

## Lesson 2.13: Physical Science – Heat Energy and Light

**Weekly Focus:** Reading for Comprehension  
**Weekly Skill:** Understand graphic information

**Lesson Summary:** This week students will practice reading for comprehension of text and graphic information. Students will learn about thermodynamics and the light spectrum.

### Materials Needed:

- **Comprehension Reading:** [Unit 2.13 Handout 1](#) (Spectrum Science, Grade 6, pages 28-29)
- Video on MLC YouTube Channel: [GED Science Video Unit 2.13](#) – Time 5:58 minutes
- Video Guide and worksheets: [Unit 2.13 Handout 2](#)
- **Extra Work/Homework:** [Unit 2.13 Handout 3](#) (6-way Paragraphs Introductory, #23, pages 46-47)

**Objectives:** Students will be able to...

- Gain an understanding of laws of thermodynamics
- Understand graphic information presented

**College and Career Readiness Standards:** RI, RST, WHST, SL

**ACES Skills Addressed:** EC, LS, ALS, CT, SM, N

**Notes:** Please review and be familiar with classroom routine notes for: reading for fluency strategies ([Routine 2](#)), summarizing techniques ([Routine 4](#)), and self-management skills ([Routine 1](#)). The notes will help with making a smooth transition to each activity.

If possible, **print page 2 of Unit 2.13: Handout 2 in color.** It contains a color image of the light spectrum which students may need in order to answer some questions found further in the handout.

### GED 2014 Science Test Overview – For Teachers and Students

The GED Science Test will be 90 minutes long and include approximately 34 questions with a total score value of 40. The questions will have focus on three content areas: life science (~40%), physical science (~40%), and Earth and space science (~20%). Students may be asked to read, analyze, understand, and extract information from a scientific reading, a news brief, a diagram, graph, table, or other material with scientific data and concepts or ideas.

The online test may consist of multiple choice, drop down menu, and fill-in-the-blank questions. There will also be a short answer portion (suggested 10 minutes) where students may have to summarize, find evidence (supporting details), and reason or make a conclusion from the information (data) presented.

The work students are doing in class will help them with the GED Science Test. They are also learning skills that will help in many other areas of their lives.

## Lesson 2.13: Physical Science – Heat Energy and Light

### Activities:

#### Warm-Up: Light Spectrum

Time: 5 - 10 minutes

Today's lesson involves an introduction to light waves and the visible light spectrum. Write on the board, "ROY-G-BIV: What does it mean?" Ask students as they come into class if they have heard of this before. Ask them to write down what they think the letters ROY-G-BIV mean. Circulate the classroom as students are writing to see if they understand. Help them with the topic by informing them that this is about the light spectrum (think rainbow), which may help them. Review as a class **R**ed, **O**range, **Y**ellow, **G**reen, **B**lue, **I**ndigo, **V**iolet.

#### Activity 1: Comprehension Reading (Unit 2.13 Handout 1)

Time: 40 - 45 minutes

- 1) Distribute **Unit 2.13 Handout 1** to students.
- 2) Explain to students that the purpose of the reading passage is to introduce them to key vocabulary and concepts surrounding thermodynamics, an aspect of energy—a subject they have been reading about for a few weeks. The reading discusses 3 laws of thermodynamics, make sure students don't get confused or mixed up with Newton's Laws of Motion.
- 3) Ask students to review the title and count the number of paragraphs in the reading passage. Ask students how they know where a paragraph begins. Explain that it is important to know how to find a paragraph quickly as some test questions may ask students to refer to a certain paragraph. If you have an overhead, point to it and/or label the indents.
- 4) Explain to students they should read all of the paragraphs silently in order to answer the questions that follow. To help students find the main idea of the reading passage, remind them to think "What are all of the paragraphs about?" and "What is the point that the author is trying to make?" while reading.
- 5) While students are reading, circulate and discuss with students that when reading for comprehension, there are many strategies to use: read the title to predict what the reading is about; look at images, use the vocabulary in bold to guide them to more meaning while reading. Discuss that they should remember to ask "What is this all about?"
- 6) Review answers as a whole class. Ask students to point out the evidence (proof) from the reading that led them to the answer.
- 7) If there is extra time, have students read passage in pairs to promote reading fluency. If there is extra time or to challenge students, they can write a 3 – 5 sentence summary of all of the material presented. Use Routine 4 Summarizing Techniques Handout.

