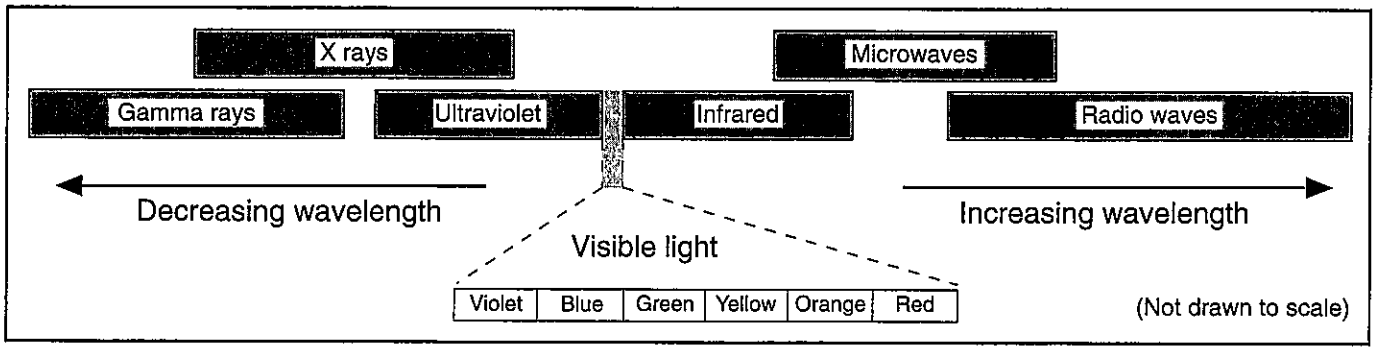
Electromagnetic Spectrum



Overview:

The electromagnetic spectrum consists of waves with both electric and magnetic properties. All electromagnetic waves travel at the speed of light. The difference between them is their wavelengths. Gamma rays are the shortest waves, while radio waves are the longest. The shortest waves, gamma rays and *x*-rays, are more dangerous due to their penetrating power. The ultraviolet (UV) rays are those harmful sun-tanning waves. The visible light that is being reflected off this paper is the only part of the spectrum that we can see. The infrared waves can't be seen, but can be felt as heat. The Sun radiates all of these different electromagnetic waves in different amounts, but sends out more visible waves than any other part of the spectrum. The Earth absorbs these waves during the day and heats up. At night, the Earth reradiates much of this energy back to space in the form of heat waves – infrared waves. Some of these infrared waves are absorbed by greenhouse gases, causing an increase in the Earth's atmospheric temperature. This process is needed, giving our planet a temperature that is favorable for life. But with the increase of greenhouse gases, especially CO_2, that is released by burning fossil fuel, more infrared waves are being absorbed. This is causing an increase in global temperature. The consequences of this situation is being documented globally and may be disastrous for some plants and animals.

The Chart:

We will start with the visible wavelength spectrum. This has been expanded into a lower section to show the wavelengths of the six colors that make up the visible spectrum. Within the visible spectrum, violet has the shortest wavelength, while red has the longest wavelength. Moving from the visible spectrum to the left, as the arrow indicates, are electromagnetic waves of decreasing wavelengths. Moving from the visible spectrum to the right are the longer wavelengths. Some of these wavelengths, especially microwaves, and *x*-rays, overlap others as shown by the gray bars.

Additional information:

- When an object absorbs electromagnetic energy, it will later reradiate energy off in longer wavelengths.
- The ozone layer protects our planet from harmful UV waves by absorbing a percentage of them. The deterioration of the ozone layer by pollutants has caused more UV waves to reach the surface of our planet. This is one component of global warming and is the reason for an increase in skin cancer.

