

Name: \_\_\_\_\_ ID#: \_\_\_\_\_

# NORTH CENTRAL HIGH SCHOOL NOTE & STUDY GUIDE

## Honors Biology I

### Unit 1-1: Introduction to Biology

*REQUIRED READING FROM BIOLOGY: CONCEPTS & CONNECTION (CAMPBELL, ET. AL.):  
CHAPTER 1, BIOLOGY: EXPLORING LIFE*

Additional resources available at  
[www.mrdocsonlinelab.com](http://www.mrdocsonlinelab.com)

## Objectives

- \* \_\_\_\_\_
- \* \_\_\_\_\_
- \* \_\_\_\_\_
- \* \_\_\_\_\_
- \* \_\_\_\_\_

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## What is Science?

- \* Science is  
\_\_\_\_\_  
\_\_\_\_\_
- \* The goal of any science is use observations to make predictions.
- \* This means that scientific theories and hypotheses are only as good as  
\_\_\_\_\_  
\_\_\_\_\_

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## The Branches of Science

- \* There are 3 main branches of science:
  - \* \_\_\_\_\_
  - \* Living things
  - \* Matter & Energy
  - \* \_\_\_\_\_
  - \* Duh!

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graph TD;
  NS[Natural Science] --- BS[Biological Science: Science of living things];
  NS --- PS[Physical Science: Science of matter and energy];
  NS --- ES[Earth Science: Science of Earth];
  BS --- Botany;
  BS --- Zoology;
  BS --- Ecology;
  BS --- MB1[Many other branches];
  PS --- Physics[Physics: Forces and energy];
  PS --- Chemistry[Chemistry: Matter and its changes];
  PS --- MB2[Many other branches];
  ES --- Geology;
  ES --- Meteorology;
  ES --- MB3[Many other branches];
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## The Scientific Method

- ✦ The \_\_\_\_\_ is a step-by-step process used to solve a problem.
- ✦ It involves making \_\_\_\_\_, asking \_\_\_\_\_, forming \_\_\_\_\_, making \_\_\_\_\_, designing \_\_\_\_\_, \_\_\_\_\_ data, and drawing \_\_\_\_\_.
- ✦ Most other problem solving models originate with the scientific method.

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## Step 1: Define the Problem

- ✦ The first step to the scientific method is to identify the problem you are trying to solve.
- ✦ This is a most important step because it \_\_\_\_\_  
\_\_\_\_\_
- ✦ It is impossible to solve a problem or find a solution for a problem that does not exist.

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## Step 2: Make Observations

- ✦ An observation is information that is gathered \_\_\_\_\_
- ✦ Observations allow you to learn more about the different aspects of the problem.
- ✦ It is important not to confuse observation with judgment because judgments are not always based on fact.
- ✦ EXAMPLE:
  - ✦ \_\_\_\_\_ (Judgment)
  - ✦ \_\_\_\_\_ (Observation)

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### Step 3: Forming a Hypothesis

- \* A hypothesis is \_\_\_\_\_
- \* All hypotheses have 2 parts:
  - \* A guess: This is your thoughts on the subject and can include a prediction.
  - \* The "Educated" part: This is what lead to you the guess (observations.)
- \* In other words, a hypothesis is what you think and why you think that way.
- \* A hypothesis without reasons is just a guess.

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### Step 4: Testing Hypothesis

- \* Experimentation is often used to test a hypothesis.
- \* Experiments are models in which the conditions are controlled to produce a result.
- \* In an experiment there are 2 groups:
  - \* \_\_\_\_\_: Under "normal" conditions.
  - \* \_\_\_\_\_: Under "test" conditions.

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### Variables

- \* There are 3 types of variables in a controlled experiment:
  - \* \_\_\_\_\_: These are variables that are the same for both groups that are not being tested.
  - \* \_\_\_\_\_: This is the variable that is altered in the "experimental" group. It is the variable being tested.
  - \* \_\_\_\_\_: This is the variable that changes as a result of the independent variable. It is used to measure the results of the experiment.