Break: 10 minutes

#### Activity 2: Video Guide and worksheets (Unit 2.13 Handout 2)

Time: 40 - 45 minutes

- 1) Distribute the handout (**Unit 2.13 Handout 2**) to students.
- 2) Explain to students that they will watch a TED talk video about light waves. You may want to ask if students have ever watched or listened to TED talks. (**T**echnology – **E**ducation – **D**esign = ideas

## Lesson 2.13: Physical Science – Heat Energy and Light

worth spreading – online videos on important topics for today's world). Discuss with students the purpose of this video is for students to gain the basic information about light waves and visible light spectrum that they may need to know for 2014 GED Science Module.

**3)** The video is 5:57 minutes in length. Students should follow along and fill in key vocabulary and information on **page 1 of Unit 2.13 Handout 2** as they watch. Teachers may need to play the video two times to get all of the information.

**4)** Review answers to the video guide as a class, then have students go further in depth with light and waves with the remaining 3 pages of Unit 2.13 Handout 2.

**5)** While students are working independently or in their table groups, circulate the classroom to make sure they understand the information presented in the diagrams.

**6)** Review answers as a whole class.

**7)** If there is extra time, students can discuss in their table groups the information that was presented in the video and in the handouts.

**Note:** If possible, **print page 2 of Unit 2.13 Handout 2** in color – it contains an image of the visible light spectrum that students may want to view to answer some other questions.

### Wrap-Up: Summarize

Time: 5 minutes

Have students turn to a partner (or write in their journals) about what they have learned today about light and waves. They may want to discuss some of the areas that they would like to do further study on in the future. Their summary may include any wonderings they have about the subject. *Note: Use Routine 4 Handout*

### Extra Work/Homework: Unit 2.13 Handout 3

Time: 20 minutes outside of class

Students can read and answer questions from the **Unit 2.13 handout 3**. It is a way to incorporate and expand upon the information gained in today's lesson.

### Differentiated Instruction/ELL Accommodation Suggestions

### Activity

If some student groups finish early, they can turn their paper over and summarize the passage on thermodynamics and energy.

**Activity 1  
Handout 1**

There may be a lot of new vocabulary and ideas for some students, be prepared to assist by circulating while they are reviewing after the video.

**Activity 2  
video and  
handout**

### Online Resources:

#### Online Quiz of Light wave, visible and invisible

If students have Internet connection, they should try to use the online quiz after the video presentation: <http://ed.ted.com/lessons/light-waves-visible-and-invisible-lucianne-walkowicz#review>

### Index of terms used with waves in physical science

<http://www.gcsescience.com/piwaves.htm>

### **Suggested Teacher Readings:**

- GED Testing Service – GED Science Item Sample (to get an idea of what the test may be like)  
<http://www.gedtestingservice.com/itemsamplerscience/>
- Assessment Guide for Educators: A guide to the 2014 assessment content from GED Testing Service:  
<http://www.riaepdc.org/Documents/ALALBAASSESSMENT%20GUIDE%20CHAPTER%203.pdf>
- Minnesota is getting ready for the 2014 GED test! – website with updated information on the professional development in Minnesota regarding the 2014 GED.  
[http://abe.mpls.k12.mn.us/ged\\_2014\\_2](http://abe.mpls.k12.mn.us/ged_2014_2)
- ATLAS: ABE Teaching & Learning Advancement System: 2014 GED® Classroom: Science: Minnesota's state-wide website for resources for the science module  
<http://atlasabe.org/resources/ged/science>

Unit 2.13 Handout 1 (2 pages total)

### TEACHER ANSWER KEY

1. c
2. b
3. d
4. the second law
5. *Answers may vary, possible answer:* The molecules in the sidewalk are excited because they have a lot of thermal energy. This thermal energy moves into the molecules of my feet, and I feel their increased thermal energy as heat.
6. *Answers may vary, possible answer:* My hand has more thermal energy than the ice cube, so energy flows out of my hand into the ice. The heat moving away from my hand makes my hand feel cold.

