GEORGIA DEPARTMENT OF EDUCATION

Exam Preparation for Science and Social Studies Program

EXPress

June 14 through June 25
2010

TEACHER

Week One

Georgia High School Graduation Test
Science Content

Cells and Heredity

- Evaluates the nature of the relationships between structures and function in living cells by explaining the roles of cell organelles and by analyzing the function of the four major macromolecules.
- Evaluates how biological traits are passed on to successive generations by comparing and contrasting the roles of DNA and RNA.
- Analyze the role of DNA in storing and transmitting cellular information.
- Explains Mendel's laws and the role of meiosis in reproductive variability.
- Investigates the use of DNA technology in forensics, medicine, and agriculture.
- Derives the relationship between single-celled and multi-celled organisms by analyzing the complexity and organization of organisms in their ability for obtaining, transforming, transporting, releasing, and eliminating the matter and energy used to sustain the organisms.

Ecology

- Describes the interdependence of all organisms on one another and evaluates the relationships among organisms, populations, communities, ecosystems, and biomes.
- Analyzes the flow of matter and energy through ecosystems as components of a food chain or food web.

Structure and Properties of Matter

- Analyzes the structure of the atom in terms of proton, electron, and neutron locations as well as atomic mass, atomic number, atoms with different numbers of neutrons and different numbers of protons.
- Explains properties of solutions.

Energy Transformations

- Distinguishes the characteristics and components of radioactivity and explains the process of half-life as related to radioactive decay.
- Analyzes the atomic/molecular motion of solids, liquids, gases and plasmas.
- Identifies and explains energy transformation within a system.
- Investigates and describes molecular motion as it relates to thermal energy changes in conduction, convection, and radiation.

Forces, Waves, and Electricity

- Analyzes relationships between force, mass, and motion by applying the calculations of velocity and acceleration.
- Evaluates the application of Newton's three laws in everyday situations related to inertia explaining falling objects as related to gravitational force.
- Applies mass and weight to appropriate situations.
- Applies the calculations of work and mechanical advantage to complex systems.
- Analyzes the properties of waves by explaining the transfer of light, heat, and sound energy through the application of wave theory.
- Explains the properties of electricity and magnetism by applying and relating these to electromagnets and simple motors.

<u>**Instructional Calendar at a Glance**</u>

<table>
<tr><th>Day</th><th>Content</th></tr>
<tr><td rowspan="2">Monday
June 14</td><td>Domain: Cells and Heredity
Students describe the structures of cells and the structure and function of their components.
Students examine the similarities and differences between prokaryotic and eukaryotic cells.</td></tr>
<tr><td>Domain: Structure and Properties of Matter
Students describe atoms, understanding the structure of an atom.
Students identify the symbol, atomic number, and atomic mass of the first 20 elements on the periodic table.</td></tr>
<tr><td rowspan="2">Tuesday
June 15</td><td>Domain: Cells and Heredity
Students explain the process of inheritance of genetic traits.
Students differentiate between DNA and RNA, recognizing the role of each in heredity.</td></tr>
<tr><td>Domain: Structure and Properties of Matter
Students apply the properties of solutions, analyzing solutions in terms of solutes and solvents.</td></tr>
<tr><td rowspan="2">Wednesday
June 16</td><td>Domain: Cells and Heredity
Students analyze the similarities and differences between organisms of different kingdoms.</td></tr>
<tr><td>Domain: Energy Transformations
Students understand radioactivity.
Students examine the phases of matter and the related atomic and molecular motion.</td></tr>
<tr><td rowspan="2">Thursday
June17</td><td>Domain: Cells and Heredity
Students explain the process of inheritance of genetic traits.
❖ Students demonstrate understanding of Mendel’s Laws in genetic inheritance and variability.
Students discuss the use of DNA technology in the fields of medicine and agriculture.</td></tr>
<tr><td>Domain: Energy Transformations
Students investigate and describe molecular motion as it relates to thermal energy changes in conduction, convection, and radiation.
Students analyze energy transformations and the flow of energy in systems.</td></tr>
<tr><td rowspan="2">Friday
June 18</td><td>Domain: Cells and Heredity
Students differentiate how organisms from different kingdoms obtain, transform, and transport, energy and/or material.
Students understand the relationships between single-celled and multi-celled organisms, on a broad, conceptual level.</td></tr>
<tr><td>Progress Assessment</td></tr>
</table>

Day	Content
Monday June 21	**Domain: Ecology** • Students evaluate relationships between organisms, populations, communities, ecosystems, and biomes.
	Domain: Forces, Waves, and Electricity ▪ Analyzes relationships between force, mass, and motion by applying the calculations of velocity and acceleration.
Tuesday June 22	**Domain: Ecology** • Students describe the flow of matter and energy through an ecosystem by organizing the components of food chains and webs.
	Domain: Forces, Waves, and Electricity ▪ Students evaluate the application of Newton's three laws in everyday situations related to inertia explaining falling objects as related to gravitational force. ❖ Applies the calculations of work and mechanical advantage to complex systems.
Wednesday June 23	**Domain: Cells and Heredity** • Students differentiate the functions of the macromolecules. • Students describe the structures of cells and the structure and function of their components.
	Domain: Forces, Waves, and Electricity • Students describe the properties of waves.
Thursday June 24	**Domain: Ecology** • Students use diagrams to interpret the interactions of organisms within food chains and webs. • Students determining the role of different organisms in food chains and webs.
	Domain: Forces, Waves, and Electricity • Students understand the properties of electricity and magnetism.
Friday June 25	**Biology Key Concepts – Review**
	Physical Science Key Concepts –Review
	Administration of the Georgia High School Graduation Test

Georgia High School Graduation Test
Science Instructional Plan

<table>
<tr><th colspan="3">Monday, June 14</th></tr>
<tr><td colspan="3">Objective
Domain: Cells and Heredity
• Students examine the similarities and differences between prokaryotic and eukaryotic cells.</td></tr>
<tr><th>Time</th><th>Activity/Task</th><th>Assessment</th></tr>
<tr><td>20 min</td><td>Prokaryotic and Eukaryotic Cell Activity
Provide each student with two baggies; one represents a prokaryotic cell and the other represents a eukaryotic cell. Students will complete a double sided double bubble map on comparing and contrasting each bag (See Monday’s, June 14 materials section). The teacher should draw a double sided double bubble map on chart paper and post it on the board. Each student contributes one attribute to the class double sided double bubble map.
Teacher Note: Teacher will place their suggestions on the class map. Be sure that the class double sided double bubble map contains the information on the Teacher Notes page. (See Teacher Notes page in Monday’s, June 14 materials section).</td><td>Student graphic organizers.
Student participation in classroom discussions.</td></tr>
<tr><td>10 min</td><td>Interactive Notebook
Teacher Note: Students should keep an interactive notebook during the 2 weeks of the ExPreSS program. The notebook can be used to study and engage them in the content.
Students should copy the class double sided double bubble map in their notebooks. Ask students to identify at least one difference and explain why they are different in their notebooks. After everyone has finished, ask the students to share their notebook with a classmate and to have a discussion about their notes.</td><td>Student’s notebooks.</td></tr>
<tr><td>15 min</td><td>Assessment Questions -Prokaryotic vs. Eukaryotic Activity
Give each student an assessment card (see Assessment Cards questions in Monday’s, June 14 materials section). Give students time to think about the answer prior to raising their hands to answer orally. If they are correct they get a new question. Incorrect questions result in another attempt and then individual help. Students only respond by giving the letter of the answer choice. Do this for several minutes and identify any areas that students seem to have problems with. Review these areas with the group.
Teacher Note: Each student has a different question.</td><td>Student’s answer to the questions.</td></tr>
</table>

Monday, June 14 (continuation)		
Time	**Activity/Task**	**Assessment**
10 min	Review Questions The teacher asks students three questions (see Review Questions for biology in Monday's, June 14 materials section) and gives students enough time to write their answers on three different index cards (one for each question). The teacher asks for two or three volunteers to share their answers and write these answers on a bulletin board to be visited again after the activity is completed. *Teacher Note: Ask students to put their names on the index cards and collect them at the end of the activity to provide individual feedback. Return the cards the next day.*	Student's answers to the questions.

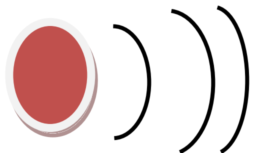
Monday, June 14 (continuation)

Objective
Domain: Cells and Heredity

- Students describe the structures of cells and the structure and function of their components.
    - * describing the roles of cell organelles in the following:
        - information feedback
        - motility
        - obtaining, storing, and using energy
        - protein construction
        - reproduction
        - transport of material
        - waste disposal

Time	Activity/Task	Assessment
15 min	*Cell Structure and Function Activity* Each student has a baggie with the name, structure, cell models, and pictures of the organelles. Ask the students to identify each organelle's picture by placing the name tag on top of it and to match each organelle with its corresponding function (see below for an example). Chloroplasts  **Responsible for photosynthesis** *Teacher Note: Teachers will walk around and assess as they direct students in which organelle is being identified. Give students clues as they determine which picture to choose or give them clues about the function if they are struggling.*	Students demonstrate understanding through the use of the manipulative
15 min	*Cell Structure and Function Activity (continuation)* Students will then draw the organelles in their notebook, describe how it looks and give an analogy to remind them of its function. *Teacher note: The function of the organelles is a major focus of this activity. Relating the functions to different types of cells is also critical. The assessment of this activity should not be a diagram of the cell to label the specific parts but rather a comparison of why some organelles are in some cells but not others. The assessment should also include the relationship of the cell organelles to the life processes (protein synthesis, respiration, photosynthesis, etc.).*	Student's drawing and description of their organelle's

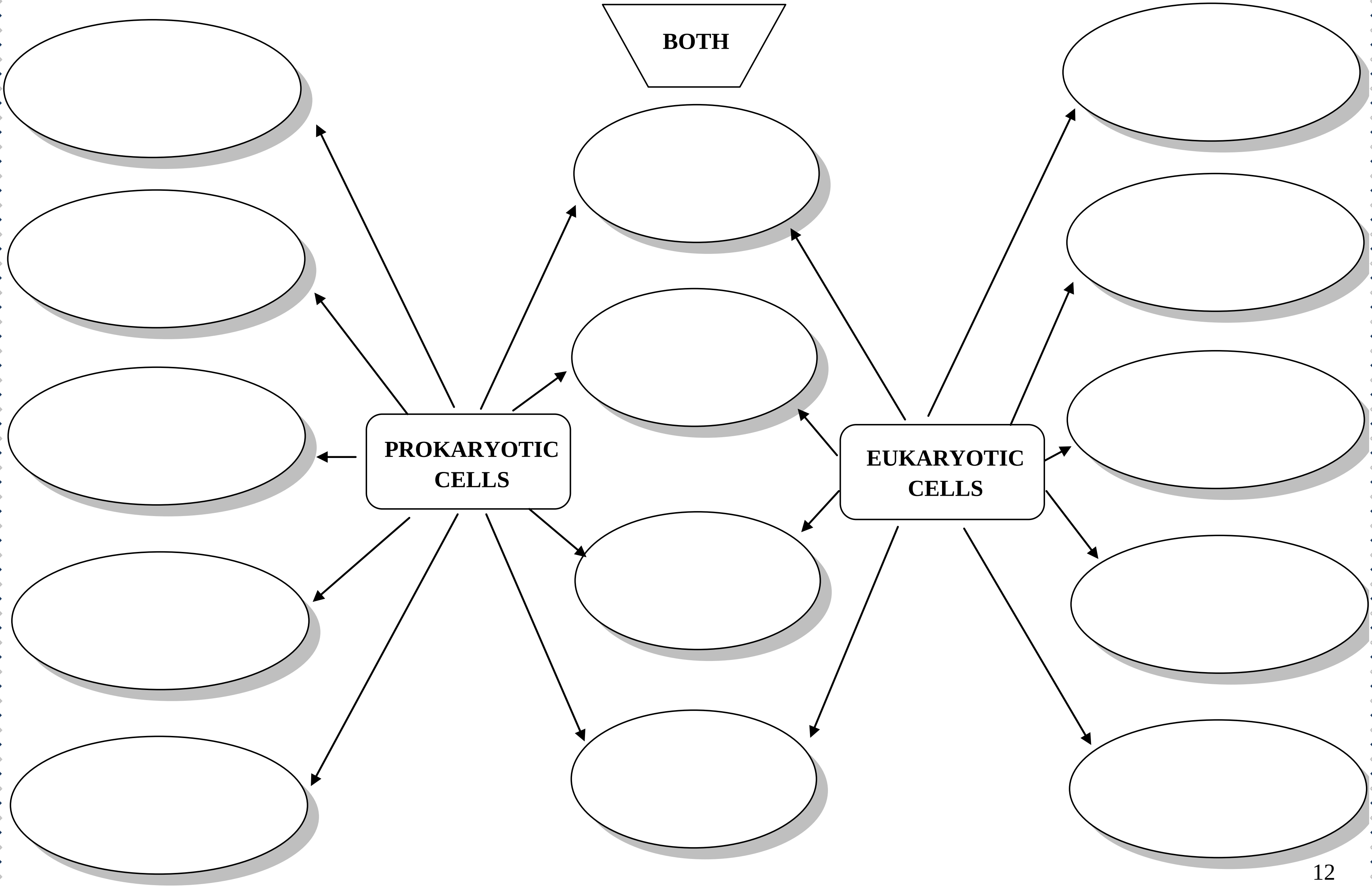
Monday, June 14 (continuation)		
Time	**Activity/Task**	**Assessment**
15 min	*Assessment Questions –Organelle's Functions Activity* Give each student an assessment card (see Assessment Cards questions in Monday's, June 14 materials section). Give students time to think about the answer prior to raising their hands to answer orally. If they are correct they get a new question. Incorrect questions result in another attempt and then individual help. Students only respond by giving the letter of the answer choice. Do this for several minutes and identify any areas that students seem to have problems with. Review these areas with the group. *Teacher Note: Each student has a different question.*	Student's answer to the questions.
20 min	*Review Questions* Provide students with a set of questions (see Review Questions 1 handout in Monday's, June 14 materials section) about the cell organelles, their function and the differences between prokaryotic and eukaryotic cells. Give them 15 minutes to answer the questions individually. Conduct a group discussion of the answer to the questions and ask the students to correct their own answer if necessary and to write an explanation of why the answer needed to be corrected. The explanation must state the original reason the student chose the wrong answer and what makes the correct answer correct.	Student questionnaire

<table>
<tr><th colspan="3">Monday, June 14 (continuation)</th></tr>
<tr><td colspan="3">Objective
Domain: Structure and Properties of Matter
• Students describe atoms, understanding the structure of an atom.
• Students identify the symbol, atomic number, and atomic mass of the first 20 elements on the periodic table.</td></tr>
<tr><th>Time</th><th>Activity/Task</th><th>Assessment</th></tr>
<tr><td>30 min</td><td>Atomic Structure-Activating Strategy
Have students to draw on paper a circle with three half circles beside the circle (see below).

Tell them this is an early model of the atom then ask what the circle represents? What do the half-circles represent? (Electron clouds of different energy levels). Give the students pom-poms of different colors, so that one color represents protons, a different color represents electrons, and a third color represents neutrons. Then ask students to build a model of the lithium atom with their pom-poms or construction paper using only protons and electrons at this point.
Teacher notes: Walk around and assess student knowledge of atomic structure. At this point, direct instruction may be necessary where you ask them which subatomic particle resides in the nucleus and which one resides in the energy levels. Differentiate how many in each level. Then ask students to put the correct number of protons and electrons in an atom of carbon. Give them several other atoms until everyone can build a model of the atom with the correct number of electrons, protons, and neutrons. Point out the fact that the atomic number gives them this info. Differentiate among charges on subatomic particles.</td><td>Students correctly place protons and electrons in the model.</td></tr>
<tr><td>20 min.</td><td>Atomic Mass and Atomic Number
Differentiate between atomic mass number and atomic number on the Periodic Table. Explain that the atomic mass is the mass of the nucleus which includes protons and neutrons. Therefore, if the atomic mass is the number of protons and neutrons and the atomic number tells us the number of protons, everything left over must be neutrons. Make them understand why they subtract the atomic number from the atomic mass. Return to the original lithium atom and have students build it again including neutrons in their model. Give students several to build while you walk around and provide oral feedback on the correctness of the models.</td><td>Students correctly place protons, electrons, and neutrons in the model.</td></tr>
</table>

Monday, June 14 (continuation)		
Time	**Activity/Task**	**Assessment**
10 min	*Structure of the atom* Put the students in groups of three and ask them to complete the first three sections of the anticipation guide Structure of the Atom (see Structure of the Atom anticipation guide in Monday's, June 14 materials section).	Completing the reading anticipation guide.
25 min	*Structure of the atom (continuation)* Either individually or in groups, asks the students to watch the video Physical Science Series: Atomic Structure and the Periodic Table (only the first 11 segments) on unitedstreaming.com. Conduct a round table discussion of the video and ask the students to review their anticipation guide by including any new information that they may have learned.	Round table discussion
20 min	*Structure of the atom* Provide students with the Atomic Structure tiles (see Atomic Structure tiles handout in the Monday materials section) and ask them to answer the questions. *Teacher Notes: Due to time constrains you may want to assign different groups to each student or groups of students and then have the students or groups present the information to the class. If you decide for the latter option, make sure that the students fill in the missing answers in their own tiles.*	Answering the questions for each atom tile.
20 min	*Review Questions 2* Provide students with a set of questions (see Review Questions 2 handout in the Monday materials section) about the structure of the atom and the concepts of atomic number and atomic mass. Give them 15 minutes to answer the questions individually. Conduct a group discussion of the answers to the questions. Ask students to correct their answers if necessary providing an explanation for the correction. The explanation must state the original reason the student choose the wrong answer and what makes the answer choice correct.	Student questionnaire
10 min	*Closing for Physical Science Day 1* Have students do a Think-Pair-Share where they explain to another person how to determine the number of protons, electrons, and neutrons in an atom. While students share, the teacher "cruises" the room and listens for incorrect explanations. If students are still confused, you may have to pull some aside and work with them one-on-one while others are doing a different assignment.	

Monday's, June 14
Materials Section

Double Bubble Double Sided Map of Eukaryotic and Prokaryotic Cells Comparisons

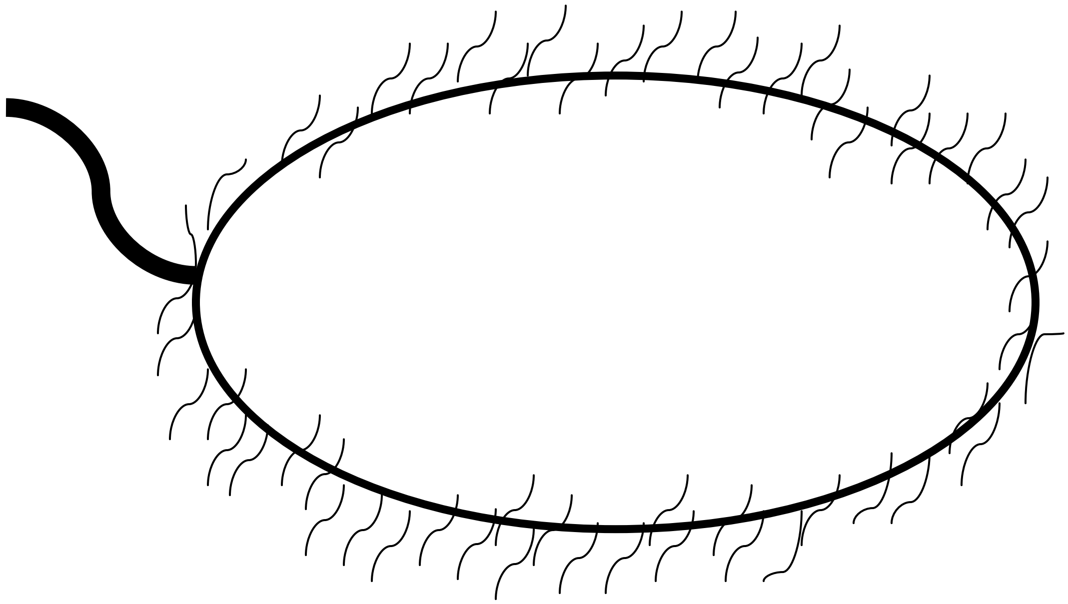


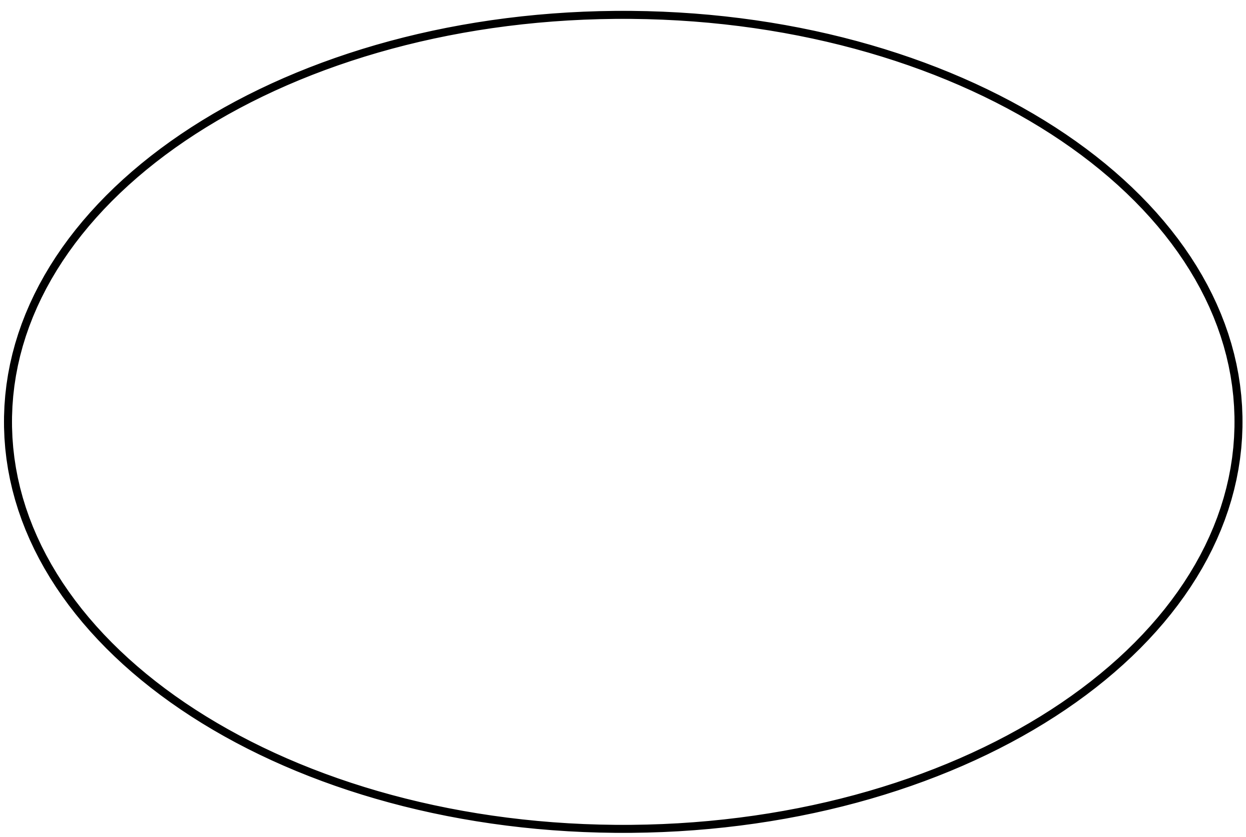
Teacher Notes for the Prokaryotic and Eukaryotic Cells Activity

The following chart represents some of the points the teacher might want to cover in discussing prokaryotic versus eukaryotic cells. Student input in the baggie activity might be as simple as, "one has a lot of stuff and the other one has hardly any parts". Clearly, you as the teacher will need to ask probing questions to get the students to expand on their observations prior to going into the direct instruction.

PROKARYOTES	EUKARYOTES
Typically considered to have no internal membranes, other than cytoplasmic membrane.	Have many internal organelles surrounded by membranes.
No organized nucleus	Have an organized nucleus with nuclear membrane
Few specialized cell organelles (for example - ribosomes without their own membranes)	Contain a variety of specialized membrane enclosed organelles like mitochondria, vacuoles, chloroplasts etc.
Typically contain circular DNA strands called plasmids which do not contain histones	Contains DNA with histones attached; forms chromosomes
Metabolism is often anaerobic (without oxygen), or aerobic (with oxygen)	Most metabolism is aerobic
Mostly unicellular (one-celled)	Both unicellular and multicellular types
Cells are typically small (1 to 10 microns)	Cells are larger (10 to 100 microns)
Classified into Kingdoms of Archaebacteria and Eubacteria.	Classified in Protist (Protista), Fungi, Plant and Animal Kingdoms
Primitive structures	More organized structures

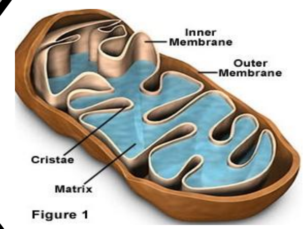
Prokaryotic and Eukaryotic Activity

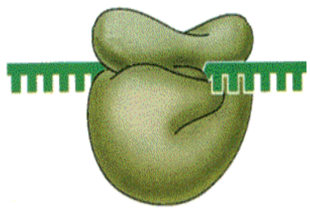




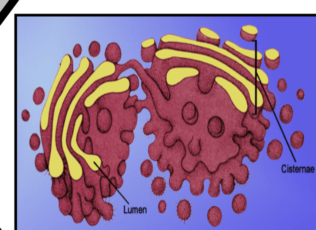
Plant and Animal Cell Activity

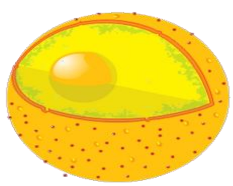
Prokaryotic and Eukaryotic Activity

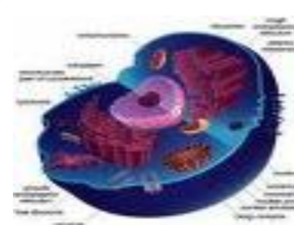


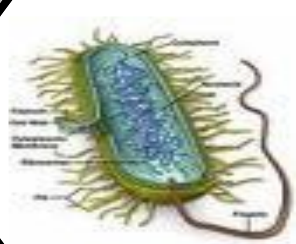


Chromatin









Prokaryotic and Eukaryotic Activity

Cytoplasm

No membrane bound organelles

Membrane bound organelles

Ribosomes

DNA/RNA

No Nucleus

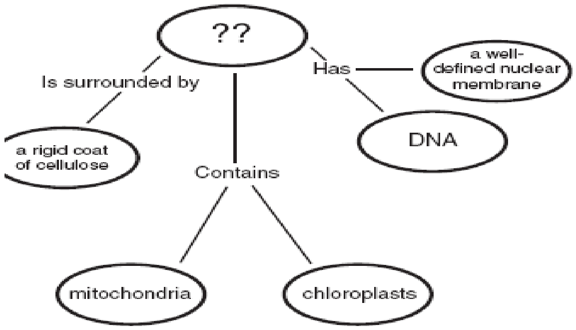
Nucleus

Cell Membrane

Peptidoglycan cell wall

Assessment Cards -Prokaryotic vs. Eukaryotic Activity

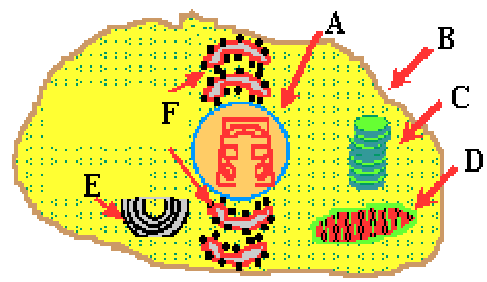
1.



Which of the words below best completes this concept map?

a. Animal Cell
b. Eukaryote
c. Prokaryote
d. Plant Cell

2.



The drawing above is a eukaryotic cell because

a. It has organelles
b. It has a nucleus
c. It's DNA is separate from the rest of the cell
d. All of the above

3.

Which organelle contains a eukaryotic cell's chromosomes?

a. Golgi body
b. Nucleus
c. Cell membrane
d. Nucleolus

4.

Prokaryotic cells are

a. Small
b. Bacteria
c. Surrounded by a cell wall
d. All of the above

5.

One difference in prokaryotic cells and eukaryotic cells is that eukaryotic cells

a. Contain organelles
b. Do not have a nucleus
c. Are all surrounded by a cell wall
d. Are very small compared to prokaryotic cells

6.

In prokaryotic cells, the DNA is

a. Surrounded by a nucleus
b. Physically separated from the rest of the cytoplasm by a membrane
c. Usually coiled and circular
d. Not present

Assessment Cards -Prokaryotic vs. Eukaryotic Activity

7.

In eukaryotic cells, the DNA is

a. Floating free in the cytoplasm
b. Not present
c. Surrounded by a nucleus
d. Found in the cell membrane

8.

Eukaryotic cells are differentiated from prokaryotic cells because eukaryotic cells

a. Are much smaller.
b. Have permeable membranes.
c. Have a higher rate of reproduction.
d. Have nuclei.

9.

A cell that contains no nucleus, is generally smaller than the other, and is considered "primitive" would be classified as

a. A prokaryotic cell
b. A eukaryotic cell
c. Both

10.

A cell is discovered that contains a cell membrane. Biologists might decide it could be

a. A eukaryotic cell
b. A prokaryotic cell
c. Neither a eukaryotic or prokaryotic cell
d. Both a eukaryotic or prokaryotic cell

11.

A cell that contains chloroplasts, a nucleus, and mitochondria is discovered. Biologists might decide it could be

a. A eukaryotic cell
b. A prokaryotic cell
c. Neither a eukaryotic or prokaryotic cell
d. Both a eukaryotic or prokaryotic cell

12.

Bacteria cells are prokaryotic. In comparison to eukaryotic cells they usually

a. Have a smaller nucleus
b. Are smaller
c. Have a greater variety of organelles
d. Have smaller organelle compartments

13.

A cell has mitochondria, ribosomes, smooth and rough ER, and other parts. Based on this information, it could not be

a. A cell from a pine tree
b. A bacterium
c. A yeast (fungus) cell
d. A grasshopper cell

14.

Which of the following clues would tell you whether a cell is prokaryotic or eukaryotic?

a. The presence or absence of a rigid cell wall
b. Whether or not the cell is partitioned by internal membranes
c. The presence or absence of ribosomes
d. Whether or not the cell carries out reproduction

Index Card Questions for Biology

1. What structures can be identified in a typical animal or plant cell?

2. Compare prokaryotic and eukaryotic cells.

3. Describe the role of the cell membrane in maintaining homeostasis.

4. Which of the following statements about plant and animal cells is true?

   A. Plant cells have a nucleus and a cell wall; animal cells do not have either of these structures.
   B. Plant cells have a cell wall and chloroplasts; animal cells do not have either of these structures.
   C. Plant cells have a cell wall and a cell membrane; animal cells have a cell wall but not a cell membrane.
   D. Plant cells have chloroplasts and mitochondria; animal cells have chloroplasts but do not have mitochondria.

5. Which of these is a function of the cell membrane in all cells?

   A. Producing cellular nutrients.
   B. Preserving cellular wastes.
   C. Neutralizing chemicals.
   D. Maintaining homeostasis.

6. In which organelle are proteins produced?

   I. nucleus
   II. lysosome
   III. ribosome
   IV. mitochondria

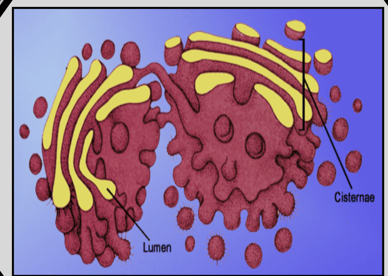
7. **Experimental Observations**

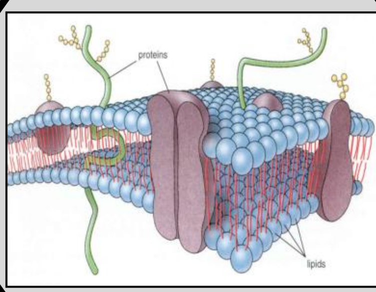
   1. Nucleus is present.
   2. Cell wall is present.
   3. Chloroplasts and mitochondria are both present.

