Name: _____

Class: _____

Due Date: _____

C.2 Wave Model

Understandings

- Transverse and longitudinal traveling waves.
- Wavelength λ, frequency f, time period T, and wave speed v applied to wave motion as given by $v = f\lambda = \frac{\lambda}{T}$.
- The nature of sound waves.
- The nature of electromagnetic waves.
- The differences between mechanical waves and electromagnetic waves.

Equations

$v = f\lambda = \frac{\lambda}{T}$

The solutions can be found on the YouTube channel Go Physics Go:

https://www.youtube.com/@gophysicsgo/playlists

Use your favorite sources to answer the following questions

1. C: What is a *wave*? What do waves transfer? What do waves not transfer?

2. C: How are all waves created?

3. C: Define *medium.*

4. C: Define *vacuum.*

5. C: Define *mechanical wave.* Give an example.

6. C: Define *electromagnetic waves*. Give some examples.

7. C: List the seven electromagnetic waves in order of decreasing wavelength λ, increasing frequency f, and increasing energy $E = hf$.
   a.

   b.

   c.

   d.

   e.

   f.

   g.

8. C: State the meaning of ROY G BIV
   https://www.youtube.com/watch?v=wfIgC_PRTVc

9. C: Define *longitudinal wave*. Give an example.

10. C: Define *compression.*

11. C: Define *rarefaction.* Do not confuse *rarefaction* with *refraction*!

12. C: **Use a pencil and ruler!** Draw a *longitudinal wave*. Label the *compression* and *rarefaction*.

13. C: Define *transverse wave.* Give an example.

14. C: Define *crest.*

15. C: Define *trough.*

16. C: **Use a pencil and ruler!** Draw a *transverse wave*. Label the *crest* and *trough*.

17. C: Define *wavelength* λ. Units?

18. C: Define *period* T. Units?

19. C: Define *frequency* f. Units?

20. C: State the equation which relates the *speed*, *wavelength*, and *frequency* of a wave.

21. E: What will be the wavelength of a wave which has a wave speed of 0.560 m/s and a frequency of 4.40 Hz?

22. E: A wave has a period of 2.20 s. What is the frequency of this wave?

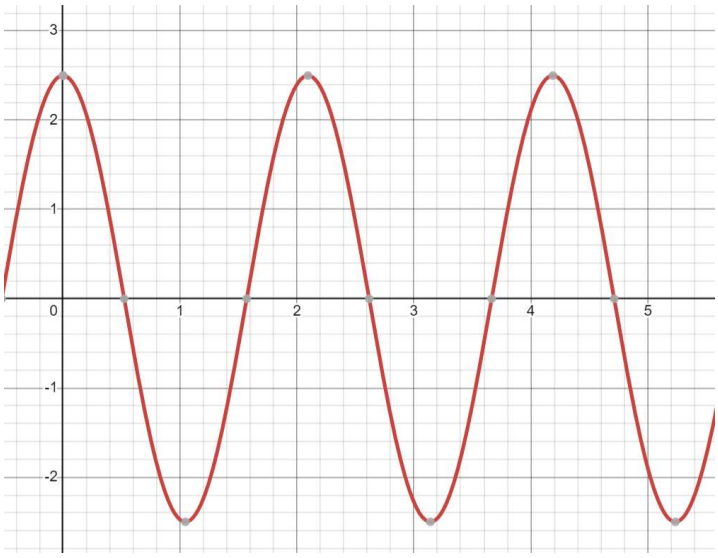
23. E: A wave has a frequency of 14.0 Hz. What is the period of this wave?

24. E: You are at the beach sitting on a pier in the water and you notice that the water level where you are sitting rises and falls once every 4.10 s. What is the frequency of these waves?

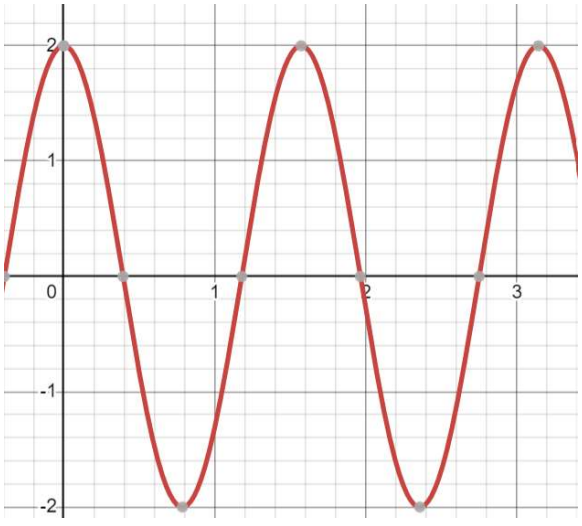
25. E: A wave has a frequency of 5.50 Hz and a wavelength of 2.50 m. What is the speed of this wave?

26. C: What information can we obtain from a *displacement vs. distance* graph?

27.E A *displacement vs. distance* graph of a sound wave traveling at 340. m/s is shown below. Both the vertical axis and the horizontal axis are in meters. Determine the amplitude, wavelength, frequency, and period of the wave.

