EWCE-103

SURVEYING

Units of Measurements

Units of Measurements

Measurements

- Horizontal & Vertical distances/angles.
- Linear Measurements
- Area Measurement
- Volume Measurement

Angular Measurement

- Sexagesimal (degree, minutes, seconds)
- Hours System (hours, minutes, seconds)

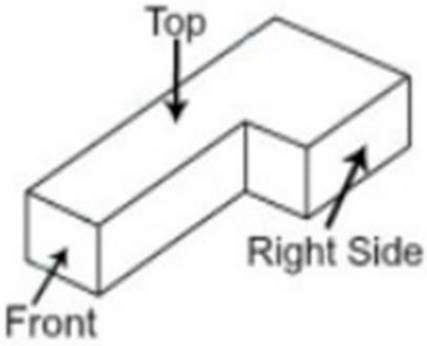
Plan & Map

- Graphical representation of features of the earth as projected.
- Represented by plane of the paper, on which plan is drawn.
- Distorted representation of the earth's surface.
- Constructed by **orthographic projections** without measurable distortion.

Orthographic Projection

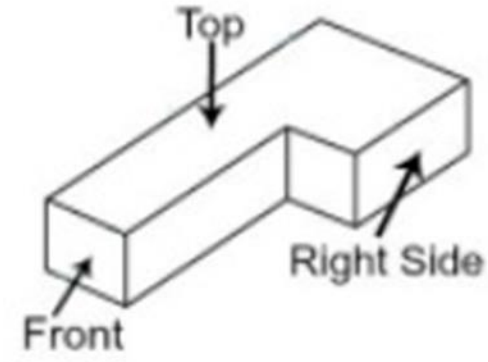
- **In which** an **object is depicted using parallel lines** to **project its outline** on to a plane.

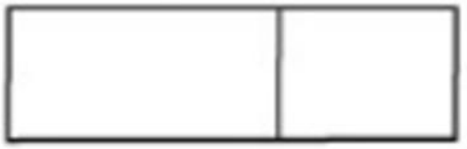
- Are tools that allow us to represent **three-dimensional objects with two-dimensional drawings.**





Front Side
Orthographic View





Right side
Orthographic View

Scale of Map/Plan

Definition:

- **Fixed ratio** that **every distance** on the plan/map, **bears with the corresponding distant on the ground.**

Methods of Representation of Scale:

- **Numerical Scale**
  - **Engineer' Scale**
  - **Representative Fraction (RF)**
- **Graphical Scale**

Numerical Scale

Engineers' scale-

- **One centimeter** on plan/map represents some **whole number of meters** on the ground.

- **Example**: 1 cm= 10m or 100m or 1000m etc.

Representative Fraction or RF:

- It is the **ratio of plan/map distance to the corresponding ground distance**, which is **independent of units of measurements.**

- One unit of **length on the plan/map represents** some number of same units of length on the ground.

- Example: RF= **1/1000 or 1: 1,000**

Graphical Scale

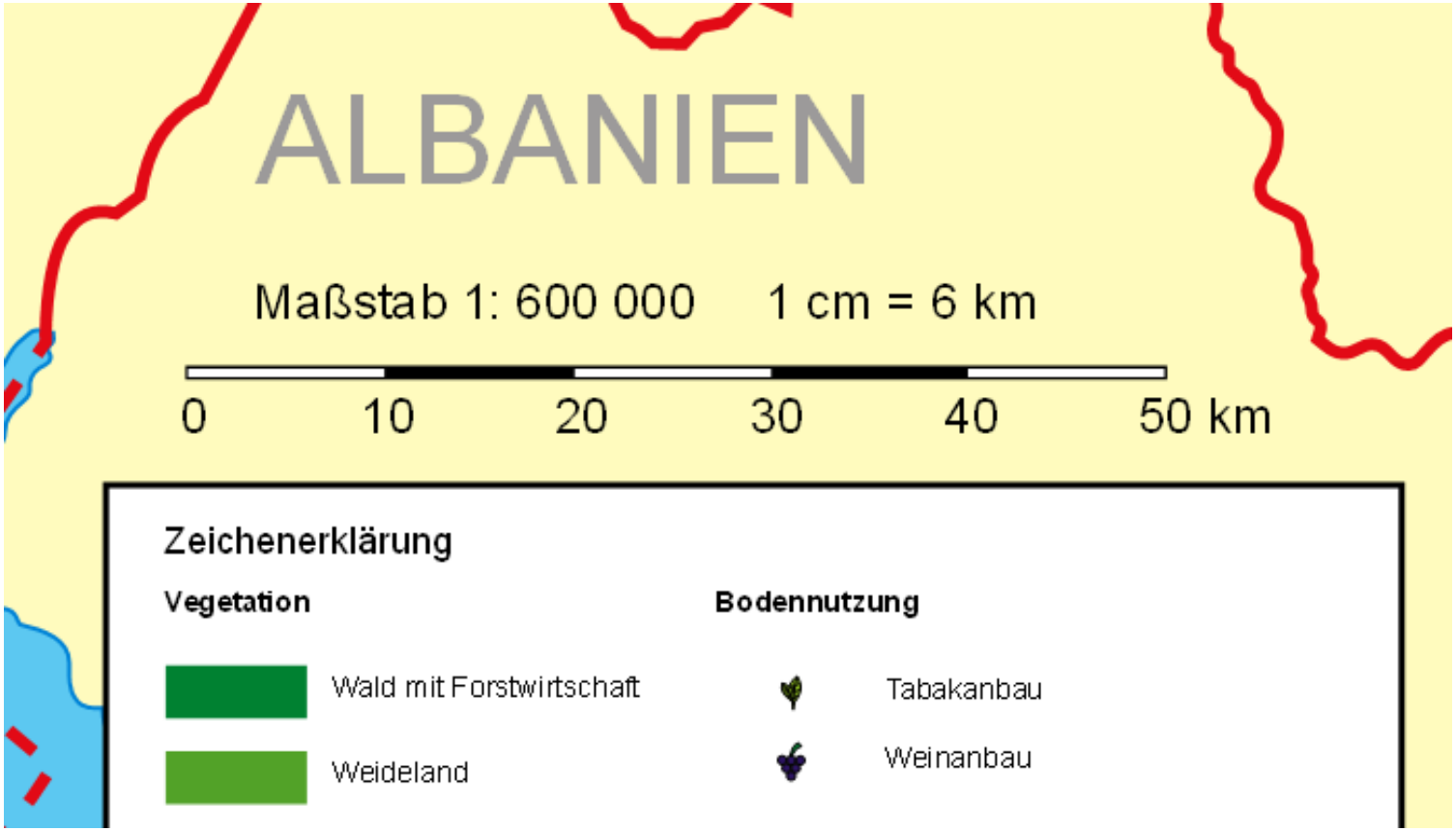
- Scale **drawn directly on the plan or map** is known as graphical scale.

