

TOPIC 4: UNITS

A unit – is defined as a symbol or sign which is assigned to a number to describe a kind of measurement made

Units of Length

Conversion of One Unit of Length to Another

Convert one unit of length to another

The conversion of one unit to another is done by considering the arrangement below

<i>km</i>						1
<i>hm</i>				1	0	
<i>dam</i>			1	0	0	
<i>m</i>		1	0	0	0	
<i>dm</i>	1	0	0	0	0	
<i>cm</i>	1	0	0	0	0	0
<i>mm</i>	0	0	0	0	0	0

Example, from the above we get

1 km = 1,000,000 mm
1 hm = 100,000 mm
1 dam = 1000 cm
1 m = 100 cm

Computations on Metric Units of Length

Perform computations on metric units of length

Example 1

Convert

(a) 12cm to dm

(b) 2,500 mm to m

(c) 87 km to cm

Solution

(a) 12cm to dm

$$\begin{array}{l} 1dm = 10\text{ cm} \\ \quad \times \\ ? = 12\text{ cm} \end{array}$$

By cross multiplication, we get

$$\models \frac{1\text{ dm} \times 12\text{ cm}}{10\text{ cm}} = \frac{12}{10}\text{ dm} = 1.2\text{ dm}$$

(b) 2,500 mm to m

$$\begin{array}{l} 1m = 1000\text{ mm} \\ \quad \times \\ ? = 2500\text{ mm} \end{array}$$

By cross multiplication, we get

$$= \frac{1\text{ m} \times 2\,500\text{ mm}}{1000\text{ mm}} = \frac{2500}{1000}\text{ m} = 2.5\text{ m}$$

(c) 87 km to cm

$$\begin{array}{rcl} 1 \text{ km} & = & 100\,000 \text{ cm} \\ 87 \text{ km} & = & ? \end{array}$$

By cross multiplication, we get

$$= \frac{87 \text{ km} \times 100\,000 \text{ cm}}{1 \text{ km}} = \frac{8\,700\,000}{1} \text{ cm} = 8\,700\,000 \text{ cm}$$

Example 2

Three pieces of a string measures 90 dam, 400 m and 25000 cm. Find their total length.

Solution:

$$100 \text{ dam} = 1 \text{ km}$$

$$90 \text{ dam} = 90/100$$

$$90 \text{ dam} = 0.9 \text{ km}$$

$$1000 \text{ m} = 1 \text{ km}$$

$$400 \text{ m} = 400/1000 \text{ km}$$

$$400 \text{ m} = 0.4 \text{ km}$$

$$1 \text{ km} = 100\,000 \text{ cm}$$

$$x = 25\,000 \text{ cm}$$

$$25\,000 = 25\,000/100\,000 = 0.25 \text{ km}$$

Therefore, the total length is $0.9 + 0.4 + 0.25 = 1.55 \text{ km}$

Unit of Mass

Conversion of One Unit of Mass to Another

Convert one unit of mass to another

The conversion of one unit to another is done by considering the arrangement below

<i>kg</i>						1
<i>hg</i>				1	0	
<i>dag</i>			1	0	0	
<i>g</i>		1	0	0	0	
<i>dg</i>	1	0	0	0	0	
<i>cg</i>	1	0	0	0	0	
<i>mg</i>	0	0	0	0	0	

Example, from the above

$$\begin{aligned}
 1 \text{ kg} &= 1,000,000 \text{ mg} \\
 1 \text{ hg} &= 100,000 \text{ mg} \\
 1 \text{ dag} &= 1000 \text{ cg} \\
 1 \text{ g} &= 100 \text{ cg}
 \end{aligned}$$

The conversion of *tonne* to other units is done converting it to *kilogram* first and then from *kilogram* to the required unit.

$$1 \text{ tonne} = 1000 \text{ kg}$$

Computation on Metric Units of Mass

Perform computation on metric units of mass

Example 3

Convert (i) 8 500 g to kg

(ii) 0.000025 kg to mg

(iii) 4.67cg to dg

Solution

(i) 8 500 g to kg

$$1 \text{ kg} = 1000 \text{ g}$$

$$? = 8\,500 \text{ g}$$

$$= \frac{1 \text{ kg} \times 8\,500 \text{ g}}{1000 \text{ g}} = \frac{8\,500}{1000} \text{ kg} = 8.5 \text{ kg}$$

(ii) 0.000025 kg to mg

$$1 \text{ kg} = 1\,000\,000 \text{ mg}$$

$$0.000025 \text{ kg} = ?$$

$$= \frac{0.000025 \text{ kg} \times 1\,000\,000 \text{ mg}}{1 \text{ kg}} = \frac{25}{1} \text{ mg} =$$

(iii) 4.67cg to dg

$$1 \text{ dg} = 10 \text{ cg}$$

$$? = 4.67 \text{ cg}$$

$$= \frac{1 \text{ dg} \times 4.67 \text{ cg}}{10 \text{ cg}} = \frac{4.67}{10} \text{ dg} = 0.467 \text{ dg}$$

Example 4

How many grams are there in 0.0098 kg?