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## EXPERIMENT: The Effect of Light on Plant Growth



\* Problem: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

\* Control Group: \_\_\_\_\_

\* Experimental Group: \_\_\_\_\_

Constants: \_\_\_\_\_  
\_\_\_\_\_

\* Independent Variable: \_\_\_\_\_

\* Dependent Variable: \_\_\_\_\_  
\_\_\_\_\_

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## Step 5: Analyze Results

- \* The next step is to look at the information that you have generated and try to find meaning.
- \* This is the part of the experiment where \_\_\_\_\_  
\_\_\_\_\_
- \* \_\_\_\_\_  
\_\_\_\_\_ are often used to organize data to make analyzing easier.

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## Step 6: Form a Conclusion Step 7: Publish Results

- \* Once you have analyzed your results, you should be at the point where you can make a final conclusion.
  - \* A conclusion is \_\_\_\_\_
- \* It is important to communicate results of experimentation to others who can attempt to recreate your experiment and so you have a record of what you have done.
- \* If multiple people test a conclusion and find that it is correct, then a \_\_\_\_\_ can be made.
- \* If a theory is proven correct under all circumstances, then it can be established as a \_\_\_\_\_

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## Part I: Science and the Scientific Method

- \_\_\_\_ 1. A scientist noticed that in acidic pond water some salamanders developed with curved spines. This was a(n)
- hypothesis.
  - theory.
  - observation.
  - control.
- \_\_\_\_ 2. Which example of scientific methodology is *incorrect*?
- observation—a number of people in a certain place dying of a disease outbreak
  - measurement—a record of the number of people with symptoms of a disease and the number of people who had died from the disease
  - analysis of data—comparison of the effects of mixing monkey cells with virus-containing blood in test tubes and the effects of mixing liquid from these test tubes with fresh monkey cells
  - inference making—identification of the Ebola virus as the cause of a disease by taking electron micrographs of substances found in the blood of persons affected with the disease
- \_\_\_\_ 3. Physician Ronald Ross wanted to try to find the cause of malaria. Based on his observations, Dr. Ross suggested that the *Anopheles* mosquito might spread malaria from person to person. This is a
- prediction.
  - hypothesis.
  - theory.
  - scientific “truth.”
- \_\_\_\_ 4. Physician Ronald Ross knew that the parasite *Plasmodium* was always found in the blood of malaria patients. He thought that if the *Anopheles* mosquitoes were responsible for spreading malaria, then *Plasmodium* would be found in the mosquitoes. This idea was a
- prediction.
  - hypothesis.
  - theory.
  - scientific “truth.”
- \_\_\_\_ 5. Scientific hypotheses are most often tested by the process of
- communicating.
  - inferring.
  - experimenting.
  - analyzing data.
- \_\_\_\_ 6. A hypothesis is
- a definite answer to a given problem.
  - a testable possible explanation of an observation.
  - a proven statement.
  - a concluding statement.
- \_\_\_\_ 7. A unifying explanation for a broad range of observations is a
- hypothesis.
  - theory.
  - prediction.
  - controlled experiment.
- \_\_\_\_ 8. A hypothesis that does not explain an observation
- is known as an inaccurate forecast.
  - often predicts a different observation.
  - is rejected.
  - None of the above
- \_\_\_\_ 9. Scientists usually design experiments
- with a good idea of the expected experimental results.
  - based on wild guesses.
  - in order to develop new laboratory tools.
  - All of the above
- \_\_\_\_ 10. A scientific theory
- is absolutely certain.
  - is unchangeable.
  - may be revised as new evidence is presented.
  - is a controlled experiment.
- \_\_\_\_ 11. The word *theory* used in a scientific sense means
- a highly tested, generally accepted principle.
  - a guess made with very little knowledge to support it.
  - an absolute scientific certainty.
  - None of the above

\_\_\_\_\_ 12. observation : hypothesis ::

- a. theory : observation
- b. guess : hypothesis
- c. hypothesis : experiment
- d. theory : control

\_\_\_\_\_ 13. Which of the following components of a scientific investigation would benefit from communication between scientists?