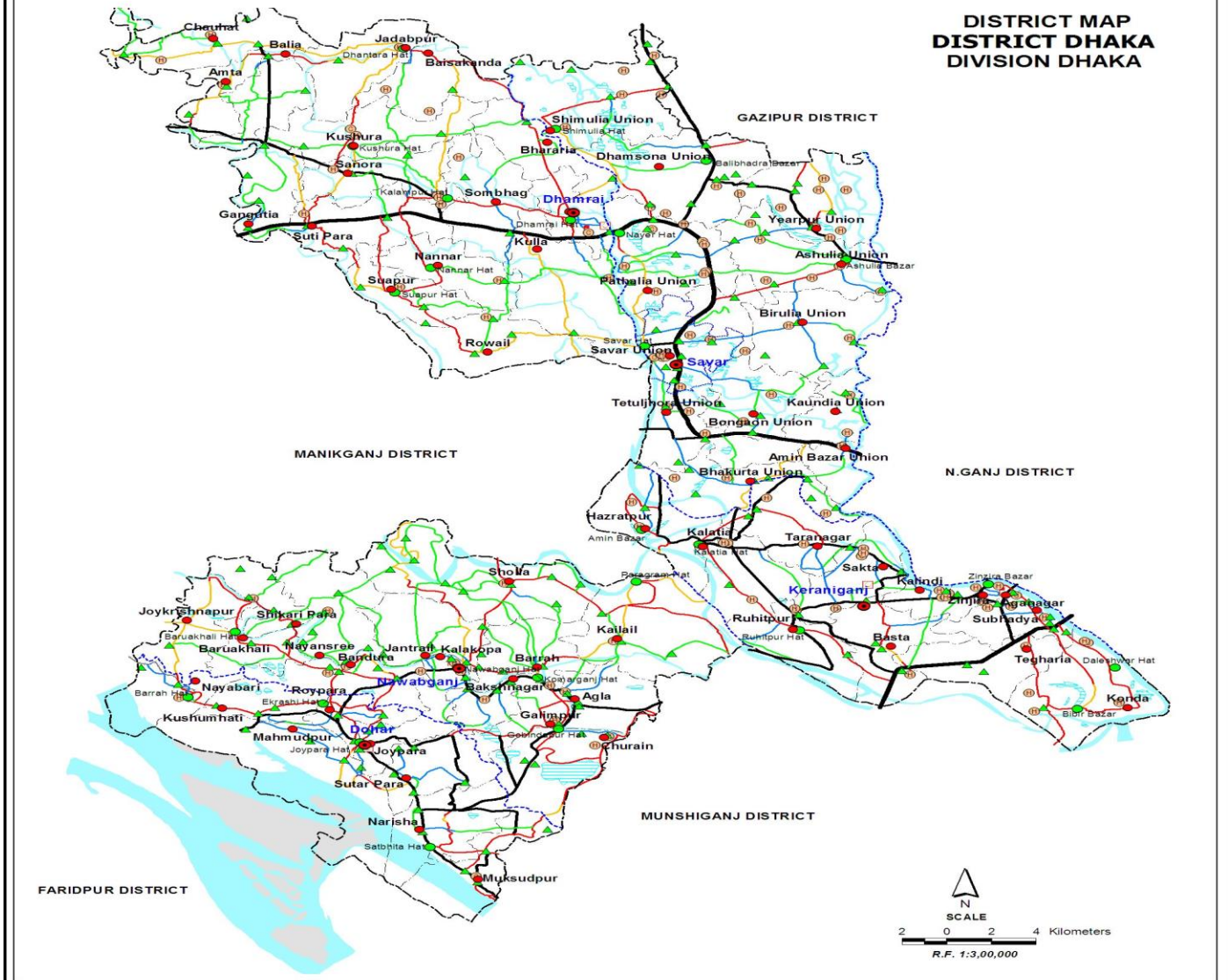
Advantages of Graphical scale over Numerical Scale:

- Numerical scale **may not give accurate results** after a few years, **if the sheet or paper shrinks.**

- Graphical scale drawn on the map/plan sheet or paper also shrink with the map/sheet, will give more accurate results.

