

Exam Preparation for Science and Social Studies Program

EXPreSS

June 8 through June 19

2009

TEACHER

**Wednesday, June 17**

**Domain: Cells and Heredity**

- Students differentiate the functions of macromolecules
- Students describe the structures of cells and the structure and function of their components

Time	Activity/Task	Assessment
10 min	<p><i>Warm-up</i> Ask students to complete the “Setting the Stage” (see Setting the Stage handout in the Wednesday’s June 17 materials section) graphic organizer.</p>	Completion of the Setting the Stage activity
20 min	<p><i>Diffusion Lab</i> Students set up the Diffusion lab activity for later review (see Diffusion and Osmosis activity in the Wednesday’s June 17 materials section). Teacher Notes: Make sure that you do this first thing in the morning. After the lab has been set, it needs to be left alone for about two hours.</p>	Proper set up of the lab experiment.
20 min	<p><i>Osmosis and Diffusion -Research</i> Divide the classroom in four groups, two of the groups should prepare a five minute presentation on osmosis and the other two a five minute presentation on diffusion. <i>Teacher notes:</i> Take the students to the computer lab or the school library to do their research. Pass out the guiding questions for research handout (see Osmosis and Diffusion guiding questions in the Wednesday’s June 17 materials section). Provide students with large chart paper, markers or if available a computer to do a multimedia presentation.</p>	Group presentations
20 min	<p><i>Osmosis and Diffusion -Presentations</i> Each group will present the results of their work. Students should complete the answers to the Osmosis and Diffusion guiding questions handout. (See Osmosis and Diffusion guiding questions in the Wednesday’s June 17 materials section).</p>	Student’s presentations. Guiding questions completion.
15 min	<p><i>Macromolecules’ functions - Information</i> Divide the students into four groups and assigned to each group one of the four macromolecules (carbohydrates, proteins, lipids, and nucleic acids). Ask each group to watch the corresponding Unitedstreaming video on their assigned macromolecule and to complete the Macromolecules video information form (see Macromolecules video information form handout in the Wednesday’s June 17 materials section). <i>Teacher Notes:</i> The following videos from Unitedstreaming can be found in the resource DVD provided with this handbook</p> <ul style="list-style-type: none"> <li>• Carbohydrates</li> <li>• Proteins</li> </ul>	Completion of Macromolecules information sheets.

**Wednesday, June 17 (continuation)**

Time	Activity/Task	Assessment
20 min	<p><i>Macromolecules' functions – Discussion</i>                      Form four new groups of students, making sure that there is at least one representative for each type of macromolecule. Ask the students to complete information under each macromolecule on the placemat board. (See the Wednesday's June 17 materials section for the labels for the placemat).</p> <div data-bbox="415 554 1099 1087" data-label="Diagram"> <p>The diagram shows a placemat divided into four quadrants. Each quadrant is red and contains a yellow box for 'Structure/Composition' and a yellow box for 'Function', separated by a vertical dashed line. The quadrants are labeled: Carbohydrates (top-left), Lipids (top-right), Proteins (bottom-left), and Nucleic Acids (bottom-right).</p> </div> <p>After you have reviewed the information on the placemat, ask the students to copy it on their notebooks.</p>	Completion of placemats.
15 min	<p><i>Diffusion Lab -Conclusion</i>                      Record observations of diffusion activity set up at beginning of day                      Students should see evidence of diffusion across baggies (cell membranes)</p>	Lab report observations

