Activity

Topic

Making of Clinometer

Objective

To make a mathematical instrument 'clinometer' to measure the height of a distant object.

Previous Knowledge Required

1. Concept of angle of elevation and depression.
2. Properties of right-angled triangle.

Materials Required

Small pipe or drinking straw, a wooden board, wooden strip, thread, weight, screw, geometry box, etc.

Procedure

1. Prepare a semi-circular protractor with the help of geometry box. Mark degrees in sexagesimal scale with 0° at the lowest and 10 to 90° proceeding both clockwise and anti-clockwise.
2. Fix a hollow pipe along the diameter of its fig. (i).
3. Punch a whole at the centre of a semicircle.
4. Suspend a weight (w) from a small nail fixed to the centre.
5. Ensure that the weight at the end of the string hangs below the protractor.

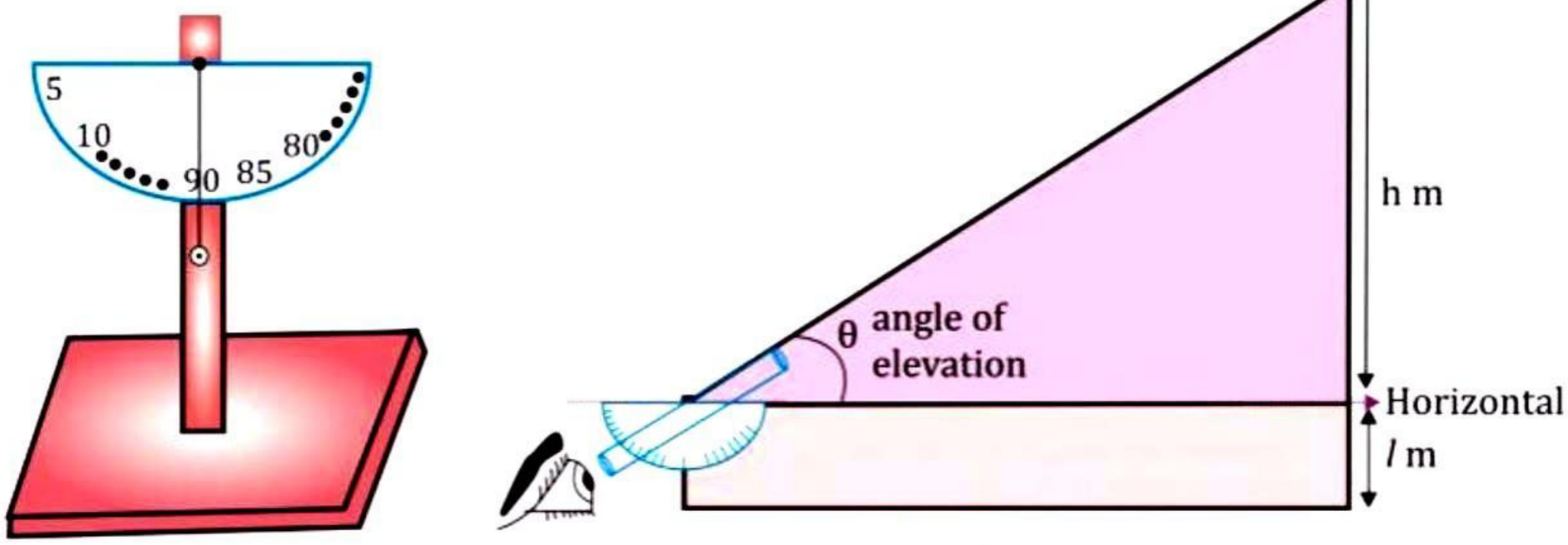


Fig.(i)

Determining the Height of an Object:

1. Measure the distance of the object from you. Let it is d.

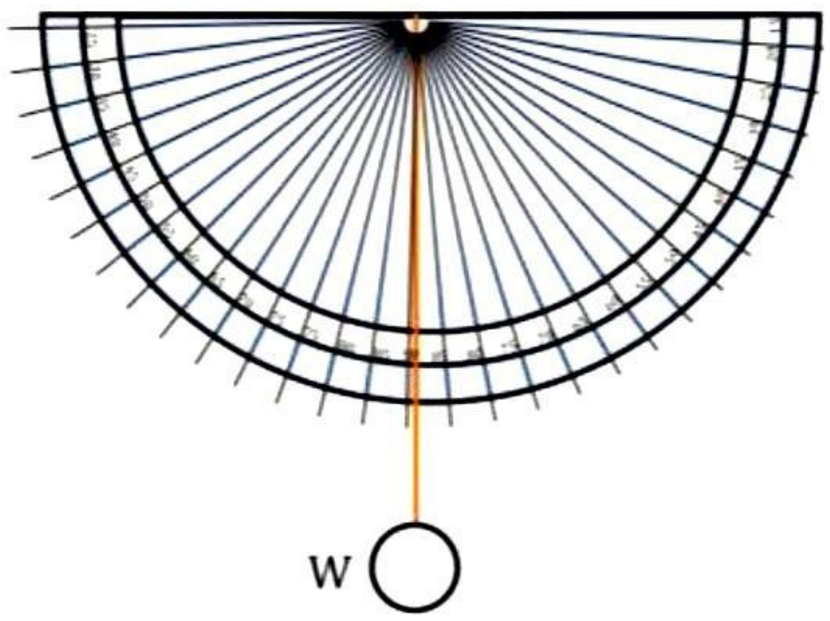
2. Look through the hollow pipe straw at the top of the object by rotating it gradually. Make sure that you can clearly see the top of the object.
3. Hold the clinometer steady and record the angle which the string makes on the scale of the clinometer. This angle is the required angle of elevation, let be θ.
4. Using trigonometric ratio:

$$\tan\theta = \frac{\text{height}}{\text{distance}} = \frac{h}{d}$$

$$h = d \cdot \tan\theta$$

Observation

1. Angle of elevation 0.
2. Distance between object and clinometer d.
3. Height of clinometer/(let)
4. Therefore, height of object = l + h = l + dtan θ



Clinometer

Result

Angle of elevation can be found easily.

Learning Outcome

Students learn how to determine the angle of elevation of an object by clinometer and use of it to determine the height of an object at a known distance.

Activity Time

1. If the height of clinometer is 3 m, distance between object and clinometer is 27 m and angle of elevation is 45°. What is the height of an object?
2. A kite is flying at a height of $40\sqrt{3}$ metre from the ground level, attached to a string inclined at 60° to the horizontal. What is the length of the string?

VIVA VOCE

Q 1. What is trigonometry

Ans. It is an important branch of mathematics. In this branch we deal with the relation and measurement of the sides and the angles of a triangle.

Q 2. How many trigonometric ratios are there for an acute angle in a right-angled triangle?

Ans. 6

Q 3. Is each trigonometric ratio a real number?

Ans. Yes

Q 4. Which triangle is used in trigonometry?

Ans. Right-angled triangle

Q 5. If tan A = cot B, then is it right A + B = 90°?

Ans. Yes

MULTIPLE CHOICE QUESTIONS

Q 1. If $3\cot A = 4$, then $\frac{1-\tan^2 A}{1+\tan^2 A}$ is equal to:

(a) $\cos^2 A - \sin^2 A$ (b) $\sin^2 A - \cos^2 A$

(c) $\sin^2 A + \cos^2 A$ (d) None of these

Q 2. In $\triangle ABC$, right angled at B, if ta n $A = \frac{1}{\sqrt{3}}$, then the value of $\sin A.\cos C + \cos A.\sin C$ is:

(a) 0 (b) 1 (c) 2 (d) None of these

Q 3. In $\triangle$ ABC right angled at C if $\angle A = \angle B$, then which is correct?

(a) $\cos A = \cos B$ (b) $\cos A = \cos C$ (c) $\cos B = \cos C$ (d) None of these

Q 4. Choose the correct option for, $\frac{2\tan 30^\circ}{1+\tan^2 30^\circ} =$

(a) $\sin 60^\circ$ (b) $\cos 60^\circ$ (c) $\tan 60^\circ$ (d) $\sin 30^\circ$

Q 5. If $\sin(A+B) = 1, \cos(A-B) = 1, 0^\circ < A+B \leq 90^\circ, A \geq B$, then A and B are respectively:

(a) 45° and 45° (b) 45° and 15° (c) 30° and 30° (d) 30° and 15°

Answer Key

1.(a)	2.(b)	3.(a)	4.(a)	5.(a)