Scale:


ALBANIEN
Maßstab 1: 600 000
1 cm = 6 km
0
10
20
30
40
50 km
Zeichenerklärung
Vegetation
Wald mit Forstwirtschaft
Weideland
Bodennutzung
Tabakanbau
Weinanbau


DISTRICT MAP
DISTRICT DHAKA
DIVISION DHAKA
GAZIPUR DISTRICT
MANIKGANJ DISTRICT
N.GANJ DISTRICT
MUNSHIGANJ DISTRICT
FARIDPUR DISTRICT
Chauhat
Balia
Jadabpur
Dhantera Hat
Baisakanda
Amta
Shimulia Union
Shimulia Hat
Kushura
Kushura Hat
Bhararia
Dhamsona Union
Balibhadra Bazar
Sanora
Kalampur Hat
Sombhag
Dhamrai
Gaganatia
Dhamrai Hat
Yearpur Union
Suti Para
Kulla
Nayer Hat
Ashulia Union
Ashulia Bazar
Nannar
Nannar Hat
Pathalia Union
Suapur
Suapur Hat
Birulia Union
Rowail
Savar Hat
Savar Union
Savar
Tetuljhora Union
Kaundia Union
Bongaon Union
Amin Bazar Union
Bhakurta Union
Hazratpur
Amin Bazar
Kalatia
Kalatia Hat
Taranagar
Sakta
Sholla
Bajagram Hat
Kalindi
Zinjira Bazar
Keraniganj
Zinjira
Agganagar
Subhadya
Joykrishnapur
Shikari Para
Baruakhali Hat
Kallail
Ruhitpur
Ruhitpur Hat
Basta
Baruakhali
Nayansree
Jantrail
Kalakopa
Bandura
Barrah
Tegharia
Dalesh war Hat
Nayabari
Barrah Hat
Nawabganj
Nawabganj Hat
Roypara
Baksnagar
Kolatarganj Hat
Agla
Ekrashi Hat
Konda
Bilon Bazar
Kushumhati
Galimpur
Dohar
Mahmudpur
Gobindapur Hat
Churain
Joypara Hat
Joypara
Sutar Para
Narisha
Satbhita Hat
Muksudpur
N
SCALE
2 0 2 4 Kilometers
R.F. 1:3,00,000
LEGEND
Administrative Boundary
International Boundary
District Boundary
Upazila Boundary
Union Boundary
Municipal Boundary
Administrative HQs
District HQ
Upazila HQ
Union HQ
Physical Infrastructures
National Highways
Regional Highways
Zila Road
Upazila Road Pucca
Upazila Road Katcha
Union Road Pucca
Union Road Katcha
Railways Network
Embankment
Natural Features
Wide River
Water Bodies
Cher Area
Socio-economic Infrastructures
Growth Centre
Rural Market
Police Station
Upazila Health Complex
College
High School
University
Compiled from : SPOT Image 1989-90, Aerial Photograph 1993-94, Topographic Maps, Thana Maps, B.B. S and Field Checking 2008
Projection : Lambert's Conformal Conic
Data Source : GPS Field Survey 1993
PREPARED BY : GIS UNIT
LOCAL GOVERNMENT ENGINEERING DEPARTMENT

Choice of Scale

- Most common scale is 1 cm=10m
  =100m or multiple of 10

- **Preliminary Considerations**
  - Use of the map
  - Extent of territory to be represented

General Rules

- Choose a scale**, large enough** so that in plotting or scaling distances from the finished map, it will not be necessary to read the scale closer than 0.25mm.

- Chose a scale, **small enough**, as is consistent with **clear delineation** of **smallest details** to be plotted.

Types of Scale

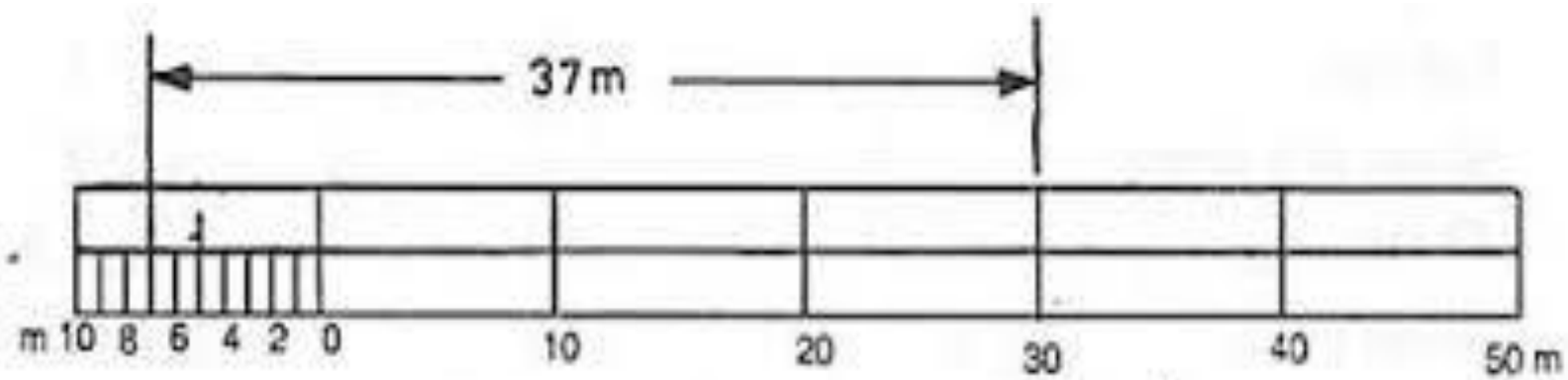
a. Plain scale

b. Diagonal scale

c. Vernier Scale

Plain Scale:

To measure the **two dimensions** ie unit and tenths.