**Wednesday, June 17 (continuation)**

**Domain: Forces, Waves and Electricity**

- Students describe the properties of waves

<b>Time</b>	<b>Activity/Task</b>	<b>Assessment</b>
10 min	<p><i>Warm-up</i> Provide the students with the Waves anticipation guide handout and ask them to fill out the column titled “Me” and leave the column titled “After the Lesson” blank for now.</p>	Completion of anticipation guide.
20 min	<p><i>Mechanical vs. Electromagnetic Waves</i> Students watch the Unitedstreaming videos on waves and energy and complete the Mechanical and Electromagnetic Waves video information handout. (See the Mechanical and Electromagnetic Waves video information handout in the Wednesday’s June 17 materials section). Teacher notes: The students should watch the following Unitedstreaming videos to complete this section</p> <ul style="list-style-type: none"> <li>• Waves and the movement of energy</li> <li>• The nature of waves</li> <li>• Sound Waves</li> <li>• Electromagnetic waves</li> </ul>	Completion of the video information handout
15 min	<p><i>Group Discussion</i> After finishing watching the videos, go over each questions by asking different students to share their answers with the group. Form groups of three or four students, provide them with a large chart paper sheet and markers and ask them to draw a large transversal and a longitudinal wave. Instruct the students to label all the parts of both waves and to indicate below each one some of its important characteristics.</p>	Participation in the classroom discussion. Illustrations of the different types of waves.
20 min	<p><i>The Electromagnetic Spectrum</i> Students use Electromagnetic Spectrum manipulative and work in small groups. Ask students to identify each region of the electromagnetic spectrum by using the labels and arrows provided to the in the plastic bag. After the students have finished placing the labels where they believe they go, ask the students to watch the Unitedstreaming video The Electromagnetic Spectrum Ask the students to modify/correct their original identification of the regions of the electromagnetic spectrum Conduct a discussion about characteristics and uses of the different types of energy waves in the electromagnetic spectrum. Simultaneously with this discussion ask students to complete the Electromagnetic Spectrum information sheet (See Electromagnetic Spectrum information handout in the Wednesday’s June 17 materials section).</p>	Correctly identifying the regions of the electromagnetic spectrum

**Wednesday, June 17 (continuation)**

**Domain: Forces, Waves and Electricity**

- Explain the transfer of light, heat, and sound energy through the application of wave theory.

<b>Time</b>	<b>Activity/Task</b>	<b>Assessment</b>
20 min	<p><i>Wave Behavior</i></p> <p>Ask students to complete the graphic organizers on refraction, reflection, diffraction, and interference (see concept map handouts in the Wednesday's June 17 materials section).</p> <p>Provide every group with the Wave Behavior manipulatives (see Wave Behavior manipulatives in the Wednesday's June 17 materials section). Conduct a classroom discussion of each wave behavior and have the students use the Wave Behavior manipulatives to illustrate that particular phenomenon.</p> <p>Students should, if necessary, correct/improve their own graphic organizers based on the classroom discussion.</p>	Completion of concept maps Classroom participation
20 min	<p><i>Review Questions 13</i></p> <p>Provide students with a set of questions (see Review Questions 13 handout in the Wednesday's June 17, materials section) about the mechanic and electromagnetic waves. Give them 15 minutes to answer the questions individually.</p> <p>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.</p>	Student questionnaire

**Wednesday's June 17**

**Materials Section**

## Exploring What I Know

**Instructions:**

Answer the following questions the best you can. You can consult with a classmate if you have doubts about a particular answer.

Which biological macromolecule is made of amino acids?

Which biological macromolecule has the greatest energy value per gram?

You are a member of the coaching staff for the next Olympic track and field team. The chef at your Olympic training facility is asking you for a recommendation for a meal before a competition. Which type of food will you recommend to feed to the athletes so that they will have the energy they will need to run in the events? Why?

## Diffusion across a semi-permeable membrane

### Background information

The cell membrane, in addition to providing protection and support for the cell, also regulates what comes into the cell and what leaves the cell. This movement of material through the cell membrane in either direction is very important. In the cells' normal activities, nutrients are going to need to be supplied, waste materials are going to need to be eliminated and the cell membrane is central to those processes.

Small molecules can move through the cell membrane with little difficulty, passing between the lipid bilayer-construction of the membrane. Larger molecules however need help getting through which comes from proteins embedded in the bilayer membrane.

One of the ways that material can move through a cell membrane is **diffusion**. This is especially true of smaller molecules or dissolved ions which are able to pass between the bilayer-construction of the cell membrane. In diffusion, particles move through the membrane according to concentration; they move from areas of higher concentration to areas of lower concentration. For example, as nutrients are used in the cell, the concentration of nutrients becomes lower in the cell than outside the cell; therefore nutrients move into the cell by diffusion. Wastes, on the other hand, will accumulate inside the cell and be at a higher concentration than outside the cell. Wastes will then move out of the cell. Some particles are too large to pass between the molecules making up the membrane.

In this activity, we will use a sandwich bag to model a cell membrane and we will observe the movement of some materials through the bag. We will use glucose or dextrose as a monosaccharide (small enough to move through the membrane) and cornstarch, a polysaccharide (too large to pass through the membrane). The indicators that we will use will be glucose test strips to detect the presence of glucose and iodine to detect for the presence of the starch. Your teacher will demonstrate what the iodine test looks like when placed in a starch solution and what the glucose test strip will look like when placed in a sugar solution.