## Lesson 2.13: Physical Science – Heat Energy and Light

Unit 2.13 Handout 2 (4 pages total)

Video: Light Waves, Visible and Invisible – Lucianne Walkowicz

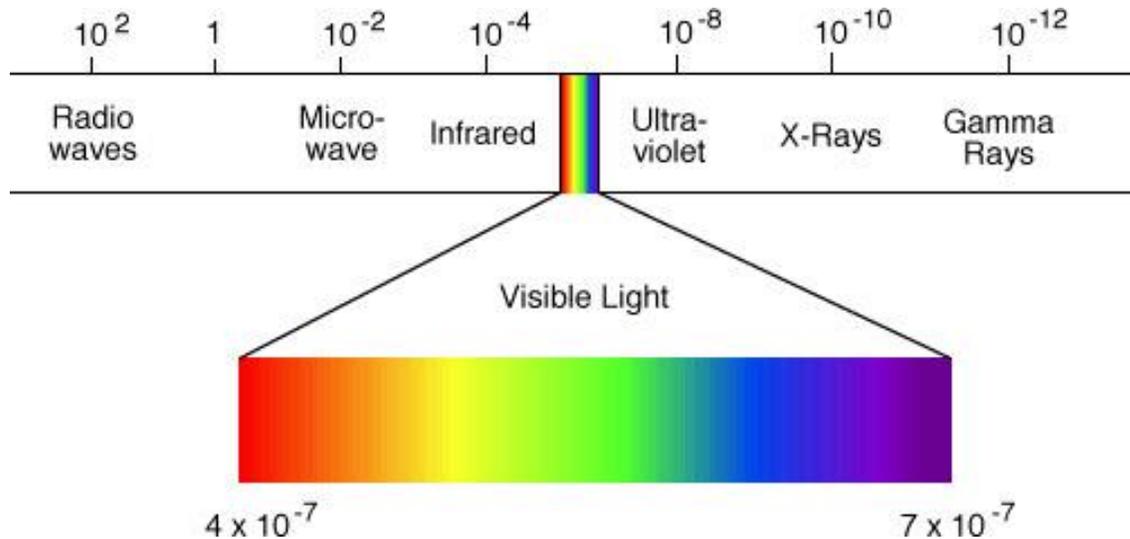
Watch the video on light waves and fill in the blanks with information presented in the video.

### What Is Light?

1. Light is electromagnetic radiation that acts like both a \_\_\_\_\_ and a \_\_\_\_\_.
2. The size of a wave is called its \_\_\_\_\_. And how often it comes by is called its \_\_\_\_\_.
3. Long wavelengths have \_\_\_\_\_ frequency.
4. Short wavelengths have \_\_\_\_\_ frequency.
5. Long wavelengths have \_\_\_\_\_ energy.
6. Short wavelengths have \_\_\_\_\_ energy.
7. \_\_\_\_\_ light is the range of light recognized by the retina of a human eye.
8. In the retina, \_\_\_\_\_ measure brightness and \_\_\_\_\_ are sensitive to the different colors of light.
9. What is the only thing that makes one kind of light different from another?  
\_\_\_\_\_
10. What is another example that gives off the full spectrum of light?  
\_\_\_\_\_
11. Is the light we see in the distant universe the same as the light we see and study on Earth?  
Yes \_\_\_\_\_ No \_\_\_\_\_

## Lesson 2.13: Physical Science – Heat Energy and Light

**Electromagnetic Spectrum** - The electromagnetic spectrum describes the various types of electromagnetic radiation based on their wavelengths.



**Radio Waves** - Radio is at the weak end of the spectrum, with low energy and long wavelength. It's used for transmission of data, via modulation. Television, mobile phones, wireless networking and amateur radio all use it.

**Microwaves:** - Microwaves come next. They can cause entire molecules to resonate. This resonance causes water to move rapidly and enables the microwave oven to cook food.

**Infra-red Radiation** - The next category is infra-red. This makes chemical bonds resonate. When a chemical bond resonates, the vibrations add internal energy to the molecule. The molecule becomes hot. The bulk substance becomes hot when its molecules' bonds are all resonating. When you touch it, you feel its warmth or you lose the tip of your finger, depending on how violent the resonance is.

**Visible radiation (light)** - After infra-red comes visible light. This is the range in which the sun and stars similar to it emit most of their radiation. When this is scattered or reflected by an object, we can infer the existence of the object. ROY-G-BIV = the colors **R**ed **O**range **Y**ellow **G**reen **B**lue **I**ndigo **V**iolet

**X-rays** - After UV come X-rays. Hard X-rays are of shorter wavelength than soft X-rays. X-rays are used for seeing through some things and not others, as well as for high-energy physics and astronomy.

**Gamma rays** - After hard X-rays come gamma rays. These are the most energetic photons, having no lower limit to their wavelength. They are useful to astronomers.

