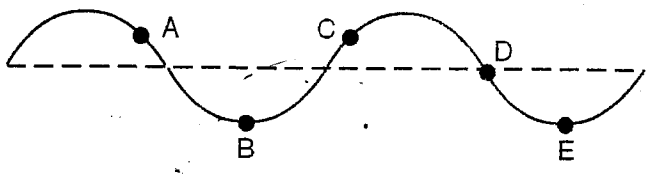
Dual Nature of Light Test Take Home

Name _____

1) The diagram below represents a periodic wave.



Which two points on the wave are in phase?

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

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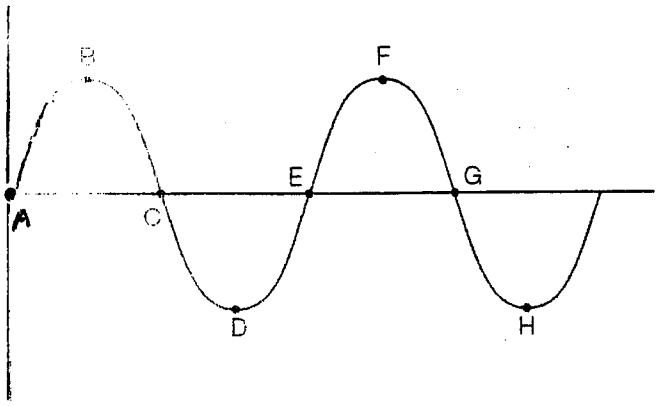
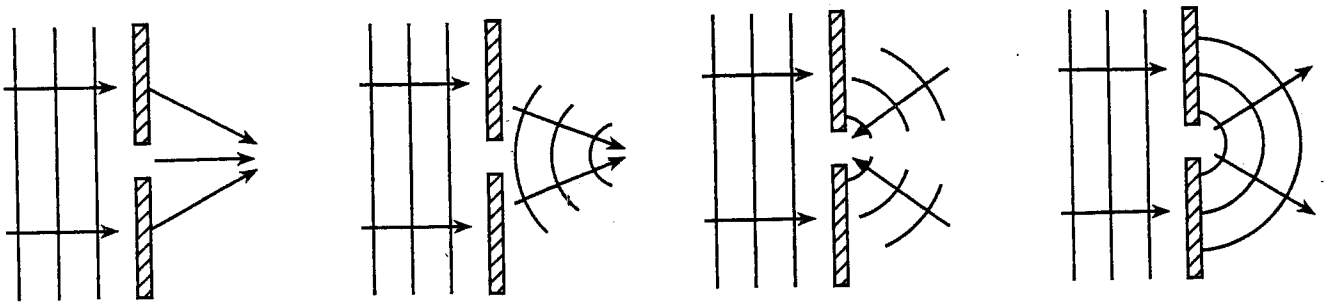
2) The diagram below represents a transverse wave traveling in a string.



Which two labeled points are 180° out of phase?

(1) *A* and *D*
(2) *B* and *F*
(3) *D* and *F*
(4) *D* and *H*

Which diagram best represents the shape and direction of a series of wave fronts after they have passed through a small opening in a barrier?

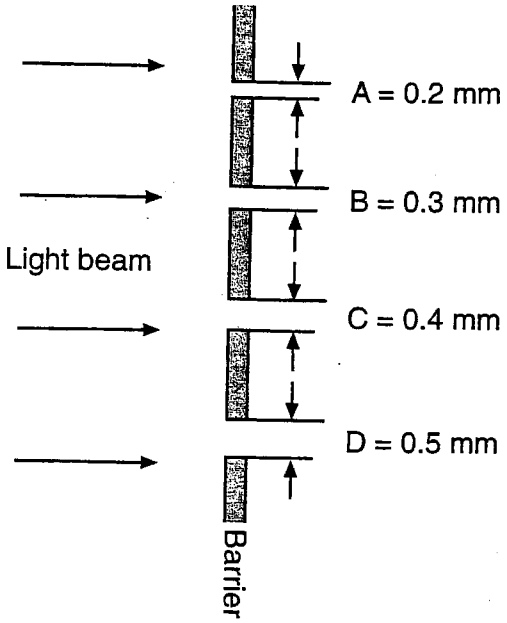


(1) (2) (3) (4)

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°

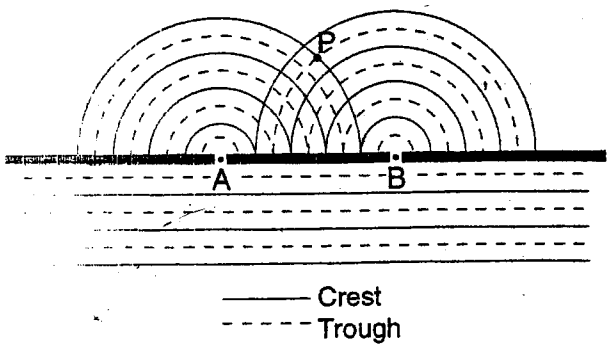
A beam of monochromatic light approaches a barrier having four openings, *A*, *B*, *C*, and *D*, of different sizes as shown below.