### Materials:

For each group you will need:

1-250 ml beaker

1-sandwich bag

1-rubber band

Cornstarch

Dextrose or glucose

Water

Iodine solution

Glucose test strips

Scoop or spatula



**Procedure: (Part 1)**

This part of the procedure should be done on the previous afternoon or first thing in the morning of the day on which the activity will be conducted.

1. Place about 100 ml of water, a scoop of cornstarch in the bag and mix thoroughly. Since we know that starch is present in the baggie, record starch present in the 'before' column of the data table.
2. Place about 150 ml of water in the beaker along with 2 scoops of glucose or dextrose and dissolve. In the 'before' column of the data table, record that sugar is present.
3. To the contents of the beaker, now add a couple of drops of the iodine indicator. Describe the color of the solution in the beaker after adding the iodine. Is it showing the same color that you saw when the demonstration was done with iodine and starch? Is starch present in the beaker? Record in the 'before' column of the data table.
4. Seal up the baggie by twisting/folding/rubber band and submerge it in the beaker, taking care not to allow the contents to overflow.
5. Label and place the beaker aside for use later.

**Procedure: (Part 2)**

This part of the procedure should be done app. 3 hours after Part 1 is set up to allow for the movement of any material across the bag membranes.

1. Remove the baggie carefully from the beaker and place on some paper towels. Notice any changes in color that occurred compared to the original colors when you set up the activity.
2. Based on the positive starch test, did any starch move out of the bag? Record on the data table in the 'after' column.
3. Based on the positive starch test, what must have moved through the membrane to the inside of the bag to account for the color?
4. Using the glucose test strips, test the contents of the bag. Is glucose present in the bag? Record on the data table in the 'after' column.

Data table

	Before submerging		After submerging	
	Initial color	Substance(s) present	Final color	Substance(s) present
Solution in baggie				
Solution in beaker				

**Analysis:**

Based on your observations and data answer the following questions:

1. Based on your observations, what substance(s) moved, the iodine, starch, and/or glucose?
2. How did you determine this?
3. The plastic baggie was permeable to which substance?
4. Is the plastic baggie selectively permeable? Explain.
5. Sketch the cup and baggie in the space below. Use arrows to illustrate how diffusion occurred in this lab.

**Diffusion and Osmosis  
Guiding Questions**

**Instructions:**

Your research on diffusion or osmosis must answer the following questions

What is osmosis?

What is diffusion?

What is the difference between diffusion and osmosis?

What is passive transport?

What is active transport?

What is the role of mitochondria in the active transport process?

## Macromolecules Information: Carbohydrates

### Instructions:

Complete the following information sheet for the molecule assigned to your group. Work with your teammates to get the best answer to each question.

What elements make carbohydrates?

What is the more important sugar for life? What is its chemical composition?

What are polymers? What is an example of a polymer found in plants?

What is the main function of polymers?

## Macromolecules Information: Lipids

### Instructions:

Complete the following information sheet for the molecule assigned to your group. Work with your teammates to get the best answer to each question.

What elements make lipids?

What is the main function of lipids in living organisms?

Where are lipids stored?

## Lipids

Lipids are present in all living cells, but the proportion varies from tissue to tissue. They are organic compounds, insoluble in water, but that dissolves readily in other lipids and in organic solvents such as alcohol, chloroform, and ether. Lipids contain carbon, hydrogen, oxygen, and sometimes phosphorus. They are classified according to their solubility and include neutral fats (triglycerides), phospholipids, and steroids.

The triglycerides accumulate in certain areas, such as adipose tissue in the human being and in the seeds of plants, where they represent a form of energy storage. The more complex lipids occur closely linked with protein in the membranes of cells and of subcellular particles. More active tissues generally have higher complex lipid content; for example, the brain, liver, kidney, lung, and blood contain the highest concentration of phosphatides in the mammal.

In living organisms lipids serve as the basis of cell membranes and as a form of fuel storage. Often lipids are found conjugated with proteins or carbohydrates, and the resulting substances are known as lipoproteins and lipopolysaccharides. The fat-soluble vitamins can be classified as lipids.

Lipids (fats and oils) have borne the brunt of the blame for the degenerative diseases (heart disease and cancer) that are the major causes of death in the developed world. The negative view of lipids has obscured their essentiality for human health. If a problem exists, it is one of quantity, in general, and specific lipids in particular.

Lipids are important for maintenance of human health and well-being in a number of ways. Probably the most important function of lipids is provision of an efficient energy source. Fat provides 9 calories of energy per gram or 2.25 times as much as either carbohydrate or protein. Carbohydrate is not stored in the body and protein stores are predominantly muscle, whose breakdown entails serious health consequences. Fat is stored as such and can be easily mobilized if needed.