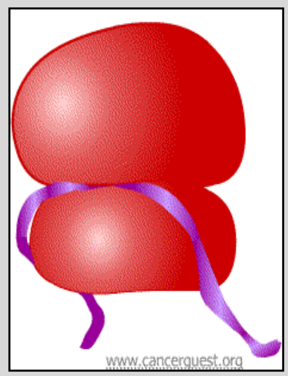
The eukaryotic organism described above should be classified as

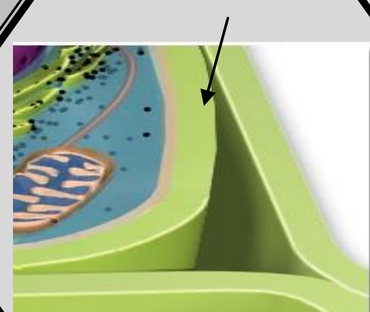
A. an animal
B. a bacterium
C. a fungus
D. a plant

Cell Structure and Function Activity

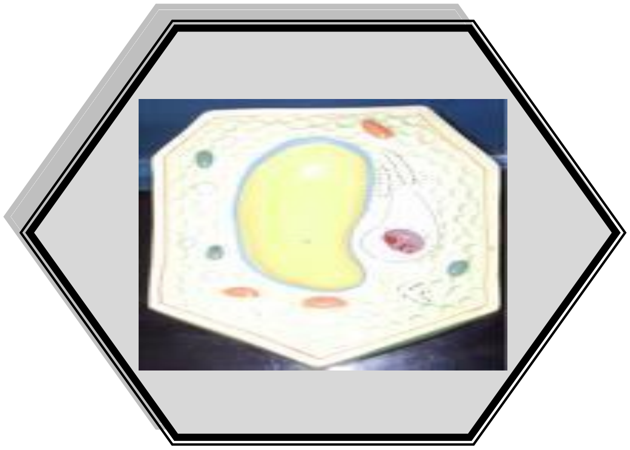


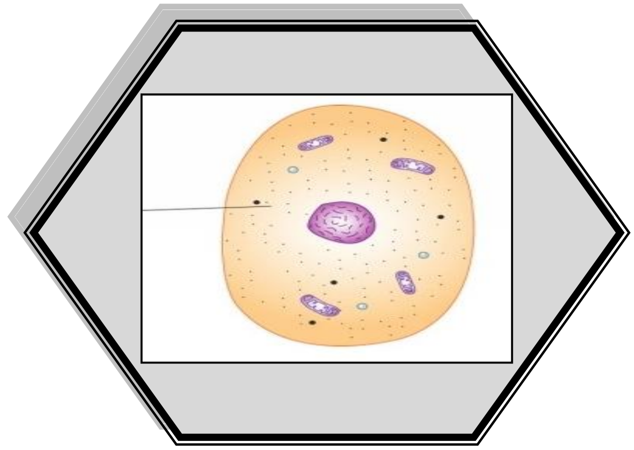


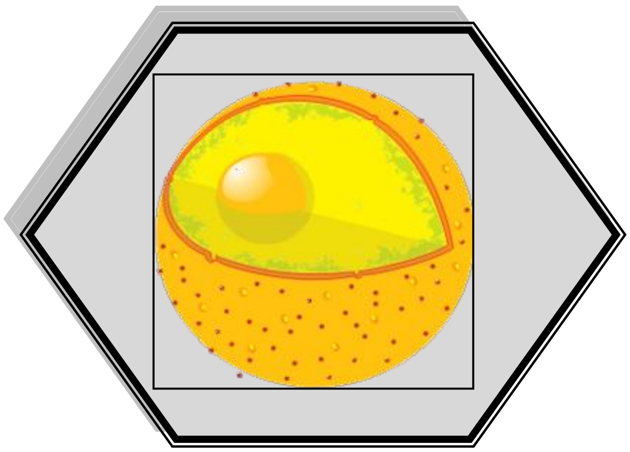


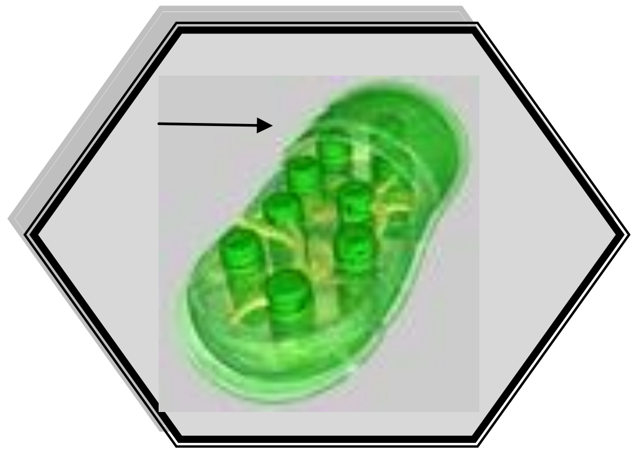


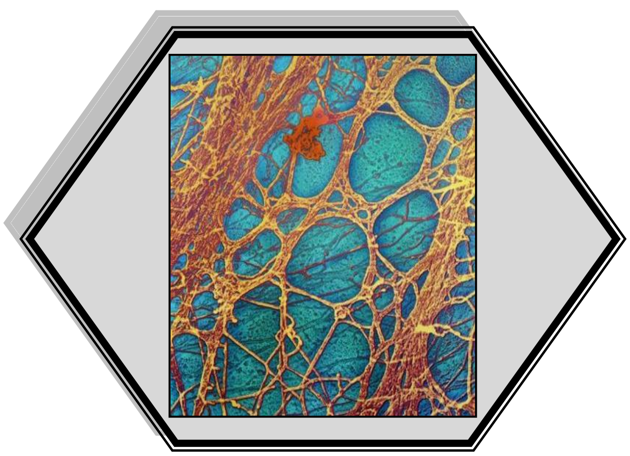
Cell Structure and Function Activity

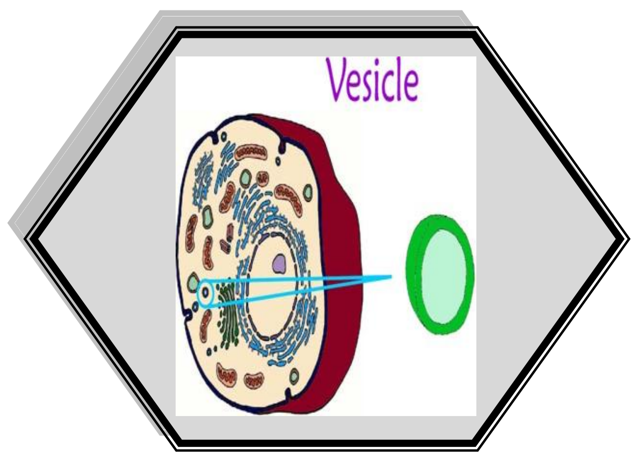




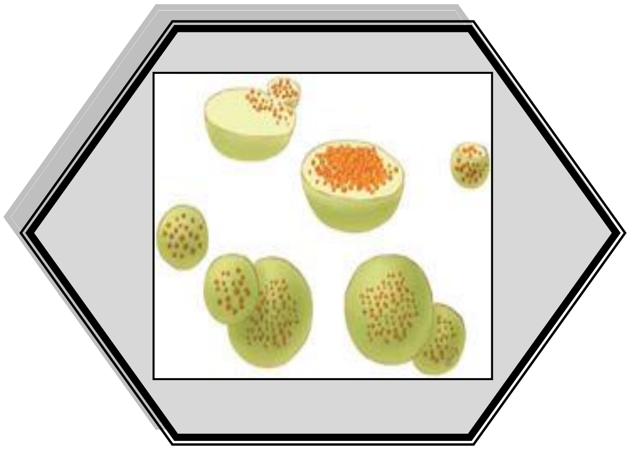








Cell Structure and Function Activity



Cell Structure and Function Activity

Bathes the organelles in fluid

Involved in cell division

Provides a “skeleton” for the cell

Produces energy for the cell

Protects the cell

Removes wastes from the cell

Stores water & nutrients

Responsible for photosynthesis

Modifies or changes proteins & lipids

Controls the cell

Builds protein

Supports and protects the cell

Makes ribosomes

Packages proteins for transport out of the cell

Transports materials from the Golgi to the cell membrane

Cell Structure and Function Activity

NUCLEUS	RIBOSOMES
CHOLOROPLAST	MITOCHONDRIA
CELL WALL	LYSOSOME
VACUOLE	NUCLEOLUS
ENDOPLASMIC RETICULUM	CELL MEMBRANE
GOLGI BODY	CYTOSKELETON
VESICLES	CYTOPLASM

Assessment Cards –Organelle's Function Activity

1.

Plant and animal cells are similar in structure, function, and development. What does the plant cell have that the animal cell does not have?

a. Nucleus
b. Cell membrane
c. Organelles
d. Cell wall

2.

Cellular respiration is to the mitochondria as photosynthesis is to the

a. Endoplasmic reticulum
b. Nucleus
c. Golgi
d. Chloroplast

3.

A researcher made an interesting observation about a protein made by the ribosome and eventually used to build a cell's plasma membrane. The protein in the membrane was actually slightly different from the protein made in the ribosome. The protein was probably changed in the

a. Golgi apparatus
b. Endoplasmic reticulum
c. mitochondrion
d. nucleus

4.

Genetic information is stored in the

a. RNA molecule
b. ATP molecule
c. DNA molecule
d. Ribosome

5.

The cell organelle shown on this photograph is responsible for

a. Controlling the cell
b. Cellular respiration
c. Transporting proteins across the cell membrane
d. Modifying proteins and carbohydrates

6.

Of the following organelles, which group is involved in manufacturing substances needed by the cell?

a. lysosome, vacuole, ribosome
b. ribosome, rough ER, smooth ER
c. vacuole, rough ER, smooth ER
d. smooth ER, ribosome, vacuole
e. rough ER, lysosome, vacuole

Assessment Cards –Organelle's Function Activity

7.

Which organelle is directly involved in cellular transport?

a. Chloroplast
b. Mitochondria
c. Endoplasmic reticulum
d. Lysosome

8.

Which of the following correctly matches an organelle with its function?

a. mitochondrion . . . photosynthesis
b. nucleus . . . cellular respiration
c. ribosome . . . manufacture of lipids
d. lysosome . . . movement
e. central vacuole . . . storage

9.

You would expect a cell with an extensive Golgi apparatus to

a. make a lot of ATP
b. secrete a lot of material
c. move actively
d. perform photosynthesis
e. store large quantities of food

10.

To enter or leave a cell, substances must pass through

a. a microtubule
b. the Golgi apparatus
c. a ribosome
d. the nucleus
e. the cell membrane

11.

The organelle responsible for the breakdown of carbohydrates is the

a. Ribosome
b. Mitochondria
c. Chloroplast
d. Nucleus

12.

Plant and animal cells are similar in structure, function, and development. What does the plant cell have that the animal cell does not have?

a. Nucleus
b. Cell membrane
c. Organelles
d. Cell wall

13.

The organelle most directly involved in cellular aerobic respiration is the

a. ribosome
b. mitochondrion
c. nucleus
d. lysosome
e. Golgi apparatus

14.

The organelle most closely associated with the manufacture of proteins within the cell is the

a. ribosome
b. lysosome
c. nucleolus
d. cell wall
e. cell membrane

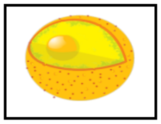
Assessment Cards –Organelle's Function Activity

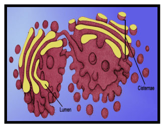
15.

Which of the following organelles is NOT found in animals?

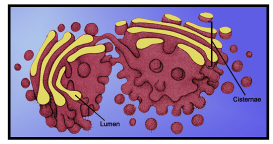
a. 

C. 

b. 

D. 

16.



What is the function of the organelle shown above in cells?

a. Provide the cell with energy
b. Carry out cellular respiration
c. Expel cellular wastes
d. Package and store proteins

17.

The cell has up to several thousands of these tiny organelles scattered in its cytoplasm. They are often called "cellular power plants," because they convert organic materials into energy.

a. Mitochondria
b. Ribosomes
c. Chloroplasts
d. Nuclei

18.

Which of these is not among the vacuole's functions in the cell?

a. Exporting unwanted substances
b. Production of energy
c. Maintaining the internal pH
d. Capturing food materials

19.

The cell's primary site of ATP production is the

a. mitochondria
b. lysosomes
c. nucleus
d. nucleolus
e. vacuoles

20.

Which cell parts are only found in plant cells?

a. chloroplast and ribosomes
b. mitochondria and ribosomes
c. cell wall and nucleus
d. chloroplast and cell wall

<u>**Index Card Questions for Physical Science**</u>

1. Compared to the charge and mass of a proton, an electron has

   A. the same charge and a smaller mass
   B. the same charge and the same mass
   C. an opposite charge and a smaller mass
   D. an opposite charge and the same mass

2. Which symbols represent atoms that are isotopes?

   A. C-14 and N-14
   B. O-16 and O-18
   C. I-131 and I-131
   D. Rn-222 and Ra-222

3. Which atom contains exactly 15 protons?

   A. P-32
   B. S-32
   C. O-15
   D. N-15

4. What is the mass number of an atom which contains 28 protons, 28 electrons, and 34 neutrons?

   A. 28
   B. 56
   C. 62
   D. 90

5. The mass number of an element is 19 and the atomic number is 9. The total number of electrons in the atom is:

   A. 19
   B. 9
   C. 29
   D. 10

6. The atom z has a mass number of 32. It contains in its nucleus:

   A. 32 protons
   B. 32 protons and 32 electrons
   C. a total of 40 protons and neutrons
   D. 16 protons and 16 neutrons

1 H 1 1							2 He 4 2
3 Li 7 2-1	4 Be 9 2-2	5 B 11 2-3	6 C 12 2-4	7 N 14 2-5	8 O 16 2-6	9 F 19 2-7	10 Ne 20 2-8

Table 1

7. Based on the table above, the total number of electrons in an atom of any element equals which of the following quantities?

   A. The element's atomic mass
   B. The element's atomic number
   C. The sum of the element's atomic mass and the element's atomic number
   D. The difference between the element's atomic mass and the element's atomic number

Cell Organelles

Name: ____

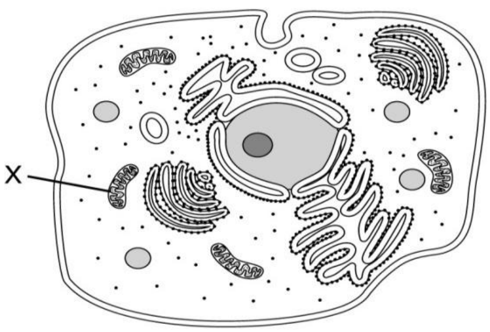
Organelle	Prokaryotic or Eukaryotic or Both	Plant or Animal or Both	Location in cell [nucleus or cytoplasm]	Describe the function
Nucleus				
Cell Membrane				
Cytoplasm				
Ribosomes				
Endoplasmic Reticulum				
Golgi Apparatus				
Lysosomes				
Mitochondria				
Chloroplasts				
Cell Wall				
Plasmid				
Chromosome				

Review Questions 1
Cell Organelles: Structure and Function

1. Which cell structure is a passageway for materials, provides protection, and allows cell recognition?

   A. cell membrane
   B. Golgi apparatus
   C. mitochondrion
   D. nucleus

2. This diagram represents structures within an animal cell.



   Structure X is a mitochondrion. What is the function of structure X?

   A. to make new cells
   B. to make cellular energy
   C. to store information
   D. to control movement

3. Which type of organelle allows glucose to enter cells?

   A. cell membrane
   B. mitochondria
   C. nucleus
   D. ribosomes

4. Which organelle breaks down food into particles the cell can use?

   A. Golgi apparatus
   B. lysosome
   C. endoplasmic reticulum
   D. mitochondrion

5. Which organelle makes proteins using coded instructions that come from the nucleus?

   A. Golgi apparatus
   B. mitochondrion
   C. vacuole
   D. ribosome

6. Which organelles help provide cells with energy?

   A. mitochondria and chloroplasts
   B. rough endoplasmic reticulum
   C. smooth endoplasmic reticulum
   D. Golgi apparatus and ribosomes

7. Which of the following is a function of the cell membrane?

   A. breaks down lipids, carbohydrates, and proteins from foods
   B. stores water, salt, proteins, and carbohydrates
   C. keeps the cell wall in place
   D. regulates which materials enter and leave the cell

8. Which organelle is the principal site of protein synthesis in eukaryotic cells?

   A. Nucleus
   B. Ribosomes
   C. Mitochondria
   D. Chloroplasts

9. Which of these is a function of the cell membrane in all cells?

   A. Producing cellular nutrients.
   B. Preserving cellular wastes.
   C. Neutralizing chemicals.
   D. Maintaining homeostasis.

10. In which organelle are proteins produced?

    A. nucleus
    B. lysosome
    C. ribosome
    D. mitochondria

11. Which of the following clues would tell you whether a cell is prokaryotic or eukaryotic?

    A. the presence or absence of a rigid cell wall
    B. whether or not the cell is partitioned by internal membranes
    C. the presence or absence of ribosomes
    D. whether or not the cell carries out cellular metabolism

12. You would expect a cell with an extensive Golgi apparatus to

    A. make a lot of ATP
    B. secrete a lot of material
    C. move actively
    D. store large quantities of food

13. Of the following organelles, which group is involved in manufacturing substances needed by the cell?

    A. lysosome, vacuole, ribosome
    B. ribosome, rough ER, smooth ER
    C. vacuole, rough ER, smooth ER
    D. smooth ER, ribosome, vacuole

14. Some unicellular organisms are mobile (have the ability to move) and some are nonmobile. Which cellular structures are associated with movement?

    A. Ribosomes
    B. Flagella
    C. Chloroplasts
    D. Vacuoles

15. Which characteristic of prokaryotic organisms makes them different from eukaryotes?

    A. Prokaryotic cells do not have membrane-bound organelles.
    B. Prokaryotes do not have chromosomes.
    C. Prokaryotes are made of cells.
    D. Prokaryotes have DNA.

16. A cell with numerous ribosomes is probably specialized for

    A. enzyme storage
    B. energy production
    C. cell division
    D. protein synthesis

Names:			

Structure of the Atom

What I know I know	
What I think I know	
What I think I will learn	
What I have learned	

Atomic Structure Tiles

1. How many protons would this element have? 2. How many electrons? 3. How many neutrons? 4. If the isotope of lithium, Li-9 were given to you, how many neutrons would you have? 5. How many valence electrons are in an atom of this element? 6. How will this atom bond? 7. Will it lose, gain, or share electrons?	1. How many protons would this element have? 2. How many electrons? 3. How many neutrons? 4. If the isotope of beryllium, Be-13 were given to you, how many neutrons would you have? 5. How many valence electrons are in an atom of this element? 6. How will this atom bond? 7. Will it lose, gain, or share electrons?	1. How many protons would this element have? 2. How many electrons? 3. How many neutrons? 4. If the isotope of boron, B-12 were given to you, how many neutrons would you have? 5. How many valence electrons are in an atom of this element? 6. How will this atom bond? 7. Will it lose, gain, or share electrons?	1. How many protons would this element have? 2. How many electrons? 3. How many neutrons? 4. If the isotope of carbon, C-16 were given to you, how many neutrons would you have? 5. How many valence electrons are in an atom of this element? 6. How will this atom bond? 7. Will it lose, gain, or share electrons?
3 **Li** 6.94	4 **Be** 9.01	5 **B** 10.81	6 **C** 12.01

Atomic Structure Tiles

1. How many protons would this element have? **2. How many electrons?** **3. How many neutrons?** **4. If the isotope of nitrogen, N-18 were given to you, how many protons & electrons would you have?** 5. **How many valence electrons are in an atom of this element?** 6. **How will this atom bond?** 7. **Will it lose, gain, or share electrons?**	**1. How many protons would this element have?** **2. How many electrons?** **3. How many neutrons?** **4. If the isotope of oxygen O-17 were given to you, how many neutrons would you have?** 5. **How many valence electrons are in an atom of this element?** 6. **How will this atom bond?** 7. **Will it lose, gain, or share electrons?**	**1. How many protons would this element have?** **2. How many electrons?** **3. How many neutrons?** **4. If the isotope of fluorine, F-25 were given to you, how many neutrons would you have?** 5. **How many valence electrons are in an atom of this element?** 6. **How will this atom bond?** 7. **Will it lose, gain, or share electrons?**	**1. How many protons would this element have?** **2. How many electrons?** **3. How many neutrons?** **4. If the isotope of neon, Ne-22 were given to you, how many neutrons would you have?** 5. **How many valence electrons are in an atom of this element?** 6. **How will this atom bond?** 7. **Will it lose, gain, or share electrons?**
7 **N** 14.01	8 **O** 16.00	9 **F** 19.00	10 **Ne** 20.18

Atomic Structure Tiles

1. How many protons would this element have? 2. How many electrons? 3. How many neutrons? 4. If the isotope of sodium, Na-27 were given to you, how many neutrons would you have? 5. How many valence electrons are in an atom of this element? 6. How will this atom bond? 7. Will it lose, gain, or share electrons?	1. How many protons would this element have? 2. How many electrons? 3. How many neutrons? 4. If the isotope of magnesium, Mg-26 were given to you, how many neutrons would you have? 5. How many valence electrons are in an atom of this element? 6. How will this atom bond? 7. Will it lose, gain, or share electrons?	1. How many protons would this element have? 2. How many electrons? 3. How many neutrons? 4. If the isotope of aluminum, Al-30 were given to you, how many neutrons would you have? 5. How many valence electrons are in an atom of this element? 6. How will this atom bond? 7. Will it lose, gain, or share electrons?	1. How many protons would this element have? 2. How many electrons? 3. How many neutrons? 4. If the isotope of silicon, Si-29 were given to you, how many neutrons would you have? 5. How many valence electrons are in an atom of this element? 6. How will this atom bond? 7. Will it lose, gain, or share electrons?
11 **Na** 22.99	12 **Mg** 24.31	13 **Al** 26.98	14 **Si** 28.09

Atomic Structure Tiles

1. How many protons would this element have? 2. How many electrons? 3. How many neutrons? 4. If the isotope of phosphorus, P-32 were given to you, how many neutrons would you have? 5. How many valence electrons are in an atom of this element? 6. How will this atom bond? 7. Will it lose, gain, or share electrons?	1. How many protons would this element have? 2. How many electrons? 3. How many neutrons? 4. If the isotope of sulfur, S-35 were given to you, how many neutrons would you have? 5. How many valence electrons are in an atom of this element? 6. How will this atom bond? 7. Will it lose, gain, or share electrons?	1. How many protons would this element have? 2. How many electrons? 3. How many neutrons? 4. If the isotope of chlorine, Cl-39 were given to you, how many neutrons would you have? 5. How many valence electrons are in an atom of this element? 6. How will this atom bond? 7. Will it lose, gain, or share electrons?	1. How many protons would this element have? 2. How many electrons? 3. How many neutrons? 4. If the isotope of argon, Ar-42 were given to you, how many neutrons would you have? 5. How many valence electrons are in an atom of this element? 6. How will this atom bond? 7. Will it lose, gain, or share electrons?
15 **P** 30.97	16 **S** 32.07	17 **Cl** 35.45	18 **Ar** 39.95

Atomic Structure Tiles

1. How many protons would this element have? **2. How many electrons?** **3. How many neutrons?** **4. If the isotope of potassium, K-41 were given to you, how many neutrons would you have?** 5. **How many valence electrons are in an atom of this element?** 6. **How will this atom bond?** 7. **Will it lose, gain, or share electrons?**	**1. How many protons would this element have?** **2. How many electrons?** **3. How many neutrons?** **4. If the isotope of calcium, Ca-42 were given to you, how many neutrons would you have?** 5. **How many valence electrons are in an atom of this element?** 6. **How will this atom bond?** 7. **Will it lose, gain, or share electrons?**	**1. How many protons would this element have?** **2. How many electrons?** **3. How many neutrons?** **4. If the isotope of hydrogen, H-3 were given to you, how many neutrons would you have?** 5. **How many valence electrons are in an atom of this element?** 6. **How will this atom bond?** 7. **Will it lose, gain, or share electrons?**	**1. How many protons would this element have?** **2. How many electrons?** **3. How many neutrons?** **4. If the isotope of helium, He-5 were given to you, how many neutrons would you have?** 5. **How many valence electrons are in an atom of this element?** 6. **How will this atom bond?** 7. **Will it lose, gain, or share electrons?**
19 **K** 39.10	20 **Ca** 40.08	1 **H** 1.01	2 **He** 4.00

Review Questions 2
The Atom and its Structure

1. Compared to the charge and mass of a proton, an electron has

   A. the same charge and a smaller mass
   B. the same charge and the same mass
   C. an opposite charge and a smaller mass
   D. an opposite charge and the same mass

2. Which symbols represent atoms that are isotopes?

   A. C-14 and N-14
   B. O-16 and O-18
   C. I-131 and I-131
   D. Rn-222 and Ra-222

3. The nucleus of sodium-23 contains:

   A. 23 protons and 11 neutrons
   B. 23 protons and 11 electrons
   C. 11 protons and 12 electrons
   D. 11 protons and 12 neutrons

4. Which pair of elements is MOST similar?

   A. Ca and F
   B. Na and Cl
   C. Ne and Ar
   D. Li and H

5. The mass number of an element is 19 and the atomic number is 9. The total number electrons in the atom is:

   A. 19
   B. 9
   C. 29
   D. 10

6. Which of the following pairs are isotopes of the same element?

   A. atom J (27 protons, 32 neutrons) and atom L (27 protons, 33 neutrons)
   B. atom Q (56 protons, 81neutrons) and atom R (57 protons, 81 neutrons)
   C. atom V (8 protons, 8 neutrons) and atom W (7 protons, 8 neutrons)
   D. atom S (17 protons, 18 neutrons) and atom T (18 protons, 17 neutrons)

7. Which of the following are transferred or shared when two atoms react chemically?

   A. protons
   B. neutrons
   C. electrons
   D. photons

8. The illustration below shows the box from the Periodic Table that represents the element Oxygen (O)

8
O
15.999

   Based on the information provided, how many neutrons do most oxygen atoms contain in their nucleus?

   A. 4
   B. 6
   C. 8
   D. 15

Teacher Notes for Interactive Notebook

Students would be well served by keeping an interactive notebook during the 2 week ExPreSS period. The notebook can be used to study and engage them in the content. Some examples of several ways to make a notebook interactive are shown below.

Physical Science:

Atoms-Figure 1: Students can cut a piece of paper into three sections then glue the top of it into the notebook. Teachers can assign different students different atoms. Figure 2 shows how students can draw the parts of the atom underneath the top sheet.

Figure 1

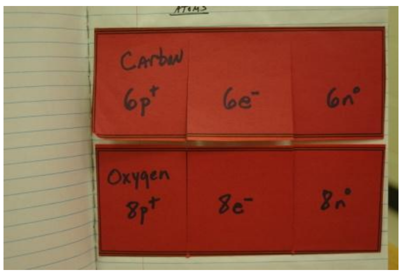
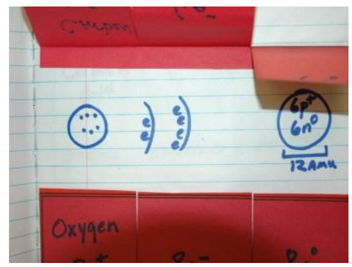
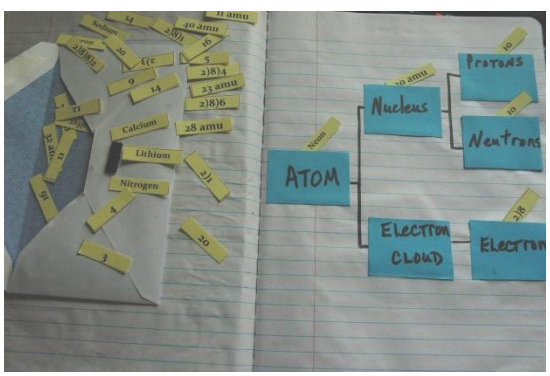


Figure 2



Atoms-Figure 3: To study the atom, have students glue small "pockets" into the notebook with a variety of atoms and their subatomic particle numbers available for them to place into the correct pocket.

Figure 3



Biology:

Cell Structures - Figures 5 & 6: Students can make an interactive study site in their notebook for cell structures and functions. Provide each student with the Cell Structure and Function manipulatives and have them create a cell structures study guide where they create “pockets”. They can place the structures, function or name in the pockets. Others are glued directly onto the paper. Students may then exchange notebooks with each other to determine if they can put the correct answers in each pocket.

Figure 5

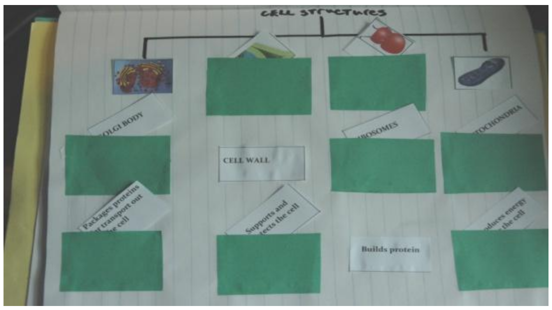


Figure 6

DNA vs. RNA –Figure 7: Pockets can be glued into student notebooks where one side is RNA only, the other is DNA only, and the center is BOTH. Students then have RNA and DNA descriptions on small cards stored in an envelope on the left of the page. Students can categorize the descriptions based upon where they belong. Template for this is in Table 1.

Figure 7

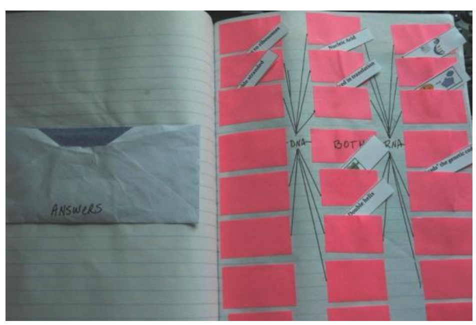
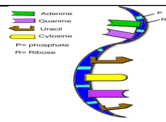
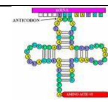
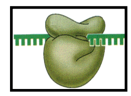


Table 1: DNA vs. RNA Template

Contains thymine	**Contains adenine**	**Contains guanine**	**Contains cytosine**
Contains uracil	**Double stranded**	**Single stranded**	**Deoxyribose sugar**
Ribose sugar	**Stays in the nucleus**	**Leaves the nucleus**	**Involved in transcription**
Involved in translation	**Attaches to ribosomes**	**Provides genetic code**	**Nucleic Acid**
Messenger, transfer, & ribosomal	**"Reads" the genetic code**	**Made up of nucleotides**	**Double helix**
			

Food Chains –Figures 8 & 9: Students can glue small "flaps" into their notebooks and can organize pictures of different food chains into the correct order. Teachers can check each student to make sure they understand the flow of energy correctly. If you have different food chains, students can exchange with each other after they have been checked.

Figure 8

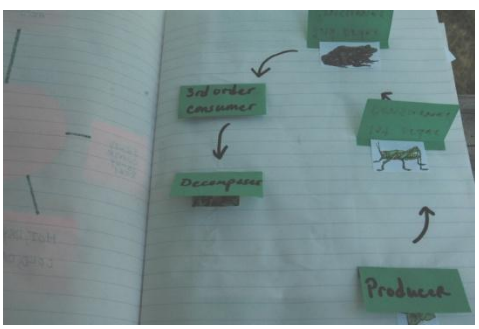
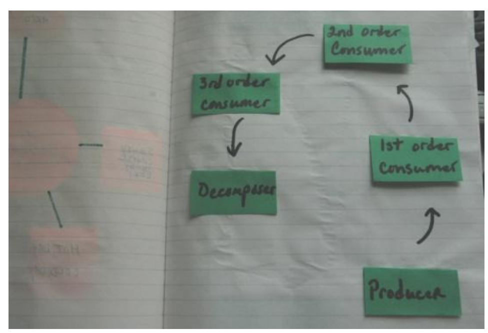
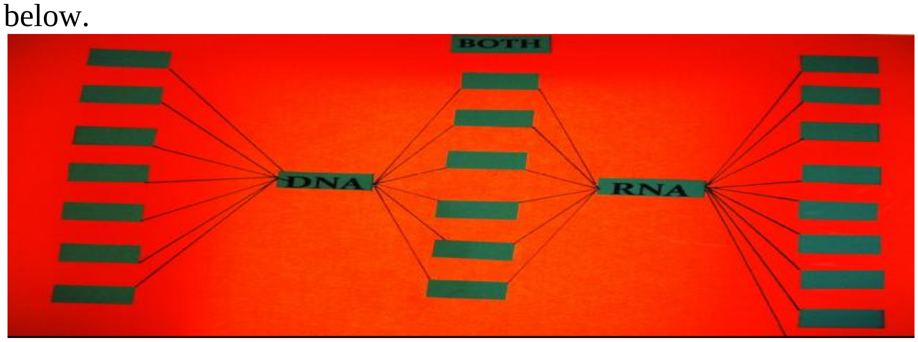
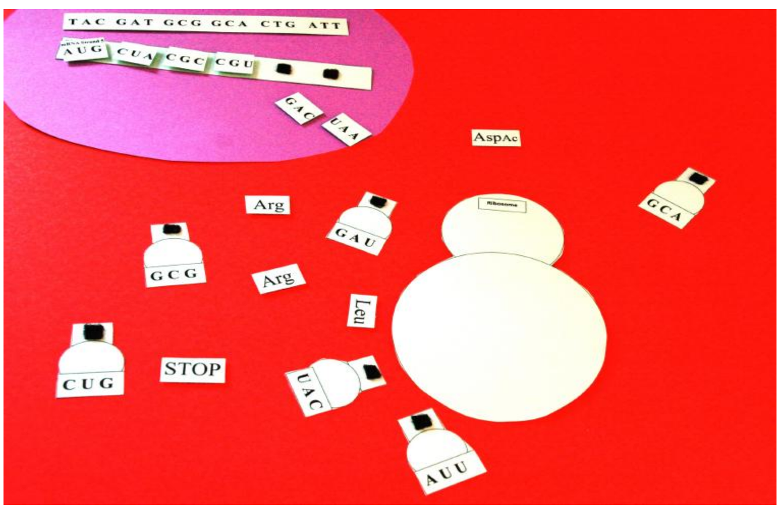


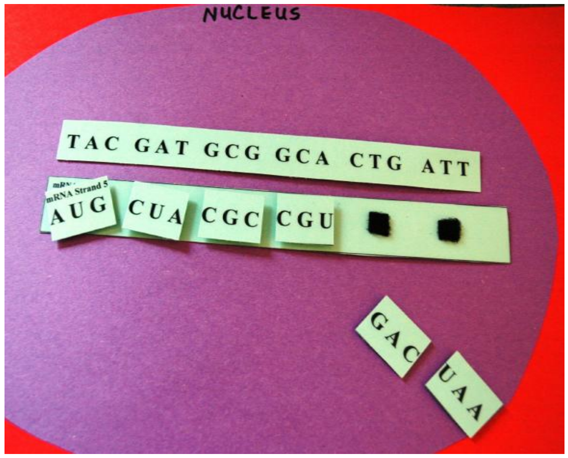
Figure 9



Tuesday, June 15		
Objective **Domain: Cells and Heredity** • Students explain the process of inheritance of genetic traits. • Students differentiate between DNA and RNA, recognizing the role of each in heredity.		
Time	**Activity/Task**	**Assessment**
10 min	*Activating Strategy – DNA and RNA* The teacher provides students with a list of terms (see Term Tiles on the Tuesday's, June 15 Warm up Activity) and asks the students to group the terms into categories based on prior knowledge. Students are then asked to come up with a label for each grouping. The teacher will facilitate a class discussion by asking different pairs to share their groupings.	Students complete groupings and provide explanation.
10 min	*Exploring students ideas: DNA and RNA Anticipation Guide* Transition into lesson by asking students what they think the topic of the lesson will be and discuss the standard and element making sure that students understand the language of the standard. Students then complete the Anticipation Guide for DNA/RNA (see Tuesday's, June 15 Materials Section).	Completion of the anticipation guide.
25 min	*DNA and RNA Activity Cards* Provide students with a poster board as the one shown on the picture below.  Ask the students to place each word in the correct box if it only describes DNA, only describes RNA or in the center boxes if it describes both molecules. After the students complete the table provide them with reading material about DNA and RNA. Allow students time to read the material (aloud in groups, individually, jigsaw, etc.) After reading, students make adjustments to their organizer. Have a short class discussion about differences and similarities of DNA and RNA. Students complete the after section of the Anticipation Guide. Have students write a short summary about DNA and RNA. Use this information as a formative assessment. *Teacher Notes: Materials for this activity are provided for you and there is also an electronic copy of all the materials on the Tuesday materials section of this instructional booklet.*	Rationale for Classification handout. Students completing the chart.