Set 1 — Electromagnetic Spectrum

1. Which process transfers energy primarily by electromagnetic waves?

   (1) radiation (3) conduction
   (2) evaporation (4) convection 1 _____

2. Which type of radiation has the shortest wavelength?

   (1) microwaves (3) ultraviolet
   (2) visible light (4) infrared 2 _____

3. Of the following choices, which visible radiation has the shortest wavelength?

   (1) red (3) green
   (2) blue (4) yellow 3 _____

4. Most of the energy radiated by Earth's surface at night is in the form of

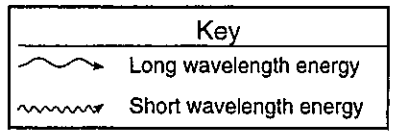
   (1) infrared rays (3) visible light rays
   (2) ultraviolet rays (4) *x*-rays 4 _____

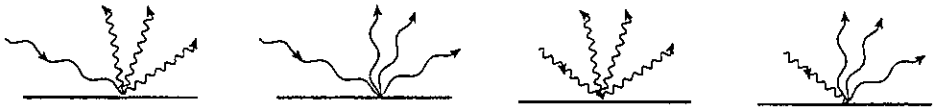
5. Scientists have theorized that an increased concentration of carbon dioxide will cause an increase in worldwide atmospheric temperature. This theory is based on the fact that carbon dioxide is a

   (1) good absorber of infrared radiation
   (2) poor absorber of infrared radiation
   (3) good reflector of ultraviolet radiation
   (4) poor reflector of ultraviolet radiation

   5 _____

6. Which diagram best represents the wavelength of most of the sunlight energy absorbed and the wavelength of infrared energy reradiated by the roof of a building at 2 p.m. on a clear summer day?

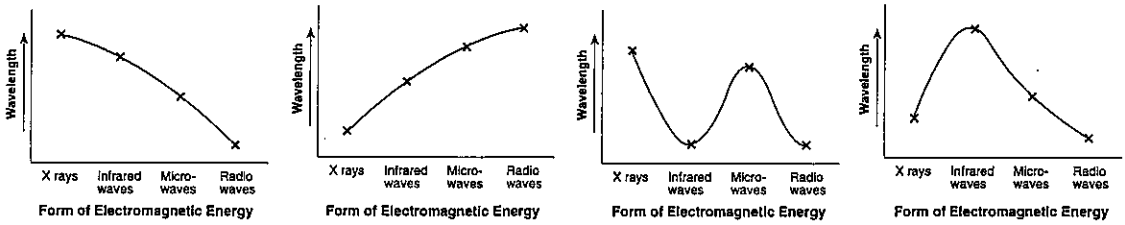




(1) (2) (3) (4)

6 _____

7. Which graph best represents the relative wavelengths of the different forms of electromagnetic energy?



(1) (2) (3) (4)

7 _____

8. Which form of electromagnetic radiation can be shorter than ultraviolet, but longer than gamma rays?

(1) gamma rays
(2) ultraviolet
(3) infrared
(4) *x*-rays

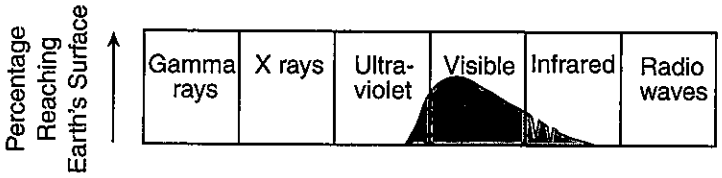
8 _____

9. In the visible spectrum, which color has the longest wavelength?

(1) red
(2) green
(3) orange
(4) violet

9 _____

10. The diagram below shows the types of electromagnetic energy given off by the Sun. The shaded part of the diagram shows the approximate amount of each type actually reaching Earth's surface.



Which conclusion is best supported by the diagram?

(1) All types of electromagnetic energy reach Earth's surface.
(2) Gamma rays and *x*-rays make up the greatest amount of electromagnetic energy reaching Earth's surface.
(3) Visible light makes up the greatest amount of electromagnetic energy reaching Earth's surface.
(4) Ultraviolet and infrared radiation make up the greatest amount of electromagnetic energy reaching Earth's surface.

10 _____

11. What physical property is different between visible waves and radio waves?

_____

12. Explain how deforestation and the burning of these trees from tropical rain forest contributes to the greenhouse effect.

_____

_____

13. Give 3 consequences that could occur if the ozone layer continues to be depleted due to destructive ozone pollutants.

1) _____

2) _____

3) _____