## Macromolecules Video Information: Proteins

### Instructions:

Complete the following information sheet for the molecule assigned to your group. Work with your teammates to get the best answer to each question.

What elements make proteins?

What determines how a protein functions?

What are some examples of proteins in the human body?  
What is their function?

What are enzymes?

## Macromolecules Video Information: Nucleic Acids

### Instructions:

Complete the following information sheet for the molecule assigned to your group. Work with your teammates to get the best answer to each question.

What elements make nucleic acids?

What is the function of the nucleic acids?

What are the two classes of nucleic acids? What is their importance for living organisms?

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## Nucleic Acids

Nucleic acids are extremely complex molecules that are found in living cells and viruses and constitute the fundamental substances of living things. Their name comes from their initial isolation from the nuclei of living cells, but they also occur elsewhere in cells. Their functions include the transmission of hereditary characteristics from one generation to the next and the triggering and controlling of the manufacture of specific proteins.

The two classes of nucleic acids occurring naturally are DNA, or deoxyribonucleic acid, and RNA, or ribonucleic acid. The backbones of DNA and RNA molecules are generally shaped like helical strands. A typical strand consists of a chain with a great number of links. Each of the links of the chain includes a phosphate group and a particular type of sugar: deoxyribose for DNA and ribose for RNA--a deoxyribose molecule has one less oxygen atom than does ribose. Also, to each of the sugar subunits in the backbone there is connected a smaller molecule, or "side group," which belongs to the class of chemical compounds known as bases. These side-group bases contain nitrogen and, for each type of nucleic acid, only four specific bases are allowed. The combination of the three subunits--sugar, base, and phosphate--is called a "nucleotide."

The sequence of these bases on the strand determines the code of the particular nucleic acid. This code, in turn, signals the cell how to produce a duplicate of itself or the proteins it requires for survival. In all living cells and most viruses, DNA carries the genetic code; in some viruses, known as RNA viruses, or riboviruses, RNA serves as the genetic material. RNA, for its part, plays an important role in the transfer, expression, and replication of the genetic information carried by DNA.



Scaffolded Notes (teacher page)

	<b>Structure/Composition</b>	<b>Function</b>
Carbohydrates	Carbon, hydrogen, oxygen atoms – ratio of <b>1:2:1</b> Made of monomers (monosaccharides), simple sugars or molecules composed of 2 or more simple sugars	Maintain structure – cellulose Energy – glucose
Lipids	Carbon, hydrogen, oxygen – but more complex than carbohydrates. Composed of C-H bonds, with fewer oxygen atoms than carbohydrates. Nonpolar molecules, therefore <i>insoluble</i> in H <sub>2</sub> O	Used for long term energy storage, insulation and protective coatings. Lipids are the major component of membranes surrounding all living organisms. <b>Waxes</b> are long chain fatty acids attached to an alcohol group. Example: cutin – helps plants retain H <sub>2</sub> O
Proteins	Carbon, hydrogen, oxygen, nitrogen and sulfur Made of a series of amino acids	<b><i>Essential to all life</i></b> Used as enzymes, channel proteins in the cell membrane and used to build muscle Important in muscle contraction, transporting oxygen in blood and the immune system. Also an important component of membrane surrounding cells. Examples are collagen, enzymes, hemoglobin, insulin and antibodies.
Nucleic Acids	Made of nucleotides strung together. Nucleotides are small organic compounds consisting of a 5 carbon sugar, a nitrogen containing base and a phosphate group. Adenine, cytosine, guanine, thymine or uracil.	Store genetic material and transport genetic material to ribosome to make protein  Make up ATP, NAD <sup>+</sup> , NADP <sup>+</sup> , DNA and RNA



CARBOHYDRATES

PROTEINS

LIPIDS

NUCLEIC ACIDS



FUNCTION

FUNCTION

FUNCTION

FUNCTION



STRUCTURE/COMPOSITION

STRUCTURE/COMPOSITION

STRUCTURE/COMPOSITION

STRUCTURE/COMPOSITION

### Anticipation Guide: Waves

**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. All waves travel at the same speed.
		2. Sound waves travel better in air than in water.
		3. Waves transport energy not matter.
		4. Only mechanical waves need a medium to propagate.
		5. An electromagnetic wave in vacuum travels at the speed of light.
		6. Light is a form of electromagnetic wave.
		7. Frequency is the same as wavelength.
		8. The energy of an electromagnetic wave is associated with its wavelength.
		9. Long wavelength electromagnetic waves (red light) has more energy than short wavelength electromagnetic waves (blue light)
		10. Radio waves are electromagnetic waves.

