**Light and Color Questions**

**Question 1:**

aa. Ole Roemer was able to measure the speed of light by \_\_\_\_\_.

a. observing the orbit of Jupiter about the sun

b. observing the orbit of one of Jupiter's moons

c. using resonance in a closed end air column

d. using a reflection of laser light off Earth's moon

e. using a reflection of light off two octagonal mirrors mounted on California mountains

**Question 2:**

aa. The speed at which light moves through a vacuum is now known to be approximately \_\_\_\_\_ m/s.

a. 10.0 b. 345 c. 2.2 x 108

d. 3.00 x 108 e. 9.46 x 1012

ab. .... nonsense! Light cannot travel through a vacuum.

ac. ... nonsense! It is impossible to say without knowing the temperature.

ad. ... ridiculous! Who would ever want to shine a light into a vacuum cleaner?

**Question 3:**

aa. The sun and a light bulb are examples of \_\_\_\_\_ objects.

a. luminous b. illuminated

**Question 4:**

aa. The moon and a bicycle reflector are examples of \_\_\_\_\_ objects.

a. luminous b. illuminated

**Question 5:**

aa. A light wave that is vibrating in a single plane is referred to as being \_\_\_\_.

a. visible b. polarized c. unpolarized

d. monochromatic e. monomagnetic

**Question 6:**

aa. A light wave that is vibrating in more than one plane is referred to as being \_\_\_\_.

a. visible b. polarized c. unpolarized

d. monochromatic e. magnetized

**Question 7:**

aa. Incident light passes through a Polaroid filter and becomes polarized. The best description of the role of the filter is to state that it serves to \_\_\_\_.

a. add certain colors to the incident light

b. subtract certain colors from the incident light

c. simply absorb the light, regardless of its vibrational direction

d. absorb a portion of the vibrations that are aligned in a specific direction

e. take all the vibrations and twist them so that they align in a single direction

**Question 8:**

aa. How does the direction of the alignment of molecules in a Polaroid filter compare to the direction of the polarization axis of a Polaroid filter?

a. The polarization axes are parallel to the molecules' alignment.

b. The polarization axes are perpendicular to the molecules' alignment.

**Question 9:**

aa. Unpolarized light is approaching a Polaroid filter whose polarization axis is aligned horizontally. Upon passing through the filter, the light will have \_\_\_\_ and be vibrating in a \_\_\_\_ plane of vibration.

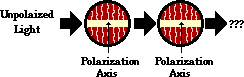
a. the same intensity, vertical b. twice the intensity, vertical

c. the same intensity, horizontal d. one-half the intensity, vertical

e. twice the intensity, horizontal ab. one-half the intensity, horizontal

**Question 10:**

aa. Unpolarized light passes through a first Polaroid filter and then through a second Polarioid filter whose polarization axes are aligned as shown.



The light emerging from the second filter will have \_\_\_\_ the original intensity and be vibrating in a \_\_\_\_ plane of vibration.

a. one-half, vertical b. one-fourth, vertical

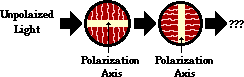
c. one-half, horizontal d. one-fourth, horizontal

e. the same intensity as, vertical ab. the same intensity as, horizontal

ac. ... nonsense! This system will block all the light.

**Question 11:**

aa. Unpolarized light passes through a first Polaroid filter and then through a second Polarioid filter whose polarization axes are aligned as shown.



The light emerging from the second filter will have \_\_\_\_ the original intensity and be vibrating in a \_\_\_\_ plane of vibration.

a. one-half, vertical b. one-fourth, vertical

c. one-half, horizontal d. one-fourth, horizontal

e. the same intensity as, vertical ab. the same intensity as, horizontal

ac. ... nonsense! This system will block all the light.

**Question 12:**

aa. When light reflects off a non-metallic surface, it becomes polarized. A generalization can be made about the direction of vibration of the polarized light. The reflected light tends to be vibrating in a plane that is \_\_\_\_.

a. horizontal b. vertical c. diagonal

d. parallel to the reflecting surface

e. perpendicular to the reflecting surface

ab. nonsense! Light does not polarize when reflecting off non-metallic surfaces.

