Electromagnetic Spectrum and Visible Light Study Guide – 2017 - Answers

A proficient student will be able to explain how the electromagnetic spectrum is organized and describe the types of electromagnetic waves that make up the spectrum

1. Describe the electromagnetic spectrum:- - electromagnetic spectrum-the complete range of electromagnetic waves, in order by wavelength/frequency
2. Describe the different types of electromagnetic waves in the electromagnetic spectrum, in order, from shortest wavelength to longest wavelength.

* Shortest – gamma rays – invisible to us; used to treat cancer and make detailed pictures for diagnoses; smallest wavelength and most energy; produced in high energy nuclear explosions and supernovas
* X-Rays – invisible to us, used to detect broken bones, cavities, dangerous materials in airports
* Ultraviolet – invisible to us, can cause skin cancer, ozone layer helps protect us from some of these rays; some insects like bumblebees can see UV light
* Visible light – this is the light we can see; allows us to see colors, objects; makes up a very small portion of the electromagnetic spectrum
* Infrared – used in night vision goggles, remote controls, and heat lamps; snakes like rattlesnakes can “see” infrared light
* Microwaves – used for cooking, tv weather reporting, gps; can penetrate clouds, smoke and light rain
* Radiowaves – longest wavelengths; used for listening to radio, watching tv, cell phones, and the internet

1. How are energy and the different types of electromagnetic waves related?-The shorter the wavelength of the electromagnetic waves, the higher the energy
2. What kind of waves do not require a medium to travel through?-electromagnetic waves
3. What kinds of electromagnetic waves are invisible to us-radio waves, microwaves, infrared waves, ultraviolet rays,

x-rays, and gamma rays. What kinds of electromagnetic waves are visible to us?-visible light waves

1. How does the color of an object affect the amount of energy it receives from sunlight? Dark colors absorb more electromagnetic waves, so receive more energy from the sun. Light colors reflect more electromagnetic waves so receive less energy from the sun.

A proficient student will be able to explain the relationship between visible light and sight.

1. Define the following light vocabulary:

- absorption- when waves enter a substance and turn into another type of energy

- reflection-when waves bounce off of something

- refraction- the bending of a ray when it passes at an angle from one medium into another in which it’s

speed is different

- visible light – electromagnetic wave energy we can see, made of colors

- scatter- when light reflects off an object in several different directions

- transmit – to pass, or cause to pass through space or material

- opaque – a material that cannot be seen through

- translucent – a material that can only partially be seen through; the image is blurry

- transparent – a material that can be seen through clearly

- prism – a wedge shaped transparent object that causes light to separate into its wavelengths upon exiting

The prism

- white light – the combination of all the wavelengths of visible light

1. Describe the order light travels in order for us to see (hint: it starts at the light source)-the light goes from the light source to the object, to our eyes
2. Give examples of opaque, translucent and transparent objects-opaque=book, table, solid door, tree; translucent=

Wax paper, frosted glass windows in cafeteria, tissue paper; transparent=clear glass window, clean water, eyeglass lenses

1. Why does a red shirt look red to us? – the shirt absorbs all the wavelengths of color except red…the red light reflects from the shirt to our eyes
2. What types of waves are visible light waves?- transverse waves and electromagnetic waves
3. What does a prism do?- it bends or refracts white light into its separate wavelengths so you can see the individual colors
4. How does the speed of light compare to the speed of sound?-the speed of light is much faster than the speed of sound
5. How do the types of matter a medium is made of affect the speed of light?-light travels fastest through a gas, next fastest through a liquid, and slowest through a solid
6. How are colors and wavelengths related? Name the colors in order, from shortest wavelength to longest wavelength. Each color of visible light has a different wavelength. In order, the shortest wavelength is violet, next shortest is indigo, then blue, green, yellow, orange, and red has the longest wavelength.
7. Why does a pencil in a glass of water appear to be bent or broken? – the light is being refracted as it goes from the air into the water
8. What is the absence of color?- black
9. What is the combination of all the colors?- white
10. Give examples of opaque, translucent and transparent objects – this is a repeat of #3
11. What is the acronym for the colors of visible light?-ROY G BIV
12. Why do light waves get refracted?-they get refracted because their speed changes when they move from one medium into another
13. What process forms an image in the mirror? – reflection
14. Explain how we see, being sure to mention: cornea, iris, pupil, lens, retina, optic nerve-Light goes from a light source to an object, is then reflected into our eye. It passes through the cornea (a clear, protective covering of the eye, then through the pupil (a hole in the eye whose size is determined by the iris), then through the lens where it is refracted to focus the light, then to the retina (whose rod and cone cells help us see black, white, gray, and colors.) The retina changes the light energy to electrical signals that are sent to the brain through the optic nerve, where the brain interprets the images we see.
15. What do rods and cones in our eyes do?-The rod cells allow us to see black, white and shades of gray. The cone cells allow us to see colors.