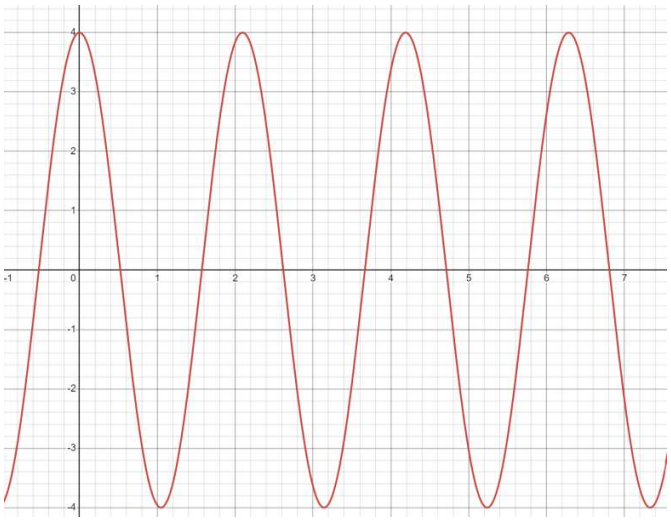


28.E A *displacement vs. distance* graph of an electromagnetic wave traveling at $3.00 \times 10^{8}\ \frac{\text{m}}{\text{s}}$ is shown below. The vertical axis is in meters while the horizontal axis is in 10^{-6} m. Determine the amplitude, wavelength, frequency, and period of the wave.

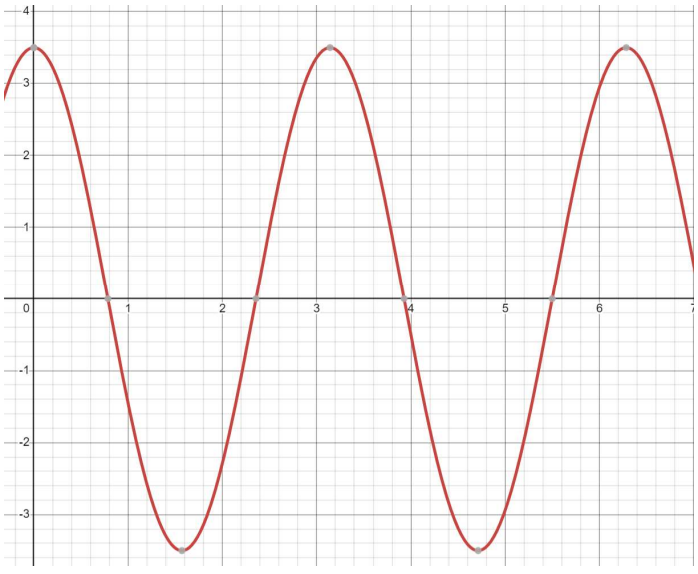


29.C: What information can we obtain from a *displacement vs. time* graph?

30.E A *displacement vs. time* graph of a sound wave traveling at 340. m/s is shown below. The vertical axis is in meters and the horizontal axis is in seconds. Determine the amplitude, period, frequency, and wavelength of the wave.



31.E: A *displacement vs. time* graph of an electromagnetic wave traveling at $3.00 \times 10^{8}\ \frac{\text{m}}{\text{s}}$ is shown below. The vertical axis is in meters and the horizontal axis is in 10^{-6} seconds. Determine the amplitude, period, frequency, and wavelength of the wave.



32. C: Define *intensity*. Units?

33. C: What is the mathematical relationship between the *intensity* and *amplitude* of a wave? What about the *energy* and *amplitude* of a wave?

34. E: An IB student sends a single wave pulse along a string such that the amplitude of the wave pulse is 0.440 m and the energy content of the pulse is 3.50 J.

    a. Another IB student sends another single wave pulse along the same string with an amplitude of 0.880 m. What is the energy of the second wave pulse?

    b. What is the energy of a third wave pulse if the amplitude of the third wave is 0.220 m?

35. E: An IB student sends a single wave pulse along a string such that the amplitude of the wave pulse is 0.555 m and the energy content of the pulse is 3.33 J.

    a. Another IB student sends another single wave pulse along the same string with an amplitude of 0.111 m. What is the energy of the second wave pulse?

    b. What is the energy of a third wave pulse if the amplitude of the third wave is 0.444 m?

36. C: What is the mathematical relationship between the *intensity* and *distance* from a wave source?

37. E: An IB student has a really loud and annoying physics teacher. When the student is 12.5 m from his teacher he measures a sound intensity of 145 decibels. What would be the measured intensity of the loud and annoying physics teacher if a student is 20.0 m from the source?

38. E: An IB student has a really soft and gentle physics teacher. When the student is 20.5 m from his teacher he measures a sound intensity of 12.0 decibels. At which distance does the IB student need to be from his teacher to hear the teacher with a sound intensity of 30.5 decibels?

39. C: Imagine a boat which is in the middle of the ocean. Several water waves passes under it. What happens to the boat? Does it oscillate vertically (up and down)? Does it oscillate horizontally (left and right)? Both? Neither?

40. C: What is the speed of sound in a vacuum? In air? In a metal?

41. C: What is the speed of an electromagnetic wave in a vacuum? In air? In a metal?

42. C: For sound waves pitch is directly proportional to _____ and loudness is directly proportional to _____.

43. E: The speed of sound waves at 25.0°C is 346 m/s. What will be the wavelength of a sound wave which has a frequency of 512 Hz under these conditions?

44. E: The speed of light waves is $3.00 \times 10^8 \ \frac{\mathrm{m}}{\mathrm{s}}$ in a vacuum. What will be the wavelength of the radio signal generated by WCBS FM, given that the frequency assigned to it by the FCC is 101 MHz?