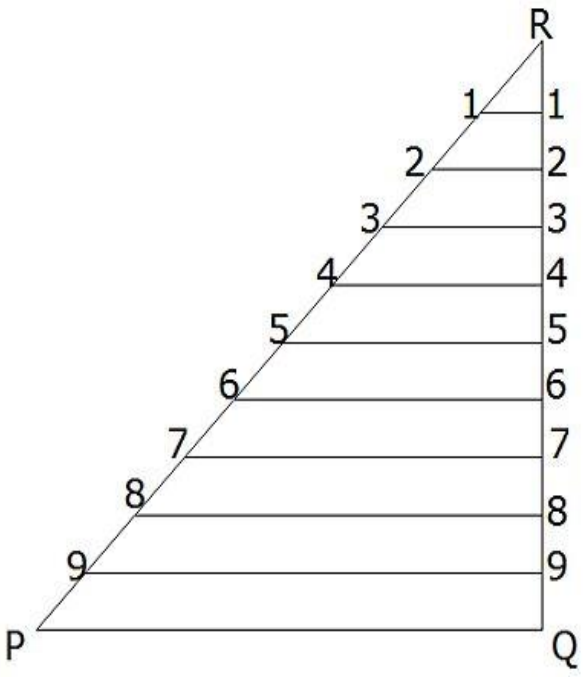
Plain Scale : 1 cm = 3 m ; R.F. = $\frac{1}{300}$

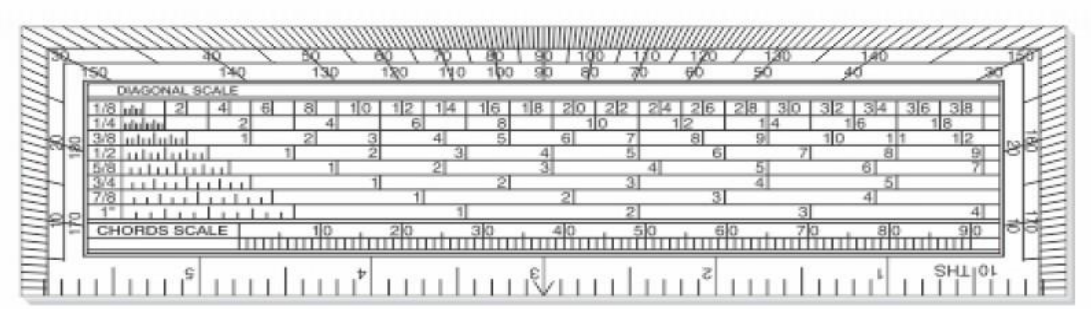
Plain Scale:

- Consists of a **line divided into suitable number of equal units**.
- **First unit is subdivided** into smaller parts.
- Zero should be placed at the end of the 1st main unit
- From the **zero mark**, the units should be numbered to the right and the sub-divisions to the left.
- Units and the subdivisions should be labeled clearly.
- **R.F. should be mentioned below the scale**.

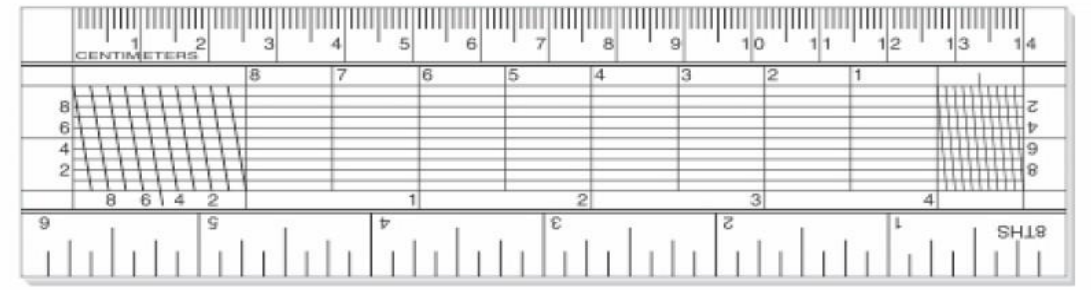
Diagonal Scale:

Possible to measure three dimensions ie unit, tenths and 100ths (m,cm and decimeter).