Which opening will cause the greatest diffraction?

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

(7) The diagram below represents shallow water waves of wavelength λ passing through two small openings, *A* and *B*, in a barrier.



Compared to the length of path *BP*, the length of path *AP* is

(1) 1λ longer
(2) 2λ longer
(3) $\frac{1}{2}\lambda$ longer
(4) the same

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(8)

Diffraction of light demonstrates that light

(1) can be polarized
(2) has wave properties
(3) can be reflected
(4) is composed of tiny units of energy

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(9) Radio waves diffract around buildings more than light waves do because, compared to light waves, radio waves

(1) move faster
(2) move slower
(3) have a higher frequency
(4) have a longer wavelength

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(10)

Which phenomenon is best explained by the wave theory?

(1) reflection
(2) illumination
(3) interference
(4) the photoelectric effect

Radio waves are propagated through the interaction of

(1) nuclear and electric fields
(2) electric and magnetic fields
(3) gravitational and magnetic fields
(4) gravitational and electric fields

Experiments performed with light indicate that light exhibits

(1) particle properties, only
(2) wave properties, only
(3) both particle and wave properties
(4) neither particle nor wave properties

A variable-frequency light source emits a series of photons. As the frequency of the photon increases, what happens to the energy and wavelength of the photon?

(1) The energy decreases and the wavelength decreases.
(2) The energy decreases and the wavelength increases.
(3) The energy increases and the wavelength decreases.
(4) The energy increases and the wavelength increases.

Compared to a photon of red light, a photon of blue light has a

(1) greater energy
(2) longer wavelength
(3) smaller momentum
(4) lower frequency

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What is the energy of a quantum of light having a frequency of 6.0×10^{14} hertz?

(1) 1.6×10^{-19} J
(2) 4.0×10^{-19} J
(3) 3.0×10^{8} J
(4) 5.0×10^{-7} J

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The wavelength of photon *A* is greater than that of photon *B*. Compared to the energy of photon *A*, the energy of photon *B* is

(1) less
(2) greater
(3) the same

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Which phenomenon is most easily explained by the particle theory of light?

(1) photoelectric effect
(2) constructive interference
(3) polarization
(4) diffraction

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An x-ray photon collides with an electron in an atom, ejecting the electron and emitting another photon. During the collision, there is conservation of

(1) momentum, only
(2) energy, only
(3) both momentum and energy
(4) neither momentum nor energy

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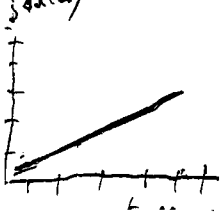
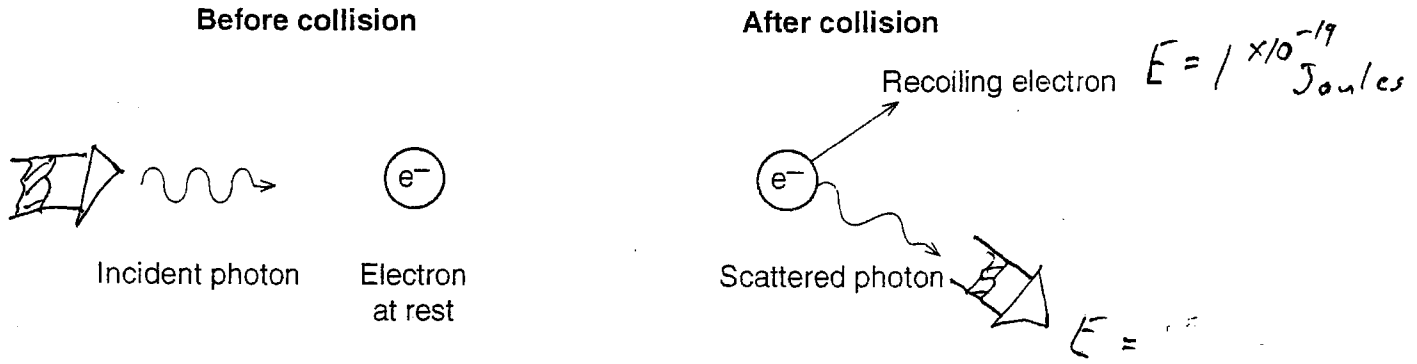
A student looks at different colored LED's & measures their energy (By $E = h\frac{c}{\lambda}$), & measures their frequency. A graph of Energy vs. frequency is made. The slope of the graph is —



(1) 3×10^{8} m/s
(2) 1.6×10^{-19} J
(3) 6.6×10^{-34} J·s
(4) 5×10^{14} Hz

10. Exposure to ultraviolet radiation can damage skin. Exposure to visible light does not damage skin. State *one* possible reason for this difference. (1 credit)

Base your answer to the following question on the information and diagram below. The diagram shows the collision of an incident photon having a frequency of 2.00×10^{19} hertz with an electron initially at rest.

