

Name: Key Period: _____ DUE DATE: Wednesday 2/13

OPTICS
INTRODUCTION TO LIGHT: WAVE THEORY (Unit 1)
Study Guide and Practice Test

Vocabulary:

1. D Wave

2. B Physical Optics

3. G Amplitude

4. E Transverse wave

5. J Superposition

6. M Electromagnetic Waves

7. A Geometric Optics

8. N Visible light

9. F Longitudinal wave

10. K Constructive Interference

11. L Destructive Interference

12. C Quantum Optics

13. H Frequency

14. I Wavelength

~~a)~~ The study of optics that considers light as a ray

~~b)~~ The study of optics that considers light as a wave

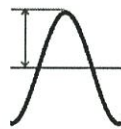
~~c)~~ The study of optics that considers light as a photon

~~d)~~ A disturbance that travels through space and matter transferring energy from one place to another

~~e)~~ Medium vibrates perpendicular to wave's motion

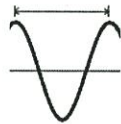
~~f)~~ Medium vibrates parallel to wave's motion

~~g)~~ Determines the brightness of light; see image below



~~h)~~ Number of complete wave cycles per second

~~i)~~ Determines color of light ; see image below



~~j)~~ When two waves meet

~~k)~~ Amplitude of two waves are greater than original (add together)

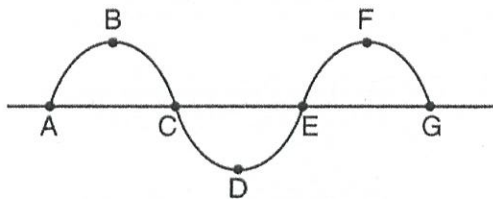
~~l)~~ Amplitude of two waves are less than original

~~m)~~ Transfer of energy that doesn't need a medium to travel through

~~n)~~ The small portion of the EM spectrum that humans can see (ROYGBIV)

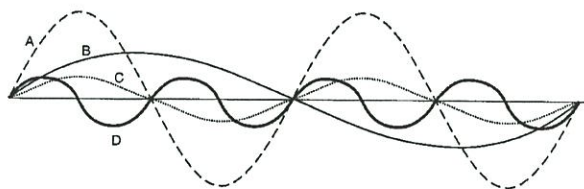
Practice Problems

1. The diagram below represents a transverse wave.



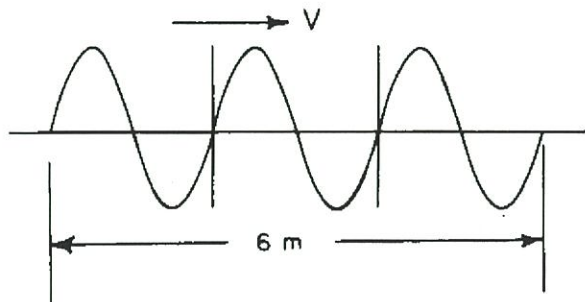
The wavelength of the wave is equal to the distance between points

- A) *A* and *G* **B) *B* and *F***
 C) *C* and *E* D) *D* and *F*
2. Base your answer to the following question on the diagram below, which represents waves *A*, *B*, *C*, and *D* traveling in the same medium.



Which two waves have the same wavelength?

- A) *A* and *B* **B) *A* and *C***
 C) *B* and *D* D) *C* and *D*
3. In the diagram below, a train of waves is moving along a string.



What is the wavelength?

- A) 1 m **B) 2 m** C) 3 m D) 6 m

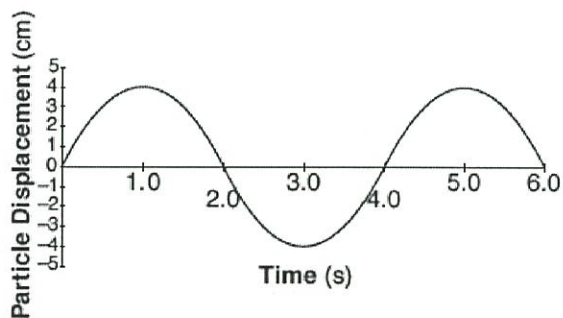
4. As represented in the diagram below, two wave pulses, X and Y, are traveling toward each other in a rope. Both wave pulses have an amplitude of 0.30 m.



Which diagram shows the pulse produced due to the superposition of pulse X and pulse Y?

- A) B)
C) D)

5. The graph below represents the displacement of a particle in a medium over a period of time.



The amplitude of the wave is

- A) 4.0 s B) 6.0 s C) 8 cm **D) 4 cm**
6. When a wave travels through a medium, the wave transfers
- A) mass, only
B) energy, only
 C) both mass and energy
 D) neither mass nor energy

7. As a transverse wave travels through a medium, the individual particles of the medium move
- A) perpendicular to the direction of wave travel
 - B) parallel to the direction of wave travel
 - C) in circles
 - D) in ellipses

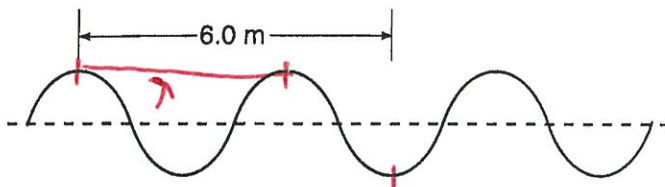
8. An observer counts 4 complete water waves passing by the end of a dock every 10. seconds. What is the frequency of the waves?