Solution:

|
 1 kg = 1000 g
 0.0098 kg = 0.0098 x 1000 g
 0.0098 kg = 9.8 g
 There are 9.8 g in 0.0098 kg

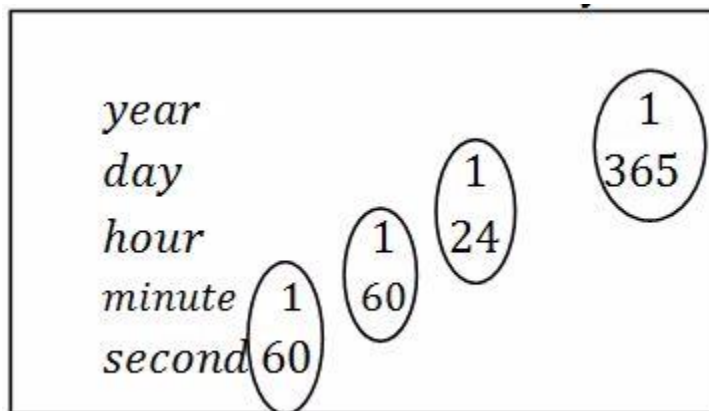
Units of Time

The units of time are of two types, smaller and larger units of time. Smaller units of time includes seconds, minutes, hours and days. Larger units of time includes week, month, year, decade, century, millennium.

Conversion of One Unit of Time to another

Convert one unit of time to another

The conversion of units of time to another can be done by considering the arrangement below



Example, from the circle above

$$1 \text{ min} = 60 \text{ sec} \quad 1 \text{ hour} = 60 \text{ min} \quad 1 \text{ day} = 24 \text{ hours} \quad 1 \text{ year} = 365 \text{ days}$$

Also

$$1 \text{ year} = 365 \times 24 \times 60 \times 60 \text{ seconds}$$

$$1 \text{ days} = 24 \times 60 \times 60 \text{ seconds}$$

$$1 \text{ hour} = 60 \times 60 \text{ seconds}$$

$$1 \text{ minute} = 60 \text{ seconds}$$

Example 5

Convert

(i) 54,000 seconds to minutes

(ii) 7,200 minutes to hours

(iii) 6 hours to seconds

Solution

(i) 54,000 seconds to minutes

$$\begin{aligned} 1 \text{ min} &= 60 \text{ sec} \\ ? &= 54\,000 \text{ s} \\ &= \frac{1 \text{ min} \times 54\,000 \text{ sec}}{60 \text{ sec}} = \frac{54\,000}{60} \text{ min} = 900 \end{aligned}$$

(ii) 7,200 minutes to hours

$$\begin{aligned} 1 \text{ hour} &= 60 \text{ minutes} \\ ? &= 7\,200 \text{ min} \\ &= \frac{1 \text{ hour} \times 7\,200 \text{ minutes}}{60 \text{ minutes}} = \frac{7\,200}{60} \text{ hours} = 120 \end{aligned}$$

(iii) 6 hours to seconds

$$\begin{aligned} 1 \text{ hour} &= 60 \times 60 \text{ sec} \\ 6 \text{ hours} &= ? \\ &= \frac{1 \text{ hours} \times 60 \times 60 \text{ sec}}{1 \text{ hour}} = \frac{3600}{1} \text{ seconds} = 3\,600 \end{aligned}$$

Example 6

How many hours are there in 5 days?

Solution:

$$\begin{aligned} 1 \text{ day} &= 24 \text{ hours} \\ 5 \text{ days} &= 24 \times 5 \text{ hours} \\ 5 \text{ days} &= 120 \text{ hours} \end{aligned}$$

Conversion of Unit Time of 12 Hour Clock to 24 Hour Clock and Vice Versa

Read and convert unit time of 12 hour clock to 24 hour clock and vice versa

The hours can exist in two systems: 12- hour clock and 24 – hour clock.

A 12- *hour clock* has 12 hours between midnight and midday (*a.m*) and 12 hours between midday and midnight (*p.m*).

A day starts at mid night and ends after 24 hours. Times in the morning are the same in both systems. For times in the afternoon, convert by adding or subtracting 12 hours.

Example 7

Convert the following times from the 12 – hour clock to 24 – hour clock.

- (i) 5.30 *a.m*
- (ii) 1.40 *p.m*
- (iii) 7.15 *p.m*

Solution

- (i) 5.30 *a.m* = 0530 *hrs*
- (ii) 1.40 *p.m* = (0140 + 1200) = 1340 *hrs*
- (iii) 7.15 *p.m* = (0715 + 1200) = 1915 *hrs*

Example 8

Convert the following times from the 24 – hour clock to 12 – hour clock.

- (i) 0450 *hrs*
- (ii) 1245 *hrs*
- (iii) 2300 *hrs*

Solution

- (i) 0450 *hrs* = 4.50 *a.m*
- (ii) 1245 *hrs* = 12.45 *p.m*
- (iii) 2300 *hrs* = (2300 – 1200) = 11.00 *p.m*

Example 9

Change 25 minutes past 10 in the evening using; (a) 12-hour clock (b) 24- hour clock.

