# Course Title:Physical chemistry
course code:CHEM-5101

TRIGNOMETRIC FUNCTIONS

Trigonometry

➢ Trigonometry is derived from Greek words *trigonon* (three angles) and *metron* (measure).

➢ Trigonometry is the branch of mathematics which deals with triangles, particularly triangles in a plane where one angle of the triangle is 90 degrees

➢ Triangles on a sphere are also studied, in spherical trigonometry.

➢ Trigonometry specifically deals with the relationships between the sides and the angles of triangles, that is, on the trigonometric functions, and with calculations based on these functions.
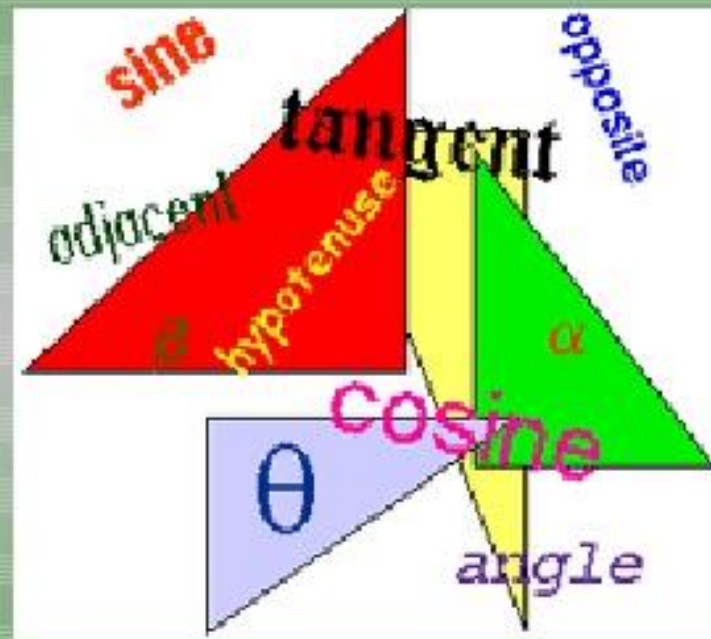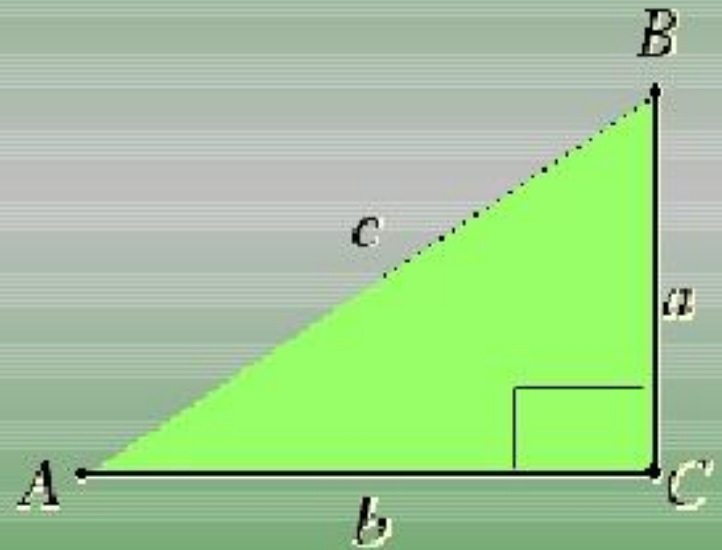
Right Triangle

- A triangle in which one angle is equal to 90° is called right triangle.

- The side opposite to the right angle is known as hypotenuse.

  AB is the hypotenuse
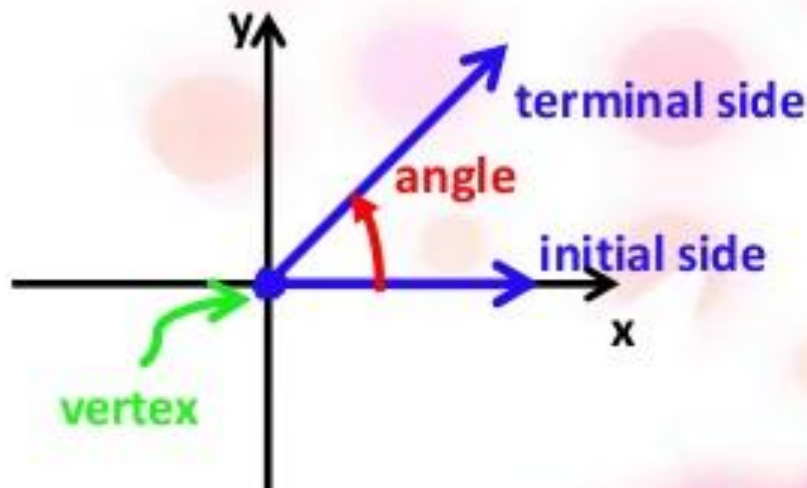
- The other two sides are known as legs.

