Person's Optics Test

SSSS 2017-18

Competitors' Names:

_____

School Name: _____

All questions are worth one point unless otherwise stated. Show ALL WORK or you may not receive credit. Include correct units whenever possible.

1a. What are the two types of reflection?

1b. What type of reflection is present in a normal sheet of paper?

1c. Draw a diagram of the incident and reflected light rays for that reflection.

2. A ray of light passes from air into a block of the newly discovered material Entomologium. It refracts at an angle of 25° to the normal. Given that the refractive index of Entomologium equals 1.346, what is the incident angle?

3. A triangular prism of Entomologium has an internal angle of 62°. What is the angle of minimum deviation?

4. What is the angle of minimum deviation of rectangular slab of Entomologium?

5. A convex thin lens made of Entomologium has surface radii R1 = 4cm and R2 = -2 cm. What is the power of this lens in air, in diopters?

6. Calculate the critical angle for an Entomologium-Air boundary.

7. What does the angle of deviation refer to in a prism?

8. A ray of light traveling from air into an unknown material slows to $1.23 * 10^8$ meters/second. What is the index of refraction of the material?

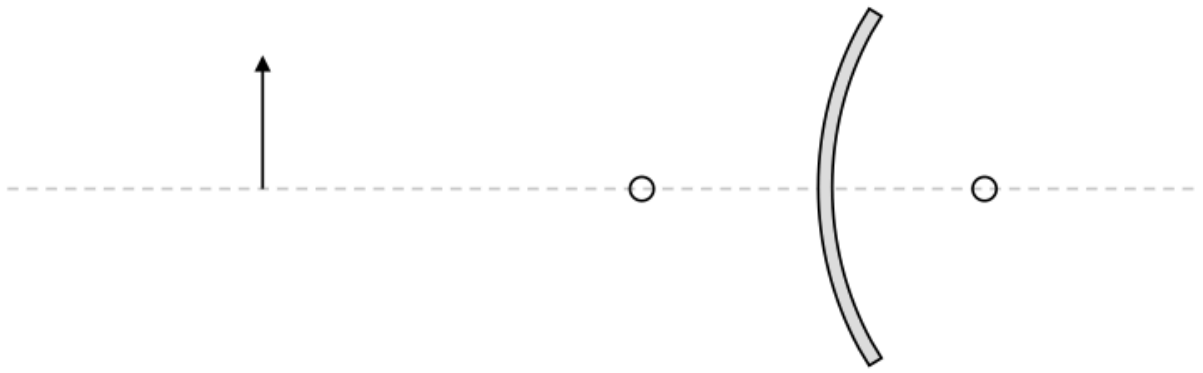
9. If you are 1.4 meters tall, what is the smallest size a plane mirror can be in order for you to see your entire body?

10. Fill out the following table for a concave mirror. 0.25 points per cell. (Table on next page)

Object Location	Image Location	Image Size (Larger/Smaller than object)	Image Type (Real/Virtual)	Upright/Inverted
Beyond center of curvature				
At center of curvature				
Between center of curvature and focal point				
At focal point				
In front of focal point				

11. Is spherical aberration present in a concave mirror? If so, how can it be reduced? 2 points.

12. Complete the ray diagram for this mirror. 2 points.



13. List 3 differences each between compound and stereoscopic microscopes (3 in compound, 3 in stereoscopic). 1 point each.

Compound	Stereoscopic

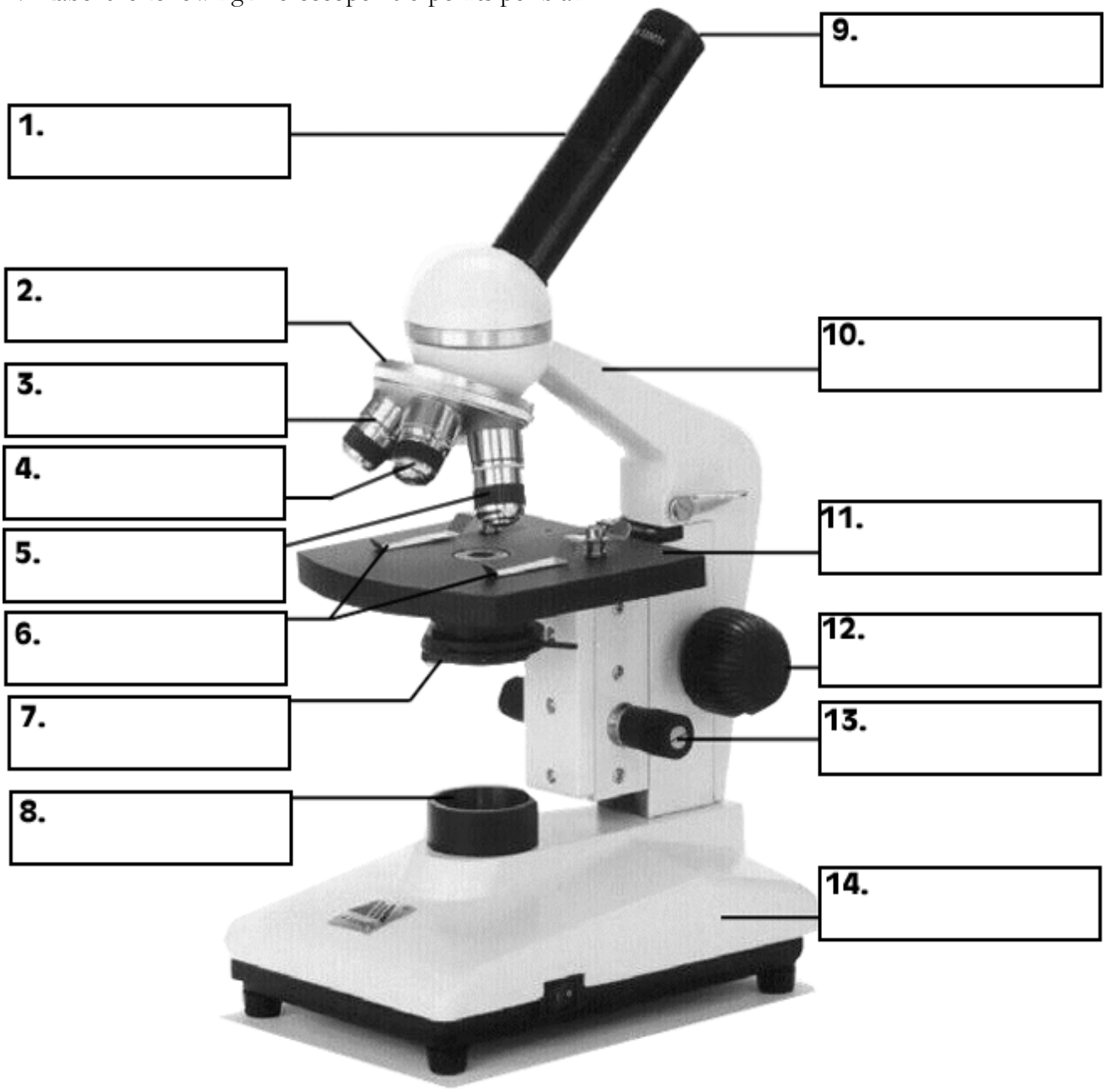
14. List 2 advantages each of refractor and reflector telescopes. (Two in refractor, two in reflector) 1 point each.

