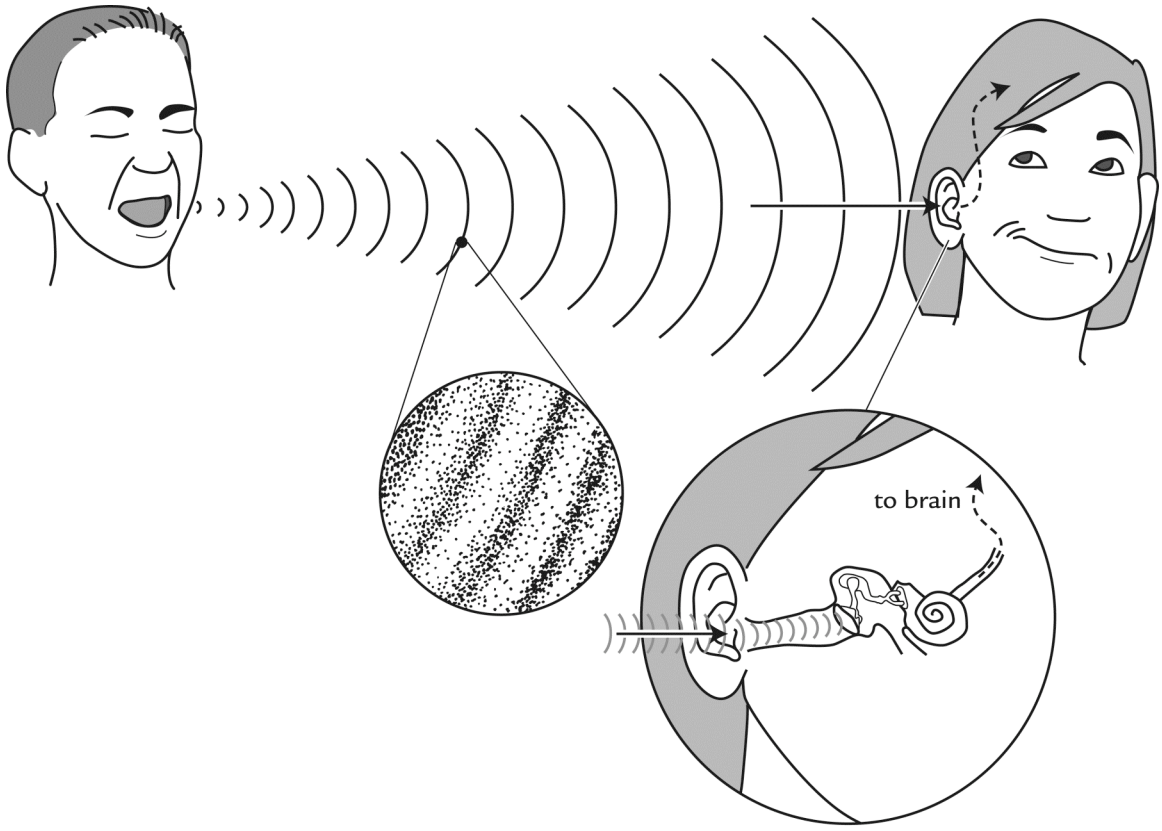
Sound Transmission



Waves Transparency 2.1

Name _____ **Date** _____

Anticipation Guide: Wave Characteristics

Before starting the activity, mark whether you agree (+) or disagree (-) with each statement below.

After completing the activity, mark whether you agree (+) or disagree (-) with each statement below. Under each statement, explain how the activity gave evidence to support or change your ideas.

Before	**After**	
_____	_____	**1.** All waves have a frequency and a wavelength.
_____	_____	**2.** All waves need a medium in which to transmit energy.
_____	_____	**3.** A wave will have the same speed through all mediums.
_____	_____	**4.** If a wave changes the medium it travels through, and speeds up in the process, its frequency, wavelength, or both must change.
_____	_____	**5.** It is impossible to increase the frequency of a wave if the wavelength is shortened.
_____	_____	**6.** A seismic longitudinal (P-wave) travels more quickly than it's transverse (S-wave).
_____	_____	**7.** A slinky can be used to model both transverse and longitudinal waves.

Three-Level Reading Guide: Building Safely for Earthquakes

1. Check the statements below that you believe say what the reading says. Sometimes, the exact words found in the reading are used. At other times, other words may be used to communicate the same meaning.