- a. observing
- b. measuring
- c. analyzing data
- d. All of the above

\_\_\_\_\_ 14. Typically, the order in which the steps of the scientific method are applied is

- a. observations, predictions, hypothesis, controlled testing, theory, verification.
- b. predictions, observations, hypothesis, theory, controlled testing, verification.
- c. observations, hypothesis, predictions, controlled testing, theory, verification.
- d. observations, hypothesis, predictions, controlled testing, verification, theory.

15. An educated guess, or a(n) \_\_\_\_\_, may be tested by experimentation.

16. Stating in advance the result that may be obtained from testing a hypothesis is called \_\_\_\_\_.

17. A unifying explanation for a broad range of observations is a \_\_\_\_\_.

18. A \_\_\_\_\_ experiment is one in which the condition suspected to cause the effect is compared to the same situation without the suspected condition.

19. The results of an experiment do not support the hypothesis that the experiment was designed to test. Was the experiment a waste of time? Explain.

20. Some scientists conducted an experiment in which they evaluated various measurements of human health in people who drank at least one cup of coffee a day. They found no significant differences in these health indicators between the subjects who drank only one cup of coffee a day and those who drank as many as 20 cups a day. They concluded that coffee has no adverse effects on human health. Write your answers to the following in the spaces below.

a. What were the independent and dependent variables in this experiment?

b. Was this a controlled experiment? If so, what were the control and experimental groups?

c. Do you agree with the conclusion the scientists drew from their results? Why or why not?



## **LANDING PAGE 1**

STAPLE THE ASSIGNMENTS FOR THIS SECTION HERE WHEN YOU GET THE BACK (GRADED) FROM YOUR TEACHER.

# NOTES: The Study of Life

## Objectives

- \* \_\_\_\_\_
- \* \_\_\_\_\_
- \* \_\_\_\_\_
- \* \_\_\_\_\_

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## Biology

- \* **Biology** is the study of life.
- \* "**Bio**" means \_\_\_\_\_, "**ology**" means to study of, or \_\_\_\_\_ (Greek)
- \* Some sub-fields under biology include:
  - \* Zoology (Animals)
  - \* Botany (Plants)
  - \* Genetics (Heredity)
  - \* Ecology (Environment)
  - \* Others?

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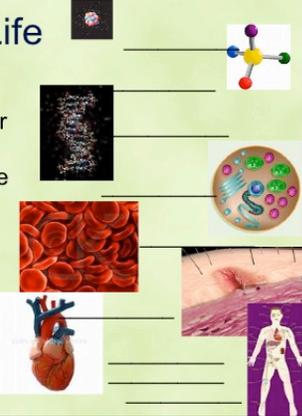
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## Hierarchy of Life

- \* Living things are built up from smaller units.
- \* This is known as the \_\_\_\_\_
- \* Each step is made up of the previous step.
- \* Each step is more complex than the previous.



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## What is Life?

- \* Life can be defined by 8 distinct traits.
- \* ALL living things possess ALL 8 of these characteristics.
- \* If something possesses one of these traits, but not the others, then it is not living.

### \* Characteristics of Life:

- \* \_\_\_\_\_
- \* \_\_\_\_\_
- \* \_\_\_\_\_
- \* \_\_\_\_\_
- \* \_\_\_\_\_
- \* \_\_\_\_\_
- \* \_\_\_\_\_
- \* \_\_\_\_\_

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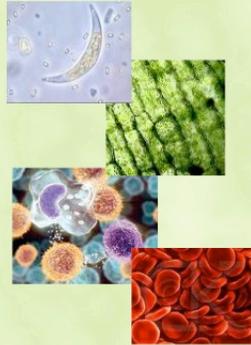
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## Cellular Organization

- \* All living organisms are made up of one or more cells.
  - \* \_\_\_\_\_ - One Cell
  - \* \_\_\_\_\_ - Duh!
- \* A cell is the smallest unit of life.
- \* Cells provide organization and special functions for living things.  
( \_\_\_\_\_ )
- \* Organized and complex are not the same thing.