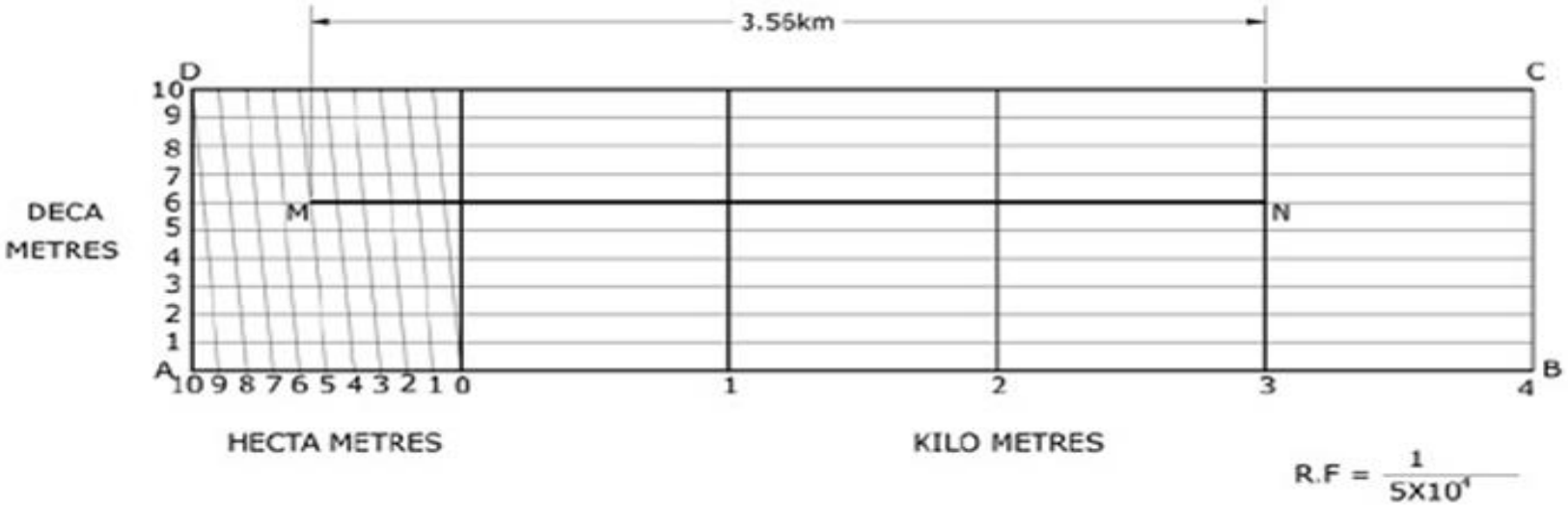




Front



Back



8. Show a measurement of 4.56 m (4m, 5dm and 6cm).

Construction of Plain & Diagonal Scale



Diagonal Scale

Draw the line AC of convenient length at right angles to plain scale AB. Divide it into 10 equal parts. Join BC. From each tenth point on line AC draw lines parallel to AB till they meet line BC. Then line 1–1 represent $\frac{1}{10}$ th of AB, 6–6 represent $\frac{6}{10}$ th of AB and so on. Figure 11.8 shows the construction of diagonal scale with RF $= \frac{1}{500}$ and indicates 62.6 m.