_____ a. Before building, engineers must model what happens to a building in an earthquake.

_____ b. A taller building usually has a natural frequency that is higher than a shorter building.

_____ c. An irregularly shaped building is more likely than a uniformly built one to fail in an earthquake.

2. Check the statements below that you believe represent the *intended* meaning of the reading.

_____ a. Buildings should be able to withstand even the largest earthquake possible without sustaining damage.

_____ b. Sometimes the natural frequency of an earthquake can match that of the building, causing the building to resonate.

3. Check the statements below that you agree with, and be ready to support your choices with ideas from the reading and from your own knowledge and ideas.

_____ a. Earthquake damage cannot be predicted.

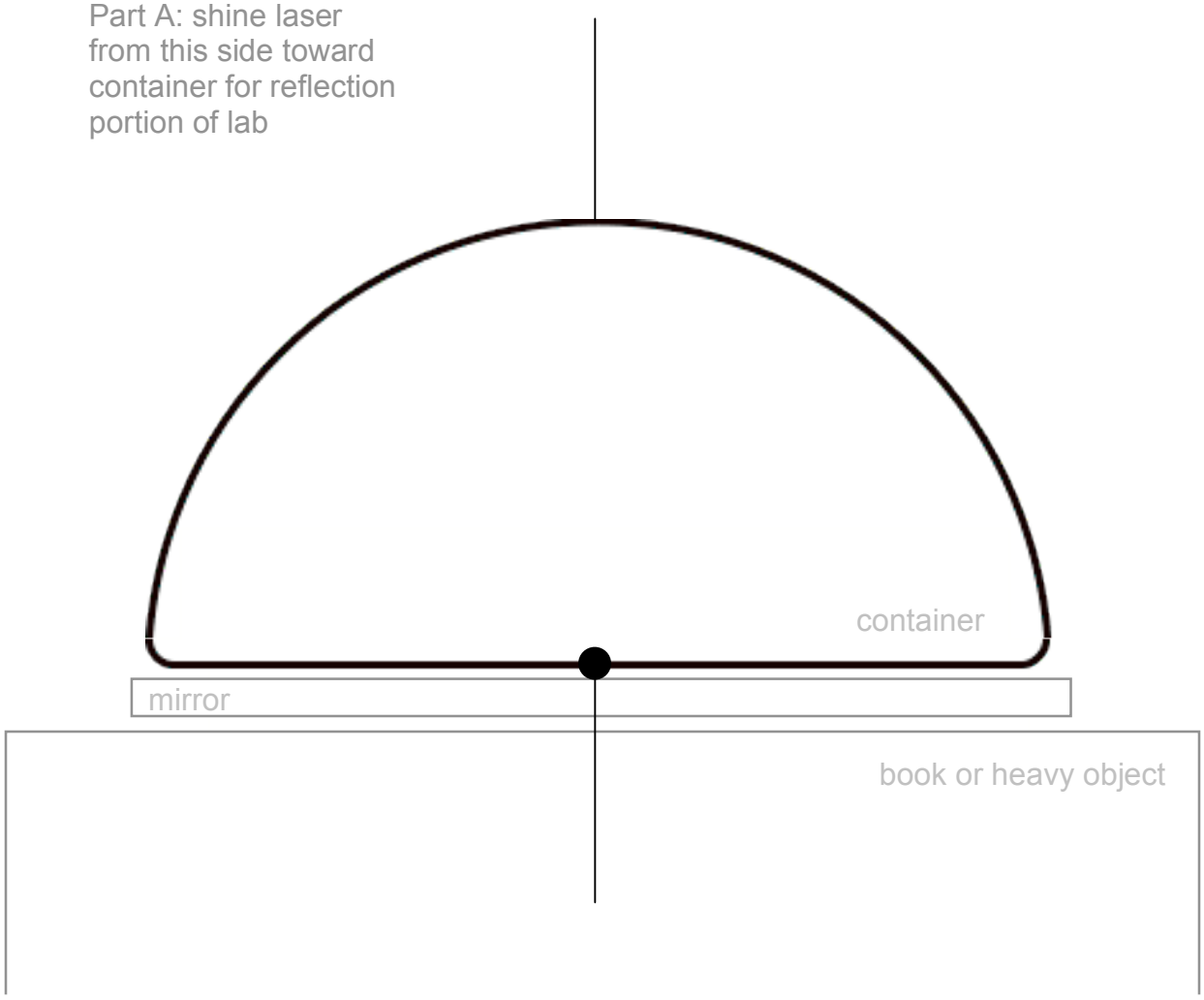
_____ b. Earthquake resistant buildings should be built everywhere.