### Mechanical and Electromagnetic Waves Videos

Provide three examples of forms in which energy is transported by waves.

What are the two basic types of waves?

How is energy transported on a transverse wave? Sketch this phenomenon.

How is energy transported on a longitudinal wave? Sketch this phenomenon.

### Mechanical and Electromagnetic Waves Videos

What is frequency?	
What is the Amplitude of a wave?	
What limits the velocity of a wave?	
How are all waves similar?	
What causes sound? How is transmitted?	
What other name do sound waves received? Why is this?	

### Mechanical and Electromagnetic Waves Videos

What is necessary for sound waves to propagate? Why?

What is the relation between pitch and frequency?










What is the cause of the electromagnetic waves?  
What type of waves does it generates?

Where can electromagnetic waves travel through?

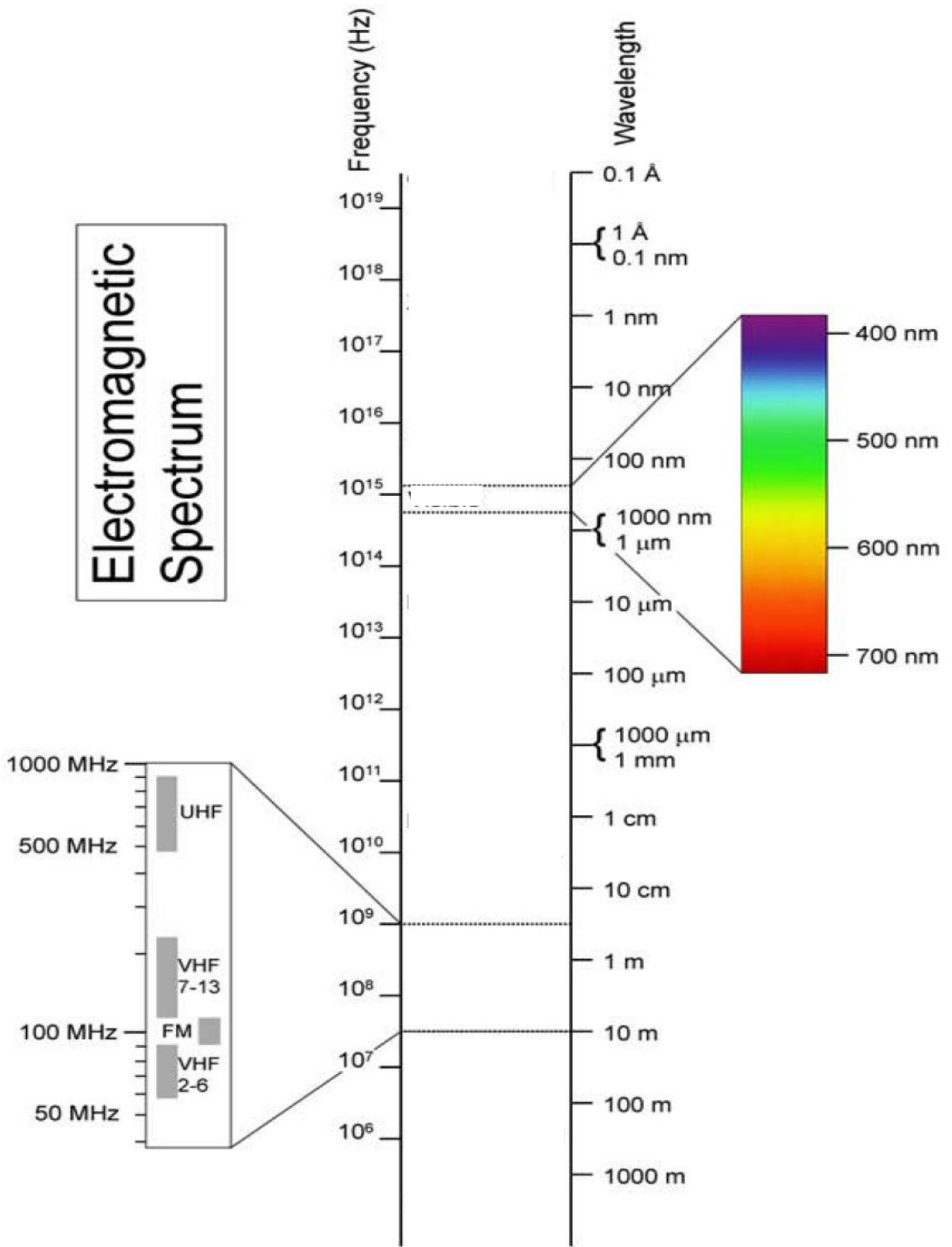
What is the velocity at which all electromagnetic waves travel?