  AC and BC are the legs

Trigonometry deals with Right Triangles
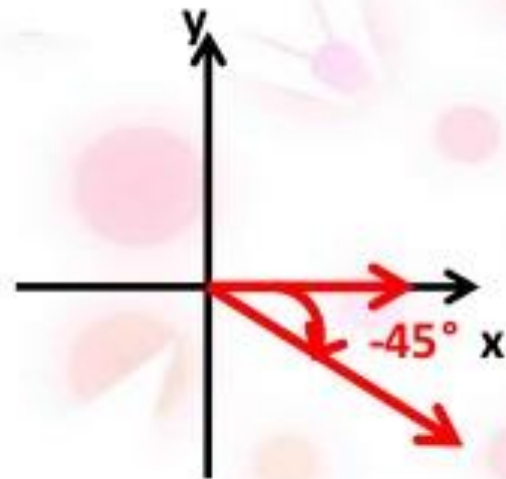
4

ANGLES AND THEIR MEASURE

- An angle is determined by rotating a ray about about its endpoint.
- The starting position: **initial side**
- The position after rotation: **terminal side**
- The point connecting the two sides: **vertex**

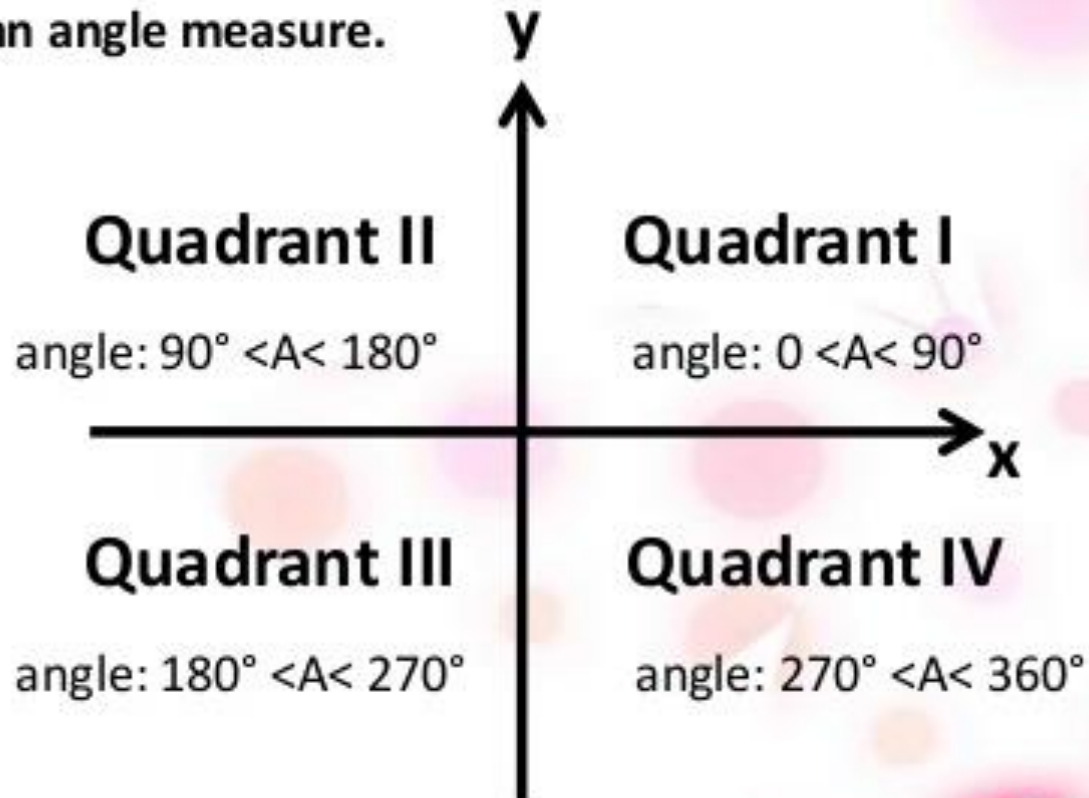**Positive angles** are generated with **anticlockwise rotation.**
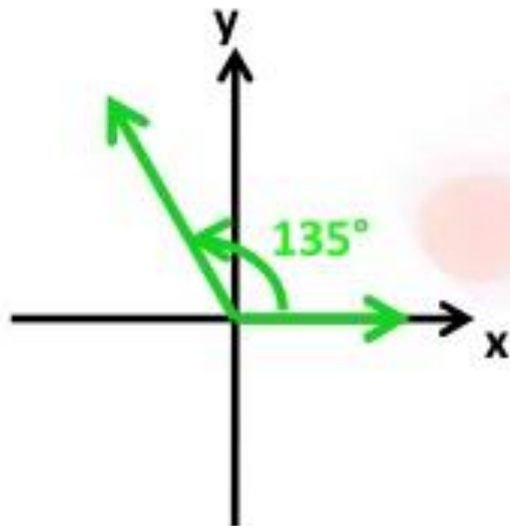
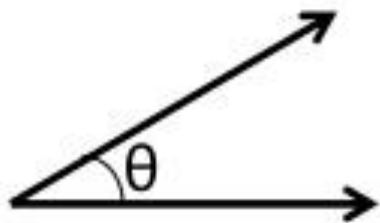**Negative angles** are generated with **clockwise rotation.**