- A) 0.40 Hz
 - B) 2.5 Hz
 - C) 40. Hz
 - D) 4.0 Hz
- $\frac{4}{10}$

9. A physics student notices that 4.0 waves arrive at the beach every 20. seconds. The frequency of these waves is

- A) 0.20 Hz
 - B) 5.0 Hz
 - C) 16 Hz
 - D) 80. Hz
- $\frac{4}{20}$

10. The diagram below represents a periodic wave traveling through a uniform medium.



If the frequency of the wave is 2.0 hertz, the speed of the wave is

- A) 6.0 m/s
- B) 2.0 m/s
- C) 8.0 m/s
- D) 4.0 m/s

$speed = \lambda \times f$
 $= 4 \times 2$
 $= 8$

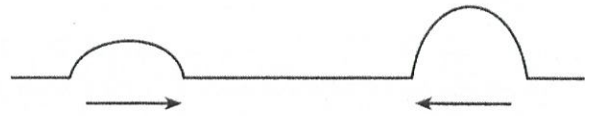
11. What is the velocity of a wave having a frequency of 25 cycles per second and a wavelength of 10 meters?

- A) 2.5 m/s
 - B) 15 m/s
 - C) 35 m/s
 - D) 250 m/s
- 25×10

12. Which statement describes a characteristics common to all electromagnetic waves and mechanical waves?

- A) Both types of waves travel at the same speed.
- B) Both types of waves require a material medium for propagation.
- C) Both types of waves propagate in a vacuum.
- D) Both types of waves transfer energy.

13. The diagram below represents two pulses approaching each other from opposite directions in the same medium.



Which diagram best represents the medium after the pulses have passed through each other?

- A)
- B)
- C)
- D)

14. Which phenomenon is the best evidence for the wave nature of light?

- A) reflection
- B) photoelectric emission
- C) diffusion
- D) interference

15. Which electromagnetic radiation has the most energy?

- A) ultraviolet
- B) x-ray
- C) infrared
- D) microwave

16. A gamma ray photon and a microwave photon are traveling in a vacuum. Compared to the wavelength and energy of the gamma ray photon, the microwave photon has a

- A) shorter wavelength and less energy
- B) shorter wavelength and more energy
- C) longer wavelength and less energy
- D) longer wavelength and more energy

17. Compared to the wavelength of red light, the wavelength of yellow light is

- A) shorter
- B) longer
- C) the same

18. A beam of green light may have a frequency of

- A) 5.0×10^{-7} Hz B) 1.5×10^2 Hz
C) 3.0×10^8 Hz D) 6.0×10^{14} Hz

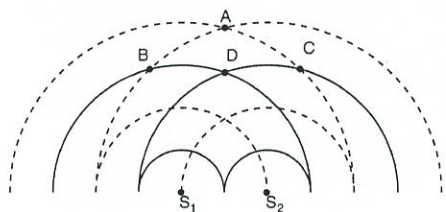
19. A monochromatic beam of light has a frequency of 6.5×10^{14} hertz. What color is the light?

- A) yellow B) orange
C) violet D) blue

20. The effect produced when two or more sound waves pass through the same point simultaneously is called

- A) interference B) diffraction
C) refraction D) resonance

21. Two speakers, S_1 and S_2 , operating in phase in the same medium produce the circular wave patterns shown in the diagram below.

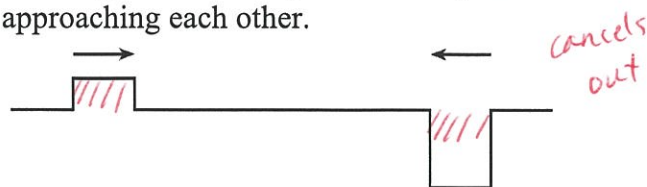


Key	
—	Wave crest
- - -	Wave trough

At which two points is constructive interference occurring?

- A) ~~A and B~~ B) A and D
C) B and C D) B and D

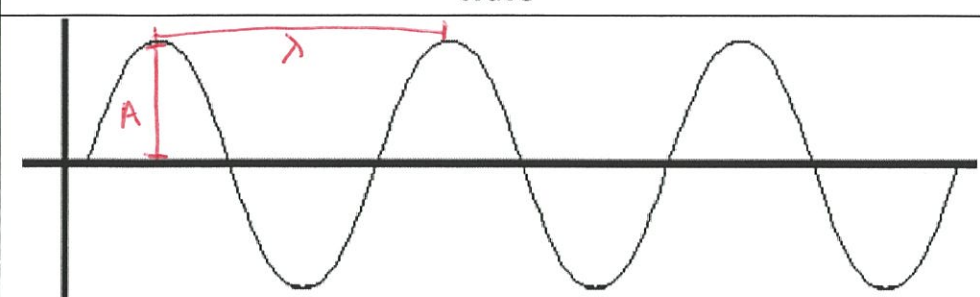
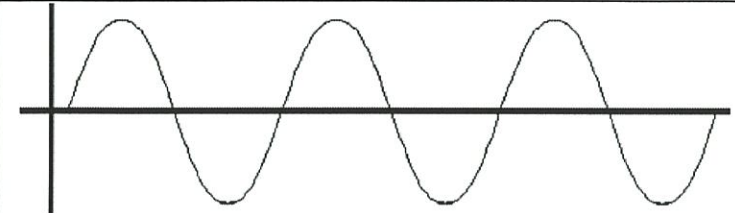

22. The diagram below represents two pulses approaching each other.



Which diagram best represents the resultant pulse at the instant the pulses are passing through each other?

- A) B)
C) D)

23. Use a ruler to measure, in centimeters, the amplitude and wavelength of each wave below.

Wave	Amplitude	Wavelength
	1.6 cm	3.9 cm
	1.2 cm	2.9 cm
	0.8 cm	2.0 cm

24. Provide one real world application of an electromagnetic wave (i.e. Microwaves are used to heat up food, X rays are used by doctors to detect broken bones).

- IR rays used for night vision
- gamma rays used to treat cancer
- radio waves for communication
- many more...