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Adventures in Practical Physics: Physics in Our Lives

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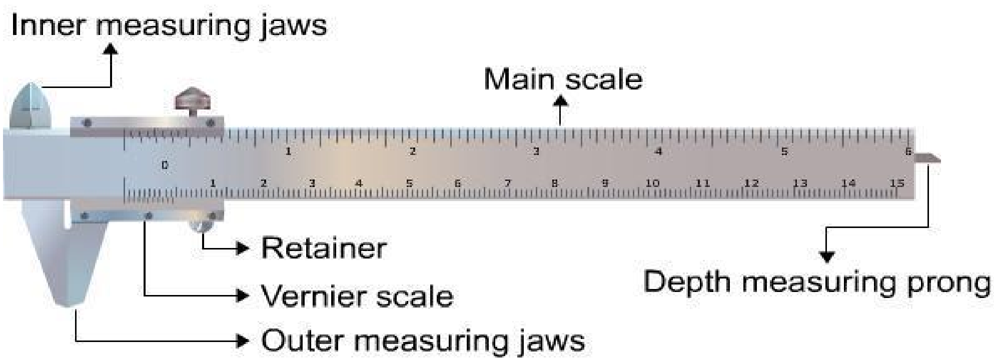
Abstract
Physics has played a major role in the development of science and technology during the years. It covers a wide range of phenomena, from the smallest sub-atomic particles to the largest galaxies. It is the study of matter and energy and the interaction between them. Practical physics has applications in the fields of engineering, medicine, technology etc. In practical physics the student obtain laboratory skills, design experiments and apply instrumentation such as electronic circuits to observe and measure natural phenomena. To master the science of physics practical one needs to have a complete and thorough knowledge of all the experiments involved.

Keywords: Vernier callipers, Screw gauge, Microscope, Telescope.

Introduction
Physics has fascinated the imagination of scientists, engineers and technologists, because of its immense potentialities and its positive impact on the way people live today. In almost every physical situation, there is a need for measurement. Length and time measurements are the fundamental requirements in physics and in our daily life. There are various devices available in the market for precise measurements. If the measuring length of large scale then we go ahead with a meter scale or a measuring tape, but when we deal with small lengths there is need of such apparatus. Furthermore these require accuracy better than that obtained from meter scale or measuring tape. This paper gives us basic ideas about vernier calipers, screw gauge, microscope and telescope. In last we can conclude that no measurement can be more accurate than the precision of measuring instrument.

1. Vernier caliper
Vernier caliper is an instrument which is used to measure internal and external distances (diameter) and depth with accuracy. Measurements are interpreted from the scale of caliper as shown in diagram below. It is more difficult to operate digital vernier caliper which has an LCD digital display. The manual version has both an imperial and metric scale.
Manually operated vernier caliper is used and popular because it is much cheaper than digital version. Also digital version requires a small battery whereas the manual version does not need any power source.



Important parts of vernier caliper are:-

1. Main Scale: The main scale consists of a steel metallic scale graduated in inches at upper edge and in centimeters at lower edge. It carries the inner and outer measuring jaws. When the two jaws are in contact with each other, the zero of themain scale and thezero of the vernier scale should coincide. If both the zeros do not coincide then there will be a positive and negative.
2. Vernier Scale: A vernier slides on the metallic scale which can be fixed at any position by the retainer on the vernier scale. It is 0.9 cm divided onto ten equal parts.
3. Outer (Lower) Measuring Jaws: The outer measuring jaws help to take the outer dimension of an object.
4. Inner (Upper) measuring Jaws: The inner measuring jaws helps to take the inner dimension of an object.
5. Retainer: The retainer helps to take the retain the object within the jaws of the vernier calipers.
6. Depth Measuring Prong: The depth measuring prong helps to measure the depth of an object.

Least Count
Least count = One Main scale division - One Vernier scale division

1 M.S.D. = 1 mm
10 V.S.D. = 9 M.S.D.
1 V.S.D. = 9/10 M.S = 0.9 mm
V.C. = 1 M.S.D. - V.S.D.= (1 - 0.9) mm = 0.1 mm = 0.01 cm

Reading
When a body is in between jaws of vernier caliper.

If the zero of the vernier scale lies ahead of the nth division of the main scale, then the main scale reading is

MSR = N

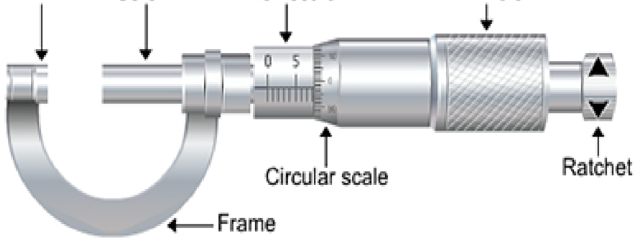
If nth division of vernier scale coincide with any division of the main scale, then the vernier scale reading is;

VSR = n x L.C.,
Total reading TR = MSR + VSR = N + (n x L.C.)