Lesson 2.13: Physical Science – Heat Energy and Light

Name \_\_\_\_\_ Date \_\_\_\_\_

# White Light Spectrum

Our eyes are sensitive to only a very small part of the electromagnetic spectrum. This portion that we can see is called **visible light**. This white light is a combination of the colors of the light spectrum. Each color is a different wavelength. Violet is the color with the shortest wavelength. Red is the color with the longest wavelength. Use the terms in the word box to label the colors of the spectrum and their wavelengths.

red	blue	violet	green
indigo	yellow	orange	492 – 475 nm
445 – 390 nm	780 – 622 nm	622 – 597 nm	577 – 492 nm
475 – 445 nm	597 – 577 nm		

	Color	Wavelength
1		
2		
3		
4		
5		
6		
7		

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Name \_\_\_\_\_

**Unit  
Review**

*Visual Literacy*

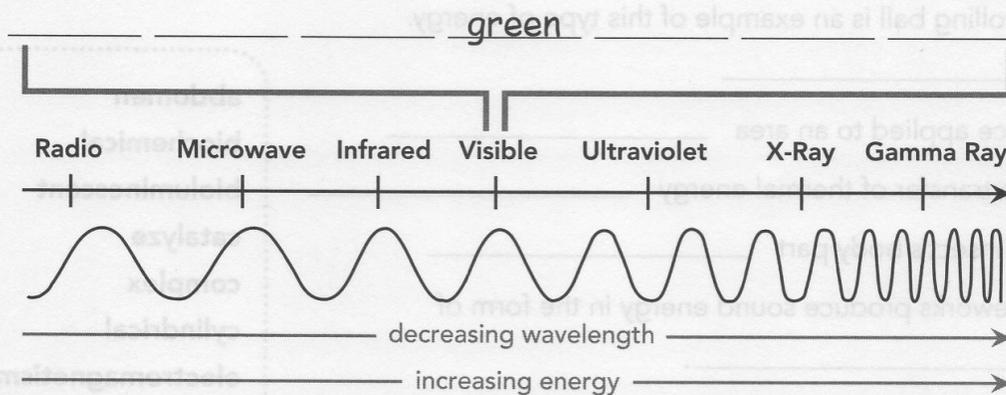
## Electromagnetic Spectrum

Use the electromagnetic spectrum to answer the questions.

Daily Science

**Big  
Idea 6**

**WEEK 5**



- Which type of electromagnetic wave has the highest energy?  
\_\_\_\_\_
- Which type of electromagnetic wave has the longest wavelength?  
\_\_\_\_\_
- Infrared* means "below red." *Ultraviolet* means "beyond violet." Based on these definitions, is the color red to the left or the right of the color violet in the visible portion of the spectrum?  
\_\_\_\_\_
- What are the colors of the visible portion of the electromagnetic spectrum? Write them above the spectrum using the words in the box below. (Green has already been filled in for you.)

blue      red      yellow  
orange      violet      indigo

Unit 2.13 Handout 2 (4 pages total)

## TEACHER ANSWER KEY: Page 1

### What Is Light?

1. Light is electromagnetic radiation that acts like both a **wave** and a **particle**
2. The size of a wave is called its **wavelength** And how often it comes by is called it **frequency**.
3. Long wavelengths have **low** frequency.
4. Short wavelengths have **high** frequency.
5. Long wavelengths have **low** energy.
6. Short wavelengths have **high** energy.
7. **Visible** light is the range of light recognized by the retina of a human eye.
8. In the retina, **rods** measure brightness and **cones** are sensitive to the different colors of light.
9. What is the only thing that makes one kind of light different from another?

#### **Its wavelength**

10. What is another example that gives off the full spectrum of light?

#### **The universe**

11. Is the light we see in the distant universe the same as the light we see and study on Earth?

Yes **XXX** \_ No \_\_\_\_\_

## TEACHER ANSWER KEY: Page 3

### White Light Spectrum

1. red; 780 – 622 nm
2. Orange; 6220-0597 nm
3. yellow; 597 – 577 nm
4. Green; 577 – 492 nm
5. blue; 492 – 475 nm
6. Indigo; 475 – 445 nm
7. violet; 445 – 390 nm

### Page 4

### Electromagnetic Spectrum

Red orange yellow green blue indigo violet

1. gamma ray
2. radio
3. red is to the left of violet

## Unit 2.13 Handout 3

### ANSWER KEY

1. a. N (narrow)  
b. B (broad)  
c. M (main)
2. c
3. b
4. d
5. b
6. c