

Chapter 1

Physics and Measurement

Several Fundamental physical quantities are length, mass, and time.

Systems of Units:

- Metric ; English; cgs

Metric System

length	meter	m
mass	kilogram	kg
time	second	s

The metric system is also known as the International System of Units (or SI Units)

The advantage of the metric system is that units go in powers of 10.

Dimensional Analysis

Square Brackets [] are used to denote the dimensions of a physical quantity.

Example: Show that the expression

$$v = v_0 + at$$

is dimensionally correct.

v = final velocity

v_0 = initial velocity

a = acceleration

t = time

$$[v] = \text{m/s}$$

$$[a] = \text{m/s}^2$$

$$[v_0] = \text{m/s}$$

$$[t] = \text{s}$$

(using SI units)

Answer

Dimensions are correct

Conversion of Units

Several Conversion factors

$$1 \text{ mile} = 1609 \text{ m} = 1.609 \text{ km}$$

$$1 \text{ m} = 39.37 \text{ in} = 3.281 \text{ ft}$$

$$1 \text{ ft} = 0.3048 \text{ m} = 30.48 \text{ cm}$$

$$1 \text{ in} = 0.0254 \text{ m} = 2.54 \text{ cm}$$

Example Convert $50 \frac{\text{mi}}{\text{hr}}$ into $\frac{\text{m}}{\text{s}}$.

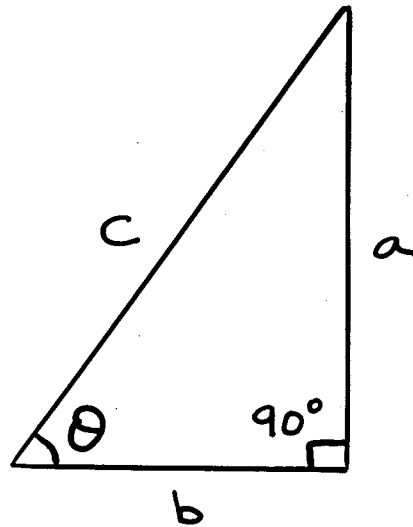
Note: $60 \text{ s} = 1 \text{ min}$
 $60 \text{ min} = 1 \text{ hr}$

Answer

$$50 \frac{\text{mi}}{\text{hr}} = 22.35 \frac{\text{m}}{\text{s}}$$

Trigonometry

Consider the right triangle



side a is opposite the angle θ
side b is adjacent to the angle θ
side c is the hypotenuse of
the triangle

The basic trigonometry
functions relating the ratios
of the lengths of certain
sides of the triangle are

sine, cosine, and tangent.

$$\sin \theta = \frac{\text{side opposite } \theta}{\text{hypotenuse}} = \frac{a}{c}$$

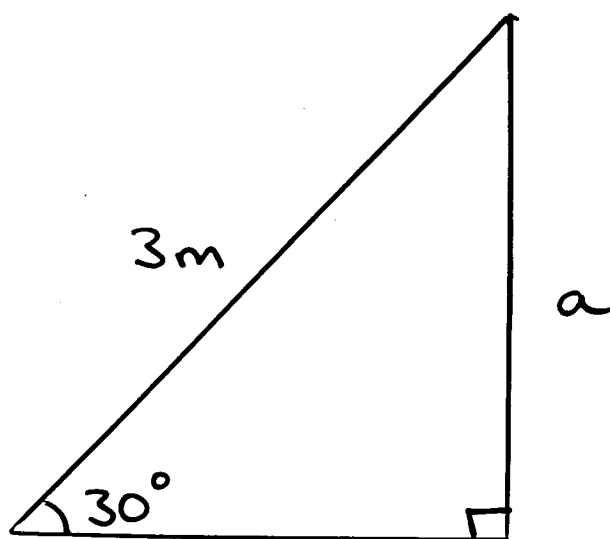
$$\cos \theta = \frac{\text{side adjacent to } \theta}{\text{hypotenuse}} = \frac{b}{c}$$

$$\tan \theta = \frac{\text{side opposite } \theta}{\text{side adjacent to } \theta} = \frac{a}{b}$$

The relationship existing between the lengths of the sides of a right triangle is known as the Pythagorean theorem.

$$a^2 + b^2 = c^2$$

Example: A right triangle has a hypotenuse of length 3 m, and one of its angles is 30° . What is the length of the side opposite the 30° angle?



Answer

$$a = 1.5\text{m}$$

Problem Solving Guide