**Question 13:**

aa. A fisherman wishes to purchase some Polaroid sunglasses that are capable of blocking the glare resulting from reflection of sunlight off lake water. Consider the choices shown below.



The lines represent the polarization axes of the filters. Which pair(s) should he/she purchase?

a.. Pair A b. Pair B c. Pair C

**Question 14:**

aa. Constructive interference occurs when a \_\_\_\_ of one wave meets a \_\_\_\_ of another wave. Select all that apply.

a. trough, trough b. crest, crest c. crest, trough

**Question 15:**

aa. Destructive interference occurs when a \_\_\_\_ of one wave meets a \_\_\_\_ of another wave. Select all that apply.

a. trough, trough b. crest, crest c. crest, trough

**Question 16:**

aa. In a two-point source, light interference pattern, bright lines appear at positions of \_\_\_\_ interference.

a. destructive b. constructive c. no

**Question 17:**

aa. In an interference pattern, dark lines appear at positions of \_\_\_\_ interference.

a. destructive b. constructive c. no

**Questions 18-20:**

aa. When light reaches an object, it can be reflected, absorbed, transmitted and diffracted. Materials that do not transmit light but only reflect it are referred to as \_\_\_\_\_ materials.

a. opaque b. translucent c. transparent

aa. (Continued from the previous question.) … Materials that transmit light in a manner that objects beyond them are clearly visible are known as \_\_\_\_\_ materials.

a. opaque b. translucent c. transparent

aa. (Continued from the previous question.) … And materials that transmit light but do not allow clear images of objects to be seen through them are known as \_\_\_\_\_ materials.

a. opaque b. translucent c. transparent

**Questions 21-23:**

A sensor is used to measure the illuminance (the rate at which light lands upon a surface) at varying distances from a light source. The illuminance is inversely proportional to the square of the distance from the source.

aa. As the distance from the source is doubled, the illuminance is \_\_\_\_\_.

a. two times greater b. four times greater

b. one-half the amount c. one-fourth the amount

aa. (Continued from the previous question.) … As the distance from the source is tripled, the illuminance is \_\_\_\_\_.

a. three times greater b. nine times greater

c. one-third the amount d. one-ninth the amount

aa. (Continued from the previous question.) … As the distance from the source is quadrupled, the illuminance is \_\_\_\_\_.

a. four times greater b. sixteen times greater

c. one-fourth the amount d. one-sixteenth the amount

**Question 24:**

aa. **Diffraction** is \_\_\_\_\_.

a. the bouncing of a light wave off a surface

b. the bending of the path of a light wave around a barrier or obstacle

c. the bending of the path of a light wave as it passes from one medium to another

d. the meeting of two or more waves traveling in different directions through the same medium.

**Questions 25-26:**

The objects that we see are seen because light from the object travels to our eyes. These objects can be categorized as being either a luminous object or an illuminated object.

aa. Luminous objects are objects that \_\_\_\_\_.

a. give off their own light

b. are seen because they reflect from other sources

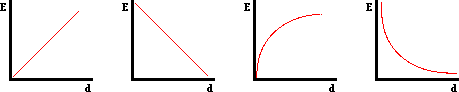
aa. lluminated objects are objects that \_\_\_\_\_.

a. give off their own light

b. are seen because they reflect from other sources

**Question 27:**

aa. Which one of the following graphical displays represents the relationship between illuminance (**E**) and distance from a source (**d**)?