QUADRANT

'A' represent an angle measure.

Quadrant II

angle: $90° < A < 180°$

Quadrant I

angle: $0 < A < 90°$

Quadrant III

angle: $180° < A < 270°$

Quadrant IV

angle: $270° < A < 360°$

ANGLES

θ

Acute angle (0°< θ < 90°)

θ

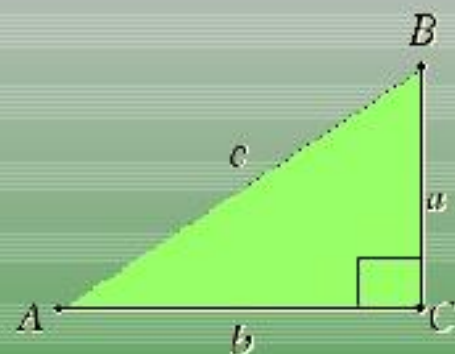Obtuse angle (90° <θ< 180°)

90°
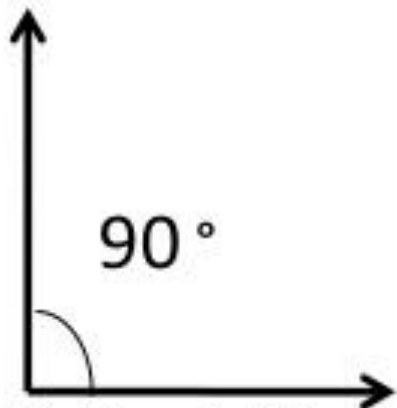
Right angle (¼ rotation)

180°

Straight angle (1/2 rotation)

Pythagoras Theorem

➢In any right triangle, the area of the square whose side is the hypotenuse is equal to the sum of areas of the squares whose sides are the two legs.

➢In the figure

$$AB^2 = BC^2 + AC^2$$

Trigonometric ratios

➢ Sine(sin)   opposite side/hypotenuse

➢ Cosine(cos)   adjacent side/hypotenuse

➢ Tangent(tan)   opposite side/adjacent side

➢ Cosecant(cosec)   hypotenuse/opposite side

➢ Secant(sec)   hypotenuse/adjacent side

➢ Cotangent(cot)   adjacent side/opposite side

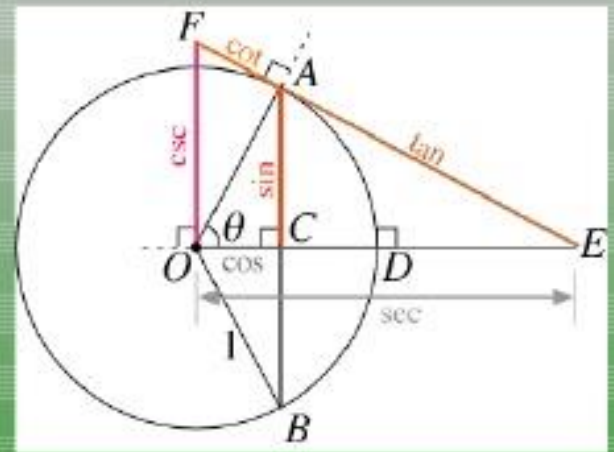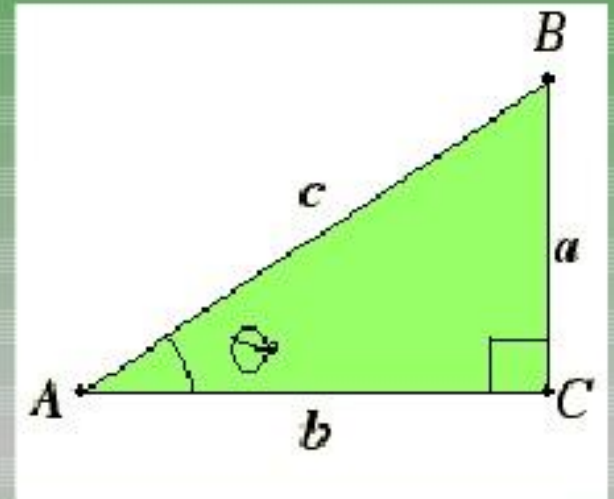# Values of trigonometric function of Angle A