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## Reproduction & Heredity

- \* Reproduction is an organism abilities to \_\_\_\_\_
- \* \_\_\_\_\_ requires 2 different organisms: a male and female.
- \* \_\_\_\_\_ is the ability to produce offspring without a mate.
- \* \_\_\_\_\_ is an organism's ability to pass on traits to its offspring.
- \* All living things contain DNA, which \_\_\_\_\_
- \* DNA is made up of 4 different nucleotides which are the same for ALL organisms, \_\_\_\_\_
- \* DNA is passed from parent to offspring.

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## Growth and Development

- ✦ Organisms change over time as a species, but rarely as individuals (\_\_\_\_\_)
- ✦ As cells age and produce more organelles, the organism gets bigger (\_\_\_\_\_)
- ✦ As cells mature the ability of these cells to carry out specific function increases (\_\_\_\_\_)
- ✦ Mature organisms have undergone growth and development to meet the needs of the species.



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## Metabolism

- ✦ **Metabolism** is the sum of all the chemical reactions within an organism.
- ✦ This includes the obtaining of materials (\_\_\_\_\_) and converting them into functional energy.
- ✦ Digesting food, filtering & excreting waste are also metabolic functions.
- ✦ Some organisms (photosynthesis in plants and bacteria), while others \_\_\_\_\_

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## Responsiveness

- ✦ Organisms must be able to respond if something threatens its safety or if there is a stimulus that would better benefit the it.
- ✦ All organisms have differing abilities to respond to environmental conditions.
  - ✦ \_\_\_\_\_
  - ✦ \_\_\_\_\_
  - ✦ \_\_\_\_\_
- ✦ Even though a tree can't move like a human, it doesn't mean that it isn't constantly responding to what is going on around it.
  - ✦ \_\_\_\_\_

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## Homeostasis

- \* All organisms must be able to maintain a consistent internal environment.  
\_\_\_\_\_
- \* The ability to maintain a certain temperature, to keep foreign objects out of the body/cells, and to fight off such invaders is homeostatic.  
\_\_\_\_\_
- \* \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

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## Why Should I Care?

- \* Though you may not realize it, or not yet care, Biology is a very important subject when it comes to your "everyday life".
  - \* Knowing that your body needs \_\_\_\_\_  
is biology.
  - \* Knowing which \_\_\_\_\_  
and which to avoid is biology.
  - \* Knowing the \_\_\_\_\_ and  
what they mean is biology.
  - \* \_\_\_\_\_  
is biology.
  - \* \_\_\_\_\_  
as you get older and mature is biology.

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## PART II: The Science of Life

- \_\_\_\_ 1. Biology is the study of
- a. minerals.
  - b. life.
  - c. the weather.
  - d. energy.
- \_\_\_\_ 2. All organisms possess DNA. DNA
- a. creates energy for cells.
  - b. allows sensitivity to environmental stimuli.
  - c. contains information for growth and development.
  - d. captures energy from the sun.
- \_\_\_\_ 3. Which of the following is *not* necessarily a characteristic of living things?
- a. homeostasis
  - b. metabolism
  - c. complexity
  - d. reproduction
- \_\_\_\_ 4. The smallest units that can carry on all the functions of life are called
- a. molecules.
  - b. cells.
  - c. organelles.
  - d. species.
- \_\_\_\_ 5. Living things
- a. need energy for life processes.
  - b. have the ability to reproduce.
  - c. are composed of cells.
  - d. All of the above

- \_\_\_\_\_ 6. All organisms are composed of
- a. diatoms.
  - b. cellulose.
  - c. cells.
  - d. None of the above
- \_\_\_\_\_ 7. All living things maintain a balance within their cells and the environment through the process of
- a. growth.
  - b. development.
  - c. homeostasis.
  - d. evolution.
- \_\_\_\_\_ 8. Which of the following is a characteristic of all living things?
- a. movement
  - b. photosynthesis
  - c. development
  - d. cellular organization
9. To function properly, all living things must maintain a constant internal environment through the process of \_\_\_\_\_.
10. \_\_\_\_\_ is the study of the interaction of organisms with their environment and with each other.
11. Name five characteristics that are considered distinct properties of all living things.
12. Toads that live in hot, dry regions bury themselves in the soil during the day. How might this be important to the toad?