Solution:

- (a) 12-hour clock is 10:25 p.m.
- (b) 24-hour clock is 2225 hours

Units of Capacity

Standard Unit of Measuring Capacity

State the standard unit of measuring capacity

Capacity is related to the volume.

Definitions:

- Capacity-is defined as the ability hold or contain something
- The S.I unit of capacity is *litre*.
- Volume –is defined as the amount of space occupied by a substance
- The S.I unit of volume is *cubic metres* (m^3)

Capacity is related to the volume as follows:

$$1 \text{ litre} = 1000\text{cm}^3 = 0.001\text{m}^3 = 1\text{dm}^3$$

Also $1\text{ ml} = 1\text{ cm}^3$

Other units related to litre are kiloliter (kl), hectoliter (hl), decalitre (dal), litre (l), deciliter (dl), centiliter (cl) and millilitre (ml).

The conversion of one unit to another is done by considering the arrangement below

<i>kl</i>						1
<i>hl</i>					1	0
<i>dal</i>				1	0	0
<i>l</i>			1	0	0	0
<i>dl</i>		1	0	0	0	0
<i>cl</i>	1	0	0	0	0	0
<i>ml</i>	0	0	0	0	0	0

Example, from the above

$1\text{ kl} = 1,000,000\text{ ml}$
$1\text{ hl} = 100,000\text{ ml}$
$1\text{ dal} = 1000\text{ cl}$
$1\text{ l} = 100\text{ cl}$

The Litre in Daily Life

Use the litre in daily life

Example 10

Convert the following units into

- (i) 3500 ml
- (ii) 0.006 m³
- (iii) 4000 dm³
- (iv) 500 mm³

Solution

- (i) Convert first 3500 ml to cm³

$$1 \text{ ml} = 1 \text{ cm}^3$$

$$3500 \text{ ml} = ?$$

$$= \frac{3500 \text{ ml} \times 1 \text{ cm}^3}{1 \text{ ml}} = \frac{3500}{1} \text{ cm}^3 = 3500 \text{ cm}^3$$

Then 3500 cm³ to litres

$$1 \text{ litre} = 1000 \text{ cm}^3$$

$$? = 3500 \text{ cm}^3$$

$$= \frac{3500 \text{ cm}^3 \times 1 \text{ litre}}{1000 \text{ cm}^3} = \frac{3500}{1000} \text{ litres} = 3.5 \text{ litres}$$

- (ii) 0.006 m³ to litres

$$1 \text{ litre} = 0.001 \text{ m}^3$$

$$? = 0.006 \text{ m}^3$$

$$= \frac{1 \text{ litre} \times 0.006 \text{ m}^3}{0.001 \text{ m}^3} = \frac{0.006}{0.001} \text{ litres} = 6 \text{ litres}$$

(iii) Convert first 4000 dm^3 to cm^3

$$1 \text{ dm} = 10 \text{ cm}$$

$$(1 \text{ dm})^3 = (10 \text{ cm})^3 \rightarrow 1 \text{ dm}^3 = 1000 \text{ cm}^3$$

So

$$1 \text{ dm}^3 = 1000 \text{ cm}^3$$

$$4000 \text{ dm}^3 = ?$$

$$= \frac{4000 \text{ dm}^3 \times 1000 \text{ cm}^3}{1 \text{ dm}^3} = \frac{4\,000\,000}{1} \text{ cm}^3 = 4\,000\,000 \text{ cm}^3$$

Second, convert $4\,000\,000 \text{ cm}^3$ to litres

$$1 \text{ litre} = 1000 \text{ cm}^3$$

$$? = 4\,000\,000 \text{ cm}^3$$

$$= \frac{1 \text{ litre} \times 4\,000\,000 \text{ cm}^3}{1000 \text{ cm}^3} = \frac{4\,000\,000}{1000} \text{ litres} = 4000 \text{ litres}$$

(iv) 500 mm^3

Convert first 500 mm^3 to cm^3

$$1 \text{ cm} = 10 \text{ mm}$$

$$(1 \text{ cm})^3 = (10 \text{ mm})^3 \rightarrow 1 \text{ cm}^3 = 1000 \text{ mm}^3$$

So

$$1 \text{ cm}^3 = 1000 \text{ mm}^3$$

$$? = 500 \text{ mm}^3$$

$$= \frac{1 \text{ cm}^3 \times 500 \text{ mm}^3}{1000 \text{ mm}^3} = \frac{500}{1000} \text{ cm}^3 = 0.5$$

Second, convert 0.5 cm^3 to litres

$$1 \text{ litre} = 1000 \text{ cm}^3$$

$$? = 0.5 \text{ cm}^3$$

$$= \frac{1 \text{ litre} \times 0.5 \text{ cm}^3}{1000 \text{ cm}^3} = \frac{0.5}{1000} \text{ litres} = 0.0005$$

Example 11

Change 35 litres into cm^3

Solution:

$$1 \text{ litre} = 1000 \text{ cm}^3$$

$$35 \text{ litres} = x$$

$$\text{Therefore, } x = 35 \times 1000$$

$$35 \text{ litres} = 35000 \text{ cm}^3$$