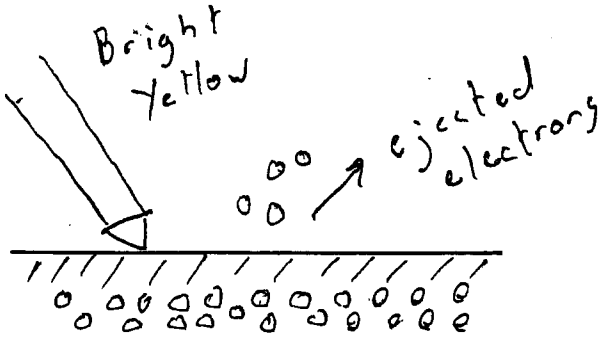


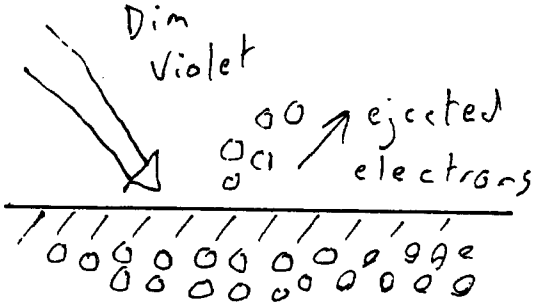
A) Find the Energy of the incident light photon in joules. (Show equ., Sub., & units) (2 credit)

) Find the Energy of the Incident photon in Electron-volts (1 credit)

)If the Energy of the recoil electron is 1×10^{-19} Joules, find the energy of the scattered photon

(22) The photoelectric experiment is performed in a bright yellow light beam shot into a metal surface, and then a dim violet beam. In both cases electrons were dislodged from the metal surface.





(A) How did the photons of the yellow beam compare to the violet beam.

a) More photons, More Energy
b) More photons, less Energy
c) Less photons, More Energy
d) Less photons, Less Energy

(B) How did the velocity & kinetic energy of the electrons knocked out by the violet beam, compare to those knocked out by the red beam

1) Greater 2) Less 3) Same

Dual Nature
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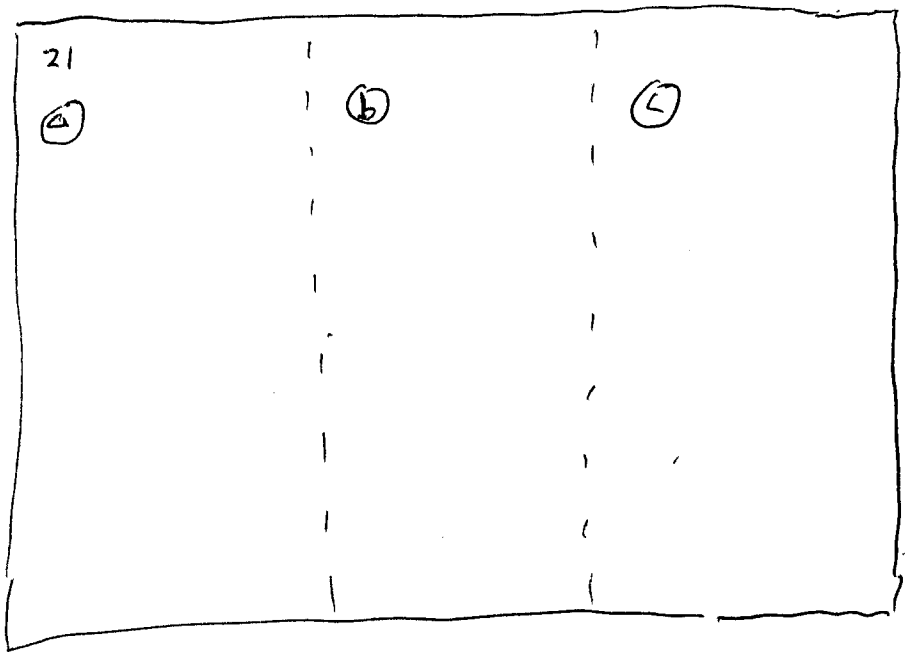

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a)

b)