Optics, Out of Sight
JC Booth Invitational, 1/22/11

Team Name: _____ Score: _____

Team Members: _____

BE SURE TO USE THE CORRECT NUMBER OF SIGNIFICANT FIGURES AND SI UNITS.

1. What is the energy of an infrared wave with a wavelength of 12.5μm? _____

2. What is the white part of the eye called? _____

3. When a light source travels toward you at speeds close to the speed of light, the result is a red shift. The perceived wavelength increases / decreases (circle one), the frequency increases / decreases (circle one), and the energy increases / decreases (circle one).

4. When a light source travels away from you at speeds close to the speed of light, the result is a blue shift. The perceived wavelength increases / decreases (circle one), the frequency increases / decreases (circle one), and the energy increases / decreases (circle one).

5. What is the frequency of an electromagnetic wave with a wavelength of 87nm? _____

6. What is the colored part of the eye called? _____

7. Put the following group of waves in order from lowest frequency to highest frequency. Infrared, Microwaves, Visible light, Gamma rays, Radio waves, Ultraviolet, and Xrays.

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____

8. What are the purpose of rods? _____

_____

9. What are the purpose of cones? _____

_____

10. Why does the eye have a blind spot? _____

_____

_____

11. Red light + blue light yield what color light? _____

12. Red light + green light yield what color light? _____

13. Green light + blue light yield what color light? _____

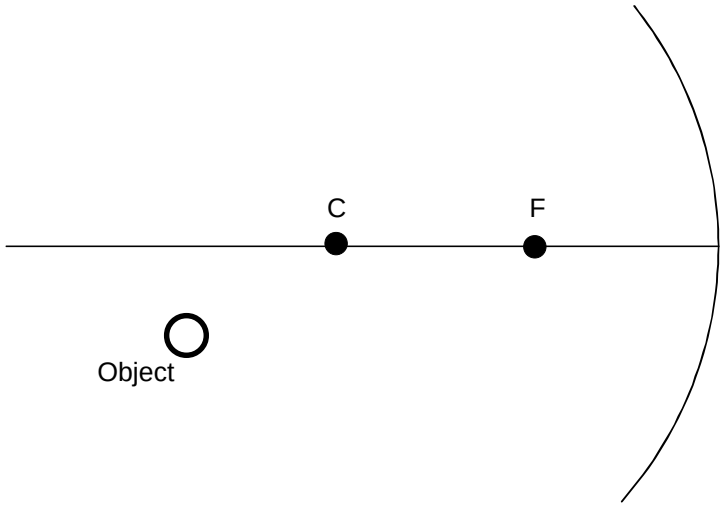
14. A magenta filter absorbs what color light? _____

15. Magenta light shines on a piece of paper contraining a yellow pigment. What color does the paper appear?

16. Cyan light shines on red paper. What color does the paper appear? _____

17. You are given a generic converging lens with an unknown focal length. Describe how you would determine the focal length.

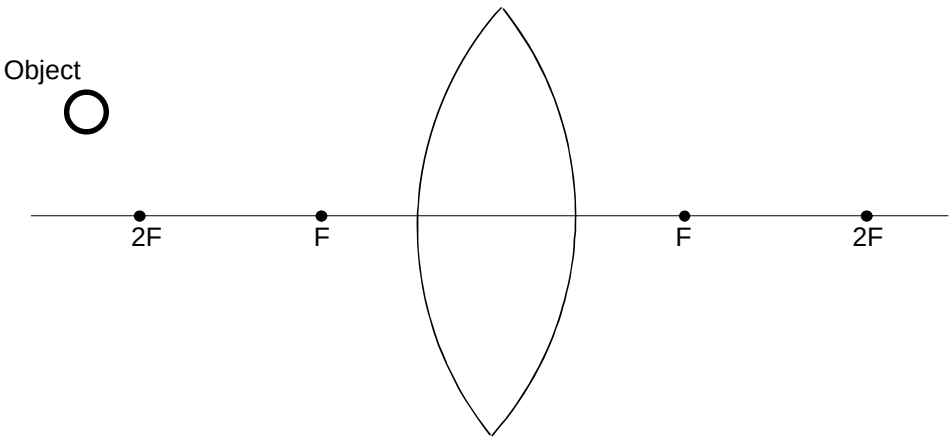
18. Show the ray diagram for the concave mirror and object below.



19. A 7.4cm pencil is placed a distance of 43.8cm from a concave mirror with a focal length of 15.8cm. Determine the image location, image orientation, image size, and image type.