Tuesday, June 15 (continuation)		
Time	**Activity/Task**	**Assessment**
20 min	*DNA replication and Protein Synthesis* Provide students with background information about how DNA is replicated. Watch the Unitedstreaming video Transcription of DNA to Messenger RNA (first six segments plus segments nine and ten). Conduct a round table discussion of the video and ask the students to complete the Video Viewing Summary handout. (See Video Viewing Summary handout in Tuesday's, June 15 materials section.)	Complete the Video Viewing Summary handout.
25min	*DNA replication and Protein Synthesis* Look at protein synthesis picture below so you can see how the manipulative is assembled. Cut each strand of DNA, mRNA, tRNA, and amino acids and place in a plastic baggie. **Be careful!** Do not cut the DNA strand or the mRNA holder into smaller pieces. All other pieces, (mRNA, tRNA, & amino acids) are cut out by individual codons, anti-codons, & amino acids, respectively. (See Protein Synthesis materials in Tuesday's, June 15 materials section.) Assign groups of students to different strands and allow them to correctly assemble the process. Students may swap strands for practice. Ask students to empty the baggie and find the DNA strand and place it in the nucleus.  	Students reflection paper

<table>
<tr><th colspan="3">Tuesday, June 15 (continuation)</th></tr>
<tr><th>Time</th><th>Activity/Task</th><th>Assessment</th></tr>
<tr><td>Continuation from previous row</td><td>
Place the mRNA holder beneath the DNA strand and match the appropriate codons.



Move the completed mRNA strand out of the nucleus.
Find the correct tRNA anticodons and pair them with the mRNA codons.

Using the amino acid chart, find the correct amino acid sequence that would be brought to the ribosome for assembly of a polypeptide.
When the students have completed the exercise, ask them to write a reflection of what they have learned about how the genetic information is transcribed and proteins synthesized.
</td><td></td></tr>
</table>

Tuesday, June 15 (continuation)		
Time	**Activity/Task**	**Assessment**
20 min	*Review Questions 3* Provide students with a set of questions (see Review Questions 3 handout in Tuesday's, June 15 materials section) on the differences between DNA and RNA and the role of each in heredity. Give them 15 minutes to answer the questions individually. Conduct a group discussion of the answers to the questions. Ask students to correct their answers if necessary providing an explanation for the correction. The explanation must state the original reason the student chose the wrong answer and what makes the answer choice correct.	Student questionnaire
10 min	*Closing for Biology Day 2* Hot Seat – Teacher writes terms and concepts from the lesson on sticky notes. One term or concept per sticky note. Affix the sticky note to the underside of student chairs. Have students look under their chair. If they have a sticky note, they pair up with someone who does not. Give pairs 2 minutes to write 2 sentences about their note based on the lesson in their notebooks. Student pairs share.	Sentences written in their notebook

Tuesday, June 15 (continuation)		
Objective **Domain: Structure and Properties of Matter** • Students apply the properties of solutions, analyzing solutions in terms of solutes and solvents.		
Time	**Activity/Task**	**Assessment**
10 min	*Guiding Questions – Solutions* The teacher asks students three questions (see Warm-up Index Cards questions for physical science in Tuesday's, June 15 materials section) and gives students enough time to write their answers on three different index cards (one for each question). The teacher asks for two or three volunteers to share their answers and write these answers on a bulletin board to be visited again after the activity is completed.	Students complete all index cards.
35 min	*Rate of Solution Lab Activity* See Tuesday's, June 15 materials section for instructions.	Students complete lab activity
20 min	*Solubility Videos* Watch the video segments on solubility from Discovery Education and ask the students to complete the Solubility handout. (see Solubility handout in Tuesday's, June 15 materials section) Review with the students the answer to the guiding questions and ask them to revise their previous understanding of mixtures as recorded on their groups' previously completed organizer.	Completion of the Solubility handout.
15 min	*Solutions –Solvents and Solutes Discussion* Divide the students in groups of three, ask them to copy on a large sheet of paper the Solution graphic organizer (see Solution graphic organizer in Tuesday's, June 15 materials section) and complete it by recording the group's understanding of each one of the concepts. *Teacher Note:* Depending on time the teacher may assign a different concept to each group and then ask each group to present their information.	Completion of the graphic organizer

Tuesday, June 15 (continuation)		
Time	**Activity/Task**	**Assessment**
25 min	*Review Questions 4* Provide students with a set of questions (see Review Questions 4 handout in the Tuesday's, June 15 materials section) about the properties of solutions. Give them 15 minutes to answer the questions individually. Conduct a group discussion of the answers to the questions, Ask students to correct their answers if necessary providing an explanation for the correction. The explanation must state the original reason the student chose the wrong answer and what makes the answer choice correct.	Student questionnaire
15 min	*Closing for Physical Science Day 2* Review the original answers to the warm-up questions and write the correct answer on the bulletin board.	

Tuesday's, June 15
Materials Section

Terms for Biology Warm up Activity

Genetics	Heredity	Traits
DNA	RNA	Sugar
Nitrogen Bases	Nucleus	Chromosome

Double Helix

Single Strand

Anticipation Guide: Facts on DNA and RNA

Instructions:
In the column labeled me, place a check next to any statement with which you agree. After the classroom discussion, compare your opinions with those presented during the lesson.

Me	After the lesson	Statements
		1. DNA is the hereditary material in humans and almost all other organisms.
		2. Nearly every cell in a person's body has the same DNA.
		3. Most DNA is located in the cell nucleus (where it is called nuclear DNA), but a small amount of DNA can also be found in the mitochondria (where is called mitochondrial DNA)
		4. DNA bases pair up with each other, Adenine with Thymine and Cytosine with Guanine, to form units called base pairs. Each base is also attached to a sugar molecule and a phosphate molecule.
		5. Each strand of DNA in the double helix can serve as a pattern for duplicating the sequence of bases.
		6. RNA serves as a temporary copy of genes that is use as a template for protein synthesis.
		7. RNA molecules are built from three basic components: ribose, phosphate, and a family of four bases guanine, adenine, cytosine, and uracil.
		8. The RNA molecule is single stranded, and folded in various shapes.
		9. RNA and DNA are both nucleic acids
		10. RNA can carry genetic information.

Video Viewing Summary

Name: ____ Date: ____________

Instructions:
Write your answer to the following questions based on the Transcription of DNA to Messenger RNA video that you just watched.

What is the structure of DNA?	
How is RNA different from DNA?	
How do the nitrogen bases pair?	
What is a nucleotide?	
What is transcription?	
How does transcription happen?	
What is a codon?	

<u>DNA Sequence 1</u>

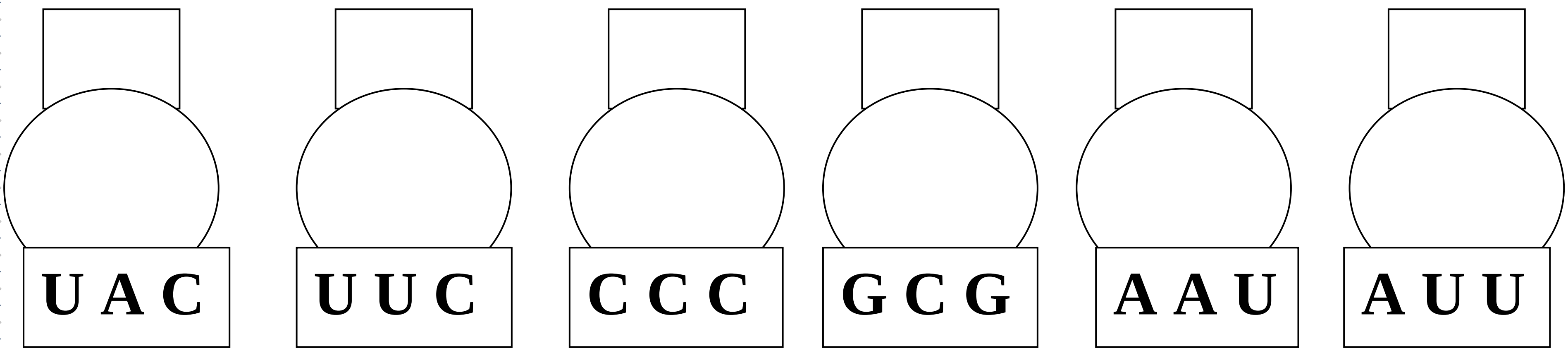
T A C   T T C   C C C   G C G   A A T   A T T

Strand 1-mRNA

A U G   A A G   G G G   C G C   U U A   U A A

mRNA holder

Strand 1 tRNA



1st mRNA Strand amino acids

Met Lys Gly Arg Leu STOP

<u>DNA Sequence 2</u>

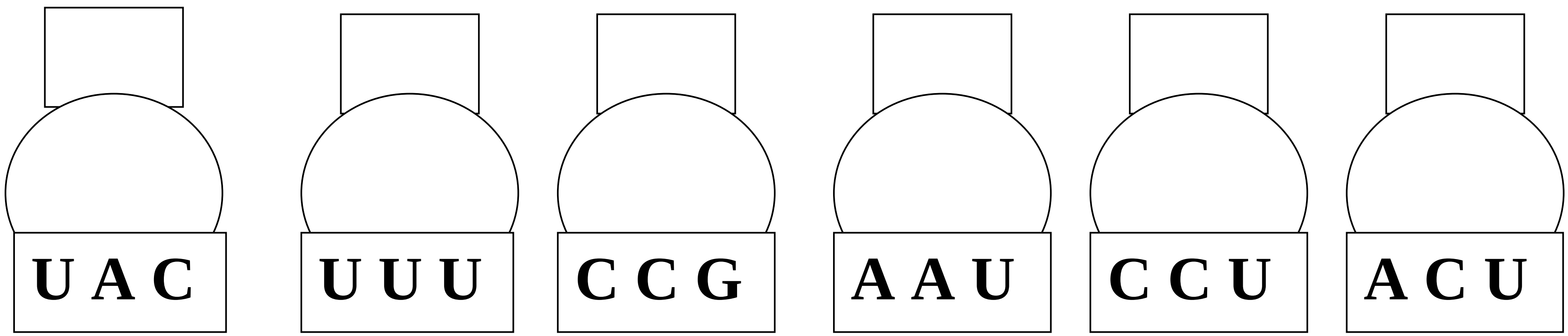
T A C   T T T   C C G   A A T   C C T   A C T

Strand 2-mRNA

A U G   A A A   G G C   U U A   G G A   U G A

mRNA holder

Strand 2 tRNA



2nd mRNA Strand amino acids

Met Lys Gly Leu Gly STOP

DNA Sequence 3

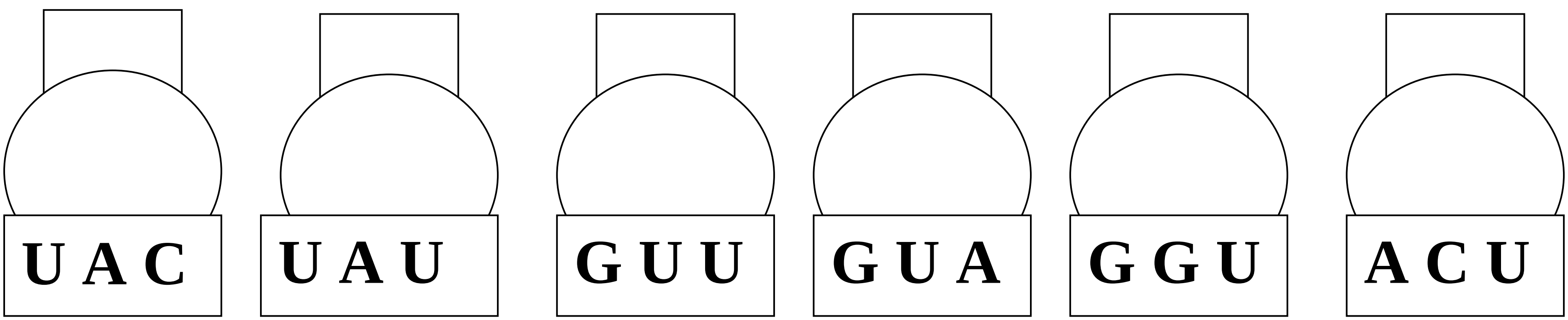
T A C T A T G T T G T A G G T A C T

mRNA Strand 3

A U G A U A C A A C A U C C A U G A

mRNA holder

tRNA strand 3



3rd mRNA Strand amino acids

Met Iso Glu His Pro STOP

DNA Sequence 4

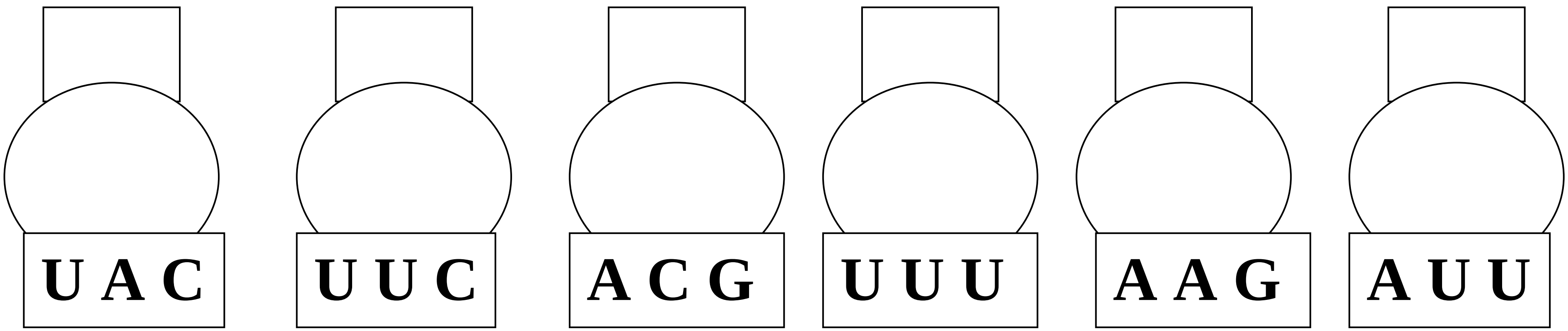
T A C T T C A C G T T T A A G A T T

mRNA Strand 4

A U G A A G U G C A A A U U C U A A

mRNA

tRNA Strand 4



4th mRNA Strand amino acids

Met Lys Cys Lys Phen STOP

<u>DNA Sequence 5</u>

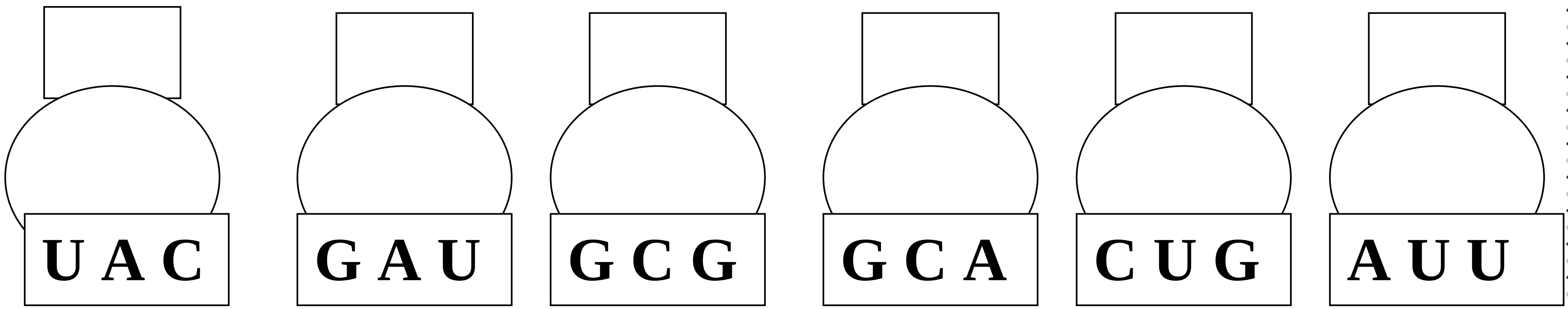
T A C G A T G C G G C A C T G A T T

mRNA Strand 5

A U G C U A C G C C G U G A C U A A

mRNA holder

tRNA strand 5



5th mRNA Strand amino acids

Met Leu Arg Arg AspAc STOP

DNA Sequence 6

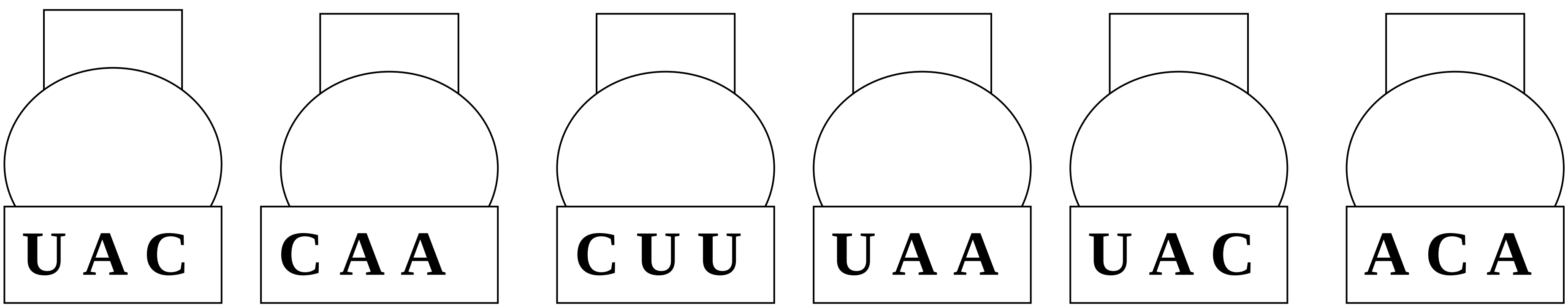
T A C   C A A   C T T   T A A   T A C   A C A

mRNA Strand 6

A U G   G U U   G A A   A U U   A U G   U G U

mRNA

tRNA strand 6



6th mRNA Strand amino acids

Met Val GluAc Iso Met STOP

Protein Synthesis Manipulative Answer Key

Strand 1

mRNA codon	**tRNA anticodon**	**Amino acid tRNA carries**
AUG	UAC	Met
AAG	UUC	Phe
GGG	CCC	Pro
CGC	GCG	Ala
UUA	AAU	Asp
UAA	AUU	Stop

Strand 2

mRNA codon	**tRNA anticodon**	**Amino acid tRNA carries**
AUG	UAC	Met
AAA	UUU	Lys
GGC	CCG	Gly
UUA	AAU	Leu
GGA	CCU	Gly
ACU	UGA	Stop

Strand 3

mRNA codon	**tRNA anticodon**	**Amino acid tRNA carries**
AUG	UAC	Met
AUA	UAU	Iso
CAA	GUU	Glu
CAU	GUA	His
CCA	GGU	Pro
UGU	ACA	Stop

Strand 4

mRNA codon	**tRNA anticodon**	**Amino acid tRNA carries**
AUG	UAC	Met
AAG	UUC	Lys
UGC	ACG	Cys
AAA	UUU	Lys
UUC	AAG	Phe
UAA	AUU	Stop

Strand 5

mRNA codon	tRNA anticodon	Amino acid tRNA carries
AUG	UAC	Met
CUA	GAU	Leu
CGC	GCG	Arg
CGU	GCA	Arg
GAC	CUG	Asp Acid
UAA	AUU	Stop

Strand 6

mRNA codon	tRNA anticodon	Amino acid tRNA carries
AUG	UAC	Met
GUU	CAA	Val
GAA	CUU	Glu Acid
AUU	UAA	Iso
AUG	UAC	Met
UGU	ACA	Stop

Strand 1

AUG AAG GGG CGC UUA UAA

Strand 2

AUG AAA GGC UUA GGA ACU

Strand 3

AUG AUA CAA CAU CCA UGU

Strand 4

AUG AAG UGC AAA UUC UAA

Strand 5

AUG CUA CGC CGU GAC UAA

Strand 6

AUG GUU GAA AUU AUG UGU

1st mRNA Strand amino acids

Met Phe Pro Ala Asp STOP

2nd mRNA Strand amino acids

Met Lys Gly Leu Gly STOP

3rd mRNA Strand amino acids

Met Iso Glu His Pro STOP

4th mRNA Strand amino acids

Met Lys Cys Lys Phen STOP

5th mRNA Strand amino acids

Met Leu Arg Arg Asp A STOP

6th mRNA Strand amino acids

Met Val GluAc Iso Met STOP

Teacher note: Keep one copy of this together to have as an answer sheet for each strand.

Review Questions 3
DNA and RNA and Their Role in Heredity

1. Which process reduces the number of chromosomes in a cell?

   A. binary fission
   B. crossing over
   C. meiosis
   D. mitosis

2. Which **best** shows the proper code-structure sequence in protein synthesis?

   A. DNA, mRNA, mRNA, polypeptide, enzyme
   B. DNA, mRNA, tRNA, polypeptide, enzyme
   C. enzyme, polypeptide, mRNA, mRNA, DNA
   D. mRNA, DNA, mRNA, enzyme, polypeptide

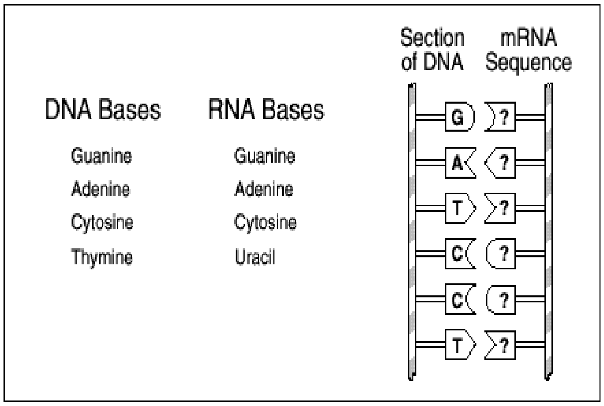
3. As each section of the genetic code on DNA is transcribed to mRNA, the two strands of DNA rejoin. Then the mRNA moves into the cytoplasm through a pore in the nuclear membrane. Ribosomes attach to the mRNA, in the cytoplasm, to carry out the formation of a protein. What is this process called?

   A. mutation
   B. synthesis
   C. translation
   D. transference

4. If the sequence of nucleotides were AGC on a strand of DNA, what would be the nucleotide sequence on a strand of mRNA formed during transcription?

   A. ACG
   B. UCG
   C. TGC
   D. TCG

5.



   Which mRNA sequence complements the above section of DNA?

   A. CUAGGA
   B. TCGAAG
   C. CTAGGC
   D. AGCUUC

6. The function of mRNA is to

   A. carry genetic information from the nucleus to the site of protein synthesis
   B. begin the "unzipping" of the DNA molecule
   C. maintain homeostasis within the cell during mitosis
   D. direct the movement of centrosomes during meiosis

7. During meiosis how many times is the DNA replicated?

   A. zero times
   B. one time
   C. two times
   D. four times

8. Cells secrete proteins, often as enzymes, that have been engineered or directed by the DNA in the nucleus. Which processes are involved in protein synthesis?

   A. transfer to RNA, then to amino acids
   B. transcription into RNA, then translation into amino acids
   C. replication of DNA, then transcription into enzymes
   D. translation into RNA, then replication into DNA

9. What kind of bonds is found between nitrogen bases in a DNA molecule?

   A. Hydrogen
   B. Nitrogen
   C. Oxygen
   D. Phosphate

10. All chromosomes are composed of

   A. DNA and lipids
   B. DNA and protein
   C. RNA and lipids
   D. RNA and protein

11. Which is in the shape of a double helix?

   A. Amino acid
   B. Deoxyribonucleic acid
   C. Enzyme
   D. Protein

12. Messenger RNA carries genetic information in groups of three bases known as

   A. Amino acids
   B. Codons
   C. Enzymes
   D. Helixes

13. Which of the following DNA base pairs are correct?

   A. A - A
C - C
   B. A - T
T - A
   C. A - T
G - A
   D. A - T
T - G

14. In living things, whether plant or animal, the carrier of hereditary instructions is

   A. DNA
   B. Genetic vacuole
   C. Messenger RNA
   D. Mitochondria in animals, chloroplasts in plants

15. DNA and RNA are similar because they both contain

   A. Deoxyribose
   B. Nucleotides
   C. Thymine
   D. Double helices

DNA and RNA Activity Cards

Tiles for Titles of the Plastic Bags

DNA	**RNA**
	BOTH

DNA and RNA Activity Cards

Contains thymine	Contains adenine	Contains guanine	Contains cytosine
Contains uracil	Double stranded	Single stranded	Deoxyribose sugar
Ribose sugar	Stays in the nucleus	Leaves the nucleus	Involved in transcription
Involved in translation	Attaches to ribosomes	Provides genetic code	Nucleic Acid
Messenger, transfer, & ribosomal	"Reads" the genetic code	Made up of nucleotides	Double Helix

Possible Index Card Warm-Up Questions –Physical Science Day 2

1. A pot containing salt water is boiled until the water is gone, leaving a salt crust on the bottom of the pot. The salt water would be considered a

   A. Substance
   B. Compound
   C. Element
   D. Mixture

2. A compound differs from a mixture in that a compound always has a

   A. homogeneous composition
   B. maximum of two components
   C. minimum of three components
   D. heterogeneous composition

3. In a solution the substance that does the dissolving is called

   A. soluble
   B. the solute
   C. the solvent
   D. an ion

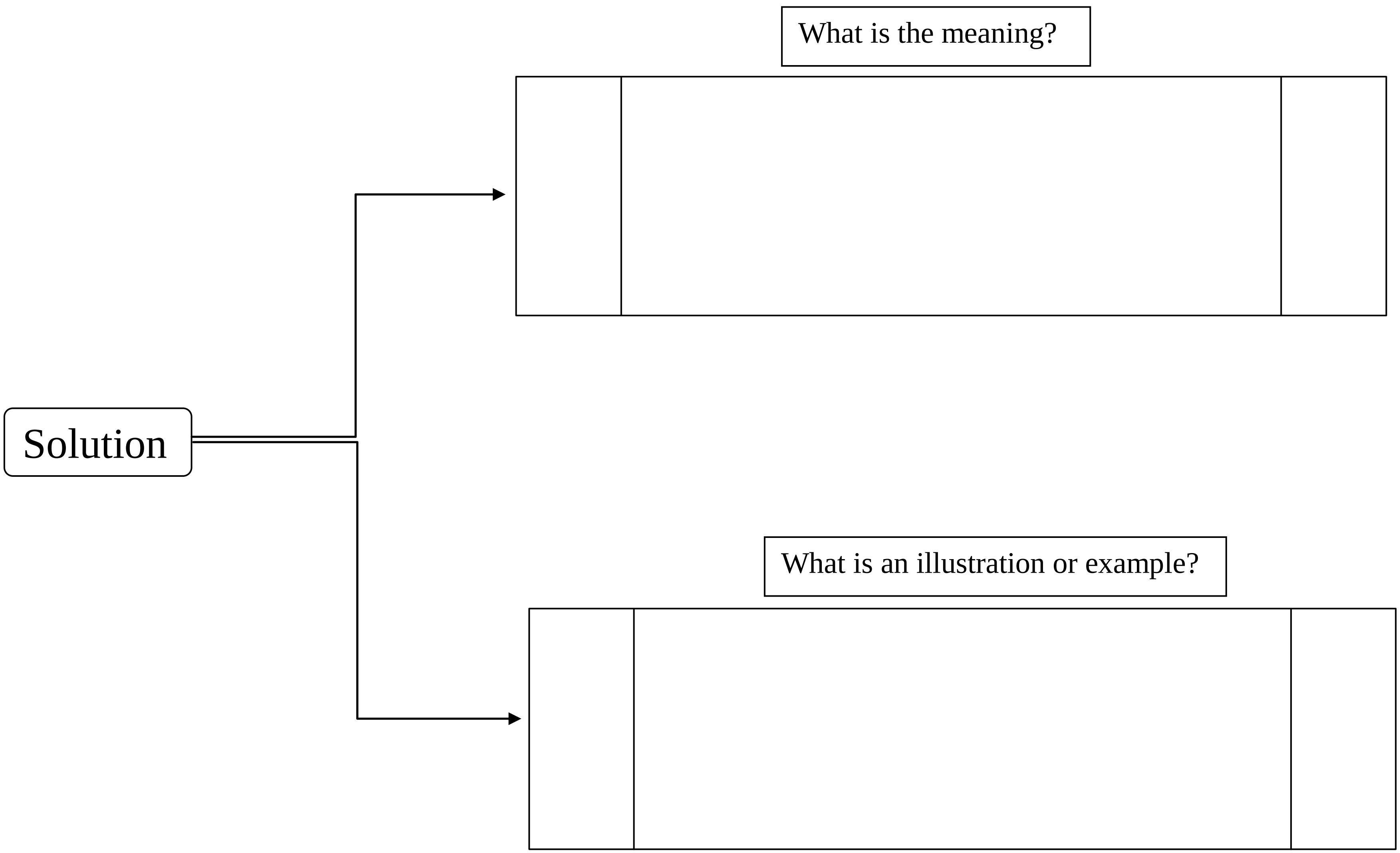
4. Many laboratory preparations of solutions call for stirring the solvent while adding the solute. Which of the following is always an effect of this procedure?

   A. It decreases the reactivity of the solute.
   B. It decreases the solubility of the solute.
   C. It brings the solute and solvent rapidly into contact
   D. It produces a chemical reaction.

Solution Concept Map

Instruction:

In the boxes to the right provide an explanation and give an illustration/example of the concept on the left.



Solvent Concept Map

Instruction:

In the boxes to the right provide an explanation and give an illustration/example of the concept on the left.

Solvent

What is the meaning?

What is an illustration or example?

Solute Concept Map

Instruction:

In the boxes to the right provide an explanation and give an illustration/example of the concept on the left.

What is the meaning?

Solute

What is an illustration or example?

Rate of Solution Inquiry Lab

Standards

SPS6. Investigate the properties of solutions

a. Describe solution in terms of
   - solute/solvent
   - conductivity
   - concentration

b. Observe factors affecting the rate a solute dissolves in a specific solvent

SCSh1. Students will evaluate the importance of curiosity, honesty, openness, and skepticism in science.

c. Explain that further understanding of scientific problems relies on the design and execution of new experiments which may reinforce or weaken opposing explanations.

SCSh2. Students will use standard safety practices for all classroom laboratory and field investigations.

a. Follow correct procedures for use of scientific apparatus.
b. Demonstrate appropriate techniques in all laboratory situations.
c. Follow correct protocol for identifying and reporting safety problems and violations.

SCSh3. Students will identify and investigate problems scientifically.

a. Suggest reasonable hypotheses for identified problems.
b. Develop procedures for solving scientific problems.
c. Collect, organize and record appropriate data.
e. Develop reasonable conclusions based on data collected.

SCSh4. Students will communicate scientific investigations and information clearly.

a. Write clear, coherent laboratory reports related to scientific investigations.

Background Information:

Solutions are usually homogeneous mixtures that contain a solute (substance being dissolved) and a solvent (material that dissolves another substance). Solutes and solvents can be solids, liquids, or gases. One of the most common types of solutions involves a solid dissolved in a liquid. Water is usually referred to as the *Universal Solvent* because of the number of solutes that dissolve in water. Alcohols and organic solvents are the other common liquid solvents.

There are several factors that affect how quickly a solute dissolves in a solvent. In this activity, you will choose one factor as your independent variable– temperature, amount of stirring, or particle size. Remember that the other factors must be held constant.

Materials:

• test tubes • beakers • mortar & pestle • spatula • thermometer (alcohol or stainless steel temp probe)	• stirring rod • 100-mL graduated cylinder • hot plate • balance	• NaCl (granular) • NaCl (crystalline rock salt) • crushed ice • distilled water

Safety:
Safety goggles and aprons must be worn! Your procedure must be approved by the instructor before beginning the lab.

Hypothesis:
Identify your independent and dependent variables. Construct a hypothesis that predicts how your independent variable will influence the rate of solution. (Will the solute dissolve faster or slower?)

Variable:
My group will manipulate ______________________ (temperature, amount of stirring, particle size)

Procedure:
Design a step-by-step procedure to test your independent variable. Before you start, ask your teacher to approve your procedure by initialing your notebook.

Data and Calculations:
Prepare a data table of your results.

Analysis:

1. Describe your experiment in terms of solute/*solvent/solution*. Explain.
2. Characterize solutions as *unsaturated*, *saturated* or *supersaturated.* Explain.
3. Summarize your results (What does your data show?). Make a statement that describes how your independent variable influences the rate of solution. State whether or not your hypothesis was correct.
4. Put your group findings on the chart. Complete the information below from the class results.

Factors that Affect Rate of Solution

Variable	**Results**
Particle size	
Temperature	
Stirring	

5. Identify in each experiment the *solute/solvent/solution*.
6. Characterize solutions in each experiment as *unsaturated, saturated* or *supersaturated.*
7. Describe how each tested independent variable influences the rate of solution.

Video Viewing Summary

Name: ____ **Date:** ____________

Instructions:

Write your answer to the following questions based on the Solubility videos that you just watched.

What needs to happen for a reaction to occur in a solution?	
What is solubility?	
What does it mean that a substance is completely soluble in water?	
What is one example of the use of knowing the solubility of a substance?	
Why do smaller particles dissolve faster than larger ones?	
What factors affect the solubility of a substance?	