Electromagnetic Spectrum Labels

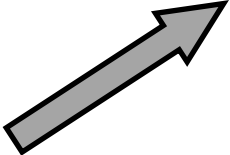
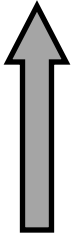
Gamma Rays	X-Rays	Ultraviolet
Microwave	Radio - TV	Infrared
Visible	Red Light	Blue Light
		
		
		

# Electromagnetic Spectrum

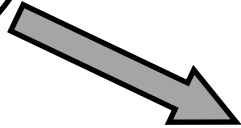


**Concept Map: Wave Phenomena**

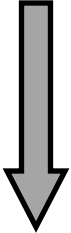
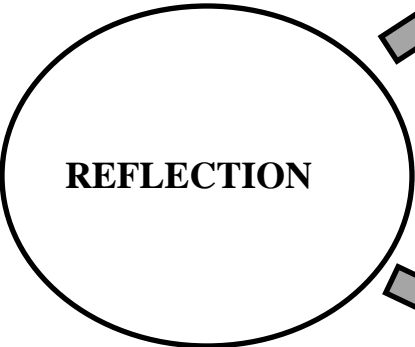
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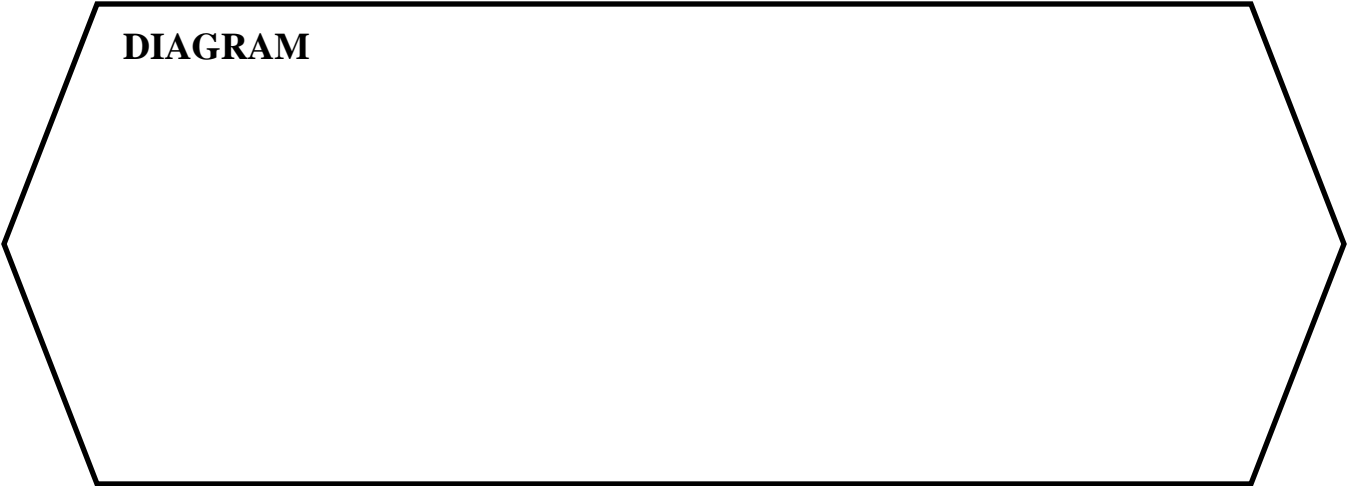
**Where it happens?**



**REFLECTION**

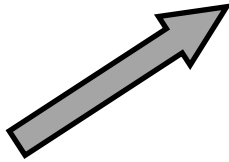
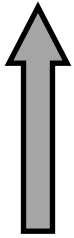


**DIAGRAM**

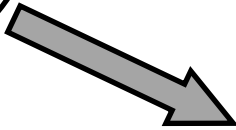


**Concept Map: Wave Phenomena**

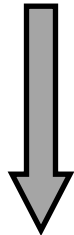
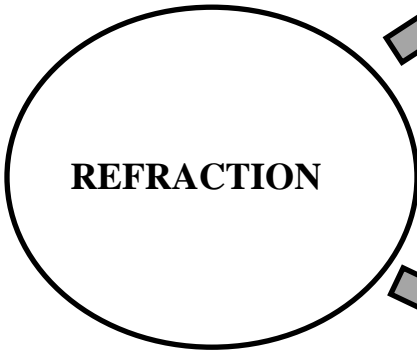
**DEFINITION**




