

TSOKOS READING ACTIVITY

Section 4-2 (4 points)

1. Essential Idea: There are many forms of waves available to be studied. A common characteristic of all travelling waves is that they carry energy, but generally the medium through which they travel will not be permanently disturbed.
2. Nature Of Science: Patterns, trends and discrepancies: Scientists have discovered common features of wave motion through careful observations of the natural world, looking for patterns, trends and discrepancies and asking further questions based on these findings.
3. International-Mindedness: Electromagnetic waves are used extensively for national and international communication
4. Theory Of Knowledge:
 - a. Scientists often transfer their perception of tangible and visible concepts to explain similar non-visible concepts, such as in wave theory.
 - b. How do scientists explain concepts that have no tangible or visible quality?
5. Understandings:
 - a. Travelling waves
 - b. Wavelength, frequency, period and wave speed
 - c. Transverse and longitudinal waves
 - d. The nature of electromagnetic waves
 - e. The nature of sound waves
6. Applications And Skills:
 - a. Explaining the motion of particles of a medium when a wave passes through it for both transverse and longitudinal cases
 - b. Sketching and interpreting displacement–distance graphs and displacement– time graphs for transverse and longitudinal waves
 - c. Solving problems involving wave speed, frequency and wavelength
 - d. Investigating the speed of sound experimentally
7. Guidance:
 - a. Students will be expected to derive $c = f\lambda$
 - b. Students should be aware of the order of magnitude of the wavelengths of radio, microwave, infra-red, visible, ultraviolet, X-ray and gamma rays
8. Data Booklet Reference:
 - a. $c = f\lambda$

9. Utilization:
- a. Communication using both sound (locally) and electromagnetic waves (near and far) involve wave theory
 - b. Emission spectra are analysed by comparison to the electromagnetic wave spectrum (see Chemistry topic 2 and Physics sub-topic 12.1)
 - c. Sight (see Biology sub-topic A.2)

10. Aims:
- a. Aim 2: there is a common body of knowledge and techniques involved in wave theory that is applicable across many areas of physics
 - b. Aim 4: there are opportunities for the analysis of data to arrive at some of the models in this section from first principles
 - c. Aim 6: experiments could include (but are not limited to): speed of waves in different media; detection of electromagnetic waves from various sources; use of echo methods (or similar) for determining wave speed, wavelength, distance, or medium elasticity and/or density

11. Read section 4-2, pg. 153-161, in your textbook.

12. Answer the following questions:

- a. What are the three large classes of waves?
 - i. _____
 - ii. _____
 - iii. _____
- b. Give the definition of a wave. _____

- c. Give an example of a wave that can travel in a vacuum? _____
- d. In what direction is the direction of energy transfer? _____

- e. What is *wavelength* and what is the variable used to represent it? _____

- f. What's the difference between a *crest* (not the toothpaste) and a *trough* (not the place where freshmen eat)? _____

- g. What is *period* and what is the variable used to represent it? _____

- h. What is *frequency* and what is its relationship to *period*? _____

- i. What is the relationship between *velocity*, *wavelength* and *period*? _____

- j. What is the relationship between *velocity*, *wavelength* and *frequency*? _____

- k. What does the speed of a wave depend on? What effect does the producing agent of the wave have on speed? _____

- l. What is a *transverse* wave and give an example? _____

- m. In figure 4.17, why are all the arrows different sizes? _____

- n. What graph is used to determine *wavelength*? _____
- o. What graph is used to determine *period/frequency*? _____
- p. In the graph of a transverse wave, what is *displacement*? _____

- q. What is the *amplitude* of a wave? _____

- r. What is a *longitudinal* wave and give an example? _____

- s. For a longitudinal wave, state the difference between a compression and an expansion/rarefaction? _____

- t. The displacement vs distance graph of a longitudinal wave looks the same as that for a transverse wave. What does the positive lobe of the sine curve mean for a longitudinal wave in terms of particle movement? What does the negative lobe indicate? _____

- u. On a displacement vs distance graph of a longitudinal wave, how can you identify the center of a compression? A center of expansion/rarefaction? _____

- v. What is an electromagnetic (EM) wave? _____

- w. What will all EM waves do in a vacuum? _____
- x. How is the speed of light affected by its source? _____
- y. What is the range of wavelengths in the electromagnetic spectrum in Figure 4.26? (give your answer in scientific notation) _____
- z. What is the range of wavelengths of the visible light spectrum in Figure 4.26? (give your answer in scientific notation) _____
- aa. Bernoulli used what device to describe simple oscillations using mathematics? _____

13. This assignment may be typed or neatly printed. Drawings may be freehand, but try to make use of the ‘Shapes’ or ‘Insert Clipart’ functions of MS Word. If you submit this assignment electronically, the filename must be in the following format, “LastnameFirstinitialPerXReadActX-X”.