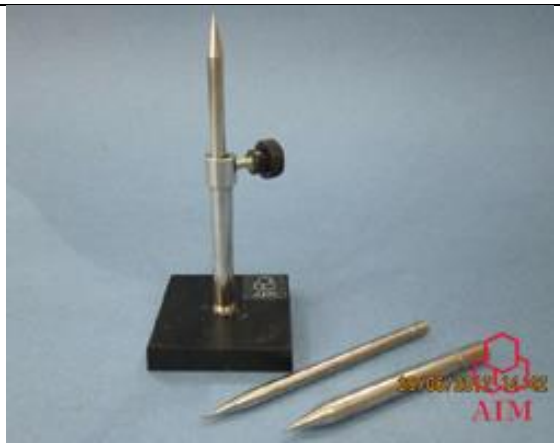
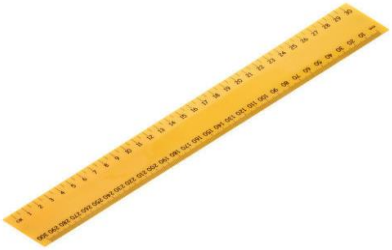
AIM

To find the value of *'v'* for different values of *'u'* in case of concave mirror and to find the focal length.

APPARATUS AND MATERIAL REQUIRED

	
An optical bench	two sharp-edged needle (pins)
	
concave lens of less than 20 cm focal length	three uprights (with clamps)
metre scale	

PRINCIPLE

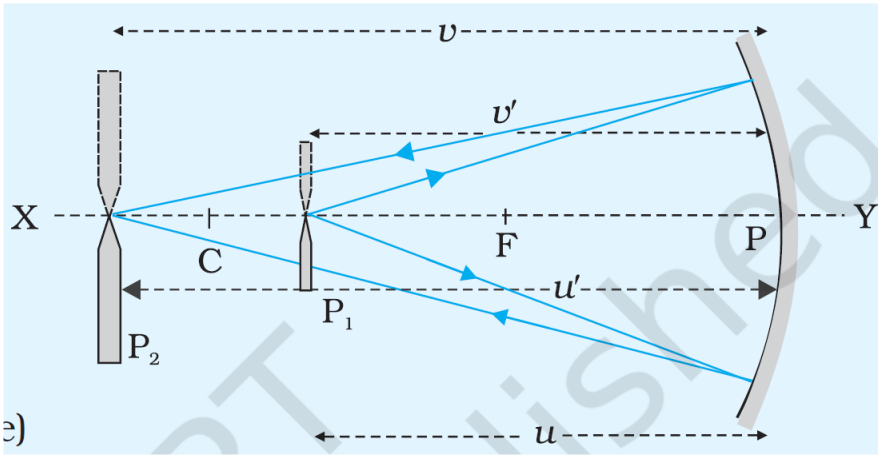
According to mirror formula $\frac{1}{f}=\frac{1}{v}+\frac{1}{u}$ or $f=\frac{uv}{u+v}$

PROCEDURE

1. Obtain approximate value of the focal length of concave mirror by focusing the image of a distant object.

   Obtain bright and clear image of a distant building or tree on a plane wall or a sheet of paper and measure

the distance between the mirror and the image which gives the approximate focal length of the concave mirror.

2. Place the optical bench on a rigid table. Make it horizontal using a spirit level and levelling screws.
3. Clamp the concave mirror on an upright and mount it vertically near one end of the optical bench. Move an object pin P_1 on the optical bench back and forth so that its image is formed at the same height. Make slight adjustments of the height of the pin or the mirror inclination. This procedure ensures that the principal axis of the mirror is parallel to the optical bench.
4. Place another vertically mounted sharp and bright pin P_2 in front of the reflecting surface of the concave mirror. Adjust the pins P_1 and P_2 so that the height of the tips of these pins become equal to the height of the pole P of the mirror from the base of the optical bench.
5. 

6. Move the pin P_1 away from the mirror and place it almost at 2F. An inverted image of same size as the pin should be visible.
7. Now place another pin P_2 on the bench, adjust its height to be almost the same as the earlier pin. Place a piece of paper on the tip of one pin, take this as the object pin.
8. Place the pin with paper at a distance lying between F and 2F.
9. Locate the image of the pin using the other pin. Remember that parallax has to be removed between the image and the pin.
10. Note the values of *u* and *v* i.e., the distances of the object and image pins from the mirror respectively.
11. Repeat the experiment for at least five different positions of the object and determine the corresponding values of *v*. Record your observations in tabular form. Find the value of focal length, *f*.
12. https://www.youtube.com/watch?v=65py8wo74ZA **OR** https://unacademy.com/lesson/focal-length-of-concave-mirror/272QZZKP **OR** https://www.youtube.com/watch?v=giRUr0IjOIE

OBSERVATIONS

1. Rough focal length of concave mirror = ... cm

2. Actual distance of the object from mirror using index needle, l_0 = ... cm
3. Observed distance of object from mirror, $l_0^{'}$ = Position of mirror upright – position of object pin upright on scale.

= ... cm – ... cm

=...cm

S.No.	Mirror position M(cm)	Object needle position P_1(cm)	Image needle position P_2(cm)	Object distance u (cm)	Image distance v (cm)	$f = \frac{uv}{u+v}$	Δf
1							
2							
3							
4							
5							
6							
					Mean		

CALCULATIONS

- Calculate the corrected values of *u* and *v*. Compute the value of *f*.
- Tabulate them in the table and find the mean value of the focal length of the given concave mirror
- Error $\Delta f = f^2\left[\frac{\Delta u}{u^2} + \frac{\Delta v}{v^2}\right]$

RESULT

The focal length of the given concave mirror is $f \pm \Delta f$ = ...cm (here *f* is mean value of the focal length)

PRECAUTIONS [ONLY TWO]

1. The uprights supporting the optical elements should be rigid and mounted vertically.
2. The object pin should be kept in between the centre of curvature and the focus of the mirror.
3. The aperture of mirror should be small otherwise the image formed will not be distinct.
4. Eye should be placed at a distance of distinct vision (25 cm) from the image needle.
5. The tip of the inverted image of the object pin must touch the tip of the image pin and must not overlap. It should be ensured while removing the parallax.
6. The image and the object pins should not be interchanged during the course of the experiment.
7. The corrected values of the distances *u* and *v* must be put in the formula for calculating *f* and then a mean value of *f* should be taken. Calculations for *f* must not be made using the mean values of *u* and *v*.

SOURCES OF ERROR

1. An error may arise in the observations if the top of the optical bench is not horizontal and similarly if the tips of pins and pole of the mirror are not at the same horizontal level.
2. The concave mirror should be front-coated, otherwise multiple reflections will come from the reflecting surface of the mirror.