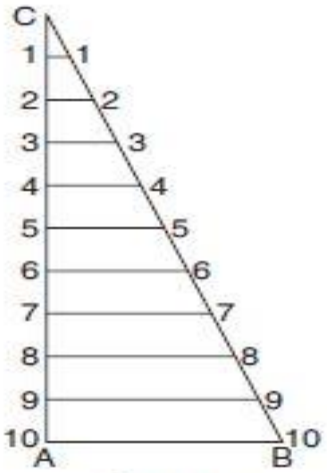


Fig. 11.7

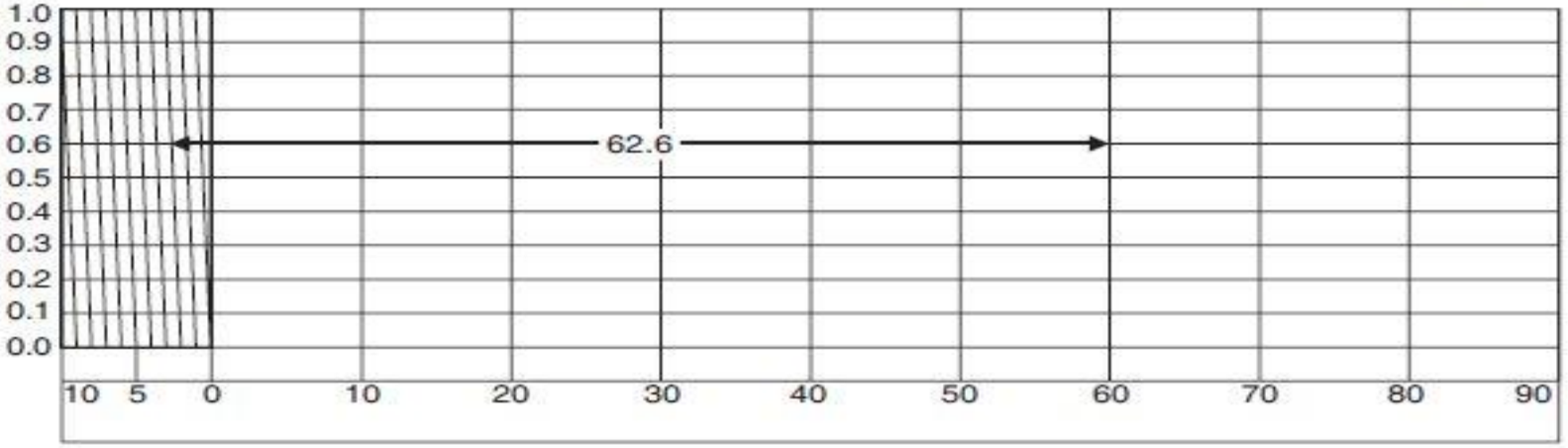
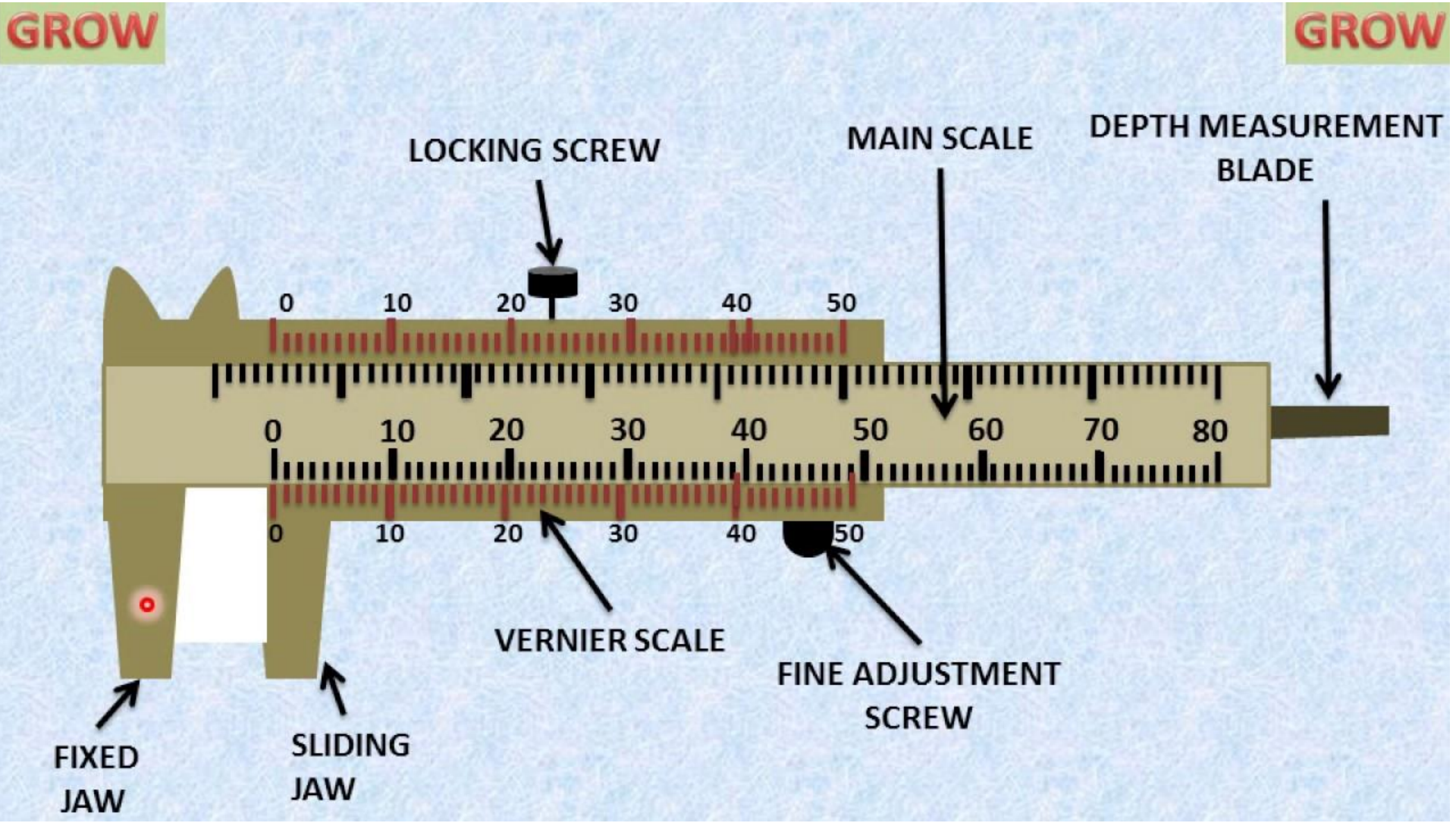


Fig. 11.8. Diagonal scale

Vernier Scale

- Invented in 1631 by Pieree Vernier, a French Mathematician.
- Consists of **two scales**, a small auxiliary scale which slides along the main scale.

Vernier Scale



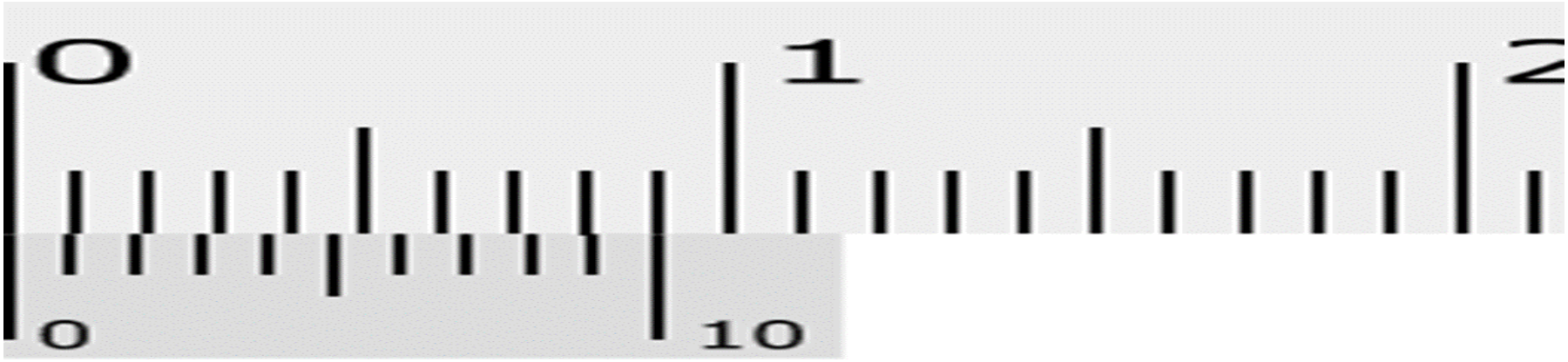
Vernier Constant

- Difference between the value of **one main scale division** and **one Vernier scale division**.
- Let say 10*th* vernier scale division coincides with the 9*th* main scale division

