

חיזון 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) For a double convex lens, light emitted from a distant star will
 - A) form an image at the focal point F behind the lens.
 - B) form an image at $2F$ behind the lens.
 - C) form an image at $2F$ in front of the lens.
 - D) form an image at the focal point F in front of the lens (on the side nearest to the star).
 - E) not form an image.

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

- 3) For a double concave lens the image size is always
 - A) real and larger than the object
 - B) virtual and smaller than the object
 - C) virtual and larger than the object.
 - D) real and smaller than the object
 - E) none of the preceding

- 4) 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) 6.00
 - C) 1.50
 - D) 1.00
 - E) 1.33

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

- 6) 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
- diffraction aberration.
 - astigmatic aberration.
 - chromatic aberration.
 - spherical aberration.
 - none of the preceding.
- 7) For a double convex lens with an object at a distance greater than $2F$, the image will be
- real, and appear between F and $2F$ behind the lens.
 - non-existent (no image will be formed).
 - virtual, and appear at the focal point in front of the lens.
 - virtual, and appear at a distance greater than $2F$ behind the lens.
 - real, and appear at the focal point. behind the lens.
- 8) An object at infinity from a double convex lens will form an image that is
- non-existent (no image will be formed).
 - real, inverted, and at a distance between F and $2f$ behind the lens.
 - a point at a distance of F behind the lens.
 - virtual, and in front of the lens at a distance of between F and $2F$.
 - a point at a distance of $2F$ behind the lens.
- 9) An object at the focal point of a double convex lens will form an image that is
- non-existent (no image will be formed).
 - real, inverted, between F and $2F$, and behind the lens.
 - real, inverted and with a magnification of 1 (i.e. unmagnified).
 - real, inverted and behind the lens at a distance of greater than $2F$.
 - virtual, in front of the lens at a distance of F .
- 10) 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?
- $1/p + 1/q = 2/f$
 - $1/p + 1/q = 1/f$
 - $p + q = f$
 - $1/p + 1/q = f$
 - $-q/p = f$
- 11) With respect to blue light red light is
- refracted the same amount
 - refracted less when passing through a more optically dense medium and more when passing through a less optically dense medium
 - refracted less
 - refracted more when passing through a more optically dense medium and less when passing through a less optically dense medium
 - refracted more

- 12) 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, upright and in front of the lens at a greater distance than the object.
 - virtual, inverted and at a distance $2F$ or greater in front of the lens
- 13) For a double convex lens with an object at a distance of $2F$, the image will be
- real, upright, and appear at a distance of $2F$ behind the lens.
 - non-existent
 - real, inverted, and appear at the focal point behind the lens.
 - virtual, upright and appear at a distance in front of the object.
 - none of the preceding
- 14) 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.
 - non-existent (no image will be formed).
 - 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.
 - real, upright, and at a distance beyond $2F$ behind the lens
- 15) Different frequencies of light travel at different speeds and will refract at different angles. This results in a type of distortion known as
- diffractive aberration.
 - spherical aberration.
 - astigmatic aberration.
 - chromatic aberration.
 - none of the preceding.
- 16) What happens to the amplitude of refracted light?
- It remains unchanged
 - It increases for concave lenses and decreases for convex lenses
 - It decreases
 - It increases
 - It increases for concave lenses and decreases for convex lenses
- 17) 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) 2.40 B) 1.12 C) 1.18 D) 2.67 E) 0.42
- 18) The image referred to as a mirage is
- an optical illusion.
 - a virtual image.
 - an hallucinations from too much heat.
 - a real image.
 - none of the preceding.

- 19) 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) 30° - 34° B) 40° - 42° C) 25° - 30° D) 38° - 40° E) 42° - 45°
- 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?
A) 2.00 cm B) 0.50 cm C) 7.50 cm D) 3.33 cm E) 5.00 cm
- 21) What is the magnification of the image formed in problem 20?
A) 30 cm
B) 15 cm
C) 10 cm
D) no image is formed
E) 12 cm
- 22) Which of the following describes the image formed in problem 20?
A) virtual, inverted
B) real, upright
C) real, inverted
D) virtual, upright
E) no image is formed
- 23) Which of the following are examples of refraction?
A) a rainbow
B) a mirage
C) light passing from air through water
D) all of the preceding
E) none of the preceding
- 24) An object placed at the focal point of a double concave lens will form an image that is
A) virtual and inverted.
B) real and inverted.
C) non-existent (no image will be formed).
D) real, and upright.
E) virtual and upright.
- 25) A double concave lens is
A) a magnifying lens
B) a diverging lens
C) a converging lens
D) a spherical lens
E) none of the preceding