OPTICS

November 4th Scrimmage

SCIENCE OLYMPIAD

™

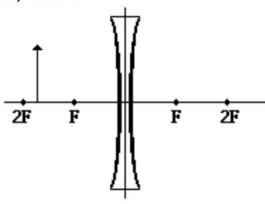*Exploring the World of Science*

Name: _____

School: _____

Directions: DO NOT open the packet until prompted to. The test will be a 50 minute test and answer each question to the best of your ability.

Total: _____/48

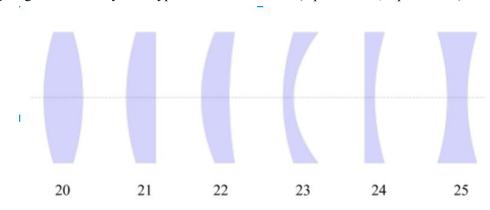Please complete the following ray tracing diagram.

Ray Trace 1

(3 points)

1. In Ray Trace 1, is the image real or virtual? Upright or inverted? (2)

2. In Ray Trace 1, assume the focal length is 10 cm and the object is 18 cm away from the lens. If the object height is 4 cm, find the image height and distance from the lens (2).

3. A compound microscope has an eyepiece that: (1)
     a. uses a real image from the objective as the object and forms its own real image
     b. uses a real image from the objective as the object and forms a virtual image
     c. uses a virtual image from the objective as the object and forms its own virtual image.
     d. uses a virtual image from the objective as the object and forms its own real image

4. What type of reflection is exhibited by your phone screen when the screen is off? (1)

5. What color is formed by adding red and blue paint? What type of color is this? (2)

6. What color is formed by adding red and blue light? (1)

7. What is the critical angle for the air-water boundary? (1)

8. Jane has myopia, and wears Ortho-K contact lenses to see. How do these lenses help improve her vision? (1 point)

9. How can Jeff see the pretty colors on the readable side of a CD? What is a CD an example of? (1 point)

10. What scenario(s) with one mirror produces a real, inverted image of Claudia? (1 point)

11. What scenario(s) with one lens produces a virtual, magnified image of Jessica? (1 point)

12. Alex needs a periscope. Explain to him why do periscopes use prisms instead of mirrors. What type of prisms do periscopes usually have? (2 points)

13. Anthony has a mole of the most visible color to humans (~550 nm).
    a. What color is the most visible color to Alexander? What type of color is it? (1 point)

    b. What is the energy of a mole of this color in Joules? (3 points)

14. Order the following from longest to shortest wavelengths: x-ray, infrared, microwave, radio, ultraviolet, visible, gamma (1 point)

15. What are the primary colors of light? (1 point)

16. What optical device creates a hologram and how? (3 points)

17. What is the speed of light (all digits required)? (2 points)

18. What would happen if you had 10 of polarizing films 90° relative to each other in a counterclockwise direction starting at 0 degrees? (1 point)
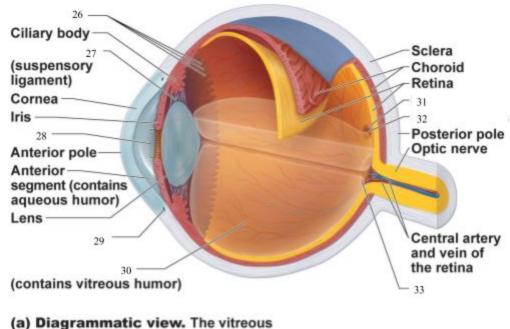
19. If take cornea out of eye, how would that affect vision? (1 point)

Use the following diagram to identify each type of lense for #20-25 (6 points total, 1 point each)

20. _____

21. _____

22. _____

23. _____

24. _____

25. _____

Identify and label all the missing parts of the eye in this diagram for #26-33 (8 points total, 1 for each)

26
Ciliary body
27
(suspensory ligament)
Cornea
Iris
28
Anterior pole
Anterior segment (contains aqueous humor)
Lens
29
30
(contains vitreous humor)

Sclera
Choroid
Retina
31
32
Posterior pole
Optic nerve
Central artery and vein of the retina
33

(a) **Diagrammatic view.** The vitreous humor is illustrated only in the bottom part of the eyeball.

26. _____

27. _____

28. _____

29. _____

30. _____

31. _____

32. _____

33. _____

34. Name the scenario that total internal refraction occurs for light: (1 point)

35. What is the ratio of cones to rods in the human eye? (1 point)