Name _____ **Date** _____

Rebuilding Recadia City: Key Information

	Proposal A	**Proposal B**
Seismic Safety	Summary: Indicators:	Summary: Indicators:
Environmental Impact	Summary: Indicators:	Summary: Indicators:
Socio-economics	Summary: Indicators:	Summary: Indicators:

Reflection and Refraction Measurements



Class Results: Ionizing Energy

Energy	Wavelength (meters)	Damaging?
Radio waves	~100	
Microwaves	~0.01	
Infrared	~0.00001	
Visible light	~0.000001	
Ultraviolet	~0.0000001	
X-rays	~0.000000001	
Gamma rays	~0.00000000001	

Waves Transparency 12.1

Name _____ **Date** _____

Anticipation Guide: Electromagnetic Radiation

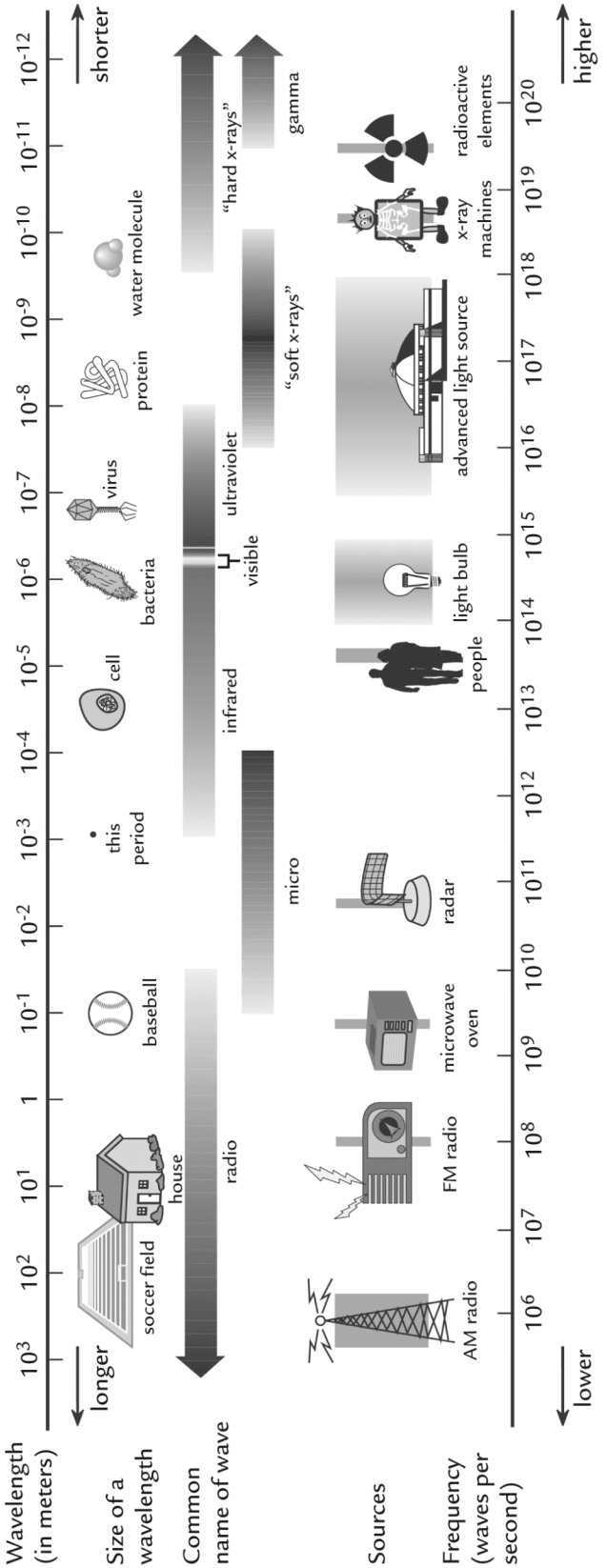
Before starting the reading, mark whether you agree (+) or disagree (-) with each statement below.

After completing the activities, mark whether you agree (+) or disagree (-) with each statement below. In the space provided under each statement, state which activity gave evidence to support or change your ideas and explain how it gave evidence.

Before	**After**		
_____	_____	**1.**	Some of the properties of light are the same as waves.
_____	_____	**2.**	Cell phones use infrared to transmit and receive information.
_____	_____	**3.**	Ultraviolet light does not damage skin or eye cells.
_____	_____	**4.**	Compare two electromagnetic waves traveling at the same intensity. The one with the longer wavelength carries more energy than the one with the shorter wavelength.
_____	_____	**5.**	Electromagnetic energy travels at different speeds depending on its amplitude.
_____	_____	**6**.	Electromagnetic waves can travel at the speed of light.
_____	_____	**7**.	People can see only a small range of electromagnetic energy.

