Review Test
Waves Light and Modern
June 2009

Name_____

This year there were 26 out of 85 possible credits or about 31 % of the test.

Part A

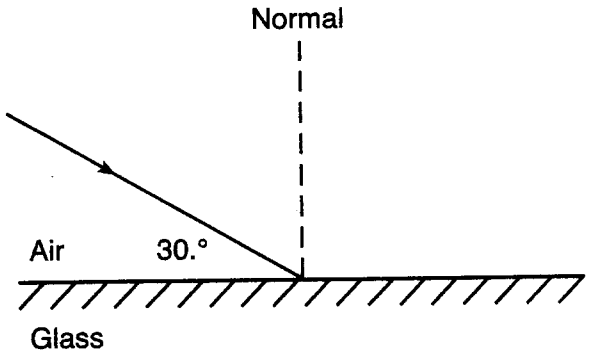
23 Which color of light has a wavelength of 5.0×10^{-7} meter in air?
(1) blue
(2) green
(3) orange
(4) violet

24 Which type of wave requires a material medium through which to travel?
(1) sound
(2) radio
(3) television
(4) x ray

25 A periodic wave is produced by a vibrating tuning fork. The amplitude of the wave would be greater if the tuning fork were
(1) struck more softly
(2) struck harder
(3) replaced by a lower frequency tuning fork
(4) replaced by a higher frequency tuning fork

26 The sound wave produced by a trumpet has a frequency of 440 hertz. What is the distance between successive compressions in this sound wave as it travels through air at STP?
(1) 1.5×10^{-6} m
(2) 0.75 m
(3) 1.3 m
(4) 6.8×10^{5} m

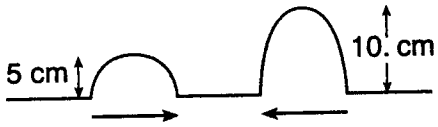
27 The diagram below represents a light ray striking the boundary between air and glass.



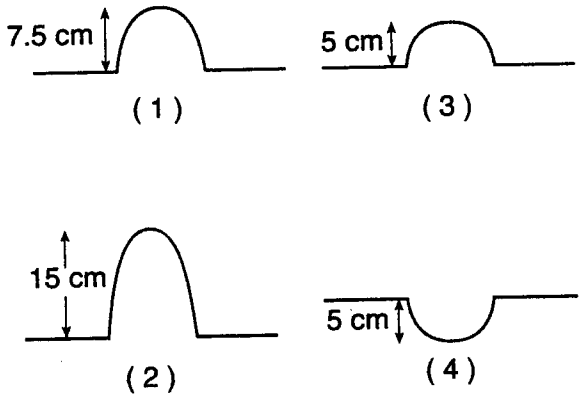
What would be the angle between this light ray and its reflected ray?
(1) 30.°
(2) 60.°
(3) 120.°
(4) 150.°

28 In which way does blue light change as it travels from diamond into crown glass?
(1) Its frequency decreases.
(2) Its frequency increases.
(3) Its speed decreases.
(4) Its speed increases.

29 The diagram below shows two pulses approaching each other in a uniform medium.



Which diagram best represents the superposition of the two pulses?



30 Sound waves strike a glass and cause it to shatter. This phenomenon illustrates
(1) resonance
(2) refraction
(3) reflection
(4) diffraction

31 An alpha particle consists of two protons and two neutrons. What is the charge of an alpha particle?
(1) 1.25×10^{19} C
(2) 2.00 C
(3) 6.40×10^{-19} C
(4) 3.20×10^{-19} C

32 An electron in the *c* level of a mercury atom returns to the ground state. Which photon energy could *not* be emitted by the atom during this process?
(1) 0.22 eV
(2) 4.64 eV
(3) 4.86 eV
(4) 5.43 eV

33 Which phenomenon provides evidence that light has a wave nature?

(1) emission of light from an energy-level transition in a hydrogen atom
(2) diffraction of light passing through a narrow opening
(3) absorption of light by a black sheet of paper
(4) reflection of light from a mirror

