tested over and over, never being contradicted or falsified.

i. SCIENCE MUST BE ADAPTABLE AND ACCEPT THAT WORTHY EVIDENCE CAN CREATE DRASTIC CHANGE WITHIN THE IDEA OF A HYPOTHESIS, LAW OR PRINCIPLE.

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c. A THEORY in a scientific context is very different than the THEORY which people use in everyday speech.
d. The layman would use the term theory in the same manner that a scientist would use the word HYPOTHESIS.
   i. Recall the meaning of the term HYPOTHESIS
e. A scientific THEORY, on the other hand is a synthesis of a large body of information that encompasses well-tested and verified hypotheses about certain aspects of the natural world.
f. Hypothesis vs. Theory
   i. Hypothesis – Untested
   ii. Theory – extensively tested and verified
g. Qualitative data vs. Quantitative data
   i. QUALITATIVE data – linguistic representation of observations (typically involving bias/high probability of misinterpretation)
   ii. QUANTITATIVE data – objective numeric representation of observation.
h. SCIENTIFIC STATEMENT vs. SPECULATION
   i. SCIENTIFIC STATEMENTS – MUST BE TESTABLE
   ii. SPECULATION – No testability (is not science)

VI. Science, Art, & Religion
a. All are manifestations of the search for order and meaning in the world.
   i. SCIENCE – Concerned with discovering and recording natural phenomena.
   ii. ART – Concerned with the value of human interactions as they pertain to the senses.
   iii. RELIGION – Concerned with the source, purpose, and meaning of everything.
b. A truly educated person is knowledgeable about all three domains
c. With true understanding, all domains can be embraced without contradiction.

VII. Tools of Understanding Science
a. ENGLISH SYSTEM – USA (IMPERIAL)
b. METRIC SYSTEM – EVERYONE ELSE
c. The METRIC System uses a base 10 system involving prefixes and base units.

Prefix	Symbol	Factor number	Factor word
kilo	k	1000	Thousand
hecto	h	100	Hundred
deca	dk	10	Ten
Base Unit	m, g, L	1	One
deci	d	0.1	Tenth
centi	c	0.01	Hundredth
milli	m	0.001	Thousandth

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d. Mnemonic for remembering Metric Prefixes

e. KIDS HAVE DROPPED OVER DEAD CONVERTING METRICS

VIII. Representing the Very Large or the Very Small

a. Scientists use what is called SCIENTIFIC NOTATION to represent very large measurements, or very small measurements.

i. EXAMPLES

1. Mass of a single electron = 9.1×10^{-31} kg
2. Mass of the Earth = 5.92×10^{24} kg

b. Significant Figures

i. A Significant Figure is each digit of a number that are used to express it to the required degree of ACCURACY, starting from the first nonzero digit.

ii. RULES

1. Non-zero digits are always significant
2. Any zeros between two significant digits are significant (sandwiched)
3. A Final zero or trailing zeros in the decimal portion ONLY are significant.

c. Precision vs. Accuracy

i. ACCURACY – How close a measured value is the ACTUAL (true) VALUE

ii. PRECISION – How close the measured values are to each other.