The Electromagnetic Spectrum

Waves Transparency 14.1



Name _____ **Date** _____

Personal Radiation Survey

Factors	Common Sources of Radiation	Your Annual Dose
Where You Live	*Cosmic Radiation (from outer space): Exposure depends on how much atmosphere is above you to block radiation*. If you live at Sea level (New York, Philadelphia, Houston, Baltimore, Boston, New Orleans, Jacksonville, Seattle), add 0.26 mSv. 1-1000 feet (Chicago, Detroit, San Diego, Dallas, Minneapolis, St. Louis, Indianapolis, San Francisco, Memphis, Washington, DC, Milwaukee, Cleveland, Columbus, Atlanta), add 0.28 mSv. 1001-2000 feet (Phoenix, Pittsburgh, San Jose, Oklahoma City), add 0.31 mSv. 2001-3000 feet (Las Vegas, Los Angeles, Honolulu, Tucson), Add 0.35 mSv. 3001-4000 feet (El Paso), add 0.41 mSv. 4001-5000 feet (Salt Lake City), add 0.47 mSv. 5001-6000 feet (Denver, Albuquerque), add 0.52 mSv. 6001-7000 feet, add 0.66 mSv. 7001-8000 feet, add 0.79 mSv. 8001-9000 feet, add 0.96 mSv.	_____

	Terrestrial Radiation (from the ground): Exposure depends on soil composition. If you live in a state that borders the Gulf of Mexico or the Atlantic Ocean, add 0.16 mSv. If you live in the Colorado Plateau area (around Denver), add 0.63 mSv. If you live anywhere else in the continental U.S., add 0.30 mSv.	_____
	House Construction: Exposure depends on ability for air to move in and out of building. If you live in a stone, adobe, brick, or concrete building, add 0.07 mSv	_____
	Power Plants: Exposure depends on type and distance from source. If you live within 50 miles of a nuclear power plant, add 0.0001 mSv. If you live within 50 miles of a coal-fired power plant, add 0.0003 mSv.	_____
Food, Water, Air	*Internal Radiation: Exposure depends on type and amount of radiation in your body.* From food (Carbon-14 and Potassium-40) and from water (radon dissolved in water), add 0.40mSv From air (radon), add 2.00mSv	0.4 2.0
How You Live	*Everyday Experience: Exposure depends on lifestyle.* Weapons test fallout exposure For every hour of jet plane travel, add 0.005 mSv. If you've gone through luggage inspection at the airport, add .0007 mSv. If you wear a luminous wristwatch, add 0.06 mSv. If you have porcelain crowns or false teeth, add 0.0007 mSv per tooth.	< .01

How You Live	*Everyday Experience: Exposure depends on lifestyle.* Weapons test fallout exposure For every hour of jet plane travel, add 0.005 mSv. If you've gone through luggage inspection at the airport, add .0007 mSv. If you wear a luminous wristwatch, add 0.06 mSv. If you have porcelain crowns or false teeth, add 0.0007 mSv per tooth. If you watch TV (Cathode Ray Tube), add 0.01 mSv If you use a computer screen (Cathode Ray Tube), add .001 mSv. If you have a smoke detector in your home, add 0.00008 mSv. If you use gas camping lantern, add 0.002 mSv. If you wear a plutonium-powered pacemaker, add 1.00 mSv. If you smoke, add 13.0 mSv.	< .01 _____
Medical Tests	*Diagnostic Tests: Exposure varies and depends on how many and what kind of tests you have.* Extremity x-ray (arm, hand, foot, or leg), add 0.01 mSv per test. Dental x-ray, add 0.01 mSv per test.	

Survey based on American Nuclear Society's "Radiation Dose Chart"
http://www.ans.org/pi/resources/dosechart/

*Smoking data from the University of Iowa Hospital and Clinics
http://www.uihealthcare.com/topics/medicaldepartments/cancercenter/prevention/preventionradiation.htmll

Units Related to Radioactivity

	Radioactivity	Absorbed Dose	Dose Equivalent
Definition	**Rate of radiation emission from a radioactive substance**	**Energy given by radiation per unit mass onto an absorbing material**	**Expression of dose in terms of its biological effect**
Common Units	**Curie (Ci)** **1 Ci = 37 GigaBq** **(this is a large amount)**	**rad** **1 rad = 100 ergs/gram**	**rem** **1 rem = .01 Sv**
International System of Units (SI)	**Becquerel (Bq)** **1Bq= 1 event of radiation emission per second (this is a very small dose)**	**Gray (Gy)** **1 Gy = 100 rad**	**Sievert** **1 Sv=100 rem (this is a large dose)** **1 Gy air dose = 0.7 Sv**

Name _____ Date _____

Writing Frame: Nuclear Power Plant

My decision for Recadia is _____.

