

Waves Light & Modern
Review Test
June 2007

Name _____

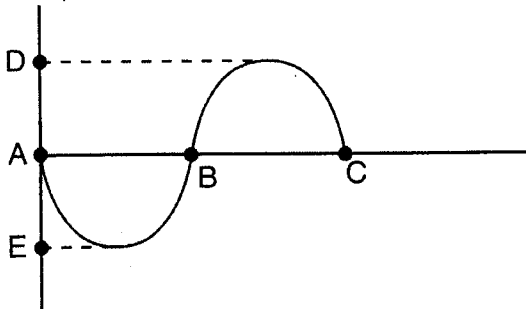
①

As yellow light ($f = 5.09 \times 10^{14}$ Hz) travels from zircon into diamond, the speed of the light

- (1) decreases
- (2) increases
- (3) remains the same

②

The diagram below represents a transverse wave.

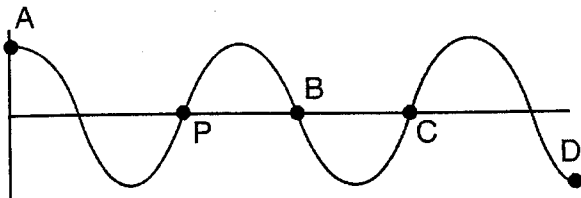


The distance between which two points identifies the amplitude of the wave?

- (1) A and B
- (2) A and C
- (3) A and E
- (4) D and E

③

The diagram below represents a periodic wave.



Which point on the wave is in phase with point P?

- (1) A
- (2) B
- (3) C
- (4) D

④

What is the period of a 60.-hertz electromagnetic wave traveling at 3.0×10^8 meters per second?

- (1) 1.7×10^{-2} s
- (2) 2.0×10^{-7} s
- (3) 6.0×10^1 s
- (4) 5.0×10^6 s

5 At an outdoor physics demonstration, a delay of 0.50 second was observed between the time sound waves left a loudspeaker and the time these sound waves reached a student through the air. If the air is at STP, how far was the student from the speaker?

- (1) 1.5×10^{-3} m (3) 6.6×10^2 m
(2) 1.7×10^2 m (4) 1.5×10^8 m

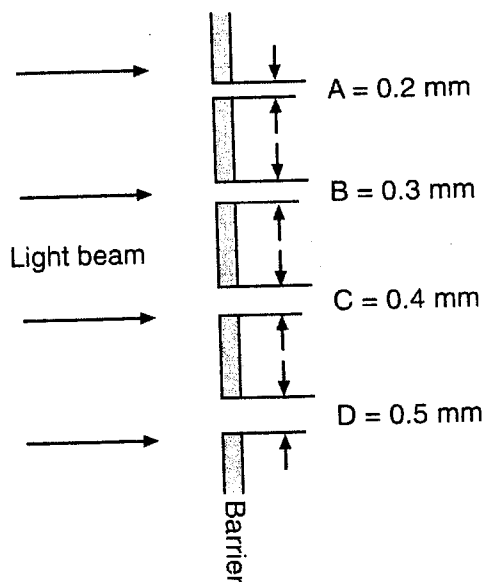
6 A microwave and an x ray are traveling in a vacuum. Compared to the wavelength and period of the microwave, the x ray has a wavelength that is

- (1) longer and a period that is shorter
(2) longer and a period that is longer
(3) shorter and a period that is longer
(4) shorter and a period that is shorter

7 Which type of wave requires a material medium through which to travel?

- (1) electromagnetic (3) sound
(2) infrared (4) radio

8 A beam of monochromatic light approaches a barrier having four openings, A, B, C, and D, of different sizes as shown below.



Which opening will cause the greatest diffraction?

- (1) A (3) C
(2) B (4) D

9 A car traveling at 70 kilometers per hour accelerates to pass a truck. When the car reaches a speed of 90 kilometers per hour the driver hears the glove compartment door start to vibrate. By the time the speed of the car is 100 kilometers per hour, the glove compartment door has stopped vibrating. This vibrating phenomenon is an example of

- (1) the Doppler effect
- (2) diffraction
- (3) resonance
- (4) destructive interference

10 Two waves having the same frequency and amplitude are traveling in the same medium. Maximum constructive interference occurs at points where the phase difference between the two superposed waves is

- (1) 0°
- (2) 90°
- (3) 180°
- (4) 270°

11 A student sees a train that is moving away from her and sounding its whistle at a constant frequency. Compared to the sound produced by the whistle, the sound observed by the student is

- (1) greater in amplitude
- (2) a transverse wave rather than a longitudinal wave
- (3) higher in pitch
- (4) lower in pitch

12 Light demonstrates the characteristics of

- (1) particles, only
- (2) waves, only
- (3) both particles and waves
- (4) neither particles nor waves

