Name _____

Group Members _____

Spherical Aberrations

1.
    a. Based on your knowledge of geometric optics and aberration theory, define spherical aberrations.

    b. Is this an on or off axis aberration? Explain.

2. Sketch a ray diagram below of your prediction of the spherical aberrations for a planar-convex lens when light is incident from the following: (Use a straight edge to create your diagram and try to keep each sketch at the same scale for comparison)
    a. Planar side

_____

    b. Curved side

_____

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      c.   Define and identify on your diagram with light incident on the planar side the circle of least confusion.

3.   Use the experimental setup shown below to observe spherical aberration with the light incident on the planar and curved side of the lens. Was your prediction correct? Explain the difference(s) between the effects of the spherical aberration when light is incident from the planar and curved sides.

4.   What factors affect spherical aberrations?

5.   Using the GeoGebra simulation found at www.geogebra.org/m/r46vBVCj , describe the changes you observe for the following (note the units for the radius of curvature are arbitrary):

    a.   Vary R_1, with $R_2 = 100$, $n_{Lens} = 1.5$ and $n_{Medium} = 1.0$.

    b.   Vary R_2, with $R_1 = 100$ and $n_{Lens} = 1.5$ and $n_{Medium} = 1.0$.

    c.   Vary n_{Lens} with $R_1 = 100$ $R_2 = 4$, and $n_{Medium} = 1.0$.

    d.   Vary n_{medium} with $R_1 = 4$, $R_2 = 4$ and $n_{Lens} = 1.5$.

6.   After your observations, do you have any additional factors that affect spherical aberrations to add to your list in question #4?

7.   Give some examples of how spherical aberrations can be eliminated/reduced.