Location: _____
Orientation: _____
Size: _____
Type: _____

20. Show the ray diagram for the converging lens and object below.



21. A diverging lens has a focal length of -10.3cm. A 9.2 cm tall object is placed 25.6cm from the lens' surface. Determine the image location, image orientation, image size, and image type.

Location: _____
Orientation: _____
Size: _____
Type: _____

22. What is the period of a wave that has a frequency of 1.23Thz? _____

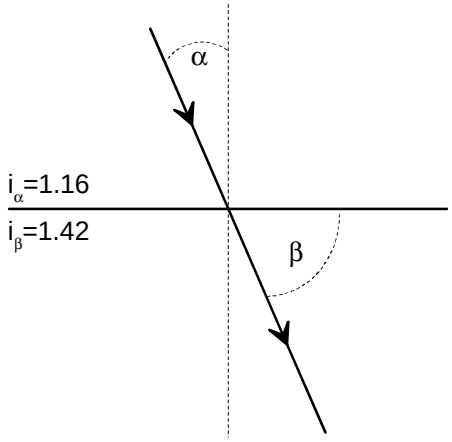
23. What is the period of an electromagnetic wave that has a wavelength of 482nm? _____

24. If light travels through a medium at a speed of 2.67×10^8 m/s, what is the material's index of refraction?

_____

25. Light shines from water, with an index of refaction of 1.333, to air, with an index of refraction of 1. What is the critical angle? _____

26. Light shines from a material with index of refraction i_α of 1.16 and an angle α of 19^o into a material with an index of refraction i_β of 1.42. What is the angle β? _____



27. Myopia is corrected with what type of eyeglass lens? _____

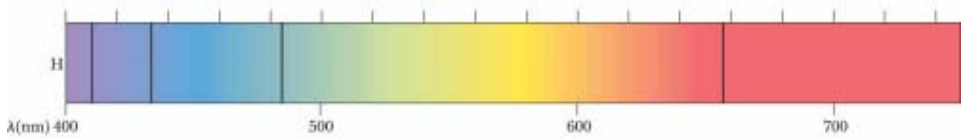
28. Hyperopia is corrected with what type of eyeglass lens? _____

29. Hydrogen gas is heated up and the result is below. What is it called? _____

_____

30. Hydrogen gas is cooled and white light shines through it. The result is below. What is it called?

_____



31. When does a concave mirror produce upright images? _____

_____

32. When does a convex mirror produce virtual images? _____

_____

33. When is the image in a converging lens upright and larger than the object? _____

34. When is the image in a converging lens the same size as the object, but inverted? _____

35. What color light does cyan paint absorb? _____

36. Which does the human eye have more of, rods or cones? _____

37. When does a diverging lens produce upright and virtual images? _____

38. If white light shines upon an object that absorbs green, what color does the object appear?

39. What type of images do flat, plane mirrors always produce? _____

40. What orientation of images do flat, plane mirrors always produce? _____

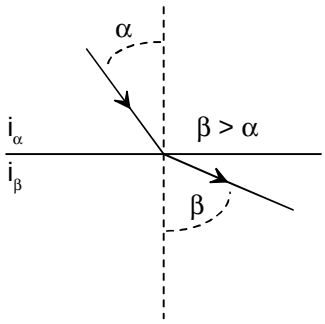
41. My hat appears green because it has a dye that absorbs what color(s) of light? _____

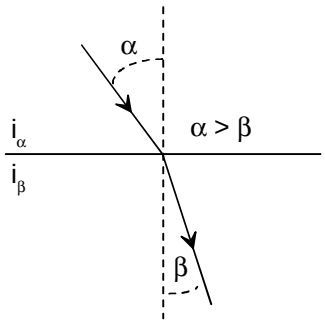
42. If green and blue light shine on a paper and it appears cyan, what color is the paper? _____

43. If yellow light shines on a paper that absorbs cyan light, what color does the paper appear? _____

44. Why is it difficult to see a poorly lit object at night if you look directly at it? _____

45. Light shines from a material with index of refraction i_α of 1.23 and an angle α into a material with an index of refraction i_β of 1.56. The refraction angle is β. Circle the correct diagram describing this.





46. If a material's index of refraction is 1.56, what is the speed of light through that material? _____

47. Superman is carrying a red lantern with wavelength 650nm. He flies toward you at a speed of 2.7×10^8 m/s. What is the observed wavelength? _____

T I E B R E A K E R

48. Superman has a blue light of wavelength 480nm. How fast must he fly away from you so that his light appears orange, with a wavelength of 600nm? _____