To Find the Volumes
Volume of a beaker = internal area of cross section x depth
V $=\pi (D/2)^2$ x d where 'D' is internal diameter of beaker and 'd' the depth of beaker.

Dimension to be measured	Main Scale ReadingMSR cm	Vernier Scale ReadingVSR cm	VSR x LCcm	Total Reading MSR + (VSR x LC)Cm
Diameter of the bob				
Diameter of the cylinder				
Length of the cylinder				
Internal diameter of the beaker				
Internal depth of the beaker				

2. Screw Gauge
The screw gauge is an instrument used to measure the diameter of circular objects like thin wires or thickness of a sheet of metal with an accuracy of 0.001cm. It consists of C-shaped frame fitted with a screwed spindle which is attached to a thimble. This screw can be moved inside the nut by fitted in the C frame by rotating the hollow cylinder called the main scale. The hollow cylinder or thimble is graduated into 50 or 100 equal parts called circular scale.



Important Parts
Frame: The C shaped frame is used to hold the stud and screw firmly in their place of micrometer screw gauges.
Stud: The fixed shiny part that the spindle moves toward where the sample rests against. It is also called Anvil.
Pitch Scale (Sleeve): The round stationary component with the linear scale on it, called main scale. It is available with adjustable sleeves which makes it easy to eliminate the zero error.
Screw: It is the heart of micrometer because all measurement is done through it. Very fine stainless steel is used for this purpose with definite pitch.
Thimble: It is the part through which measuring screw is rotated by turning our thumb, this screwing results in the displacement of stud and thimble itself.
Ratchet: It is small device which is used to provide the limits applied pressure by slipping at a calibrated torque. Final adjustment is made by a making three turns of ratchet.

Pitch of the Screw Gauge
The pitch of the screw is the distance by the spindle per revolution. The distance moved by the head scale for a definite number of complete rotations of the screw is determined.

$$\text{Pitch of the screw} = \frac{Distance\ moved\ by\ screw}{No.of\ full\ rotations\ given}$$

Least Count of the Screw Gauge
The Least count (LC) is the distance moved by the tip of the screw is turned through 1 division of the head scale.

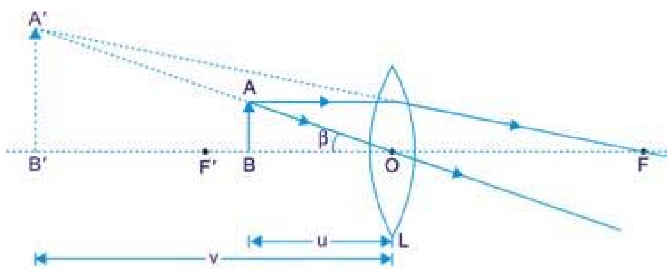
$$\text{Least Count} = \frac{Pitch}{Total\ no.of\ divisions\ on\ the\ circular\ scale}$$

To find the diameter of the lead shot
With the lead shot between the screw and anvil, if the edge of the cap lies ahead of the Nth division of the linear scale.
Linear scale reading (P.S.R.) = N.
If nth division of circular scale lies over reference line.
Then circular scale reading (H.S.R.) = n x Least Count (L.C.)

Total reading = N + (n x L.C).

Parameters determine	Linear scale readingP.S.R.	Circular scale reading H.S.R.	H.S.R. X L.C.	Total reading = P.S.R. + (H.S.R. X L.C.)
Diameter of the wire				
Thickness of the glass disc				

3. Microscope
Simple microscope
It is a convex lens of short focal length. It is used to see magnified image of a small object.
Principle: -*"A virtual, erect and magnified image is formed on same side, when a small object is placed between optical centre and focus of convex lens"*.
Let AB be an object placed between F and C. Its virtual image A`B` will be formed on same side of object.
Diagram:



1) When image formed at D:
Magnifying power (M): It may be defined as a ratio of angle subtended by the image at eye to the Angle subtended by the object at eye.

$$M = \frac{\beta}{\alpha}$$
$$M = 1 + \frac{D}{f}$$

2) When image formed at infinity (∞):
$$M = \frac{D}{f}$$

Applications:
1. For ornaments
2. For watches
3. Magnifying glass is used to see slides & to read vernier scale attached with it.