- $\sin\theta = a/c$

- $\cos\theta = b/c$

- $\tan\theta = a/b$

- $\mathrm{cosec}\,\theta = c/a$

- $\sec\theta = c/b$

- $\cot\theta = b/a$

Calculator

➤ This Calculates the values of trigonometric functions of different angles.

➤ First Enter whether you want to enter the angle in radians or in degrees. Radian gives a bit more accurate value than Degree.

➤ Then Enter the required trigonometric function in the format given below:

➤ Enter 1 for sin.

➤ Enter 2 for cosine.

➤ Enter 3 for tangent.

➤ Enter 4 for cosecant.

➤ Enter 5 for secant.

➤ Enter 6 for cotangent.

➤ Then enter the magnitude of angle.

CLICK HERE!

Trigonometric identities

- $\sin^2 A + \cos^2 A = 1$
- $1 + \tan^2 A = \sec^2 A$
- $1 + \cot^2 A = \text{cosec}^2 A$
- $\sin(A+B) = \sin A \cos B + \cos A \sin B$
- $\cos(A+B) = \cos A \cos B - \sin A \sin B$
- $\tan(A+B) = (\tan A + \tan B)/(1 - \tan A \tan B)$
- $\sin(A-B) = \sin A \cos B - \cos A \sin B$
- $\cos(A-B) = \cos A \cos B + \sin A \sin B$
- $\tan(A-B) = (\tan A - \tan B)(1 + \tan A \tan B)$
- $\sin 2A = 2 \sin A \cos A$
- $\cos 2A = \cos^2 A - \sin^2 A$
- $\tan 2A = 2\tan A/(1 - \tan^2 A)$
- $\sin(A/2) = \pm\sqrt{(1 - \cos A)/2}$
- $\cos(A/2) = \pm\sqrt{(1 + \cos A)/2}$
- $\tan(A/2) = \pm\sqrt{(1 - \cos A)/(1 + \cos A)}$
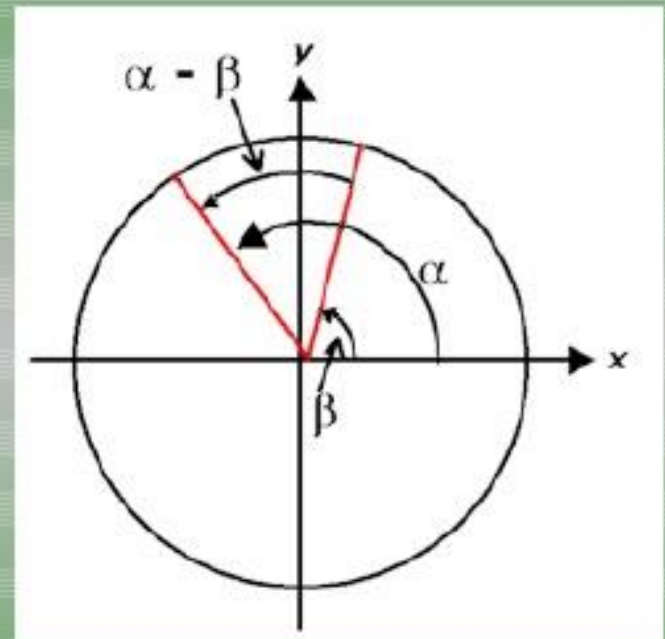
Angles of Elevation and Depression

➤ Line of sight: The line from our eyes to the object, we are viewing.

➤ Angle of Elevation:The angle through which our eyes move upwards to see an object above us.

➤ Angle of depression:The angle through which our eyes move downwards to see an object below us.

object

sight line

angle of elevation

observer

observer

angle of depression

sight line

object