Date-2077/11/23

EXPERIMENT NO. 8

NAME OF EXPERIMENT: TO DETERMINE THE FOCAL LENGTH OF A CONCAVE MIRROR

APPARATUS REQUIRED

1. Optical bench with adjustable pin and mirror holders
2. Concave mirror
3. One screen

THEORY

A beam of light proceeding from O, the top of the object at the centre of curvature C, in a direction parallel to the principal axis of a concave mirror will after reflection, pass through the principle focus F. Any ray starting from O and passing through F, falls on the mirror at A' and after reflection pass along AI meeting the previous reflected ray at I.

Then I is the position of the real and inverted image of O i.e. IC is the real and inverted image of OC. formed at the centre of curvature itself. Then the distance PC is the radius of curvature of the mirror.

Hence, focal length $f = \frac{1}{2} r$.

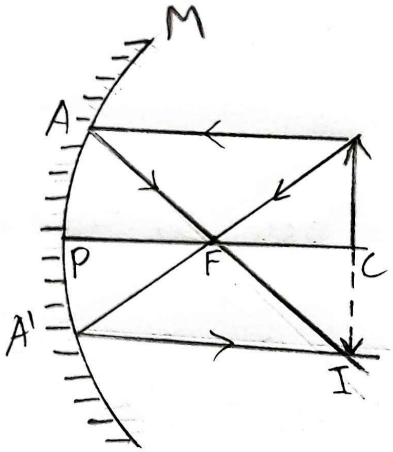

fig. Concave mirror

PROCESS

1. The concave mirror M and the object pin O ~~are~~ were mounted on suitable and adjustable stands on the optical bench. The height of the pin was to be adjusted at the height of the pole of the mirror.
2. The rough focal length of the mirror was found out by focussing a distant object on a screen placed in front of the mirror. When the distinct ~~object~~ image was seen on the ~~mirror~~ screen, the distance between the pin and the screen which gives the rough focal length was measured.
3. The pin mounted on the adjustable stand was placed at a distance equal to twice the rough focal length. Then viewing from the front, it was seen whether the pin and its inverted image as seen through the mirror just touch each other or not. If not the height of the pin or the inclination of the mirror was adjusted as required.
4. In this condition, the eye of the observer was moved sideways. If there was parallax, the object and the inverted image will have relative displacement. In case the inverted image moved ahead of the object point, the pin was moved ~~ahead~~ away from the mirror. i.e. the distance was increased. If the erect pin moved ahead, the distance of the pin was decreased. The adjustment was done till parallax was completely eliminated.
5. The positions of the mirror and the object pin were

noted from the optical bench. The difference between these two readings gives the observed radius of curvature.

6. The above operations were repeated 5 times.
7. Index rod correction was then applied. To do this the length of the rod was measured. It was held by allowing one end touching the pole of the mirror, the other end touching the tip of the object pin. Let distance (length of rod) be x. In this condition, the positions of the pin stand and the mirror stand were read from the optical bench. Let it be y. If $x=y$, no error, there is no need of any correction. If $x>y$, $x-y$ = correction to be added to the observed distance, if $x<y$, $x-y$ = correction to be subtracted from the observed distance.

OBSERVATION

Length of the index rod $= x =$ _____ cm.
Observed distance $= y =$ _____ cm.
Index correction $= x-y =$ _____ cm.

OBSERVATION TABLE

No. of Obs	Position of the Concave mirror cm.	Position of the Object pin cm	Observed distance cm. (r)	$f = \frac{1}{2} r$ cm
1.	58.4 cm	27.7	30.7	15.35
2.	54.5	23.8	30.7	15.35
3.	68.5	37.3	31.2	15.6

4.	80.6	49.2	31.4	15.7
5.	52.4	20.9	31.4	15.7

Hence, the focal length = 15.54 cm

RESULT

Hence, the focal length of a concave mirror was determined by single pin method parallax method.

PRECAUTIONS

1. To get a well illuminated and distinct object, the distant object should be well illuminated.
2. A concave mirror should be always placed near an open window.
3. There should not be any hurdle between the rays of light from the object and the concave mirror.
4. The mirror holder along with the mirror should be perpendicular to the measuring scale.

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27/12/22