35 The particles in a nucleus are held together primarily by the

(1) strong force
(2) gravitational force
(3) electrostatic force
(4) magnetic force

Part B

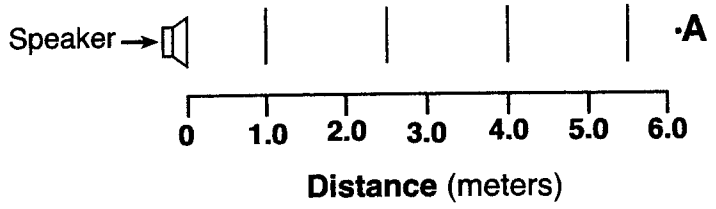
44 The momentum of a photon, p, is given by the equation $p = \frac{h}{\lambda}$ where h is Planck's constant and λ is the photon's wavelength. Which equation correctly represents the energy of a photon in terms of its momentum?

(1) $E_{photon} = phc$
(2) $E_{photon} = \frac{hp}{c}$
(3) $E_{photon} = \frac{p}{c}$
(4) $E_{photon} = pc$

57 A student and a physics teacher hold opposite ends of a horizontal spring stretched from west to east along a tabletop. Identify the directions in which the student should vibrate the end of the spring to produce transverse periodic waves. [1]

Base your answers to questions 58 and 59 on the information and diagram below.

The vertical lines in the diagram represent compressions in a sound wave of constant frequency propagating to the right from a speaker toward an observer at point *A*.



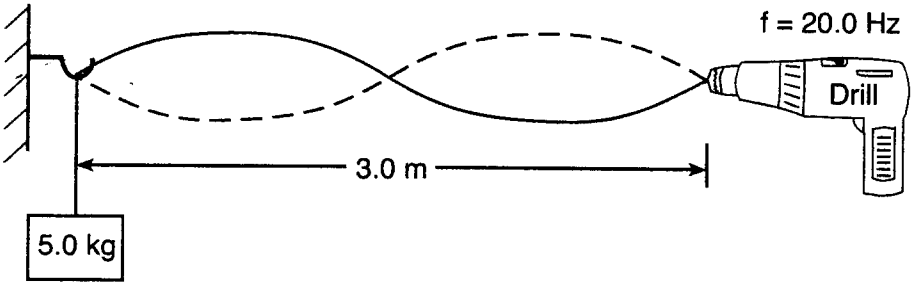
58 Determine the wavelength of this sound wave. [1]

59 The speaker is then moved at constant speed toward the observer at *A*. Compare the wavelength of the sound wave received by the observer while the speaker is moving to the wavelength observed when the speaker was at rest. [1]

Part C

Base your answers to questions 66 and 67 on the information below.

One end of a rope is attached to a variable speed drill and the other end is attached to a 5.0-kilogram mass. The rope is draped over a hook on a wall opposite the drill. When the drill rotates at a frequency of 20.0 Hz, standing waves of the same frequency are set up in the rope. The diagram below shows such a wave pattern.



66 Determine the wavelength of the waves producing the standing wave pattern. [1]

67 Calculate the speed of the wave in the rope. [Show all work, including the equation and substitution with units.] [2]

Base your answers to questions 68 and 69 on the information below.

A ray of monochromatic light ($f = 5.09 \times 10^{14}$ Hz) passes from air into Lucite at an angle of incidence of 30.°.

68 Calculate the angle of refraction in the Lucite. [Show all work, including the equation and substitution with units.] [2]

69 Using a protractor and straightedge, on the diagram *in your answer booklet*, draw the refracted ray in the Lucite. [1]

Base your answers to questions 70 through 72 on the information below.

A photon with a frequency of 5.48×10^{14} hertz is emitted when an electron in a mercury atom falls to a lower energy level.