Compound microscope
Extremely small objects can be seen with help of compound microscope only. It consists of two lenses. One is object lens having short focal length and short aperture while the other is eye- lens having short focal length and large aperture.
Principle: *"When a small object is placed outside the focus (f_0), then its real, inverted & magnified image is produced on the other side [beyond $2f_0$]"*.
Diagram:

The image produced by object lens is acts as object for eye-lens.
1) When image is at 'D': $M = \frac{\beta}{\alpha}$
2) When image is at infinity (∞): $M = \frac{V0}{U0} \times \frac{D}{fe}$

Reading of microscope
Main scale:
1 cm = 20 div
1 div. = $\frac{1}{20}$ cm
So, 1 M.S.D = 0.05cm

Vernier scale:
Total no. of divisions = 50

So, Least count = $\frac{\text{Value of 1 M.S.D}}{\text{Total no.of divisions}}$ $\frac{0.05}{50} = 0.001\ cm$

Therefore, Final reading: M.S.R+(V.S.CxL.C)
L.C = 0.001cm

Sr. No.	M.S.R Main scale reading	V.S.C Vernier scale coincidence	T.R (Total reading)
1.			
2.			
3.			
4.			

T.R = [M.S.R + (V.S.C x L.C)] x 10^{-2} m

4. Telescope: Invention of telescope was an accidental finding by a Dutch spectacle maker Hans Lippershey and his children in 1608. Galileo (1609) constructed a real working telescope, which has been used effectively till now. Invention of telescope gave impetus to research in Astronomy and Astrophysics. Magnifying power and the resolving power of the telescope are the two characteristic parameters of an astronomical telescope. Other than astronomical telescopes there is one more telescope, called reading telescope, which is frequently used in laboratory for making measurements. This telescope has magnifying power in the range of 10-15. Mounted on a stand these telescopes are used to count oscillations of pendulum or string. Using an eyepiece with scale marked on it measurements of number oscillations can be made.

It can be classified as either reflecting or refracting depends upon whether the light collecting element is a mirror or a lens respectively. So we may categorize it as:

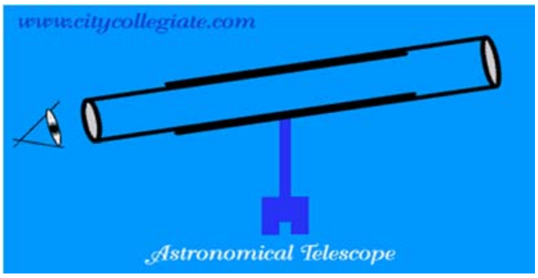
1. Astronomical Telescope (Refracting type)
2. Terrestrial telescope (Reflecting type)

1. Astronomical telescope

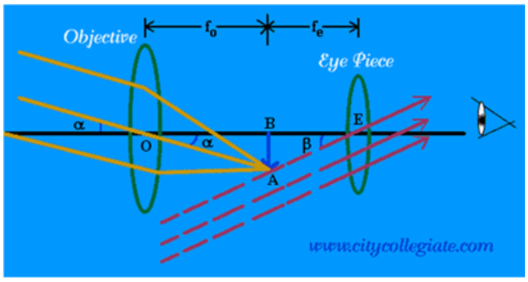
It is used to see heavenly objects. It consists of two lens systems:

a) Objective (Lens system facing the object is called objective & it has large aperture and large focal length (f_0).
b) Eye-piece (which has small aperture and short focal length (f_0).

Principle: An objective forms real & inverted image of distant object at its focal plane. The eye-piece lens acts like a magnifying glass taking the image formed by the objective as its object.



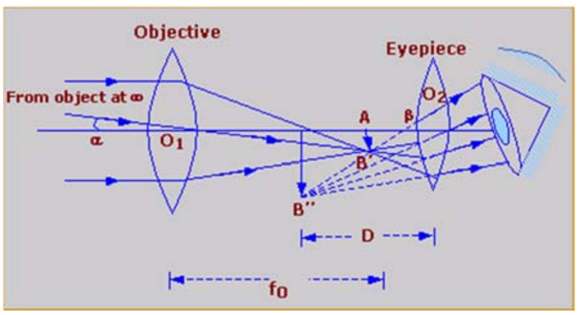
I. When final image is at infinity:-



Magnifying power (M): It may be defined as a ratio of angle subtended by the final image at eye to the Angle subtended by the object at eye.