**Where it happens?**



**REFRACTION**

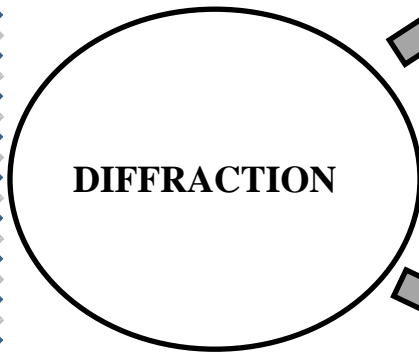


**DIAGRAM**



**Concept Map: Wave Phenomena**

**DEFINITION**

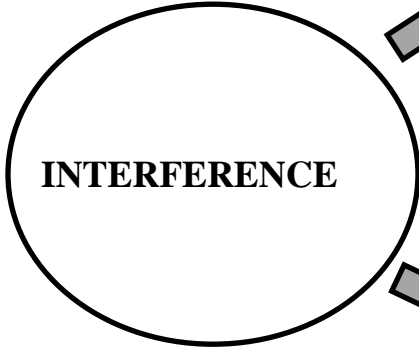


**Where it happens?**

**DIAGRAM**

**Concept Map: Wave Phenomena**

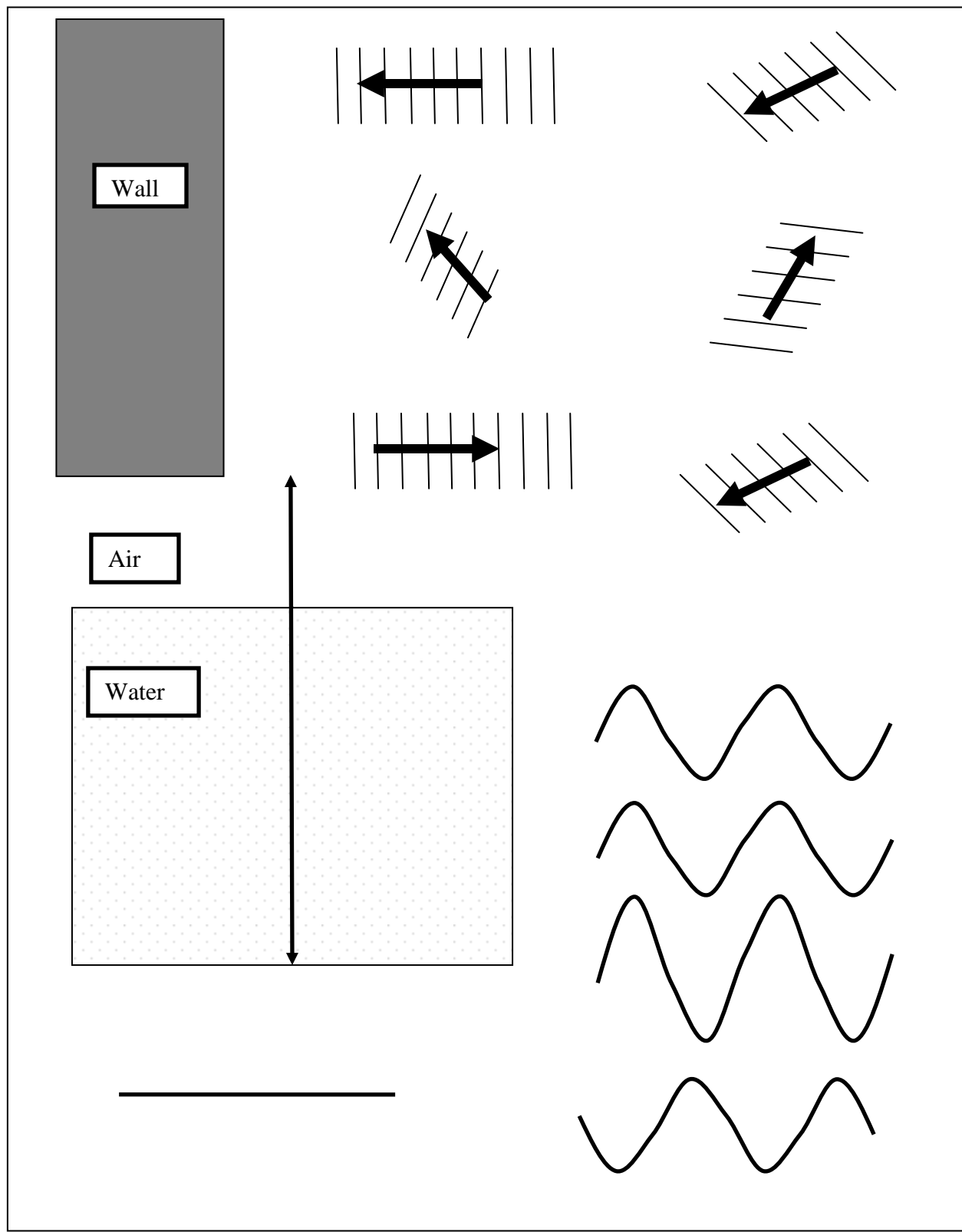
**DEFINITION**



**Where it happens?**

**DIAGRAM**

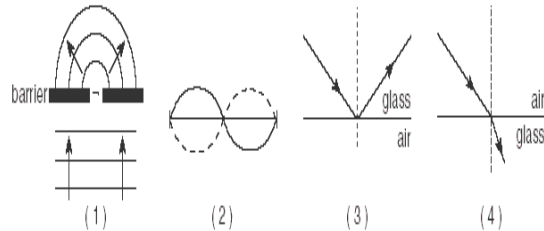
# Wave Behavior Manipulatives



**Review Questions 13**  
**Mechanical and Electromagnetic Waves**

1. Which property of waves is illustrated in the example below?  
A black car hood in the July sun becomes very hot.  
A. Refraction  
B. Diffraction  
C. Absorption  
D. Reflection
2. Which is NOT true of a light wave?  
A. it is a disturbance  
B. it transfers energy  
C. it needs a medium in which to travel  
D. it is an electromagnetic wave
3. A scientist is delivering a lecture about sound. Which statement about sound would NOT be correct?  
A. The speed of sound in a steel rail on a railroad is slower than the speed of sound in the air above it.  
B. sound needs a medium in which to travel  
C. sound travels faster in the hot air of a desert than in the colder air of Antarctica  
D. sound is a mechanical wave
4. Which property of waves is illustrated in the example below?  
Two ocean waves meet and combine to make a bigger wave.  
A. Diffraction  
B. Absorption  
C. Reflection  
D. Interference

5. Which diagram below best represents refraction?



- A. 1
  - B. 2
  - C. 3
  - D. 4
6. For a wave traveling at constant speed, frequency increases as  
A. amplitude decreases  
B. amplitude increases  
C. wavelength decreases  
D. wavelength increases
  7. The electromagnetic spectrum is arranged according to  
A. wave speed  
B. wave amplitude  
C. wave medium  
