

**חיידון המדע הירושלמי תשס"ח - 2008-2009 Jerusalem Science Contest**  
**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) According to Huygens' principle, every point along a wave front may be thought of as a
  - A) wavelet.
  - B) point source of light.
  - C) spherical wave.
  - D) plane wave.
  - E) none of the preceding
  
- 2) At distances very far from the original source, waves are very nearly
  - A) planar.
  - B) spherical.
  - C) parabolic.
  - D) circular.
  - E) none of the preceding
  
- 3) Which of the following conditions would produce the greatest diffraction?
  - A) red light passing through a 0.5 mm slit
  - B) green light passing through a 1.0 mm slit
  - C) red light passing through a 1.0 mm slit
  - D) green light passing through a 0.5 mm slit
  - E) all wavelengths will produce the same amount of diffraction, regardless of slit size
  
- 4) Total destructive interference occurs when interfering waves are
  - A) in phase.
  - B) 45° out of phase.
  - C) 90° out of phase.
  - D) 180° out of phase.
  - E) 270° out of phase.
  
- 5) 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) in FM (frequency modulation) mode, waves are more difficult to focus, due to changing frequency.
  - C) AM stations use much more power than FM stations.
  - D) AM waves are of much shorter wavelength than FM waves.
  - E) none of the preceding

- 6) Which of the following will produce the sharpest image resolution?
- A) near infrared ( $\lambda = 0.75 \mu\text{m}$ )
  - B) visible ( $\lambda = 0.53 \mu\text{m}$ )
  - C) electron ( $\lambda = 0.15 \text{nm}$ )
  - D) soft x-ray ( $\lambda = 4.5 \text{nm}$ )
  - E) vacuum uv ( $\lambda = 150 \text{nm}$ )
- 7) If two optical flats that are ground to perfect flatness are placed one on top of the other, thin film interference bands
- A) will not occur.
  - B) will appear as uniform parallel alternating light and dark bands.
  - C) will appear as wavy bands with circular inclusions.
  - D) will appear as a series of light and dark rings.
  - E) will cause an iridescent array of colors.
- 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) a series of alternating light and dark parallel bands
  - B) Newton's rings.
  - C) colored bands.
  - D) wavy, irregularly spaced bands.
  - E) none of the preceding
- 9) 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) refraction.
  - C) diffraction.
  - D) interference.
  - E) none of the preceding
- 10) Laser light is
- A) monochromatic.
  - B) coherent.
  - C) used to accurately measure the distance from the earth to the moon.
  - D) all of the preceding
  - E) none of the preceding
- 11) Which of the following can be used to diffract light?
- A) a compact disc
  - B) a convex lens
  - C) a concave lens
  - D) a convex mirror
  - E) none of the preceding
- 12) Light waves emanating from an incandescent blue lightbulb are
- A) monochromatic.
  - B) coherent.
  - C) in phase.
  - D) all the same amplitude.
  - E) none of the preceding.

- 13) The colors of a soap bubble are
- additive primaries.
  - subtractive primaries.
  - all the colors of the rainbow.
  - all of the preceding.
  - none of the preceding.
- 14) The relationship between diffraction angle, distance between slits, and wavelength of light in constructive interference is shown by which of the following equations?
- $d \sin \theta = \pm m\lambda$
  - $d \sin \theta = 1/\lambda$
  - $d \sin \theta = \pm (m + \frac{1}{2}) \lambda$
  - $\sin \theta = \pm d(m + \frac{1}{2}) \lambda$
  - none of the preceding
- 15) Light emitted from an incandescent light source is
- coherent
  - monochromatic
  - of constant phase
  - all of the preceding
  - none of the preceding
- 16) Light reflected off of a horizontal surface (glare) will be
- unpolarized.
  - plane polarized in the vertical direction.
  - plane polarized in the horizontal direction.
  - plane polarized at a 45° angle.
  - plane polarized at an angle that depends on the chemical composition of the surface.
- 17) 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
- that transmits will be plane polarized at a 0° angle with respect to the second filter.
  - that transmits will be plane polarized at a 90° angle with respect to the second filter.
  - that transmits will be plane polarized at a 45° angle.
  - that transmits will be unpolarized.
  - will be mostly blocked by the second filter and very little will transmit.
- 18) In order for a carbon compound to rotate plane polarized light the molecule must have at least
- one center of asymmetry.
  - two of the same functional groups attached to the same carbon atom.
  - three of the same functional groups attached to the same carbon atom.
  - two centers of asymmetry.
  - three centers of asymmetry.
- 19) In order for unpolarized light to be transmitted through a crystal as polarized light, the crystal must
- have all axes perpendicular to each other.
  - have all sides of the same length.
  - have a cubic structure.
  - have a non-cubic structure.
  - must have a color that is the same as that of the light source.

- 20) 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)  $0^\circ$
  - B)  $50^\circ$
  - C)  $90^\circ$
  - D)  $45^\circ$
  - E) It depends on the path length of the light and the molecular structure of the molecule in question
- 21) 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 unaffected.
  - B) light transmission will be partially to almost totally blocked.
  - C) light transmission will be blocked by the dextrorotatory isomer, but allowed by the levorotatory isomer.
  - D) light transmission will be blocked by the levorotatory isomer, but blocked by the dextrorotatory isomer.
  - E) none of the preceding
- 22) 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 images must be views of the object as seen from slightly different positions
  - B) 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
  - 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
- 23) What term is applied to two carbon compounds that are non superposable mirror images of one another?
- A) isomers
  - B) diastereomers
  - C) enantiomers
  - D) optical conjugates
  - E) none of the preceding
- 24) If a film hologram is cut into many pieces
- A) each piece will display the entire hologram in its original orientation
  - B) each piece will show only a portion of the hologram.
  - C) no image will be formed by any individual piece.
  - D) no image will be formed, even if the pieces are reassembled.
  - E) each piece will display the entire hologram, but in a reverse image, as if reflected through a mirror.
- 25) Which of the following phenomena is most important for the formation of a laser hologram
- A) reflectance
  - B) refraction
  - C) polarization
  - D) interference
  - E) none of the preceding are important