SCIENCEOLYMPIAD
™

Exploring the World of Science

OPTICS DIVISION B

School/#:_____

Names: _____

_____

Directions: Fill in your response for each question in the space provided. All questions are worth two points.

Multiple Choice
(2 points each question)

___1. Which of the following best describes the image from a plane mirror?

a. virtual and magnification greater than one
b. real and magnification less than one
c. virtual and magnification equal to one
d. real and magnification equal to one

___2. In order of increasing frequency, which of the following is correct?

a. visible, radio, ultraviolet and x-ray
b. infrared, visible, ultraviolet and gamma
c. visible, gamma, ultraviolet and x-ray
d. infrared, x-ray, visible and gamma

___3. Which portion of the electromagnetic spectrum is used in a microscope?

a. infrared waves
b. gamma rays
c. visible light
d. ultraviolet light

___4. When the reflection of an object is seen in a flat mirror, the distance from the mirror to the image depends on

a. the wavelength of light used for viewing.
b. the distance from the object to the mirror.
c. the distance of both the observer and the object to the mirror.
d. the size of the object.

___5. Which of the following is NOT an additive primary color?

a. yellow
b. blue
c. Red
d. Green

___6. The magnetic field of an electromagnetic waves is:

a. Parallel to the electric field and to the wave direction
b. Parallel to the electric field and perpendicular to the wave direction
c. Parallel to the electric field and to the wave direction
d. Perpendicular to the electric field and parallel to the wave direction

____7. Part of a pencil that is placed in a glass of water appears bent in relation to the part of the pencil that extends out of the water. What is this phenomenon called?

a. interference
b. refraction
c. diffraction
d. Reflection

____8. Light enters a glass plate at an angle of incidence of 25°. If the index of refraction of a glass is 1.6, the angle of refraction is

a. 15°
b. 16°
c. 40°
d. 43°

____9. If you know the wavelength of any form of electromagnetic radiation, you can determine its frequency because

a. all wavelengths travel at the same speed.
b. the speed of light varies for each form.
c. wavelength and frequency are equal.
d. the speed of light increases as wavelength increases.

____10. If you stand 3.0 m in front of a flat mirror, how far away from you would your image be in the mirror?

a. 1.5 m
b. 3.0 m
c. 6.0 m
d. 12.0 m

____ 11. A concave mirror forms a real image at 42 cm from the mirror surface along the principal axis. If the corresponding object is at a 88 cm distance, what is the mirror's focal length?
a. 28 cm
b. 17 cm
c. 12 cm
d. 9 cm

____12. If a virtual image is formed 10.0 cm along the principal axis from a convex mirror with a focal length of 15.0 cm, what is the object's distance from the mirror?

a. 30.0 cm
b. 12 cm
c. 6.0 cm
d. 3.0 cm

____13. An object that is 18 cm from a converging lens forms a real image 22.5 cm from the lens. What is the magnification of the image?

a. −1.25
b. 1.25
c. −0.80
d. 0.80

____14. A highly polished finish on a new car provides a ____ surface for ____ reflection.

a. rough; diffused
b. specular; diffused
c. rough; regular
d. smooth; specular

____15. Snow reflects almost all of the light incident upon it. However, a single beam of light is not reflected in the form of parallel rays. This is an example of ____ reflection off of a ____ surface.

a. regular; rough
b. regular; specular
c. diffuse; specular
d. diffuse; rough

____ 16. Light goes from Medium A to Medium B at an angle of incidence of 40°, the angle of refraction is 30°. The velocity of light in Medium B is:

a. less than in A
b. the same as in A
c. greater than in A
d. any of the above, depending on the media

Fill-In-The-Blank Questions
(1 point for each blank)

17. A telescope that uses only lenses for magnification is called a _____ telescope.

18. The human eye lens is meant to focus an object's image onto the _____.

19. The unit of measurement for corrective lenses is called_____.

20. An object that does not allow any light to pass through is considered to be_____.

21. _____ controls how much light enters the eye by changes the size of the pupil. It is also the color part of your eye.