**Question 28:**

aa. **TRUE** or **FALSE**:

Galileo was the first scientist to hypothesize that the speed of light was finite and capable of being measured.

a. True b. False

**Question 29:**

aa. **TRUE** or **FALSE**:

Albert Michelson is renown as the first person to use earth-based techniques to measure the speed of light.

a. True b. False

**Question 30:**

aa. **TRUE** or **FALSE**:

Transparent objects do not reflect light.

a. True b. False

**Question 31:**

aa. **TRUE** or **FALSE**:

Sound waves, water waves, and slinky waves can interfere constructively and destructively; light waves are incapable of either type of interference.

a. True b. False

**Question 32:**

aa. **TRUE** or **FALSE**:

Bright and dark fringes occur in an interference pattern because the wave from one source travels at a different speed in order to alternately constructively and destructively interfere with the wave from the other source.

a. True b. False

**Question 33:**

aa. **TRUE** or **FALSE**:

Light waves could never destructively interfere with each other in such a way as to cancel each other out (i.e., destroy each other) and result in darkness.

a. True b. False

**Question 34:**

aa. **TRUE** or **FALSE**:

Monochromatic light is defined as a light that travels at the same speed in a given medium.

a. True b. False

**Question 35:**

aa. In physics, complementary colors of light are combinations of light colors that \_\_\_\_.

a. will cancel each other out when mixed

b. look very stunning when used together

c. produce black when combined together

d. produce brown when combined together

e. produce white light when combined together

**Question 36:**

aa. The complementary color of red light is \_\_\_\_\_ light.

a. red b. green c. blue

d. cyan e. magenta ab. yellow

**Question 37:**

aa. The complementary color of green light is \_\_\_\_\_ light.

a. red b. green c. blue

d. cyan e. magenta ab. yellow

**Question 38:**

aa. The complementary color of blue light is \_\_\_\_\_ light.

a. red b. green c. blue

d. cyan e. magenta ab. yellow

**Question 39:**

aa. Three colored spotlights - red, green and blue - with equal intensities are used to illuminate a red shirt. Which color(s) of light is/are absorbed by the shirt? Select all that apply.

a. red b. green c. blue

**Question 40:**

aa. Three colored spotlights - red, green and blue - with equal intensities are used to illuminate a red shirt. Which color(s) of light is/are reflected by the shirt? Select all that apply.

a. red b. green c. blue

**Question 41:**

aa. Three colored spotlights - red, green and blue - with equal intensities are used to shine white light upon a cyan shirt. Which color(s) of light is/are absorbed by the shirt? Select all that apply.

a. red b. green c. blue

**Question 42:**

aa. Three colored spotlights - red, green and blue - with equal intensities are used to shine white light upon a cyan shirt. Which color(s) of light is/are reflected by the shirt? Select all that apply.

a. red b. green c. blue

**Question 43:**

aa. Which of the following describe the manner by which a dye or a pigment present in an object contributes to the color appearance of an object?

a. A pigment absorbs one or more of the wavelengths of light and reflects the rest.

b. A pigment produces light of a specific wavelength and emits it from the object.

c. A pigment transforms light of a specific wavelength into light of other wavelengths.

**Question 44:**

aa. Identify the name of the three primary pigments or paints. Select all three.

a. red b. green c. blue d. cyan

e. magenta f. yellow g. brown h. white

**Question 45:**

aa. A primary pigment is unique in that it is a pigment capable of \_\_\_\_.

a. absorbing two primary colors of light

b. absorbing a single primary color of light

c. being eligible for inclusion in Crayola's 256 top colors

d. producing black light when mixed with other primary pigments

e. producing white light when mixed with other primary pigments

ab. producing all the colors of light when mixed with other primary pigments

**Question 46:**

aa. An object that is painted with cyan pigment will be capable of absorbing \_\_\_ light.

a. red b. green c. blue

**Question 47:**

aa. An object that is painted with yellow pigment will be capable of absorbing \_\_\_ light.

a. red b. green c. blue

**Question 48:**

aa. The diffraction of light waves explains why \_\_\_\_\_.

a. light travels so fast from one location to another

b. the shadows of objects are not sharp at the edges of the shadows

c. you can hear people talking in a distant room before you can see them

d. viewing a light through finely cut glassware results in distorted images

**Question 49:**

aa. An object that is painted with magenta pigment will be capable of absorbing \_\_\_ light.

a. red b. green c. blue

**Question 50:**

aa. Most color printing processes use cyan, magenta, and yellow pigments to create a colored image on a white sheet of paper. Which pigment(s) would have to be imparted to a portion of the paper in order for that portion to appear red when viewed under white light? Select all that apply.

