Solution to immersion microscope objective

1. The object is immersed in the same index as the first hyperhemispheric lens so the first plane surface of that lens has no effect. The second surface of this lens is used for the Weierstrass points (stigmatic points) so the imaging on axis is perfect. Abbe sine condition is also verified so it is aplanetic (no coma). The angle of the ray with respect to the axis is decreased.
   Then the meniscus also does perfect aplanetic imaging: first surface is used for its center of curvature, second surface for its Weierstrass points. The angle of the ray is decreased even further. Then we can use a simpler lens (with a larger magnification) because the angle is small and we are closer to paraxial conditions.

2. distance between the object A and the hyperhemispherical lens: 1mm
   intermediate image $A'_{in}$ formed by that first lens: 3.5mm to the left of the first surface of the lens.

3. Lateral (= transverse) magnification through the hyperhemispheric lens: 2.25. Abbe sine condition (aplanetism) is verified.

4. Max angle between the ray emerging from the hyperhemispheric lens and the optical axis: 38.9°.
   Numerical aperture in the object plane: 1.414 (angle 70.5°)

5. First surface of the meniscus at 2.5mm from the second surface of the hyperhemispheric lens.
   Thickness of the meniscus on axis: 2.5mm
   Position of the second intermediate image $A''_{in}$: 18.75mm to the left of the second surface of the meniscus.
   Abbe sine condition is satisfied for each lens, so it is verified for the combination {hyperhemispheric lens + meniscus}

6. Transverse magnification through the whole meniscus: 1.5 (be careful, even though the object is at the center of the first surface, the lateral magnification is not equal to1 but to 1/n)
   Maximum angle for the emerging rays after the meniscus: 24.8° (the incident angle was limited by the first lens)

7. Focal length of the thin lens: 17mm
   Lateral magnification of the whole objective: -26.3.
   Maximum angle of the emerging rays: -3.1°