22. A person who has myopia suffers from a lens without adequate local length. A _____ Lens can correct the image.

23. A type of telescope that uses a mirror is typically called a _____ telescope and uses a _____ mirror.

24. A positive magnification signifies _____; A magnification that is less than 1 signifies _____

25. _____ came up with the first **idea** for a microscope.

26. When electrons return to their ground state, the electrons emit_____.

27. The phenomena in spherical lenses of some light rays missing the focal point is called _____.

28. _____ has a refractive index of exactly 1.000.

29. The refractive index of water is_____.

30. _____ first observed that there is a relationship between the angle of incidence and angle of refraction.

31. When an angle of refraction reaches 90 degrees, it is called the _____ angle.

Use the image below o answer questions 31-34
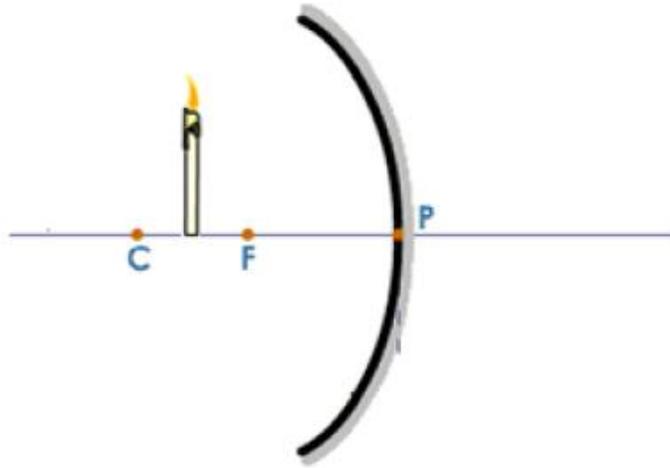
A candle is placed at a distance of 15 cm from of a concave mirror with a focal length of 10 cm. The candle is 4 cm tall. Use ray-tracing to show the image produced by the mirror. (1 point each question)

32. Find the image distance.

33. Is the image real or virtual?

34. Find the size of the image.

35. Is the image upright or inverted?

Use the image below o answer questions 35-38
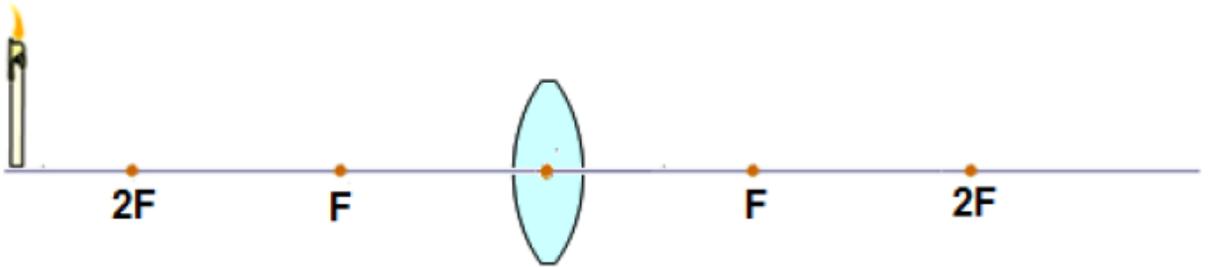
An object is placed at a distance of 60 cm from a converging lens with a focal length of 20 cm. Use ray-tracing to show the image formed by the lens. (1 point each question)

36. Calculate the image distance.

37. Is the image virtual or real?

38. If the object is 10 cm tall, what is the size of the image?

39. Is the image upright or inverted?

40. Why is a beam of white light that passes perpendicularly through a flat pane of glass not dispersed into a spectrum? (8 points)

41. How long does it take light to pass through a plate of glass (index of refraction = 1.5) 1 cm thick? (10 points)

42. The index of refraction of a diamond is 2.42, what is the velocity of light in diamond? (10 points)

43. The energy of a light beam is carried by separate photons, yet we do not perceive light as a series of tiny flashes. Why not? (9 points)

44. Find the critical angle for light going from crown glass (n=1.52) to air (n=1.00) and for light going from crown glass to water (n=1.33). (12 points)

45. Why can light waves travel through a vacuum whereas sound waves cannot? (8 points)