Chapter 5

1. One cycle per second is the definition for the unit:

a. lambda

b. hertz

c. volt

d. amplitude

e. ampere

2. The amplitude of a series of water waves is the:

a. horizontal distance from crest to trough

b. vertical distance from crest to crest

c. one-half the vertical distance from crest to trough

d. horizontal distance from crest to crest

e. velocity

3. In air, sound is a series of:

a. compressional waves

b. compressions and expansions of the air molecules

c. pressure changes above and below normal

d. all of these

e. none of these

4. A compressional wave has its amplitude or “strength” measured:

a. in the same direction as the motion of the wave

b. perpendicular to the motion of the wave

c. in cycles per second

d. in meters per second

e. from the middle of a compression to the end of an expansion

5. The wave formula states that the speed of any wave can be found by:

a. dividing the frequency by the wavelength

b. multiplying the number of crests that pass per second by the length of each wave

from crest to crest

c. multiplying the amplitude be the frequency

d. multiplying lambda by “c”

e. dividing the frequency by lambda

6. As a sound wave expands, its:

a. amplitude and energy decrease by inverse proportion to the square of the distance

b. amplitude and energy increase proportionately to the square of the distance

c. amplitude and energy remain equal

d. amplitude decreases, while energy increases

e. becomes easier to hear

7. In the absence of any current, as a series of waves moves through water, a particular molecule

of water will:

a. continuously move in the direction of the wave’s travel

b. continuously move sliding away from the direction of the wave’s travel

c. not move at all

d. oscillate up and down, but not move horizontally

e. oscillate up and down and also move in the direction of the wave’s travel

8. Read carefully: A wave travels 6 meters each second. The air it travels through compresses

and expands two times each second. What is the sound’s frequency?

a. ½ hertz

b. 1 hertz

c. 2 hertz

d. 3 hertz

e. 6 hertz

9. Sounds inaudible to humans, above 20,000 hertz frequency are called:

a. echoes

b. overtones

c. ultraviolet

d. ultrasonic

e. infrasonic

10. A higher-frequency sound wave will travel through air:

a. slower than a low-frequency sound

b. faster than a low-frequency sound

c. at the same speed as a low-frequency sound

d. with longer wavelengths, but at the same speed as a low-frequency sound

11. When a particular object or molecule has a natural frequency that matches or is a multiple of

the frequency of a sound wave or electromagnetic wave striking it, it will absorb the

wave’s energy. This principle is called:

a. resonance

b. harmonics

c. conduction

d. correlation

e. pitch

12. An echo is the

a. dispersion of sound from a smooth interface

b. refraction of sound from a smooth interface

c. reflection of sound from a smooth interface

d. absorption of sound from a smooth interface

e. absorption of sound from a rough interface

13. Light that changes direction when passing from air through an interface into water is:

a. reflected

b. refracted

c. dispersed

d. scattered

e. absorbed

14. Which of the following has energies measured in the range of 2 to 3 volts:

a. cosmic rays

b radio waves

c. gamma rays

d. ultraviolet rays

e. light waves

15. The law of reflection states that the angle of incidence of a light ray striking a reflective

surface is:

a. zero

b. ninety degrees

c. less than the angle of reflection

d. greater than the angle of reflection

e. equal to the angle of reflection

16. The frequency of the second hand of a clock is:

a. 1 hertz

b. 60 hertz

c. 1/60 hertz

d. 100 hertz

e. this really hertz

17. What is the frequency for the wave shown below:

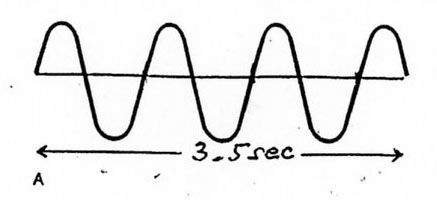
a. 0.5 Hz

b. 1 Hz

c. 2 Hz

d. 3.5 Hz

e. 7 Hz



18. In the diagram below, what is the wavelength of this wave?

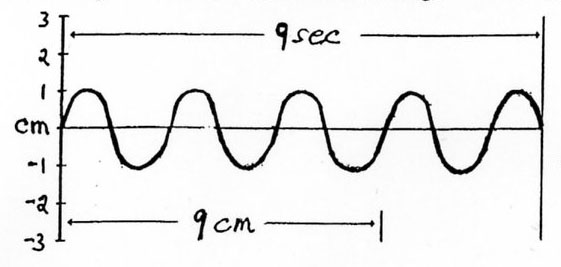
a. 1 cm

b. 1.5 cm

c. 2 cm

d. 3 cm

e. 1 cm/sec



19. In the diagram above, how fast does this wave travel through its medium?

a. 1 cm/sec

b. 1.5 cm/sec

c. 2 cm/sec

d. 3 cm/sec

e. 9 cm/sec

20. Microwave ovens produce electromagnetic waves with wavelengths longer than those of

visible light. If a particular microwave has a frequency of 4 X 1010 Hertz, what is its

wavelength?

a. 7.5 millimeters

b. 133 meters

c. 7.5 X 1018 meters

d. 1.33 X 10-2 meters

21. Which of the following has its wavelength most appropriately measured in kilometers?

a. cosmic rays

b. radio waves

c. gamma rays

d. visible light waves

e. ultraviolet waves

22. The source of all electromagnetic waves is:

a. vibrating electrical charges

b. magnetic fields

c. changes in the atomic nucleus

d. heat energy

e. radiation

23. Different colors of light are electromagnetic waves with different:

a. speeds

b. amplitudes

c. wavelengths

d. intensities

e. brightness

24. A gamma ray is:

a. a neutron

b. an electron

c. a photon

d. the nucleus of a hydrogen atom

e. the nucleus of a helium atom

25. Diagnostic x-ray wavelengths range from:

a. 40 to 120 angstroms

b. 1 to 5 angstroms

c. 0.1 to 0.5 nanometers

d. one-tenth to one-half angstrom

26. Plank’s constant times the speed of light is 12.4 when solving for wavelength in *angstroms*

from energy in *kilovolts*. If the very shortest wavelength in an x-ray beam is 0.11

angstroms, what is the kVp of this x-ray beam?

a. 113 kVp

b. 88 kVp

c. 0.008 kVp

d. 13.6 kVp

27. On a conventional radiographic image, structures that appear lighter or “white” represent

tissues within the patient’s body:

a. resonant

b. radiopaque

c. radiolucent

d. transparent

28. Which of the following describes a single unit of light or x-rays:

a. a proton

b. an electron

c. a wavelength

d. a quantum

e. a color

29. Which of the following is *not* part of the electromagnetic spectrum:

a. radio waves

b. microwaves

c. cosmic waves

d. gamma rays

e. ultrasound waves

30. Which of the following is *not* true: In outer space, an electromagnetic wave:

a. travels at the speed of light

b. is a double-transverse wave

c. cannot travel through the vacuum of space

d. can be generated by an excited electron

e. does not have mass

31. When considering electromagnetic waves, the higher the frequency, the:

a. higher the speed

b. longer the wavelength

c. greater the amplitude

d. shorter the wavelength

e. slower the speed

32. For a water wave traveling at 3 meters per second, and a wavelength of 2 meters, the

frequency is:

a. 6 hertz

b. 1.5 hertz

c. 0.67 hertz

d. 2 hertz

e. 0.67 m/sec

33. Which of the following terms best describes the partial reduction of the x-ray beam as it

passes through matter:

a. attenuation

b. absorption

c. transmission

d. radiolucency

e. annihilation

34. In magnetic resonance imaging, the image is produced by detecting emitted from the

patient’s body:

a. magnetic signals

b. electrical signals

c. radio signals

d. x-rays

e. electromagnetic currents

35. Surrounding every moving electron is:

a. a magnetic field

b. an electric field

c. a nuclear field

d. both a and b

e. none of these

36. X-rays have higher-energy photons than visible light because:

a. they are more intense than visible light

b. they have higher frequency than light

c. they have higher amplitude than light

d. they have higher speed than light

e. they have longer waves than light

37. A sound wave in outer space:

a. travels at the speed of light

b. is a transverse wave

c. cannot travel through a vacuum

d. maintains its amplitude through any distance.