Review Questions 4
Solutions

1. In the solution we call seawater, which of the following is the solvent?

   A. Water
   B. oxygen gas
   C. salt
   D. all of these are solvents

2. Air is a solution which includes many substances. See the composition of air chart below.

GAS	% in AIR
Nitrogen	78%
Oxygen	20.95%
Carbon Dioxide	0.03%
Argon	Less than 0.01%

   Based on the information in this chart, which statement is FALSE?

   A. Nitrogen gas is a solute in air.
   B. Carbon dioxide gas is a solute in air.
   C. Oxygen gas is a solute in air.
   D. Argon is a solute in air.

3. A compound differs from a mixture in that a compound always has a

   A. homogeneous composition
   B. maximum of two components
   C. minimum of three components
   D. heterogeneous composition

4. Many laboratory preparations of solutions call for stirring the solvent while adding the solute. Which of the following is always an effect of this procedure?

   A. It decreases the reactivity of the solute.
   B. It decreases the solubility of the solute.
   C. It brings the solute and solvent rapidly into contact.
   D. It produces a chemical reaction.

5. A solution in which the crystallizing and dissolving rates of the solute are equal is

   A. saturated
   B. unsaturated
   C. concentrated
   D. dilute

6. The _______ is the part of the solution that is present in the greater amount.

   A. solute
   B. solvent
   C. ion
   D. electrolyte

7. A solution in which more solute can dissolve is

   A. Saturated
   B. Unsaturated
   C. Supersaturated
   D. Concentrated

8. If you **decrease** the temperature, what happens to the dissolving rate of NaCl in water?

   A. The dissolving rate increases because more collisions occur between solute and solvent.
   B. The dissolving rate decreases because fewer collisions occur between solute and solvent.
   C. The dissolving rate decreases because more collisions occur between solute and solvent.
   D. No collisions occur between solute and solvent, so the rate goes to zero.

9. Which of the following statements shows the correct relationship between temperature and the solubility of a gas in a liquid?

   A. Dissolved oxygen in a pond decreases when the water temperature increases.
   B. Dissolved oxygen in a pond decreases when the water temperature decreases.
   C. More sodium chloride can be dissolved in cold water than in hot water.
   D. Carbon dioxide escapes from solution when you open a soda can.

10. What does it mean when a mixture is said to have reached saturation at a given temperature and pressure?

    A. A dilute solution has been formed.
    B. There is more solute than solvent in the mixture.
    C. As much solute as possible is dissolved in the solvent.
    D. The solute and solvent have formed a heterogeneous mixture.

11. Vinegar is a liquid solution containing acetic acid and water. It could be accurately classified as which of the following?

    A. A colloid
    B. A compound
    C. A homogeneous mixture
    D. A heterogeneous mixture

12. The salinity, or salt concentration, of tidal rivers flowing into the ocean increases as you travel down river approaching the mouth of the river. Describe in terms of solute and solvent this increase in salinity

    A. The solvent is increasing greater than the solute
    B. The solute is increasing greater than the solvent.
    C. The solute and solvent are increasing in equal amounts.
    D. The solute and solvent are both decreasing in equal amounts.

13. In all solutions, solutes and solvents

    A. Are always found as liquids
    B. Are found in the same amounts
    C. Can be separated by visible means.
    D. Are found in the same state of matter.

14. Carbon steel, usually simply called steel, is made by melting iron metal and adding a small amount of carbon to the liquid metal. In doing this, the alloy (solution of these metals) becomes much stronger and can be used for everything from automobile parts to I-beams found in skyscrapers. What is the solvent in steel?

    A. Carbon
    B. Carbon steel
    C. Iron
    D. Steel

15. E85 is an alcohol fuel mixture of 85% ethyl alcohol and 15% gasoline by volume. It is becoming more common in the midwestern United States where corn (the source of ethyl alcohol) can be found.

    Identify the solvent in this mixture.

    A. Ethyl alcohol
    B. Gasoline
    C. Water
    D. E85

<table>
<tr><th colspan="3">Wednesday, June 16</th></tr>
<tr><td colspan="3">Objective
Domain: Cells and Heredity
• Students analyze the similarities and differences between organisms of different kingdoms.</td></tr>
<tr><th>Time</th><th>Activity/Task</th><th>Assessment</th></tr>
<tr><td>10 min.</td><td>Activating Strategy:
Photos of viruses, protists, and bacteria. Show the students the photos of 6 organisms (see Organisms' Pictures activating strategy photos in Wednesday's. June 16 materials section). Ask the students to write in their notebook what type organism they think each one is.</td><td>Teacher checks each student's decision and asks some students to explain their decision aloud.</td></tr>
<tr><td>20 min.</td><td>Student Work Session 1:
Give each group of three students pictures of 10 different organisms including pictures of bacteria, viruses, and protists (see Photos of Organisms in Wednesday's, June 16 materials section). Introduce the names of the 6 kingdoms and designate an area on the wall for each kingdom.
• Ask the students to place their pictures on the wall under the kingdom names they think their organisms belong.
• Conduct a class discussion on the general characteristics of each kingdom and what to do with the pictures of the organisms that do not appear to fit in any category.
• Using their notes and other classroom resources, have students complete the Six Kingdom graphic organizer that identifies the characteristics of the 6 kingdoms.
Teacher note: allow students the opportunity to construct their own graphic organizer OR provide them with an outline attached here(see Six Kingdom Graphic Organizer in Wednesday's, June 16 materials section)</td><td>Completed graphic organizer
Participation in the classroom discussion</td></tr>
<tr><td>30 min</td><td>Student Work Session 2: Kingdoms Station Lab
Students will rotate through a series of specimens where they will complete the Kingdoms Station Lab data collection sheet (see the Kingdoms Stations Lab handout in Wednesday's, June 16 materials section).
Teacher note: Create stations with either live organisms or photos of them for students to rotate through. Many of these specimens can be collected in your neighborhood.</td><td>Students will complete the stations lab data collection sheet.</td></tr>
</table>

Wednesday, June 16 (continuation)		
Time	**Activity/Task**	**Assessment**
25 min.	*Formative Assessment:* Create 6 groups of students and hand out one set of kingdom circles bags (see the Kingdoms circles handouts in Wednesday's, June 16 materials section) to each group. Have the students place the appropriate wedge describing a particular characteristic on the appropriate kingdom wedge. *Teacher Note: Do not cut out kingdom circle pages titled "Kingdom Circles". Cut pages titled "Answer Circle" as wedges.* Walk from group to group checking the correctness of the work and once the students have the correct results ask each one of them to copy the information into their notebooks. Finally, ask the students to put all the materials in the plastic bag and switch the materials with another group. Repeat the process until each group has gone through all the different kingdoms.	Circle wedges are correctly placed.
25 min.	*Review Questions 5* Provide students with a set of questions (see Review Questions 5 handout in Wednesday's, June 16 materials section) on the similarities and differences between organisms of different kingdoms. Give them 15 minutes to answer the questions individually. Conduct a group discussion of the answers to the questions. Ask students to correct their answers if necessary providing an explanation for the correction. The explanation must state the original reason the student choose the wrong answer and what makes the answer choice correct.	Student questionnaire
10 min.	**Closure:** Students summarize what they have learned today OR teacher says a sentence (i.e. "there are 6 kingdoms"). The next student adds a sentence to what you said then the next student adds a sentence to that one. This continues around the room with each student adding onto what the previous student stated. Each sentence should be a fact about kingdoms and should not repeat previously state sentences.	Student participation. Homework assignment.

Wednesday, June 16 (continuation)		
Objective **Domain: Energy Transformations** • Students examine the phases of matter and the related atomic and molecular motion		
Time	**Activity/Task**	**Assessment**
15 min	*Warm up for Energy Transformations Domain* Place students in groups of 4, using a place mat/dry erase markers students will write everything they can remember about the phases or states of matter. Ask the students to number themselves from one to four. Then instruct the first student to write everything he/she can remember about the phases or states of matter. Rotate the place mat to the next student (student 2) so they can add their comments to the list. After the placemat has made one complete rotation, have each group condense their ideas into a central idea and write it in the middle. A group spokesman will then transfer the idea onto a post it note, read it to the class and place it on the "phase change" poster on the wall (a piece of butcher paper). Clear up misconceptions. *Teacher note: Give each group a post-it note as they are condensing ideas. Use one color for this part of the lesson. Save the post-it note as this is used in the summary.*	Students' placemat responses and group post it notes
10 min	*Phase Change Simulation* Divide the class into two or three groups depending on class size. Each group must demonstrate solids, liquids, and, gases using their bodies as molecules. Solids will be tightly grouped with little movement, liquids are somewhat spread out with more movement (students hopping up and down), gases will be more spread out with greater movement. Discuss temperature's role in phase change.	Students' models
15 min	*Pom- Pom Simulation* Have students return to their groups of 4 with the placemat. Give each student a bag of pom-poms and have them construct models of each phase of matter. Students will then draw pictures of their models with the corresponding temperatures' ranges. *Teacher note: Walk around the classroom and check for understanding by asking students questions as you view their models. All the pom-poms in the students' bags should be of the same size and color.*	Students' drawings

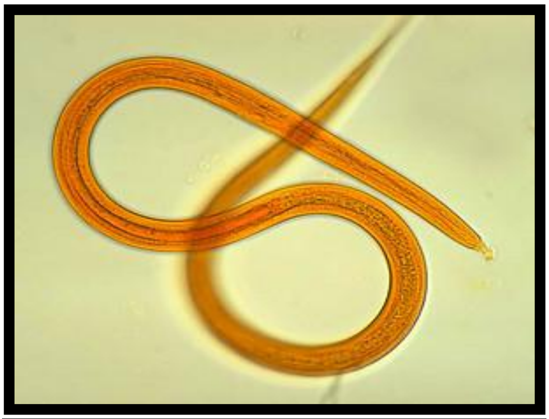
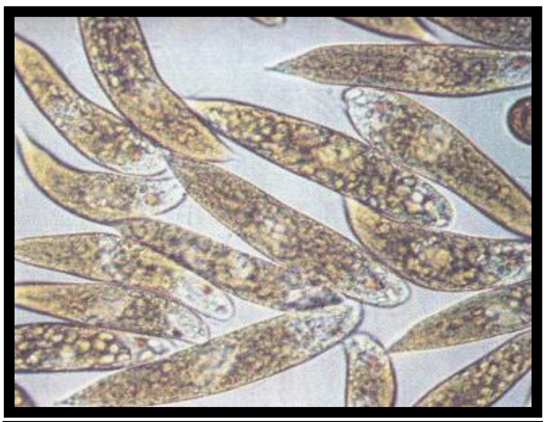
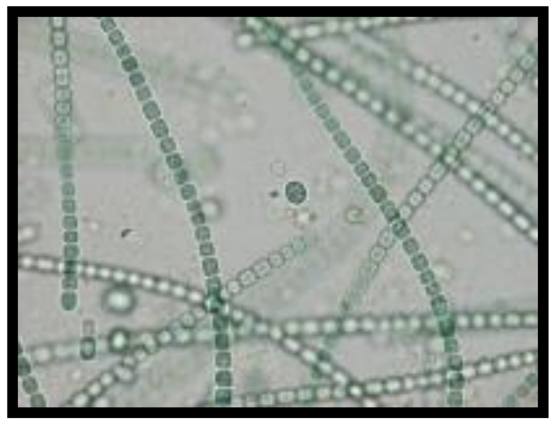
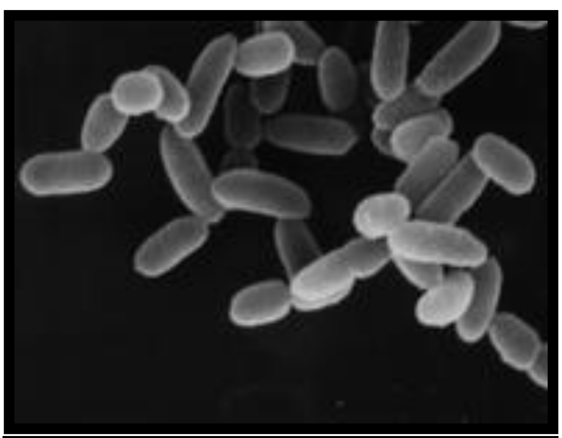
Wednesday, June 16 (continuation)		
Time	**Activity/Task**	**Assessment**
15 min	*Phase change Stations Labs* Students can remain in the groups that they were in earlier to rotate through the stations lab. Each student should complete their own lab responses (see Phase Change Observation handout in Wednesday's, June 16 materials section). Allow only 5 minutes per station. Instruct students about safety concerns briefly before beginning. See the Phases change stations lab in the Wednesday materials section. *Teacher note: Circulate around the lab to monitor and check for understanding clearing up misconceptions as they arise.*	Student lab responses
5 min	*Summary* Have students return to their groups, have them retrieve their group's post it note from earlier. Give each group different color post-it-notes and have them add/delete or revise their earlier responses. Place both notes back on the poster.	Student responses

Wednesday, June 16 (continuation)		
Objective **Domain: Energy Transformations** • Students understand radioactivity.		
Time	**Activity/Task**	**Assessment**
10 min	*Pre-assessment- Radioactivity* Ask the students to complete the Radioactivity anticipation guide (see the Radioactivity Anticipation Guide in Wednesday's June 16 materials section). Guide a discussion of the student's answers to the statements on the Radioactivity anticipation guide but do not provide them with the correct answers yet.	Student responses
15 min	*Twizzlers Lab* Give each student a piece of graph paper and 1 Twizzler. The teacher will be the timer for each ½ life and announce to the class each time they are to "take a bite". They only have 30 seconds to record their results after each ½ life. Give the student time to draw their graph on a graph paper and answer the analysis questions (see Twizzlers Lab in Wednesday's, June 16 materials section). As time allows, ask some of the students to share their answers to the questions with the class and check for understanding of the concept of half life.	Student lab report
25 min	*½ Life Calculations* Model for the students how to calculate half-life and the amount remaining (see Sample Problems in the Wednesday materials section). Give each student one of the four Half life calculation cards (see Half Life Calculation Cards in Wednesday's, June 16 materials section) and ask them to solve it. *Teacher note: While the students are solving their problems walk around the classroom to answer any questions that the students may have on how to calculate half life times.* *When all students have finished, have students complete the second half of the Anticipation Guide. After students have recorded their responses go over the statements on the guide with them.*	Half life calculation cards

<table>
<tr><th colspan="3">Wednesday, June 16 (continuation)</th></tr>
<tr><td colspan="3">Objective
Domain: Energy Transformations
• Students understand radioactivity.</td></tr>
<tr><th>Time</th><th>Activity/Task</th><th>Assessment</th></tr>
<tr><td>10 min.</td><td>Review Questions 6
Provide students with a set of questions (see Review Questions 6 handout in Wednesday’s, June 16 materials section) on the concepts of half life and radioactivity.
Conduct a group discussion of the answers to the questions. Ask students to correct their answers if necessary providing an explanation for the correction. The explanation must state the original reason the student choose the wrong answer and what makes the answer choice correct.</td><td>Student questionnaire</td></tr>
</table>

<u>Wednesday's, June 16</u>
<u>Materials Section</u>

Organisms' Pictures

Photos of Organisms

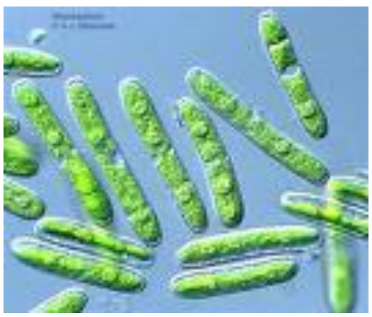
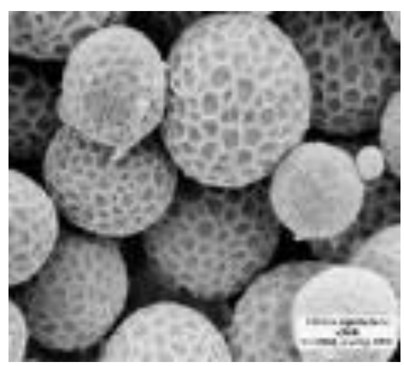
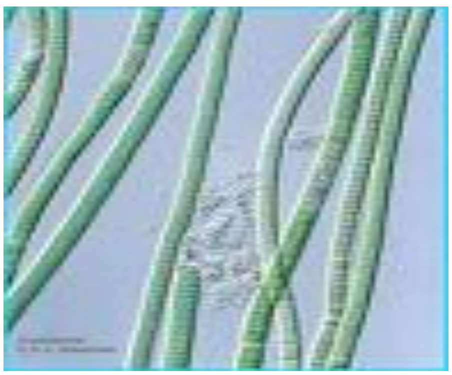
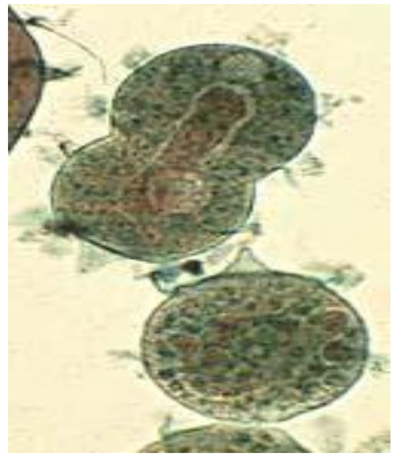
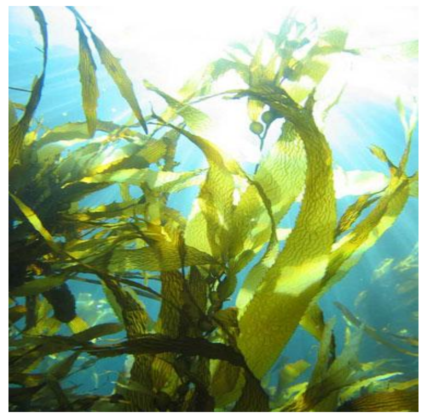
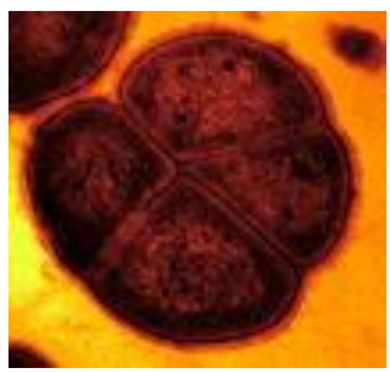
	
	
	

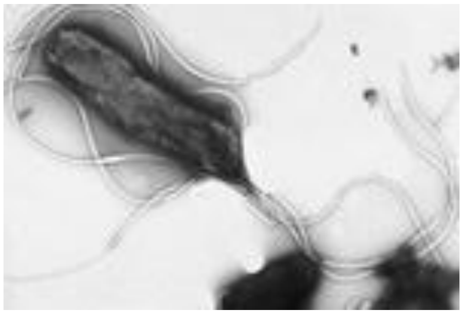
	
Photo by Bob O'Brien	
	







Six Kingdom Classification System Graphic Organizer

	Archae-bacteria	Eubacteria	Protista	Fungi	Plantae	Animalia
Common Characteristics						
Common Examples						
Cell Type (prokaryote or eukaryote)						
Complexity (unicellular or multicellular)						
Mode of Nutrition (autotrophic or heterotrophic)						
Type of Habitat						
Type of Reproduction (asexual or sexual or both)						

Kingdom Stations Lab

Station #	Organism	Kingdom	Body Type	Cell Type	Nutrition	Reproduction	Cell Structure
1							
2							
3							
4							
5							
6							

Station #1	
Organism	Fungi 
Characteristics	Fungi are not plants. The living body of the fungus is a mycelium made out of a web of tiny filaments called hyphae. The mycelium is usually hidden in the soil, in wood, or another food source. These webs live unseen until they develop mushrooms, truffles, cups, etc. Must fungi build their cell walls out of chitin, this is the same material as the hard outer shells of insects. Fungi feed by absorbing nutrients from the organic material in which they live. Fungi do not have stomachs. They must digest their food before it can pass through the cell wall in the hyphae. Fungi reproduce by releasing spores from a fruiting body, which is the mushroom. The mushroom releases spores into the air, and the wind carries the spores off to start the next generation.

Station #2	
Organism	Praying Mantis 
Characteristics	Praying Mantis is named for its prominent front legs, which are bent and held together at an angle that suggests the position of prayer. These insects are formidable predators. They have triangular heads poised on a long “neck” or elongated thorax. Mantis can turn their heads 180 degrees. Mantises are typically green or brown, so they are well camouflaged on the plants among which they live. The Praying Mantis uses their front legs to snare their prey that generally consists of moths, crickets, grasshoppers, flies, and other insects. Females regularly lay hundreds of eggs in a small case, and nymphs hatch looking much like tiny versions of their parents.

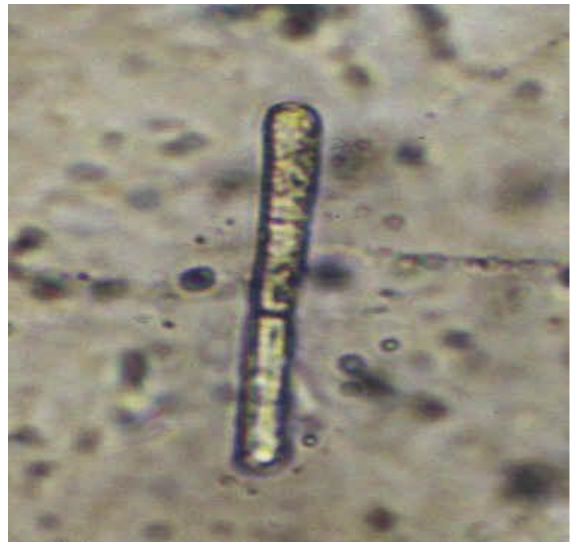
<table>
<tr><th colspan="2">Station #3</th></tr>
<tr><td>Organism</td><td>Euglena </td></tr>
<tr><td>Characteristics</td><td>Euglenas are single cell organisms that live in freshwater. Euglenas are green like plants and thus carry out photosynthesis. However, unlike plants Euglena does not have a cellulose cell wall. In addition, Euglenas possess a long whip-like structure on one side that propels them through water.
Euglena is unique in that it is both heterotrophic (must consume food) and autotrophic (can make its own food). The euglena has a stiff pellicle outside the cell membrane that helps it keep its shape. In the center of the cell is the nucleus, which contains the cell’s DNA and controls the cell’s activities. The interior of the cell contains a jelly-like fluid substance called cytoplasm.</td></tr>
</table>

Station #4	
Organism	African Elephant 
Characteristics	The African elephant is the largest living land mammal. Elephants can live in nearly any habitat that has adequate quantities of food and water. Elephants consume about 5% of their body weight and drink 20-50 gallons of water per day. The life-cycle of an elephant has been arbitrarily broken up into three main divisions; baby, adolescent, and adult. Elephants are colloquially called pachyderms which mean thick-skinned animals. The skin is covered with hair. Female elephants have one calf after a twenty-two month pregnancy.

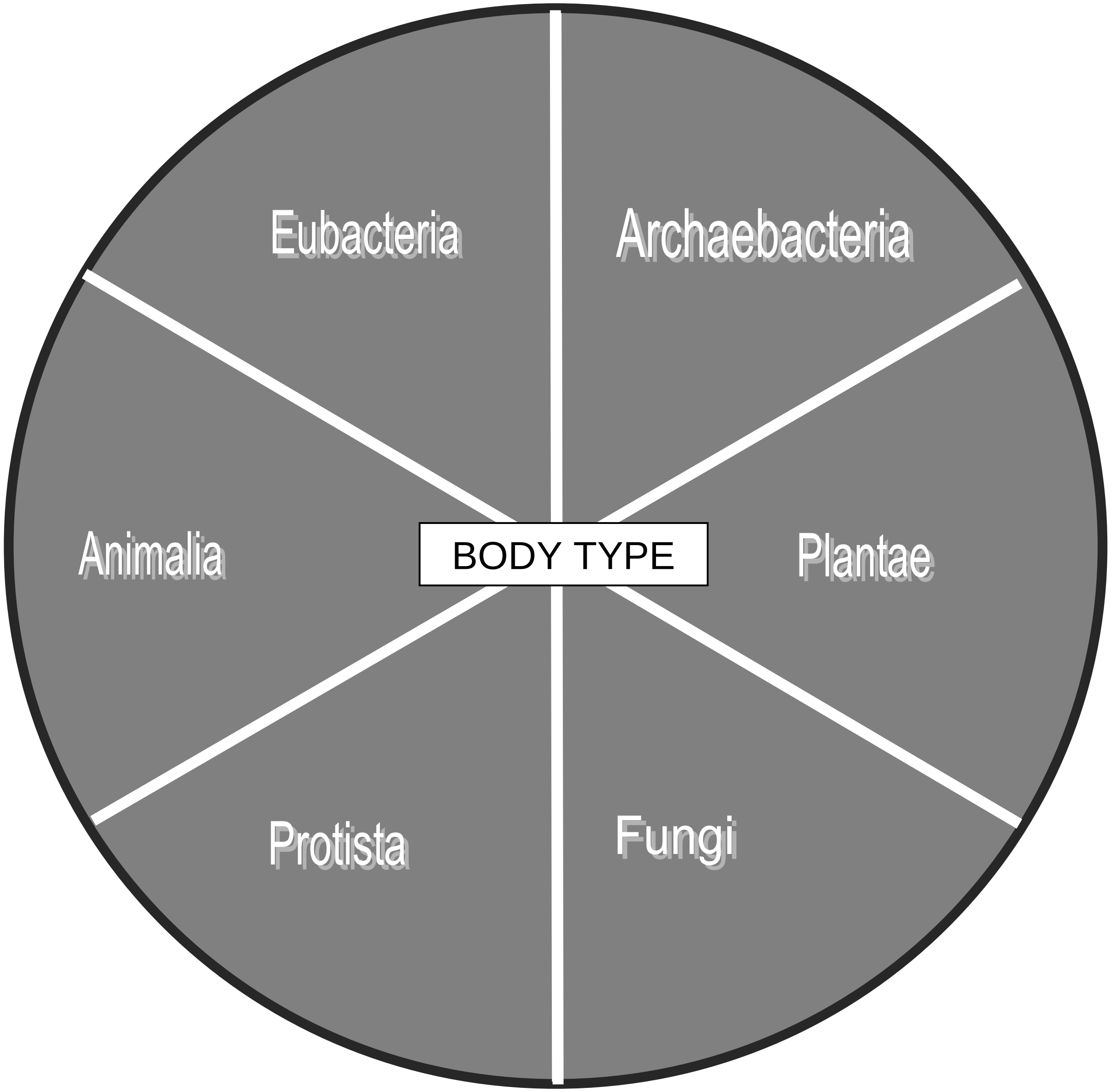
Station #5

Organism	White Pine 
Characteristics	The White Pine has the distinction of being the tallest tree in eastern North America growing to be 50' – 80' feet in height. Their leafs are in the form of needles, 3 to 5 inches long, with five, slender, flexible needles per fascicle. The needles appear blue-green because of 3 or more glaucous lines of stomata. The trees reproduce sexually by seeds that are transported by wind. The cone production begins when the tree is between 5 – 10 years old. Good seeds are produced every 3 – 5 years, with some seed produced in intervening years. The bark of these trees darkens and thickens as they age. It is smooth and gray on young growth and becomes gray-brown, deeply furrowed with broad ridges of irregular rectangular purple-tinged scaly plates as the tree gets older. The White Pines are moderately fire resistant and can grow in nearly all soil types.

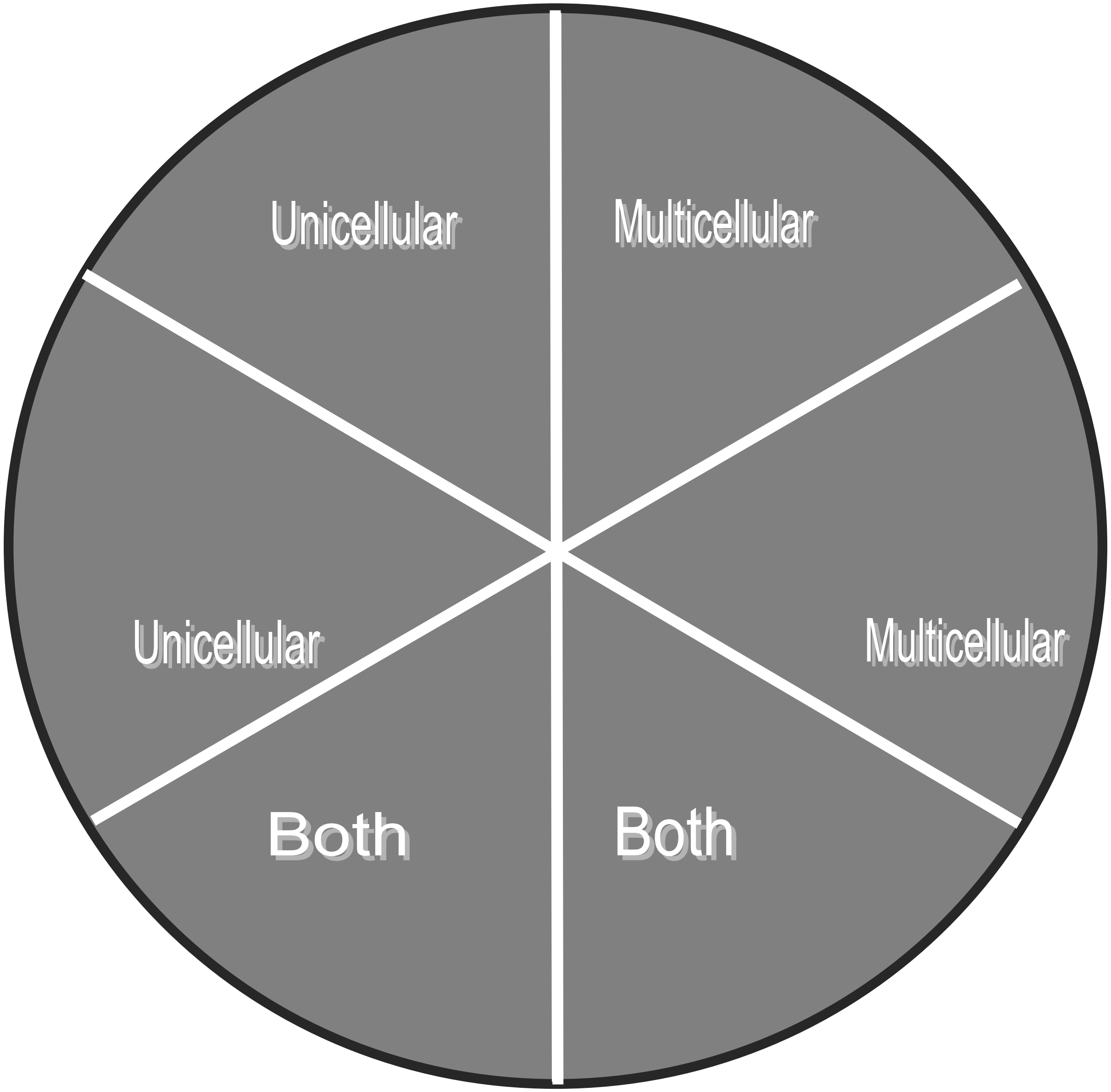
Station #6

Organism	Cyanobacterium 
Characteristics	The cyanobacteria are aquatic and photosynthetic organisms. They are quite small and usually unicellular, though they often grow in colonies large enough to see. Cyanobacteria are very important to plants as the chloroplast with which plants make food for themselves is actually a cyanobacterium living within the plant's cells. Like other bacteria, cyanobacteria have no nucleus or internal membrane systems. In many species, however, the external membrane has been folded to increase total surface area. The ability of cyanobacteria to perform oxygenic photosynthesis is thought to have dramatically changed the composition of life forms on Earth by provoking an explosion of biodiversity and leading to the near-extinction of oxygen-intolerant organisms. Cyanobacteria reproduce by binary fission (splitting in two).