a. cyan b. magenta c. yellow

**Question 51:**

aa. Most color printing processes use cyan, magenta, and yellow pigments to create a colored image on a white sheet of paper. Which pigment(s) would have to be imparted to a portion of the paper in order for that portion to appear blue when viewed under white light? Select all that apply.

a. cyan b. magenta c. yellow

**Question 52:**

aa. Most color printing processes use cyan, magenta, and yellow pigments to create a colored image on a white sheet of paper. Which pigment(s) would have to be imparted to a portion of the paper in order for that portion to appear green when viewed under white light? Select all that apply.

a. cyan b. magenta c. yellow

**Questions 53-54:**

aa. Three colored spotlights - red, green and blue - with equal intensities are used to illuminate a shirt with different colors of light. A shirt that appears red under white light is then illuminated with yellow light. When illuminated with the yellow light, the shirt will absorb \_\_\_\_\_ light …

a. red b. green c. blue

d. red and green e. red and blue

ab. green and blue ac. red, green and blue

ad. none of the

aa. (Continued from the previous question.) … and appear \_\_\_\_\_.

a. red b. green c. blue d. cyan

e. magenta ab. yellow ac. black ad. white

**Questions 55-56:**

aa. Three colored spotlights - red, green and blue - with equal intensities are used to illuminate a shirt with different colors of light. A shirt that appears red under white light is then illuminated with cyan light. When illuminated with the cyan light, the shirt will absorb \_\_\_\_\_ light …

a. red b. green c. blue

d. red and green e. red and blue

ab. green and blue ac. red, green and blue

ad. none of the

aa. (Continued from the previous question.) … and appear \_\_\_\_\_.

a. red b. green c. blue d. cyan

e. magenta ab. yellow ac. black ad. white

**Questions 57-58:**

aa. Three colored spotlights - red, green and blue - with equal intensities are used to illuminate a shirt with different colors of light. A shirt that appears red under white light is then illuminated with magenta light. When illuminated with the magenta light, the shirt will absorb \_\_\_\_\_ …

a. red b. green c. blue

d. red and green e. red and blue

ab. green and blue ac. red, green and blue

ad. none of the

aa. (Continued from the previous question.) … and appear \_\_\_\_\_.

a. red b. green c. blue d. cyan

e. magenta ab. yellow ac. black ad. white

**Questions 59-60:**

aa. Three colored spotlights - red, green and blue - with equal intensities are used to illuminate a shirt with different colors of light. A shirt that appears yellow under white light is then illuminated with yellow light. When illuminated with the yellow light, the shirt will absorb \_\_\_\_\_ …

a. red b. green c. blue

d. red and green e. red and blue

ab. green and blue ac. red, green and blue

ad. none of the

aa. (Continued from the previous question.) … and appear \_\_\_\_\_.

a. red b. green c. blue d. cyan

e. magenta ab. yellow ac. black ad. white

**Questions 61-62:**

aa. Three colored spotlights - red, green and blue - with equal intensities are used to illuminate a shirt with different colors of light. A shirt that appears yellow under white light is then illuminated with cyan light. When illuminated with the cyan light, the shirt will absorb \_\_\_\_\_ …

a. red b. green c. blue

d. red and green e. red and blue

ab. green and blue ac. red, green and blue

ad. none of the

aa. (Continued from the previous question.) … and appear \_\_\_\_\_.

a. red b. green c. blue d. cyan

e. magenta ab. yellow ac. black ad. white

**Questions 63-64:**

aa. Three colored spotlights - red, green and blue - with equal intensities are used to illuminate a shirt with different colors of light. A shirt that appears yellow under white light is then illuminated with magenta light. When illuminated with the magenta light, the shirt will absorb \_\_\_\_\_ …

a. red b. green c. blue

d. red and green e. red and blue

ab. green and blue ac. red, green and blue

ad. none of the

aa. (Continued from the previous question.) … and appear \_\_\_\_\_.

a. red b. green c. blue d. cyan

e. magenta ab. yellow ac. black ad. white

**Question 65:**

aa. What did Isaac Newton observe when light passed through a triangular prism?

a. The light was separated into a spectrum of colors.

b. The shadows of objects had colored rings around it.

c. The glass consisted of small irregularities or imperfections.

d. Each light wave was producing another small light wave known as a wavelet.

