

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) The image referred to as a mirage is
 - A) an hallucinations from too much heat.
 - B) an optical illusion.
 - C) a real image.
 - D) a virtual image.
 - E) none of the preceding.

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

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

- 4) If light travels from a medium of higher refractive index to one of lower refractive index it will
 - A) continue in a straight line
 - B) bend perpendicular to the wave front
 - C) bend toward the normal
 - D) bend away from the normal
 - E) none of the preceding

- 5) What happens to the amplitude of refracted light?
 - A) It remains unchanged
 - B) It increases
 - C) It decreases
 - D) It increases for convex lenses and decreases for concave lenses
 - E) It increases for concave lenses and decreases for convex lenses

- 6) Light of wavelength 589 nm travels at 3.00×10^8 m/s through air and 2.00×10^8 m/s through benzene. What is the refractive index of benzene at this wavelength?
 A) 0.67 B) 1.00 C) 1.33 D) 1.50 E) 6.00
- 7) 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) 0.42 B) 1.12 C) 1.18 D) 2.40 E) 2.67
- 8) 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) $1/p + 1/q = f$
 B) $1/p + 1/q = 1/f$
 C) $1/p + 1/q = 2/f$
 D) $p + q = f$
 E) $-q/p = f$
- 9) For a double convex lens, light emitted from a distant star will
 A) form an image at the focal point F in front of the lens (on the side nearest to the star).
 B) form an image at the focal point F behind the lens.
 C) form an image at 2F in front of the lens.
 D) form an image at 2F behind the lens.
 E) not form an image.
- 10) With respect to blue light red light is
 A) refracted more
 B) refracted less
 C) refracted the same amount
 D) refracted more when passing through a more optically dense medium and less when passing through a less optically dense medium
 E) refracted less when passing through a more optically dense medium and more when passing through a less optically dense medium
- 11) A double concave lens is
 A) a spherical lens
 B) a magnifying lens
 C) a diverging lens
 D) a converging lens
 E) none of the preceding
- 12) For a double convex lens with an object at a distance of 2F, the image will be
 A) real, inverted, and appear at the focal point behind the lens.
 B) virtual, upright and appear at a distance in front of the object.
 C) real, upright, and appear at a distance of 2F behind the lens.
 D) non-existent
 E) none of the preceding

- 13) For a double convex lens with an object at a distance greater than $2F$, the image will be
- real, and appear at the focal point. behind the lens.
 - virtual, and appear at the focal point in front of the lens.
 - real, and appear between F and $2F$ behind the lens.
 - virtual, and appear at a distance greater than $2F$ behind the lens.
 - non-existent (no image will be formed).
- 14) For an object placed at a distance from a double convex lens that is less than F , the focal distance,, the image will be
- real, inverted and at a distance of less than F behind the lens.
 - real, upright, and at a distance of greater than $2F$ behind the lens.
 - virtual, upright and in front of the lens at a greater distance than the object.
 - non-existent (no image will be formed).
 - virtual, inverted and at a distance $2F$ or greater in front of the lens
- 15) An object placed between F and $2F$ in front of a double convex lens will form an image that is
- real, inverted and at a distance beyond $2F$ behind the lens.
 - real, upright, and at a distance beyond $2F$ behind the lens
 - real, inverted, at a distance between F and $2F$ behind the lens
 - virtual, upright and in front of the lens at a distance greater than that of the object.
 - non-existent (no image will be formed).
- 16) An object at infinity from a double convex lens will form an image that is
- a point at a distance of F behind the lens.
 - a point at a distance of $2F$ behind the lens.
 - real, inverted, and at a distance between F and $2f$ behind the lens.
 - virtual, and in front of the lens at a distance of between F and $2F$.
 - non-existent (no image will be formed).
- 17) An object at the focal point of a double convex lens will form an image that is
- real, inverted and with a magnification of 1 (i.e. unmagnified).
 - real, inverted and behind the lens at a distance of greater than $2F$.
 - real, inverted, between F and $2F$, and behind the lens.
 - virtual, in front of the lens at a distance of F .
 - non-existent (no image will be formed).
- 18) An object placed at the focal point of a double concave lens will form an image that is
- real and inverted.
 - real, and upright.
 - virtual and inverted.
 - virtual and upright.
 - non-existent (no image will be formed).
- 19) For a double concave lens the image size is always
- virtual and smaller than the object
 - real and smaller than the object
 - virtual and larger than the object.
 - real and larger than the object
 - none of the preceding

- 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) 0.50 cm B) 2.00 cm C) 3.33 cm D) 5.00 cm E) 7.50 cm
- 21) What is the magnification of the image formed in problem 20?
A) 15 cm
B) 10 cm
C) 12 cm
D) 30 cm
E) no image is formed
- 22) Which of the following describes the image formed in problem 20
A) real, upright
B) real, inverted
C) virtual, upright
D) virtual, inverted
E) no image is formed
- 23) 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) $25^\circ - 30^\circ$ B) $30^\circ - 34^\circ$ C) $38^\circ - 40^\circ$ D) $40^\circ - 42^\circ$ E) $42^\circ - 45^\circ$
- 24) 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
A) diffractive aberration.
B) astigmatic aberration.
C) spherical aberration.
D) chromatic aberration.
E) none of the preceding.
- 25) Different frequencies of light travel at different speeds and will refract at different angles. This results in a type of distortion known as
A) diffractive aberration.
B) chromatic aberration.
C) spherical aberration.
D) astigmatic aberration.
E) none of the preceding.