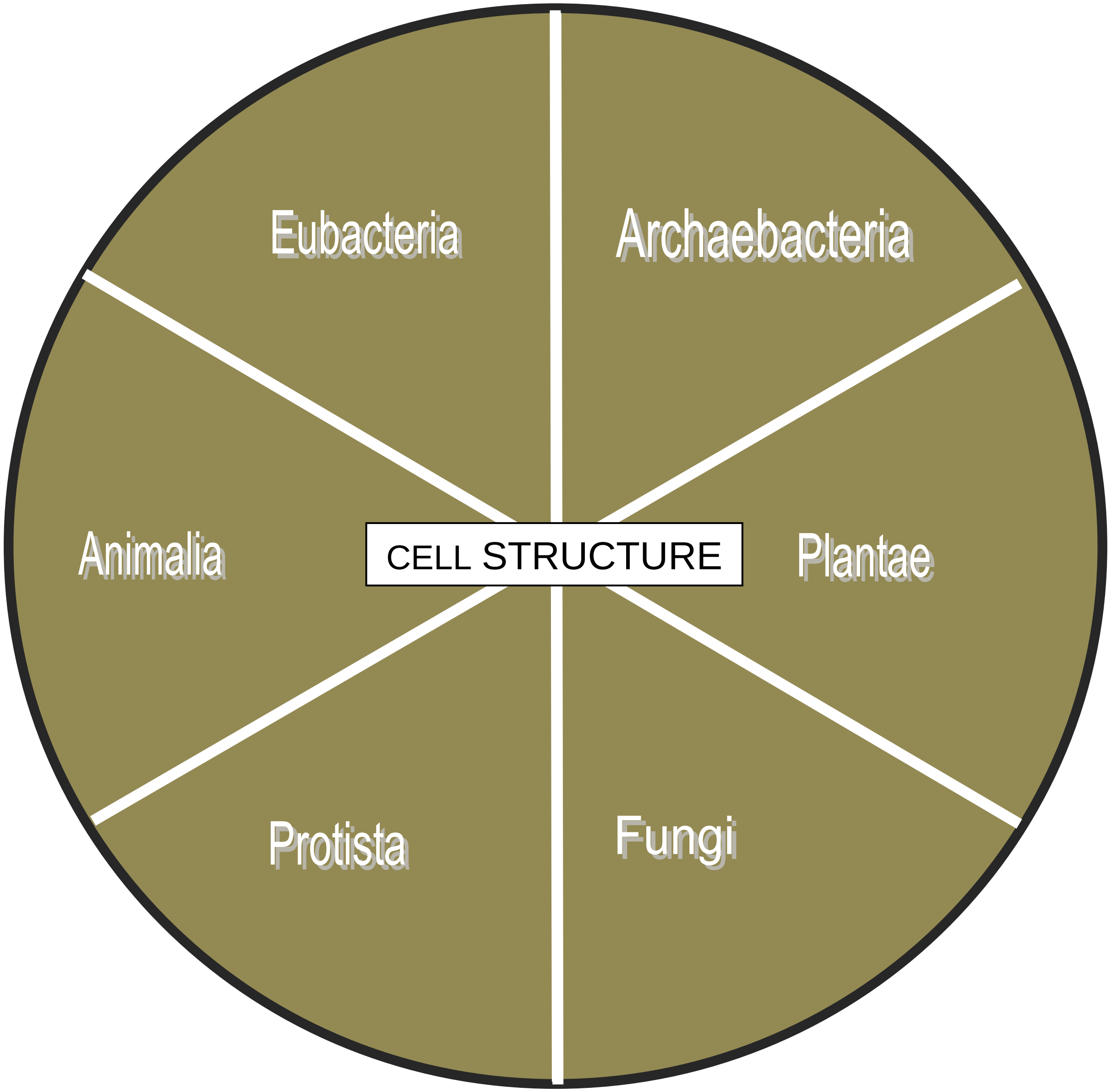
Kingdom Circles: Body Type



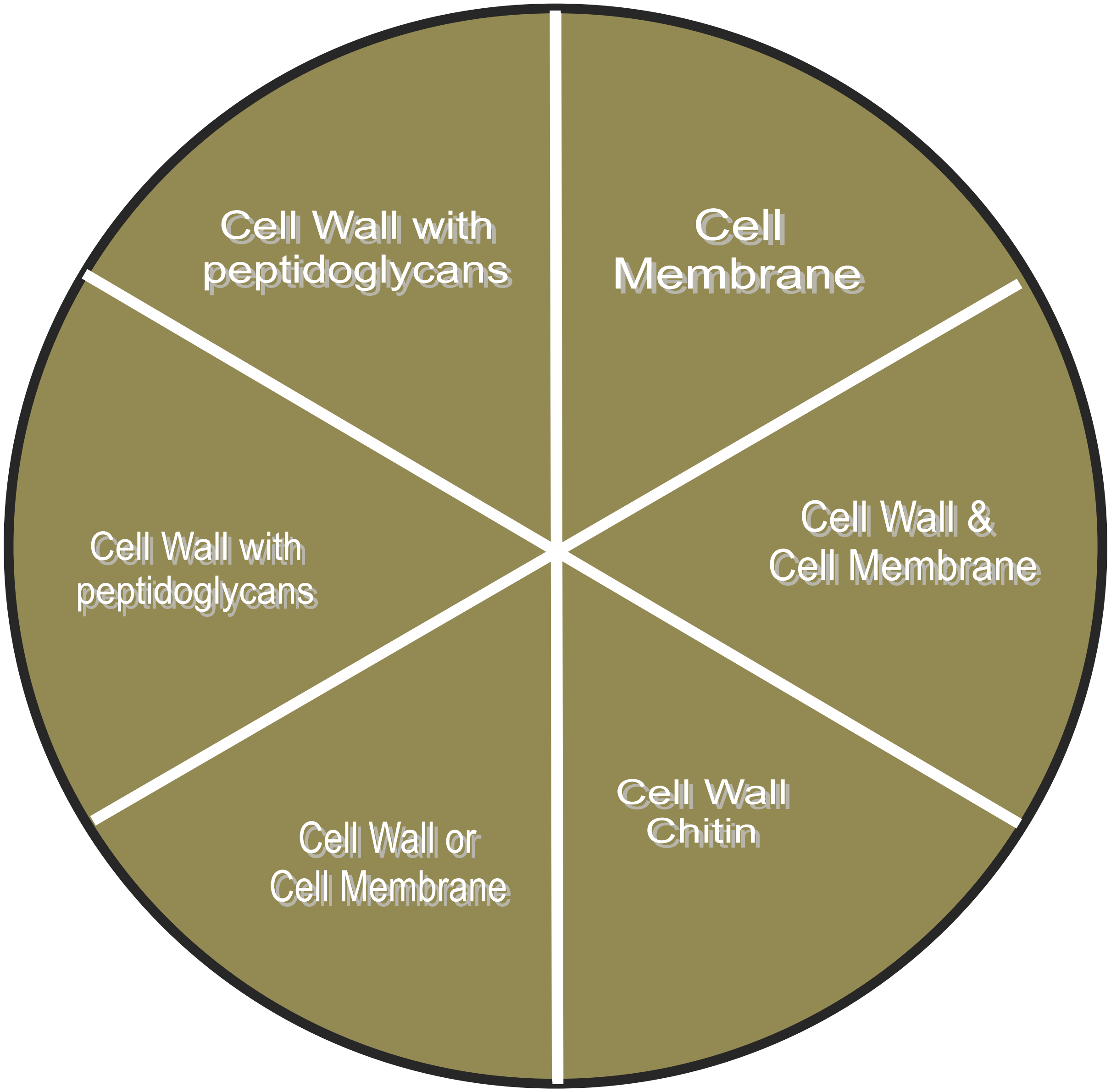
Answer Circle Wedges



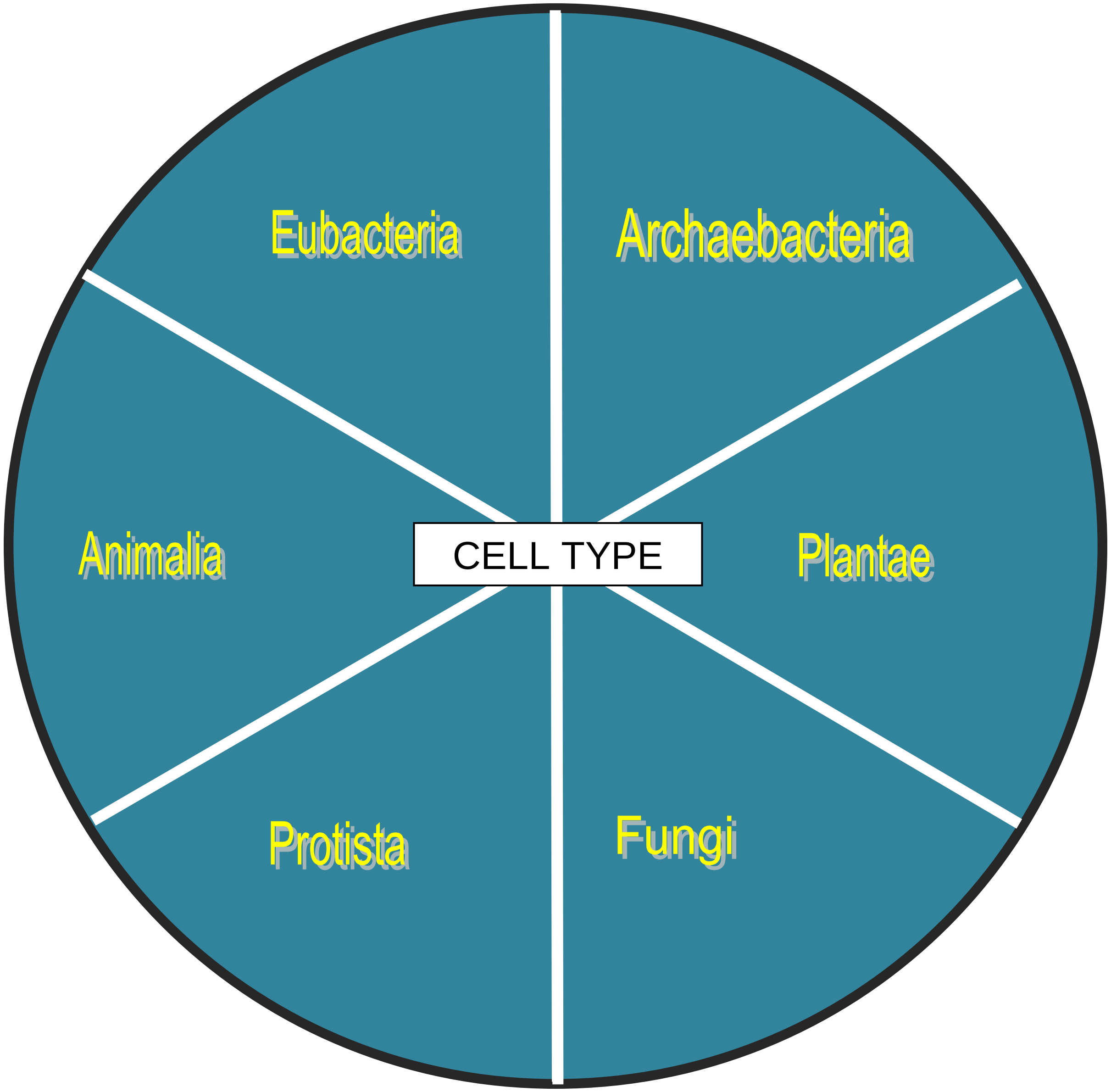
Kingdom Circles: Cell Structure



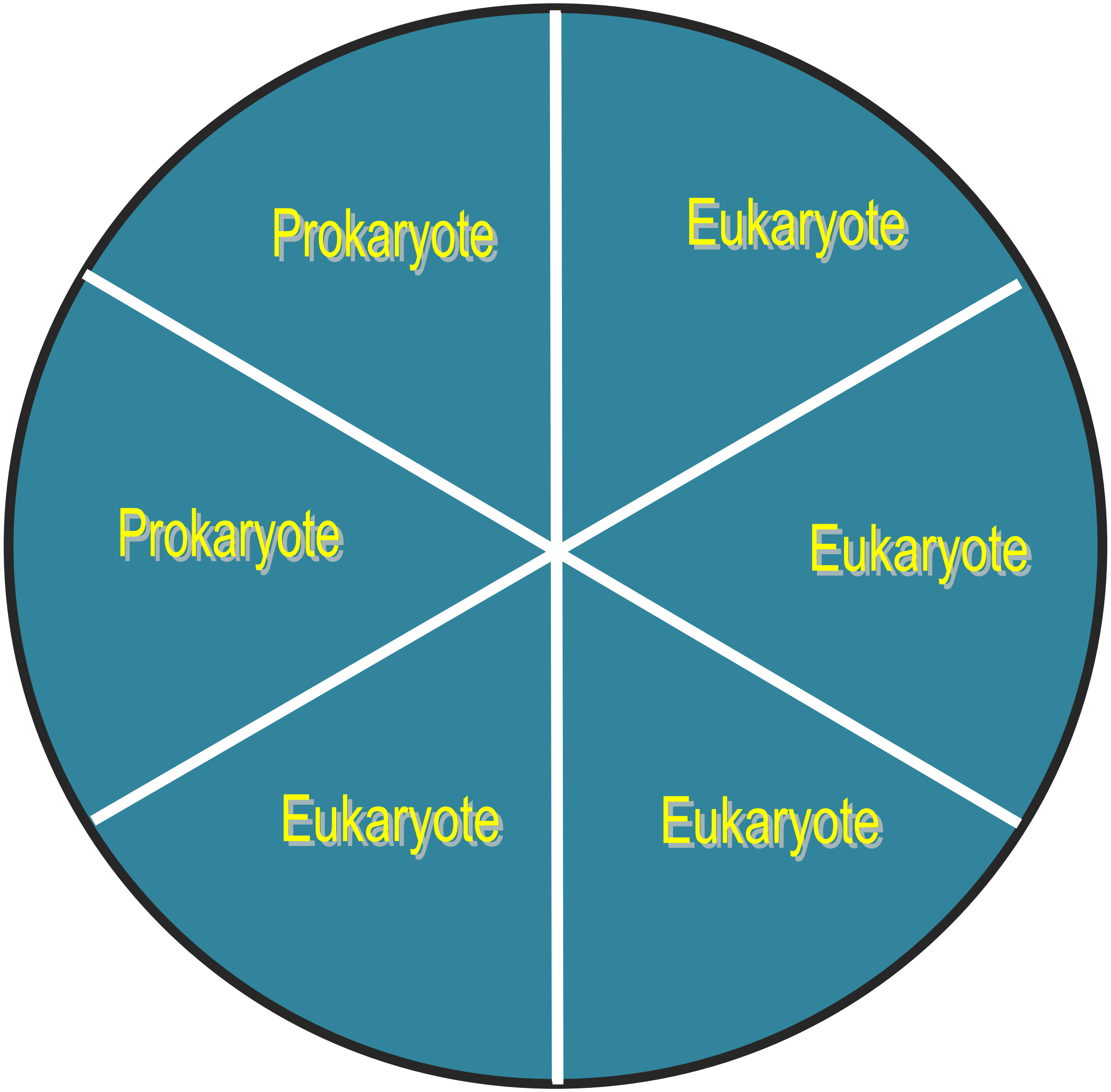
Answer Circle Wedges



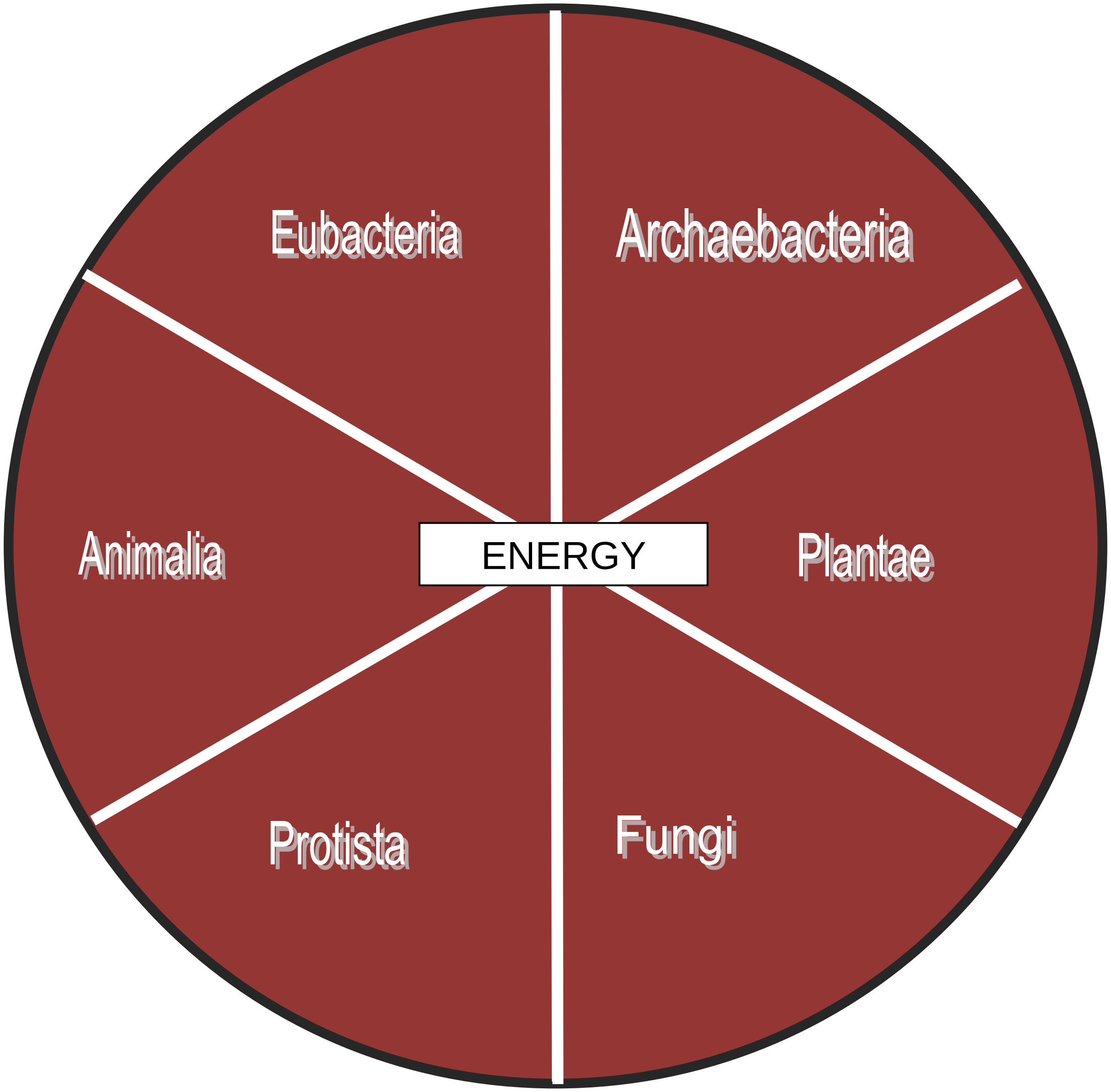
Kingdom Circles: Cell Type



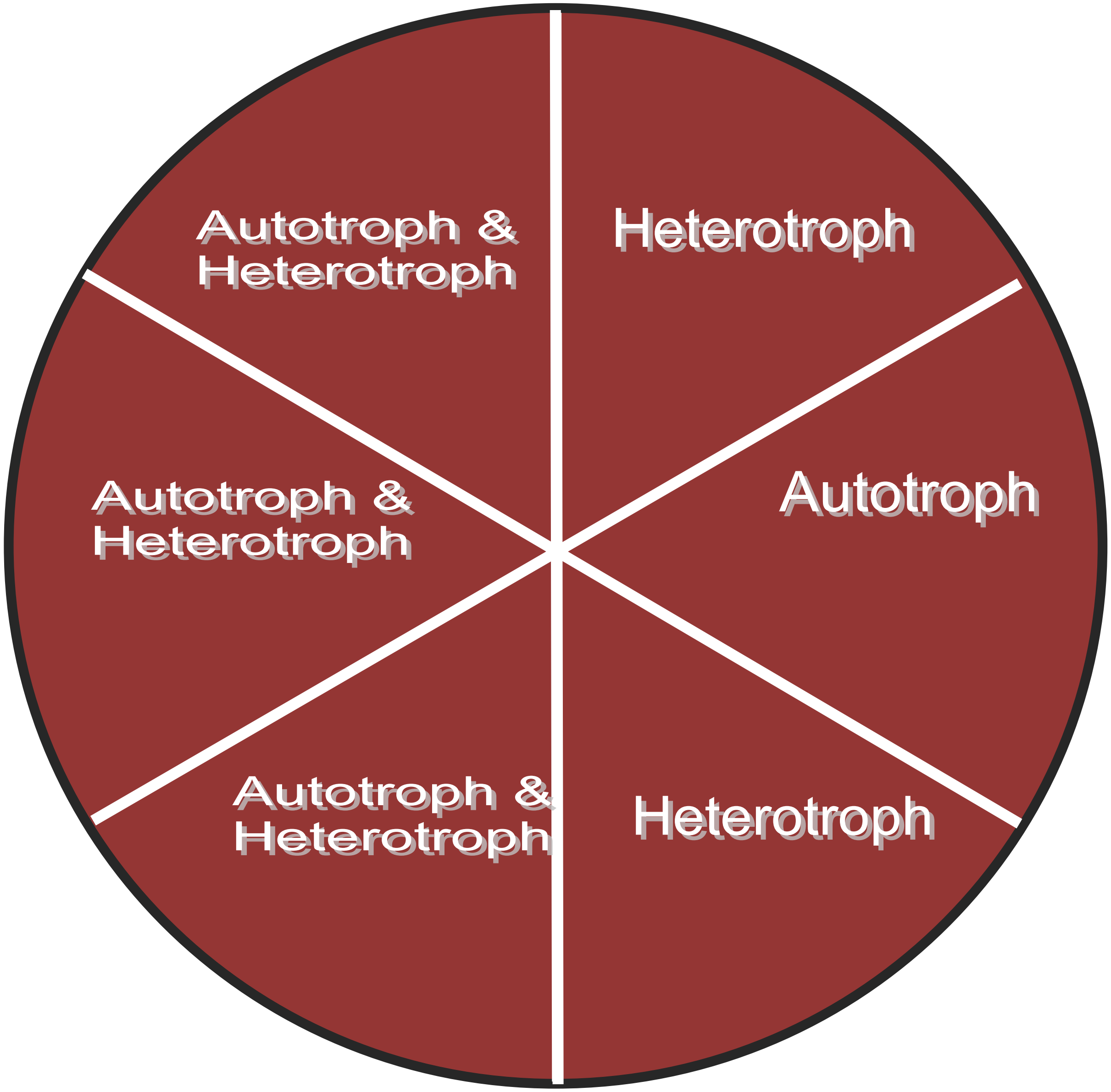
Answer Circle Wedges



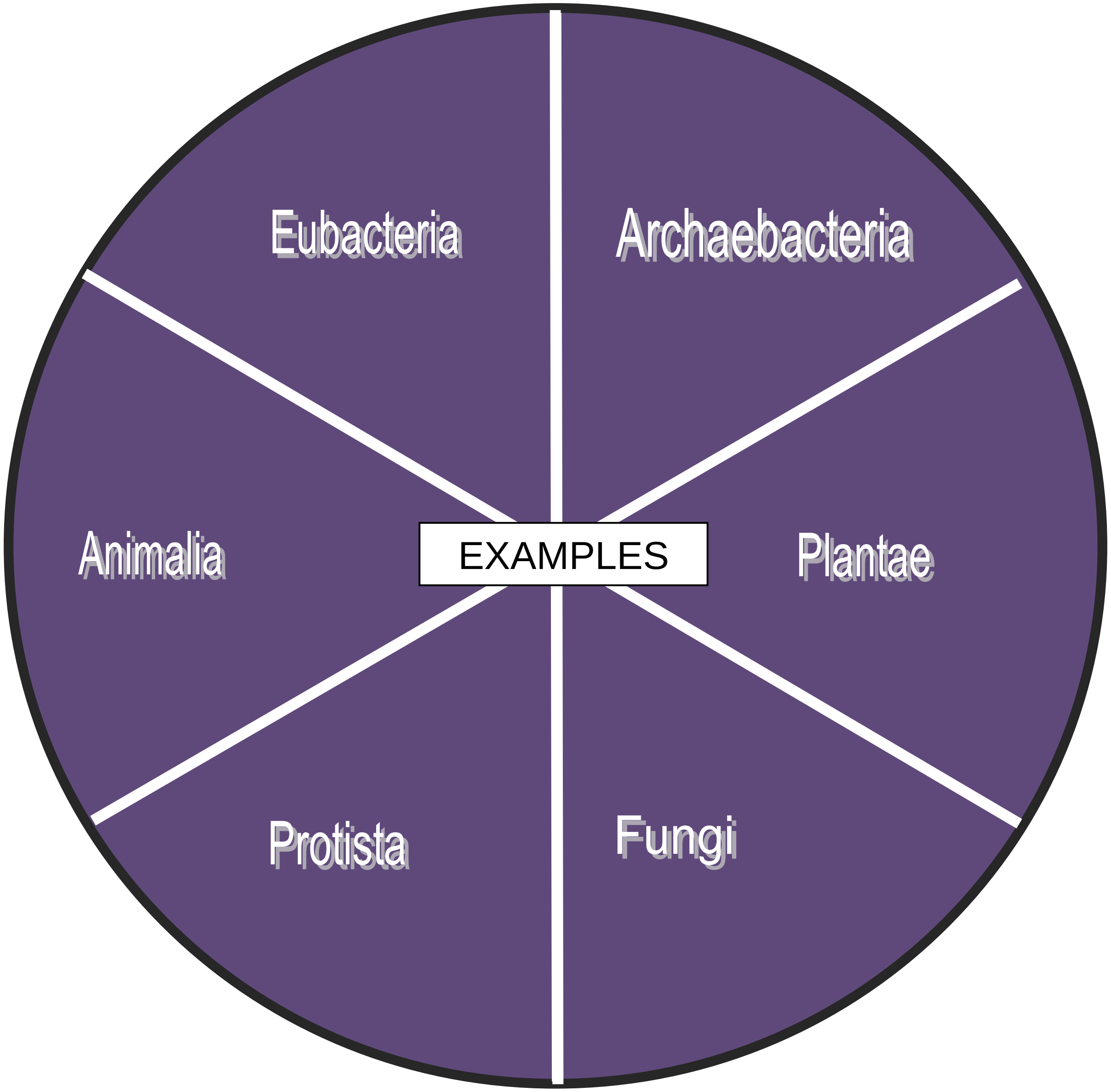
Kingdom Circles: Energy



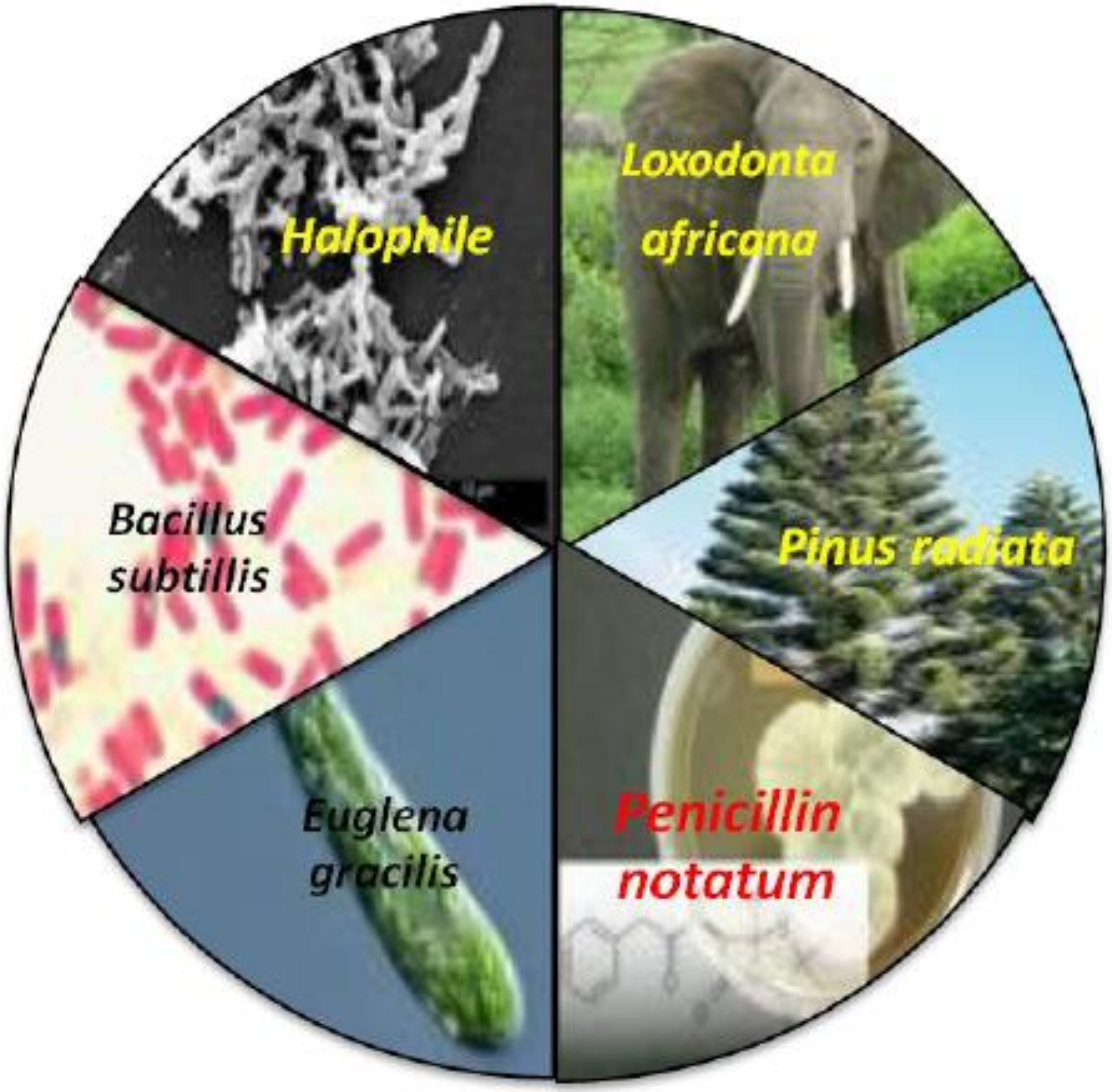
Answer Circle Wedges



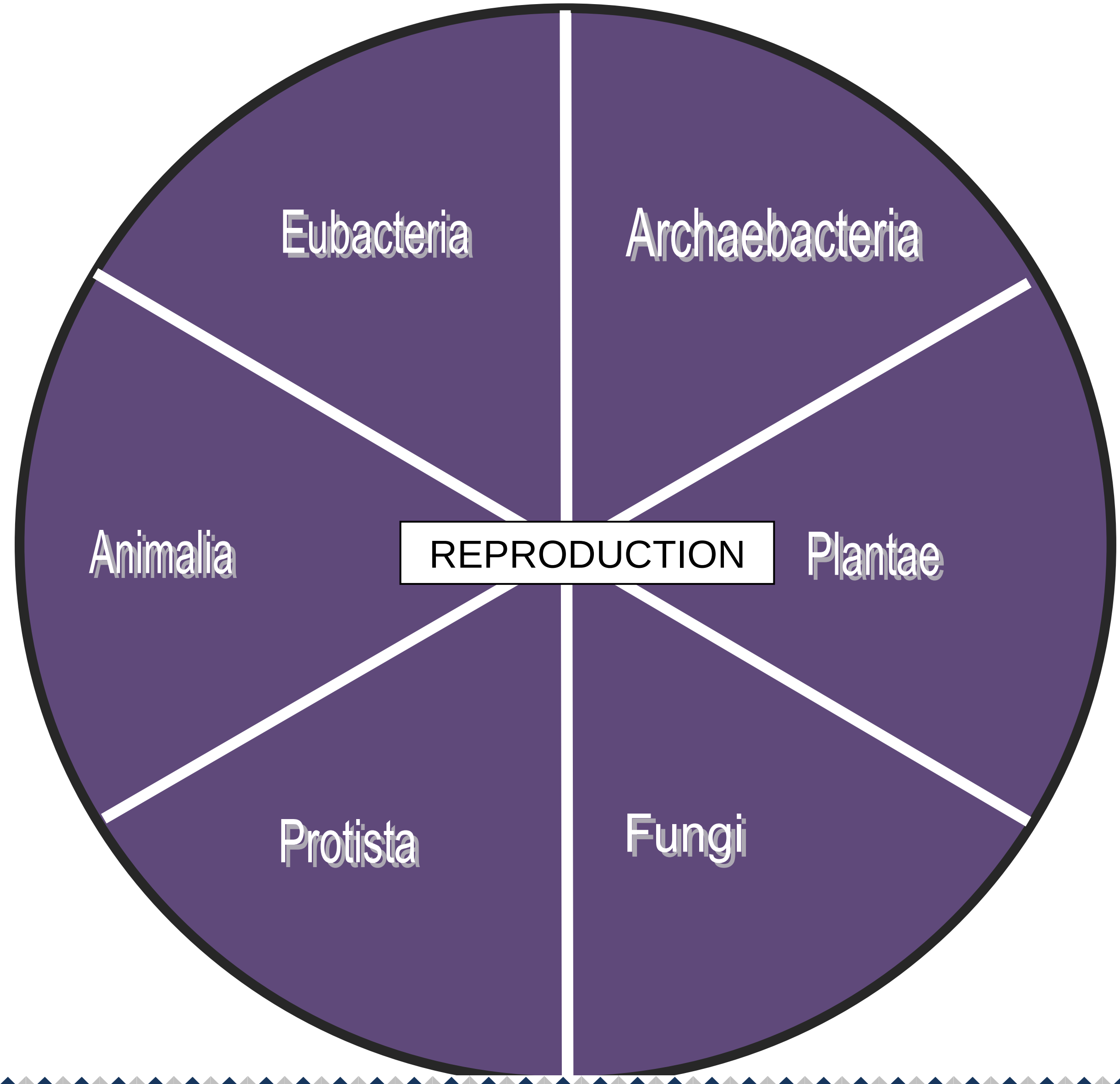
Kingdom Circles: Examples



Answer Circle Wedges



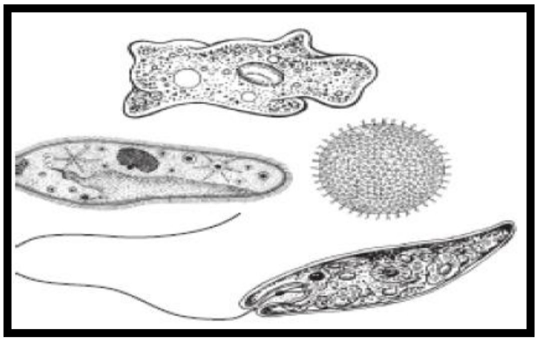
Kingdom Circles: Reproduction



Answer Circle Wedges

Review Questions 5
Similarities and Differences between Organisms of Different Kingdoms

1. The diverse organisms shown in the diagram below belong to the same kingdom.



To which kingdom do these organisms belong?

A. Animalia
B. Fungi
C. Plantae
D. Protista

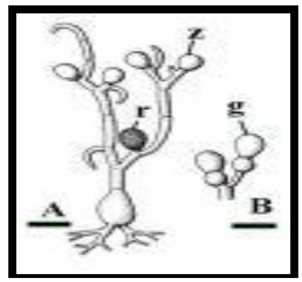
2. This kingdom is composed of autotrophs which obtain their energy exclusively from photosynthesis.

A. Archaebacteria
B. Animals
C. Protists
D. Plants

3. Members of this kingdom are exclusively anaerobic unicellular prokaryotes including a range of organisms that live in extreme environments.

A. Archaebacteria
B. Eubacteria
C. Protists
D. Animals

4. The heterotrophic eukaryotic multi-celled organism shown below absorbs its nutrients from its environment (called a saprophyte) with a network of hyphae shown in A. It reproduces asexually via budding. To which kingdom does it belong?



