**NASA – Mission: Science**

**Introduction to the Electromagnetic Spectrum**

**WebQuest**

**Directions:** Use the following website to answer the questions below.

<http://missionscience.nasa.gov/ems/01_intro.html>

Explore the website and answer the questions which follow. The questions are divided into categories which you will easily find throughout the site. (Use tabs on the right hand column.)

**Intro To The EMS**

1. Whenever you tune your radio, watch television, send text messages, or make popcorn in a microwave oven, what are you using?\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

2. How does electromagnetic energy travel?

3. The very long ones are called \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ waves, and the very short ones are called \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ waves.

4. What are the three types of electromagnetic waves which are “ionizing” waves, meaning that they have high enough energy that they can knock electrons off of atoms?

5. Our atmosphere protects us from most of the ionizing waves that the sun emits. What are the three most important gases in our atmosphere which protect us?

6. What do we call the regions of the EM spectrum which are able to pass (transmit) through our atmosphere?

**Visualization: From Energy To Image**

15. False color, also known as \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is what helps scientists visualize data from EM waves that are beyond the visible spectrum range.

16. Composite images can be put together using multiple images from different sensors. The galaxy Messier 101 is shown. What are the three different sensors used to form the composite, and what section of the EM spectrum did each record?

|  |  |
| --- | --- |
| Sensor | Type of EM waves recorded |
|  |  |
|  |  |
|  |  |

**Radio Waves**

17. Radio waves have the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ wavelengths of the spectrum.

18. Multiple space objects, including the sun, earth, Jupiter,

and even galaxies emit radio waves. Radio telescopes resemble

large dishes. Radio astronomy has what advantage compared to

attempting to study the other areas of the spectrum?

**Microwaves**

19. Microwave ovens use microwaves which are about \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in length. They force water and fat molecules to rotate. The more they rotate, the hotter they have become. This heat energy cooks the food.

20. Microwave bands which can penetrate haze, light rain, snow, etc. are very useful for \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and studying the earth from space.

21. The microwave background radiation, an image of which is shown from the WMAP project, gives wide support for what theory?

**Infrared Waves**

22. If you were to watch television tonight, how would you be utilizing infrared waves?

23. What is the name for the type of imaging that occurs when infrared waves are collected, and translated into visible images? (This type of imaging is useful for measuring temperatures of objects from a distance.)

**Visible Light**

24. List the seven colors in order from **shortest** to **longest** wavelength:

(1) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(2) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(3) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(4) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(5) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(6) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(7) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

25. Absorption lines present in a spectrum gives us evidence of specific elements located within light producing objects in space, such as stars. What element has an absorption line present at the transition between green and blue?

**Ultraviolet Waves**

26. Some insects, reptiles, and birds are able to see portions of the ultraviolet spectrum that humans cannot. What tool do we use, which emits UV light in order to attract and trap certain “pest” insects?

27. Ultraviolet waves have enough energy to put \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and other types of cellular damage at risk if overexposed.

28. What is the upper atmosphere gas which protects us from ultraviolet waves?

**X-Rays**

29. Bones are able to absorb more x-rays than skin due to bone having a higher \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ than skin.

30. When the sun ejects \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, they can be swept up by the earth’s magnetosphere (magnetic field).

This can cause an \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ which can include,

among other types of light, x-rays.

**Gamma Rays**

31. Gamma rays have the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ wavelengths and the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ energy of any waves in the EM spectrum.

32. How are gamma rays quite different from visible and x-ray waves? What object do they not interact with?

33. A \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is an event that can, in 10 seconds, release more energy than our sun will release during its entire, expected, 10 billion year lifetime.