D. wavelength
  8. When two sound waves interfere constructively,  
A. the resulting sound is louder than either sound  
B. the resulting sound is softer than either sound  
C. neither sound wave is changed  
D. there is no resulting sound



9. A wave that carries a large amount of energy will always have a
- A. large amplitude
  - B. small amplitude
  - C. high frequency
  - D. short wavelength
10. The color in the electromagnetic spectrum with the most energy would be
- A. red
  - B. orange
  - C. violet
  - D. yellow
11. Electromagnetic waves are different from other types of waves in that they do not
- A. have amplitude
  - B. have frequency
  - C. transfer energy
  - D. need a medium
12. Which of the following waves carries the most energy?
- A. Infrared
  - B. Ultraviolet
  - C. gamma rays
  - D. X – rays
13. Wave A carries more energy than wave B. Wave B has a smaller \_\_\_\_ than wave A.
- A. Frequency
  - B. Wavelength
  - C. Amplitude
  - D. Speed
14. The speed of a sound depends on
- A. its source
  - B. the force of its compressions
  - C. the number of waves per second
  - D. the medium through which it travels
15. Because of their high energy, \_\_\_\_ can be used by radiologists to treat some forms of cancer.
- A. X-rays
  - B. gamma rays
  - C. microwaves
  - D. ultraviolet radiation
16. The energy of light is proportional to
- A. its amplitude
  - B. its wavelength
  - C. its frequency
  - D. the speed of light itself
17. Refraction occurs when a wave enters a new medium at an angle because
- A. the frequency changes
  - B. the amplitude changes
  - C. the wave speed changes
  - D. none of the above
18. For a given wave, if the frequency doubles, the wavelength \_\_\_\_.
- A. Doubles
  - B. stays the same
  - C. is halved
  - D. quadruples