A. Archaebacteria
B. Eubacteria
C. Protists
D. Fungi

5. An outbreak of disease is being researched by the CDC in Atlanta. The organism causing the disease is a heterotroph with cells that do not have walls and enzymes released from organs in its digestive system. To which kingdom does this pathogen belong?

A. Animal
B. Eubacteria
C. Protists
D. Fungi

6. A fungus has a wall composed of a polysaccharide similar to cellulose, which is also found in the exoskeleton of insects. This material is

   A. chitin
   B. hemicellulose
   C. leucine
   D. protein-lipid layers

7. Which of the following are prokaryotic organisms?

   A. Bacteria
   B. Oak trees
   C. Mushrooms
   D. Brown algae

8. For which group of organisms is binary fission the most common type of asexual reproduction?

   A. Simple plants like mosses and fens
   B. Advanced flowering plants
   C. Invertebrates such as worms
   D. Unicellular organisms like amoebae

9. Bread molds, a type of fungi, reproduce sexually by conjugation and asexually by

   A. spores
   B. grafting
   C. cloning
   D. meiosis

10. Which of the following distinguishes the organisms in the kingdom Fungi from other eukaryotic organisms?

    A. fungi are unicellular
    B. fungi reproduce sexually
    C. fungi obtain nutrients by absorption
    D. fungi make food through photosynthesis

11. Which of these kingdoms includes prokaryote organisms that were among the first forms of life to evolve?

    A. Fungi
    B. Algae
    C. Plantae
    D. Archaebacteria

12. A microbiologist notices a strange organism growing on the leftover lasagna that he has left in the lab refrigerator for 2 months. He removes a sample of the organism and places it under an electron microscope. He notes that the organism has no nuclear membrane and no mitochondria in its cells. Though very small in size, a cell wall is present. He notes that the organism seems to be strictly single-celled. Based on the structure of the cells, what type of organism is this likely to be?

    A. A eukaryote in kingdom fungi
    B. A eukaryote in kingdom protista
    C. A prokaryote in kingdom plantae
    D. A prokaryote in kingdom eubacteria

13. A certain kingdom contains heterotrophic, eukaryotic organisms with cell walls. Organisms in this kingdom are usually multi-celled, but a few single-celled exceptions do exist. No organism in this kingdom can photosynthesize or move on its own. What kingdom is this?

    A. Plantae
    B. Eubacteria
    C. Fungi
    D. Animalia

14. A mushroom and a humpback whale are alike because both are

    A. Motile
    B. Heterotrophic
    C. Prokaryotic
    D. Unicellular

15. Four clear glass jars are filled half-way with water and half-way with a mixture of carbon dioxide and oxygen. No food is placed in the jars. Organisms from four different kingdoms are placed separately into the four jars. The jars are sealed and placed in direct sunlight for six months. After this period the jars are checked to see if there are living inhabitants. Which classification of organisms lacks the characteristics necessary to survive the conditions in the jar for six months?

    A. Fungi
    B. Plantae
    C. Photosynthetic eubacteria
    D. Algae

16. Which example lacks the basic structures of a living organism and cannot metabolize or maintain homeostasis?

    A. A strep throat bacteria
    B. A cold virus
    C. A green algae
    D. A yeast

17. A certain kingdom's members are always multi-celled autotrophs, and thus, have chloroplasts for sugar production. Cell walls, composed of cellulose, surround the cells of these organisms. Identify this kingdom.

    A. Algae
    B. Fungi
    C. Plantae
    D. Protista

18. Which of these criteria are used to classify organisms into the modern classification system?

    A. Diet
    B. Life span
    C. Similarities to fossils
    D. The habitat in which they live

19. An important difference between viruses and living cells is that viruses

    A. Cannot reproduce outside of cells
    B. Contain more nuclei than cells
    C. Cannot mutate but cells can
    D. Need an energy source but cells do not

20. Experimental Observation

1. Nucleus is present 2. Cell wall is present 3. Chloroplasts and mitochondria are both present

    The eukaryotic organism described above should be classified as

    A. An animal
    B. A bacterium
    C. A fungus
    D. A plant

21. Unlike plants, fungi cannot make their own food because they do not have

    A. Roots
    B. Hyphae
    C. Spores
    D. Chlorophyll

22. Which pair of structures *best* shows that plant cells have functions different from animal cells?

    A. Cytoplasm and mitochondria
    B. Chloroplasts and cell walls
    C. Nuclei and centrioles
    D. Ribosomes and cell membranes

23. When an animal eats, food stays in the stomach for a period of time. When a unicellular organism, such as *Paramecium*, takes in food, the food is contained in which organelle?

    A. Chloroplast
    B. Mitochondrion
    C. Nucleus
    D. Vacuole

RADIOACTIVITY ANTICIPATION GUIDE

Name:_________________________________ **Date:** ___________________________

Directions: You will be learning about radioactivity. BEFORE WE BEGIN, read statements below and decide if you think they are true or false. Put a check next to each statement in the "Before" column under either "True" or "False".
You will then perform two activities on Radioactive Decay.
After the two activities you will re-evaluate each statement and mark "True" or "False" in the "After" column. Note: You may change your initial opinion or keep it the way it is.

Before		**Statement**	**After**	
True	**False**		**True**	**False**
		Half-life is the amount of time it takes half of the atom in the isotope to decay to a new element. Half-life happens instantly.		
		Nuclear fission happens when charged atomic nuclei join together to form a heavier nucleus while nuclear fusion is the process whereby the nucleus of a particular heavy element splits into two nuclei.		
		Nuclear energy has great potential for practical applications.		
		Nuclear reactions convert matter into energy through the process of radioactive decay, fission and fusion.		
		Beta particles are high-energy electrons emitted by certain types of radioactive nuclei.		

Phase Change Stations Labs

STATION 1
Ice, Ice, Baby

Teacher note: At this station, place a beaker that is about halfway filled with ice. Set this up a few minutes ahead of time so that the ice has some time to melt, leaving some ice and some water in the beaker.

Materials:
Beaker
Thermometer- Laser or Traditional
Ice

Instructions

1. The ice in beaker #1 is changing phase. Draw a picture showing what is happening to the motion of the molecules as the ice changes phase.

2. Check the temperature of the ice/water mixture. What do you think will happen to the temperature as the ice turns to water?

3. Shoot the outside of the bottom of the beaker with the laser thermometer (or use a traditional thermometer). Record the temperature.

4. Shoot the outside of the top of the beaker at the point where the ice is just turning to water (or use a traditional thermometer). Record the temperature.

STATION 2
Colored Molecules?

Teacher note: Students will be able to observe how temperature affects the rate at which the particles disperse due to molecular motion.

Materials:
2 Beakers, 1 with water at room temperature, 1 with cold water
Food coloring
Timing device

Instructions
One of these beakers contains room temperature water and the other contains cold water.

1. Place 2 drops of food coloring in the room temperature water and time how long it takes for the water to completely turn color. Write it down.

2. Place 2 drops of food coloring in the cold water and time how long it takes for the water to completely turn color. Write it down.

3. Write an explanation of the effect temperature has on how fast particles move.

STATION 3
What Can the Matter Be?

Teacher note: This station is set up as an "observation only" station. Students will be able to observe boiling, evaporation, condensation, and precipitation.

Materials:

- Beaker of water on hotplate that is continuously boiling.
- Ring stand and ring with a small piece of glass placed on top of the ring directly over the boiling water on the hotplate (approximately 6 inches apart)

Instructions

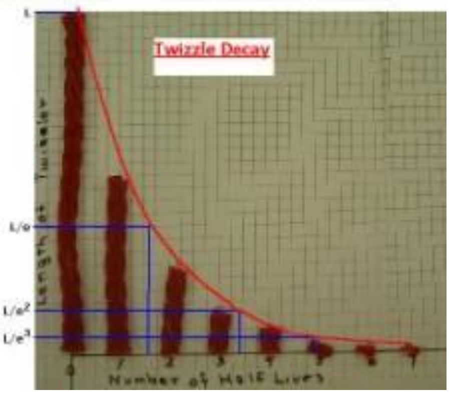
1. Draw a diagram of the experimental set-up and describe the evidence that you can see that a phase change is taking place. Identify in your diagram where you see this evidence.
2. Draw a diagram showing the motion of the molecules as they go through each phase change.

Twizzlers Lab- ½ Life

Materials:
1 Twizzlers
Graph paper
Timer
1 Pair of Scissors

Instructions:
Before beginning, draw an X and a Y axis on your graph paper. Label the Y axis “amount” and the X axis “Time”.

1. Hold the “undecayed” Twizzler vertically against the Y axis with one end at the origin. Mark the length. This represents the beginning amount. See photo below.



2. Make several equally space marks on the X axis. Each mark represents 30 seconds.
3. The teacher announces "TAKE A BITE"! Each student must eat HALF the length of the Twizzler or cut it in half.
4. Record the new Twizzler length on your graph at the 30 seconds mark.
5. After 30 seconds repeat step 3 until the Twizzler can no longer be halved, taking a bite every 30 seconds.
6. Finish graphing your results.

Analysis/Conclusions

1. Did the Twizzler ever completely disappear? Explain.
2. What is the half life time of your radioactive Twizzler? Explain.
3. If you had started with a Twizzler twice as long, how would that affect the shape of the resulting graph? Explain.
4. How would your graph look if each ½ life took 60 seconds?

Half Life Matrix: Example Problem

How many grams of iodine 131 (half life- 5 days) would be left after 20 days if you start with 25 grams? Answer: 1.56 g

The half life is			**5 days**
Number of half-lives passed	**Amount of Matter**		**Time**
0	**Started with**	**25 g**	**0 { days }**
1	How Much is left	12.5g	5 days
2	How Much is left	6.25 g	10 days
3	How Much is left	3.12 g	15 days
4	How Much is left	1.56 g	20 days
5	How Much is left		

Half Life Calculations Cards

Card #1
Problem How long will it take 600 grams of Plutonium 239 (half life 24,000 years) to decay to 18.75 grams? A. 120,000 yrs. B. 24,000 yrs. C. 3 half-lifes D. 600 yrs
Calculation Template

The half life is			**days**
Number of half-lives passed	**Amount of Matter**		**Time**
0	**Started with**		**0 {________}**
1	How Much is left		
2	How Much is left		
3	How Much is left		
4	How Much is left		
5	How Much is left		

Card #2

Problem

K-42 has a half-life of 15.5 hrs. If 13.125g of K-42 remains undecayed after 62.0 hours, what was the original sample size?

A. 26.25g
B. 39.36g
C. 52.5g
D. 13.125g

Calculation Template

The half life is			**days**
Number of half-lives passed	**Amount of Matter**		**Time**
0	**Started with**		**0 {________}**
1	How Much is left		
2	How Much is left		
3	How Much is left		
4	How Much is left		
5	How Much is left		

Card #3

Problem
An isotope of cesium (cesium-137 has a half -life of 30 years. If 20 mg of cesium-137 disintegrates over a period of 90 years, how many mg of cesium-137 would remain?

A. 5 mg
B. 10 mg
C. 20 mg
D. 2.5 mg

Calculation Template

The half life is			**days**
Number of half-lives passed	**Amount of Matter**		**Time**
0	**Started with**		**0 {________}**
1	How Much is left		
2	How Much is left		
3	How Much is left		
4	How Much is left		
5	How Much is left		

Card #4

Problem
Thallium-208 has a half-life of 3 min. How long will it take for 120.0 g to decay to 7.50 g?

A. 6 min.
B. 9 min.
C. 3 min.
D. 1.5 min.

Calculation Template

The half life is			days
Number of half-lives passed	**Amount of Matter**		**Time**
0	**Started with**		**0 {________}**
1	How Much is left		
2	How Much is left		
3	How Much is left		
4	How Much is left		
5	How Much is left		

Card #5

Problem
If 60 g of Lithium-9 has a half-life of 100 years, how long will it take for lithium-9 to decay to 15 g?

A. 400 yrs.
B. 300 yrs.
C. 200 yrs.
D. 100 yrs.

Calculation Template

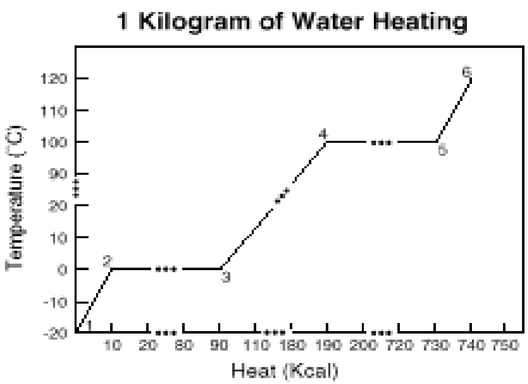
The half life is			**days**
Number of half-lives passed	**Amount of Matter**		**Time**
0	**Started with**		**0 {________}**
1	How Much is left		
2	How Much is left		
3	How Much is left		
4	How Much is left		
5	How Much is left		

Review Questions 6
Half Life and Phases of Matter

1. What fraction of carbon-14 will remain after it has decayed for 3 half-lives?

   A. $^{1}/_{16}$
   B. $^{1}/_{2}$
   C. $^{1}/_{4}$
   D. $^{1}/_{8}$

Use the diagram below to answer questions 2-4.



2. Between points 4 and 5, energy is being used to change water from a

   A. solid to a liquid
   B. solid to a gas
   C. liquid to a gas
   D. liquid to a solid

3. Between points 3 and 4 the water is in which of the following states?

   A. solid
   B. liquid
   C. gas
   D. liquid and gas

4. Between which points would you expect to receive the worst burns?

   A. 3 and 4
   B. 4 and 5
   C. 5 and 6
   D. 4 through 6

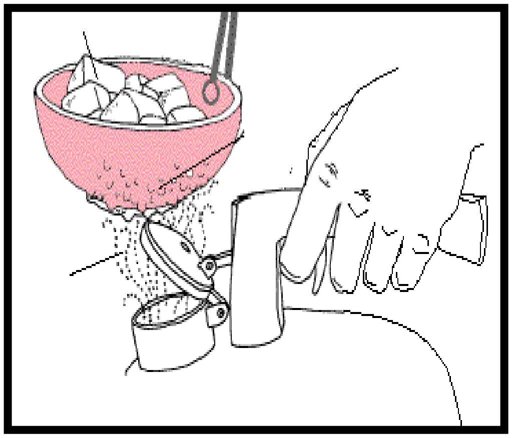
5. Which of the following changes occurs as a solid is heated?

   A. The kinetic energy of the solid decreases.
   B. The average density of the solid increases.
   C. The specific heat capacity of the solid decreases.
   D. The average molecular speed in the solid increases.

6. Carbon-14 has a half-life of approximately 5,700 years. Analysis of the carbon in a piece of charred wood found in an excavation revealed that the carbon has 25 percent of the amount of carbon-14 that is found in the carbon of living trees. Which of the following is most nearly the age of the excavated wood?

   A. 160 years
   B. 5,700 years
   C. 11,400 years
   D. 23,000 years

7. See the figure below



The particles are moving most quickly in the:

A. Ice in the bowl
B. Drops of water on the bowl
C. Steam under the bowl
D. Water inside the teapot

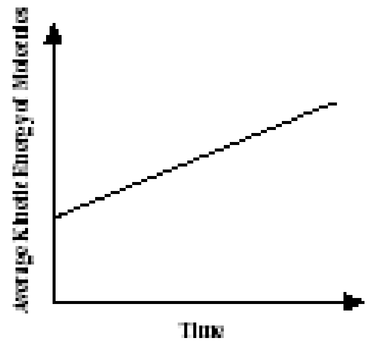
8. Which of the following correctly describes molecules of two different gases if they are at the same temperature and pressure?

A. They must have the same mass.
B. They must have the same velocity.
C. They must have the same average kinetic energy.
D. They must have the same average potential energy.

9. A sample of Francium-212 will decay to one-sixteenth its original amount after 80 minutes. What is the half-life of francium-212?

A. 10 min.
B. 20 min.
C. 30 min.
D. 80 min.

10. The graph below represents changes in molecular motion in a solid plastic cylinder over time.



These changes in the molecules of the plastic cylinder must be accompanied by which of the following?

A. an increase in mass
B. a decrease in volume
C. an increase in temperature
D. a decrease in heat capacity

11. Which arrangement correctly shows the molecular movement for the phases of water, going from the slowest to fastest (least amount of kinetic energy to the greatest amount of kinetic energy)

A. Gas-Liquid-Solid
B. Liquid-Gas-Solid
C. Solid-Liquid-Gas
D. Solid-Gas-Liquid

12. In which of the following situations would water molecules have the least energy?

A. when water is frozen as ice
B. in a mixture of ice & water
C. when water is boiling
D. when water is superheated steam

13. Which ONE of the following is a TRUE statement?

    A. In the gas state, molecules move around freely.
    B. Liquids do not change shape easily.
    C. Gas molecules move more slowly as they are heated.
    D. Plasma is the most common state of matter found on Earth.

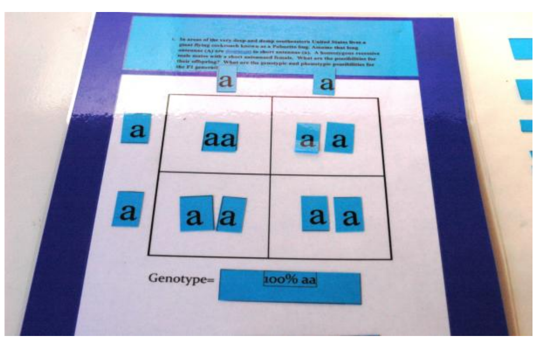
14. How long does it take a 180g sample of Au-198 to decay to 1/8 its original mass?

    A. 1 half-life
    B. 2 half-lifes
    C. 3 half-lifes
    D. 4 half-lifes

15. Health officials are concerned about radon levels in homes. The half-life of radon-222 is 3.82 days. If a sample of gas contains 4.38 micrograms of radon-222, how much will remain in the sample after 15.2 days?

    A. 27 mg
    B. .54 mg
    C. 2.19 mg
    D. .27 mg

Thursday, June 17		
Objective **Domain: Cells and Heredity** • Students explain the process of inheritance of genetic traits. • Students demonstrate understanding of Mendel's Laws in genetic inheritance and variability.		
Time	**Activity/Task**	**Assessment**
15 min	*The Perfect Pet-* The teacher distributes pictures of animals (one per student) as the students enter the class (see the animal cards in Thursday's June 17 materials section). Students will be told that this is their pet. They need to get to know it, name it if desired, and make a list of its characteristics. Students are to answer the question, "If you could genetically alter your new pet what one change would you make and why?" Students are to exchange their lists with partners. Instruct them to write pros and cons of the changes their partners made. Conduct a class discussion of changes made by the students and the pros and cons of having those changes in that animal.	Students complete a list of characteristics for their animal and a list of pros and cons for their partner's animal.
10 min	*Mendel's Laws* Watch the video segment *Gregor Mendel's Rules of Heredity: Using Punnett Squares* from United Streaming and complete the video comprehension sheet (see Mendel and Punnett Squares video comprehension sheet in Thursday's, June 17 materials section).	Video comprehension sheet.
10 min	*Genetics Basics* Students will each receive a baggie with the manipulative pieces for the Genetics Basics activity (see the Genetics Basics Activity in Thursday's, June 17 materials section). Review basic genetics vocabulary and have students manipulate the pieces to demonstrate an understanding of all vocabulary terms, i.e. "show me an example of homozygous dominant genes" etc. Have students work the genetics problems included with this activity (see Genetics Basics Problems in Thursday's, June 17 materials section).	Students complete their Punnett square activity and solve the Genetics Basic problems.

Thursday, June 17 (continuation)		
Time	**Activity/Task**	**Assessment**
20 min	*Hidden Page Foldable* You get What You See or do You? One strategy to help students grasp the meaning of phenotype and genotype and the differences between them is through the aid of a “hidden” page. Allow students to make the pamphlet with the hidden page (See instructions in Thursday’s, June 17 materials section). After completion of the hidden page allow students to glue a large magazine picture on the inside of the pamphlet. (Note: Cut the outside dimensions of the picture to fit the inside of the pamphlet. Then cut the picture in half and glue in place. See the pictures in the Thursday’s, June 17 materials section.) Ask students to write “Phenotype” over the picture. Then have them list as many characteristics as they can observe about the animal in their picture. This would be a good place to review the terms dominant traits and recessive traits in relation to phenotype. Open the pamphlet to the hidden page. Ask students to label this page with the heading “Genotype”. Ask students to record information about the genetics of their animal that they can’t see. The back of the pamphlet can be used for questions about genetics such as completing a Punnett square.	Students create foldables
15 min	*Genetics Problems* Teachers will facilitate students’ work in guided practice problems. (See Genetics Problems: Manipulatives 1 and 2 in Thursday’s, June 17 materials section). Below is the genetics problem photo of how the poster for this activity is assembled.  Provide the students with the two genetics problems and ask them to complete the Punnett Square. When the students finish and the teacher has checked the solution, ask the students to write a rationale for their answers in their notebooks.	Students complete manipulatives problems

Thursday, June 17 (continuation)		
Objective **Domain: Cells and Heredity** • Students discuss the use of DNA technology in the fields of medicine and agriculture.		
30 min	*Biotechnology as seen Today* On a T-chart students will record the pros and cons of using biotechnology in medicine and agriculture. The teacher will lead a discussion in a Think-Pair-Share format (3 minutes each sharing—student to student, pair to pair, and large group) The teacher will distribute a bag of pictures of genetically altered medicine, plants and animals to students (See Biotechnology as seen Today in Thursday's, June 17 materials section.) The teacher will ask students to record, under a *Comments* section on their T-charts, their opinions, knowledge, and/or experiences with medicines and agricultural products that have been genetically altered using biotechnology. The teacher needs to facilitate the groups' discussions making sure that each student has a chance to participate. Students need to support/defend their positions using their pros and cons from their T-charts.	Students will complete their T-charts and share their answers
20 min	*Review Questions 7* Provide students with a set of questions (see Review Questions 7 handout in Thursday's, June 17 materials section) about Mendel's laws and the use of biotechnology. Give them 15 minutes to answer the questions individually. Conduct a group discussion of the answers to the questions. Ask the students to correct their answers if necessary provide an explanation for the correction. The explanation must state the original reason the student chose the wrong answer and what makes the answer choice correct.	Student questionnaire

<table>
<tr><th colspan="3">Thursday, June 17 (continuation)</th></tr>
<tr><td colspan="3">Objective
Domain: Energy Transformations
• Students investigate and describe molecular motion as it relates to thermal energy changes in conduction, convection, and radiation.</td></tr>
<tr><th>Time</th><th>Activity/Task</th><th>Assessment</th></tr>
<tr><td>15 min</td><td>What's going On?
Prior to class the teacher should prepare the lab for student observations. Fill one cup with cold water and the other cup with warm water. (Safety reminder: Hot water from the tap is sufficient.) Using twist ties; tie a square of chocolate onto the handle of each spoon and place one spoon in each of the two cups. Place a thermometer in each of the cups.
As students enter the classroom ask them to make observations without touching, and to record their findings. Observations should include similarities and differences.
The teacher leads a discussion on what the students observed.</td><td>Students record observations and participate in discussion</td></tr>
<tr><td>15 min</td><td>Energy Transformations I
The teacher performs the demonstration; Convection, Conduction and Radiation, as her tool for explicitly teaching these concepts. (See Convection, Conduction and Radiation in Thursday's, June 17 materials section.)
Students should either sketch a diagram or write a paragraph describing what they observed and provids a possible explanation to the result of the demonstration in their notebooks.
Students should write their hypotheses on chart paper on the wall to be discussed at the end of the class.</td><td>Student's notes containing their observations and explanation of the demonstration.</td></tr>
<tr><td>15 min</td><td>Heat Transfer Concept Building
Ask the students to complete the Heat Transfer Basic Concepts organizers (see Heat Transfer Basic Concepts organizers in Thursday's, June 17 materials section). After a reasonable amount of time ask students to work with a classmate and compare their answers. Close the activity by directing a discussion on each concept. Encourage the students to revise and correct their work, if necessary, based on the results of the classroom discussion
Teacher note: Make sure that you emphasizes that
• heat transfer occurs by conduction, convection, and radiation into cooler places
• different substances absorb different amounts of heat before their temperature changes
• temperature can change as heat is being transferred</td><td>Foldable-check for correct understanding</td></tr>
</table>

<table>
<tr><th colspan="3">Thursday, June 17 (continuation)</th></tr>
<tr><td colspan="3">Objective
Domain: Energy Transformations
• Students investigate and describe molecular motion as it relates to thermal energy changes in conduction, convection, and radiation.</td></tr>
<tr><th>Time</th><th>Activity/Task</th><th>Assessment</th></tr>
<tr><td>20 min</td><td>Conduction, Convection, and Radiation Foldable Activity
Students will complete the foldable activity (See Conduction, Convection, and Radiation Foldable in the Thursday's, June 17 Materials Section).</td><td></td></tr>
<tr><td>20 min</td><td>Heat Transfer Manipulative
The teacher will give each student a bag containing the Heat Transfer Manipulative activity. (See Heat Transfer Manipulative in Thursday's, June 17 materials section.)
Students should lay the three terms conduction, convection, and radiation at the top of the table and place the pictures and descriptions under the correct term that describes the type of heat transfer shown.
Students will work independently to complete the activity and then check with a partner. The teacher will monitor the activity and pair sharing. The teacher will then lead a large group discussion of the activity.</td><td>Students will complete the manipulative and participate in the discussion</td></tr>
<tr><td>20 min</td><td>Energy Transformation Manipulative
The teacher will give each student a bag containing the Energy Transformation Manipulative activity. (See Energy Transformation Manipulative in Thursday's, June 17 materials section.)
Students will place beside each picture of an energy transformation a label indicating what energy change took place within the system.
Students will work independently to complete the activity and then check with a partner. The teacher will monitor the activity and pair sharing. The teacher will then lead a large group discussion of the activity</td><td>Students will complete the manipulative and participate in the discussion</td></tr>
<tr><td>15 min</td><td>Review Questions 8
Provide students with a set of questions (see Review Questions 7 handout in Thursday's, June 17 materials section) about energy transformation and heat transfer. Give them 15 minutes to answer the questions individually.
Conduct a group discussion of the answers to the questions. Ask the students to correct their answers if necessary providing an explanation for the correction. The explanation must state the original reason the student chose the wrong answer and what makes the answer choice correct.</td><td>Student questionnaire</td></tr>
</table>

Thursday's, June 17
Materials Section

Pets for The Perfect Pet Activity

Pets for the Perfect Pet Activity

Pets for the Perfect Pet Activity

Pets for the Perfect Pet Activity

Video Viewing Summary

Name: ____ **Date: ___________**

Instructions:

Write your answer to the following questions based on Gregor Mendel's Rules of Heredity: Using the Punnett Squares video that you just watched.

What are traits?	
What determines which traits will be passed down?	Rule 1:
	Rule 2:
Why are Punnett Squares used in heredity?	
What does it mean to have an organism that is purebred?	
What is a dominant trait?	
What is a recessive trait?	
When is offspring called hybrid?	

Basic Genetics Activity

Basic Genetics Activity (Continuation)

Aa	Aa	Aa
Aa	Aa	Aa
AA	AA	AA
AA	AA	AA
aa	aa	aa

Basic Genetics Activity (Continuation)

aa	aa	aa
a	a	a
a	a	a
A	A	A
A	A	A

Basic Genetics Activity (Continuation)

X	X	X
X	X	X

Phenotype	Heterozygous
Homozygous	Alleles
Dominant	Recessive

Basic Genetics Activity (Continuation)

Dominant	Recessive
Heterozygous	Homozygous
Alleles	Genotype
Genotype	

GENETICS BASICS

Practice Problems

PROBLEM 1

In dogs, wire hair (A) is dominant to smooth (a). In a cross of a homozygous wire-haired dog with a smooth-haired dog, what will be the phenotype of the F_1 generation?

What would be the genotype?

GENETICS BASICS

Practice Problems

PROBLEM 2

Woodrats are medium sized rodents with lots of interesting behaviors. You may know of them as packrats. Let's assume that the trait of bringing home shiny objects (A) is controlled by a single locus gene and is dominant to the trait of carrying home only dull objects (a). Suppose two heterozygous individuals are crossed.

a. How many of each genotype would be expected if only 4 offspring were produced?

AA____ Aa_____ aa_____

b. How many of each phenotype brings home shiny objects?

AA____ Aa_____ aa_____

c. How many of each phenotype brings home dull objects?

AA____ Aa_____ aa_____

GENETICS BASICS

Practice Problems

PROBLEM 3

The common grackle is a species of robin-sized blackbirds that are fairly common over most of the United States. Suppose that long tails (A) were dominant to short tails in these birds. A female short-tailed grackle mates with a male long-tailed grackle who had one parent with a long tail and one parent with a short tail.

a. What is the male's genotype?

b. How many of each genotype will be found in the F_1 generation (assume 4 offspring)?

AA_____ Aa_____ aa_____

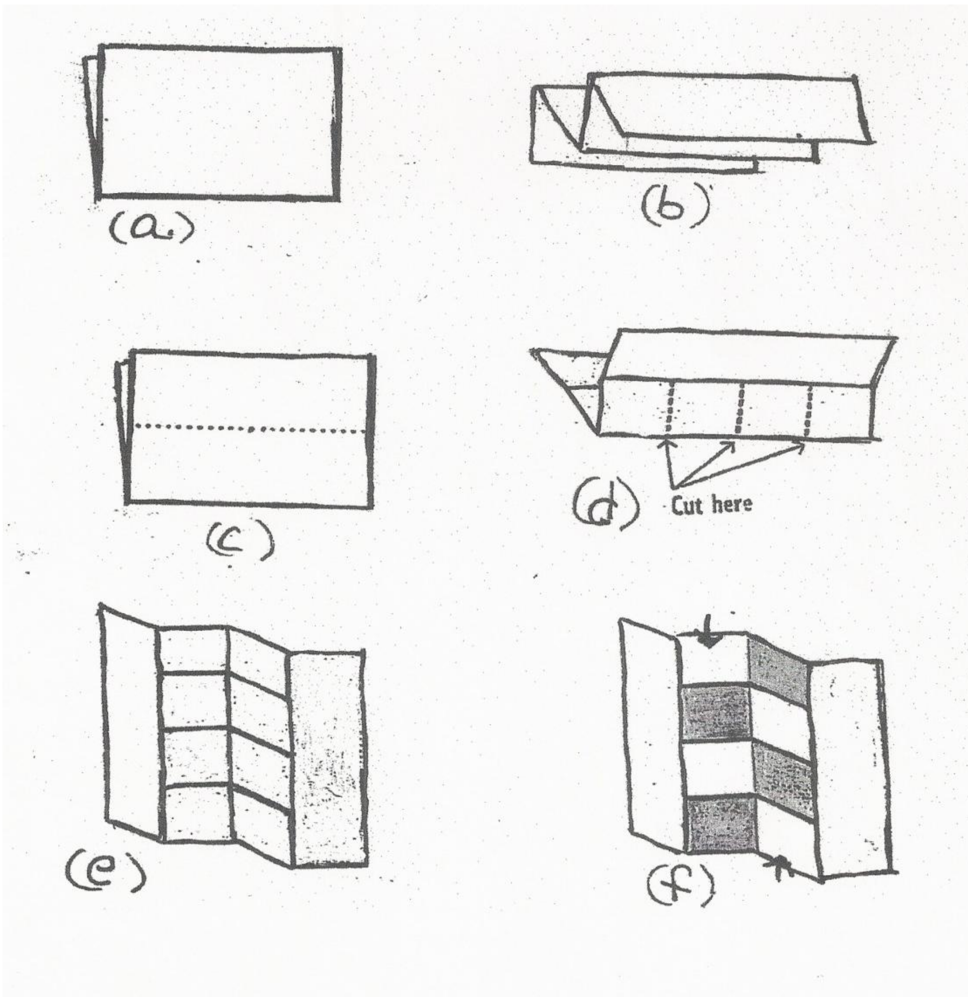
c. How many of each phenotype will be found in the F_1 generation?

Long Tail_____ Short Tail_____

Hidden Page Foldable

Instructions:

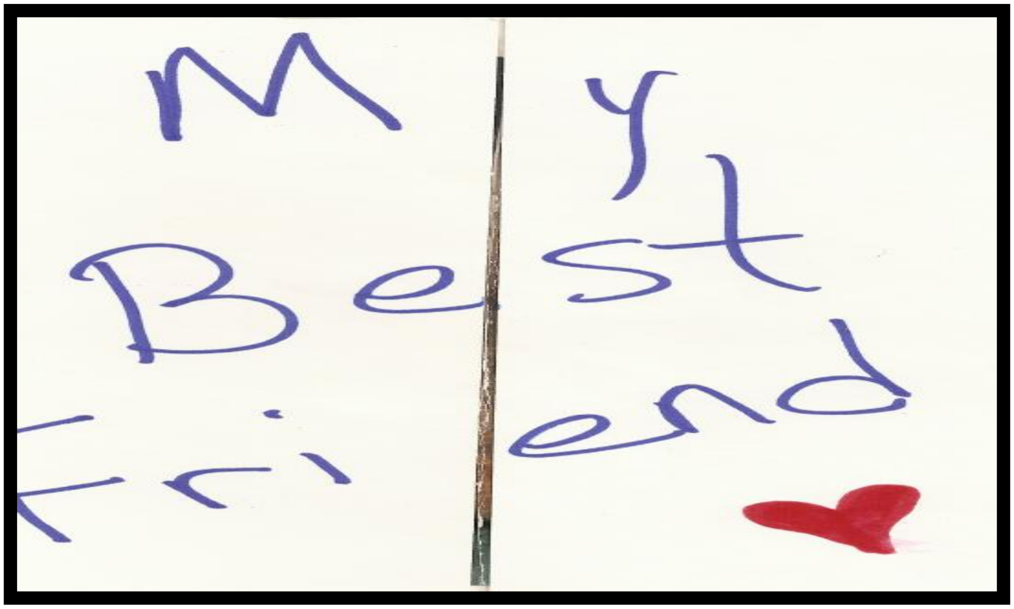
a. Fold a piece of paper in half "hamburger style" (see picture a).
b. Fold the two sides back towards the center (see picture b). You should now have a "W".
c. Return the side folds to their original positions (see picture c).
d. Holding your paper on the fold, cut a line in the middle of the paper from the fold to the creased mark made in step b.
e. Make two additional cuts halfway between the middle cut and the outside edges (see picture d).
f. Open the sheet of paper (see picture e).
g. Cut two strips of paper such that each one fits through the slots made by the cuts made on step e.
h. Weave a strip of paper that has been previously cut to fit through ½ of the slotted area. Weave the second strip of paper in the opposing remaining slots (see picture f).



