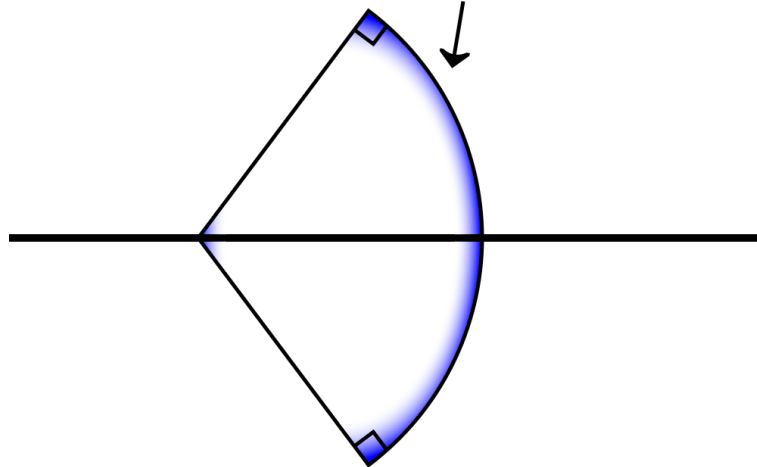**Problem 1**. The figure below shows a light ray incident on a spherical mirror. The mirror has its center on the optical axis.

a) Continue the path of the light ray. Explain. (2p)

Lösning: ....

Problem 2. A photographer uses a thin symmetrical spherical lens (f-number $= 8$) with a nominal focal length of 800 mm to make images of stars on standard 36×24 mm film. The index of refraction of the lens is given as $n(\lambda) = A + B/\lambda^2$ with $A = 1.466$ and $B = 4.153 \cdot 10^{-15}$ m^2.

a) For the first exposures, he is using a filter that only transmits the hydrogen alpha line at 653.6 nm. Theoretically, what would be the smallest possible images of the stars on the film? Explain. (1p)

Lösning:

b) In practice, the images turn out to be larger. What causes this? How would you proceed to calculate the expected size of the star images? (I am not asking to do the calculation.) (1p)

Lösning:

c) For later exposures, the photographer looks at the full visible spectrum. He uses a diaphragm to achieve better resolution. What is the smallest possible size of the stars on the film? (1p)

Lösning:

Problem 3. Suppose you want to design a quarter-wave plate using calcite which has $n_o = 1.6584$ and $n_e = 1.4864$.

a) How should the optic axis be aligned? Explain. (1p)

Lösning: ....

b) How thick should the plate be for use with light with wavelength 550 nm? (1p)

Lösning:

c) If you want to use the plate to produce circularly polarized light from linearly polarized light, explain how the linear polarization should be oriented. (1p)

Lösning:

Problem 4. A 632 nm laser ray travels through a fishtank with water to a screen behind the tank. A 600 lines/mm grating is mounted inside the tank, on the front window. The tank is 40 cm wide, the laser beam is normal to the windows. The distance between the tank and the screen is 60 cm.
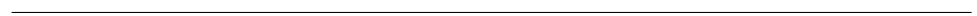
a) Where does one see the first-order diffraction spots on the screen? (2p)

Lösning:

b) How does the calculation change when the grating is on the outside of the tank? (1p)

Lösning:

Växjö universitet

TENTAMEN

Institution: MSI, Fysik

Examinator: Pieter Kuiper

Datum: November 21, 2009

Tid:

Plats:

Kurskod: FY3083

Kurs/provmoment: Optics

Hjälpmedel: ruler, calculator, Hecht or any other books about optics, notes

Namn: ....

Adress: ....

....

Personnummer: □□□□□□ – □□□□

Please write your solutions on this exam. Write your name on any additional pages.

This exam has 4 problems.

Lycka till!

	1	2	3	4	5	Summa	Betyg
Inlämnad							
Poäng							