The evidence for this decision is

1. ____

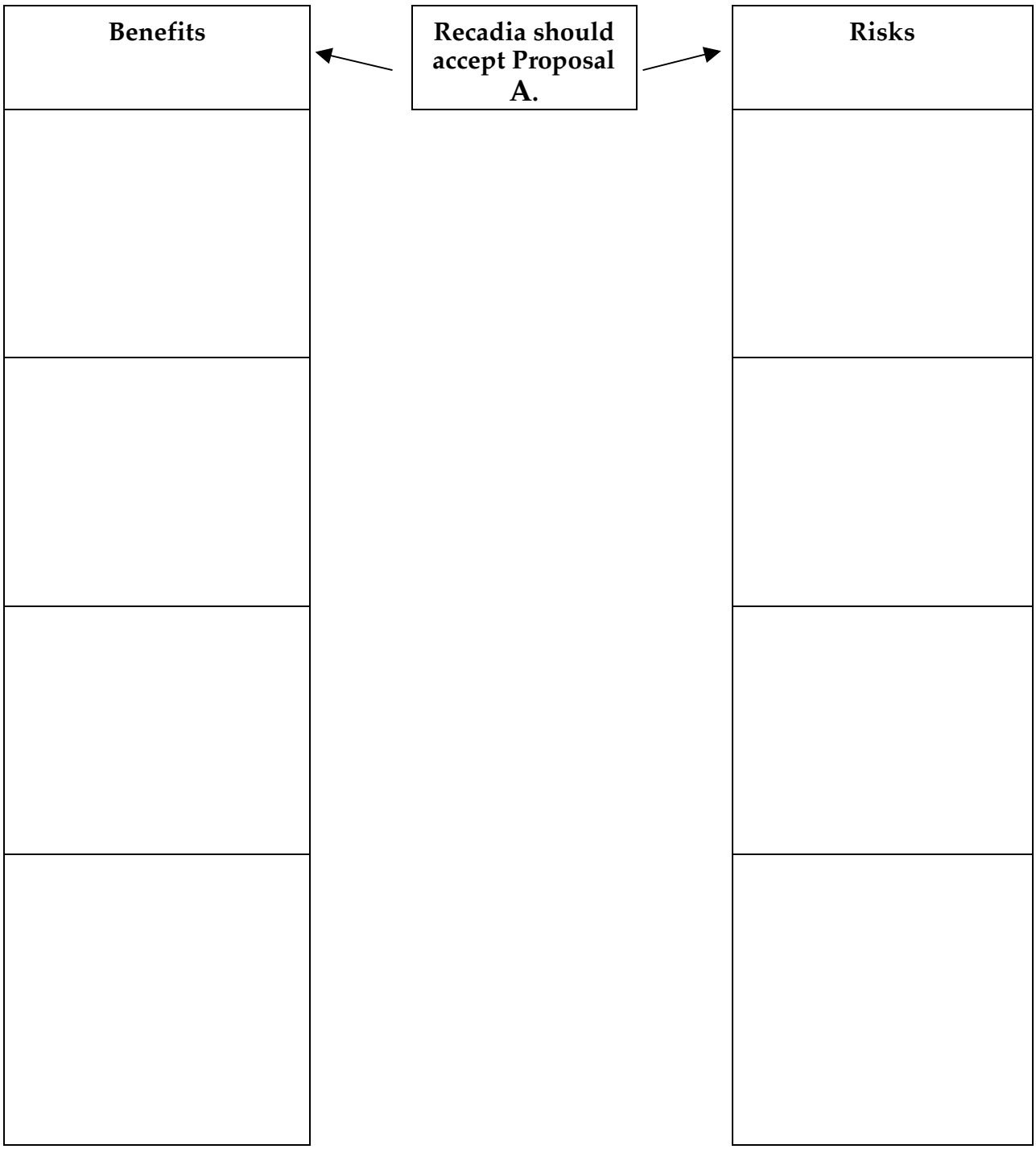
2. ____

3. ____

The trade-offs that result from this decision is/are _____.

Name _____ Date_____

Discussion Web: Recadia's Energy Choices



Waves Student Sheet 18.1a (optional)

Name _____Date_____

Discussion Web: Recadia's Energy Choices