Hidden Page Foldable (continuation)

Example of the final product

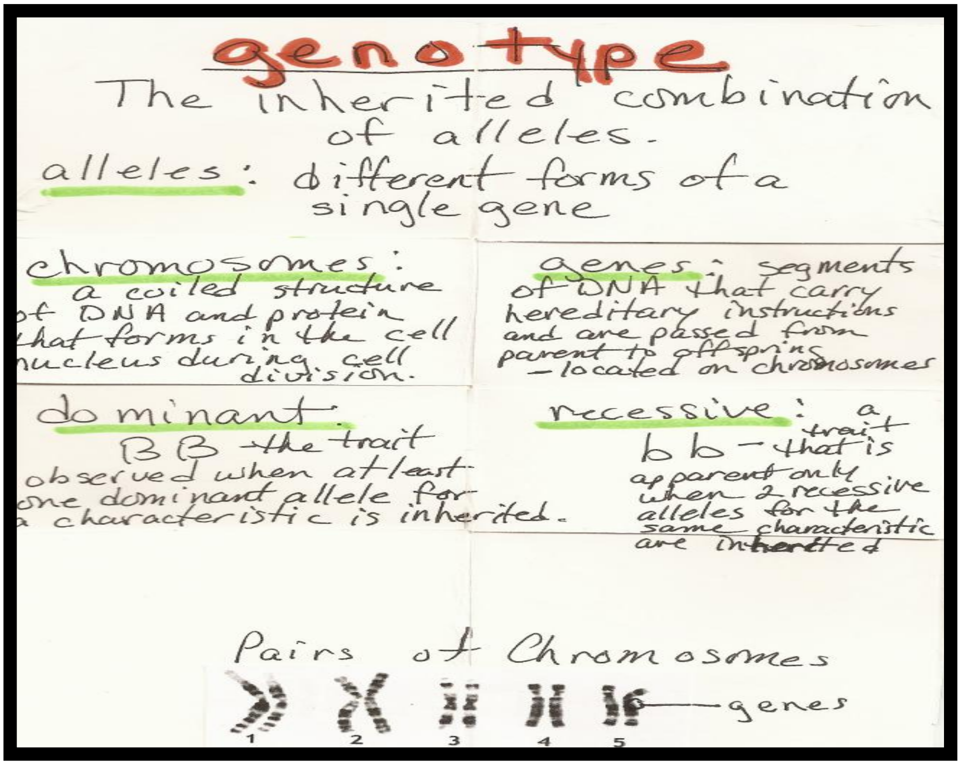
Front View



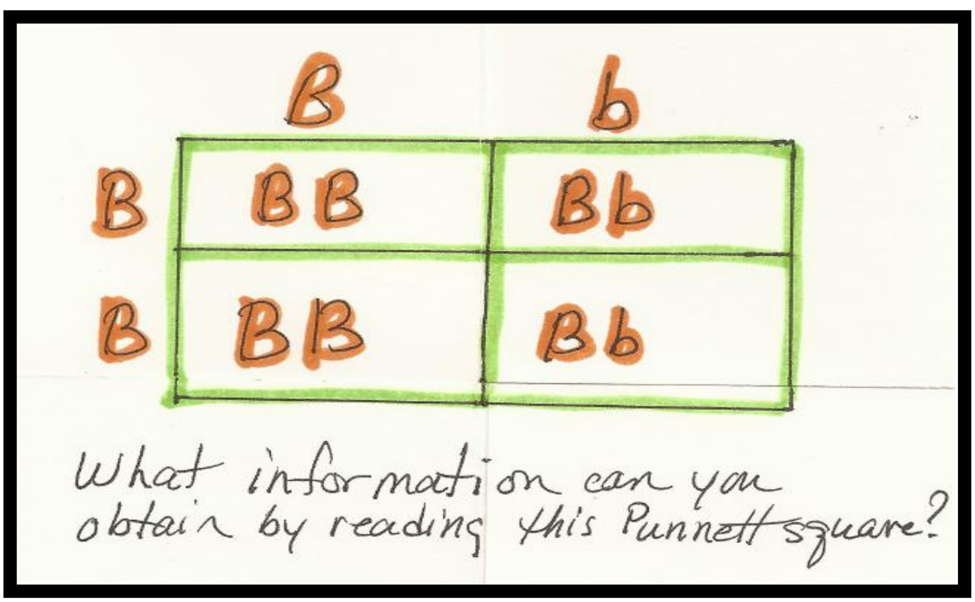
Inside View 1

Hidden Page Foldable (continuation)

Inside View 2



Inside View 3



Genetics Problems Manipulatives 1

In areas of the very deep and damp southeastern United States lives a giant flying cockroach known as a Palmetto bug. Assume that long antennae (A) are dominant to short antennae (a). Supposed that a homozygous recessive male mates with a short antennae female. What are the possibilities for their offspring? What are the genotypic and phenotypic possibilities for the F1 generation?

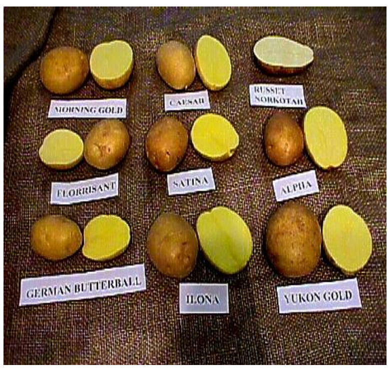
GENOTYPE **PHENOTYPE**

Genetics Problems Manipulatives 2

Kelp, a large, multi-cellular type of algae, has air bladders in the blades to help them float near the surface of the ocean where they can get more sunlight. Assume that having many air bladders (A) is a dominant trait. What would the offspring possibilities be of two heterozygous individuals?

GENOTYPE **PHENOTYPE**

Pictures of Biotechnology as seen Today



Biotechnology as Seen Today –Pros and Cons

PROS	CONS
Comments	**Comments**

Review Questions 7
Mendel's Laws and Biotechnology

1. Which explains how the advantage of genetic variation through sexual reproduction occurs?

   A. One of each pair of chromosomes comes from each parent.
   B. The union of sperm and egg occurs during meiosis.
   C. Meiosis occurs in all body cells also.
   D. Division of body cells results in a greater variety of traits.

2. Why is meiosis important?

   A. The process allows an organism to reproduce asexually.
   B. The process produces two cells identical to the parent cell.
   C. The process produces cells with half the normal number of chromosomes.
   D. The process causes a fertilized egg to multiply and develop into an embryo.

3. Which of the following would be an important advantage of sexual reproduction over asexual reproduction?

   A. more variation among offspring
   B. the production of more offspring
   C. the quicker development of offspring
   D. the protection of the offspring by the parent

4. The process of asexual reproduction forms offspring from

   A. a single organism
   B. the process of mating
   C. male and female parents
   D. the joining of two sets of chromosomes

5. Which is an example of cloning?

   A. taking leaf cuttings from a houseplant and growing new plants from them
   B. transferring pollen from one flower to another
   C. conjugation of two paramecia
   D. none of these

6. A normal cell formed by fertilization, containing two copies of each chromosome, one from the mother and one from the father, is

   A. diploid
   B. haploid
   C. a gamete
   D. an allele

7. Scientists use artificial pollination to develop new kinds of flowers, fruits, and vegetables. This type of selective breeding produces new varieties called

   A. dicots
   B. hybrids
   C. predators
   D. monocots

8. The curled ears of the American Curl cat are caused by an autosomal dominant allele. What are the chances of a heterozygous female and a homozygous recessive male producing offspring with curled ears?

   A. 1 in 4
   B. 2 in 4
   C. 3 in 4
   D. 4 in 4

9. An animal combines DNA from two parent organisms through sexual reproduction. Organisms that do NOT exchange genetic material must rely on what for new traits?

   A. Meiosis
   B. Mutation
   C. Hemolysis
   D. Cross breeding

10. Artificial selection is human intervention allowing only the **best** organisms to produce offspring. How is this process **most** useful to humanity?

    A. It allows the development of new species not dependent on the environment
    B. It allows geneticists to emphasize desirable traits in food, plants, and animals.
    C. It prevents the development of new species.
    D. It gives the existing species a better chance to reproduce in greater numbers.

11. Read the passage and answer the question. The French biologist Cuenot crossed wild, gray-colored mice with white (albino) mice. In the first generation, all were gray. From the many litters of the second generation, 223 were gray and 72 were white. What principle of genetics is demonstrated by the data?

    A. Codominance
    B. Crossing over
    C. Dominance
    D. Epistasis

12. During sexual reproduction, traits pass from parents to offspring. The meiosis phase allows chromosomes to

    A. Remain constant in number after fertilization
    B. Fluctuate in number with environmental changes
    C. Increase in number from the previous generation
    D. Remain constant in number from parent to offspring

13. The process of meiosis, which is a special kind of cell division, forms gametes for

    A. Growth
    B. Repair
    C. Replacement
    D. Reproduction

14. What happens during meiosis?

    A. The number of chromosomes increases from haploid to diploid
    B. The number of chromosomes decreases from diploid to haploid
    C. There is a segregation of dominant and recessive genes
    D. There is an integration of dominant and recessive genes

15. Few of Wendy’s chromosomes are identical to those of either parent because most of the genes on them have been exchanged with genes on other chromosomes. What process accounts for this?

    A. Independent assortment
    B. Crossing over
    C. Nondisjunction
    D. Segregation

16. Which describes a current use of genetic engineering?

    A. Indentifying hereditary diseases
    B. Vaccinating a child for measles
    C. Making human insulin using bacteria
    D. Treating cancer with radiation therapy

17. An organism that is capable of passing on a trait for a specific disease to its offspring, but which does NOT express the disease itself, is described as which of the following?

    A. A carrier
    B. A homozygote
    C. A mutant
    D. A purebred

18. A normal cell formed by fertilization, containing two copies of each chromosome, one from the mother and one from the father, is

    A. Diploid
    B. Haploid
    C. A gamete
    D. An allele

19. The observed trait that appears in an organism as a result of its genetic makeup is called the organism's

    A. Allele
    B. Genotype
    C. Phenotype
    D. Karyotype

20. Genetic information for a breed of chicken is shown below.

Frizzle Fowl

Types of Chickens with Different Feathers

Genotype	Phenotype
FF	Normal (Normal feathers)
Ff	Frizzle fowl (Curly feathers)
ff	Feather shedder (Loses feathers easily)

Which of the following crosses of chickens will produce **only** Frizzle fowl offspring?

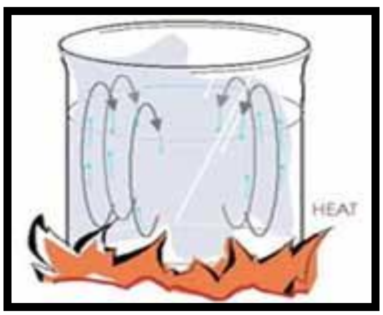
    A. Normal X Frizzle fowl
    B. Frizzle fowl X Frizzle fowl
    C. Normal X Feather shedder
    D. Feather shedder X Feather shedder

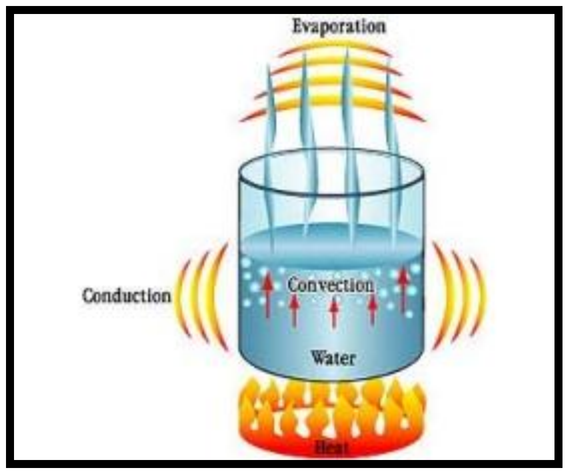
Conduction, Convection & Radiation Demo

Instructions:

1. Take a beaker and fill it with tap water.
2. Place the beaker on a hotplate on high.
3. Add a few drops of food coloring.

The water will be heated from the conduction of heat from the hotplate to the glass to the water. Water near the base of the beaker will heat up and become less dense then the water above it. This will cause it to move towards the top of the beaker and it will carry the dye with it in a convection cell. Explain the dynamics to the students as they observe it. Relate this to thermals in the atmosphere and vultures that ride them higher into the atmosphere.





Heat Transfer Basic Concepts

Concept

Convection

	Your definition

Drawing

Heat Transfer Basic Concepts

Concept

Radiation

	Your definition

Drawing

Heat Transfer Basic Concepts

Concept

Conduction

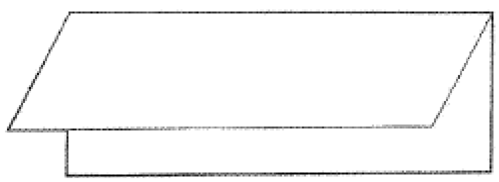
	Your definition

Drawing

Conduction, Convection, Radiation Foldable Activity

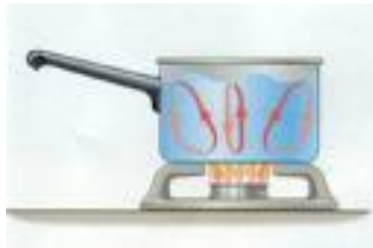
Instructions:

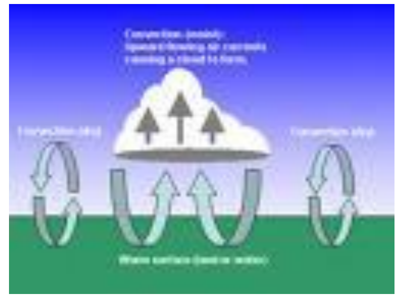
i. Have students take a piece of construction paper and fold it ‘hotdog’ style (see picture a).
ii. Cut two slits to the fold line to create three flaps.
iii. On those flaps, have students write the words “conduction”, “convection”, and “radiation” along with a picture representing each type of thermal energy transfer.
iv. Using the information given by the teacher during direct instruction, have students write the definition given and in their own words on the inside of each flap.
v. On the inside bottom, students should include general information about energy transfer that was given during direct instruction.

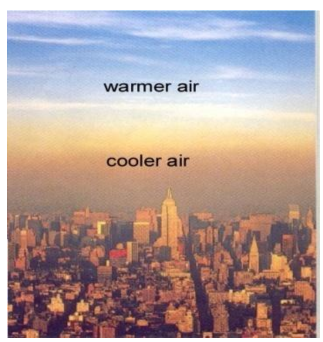


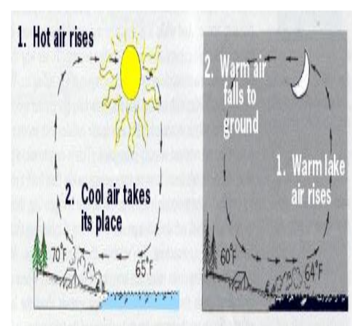
Picture a

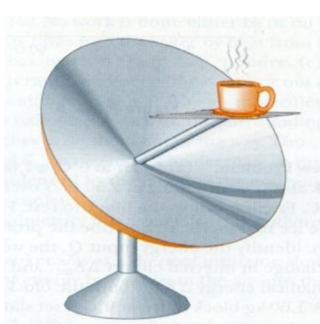
Heat Transfer Manipulatives

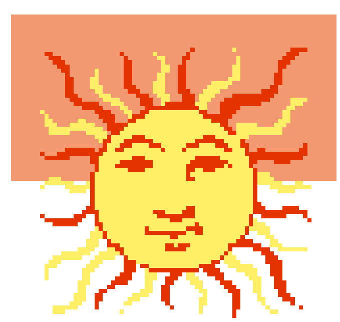












Heat Transfer Manipulatives

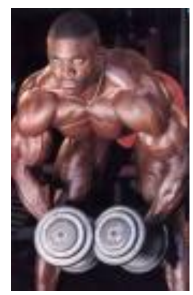
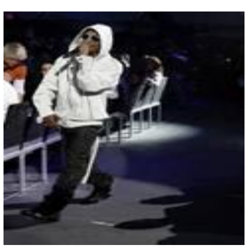
When hot air in a hot air balloon is heated, the balloon rises.	**If you observe a pan of boiling spaghetti, you will see the spaghetti rise and fall in the water.**	**You leave a spoon in hot soup and the spoon gets hot too.**
The sun feels warm on your skin.	**You place your hand in water and it feels warm.**	**You place your hand in water and it feels cold.**

CONVECTION	**RADIATION**
CONDUCTION	

<u>Energy Transformations Manipulative</u>

 George cooking on Foreman grill	Flashlight 	 Woman playing guitar
 Candle burning	 Man pushing mower	 Microwave cooking food
 Lightning bolt striking	 Hammer hitting nail	 Water flowing over generators

Energy Transformations Manipulative

 Marion Jones running	 Tim Duncan dunking	 Campfire
 Lance Armstrong riding bike	 Bird flying	 Man lifting weights
 T.I. singing in microphone	 Windmills generating electricity	 Solar collectors

Energy Transformations Manipulative

LIGHT	ELECTRICAL
THERMAL	MECHANICAL
CHEMICAL	SOUND
LIGHT	ELECTRICAL
THERMAL	MECHANICAL
CHEMICAL	SOUND

Energy Transformations Manipulative

ANSWERS		
Chemical to mechanical George cooking on Foreman grill	**Electrical to light or heat** Flashlight shining	**Chemical to mechanical** Woman playing guitar
Chemical to light or heat Candle burning	**Chemical to mechanical** Man pushing mower	**Electrical to thermal** Microwave cooking food
Electrical to thermal Lightning bolt striking	**Mechanical to heat** (nail gets hot) Hammer hitting nail	**Mechanical to electrical** Water flowing over generators
Chemical to mechanical Marion Jones running	**Chemical to mechanical** Tim Duncan dunking	**Chemical to thermal or light** Campfire
Chemical to mechanical Lance Armstrong riding bike	**Chemical to mechanical** Bird flying	**Chemical to mechanical** Man lifting weights
Chemical to sound T.I. singing in microphone	**Mechanical to electrical** Windmills generating electricity	**Heat to electrical** Solar collectors

Review Questions 8
Energy Transformation and Heat Transfer

1. Which of the following changes occurs as a solid is heated?

   A. The kinetic energy of the solid decreases.
   B. The average density of the solid increases.
   C. The specific heat capacity of the solid decreases.
   D. The average molecular speed in the solid increases.

2. Which system shows a transformation from chemical to electrical and light energy?

   A. A car battery causes the headlights to shine.
   B. A candle burns and lights up the room.
   C. A display of fireworks in the night sky.
   D. An avalanche rolls down a steep mountain.

3. Which of the following most correctly explains the flow of thermal energy in the picture below?

   A. gas to a liquid
   B. a liquid to a solid
   C. a warmer region to a cooler region
   D. a freezing material to a boiling material

4. A hang glider is able to sail through the air on warm winds which are heated by Earth's surface. This **best** illustrates one use of which principle of heat transfer?

   A. conduction
   B. convection
   C. radiation
   D. solar transfer

5. The sun's heat reaches Earth by what means?

   A. convection
   B. conduction
   C. collision
   D. radiation

6. The transfer of heat energy by heat traveling through a metal is known as

   A. Conduction
   B. Convection
   C. Radiation
   D. Reflection

7. When you put ice in a drink to cool it off

   A. coldness is transferred from the ice to the warmer drink
   B. heat is transferred from the warmer drink to the cooler ice
   C. eat from the ice is lost to the warmer liquid around it
   D. the ice cracks and releases cold air molecules which cool off the drink

8. The gasoline used in a car and the hamburger you ate for lunch, have which of the following similarities?

I. Both materials contain potential energy stored in their chemical bonds.
II. Both materials have complex compounds containing carbon.
III. The combination of either material with oxygen requires a net consumption of energy.

A. I only
B. III only
C. I and II only
D. I, II, and III

9. Although we rarely notice or think about it, we observe and use some of the basic principles of chemistry every day. The following questions ask you to consider some basic chemistry in the context of a camping trip. Before the camp fire is completely burned out, you ask your friend to get some more firewood. Jokingly, your friend asks why you cannot burn the ashes. Which of the following best explains why you cannot burn the ashes?

A. The stored chemical energy of the firewood has already been released
B. The kinetic energy of the wood has already been changed to chemical energy
C. The volume of the ashes is less than the volume of the wood burned
D. The temperature of the ashes in the fire is too high

10. Which energy transformation takes place when a match is struck against the side of a matchbox and bursts into flames?

A. electrical energy to light energy
B. Heat energy to kinetic energy
C. chemical energy to heat energy
D. Potential energy to electrical energy

11. While sitting next to a campfire, Susan noticed several different forms of energy being transformed from the potential chemical energy of the wood. She correctly named all of the following forms of energy except

A. Heat
B. Nuclear
C. Light
D. Sound

12. As a car is slowed, most of its kinetic energy is converted by the brakes to

A. potential energy
B. electrical energy
C. thermal energy
D. chemical energy

13. The best example of an object that possesses potential energy is

A. a rock sitting on the cliff
B. a falling rock
C. a rolling ball
D. a burning log

14. The potential energy of an object decreases as its _____ increases

    A. Velocity
    B. kinetic energy
    C. volume
    D. mechanical

15. While listening to your CD player, there are several different forms of energy being transformed from the chemical energy of the battery. Which of the following types of energy is the chemical energy that is not being transformed to another type?

    A. Heat
    B. Sound
    C. Nuclear
    D. Kinetic

16. As a basket ball is thrown up in the air, the kinetic energy _______ while the potential energy ______

    A. increases, increases
    B. decreases, decreases
    C. decreases, increases
    D. increases, decreases

17. The amount of thermal energy stored in an object depends on

    A. the mass of the object
    B. the temperature of the object
    C. the amount of energy that the particular material stores per degree of temperature
    D. the amount of thermal energy depends on all of the above

Friday, June 18		
Objective **Domain: Cells and Heredity** • Students differentiate how organisms from different kingdoms obtain, transform, and transport, energy and/or material. • Students understand the relationships between single-celled and multi-celled organisms, on a broad, conceptual level.		
Time	**Activity/Task**	**Assessment**
15 min	*Warm-up Activity* Divide students into groups of four. Give each group a sheet of chart paper and a marker. Have students list the basic requirements that all living things share and explain how energy is involved in each process. One person from each group presents information and short class discussion. Ask each group to discuss what they know about the properties of water and how water is involved with energy in an organism. Instruct each group to write their ideas on their chart paper. *Teacher Note: The purpose of this activity is to pre-assess student knowledge and to identify misconceptions.*	Group charts and participation in the group discussion.
15 min	*Water and Life* Watch the video segments Why Is Water Essential to Life on Earth? and Water and Plants: A Unique Relationship from Unitedstreaming. Ask the students to complete the Water and Life video reflection handout. (See Water and Life video reflection handout in Friday's, June 18 materials section) Use the video segments Cell Membrane: Homeostasis, Cell Membrane: Diffusion and Cell Membrane: Active Transport to illustrate the importance of water in cellular processes. Review questions for these three videos are also in the Water and Life video reflection handout. Allow students the opportunity to share answers from the video handouts with each other to check for accuracy. Go over the information with students.	Video handout.
5 min	*Photosynthesis and Respiration* Ask the students to complete the sentence stems under the "what I already know" column of the Photosynthesis and Respiration Information handout. (See Photosynthesis and Respiration Information handout in Friday's, June 18 materials section).	Complete the activity.

Friday, June 18 (continuation)		
Objective **Domain: Cells and Heredity** • Students differentiate how organisms from different kingdoms obtain, transform, and transport, energy and/or material. • Students understand the relationships between single-celled and multi-celled organisms, on a broad, conceptual level.		
Time	**Activity/Task**	**Assessment**
20 min	*Photosynthesis and Respiration* Photosynthesis and Respiration flashcards (See Photosynthesis and Respiration flashcards in Friday's, June 18 materials section). Pair students and have them create the equation for photosynthesis. *Teacher note*: Explain to the students that they will be studying the process of photosynthesis and respiration at a cellular level. Then have each pair reorganize the cards for cellular respiration and compare the processes in their notes. Have students complete a Venn diagram for photosynthesis and respiration. (See Photosynthesis and Respiration Venn diagram in Friday's, June 18 materials section). Review with students for accuracy.	Student's notes. Completing the Photosynthesis and Respiration Venn diagram
20 min	*Photosynthesis Activity* Divide the students in groups of three and provide them with the organizational charts for light dependent and light independent photosynthesis and one bag with the chart pieces (see Photosynthesis chart and pieces in Friday's, June 18 materials section). Ask the students to put the pieces in the order that they think they should go. Watch the video Photosynthesis from Unitedstreaming and complete the Photosynthesis video information handout (see Photosynthesis video information handout in Friday's, June 18 materials section).	Completion of organizational charts and video information handout.
20 min	*Photosynthesis –self evaluation* Based on the information from the video ask the students to review their organizational charts and make any changes that they may consider necessary. On the board or in a sheet of chart paper draw the same organizational charts that the students have and working together fill out the information. Ask the students to copy the information in their notebooks and complete the sentence stems under the "what I found out" column to evaluate understanding. (See Photosynthesis and Respiration Information handout in Friday's, June 18 materials section).	Reflection piece Participation in the classroom discussion
150 min	*Progress Assessment* See Practice test materials in the Friday's, June 18 material section.	

Friday's, June 18
Materials Section

Water and Life Video	
Why is water so important for life?	
Why is water important for plants?	
How is water important for photosynthesis?	
How does water move up from the soil to the leaf of the plants?	
What is homeostasis?	
Why is the cell membrane important for the cell?	
What are the two ways in which materials can pass through the cell membrane?	
Explain diffusion	
What is osmosis?	
Explain Active Transport	

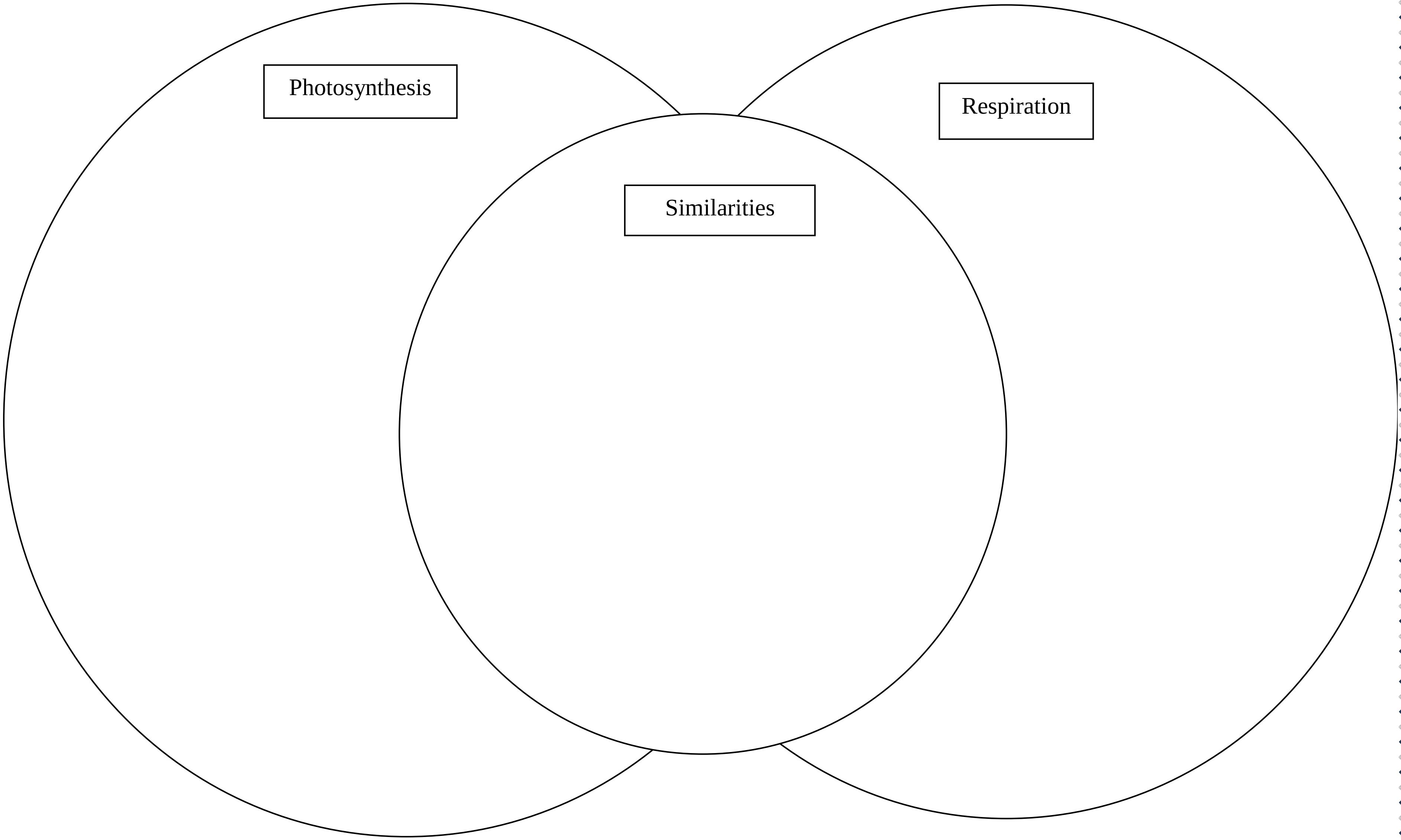
Photosynthesis and Respiration Flash Cards

OXYGEN	YIELDS	PLUS
CARBON DIOXIDE	PLUS	WATER
SOLAR ENERGY	GLUCOSE	$C_6H_{12}O_6$
O_2	H_2O	CO_2

Photosynthesis and Respiration Flash Cards

+	+	→
CHLOROPLAST		

Photosynthesis and Respiration Venn Diagram



Optional Phrases for Venn Diagram

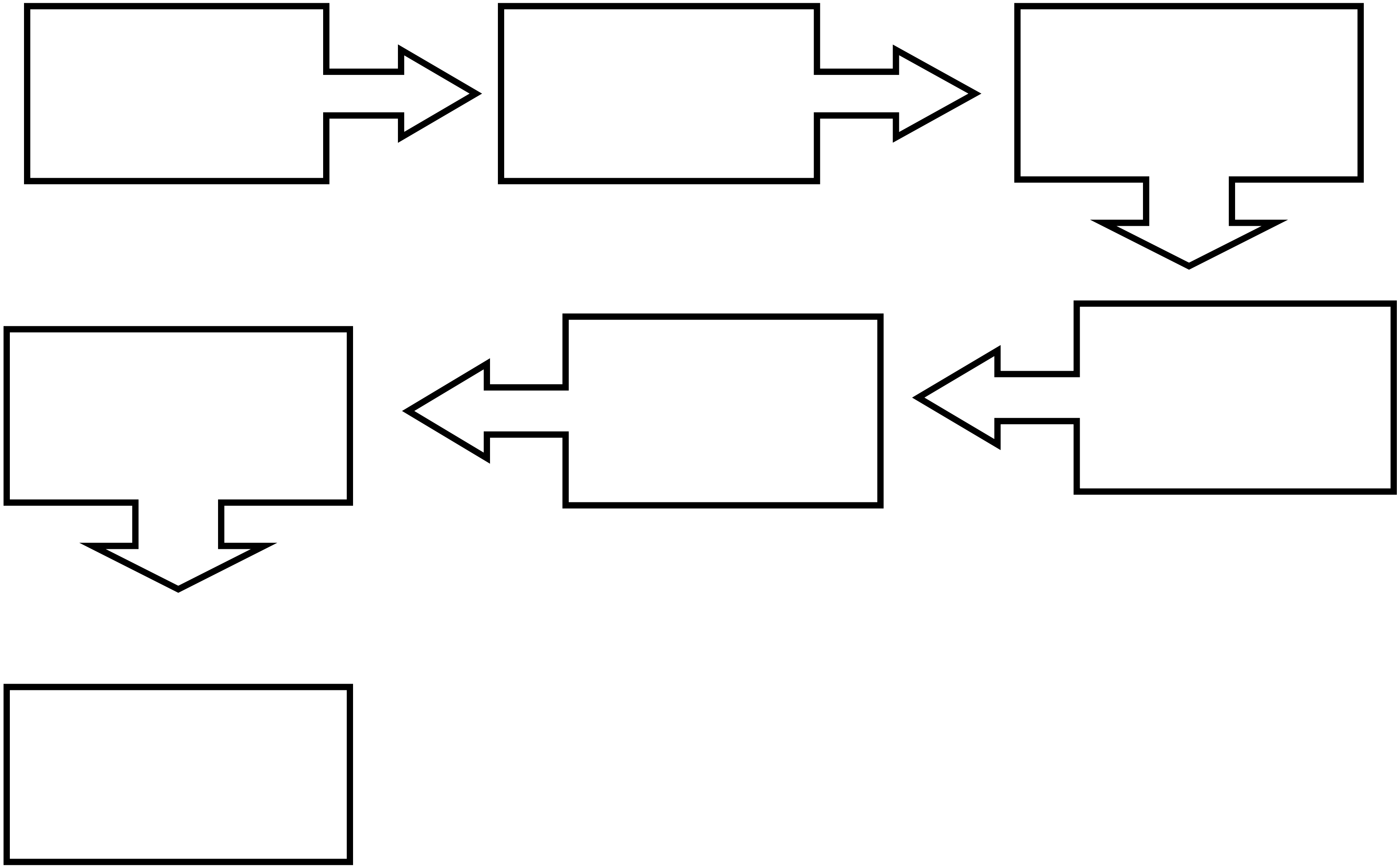
Involves chemical reactions
Occurs in chloroplasts
Occurs in mitochondria
Produces glucose$C_6H_{12}O_6$
Produces H_2O
Requires enzymes
Used by all organisms
Used by animals
Used by plants
Uses CO_2
Uses O_2

