

חיזון המדע הירושלמי תשס"ח - Jerusalem Science Contest 2008-2009
Electromagnetic and Ionizing radiation
Exam 5 — Chapter 29 - Light Waves

Name: _____

Date: _____

Raw Score: _____

Percentage Score: _____ %

Proctor for this Examinaton: _____ Form: _____

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

- 1) Total destructive interference occurs when interfering waves are
 - A) in phase.
 - B) 270° out of phase.
 - C) 45° out of phase.
 - D) 90° out of phase.
 - E) 180° out of phase.

- 2) At distances very far from the original source, waves are very nearly
 - A) spherical.
 - B) planar.
 - C) parabolic.
 - D) circular.
 - E) none of the preceding

- 3) Which of the following can be used to diffract light?
 - A) a convex lens
 - B) a compact disc
 - C) a concave lens
 - D) a convex mirror
 - E) none of the preceding

- 4) In order for unpolarized light to be transmitted through a crystal as polarized light, the crystal must
 - A) have a cubic structure.
 - B) have a non-cubic structure.
 - C) must have a color that is the same as that of the light source.
 - D) have all sides of the same length.
 - E) have all axes perpendicular to each other.

- 5) If a film hologram is cut into many pieces
 - A) no image will be formed, even if the pieces are reassembled.
 - B) each piece will show only a portion of the hologram.
 - C) each piece will display the entire hologram, but in a reverse image, as if reflected through a mirror.
 - D) each piece will display the entire hologram.in its original orientation
 - E) no image will be formed by any individual piece.

- 6) If two polaroid filters are placed in such an orientation that light is fully transmitted through both, and a solution of an optically active compound such as fructose is placed between the filters
- A) light transmission will be blocked by the dextrorotatory isomer, but allowed by the levorotatory isomer.
 - B) light transmission will be blocked by the levorotatory isomer, but blocked by the dextrorotatory isomer
 - C) light transmission will be partially to almost totally blocked.
 - D) light transmission will be unaffected.
 - E) none of the preceding
- 7) Light waves emanating from an incandescent blue lightbulb are
- A) coherent.
 - B) monochromatic.
 - C) all the same amplitude.
 - D) in phase.
 - E) none of the preceding.
- 8) If a lens that is flat on one side and convex on the other is placed convex side down on an optically flat plate and illuminated from above with monochromatic light, interference results in the formation of
- A) colored bands.
 - B) wavy, irregularly spaced bands.
 - C) Newton's rings.
 - D) a series of alternating light and dark parallel bands
 - E) none of the preceding
- 9) Which of the following phenomena is most important for the formation of a laser hologram
- A) refraction
 - B) interference
 - C) reflectance
 - D) polarization
 - E) none of the preceding are important
- 10) Light emitted from an incandescent light source is
- A) of constant phase
 - B) coherent
 - C) monochromatic
 - D) all of the preceding
 - E) none of the preceding
- 11) When the transmission axes of two polaroid filters are held at a 90° angle with respect to each other and a beam of light is passed successively through one then the other, light
- A) that transmits will be plane polarized at a 45° angle.
 - B) that transmits will be unpolarized.
 - C) will be mostly blocked by the second filter and very little will transmit.
 - D) that transmits will be plane polarized at a 90° angle with respect to the second filter.
 - E) that transmits will be plane polarized at a 0° angle with respect to the second filter.

- 12) If two optical flats that are ground to perfect flatness are placed one on top of the other, thin film interference bands
- A) will appear as wavy bands with circular inclusions.
 - B) will cause an iridescent array of colors.
 - C) will not occur.
 - D) will appear as uniform parallel alternating light and dark bands.
 - E) will appear as a series of light and dark rings.
- 13) What is the rotation in degrees of a beam of plane polarized light after it passes through a 50/50 mixture of two optical isomers of the same compound at the same concentration?
- A) 50°
 - B) 0°
 - C) 90°
 - D) 45°
 - E) It depends on the path length of the light and the molecular structure of the molecule in question
- 14) The relationship between diffraction angle, distance between slits, and wavelength of light in constructive interference is shown by which of the following equations?
- A) $d \sin \theta = 1/\lambda$
 - B) $d \sin \theta = \pm m\lambda$
 - C) $d \sin \theta = \pm (m + \frac{1}{2}) \lambda$
 - D) $\sin \theta = \pm d(m + \frac{1}{2}) \lambda$
 - E) none of the preceding
- 15) The reason that AM radio waves are less interfered with by tall obstructions in their path is due to the fact that
- A) in AM, the amplitude of the wave is modulated so it can become higher than the obstruction.
 - B) AM stations use much more power than FM stations.
 - C) AM waves are of much shorter wavelength than FM waves.
 - D) in FM (frequency modulation) mode, waves are more difficult to focus, due to changing frequency.
 - E) none of the preceding
- 16) Laser light is
- A) monochromatic.
 - B) used to accurately measure the distance from the earth to the moon.
 - C) coherent.
 - D) all of the preceding
 - E) none of the preceding
- 17) Which of the following conditions would produce the greatest diffraction?
- A) green light passing through a 0.5 mm slit
 - B) all wavelengths will produce the same amount of diffraction, regardless of slit size
 - C) green light passing through a 1.0 mm slit
 - D) red light passing through a 1.0 mm slit
 - E) red light passing through a 0.5 mm slit
- 18) What term is applied to two carbon compounds that are non superposable mirror images of one another?
- A) isomers
 - B) diastereomers
 - C) optical conjugates
 - D) enantiomers
 - E) none of the preceding

- 19) According to Huygens' principle, every point along a wave front may be thought of as a
- A) point source of light.
 - B) spherical wave.
 - C) wavelet.
 - D) plane wave.
 - E) none of the preceding
- 20) The blue color of both the wings of the blue morpho butterfly and the mineral peristerite are due primarily to light wave
- A) reflection.
 - B) interference.
 - C) diffraction.
 - D) refraction.
 - E) none of the preceding
- 21) In order for a carbon compound to rotate plane polarized light the molecule must have at least
- A) three centers of asymmetry.
 - B) one center of asymmetry.
 - C) two of the same functional groups attached to the same carbon atom.
 - D) two centers of asymmetry.
 - E) three of the same functional groups attached to the same carbon atom.
- 22) Which of the following will produce the sharpest image resolution?
- A) near infrared ($\lambda = 0.75 \mu\text{m}$)
 - B) soft x-ray ($\lambda = 4.5 \text{ nm}$)
 - C) visible ($\lambda = 0.53 \mu\text{m}$)
 - D) electron ($\lambda = 0.15 \text{ nm}$)
 - E) vacuum uv ($\lambda = 150 \text{ nm}$)
- 23) Light reflected off of a horizontal surface (glare) will be
- A) plane polarized at a 45° angle.
 - B) plane polarized in the horizontal direction.
 - C) unpolarized.
 - D) plane polarized at an angle that depends on the chemical composition of the surface.
 - E) plane polarized in the vertical direction.
- 24) Stereograms and stereoptic 3-dimensional images are formed when the brain fuses two images of the same object into one. In order for this to occur
- A) the left eye must see the image as viewed from the left and the right eye must see the image as viewed from the right
 - B) the images must be views of the object as seen from slightly different positions
 - C) the left eye must ignore the right image (or it must be blocked with respect to that eye, and the right eye must ignore the left image (or it must be blocked with respect to that eye).
 - D) all of the preceding
 - E) none of the preceding

- 25) The colors of a soap bubble are
- A) all the colors of the rainbow.
 - B) additive primaries.
 - C) subtractive primaries.
 - D) all of the preceding.
 - E) none of the preceding.