70 Identify the color of light associated with this photon. [1]

71 Calculate the energy of this photon in joules. [Show all work, including the equation and substitution with units.] [2]

72 Determine the energy of this photon in electronvolts. [1]

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Name _____

24 _____
25 _____
26 _____
27 _____

28 _____
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33 _____
35 _____

Part B

44 _____

57

58 λ = _____ meters

59

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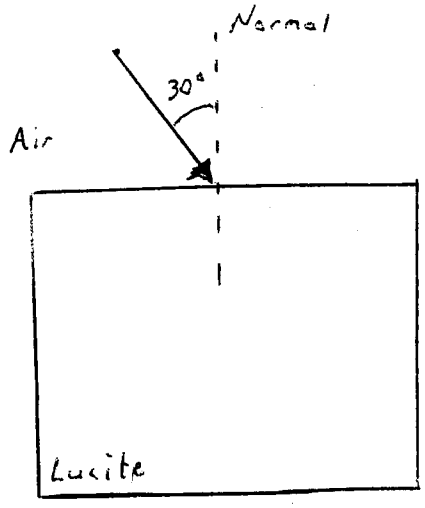

70

71

72

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Name Key

24 1

25 2

26 2

27 3

28 4

29 2

30 1

31 4

32 4

33 2

35 4

Part B

44 4

57 North & South OR Up & Down OR perpendicular OR Right & Left

58 λ = 1.5 meters

59 Waves observer hears are shorter, higher Freq. (Doppler Effect)

66 λ = 3 meters

67 $V = f\lambda$

$V = 20\,Hz\,(3m)$

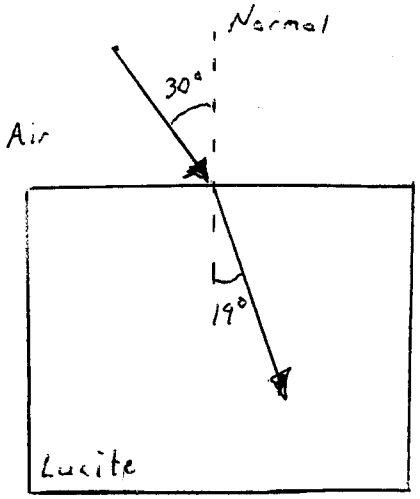
$= 60\,m/s$

68 $n_1 \sin\theta_1 = n_2 \sin\theta_2$

$1 \sin 30° = 1.5 \sin\theta_2$

$\theta_2 = 19°$

69



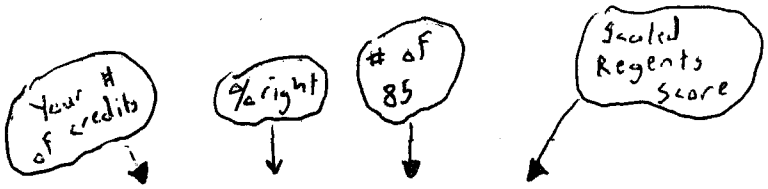
70 Green

71 $E = hf$

$= 6.63 \times 10^{-34}\ J \cdot s\ (5.48 \times 10^{14}\ Hz)$

$= 3.63 \times 10^{-19}$ Joules

72 $\frac{3.6 \times 10^{-19}}{1.6 \times 10^{-19}} = 2.27 ev$



26	100.0	85.0	100
25	96.2	81.7	97
24	92.3	78.5	94
23	88.5	75.2	90
22	84.6	71.9	87
21	80.8	68.7	84
20	76.9	65.4	80
19	73.1	62.1	78
18	69.2	58.8	75
17	65.4	55.6	72
16	61.5	52.3	68
15	57.7	49.0	65
14	53.8	45.8	63
13	50.0	42.5	60
12	46.2	39.2	56
11	42.3	36.0	52
10	38.5	32.7	49
9	34.6	29.4	44
8	30.8	26.2	41
7	26.9	22.9	37
6	23.1	19.6	33
5	19.2	16.3	28
4	15.4	13.1	23