Involves energy
Converts energy from one form to another
Involves an electron transport chain
Light independent reactions (Calvin Cycle)
Light dependent reactions
Requires chlorophyll
Traps light energy
Produces CO_2
Produces O_2
Aerobic or anaerobic
Glycolysis

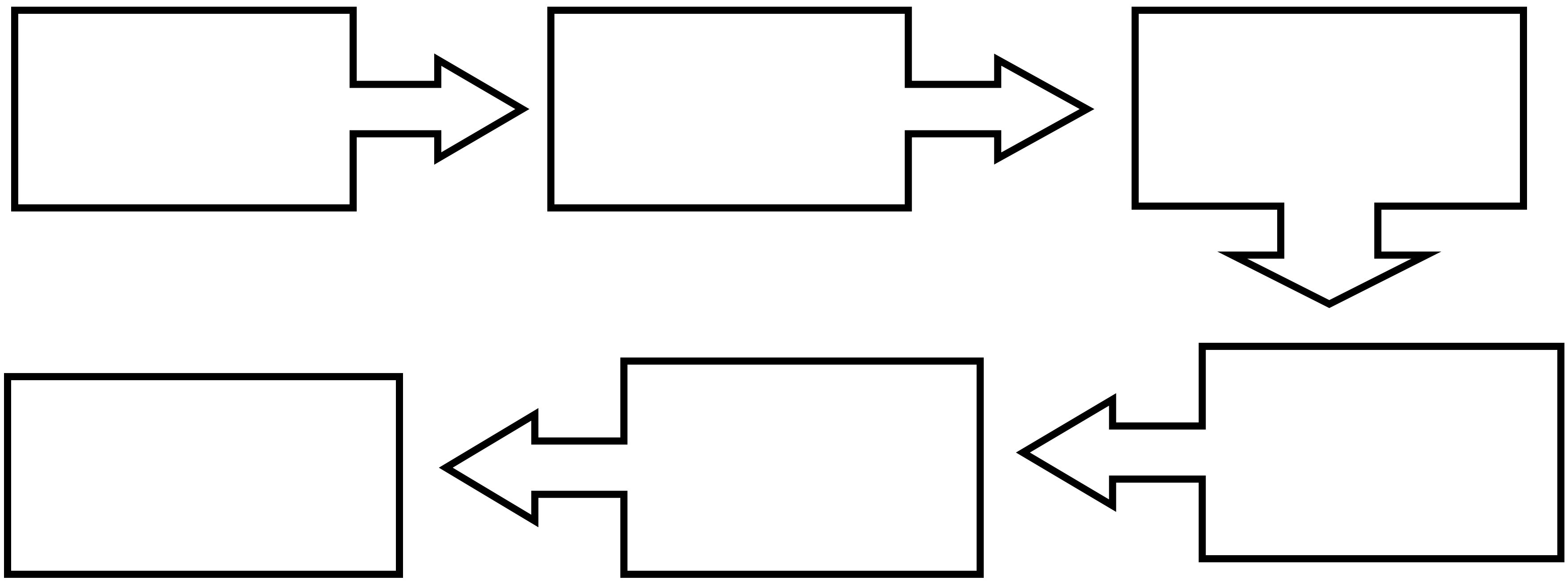
Photosynthesis Pieces

Light is absorbed by chlorophyll in plant leaves.	**Energy from light is transferred to electrons in chlorophyll and other plant pigments.**	**Water molecules are split.**
Oxygen molecules are formed (O_2).	**Oxygen is released from plant leaves.**	**Hydrogen ions accumulate inside thylakoids setting up a concentration gradient that provides energy to make ATP & NADPH.**
ATP & NADPH provide the energy for the light independent reactions.	**A carbon from a molecule of CO_2 is added to a 5-Carbon compound.**	**The resulting 6-carbon compound splits into two 3-carbon compounds.**
One of the 3-carbon compounds is used to make carbohydrates such as starch, cellulose, & glucose for plant growth.	**The other 3-carbon compounds are used to regenerate the initial 5-carbon compound.**	**These reactions may occur without light.**
Light is absorbed by chlorophyll in plant leaves.	**Energy from light is transferred to electrons in chlorophyll and other plant pigments.**	**Water molecules are split.**
Oxygen molecules are formed (O2).	**Oxygen is released from plant leaves.**	**Hydrogen ions accumulate inside thylakoids setting up a concentration gradient that provides energy to make ATP & NADPH.**
ATP & NADPH provide the energy for the light independent reactions.	**A carbon from a molecule of CO2 is added to a 5-Carbon compound.**	**The resulting 6-carbon compound splits into two 3-carbon compounds.**
One of the 3-carbon compounds is used to make carbohydrates such as starch, cellulose, & glucose sucrose for plant growth.	**The other 3-carbon compounds are used to regenerate the initial 5-carbon compound.**	**These reactions may occur without light.**
Photosynthesis is now complete with the release of oxygen in the light dependent reaction and the creation of glucose in the light independent reaction.	**Photosynthesis is now complete with the release of oxygen in the light dependent reaction and the creation of glucose in the light independent reaction.**	

PHOTOSYNTHESIS LIGHT DEPENDENT REACTIONS



PHOTOSYNTHESIS LIGHT INDEPENDENT REACTIONS



Photosynthesis Video Review	
Which organisms have the ability to carry out photosynthesis?	
How are the organisms that are capable of using light energy to produce their own food called?	
How are the organisms that are not capable of using light energy to produce their own food called?	
Write the chemical reaction for photosynthesis and identify its products	
How is glucose used?	
In which organelle does photosynthesis occurs?	
What is the role of enzymes in the process of photosynthesis?	
How is the ATP molecule used?	
How is the ATP used?	

Reflection Guide Questions

	What I already know	What I found out
Photosynthesis is		
Cellular respiration is		
How can I distinguish between photosynthesis and cellular respiration?		

Practice Test

1. Which occurrence is a major source of the gases that can produce acid rain?

   A. a hole in the ozone layer
   B. burning of fossil fuels
   C. cloud-seeding by airplanes
   D. emissions by nuclear reactors

2. Cells use passive and active transport to move materials across cell membranes in order to maintain a constant internal environment. What is the process of maintaining a constant internal environment called?

   A. diffusion
   B. evolution
   C. homeostasis
   D. respiration

3. Which of the following examples illustrates osmosis?

   A. Water leaves the tubules of the kidney in response to the hypertonic fluid surrounding the tubules.
   B. Digestive enzymes are excreted into the small intestine.
   C. White blood cells consume pathogens and cell debris at the site of an infection.
   D. Calcium is pumped inside a muscle cell after the muscle completes its contraction.

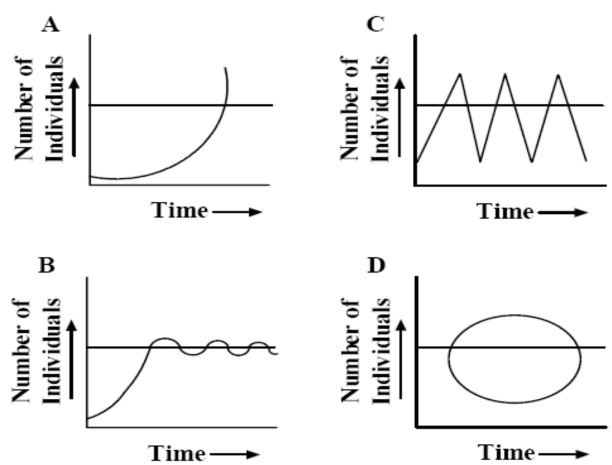
4. The observed trait that appears in an organism as a result of its genetic makeup is called the organism's

   A. allele
   B. genotype
   C. phenotype
   D. Karyotype

5. Unlike prokaryotic cells, eukaryotic cells have the capacity to

   A. assemble into multicellular organisms
   B. establish symbiotic relationships with other organisms
   C. obtain energy from the Sun
   D. store genetic information in the form of DNA

6. An undisturbed deer population grows until its carrying capacity is reached. Which of the graphs below BEST resembles this deer population?



7. Which of the following practices is MOST likely to slow the buildup of CO_2 in the atmosphere?

   A. increased use of tropical rain forest areas for agriculture
   B. increased use of genetically engineered plants
   C. decreased pesticide use in favor of biological controls
   D. decreased use of fossil fuels

8. Humans have had a tremendous impact on the environment. What has caused an increase in the amount of acid rain?

   A. use of chlorofluorocarbons
   B. use of pesticides
   C. coal burning power plants
   D. nuclear power plants

9. Which of the following is a primary function of carbohydrates?

   A. storage of energy
   B. transmission of genetic material
   C. acceleration of chemical reactions
   D. transport of molecules across membranes

10. Genetic information usually flows in one specific direction. Which of the following best represents this flow?

   A. DNA → Protein → RNA
   B. Protein → RNA → DNA
   C. RNA → Protein → DNA
   D. DNA → RNA → Protein

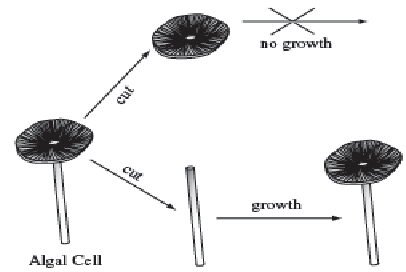
11. Which of the following is an example of codominance in genetic traits?

   A. A tall pea plant and a short pea plant produce tall pea plants.
   B. An orange cat and a black cat produce an orange-and-black kitten.
   C. A blue-eyed man and a brown-eyed woman produce a blue-eyed child.
   D. A color-blind woman and a man with normal vision produce a color-blind son.

12. A cell has a defect that results in the loss of its ability to regulate the passage of water, food, and wastes into and out of the cell. In which of the following cell structures is this defect most likely to be located?

   A. ribosomes
   B. chloroplasts
   C. cell membrane
   D. endoplasmic reticulum

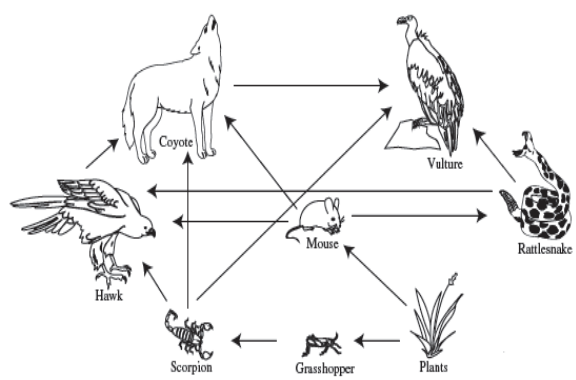
13. The algal cell picture below is a single-celled organism.



When the algal cell is cut in two as shown, the bottom part can grow into a complete cell, but the top part cannot. What conclusion does this support?

   A. The ribosomes are found in the top of the cell.
   B. The nucleus is found in the bottom of the cell.
   C. The top of the cell contains most of its chromosomes.
   D. The bottom of the cell contains most of its cytoplasm.

14. The diagram below shows some of the feeding relationships in a desert food web.



Which of the following trophic levels is not shown in this diagram?

   A. producers
   B. decomposers
   C. primary consumers

D. secondary consumers

15. A mutation that prevents a maple tree from efficiently taking gases from the air would most directly affect which of the following processes

A. reproduction
B. photosynthesis
C. water uptake
D. DNA replication

16. As you move from left to right across a row of elements in the periodic table, what happens to the number of neutrons in a typical atom?

A. It stays the same.
B. It increases.
C. It decreases.
D. It decreases until you reach the middle and then it increases.

17. Which of the following could be used to convert light energy to electrical energy?

A. a windmill
B. a chemical storage battery
C. a solar cell
D. rotating coils in a magnetic field

18. In a restaurant kitchen, lamps are used to keep food warm. Which type of electromagnetic radiation do the lamps emit that is primarily responsible for keeping the food warm?

A. gamma
B. infrared
C. ultraviolet
D. visible

19. Carbon atoms can link themselves together into long chains and rigs to form a vast number of highly complicated molecules. Which of the following statements BEST explains why carbon atoms behave this way?

A. They easily form ionic bonds with each other.
B. They easily form covalent bonds with each other.
C. They easily combine with atoms of oxygen.
D. They easily become highly charged ions.

20. Which of the following situations violates the law of conservation of energy?

A. A ball, dropped from the top of a building, increases in speed until it hits the ground.
B. A block sliding freely on level ice increases in speed until it hits a wall.
C. A child playing on a swing moves fastest at the bottom of the swing's path.
D. The height a ball bounces decreases with each bounce.

21. Aluminum oxide, Al_2O_3, is produced by combining Al^{3+} and O^{2-} particles. What type of compound has been formed?

A. covalent
B. ionic
C. metallic
D. molecular

22. Which of the following pairs are isotopes of the same element?

E. atom J (27 protons, 32 neutrons) and atom L (27 protons, 33 neutrons)
F. atom Q (56 protons, 81neutrons) and atom R (57 protons, 81 neutrons)
G. atom V (8 protons, 8 neutrons) and atom W (7 protons, 8 neutrons) atom
H. S (17 protons, 18 neutrons) and atom T (18 protons, 17 neutrons)

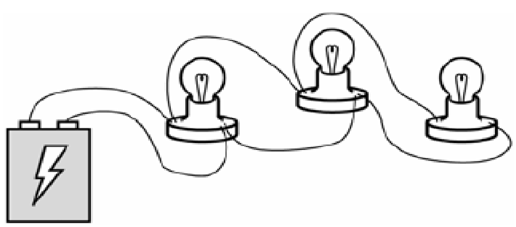
23. An ionic bond typically forms between certain types of elements. Which pair of elements will form an ionic compound?

A. Na and Cu
B. K and Cl
C. Ne and O
D. Li and Mg

24. Albert stirs a mug of hot chocolate with a metal spoon. What type of heat transfer is responsible for the spoon getting hot?

A. conduction
B. convection
C. thermoelectric
D. radiation

25. A student connects three identical light bulbs in a parallel to a dry cell as shown below. What happens when the student removes one of the light bulbs from its socket?

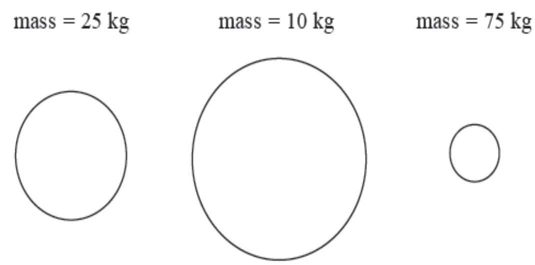


A. All the light bulbs go out.
B. The other light bulbs remain on and will be equally bright.
C. The other light bulbs remain on, one less bright and the other the same brightness as before.
D. The other light bulbs remain on, one brighter and the other less bright than before.

26. Which of the following are transferred or shared when two atoms react chemically?

E. protons
F. neutrons
G. electrons
H. photons

27. In the absence of air resistance, which of these objects will fall at the fastest rate when dropped?

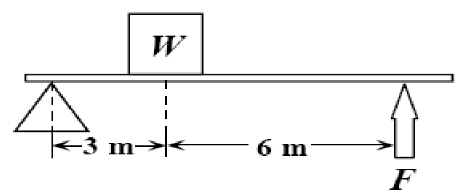


A. the ball with a mass of 75 kg
B. the ball with a mass of 25 kg
C. the ball with a mass of 10 kg
D. They all fall at the same rate.

28. Which pair of elements is MOST similar?

E. Ca and F
F. Na and Cl
G. Ne and Ar
H. Li and H

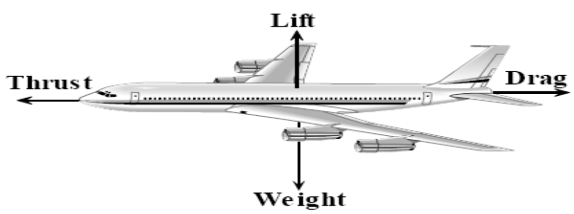
29. A box of weight W is lifted by a force F using a lever as shown below.



What is the mechanical advantage of the lever?

A. $\frac{1}{2}$
B. 2
C. 3
D. 6

30. An airplane in level flight is acted on by four basic forces. Drag is air resistance, lift is the upward force provided by the wings, thrust is the force provided by the airplane's engines, and weight is the downward force of gravity acting on the airplane.



In level flight at constant speed, which pair of forces must be equal

A. lift and drag
B. drag and weight
C. lift and weight
D. thrust and lift

31. Pat measures a small rubber ball and then makes three other balls of the same diameter from lead, foam, and wood. Which ball has the greatest inertia?

A. the rubber ball
B. the lead ball
C. the foam ball
D. the wood ball

32. A sound wave is produced and begins to travel from left to right through four different media. The speed of the wave varies as it travels. The media are solid, liquid, gas, and vacuum, but not necessarily in that order.

1	2	3	4
344 m/sec	5000 m/sec	1450 m/sec	No transmission

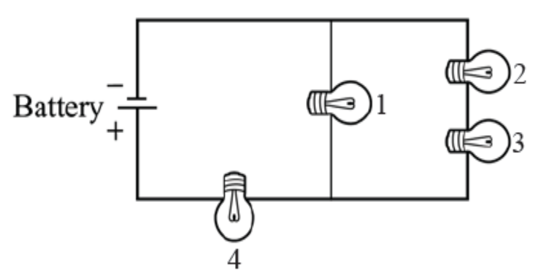
Which speed MOST likely represents a gas?

A. 1
B. 2
C. 3
D. 4

33. A car was sitting in sunlight all day long. The heat that is now contained in the car was transferred to the car primarily by which of the following processes?

A. convection
B. conduction
C. radiation
D. electrical energy transfer

34. Four identical light bulbs are connected in a circuit as shown below.



The current is greatest through which of the light bulbs?

A. 1
B. 2
C. 3

D. 4

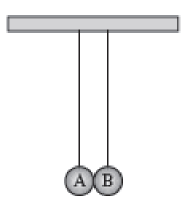
35. What property of electromagnetic waves makes it possible to use these waves to transmit information between a space shuttle and NASA mission control centers on the ground?

A. Electromagnetic waves are transverse waves.
B. Electromagnetic waves have very low velocity.
C. Electromagnetic waves are all visible to human eyes.
D. Electromagnetic waves can travel through a vacuum.

36. Which of the following is certain to change as a ball accelerates?

A. mass of the ball
B. inertia of the ball
C. velocity of the ball
D. force acting on the ball

37. The diagram below shows two aluminum spheres



Aluminum sphere A contains a small negative charge and is touched by aluminum sphere B, which has a larger negative charge. Which of the following occurs next?

A. Protons flow from sphere B to sphere A.
B. Protons flow from sphere A to sphere B.
C. Electrons flow from sphere B to sphere A.
D. Electrons flow from sphere A to sphere B.

38. The chart below shows a portion of the electromagnetic spectrum.

Gamma	X-rays	Ultraviolet	Visible	Infrared	Microwave	Radio

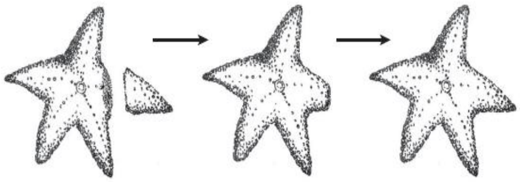
A plastic filter is fitted over a light. The light emits white light, but the filter only lets the longest wavelengths of visible light pass through. Which color would a person looking at the filtered light see?

A. green
B. red
C. violet
D. yellow

39 A party shop delivers helium-filled balloons to homes and businesses. The owners realize from experience that on hot summer days they should inflate the balloons only three-quarters full. On cold winter days they can fully inflate the balloons. Which of the following is the **best** hypothesis to explain this observation?

A. The helium gas is more active in the winter season.
B. Air outside the balloons leaks into the balloons.
C. As the temperature increases, the helium in the balloons expands.
D. Outdoor air pressure in the summer is less than indoor air pressure.

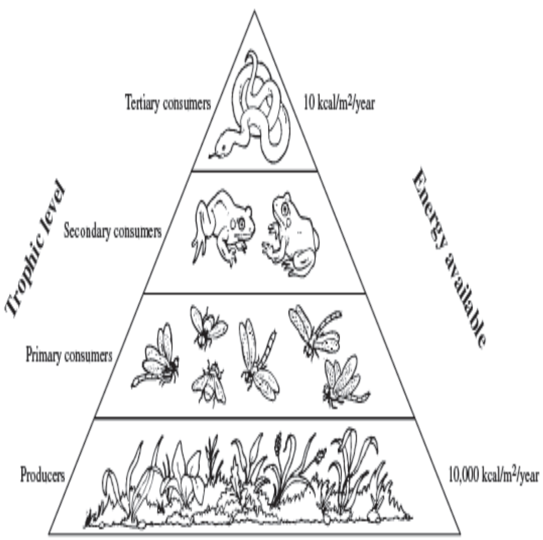
40. The diagram below shows a sea star in various stages of regeneration.



What cellular process is directly responsible for this regeneration?

A. meiosis
B. mitosis
C. transpiration
D. respiration

41. The diagram below shows an energy pyramid.



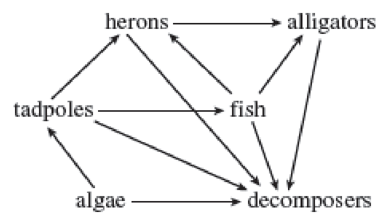
Approximately how much energy is available to the secondary consumers in this energy pyramid?

A. 10 kcal/m^2/year
B. 100 kcal/m^2/year
C. 1,000 kcal/m^2/year
D. 5,000 kcal/m^2/year

42. DNA and RNA are similar because the both contain

A. deoxyribose
B. nucleotides
C. thymine
D. double helices

43. The diagram below shows a food web.



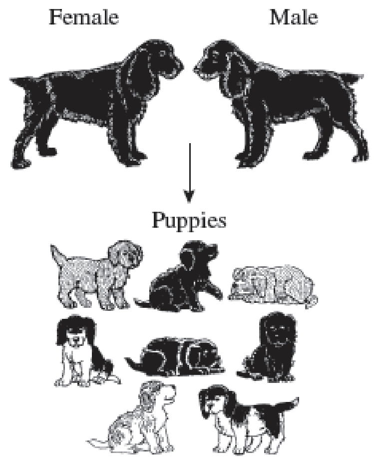
Which population would probably increase if the tadpole population decreased?

A. herons
B. alligators
C. fish
D. algae

44. Many animals have internal or external skeletons that provide support and structure. Which of the following parts of plant cells play a similar role?

A. cell membranes
B. cell walls
C. chloroplasts
D. cytoplasm

45. The picture below shows two dogs and their puppies.



The parent dogs are each heterozygous for two traits: fur color and white spotting. Both parent dogs are solid black. Their puppies, however, have four different phenotypes as listed below.

- solid black
- black with white spots
- solid red
- red with white spots

Which of the following explains how these parent dogs can produce puppies with these four phenotypes?

A. The genes for these traits are sex-linked.
B. The genes for these traits mutate frequently.
C. The genes for these traits assort independently.
D. The genes for these traits are on the same chromosome.

46. A student heated a 10 g sample of a compound in an open container. A chemical reaction occurred. The mass of the sample was measured again and found to be less than before. Which of the following explains the change in mass of the sample?

A. The heat caused the compound to become less dense.
B. The reaction gave off more heat than was added.
C. Some of the lighter atoms were converted to energy.
D. One of the reaction products was a gas.

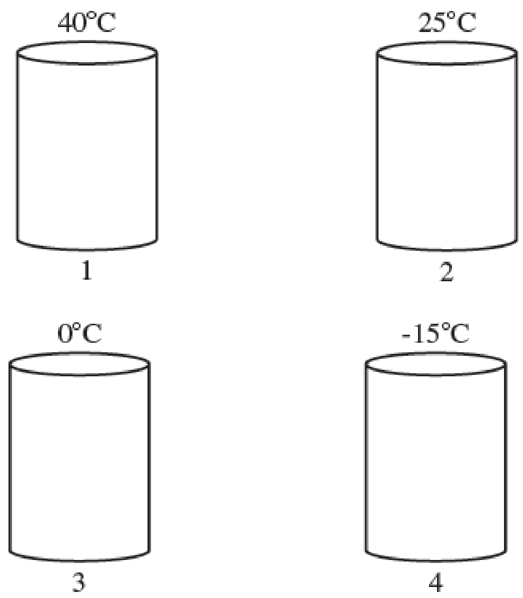
47. Which of the following represents a pair of isotopes?

A. ^{1}H and ^{3}H
B. $^{16}O^{2-}$ and $^{19}F^{1-}$
C. ^{40}K and ^{40}Ca
D. $^{16}O^{2-}$ and $^{32}S^{2-}$

48. The water from hot springs near the Ebeko volcano in the Pacific Ocean has a very low pH.
A low pH indicates which of the following about the water?

A. It has no detectable H^+ or OH^- ions.
B. It has equal concentrations of H^+ and OH^- ions.
C. It has high concentrations of H^+ ions.
D. It has equal numbers of positive and negative ions.

49. The illustration below shows four containers. Each container is full of helium gas at a different temperature.



If all of the containers are closed and have a pressure of 1 atm, which container has helium particles with the **greatest** average kinetic energy?

A. 1
B. 2
C. 3
D. 4

50. While hiking through Granville State Forest, a student finds an unusual plant-like organism that appears to lack chlorophyll. When the student examines a sample using a microscope, he sees many cells with cell walls and no chloroplasts.
This organism is **most likely** a member of what Kingdom?

a. Animalia
b. Eubacteria
c. Fungi
d. Protista

Practice Test
Answer Sheet

Name: ________________________________

Question				
1.	A	B	C	D
2.	A	B	C	D
3.	A	B	C	D
4.	A	B	C	D
5.	A	B	C	D
6.	A	B	C	D
7.	A	B	C	D
8.	A	B	C	D
9.	A	B	C	D
10.	A	B	C	D
11.	A	B	C	D
12.	A	B	C	D
13.	A	B	C	D
14.	A	B	C	D
15.	A	B	C	D
16.	A	B	C	D
17.	A	B	C	D
18.	A	B	C	D
19.	A	B	C	D
20.	A	B	C	D

Question				
21.	A	B	C	D
22.	A	B	C	D
23.	A	B	C	D
24.	A	B	C	D
25.	A	B	C	D
26.	A	B	C	D
27.	A	B	C	D
28.	A	B	C	D
29.	A	B	C	D
30.	A	B	C	D
31.	A	B	C	D
32.	A	B	C	D
33.	A	B	C	D
34.	A	B	C	D
35.	A	B	C	D
36.	A	B	C	D
37.	A	B	C	D
38.	A	B	C	D
39.	A	B	C	D
40.	A	B	C	D

Question				
41.	A	B	C	D
42.	A	B	C	D
43.	A	B	C	D
44.	A	B	C	D
45.	A	B	C	D
46.	A	B	C	D
47.	A	B	C	D
48.	A	B	C	D
49.	A	B	C	D
50.	A	B	C	D
51.	A	B	C	D
52.	A	B	C	D
53.	A	B	C	D
54.	A	B	C	D
55.	A	B	C	D
56.	A	B	C	D
57.	A	B	C	D
58.	A	B	C	D
59.	A	B	C	D
60.	A	B	C	D

General Resources

Revised 3/30/05

PERIODIC TABLE

KEY

atomic number - 5
atomic symbol - B
name of element - Boron
atomic weight - 10.811
electron arrangement - 2, 3

PERIODS	GROUP 1 (Ia)	2 (IIa)	3	4	5	6	7	8	9	10	11	12	GROUP 13 (IIIa)	14 (IVa)	15 (Va)	16 (VIa)	17 (VIIa)	18 (VIIIa)
1	1 **H** *Hydrogen* 1.00797 1																	2 **He** *Helium* 4.0026 2
2	3 **Li** *Lithium* 6.941 2, 1	4 **Be** *Beryllium* 9.0122 2, 2											5 **B** *Boron* 10.811 2, 3	6 **C** *Carbon* 12.011 2, 4	7 **N** *Nitrogen* 14.0067 2, 5	8 **O** *Oxygen* 15.9994 2, 6	9 **F** *Fluorine* 18.998 2, 7	10 **Ne** *Neon* 20.183 2, 8
3	11 **Na** *Sodium* 22.9898 2, 8, 1	12 **Mg** *Magnesium* 24.312 2, 8, 2											13 **Al** *Aluminum* 26.9815 2, 8, 3	14 **Si** *Silicon* 28.086 2, 8, 4	15 **P** *Phosphorus* 30.9738 2, 8, 5	16 **S** *Sulfur* 32.064 2, 8, 6	17 **Cl** *Chlorine* 35.453 2, 8, 7	18 **Ar** *Argon* 39.948 2, 8, 8
4	19 **K** *Potassium* 39.102 2, 8, 8, 1	20 **Ca** *Calcium* 40.08 2, 8, 8, 2	21 **Sc** *Scandium* 44.956 2, 8, 9, 2	22 **Ti** *Titanium* 47.90 2, 8, 10, 2	23 **V** *Vanadium* 50.942 2, 8, 11, 2	24 **Cr** *Chromium* 51.996 2, 8, 13, 1	25 **Mn** *Manganese* 54.9380 2, 8, 13, 2	26 **Fe** *Iron* 55.847 2, 8, 14, 2	27 **Co** *Cobalt* 58.9332 2, 8, 15, 2	28 **Ni** *Nickel* 58.71 2, 8, 16, 2	29 **Cu** *Copper* 63.546 2, 8, 18, 1	30 **Zn** *Zinc* 65.37 2, 8, 18, 2	31 **Ga** *Gallium* 69.72 2, 8, 18, 3	32 **Ge** *Germanium* 72.59 2, 8, 18, 4	33 **As** *Arsenic* 74.9216 2, 8, 18, 5	34 **Se** *Selenium* 78.96 2, 8, 18, 6	35 **Br** *Bromine* 79.904 2, 8, 18, 7	36 **Kr** *Krypton* 83.80 2, 8, 18, 8
5	37 **Rb** *Rubidium* 85.47 2, 8, 18, 8, 1	38 **Sr** *Strontium* 88.905 2, 8, 18, 8, 2	39 **Y** *Yttrium* 88.905 2, 8, 18, 9, 2	40 **Zr** *Zirconium* 91.22 2,8,18, 10, 2	41 **Nb** *Niobium* 92.906 2,8,18,12,1	42 **Mo** *Molybdenum* 95.94 2,8,18,13,1	43 **Tc** *Technetium* (97) 2,8,18,13, 2	44 **Ru** *Ruthenium* 101.07 2,8,18,15,1	45 **Rh** *Rhodium* 102.905 2,8,18,16, 1	46 **Pd** *Palladium* 106.4 2,8,18,18,0	47 **Ag** *Silver* 107.868 2,8,18,18,1	48 **Cd** *Cadmium* 112.40 2,8,18,18,2	49 **In** *Indium* 114.82 2,8,18,18,3	50 **Sn** *Tin* 118.69 2,8,18,18,4	51 **Sb** *Antimony* 121.75 2,8,18,18,5	52 **Te** *Tellurium* 127.60 2,8,18,18,6	53 **I** *Iodine* 126.9045 2,8,18,18,7	54 **Xe** *Xenon* 131.30 2,8,18,18,8
6	55 **Cs** *Cesium* 132.905 2,8,18,18,8,1	56 **Ba** *Barium* 137.34 2,8,18,18,8,2	57-71 *Lanthanide Series**	72 **Hf** *Hafnium* 178.49 2,8,18,32,10,2	73 **Ta** *Tantalum* 180.9488 2,8,18,32,11,2	74 **W** *Tungsten* 183.85 2,8,18,32,12,2	75 **Re** *Rhenium* 186.2 2,8,18,32,13,2	76 **Os** *Osmium* 190.2 2,8,18,32,14,2	77 **Ir** *Iridium* 192.2 2,8,18,32,15,2	78 **Pt** *Platinum* 195.09 2,8,18,32,16,2	79 **Au** *Gold* 196.967 2,8,18,32,18,1	80 **Hg** *Mercury* 200.59 2,8,18,32,18,2	81 **Tl** *Thallium* 204.37 2,8,18,32,18,3	82 **Pb** *Lead* 207.19 2,8,18,32,18,4	83 **Bi** *Bismuth* 208.9806 2,8,18,32,18,5	84 **Po** *Polonium* (209) 2,8,18,32,18,6	85 **At** *Astatine* (210) 2,8,18,32,18,7	86 **Rn** *Radon* (222) 2,8,18,32,18,8
7	87 **Fr** *Francium* (223) 2,8,18,32,18,8,1	88 **Ra** *Radium* (226) 2,8,18,32,18,8,2	89-103 *Actinide Series**	104	105													

SCIENCE FACTS AND FORMULAS

Some of the questions in this test require you to solve problems. This page contains all the basic facts and formulas you will need to solve those problems. You may refer to this page as often as you wish while you take the test. Some questions may require information from the periodic table on the previous page.

Basic Facts

- Acceleration due to gravity = 9.8 meters/second/second (9.8 m/s^2)
- Weight = Mass (m) × Acceleration due to gravity (g) ($W = mg$)
- Density = Mass/Volume
- Volume of a Rectangular Solid = Length × Width × Height ($V = lwh$)
- 1 Newton = 1 kilogram·meter/second/second
- 1 joule = 1 Newton·meter
- 1 watt = 1 Newton·meter/second = 1 joule/second

Motion

Velocity (V) = $V_0 + at$,

Where V_0 = Initial Velocity, a = Acceleration, and t = Time

Acceleration = Change in Velocity/Time Elapsed $\left(a = \dfrac{V - V_0}{t}\right)$

Force

Force = Mass × Acceleration ($F = ma$)

Mechanical Advantage

Actual Mechanical Advantage: $\left(AMA = \dfrac{F_R}{F_E}\right)$

Where F_R is Force due to resistance and F_E is Force due to effort.

Ideal Mechanical Advantage: $\left(\text{IMA} = \dfrac{\text{Effort Length}}{\text{Resistance Length}}\right)$

Work

Work = Force × Distance ($W = F \cdot d$)

Electricity

Voltage = Current × Resistance ($V = I \cdot R$)