13 The energy produced by the complete conversion of 2.0×10^{-5} kilogram of mass into energy is

- (1) 1.8 TJ
- (2) 6.0 GJ
- (3) 1.8 MJ
- (4) 6.0 kJ

- 14 Baryons may have charges of
- (1) $+1e$ and $+\frac{4}{3}e$ (3) $-1e$ and $+1e$
(2) $+2e$ and $+3e$ (4) $-2e$ and $-\frac{2}{3}e$

- 15 The slope of a graph of photon energy versus photon frequency represents
- (1) Planck's constant
(2) the mass of a photon
(3) the speed of light
(4) the speed of light squared

16 to 18

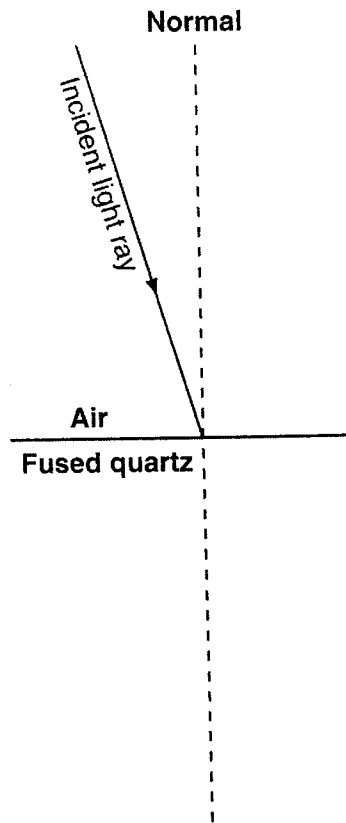
Base your answers to questions 49 through 51 on the information below.

A student generates a series of transverse waves of varying frequency by shaking one end of a loose spring. All the waves move along the spring at a speed of 6.0 meters per second.

- 16 49 Complete the data table *in your answer booklet*, by determining the wavelengths for the frequencies given. [1]
- 17 50 On the grid *in your answer booklet*, plot the data points for wavelength versus frequency. [1]
- 18 51 Draw the best-fit line or curve. [1]

19 to 22

Base your answers to questions 68 through 71 on the diagram below, which shows a light ray ($f = 5.09 \times 10^{14}$ Hz) in air, incident on a boundary with fused quartz. At the boundary, part of the light is refracted and part of the light is reflected.



- (19) 68 Using a protractor, measure the angle of incidence of the light ray at the air-fused quartz boundary. [1]
- (20) 69 Calculate the angle of refraction of the incident light ray. [Show all work, including the equation and substitution with units.] [2]
- (21) 70 Using a protractor and straightedge, construct the refracted light ray in the fused quartz on the diagram *in your answer booklet*. [1]
- (22) 71 Using a protractor and straightedge, construct the reflected light ray on the diagram *in your answer booklet*. [1]

(23) to (25)

Base your answers to questions 72 through 74 on the information below.

A photon with a frequency of 5.02×10^{14} hertz is absorbed by an excited hydrogen atom. This causes the electron to be ejected from the atom, forming an ion.

- (23) 72 Calculate the energy of this photon in joules. [Show all work, including the equation and substitution with units.] [2]
- (24) 73 Determine the energy of this photon in electronvolts. [1]
- (25) 74 What is the number of the *lowest* energy level (closest to the ground state) of a hydrogen atom that contains an electron that would be ejected by the absorption of this photon? [1]
-

1 _____

2 _____

3 _____

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6 _____

7 _____

8 _____

9 _____

10 _____

11 _____

12 _____

13 _____

14 _____

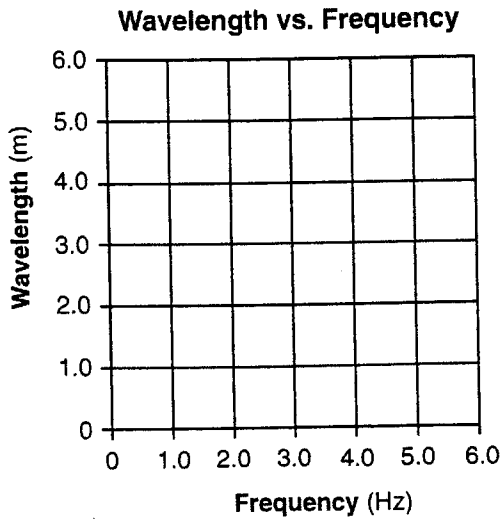
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16 to 18

