Science 30	Unit C: Physics
Lesson 11 - Electromagnetic Spectrum Review	84 mins

Science 30 - Lesson 35 - Unit C - Electromagnetic Spectrum Review

Name: _____

Practice

1) Some forms of EMR are classified as ionizing radiation.
    a. Explain the meaning of this term.

    b. Describe the effects ionizing radiation has on living tissue.

    c. Describe strategies you can use to reduce your exposure to ionizing radiation.

2) In astronomy, the unit that is often used to describe distances between Earth and stars other than the Sun is the light-year (the distance light would travel in one year… think speed of time times time….). For example, Alpha Centauri (after the Sun, the closest star to Earth that can be seen with the naked eye) is 4.3 light-years from Earth.
    a. Determine how many metres there are in one light-year.

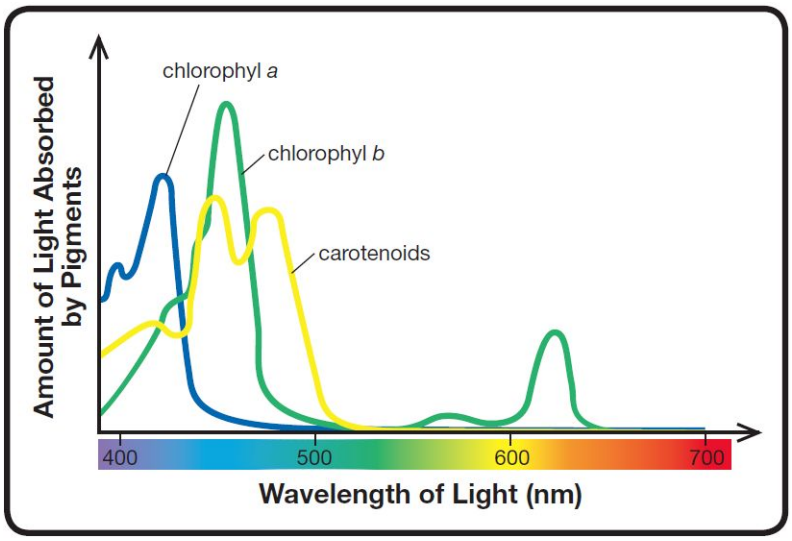
    b. Use your answer to a. to determine the distance (in metres) from Alpha Centauri to Earth.

    c. Explain the following statement:
        i) If you were to see Alpha Centauri on a clear night, you would not be seeing the way this star looks now. You would be seeing the way it looked 4.3 years ago.

    d. Sirius is the brightest star in the night sky and is located 8.3×10^{16} m from Earth. When you look at Sirius in the night sky, how far back in time are you actually seeing it?

3) A truck driver uses a citizen's band, or CB, radio to communicate with other truckers. If the broadcast frequency is 27.965 MHz, calculate the wavelength of the radio wave.

Use the following diagram to answer the next question



4) Figure above shows the wavelengths of light that are absorbed by pigments in the chloroplasts of plants.
   a. Identify the wavelengths of light that are strongly absorbed by all three pigments.

   b. Identify the wavelengths of light that are not strongly absorbed by these three pigments.

   c. If you looked at a plant leaf that contained these three pigments, what would be the colour of the leaf? Explain your answer.

5) The fact that you can listen to a portable radio inside most buildings illustrates an important property of radio waves—the ability to penetrate walls made of wood, cement, and glass.
   a. Explain why this property of radio waves is essential to the design of wireless devices.

b. Explain how this property of radio waves can create security issues when wireless devices are used to communicate sensitive information, such as credit card numbers or passwords for bank cards.

c. Explain why businesses that use wireless communication systems reduce the power of their transmitters to the minimum level necessary to run all the devices within the building.

6) The owner's manual for a wireless router includes the following recommendations for the location of the router:

- Place the wireless router in a central location within a home or business, away from outside walls.
- Avoid placing the wireless router near large metal objects, like filing cabinets.

Use your knowledge of the behaviour of radio waves to explain each of these recommendations.

7) Many brands of cordless telephones use a frequency of 2.4 GHz. This same frequency is also utilized by manufacturers of wireless routers.
   a. Explain what the phrase "a frequency of 2.4 GHz" means in terms of the interaction of a radio wave with an antenna.

   b. Calculate the wavelength of the radiation associated with this signal.

   c. Explain the difficulties that could occur if a person was using a cordless phone while using their computer's wireless router.

d. Suggest some solutions to this problem.

8) Since the number of wireless radio devices is continuing to increase, alternative technologies are being developed. Wireless infrared systems use a beam of infrared radiation to send a signal from one device to another. You utilize a system that transmits infrared signals every time you use a remote control to operate a TV or VCR. Use your experiences with remote controls to outline some of the possible advantages and disadvantages of a wireless infrared communication system.

9) Diamondbacks (a type of snake) are most sensitive to infrared radiation (they have “eyes” that can sense IR radiation) with a wavelength of 10 mm.
   a. Calculate the frequency of this radiation.

   b. Speculate why snakes have evolved to be sensitive to this frequency of infrared radiation.

10) Draw a diagram to show how a mouse that is straight ahead of a diamondback’s head would send equal amounts of infrared radiation to each sensor. Draw another diagram to show how a mouse that is off-centre would send more radiation to one sensor than the other.

Use the following information to answer the next question

In this chapter you learned of the hazards to living tissue caused by exposure to ionizing radiation. You also learned that health-care professionals go to great efforts to keep the exposure to themselves and their patients as low as reasonably achievable, or ALARA for short.

11) Safety procedures are used to ensure the safety of patients and the technicians who operate X-ray machines. Describe the procedures that are based on ALARA to minimize the risks to patients and to the health-care professionals operating the equipment.