

תידון המדע הירושלמי תשס"ח - 2008-2009 Jerusalem Science Contest
Electromagnetic and Ionizing radiation
Exam 4 — Chapter 28b; Refraction

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) Different frequencies of light travel at different speeds and will refract at different angles. This results in a type of distortion known as
 - A) chromatic aberration.
 - B) diffractive aberration.
 - C) astigmatic aberration.
 - D) spherical aberration.
 - E) none of the preceding.

- 2) A mirage forms because light bends as it
 - A) travels faster through the upper cool air layer than it does through the lower hot air layer.
 - B) travels faster through the lower hot air layer than it does through the upper cool air layer.
 - C) travels faster through the upper hot air layer than it does through the lower cool air layer.
 - D) travels faster through the lower cool air layer than it does through upper hot air layer.
 - E) none of the preceding: light is reflected from the road surface.

- 3) Which of the following are examples of refraction?
 - A) light passing from air through water
 - B) a mirage
 - C) all of the preceding
 - D) a rainbow
 - E) none of the preceding

- 4) For a double convex lens with an object at a distance greater than $2F$, the image will be
 - A) real, and appear at the focal point. behind the lens.
 - B) non-existent (no image will be formed).
 - C) real, and appear between F and $2F$ behind the lens.
 - D) virtual, and appear at a distance greater than $2F$ behind the lens.
 - E) virtual, and appear at the focal point in front of the lens.

- 5) Light passing through the edges of a lens does not focus at precisely the same point as light that passes through the center of the lens. This kind of image distortion is known as
- spherical aberration.
 - chromatic aberration.
 - astigmatic aberration.
 - diffractive aberration.
 - none of the preceding.
- 6) For an object placed at a distance from a double convex lens that is less than F , the focal distance,, the image will be
- non-existent (no image will be formed).
 - real, upright, and at a distance of greater than $2F$ behind the lens.
 - real, inverted and at a distance of less than F behind the lens.
 - virtual, inverted and at a distance $2F$ or greater in front of the lens
 - virtual, upright and in front of the lens at a greater distance than the object.
- 7) If light travels from a medium of higher refractive index to one of lower refractive index it will
- bend perpendicular to the wave front
 - bend away from the normal
 - bend toward the normal
 - continue in a straight line
 - none of the preceding
- 8) For a double convex lens, light emitted from a distant star will
- form an image at the focal point F in front of the lens (on the side nearest to the star).
 - form an image at $2F$ in front of the lens.
 - form an image at the focal point F behind the lens.
 - form an image at $2F$ behind the lens.
 - not form an image.
- 9) Light of wavelength 589 nm travels at $3.00 \times 10^8 \text{ m/s}$ through air and $2.00 \times 10^8 \text{ m/s}$ through benzene. What is the refractive index of benzene at this wavelength?
- A) 1.33 B) 1.00 C) 6.00 D) 1.50 E) 0.67
- 10) In a rainbow, two refractions off the front and back surfaces of a raindrop and one reflection off the back surface result in what dispersion angles from the normal?
- A) 40° - 42° B) 25° - 30° C) 38° - 40° D) 30° - 34° E) 42° - 45°
- 11) An object at infinity from a double convex lens will form an image that is
- virtual, and in front of the lens at a distance of between F and $2F$.
 - real, inverted, and at a distance between F and $2f$ behind the lens.
 - a point at a distance of $2F$ behind the lens.
 - a point at a distance of F behind the lens.
 - non-existent (no image will be formed).

- 12) An object placed at the focal point of a double concave lens will form an image that is
- A) real, and upright.
 - B) non-existent (no image will be formed).
 - C) virtual and upright.
 - D) real and inverted.
 - E) virtual and inverted.
- 13) With respect to blue light red light is
- A) refracted less when passing through a more optically dense medium and more when passing through a less optically dense medium
 - B) refracted more
 - C) refracted less
 - D) refracted more when passing through a more optically dense medium and less when passing through a less optically dense medium
 - E) refracted the same amount
- 14) For a double concave lens the image size is always
- A) real and larger than the object
 - B) real and smaller than the object
 - C) virtual and smaller than the object
 - D) virtual and larger than the object.
 - E) none of the preceding
- 15) For a double convex lens with an object at a distance of $2F$, the image will be
- A) virtual, upright and appear at a distance in front of the object.
 - B) real, upright, and appear at a distance of $2F$ behind the lens.
 - C) non-existent
 - D) real, inverted, and appear at the focal point behind the lens.
 - E) none of the preceding
- 16) A double concave lens is
- A) a magnifying lens
 - B) a diverging lens
 - C) a spherical lens
 - D) a converging lens
 - E) none of the preceding
- 17) An object at the focal point of a double convex lens will form an image that is
- A) real, inverted and behind the lens at a distance of greater than $2F$.
 - B) non-existent (no image will be formed).
 - C) real, inverted, between F and $2F$, and behind the lens.
 - D) real, inverted and with a magnification of 1 (i.e. unmagnified).
 - E) virtual, in front of the lens at a distance of F .
- 18) The image referred to as a mirage is
- A) an hallucinations from too much heat.
 - B) an optical illusion.
 - C) a virtual image.
 - D) a real image.
 - E) none of the preceding.

- 19) The equation $1/p + 1/q = 1/f$ was introduced as the mirror equation. What equation is used with thin lenses in order to find the image distance, if the focal length and object distances are known?
- A) $1/p + 1/q = 2/f$
 - B) $p + q = f$
 - C) $1/p + 1/q = 1/f$
 - D) $-q/p = f$
 - E) $1/p + 1/q = f$
- 20) What is the focal length of a double convex lens, if an object placed 10.0 cm from the lens produces an image that is 5.00 cm from the lens from the lens?
- A) 7.50 cm
 - B) 2.00 cm
 - C) 0.50 cm
 - D) 3.33 cm
 - E) 5.00 cm
- 21) What is the magnification of the image formed in problem 20?
- A) 10 cm
 - B) 15 cm
 - C) 12 cm
 - D) no image is formed
 - E) 30 cm
- 22) Which of the following describes the image formed in problem 20?
- A) real, inverted
 - B) real, upright
 - C) virtual, upright
 - D) no image is formed
 - E) virtual, inverted
- 23) What happens to the amplitude of refracted light?
- A) It decreases
 - B) It remains unchanged
 - C) It increases for concave lenses and decreases for convex lenses
 - D) It increases
 - E) It increases for convex lenses and decreases for concave lenses
- 24) A light ray of wavelength 589 nm travelling through the air strikes a smooth flat crystal at an angle 30° to the normal. If the light ray is refracted at an angle of 12° to the normal, what is the index of refraction of the crystal? ($\sin 12^\circ = 0.208$; $\sin 30^\circ = 0.500$)
- A) 1.12
 - B) 1.18
 - C) 2.67
 - D) 0.42
 - E) 2.40
- 25) An object placed between F and 2F in front of a double convex lens will form an image that is
- A) real, upright, and at a distance beyond 2F behind the lens
 - B) real, inverted, at a distance between F and 2F behind the lens
 - C) virtual, upright and in front of the lens at a distance greater than that of the object.
 - D) real, inverted and at a distance beyond 2F behind the lens.
 - E) non-existent (no image will be formed).