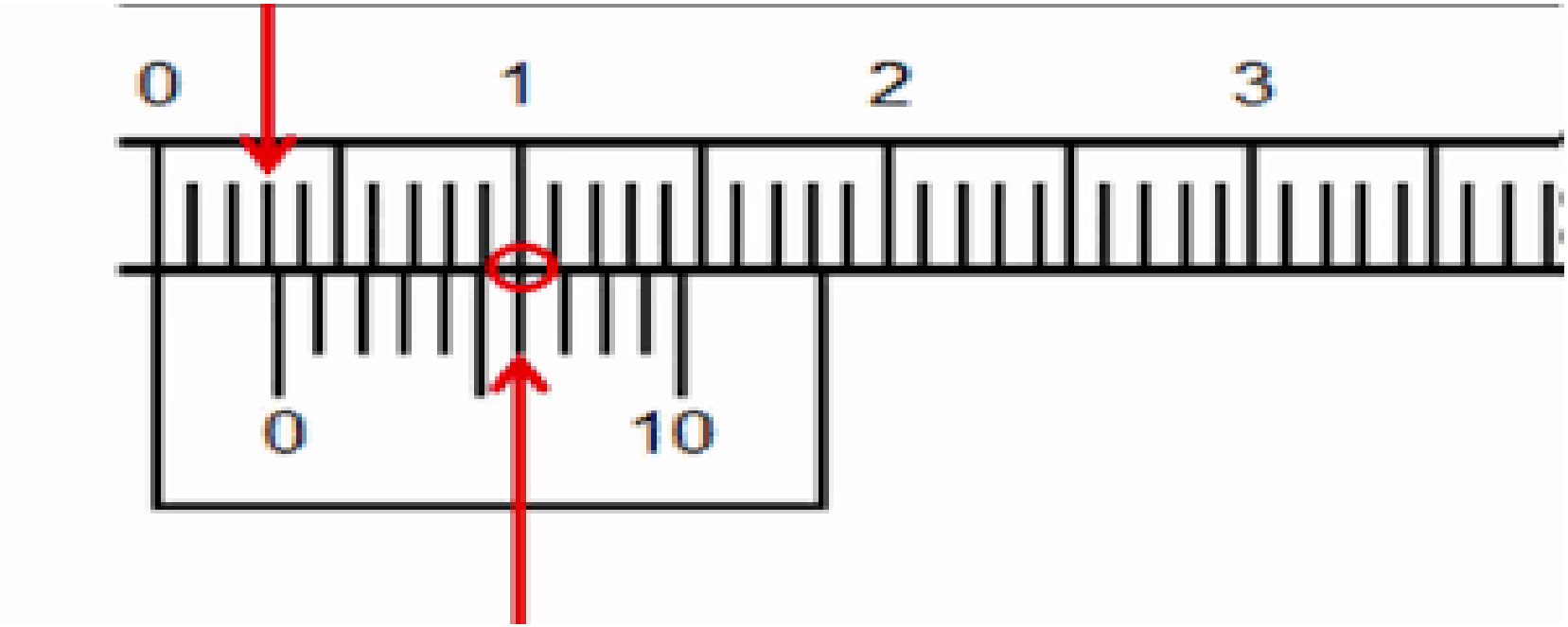
$$\therefore \text{ Vernier constant } = 1M.S.D - 1V.S.D$$