Refractor	Reflector

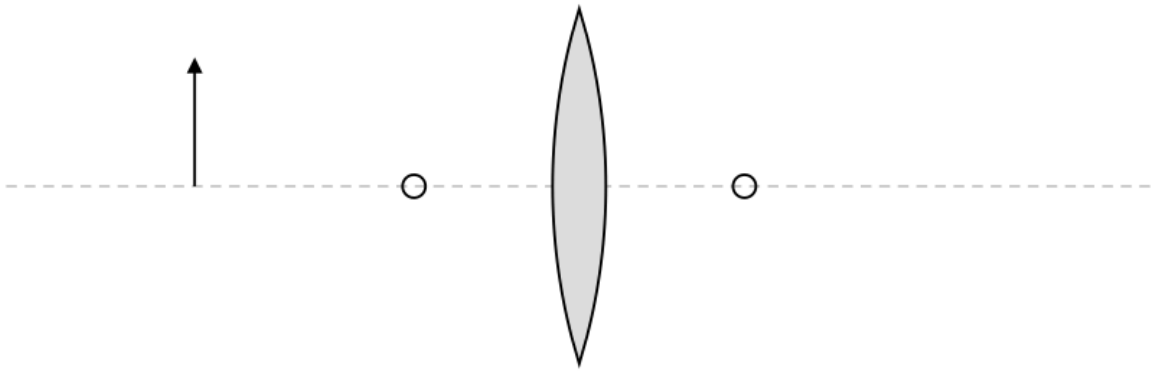
15. What kind of telescopes are all modern research telescopes?

16. What happens to the aperture on a camera as the f-stop gets larger?

17. Label the following microscope. 0.5 points per blank.



18. Complete the ray diagram. 2 points.



19. What is the focal length of a convex lens when the object is 10 cm away and the image is 30 centimeters away?

20. Where is rhodopsin stored, and what happens once it is exposed to light? 2 points.

21. In a dark room, a yellow light is shined on a paper containing blue pigment. What color does the paper appear to be when the light shines?

22. What are the three conditions necessary in order to view a rainbow? 3 points: 1 for each condition.

23. Explain why the sky appears blue. 2 points.

24. What is the focal length of a concave mirror given that its radius of curvature is 123 cm?

25a. Where is the macula located and what is it responsible for?

25b. Give three SPECIFIC examples of its usage. 1 point for each example (3 points total).

26. What type of spectrum is the light from the Sun an example of?

27. A 0.32 m tall lamp is placed 46.0 centimeters away from a concave mirror with focal length of 12.0 cm. What is the image distance and size? Two points: one each for distance and size.

28. Light reflects off of a lake. What is the relation between the polarized light and the lake's surface?

29. A transparent piece of plastic is placed between two polarizing plates. What do the concentrated areas of colored bands signify?

30. What condition does a bulging or elongated eyeball typically result in?

Complete the following statements.

31. Yellow, magenta, and cyan combine to form _____.

32. The side mirrors in a car are examples of _____ mirrors.

33. _____ muscles contract during lens accommodation.

34. Light traveling _____ to a film's polarizing axis is blocked.

35. In a convex mirror, as the object distance decreases, the image size _____.

True/False. 0.5 points each.

_____ 36. Light rays bend towards the normal when traveling into a medium with a lower refractive index.

_____ 37. Total internal reflection occurs when the light ray travels from a denser medium to a less dense medium and the angle of incidence is smaller than the critical angle.

_____ 38. Convex mirrors produce both real and virtual images.

_____ 39. Diverging lenses reduce the effects of hyperopia.

_____ 40. In a plane mirror, your dimensions are the same as the image's dimensions.

_____ 41. Reflector telescopes suffer from chromatic aberrations.

_____ 42. Red, green, and blue light can be combined to form white light.

_____ 43. Magnifying glasses utilize concave lenses.

_____ 44. The rods in the eye are sensitive to color.

_____ 45. Red and blue are complementary colors of light.