## **LANDING PAGE 2**

STAPLE THE ASSIGNMENTS FOR THIS SECTION HERE WHEN YOU GET THE BACK (GRADED) FROM YOUR TEACHER.2

## NOTES: Biological Themes



### Objectives

- \* \_\_\_\_\_
- \* \_\_\_\_\_
- \* \_\_\_\_\_
- \* \_\_\_\_\_

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### Biological Themes

- \* There are three reoccurring themes that we will focus on through our study of biology.
- \* Despite the variety of subjects covered in biology, these themes can almost always be seen.
  - \* \_\_\_\_\_
  - \* \_\_\_\_\_
  - \* \_\_\_\_\_

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### Unity and Diversity

- \* There are millions of different species on the planet, each with its own unique characteristics. (\_\_\_\_\_)
- \* Despite the large number of different species, all living organisms have similarities. (\_\_\_\_\_)
- \* Even though a tree and a human seem to have nothing in common on the outside, both need a source of energy to survive, both reproduce, contain DNA, respond to stimuli, and grow.

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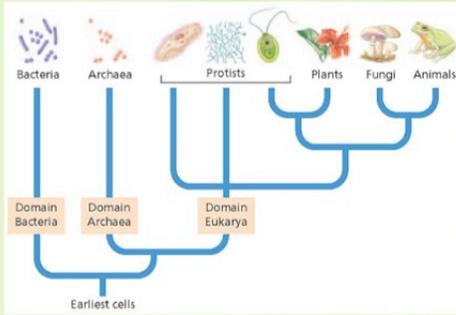
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## Phylogenetic Tree of Life



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## Biology meets Literature

✦ ***"All mankind is of one author, and is one volume; when one man dies, one chapter is not torn out of the book, but translated into a better language; and every chapter must be so translated...As therefore the bell that rings to a sermon, calls not upon the preacher only, but upon the congregation to come: so this bell calls us all...No man is an island, entire of itself...any man's death diminishes me, because I am involved in mankind; and therefore never send to know for whom the bell tolls; it tolls for thee."***

- John Donne

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## Interdependence of Organisms

- ✦ Organisms live in interdependent communities and interact with other organisms and the environment.
- ✦ This means that one type of organism may be dependent on a different type of organism to survive?

✦ Examples?

- ✦ \_\_\_\_\_
- ✦ \_\_\_\_\_
- ✦ \_\_\_\_\_

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## Evolution of Life

- ✦ **Evolution**, or descent with modification, is the process in which the inherited characteristics within populations change over generations.
- ✦ Evolution helps to explain how species came to exist, have changed over time, and adapt to their environment.
- ✦ \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_

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### Part III: Biological Themes

- \_\_\_\_\_ 1. Which of the following is *not* a partial explanation for our lack of understanding of many of the living things on Earth?
- a. Many organisms are microscopic in size and therefore difficult to observe.
  - b. Many organisms are so different from other organisms that it is difficult to understand them.
  - c. Many organisms live in areas of the world that are difficult to explore.
  - d. Tropical rain forests contain many species, and it is difficult to find all of them in these dense forests.
2. Briefly discuss some of the major themes in biology that we will examine this year.
3. Why is it important to study biology even if you are not planning a career in biology?



### **LANDING PAGE 3**

STAPLE THE ASSIGNMENTS FOR THIS SECTION HERE WHEN YOU GET THE BACK (GRADED) FROM YOUR TEACHER.