38. Which of the following is *not* a process related to the interaction of x-rays within the body of

a patient?

a. absorption

b. attenuation

c. penetration (transmission)

d. refraction

39. Microwaves travel through water at a speed of 2.25 X 108 meters per second. If the

microwaves have a frequency of 3 X 1010 hertz, what is their wavelength in water?

a. 0.75 X 10-2

b. 0.75 X 102

c. 1.3 X 1018

d. 1.3 X 102

e. 1.3 X 10-2

40. By synchronizing light waves so that all their wavelengths peak and trough together in phase,

we obtain:

a. amplitude modulation

b. frequency modulation

c. microwaves

d. MRI signals

e. laser

41. In MRI, in order for radio waves transmitted into the patient’s body to “knock over” protons,

these waves must have their frequency “tuned” so as to resonate with the of the

protons:

a. magnetic moment

b. precession

c. electrical field

d. atomic mass

e. amplitude

42. When explained as a wave, an x-ray is most accurately described as a(n):

a. single compressional wave

b. double compressional wave

c. single transverse wave

d. double transverse wave

e. standing wave

43. The photoelectric effect, described by Albert Einstein, demonstrated that because of their very high energy, x-rays usually act more like:

a. particles

b. waves

c. standing waves

d. protons

e. sound waves

44. The suspicions of French physicist Louis de Broglie, that electrons might sometimes act as

waves, were experimentally confirmed when it was found that streams of electrons could

produce:

a. ionization

b. interference patterns

c. the photoelectric effect

d. diffusion or scattering

e. attentuation

45. In the “corpuscular” model of x-rays, they are imagined to be:

a. small bundles or blobs of energy with an associated wavelength

b. small waves made up of bundles of energy

c. transverse waves emitted in a continuous stream from the x-ray tube

d. compressional waves emitted in a continuous stream from the x-ray tube

46. In the wave model of an x-ray, two transverse waves are positioned:

a. perpendicular to each other

b. parallel to each other

c. perpendicular to their amplitudes

d. parallel to their amplitudes

47. The energy of an x-ray photon is directly proportional to its:

a. wavelength

b. frequency

c. velocity

d. velocity squared

48. The formula which relates photon energy and wavelength through Plank’s constant is:

a. E = hf

b. E = hc

c. E = hc/

d. E = h/c

49. All waves transport:

a. matter

b. mass

c. charge

d. energy

e. media

50. Radiography is made possible because part of the x-ray beam makes it through the body and

part of it does not. This is referred to as of the x-ray beam:

a. attenuation

b. scattering

c. refraction

d. absorption

e. transmission

51. Plank’s constant times the speed of light is 12.4 when solving for wavelength in *angstroms*

from energy in *kilovolts*. If a single x-ray within the beam has an energy of 65 kilovolts

(kV), its wavelength must be:

a. 52 angstroms

b. 5.2 angstroms

c. 0.19 angstroms

d. 1.9 angstroms

52. An MRI unit determines the *location* of a particular body structure by:

a. the strength (amplitude) of the returning radio wave

b. varying the magnetic field strength to emit radio waves with different frequencies

c. the time it takes for the radio wave to return

d. its projection onto an image receptor

53. An ultrasound machine determines the *location* of a particular body structure by:

a. the strength of the returning sound wave

b. the frequency of the returning sound wave

c. the time it takes for the reflected sound wave to return

d. projecting it onto a transducer

54. All of the following are required to produce a laser beam *except:*

a. a piezoelectric transducer

b. a medium

c. a resonant cavity

d. a power source

55. All of the following are correct statements about the medical applications of lasers *except:*

a. In film digitizers, they are used to scan through the image to a PM tube

b. In film printers, they are used to heat carbon molecules to turn them black

c. In CR readers, they are used to scan through a PSP plate to strike a PM tube

d. For optical discs, they are used both to record and to read data from lands and pits