$$= 1mm - \frac{9}{10}mm$$

$$= 0.1mm$$



Direct Vernier



Main scale =0.3 cm

Vernier scale = 0.6

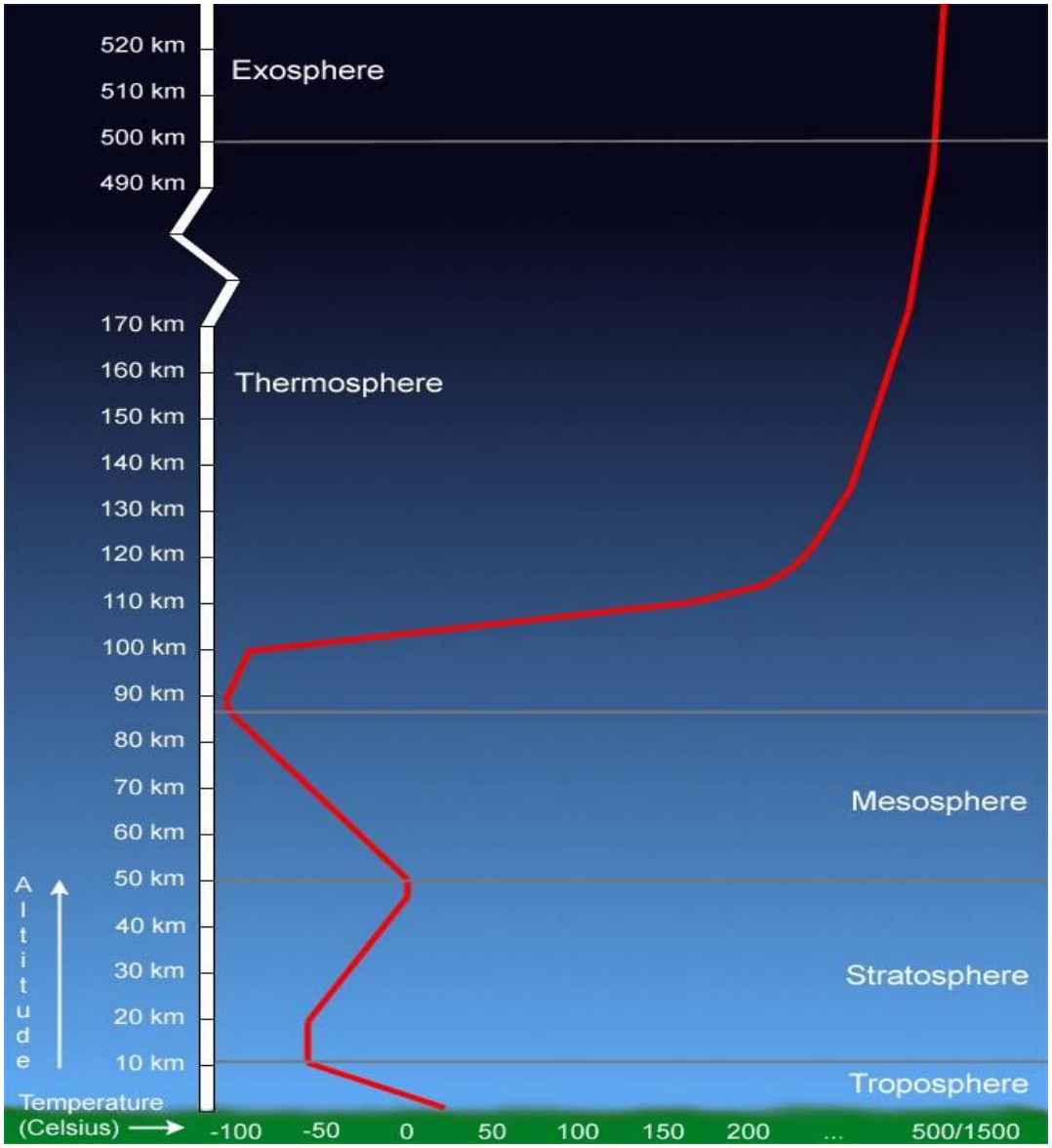
Vernier constant=0.1

Reading= 0.3+ 0.6x0.1= 0.36 cm

Above the Horizon-Earth's Atmosphere

Earth's Atmosphere. A**tmosphere** is a mixture of nitrogen (78%), oxygen (21%), and other gases (1%) that surrounds **Earth**.

High above the planet, the **atmosphere** becomes thinner until it gradually reaches space. **It is divided into five layers**.



This image shows the average temperature profile through the Earth's atmosphere. Temperatures in the thermosphere are very sensitive to solar activity and can vary from 500°C to 1500°C.

Use of Vernier Scale

Theodolite:

- Precise optical instrument for measuring angles between designated visible points in the horizontal plane and vertical plane



Sextant:

- A sextant is an instrument used for **measuring the angle** between two visible objects.
- Both **horizontal and vertical angles** can be measured using a sextant.



Clinometers:

- Optical devices for measuring elevation angles **above the horizon**.

Horizon- Apparent line that separates the earth from the sky.



Abney Level with Clinometer.

Ex. 1: The area of the plan of an **old survey** plotted to a scale of **10m to 1 cm** measures **now 100.2 sq**. cm as found by a planimeter. The plan is found to **be shrunk** so that a line originally **10 cm** long measures **9.7 cm** only. Find the shrunk scale and the true area of the survey.

Solution:

Present length 9.7cm equivalent to 10cm of original length.

Now, Shrinkage factor **(SF)=** $\frac{9.7}{10}$ **= 0.97**

True Scale, RF = $\frac{1}{10x100} = \frac{1}{1000}$

RF of Shrunk scale = SF x RF of True scale

= 0.97 x $\frac{1}{1000}$

= $\frac{1}{1030.93}$

Again, present length 9.7cm equivalent to 10cm of original length.

Present area of the plan = 100.2 sq. cm

Now, the **original area of the plan** $= \frac{10}{9.7} \times 100.2$

$= 103.3$ sq. cm

Here, scale of the plan 1cm = 10 m

Area of the survey $= 103.3 \times (10)^2$ sq. m

$= 10330$ sq.m

Ex. 2: A rectangular plot of land measures **30 cm X 20 cm** on a village map drawn to scale of **100m to 1 cm**. Calculate the area in hectares. If the plot is redrawn to a topo sheet to a scale of **1 km to 1 cm**, what will be its area on the topo sheet? Also determine the **RF of the scale** of village map as well as the topo sheet.

Solution:

Village map:

1 cm on the map= 100m on the ground.

1 cm^2 on the map= $(100)^2$ m^2 on the ground

Plot measures on the map = 20cm x 30 cm

=600 cm^2

Area of plot =600 x $(100)^2$ m^2

=600 hectors

Solutions of Ex. 2

Topo Sheet:

1 km^2 or (1000x1000) m^2 represented by 1 cm^2

Now, 600 hectare or **$6x\ 10^6\ m^2$** is represented by= $\frac{1}{1000x100}$ x $6x10^6$ cm

= **60 cm^2**(topo sheet)

RF of village map = $\frac{1}{100x100} = \frac{1}{10{,}000}$

RF of topo sheet= $\frac{1}{1000x100} = \frac{1}{100{,}000}$

Digital Planimeter



Thank you