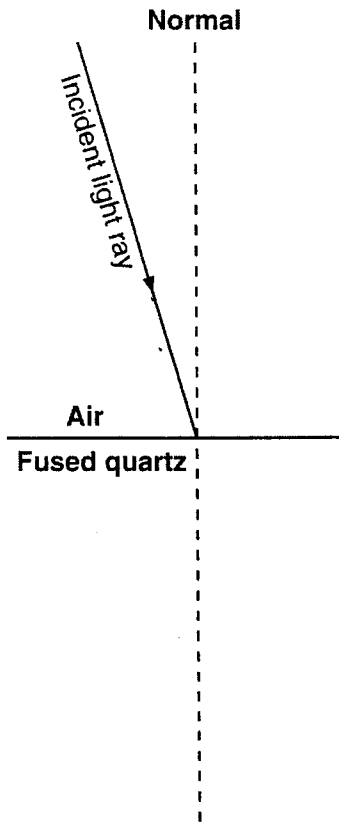
(16) 49

Data Table	
Frequency (Hz)	Wavelength (m)
1.0	
2.0	
3.0	
6.0	

(17+18) 50-51



19 to 22



19 $\theta =$ _____^o

20

21 - On diagram

22 - On diagram

23 to 25

23 -

24) 73 _____ eV

25) 74 $n =$ _____

1 1
2 3
3 3
4 1

5 2
6 4
7 3
8 1

9 3
10 1
11 4
12 3
13 1

14 3
15 1

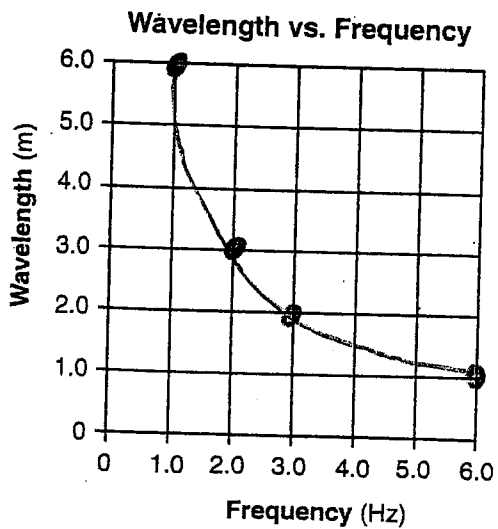
16 to 18

16 49

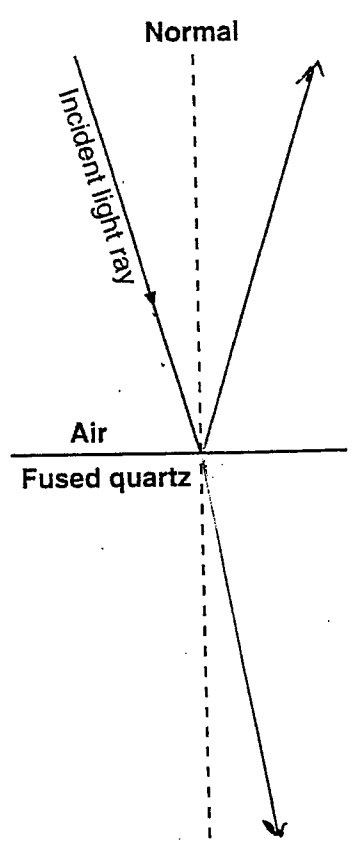
Data Table	
Frequency (Hz)	Wavelength (m)
1.0	6m
2.0	3m
3.0	2m
6.0	1m

17 & 18

50-51



$19 \theta = 17^\circ$



20 $n_1 \sin \theta_1 = n_2 \sin \theta_2$
 $1 \sin 17^\circ = 1.46 \sin \theta_2$
 $\theta_2 = 11.5^\circ$

21 - On diagram
 22 - On diagram

23 to 25

23 - $E = hf$
 $= 6.63 \times 10^{-34} \text{ s} \cdot (5.02 \times 10^{14} \text{ Hz})$
 $= 3.32 \times 10^{-19} \text{ Joules}$

24) 73 2.08 eV

25) 74 $n = \underline{n = 3}$

Credit of 27	%	Out of 25	Scaled regents
27.0	100.0	85.0	100
26.0	96.3	81.9	97
25.0	92.6	78.7	95
24.0	88.9	75.6	92
23.0	85.2	72.4	89
22.0	81.5	69.3	86
21.0	77.8	66.1	83
20.0	74.1	63.0	81
19.0	70.4	59.8	78
18.0	66.7	56.7	75
17.0	63.0	53.5	73
16.0	59.3	50.4	69
15.0	55.6	47.2	66
14.0	51.9	44.1	63
13.0	48.1	40.9	60
12.0	44.4	37.8	57
11.0	40.7	34.6	53
10.0	37.0	31.5	49
9.0	33.3	28.3	44
8.0	29.6	25.2	40
7.0	25.9	22.0	35
6.0	22.2	18.9	31
5.0	18.5	15.7	26
4.0	14.8	12.6	22