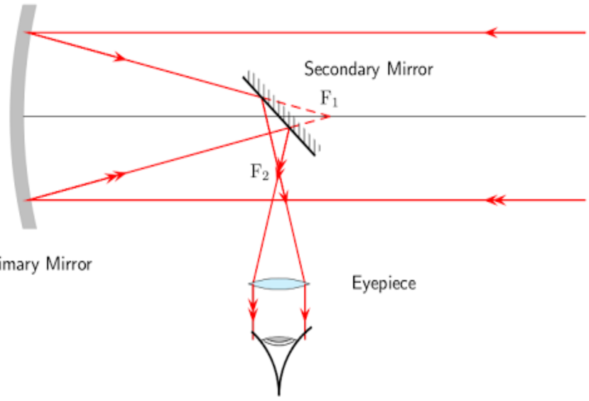
$M = -\frac{f0}{fe}$= Focal length of objective/ focal length of eye piece.

II. When final image is at least distance of distinct vision (LDDV):



$$M = \frac{f0}{fe}\left(1 + \frac{fe}{D}\right)$$

2. Terrestrial telescope: It is used to see distant stars. Resolving power & light gathering power for a telescope will be large if objective is of large aperture, so objective of this type of telescope is a spherical concave mirror of large focal length.



Working: The parallel rays from a distant object falls on a concave mirror, before being focused at the focus these rays are intercepted by a small convex mirror (M1M2) inclined at 45^0.Thus; the image is shifted towards the eye-piece. In accordance with action of eye piece it magnifies the image as usual without affected the brightness of the image.

$$M = \frac{f0}{fe}$$

Applications:

1) No chromatic aberration, because objective is not a lens.
2) With help of a parabolic mirror, a spherical aberration can be minimized.
3) If objective is of large aperture, then it can give minute details even for faint stars.

Salient features of a telescope:

a) High Resolving Power (R.P)
b) High Magnifying Power (M.P)
c) High Light-Gathering Power (L.G.P)

Resolving power: it is defined as "The ability of an optical instrument, expressed in numerical measure to resolve the images of two nearby points".

$$\theta = \frac{1.22\lambda}{D}$$

So, when θ is small & D is small.

Hence, we may also define resolving power as Reciprocal of smallest angle subtended at the objective of telescope by two small objects. Its theoretical value is given by:

$$d\theta = \frac{\lambda}{a} \text{.........} (1)$$

Where λ is wavelength of light used.

a is diameter of the objective of telescope.

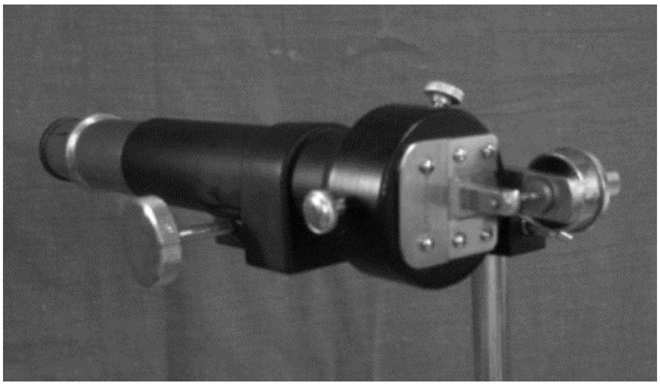
Also, Experimental value

$$d\theta = \frac{d}{D} \text{..............} (2)$$

So, from (1) and (2):

$$\frac{\lambda}{a} = \frac{d}{D}$$

Reading of micrometer screw:



Sleeve
1 Main div = 1mm
1 Sub div = 0.5mm

Thimble
1 Thimble div = $\frac{1}{50}$
Reading:
We take following example for understanding
15.00 mm (Sleeve main)
0.5 mm (sub div)
.06 mm (Thimble)
So total reading will be 15.56 mm

Conclusion
Physics has enormously contributed to the process of development and refinement of not only currently utilized technologies, but also those potentially utilizable technologies that are termed as 'the Future Technologies'. Physics is considered to be the most basic of the natural sciences. It deals with the fundamental constituents of matter and their interactions, as well as the nature of atoms and the build-up of molecules and condensed matter. We can conclude that vernier calipers and screw gauge plays a vital role for basic physics to measure length as well as breadth. Similarly, Microscope and telescope have same role in optical physics. These are elemental part of optics to measure each and everything regarding light.

References
1. Dr. Jeethendra, Kumar PK. Space Explorations; the Foundations, LE, 6(2):179.
2. Francis A Jenkins, Harvey E White. Fundamentals of Optics, 4th Edition, McGraw-Hill, 330.
3. Dr. Jeethendra, Kumar PK; Diffraction at the circular apertures, LE, 4(1):1.
4. Bednorz JG, KA Muller Z. Phys.B64, 1986, 189.
5. John Banhart, Denis Weaire. Physics Today, July 2002, 37.
6. John Rawlands, SafaKasap. Physics Today, Nov 1997, 24.