**Questions 66-67:**

aa. Three colored spotlights - red, green and blue - with equal intensities are used to illuminate a shirt with different colors of light. A shirt that appears cyan under white light is then illuminated with magenta light. When illuminated with the magenta light, the shirt will absorb \_\_\_\_\_ …

a. red b. green c. blue

d. red and green e. red and blue

ab. green and blue ac. red, green and blue

ad. none of the

aa. (Continued from the previous question.) … and appear \_\_\_\_\_.

a. red b. green c. blue d. cyan

e. magenta ab. yellow ac. black ad. white

**Question 68:**

aa. Three colored spotlights - red, green and blue - with equal intensities may be turned ON and OFF in order to illuminate a shirt with different colors of light. A shirt that appears magenta under white light is placed under the spotlights and then appears red. One can say conclusively that the \_\_\_\_ spotlight(s) is/are turned OFF.

a. red b. green c. blue

d. red and green e. red and blue ab. blue and green

**Question 69:**

aa. Three colored spotlights - red, green and blue - with equal intensities may be turned ON and OFF in order to illuminate a shirt with different colors of light. A shirt that appears cyan under white light is placed under the spotlights and then appears green. One can say conclusively that the \_\_\_\_ spotlight(s) is/are turned OFF.

a. red b. green c. blue

d. red and green e. red and blue ab. blue and green

**Question 70:**

aa. Three colored spotlights - red, green and blue - with equal intensities may be turned ON and OFF in order to illuminate a shirt with different colors of light. A shirt that appears yellow under white light is placed under the spotlights and then appears green. One can say conclusively that the \_\_\_\_ spotlight(s) is/are turned OFF.

a. red b. green c. blue

d. red and green e. red and blue ab. blue and green

**Questions 71-73:**

aa. Suppose that red, green and blue light are incident upon filters of different colors. A green filter will block \_\_\_\_\_ light; …

a. red b. green c. blue

d. red and green e. red and blue ab. blue and green

ac. red, green and blue

aa. (Continued from the previous question.) … a blue filter will block \_\_\_\_\_ light; …

a. red b. green c. blue

d. red and green e. red and blue ab. blue and green

ac. red, green and blue

aa. (Continued from the previous question.) … a red filter will block \_\_\_\_\_ light.

a. red b. green c. blue

d. red and green e. red and blue ab. blue and green

ac. red, green and blue

**Questions 74-76:**

aa. Suppose that red, green and blue light are incident upon filters of different colors. A cyan filter will block \_\_\_\_\_ light; …

a. red b. green c. blue

d. red and green e. red and blue ab. blue and green

ac. red, green and blue

aa. (Continued from the previous question.) … a magenta filter will block \_\_\_\_\_ light; …

a. red b. green c. blue

d. red and green e. red and blue ab. blue and green

ac. red, green and blue

aa. (Continued from the previous question.) … a yellow filter will block \_\_\_\_\_ light.

a. red b. green c. blue

d. red and green e. red and blue ab. blue and green

ac. red, green and blue

**Question 77:**

aa. White light is not really a color of light. Rather, white can be considered to be \_\_\_\_.

a. the result of an eye malfunction

b. the absence of all the colors of light

c. the presence of all the colors of light

d. a frequency of light which lies beyond the red of ROYGBIV

e. a frequency of light which lies beyond the violet of ROYGBIV

**Question 78:**

aa. When the three primary colors of light are mixed with equal intensities, the result will be \_\_\_\_.

a. brown b. yellow c. mauve

d. white e. black

**Questions 79-82:**

Determine the result of mixing the following colors of light with equal intensities:

aa. Red light mixed with green light produces \_\_\_\_\_ light.

a. cyan b. black c. white d. brown

e. magenta ab. yellow

aa. Red light mixed with blue light produces \_\_\_\_\_ light.

a. cyan b. black c. white d. brown

e. magenta ab. yellow

aa. Green light mixed with blue light produces \_\_\_\_\_ light.

a. cyan b. black c. white d. brown

e. magenta ab. yellow

aa. Red light, green light and blue light mixed together produces \_\_\_\_\_ light.

a. cyan b. black c. white d. brown

e. magenta ab. yellow

**Calculations and Long Answer:**

**Questions 83-87:**

Light is emitted by a light bulb at a rate of **P**. A light sensor is used to determine the rate at which it reaches a surface some distance of **d** from the surface. The sensor is measuring the **illuminance (E)**. Use this information and the following diagram to answer the next few questions.



aa. When the sensor is placed at location A, it reads an illuminance of 658.0 units. When the sensor is placed at location B, twice as far from the source, the sensor would read \_\_\_\_\_ units.

aa. When the sensor is placed at location C, three times as far from the source, the sensor would read \_\_\_\_\_ units.

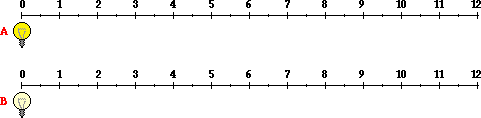
aa. When the sensor is placed at location D, four times as far from the source, the sensor would read \_\_\_\_\_ units.

aa. When the sensor is placed at location E, five times as far from the source, the sensor would read \_\_\_\_\_ units.

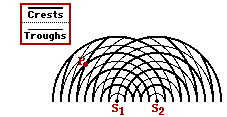
aa. When the sensor is placed at location F, six times as far from the source, the sensor would read \_\_\_\_\_ units.

**Question 88:**

aa. Consider two separate experiments conducted to measure the illuminance at a given distance from two different light bulbs. Light bulb A is two times as *bright* as light bulb B. That is, light bulb A emits light at two times the rate as light bulb B; it has two times the power or luminous flux.



A sensor is used to measure the rate at which light from a source reaches a surface - i.e, the illuminance. When placed a distance of 7.60 cm from source A, the sensor reads 186 units of illuminance. At what distance from source B will the same sensor read 186 units of illuminance?



**Question 89:**

aa. The diagram at the right represents the interference pattern created by two water waves. The waves were created by two vibrating objects that oscillate up and down in phase at the same frequency. Point P on the pattern is a distance of 21.68 cm from S1 and 24.64 cm from S2. Determine the wavelength (in cm) of the water waves.

**Question 90:**

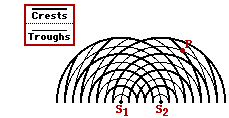
aa. A physics class uses a laser with a known wavelength of 633 nm in a double-slit experiment. The slit separation is unknown. A student places the screen 1.55 meters from the slits and finds the first antinode to be located 48.0 mm from the central anti-node.

a. What is the slit separation (in micrometers)? (106 micrometer = 1 meter)

b. If the distance from the slits to the screen is increased by a factor of 3.01, then what would be the new distance (in millimeters) from the first antinode to the central bright spot?

**Question 91:**

aa. A physics teacher is using two audio speakers to demonstrate sound interference in the school auditorium. The speakers are located on the stage and spaced apart by 3.74 meters. (Assume a speed of sound of 345 m/s.) Students are sitting in seats in the same row in an auditorium. The seats are spaced 92.5 centimeters apart. When the speakers are tuned to a frequency of 425 Hz, it is found that every fourth student is sitting at a position of destructive interference. What is the perpendicular distance (in meters) from the row of students to the speakers?



**Question 92:**

aa. The diagram at the right represents the interference pattern created by two water waves. The waves were created by two vibrating objects that oscillate up and down in phase at the same frequency. Point P on the pattern is a distance of 58.6 cm from S1 and 39.3 cm from S2. Determine the wavelength (in cm) of the water waves.

**Question 93:**

aa. A point on the fourth nodal line is a distance of 78.8 cm from the furthest source. The wavelength of the waves is 9.60 cm. What is the distance (in cm) from the same point to the nearest source?