National Medical Commission
All India Medical Entrance Examination

NTA NEET

EXPERIMENTAL SKILLS
(PRACTICAL)
PHYSICS, CHEMISTRY, BIOLOGY

Objective
Chapterwise Solved Papers
Based on NMC Reduced & Updated Syllabus

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CONTENT

PHYSICS

CHEMISTRY

BIOLOGY

PHYSICS UNIT 20. EXPERIMENTAL SKILLS:

Familiarity with the basic approach and observation of the experiments and activities:

1. Vernier calipers-its use to measure the internal and external diameter and depth of a vessel
2. Screw gauge-its use to determine thickness/diameter of thin sheet/wire,
3. Simple Pendulum-dissipation of energy by plotting a graph between the square of amplitude and time,
4. Metre Scale- the mass of a given object by the principal of moments,
5. Young's modulus of elasticity of the material of a metallic wire
6. Surf ace tension of water by capillary rise and effect of detergents,
7. Co-efficient of Viscosity of a given viscous liquid by measuring terminal velocity of a given spherical body,
8. Speed of sound in air at room temperature using a resonance tube,
9. Specific heat capacity of a given (i) solid and (ii) liquid by method of mixtures,
10. The resistivity of the material of a given wire using a meter bridge,
11. The resistance of a given wire using Ohm's law,
12. Resistance and figure of merit of a galvanometer by half deflection method,
13. The focal length of:
    (i) Convex mirror
    (ii) Concave mirror, and
    (iii) Convex lens, using the parallax method
14. The plot of the angle of deviation vs angle of incidence for a triangular prism
15. Refractive index of a glass slab using a travelling microscope.
16. characteristic curves of a p-n junction diode in forward and reverse bias.
17. characteristic curves of a Zener diode and finding reverse break down voltage.
18. Identification of Diode. L.E.D,. Resistor. A capacitor from a mixed collection of such items.

CHEMISTRY UNIT-20 PRINCIPLES RELATED TO PRACTICAL CHEMISTRY

Detection of extra elements (N, S and X) in organic compounds.
Detection of the following functional groups- Hydroxyl (alcoholic and phenolic).
Carbonyl (aldehyde and ketones), carboxyl and amino groups in organic compounds.

- The chemistry involved in the preparation of the following :
  Inorganic compounds: Mohr's salt, potash alum.
  Organic compounds : Acetanilide, p-nitro acetanilide, Aniline yellow, Iodoform.
- The chemistry involved in the titrimetric exercises:
  Acids, bases and the use of indicators,
  Oxalic-acid vs $KMNO_4$,
  Mohr's salt vs $KMnO_4$.
- Chemical principles involved in the qualitative salt analysis :
  Cations – Pb^{2+}, Cu^{2+}, Al^{3+}, Fe^{3+}, Zn^{2+}, Ni^{2+}, Ca^{2+}, Ba^{2+}, Mg^{2+}, NH_5^+

  Anions - S^{2-}, SO_4^{2-}, NO^{3-}, NO^{2-}, CO_3^{2-}, Cl^-, Br^-, I^- (Insoluble salts excluded).

  Chemical principles involved in the following experiments :
  1. Enthalpy of solution of $CuSO_4$
  2. Enthalpy of neutralization of strong acid and strong base.
  3. Preparation of lyophilic and lyophobic sols.
  4. Kinetic study of the reaction of iodide ions with hydrogen peroxide at room temperature.

BIOLOGY

Unit -2 : To be dealt with along with the relevant practical of the practical syllabus : Structural Organisation in animals and plants

Unit -5 : To be dealt with the relevant practical of the practical syllabus : Human physiology

PHYSICS EXPERIMENTAL SKILLS

Unit-1

VERNIER CALIPERS-ITS USE TO MEASURE THE INTERNAL AND EXTERNAL DIAMENTER AND DEPTH OF A VESSEL

1. What is the primary purpose of Vernier calipers?
(a) Measuring temperature
(b) Measuring time
(c) Measuring length
(d) Measuring weight

Ans. (c) : Vernier calipers are primarily used for measuring length or linear dimensions. A Vernier caliper is mostly used to measure circular objects.

2. Which of the following measurements can be taken using Vernier calipers?
(a) Mass (b) Volume
(c) Diameter (d) Temperature

Ans. (c) : Vernier calipers can be used to measure diameters, among other linear dimensions.

3. Vernier calipers consist of two main parts: the main scale and the _____.
(a) Secondary scale (b) Vernier scale
(c) Digital display (d) Thermometer

Ans. (b) : A vernier calipers has two scales one main scale and a vernier scale. The main scale and vernier scale are divided into small division though of different magnitudes.

4. Which type of Vernier calipers is used to measure internal diameters?
(a) Inside Vernier calipers
(b) Outside Vernier calipers
(c) Depth Vernier calipers
(d) None of the above

Ans. (a) : Inside Vernier calipers are used to measure internal diameters.

5. What is the minimum division on the main scale of a Vernier calipers typically in millimeters?
(a) 0.01 mm (b) 0.1 mm
(c) 1 mm (d) 10 mm

Ans. (b) : The main scale of a Vernier calipers is typically graduated in 0.1 mm divisions.

6. What is a vernier caliper?
(a) A measuring total used to measure linear dimensions and diameters of round objects.
(b) A tool used to measure the weight of an object.
(c) A tool used to measure the volume of an object.
(d) A tool used to measure the temperature of an object.

Ans. (a) : A vernier caliper is a precise measuring instrument used to measure internal and external dimensions with great accuracy. It consists of a main scale and a sliding vernier scale, which allows for more precise readings them a regular ruler.

7. What is the least count of a vernier caliper?
(a) 0.1 mm (b) 1 mm
(c) 0.01 mm (d) 10 mm

Ans. (a) : Least count of vernier caliper 0.1 mm = 0.01 cm The least count of a vernier caliper is the smallest measurement that the caliper can measure accurately. It is determined by the difference between one smallest division on the main scale and one division on the vernier scale.

8. What is the difference between the main scale and vernier scale?
(a) The main scale is the large scale on the body of the vernier caliper, while the vernier scale is the small scale on the sliding you.
(b) The main scale is the small scale on the sliding few, while the vernier scale is the large scale on the body of the vernier caliper.
(c) The main scale and vernier scale are both located on the sliding faw.
(d) The main scale and vernier scale are both located on the body of the vernier caliper.

Ans. (a) : The main scale in vernier caliper is a long scale with everly spaced markings that provide the primary measurement. On the other hand the vernier scale is a smaller, sliding scale that allows for more precise readings than the main scale.

9. What is the dial caliper?
(a) A calibrated precision calculating tool used for taking accurate measurements.
(b) A measuring tool used for measuring linear dimension and measuring the diameters of round object.
(c) A device that uses a dial indicator to measure small distances with great accuracy.
(d) None of these.

Ans. (c) : A dial caliper is a type of caliper that utilizes a dial indicator to display measurements. It functions similarly to a traditional vernier caliper, but instead of reading the measurement off a vernier scale, the measurement is shown on a circular dial.

10. Which is meant by a caliper?
(a) A device used to measure angles.
(b) A device used to measure temperature
(c) A device used to measure length or distance between two.
(d) None of the above.

Ans. (c) : A caliper is a device used to measure the distance between two opposite sides of an object. They come in different types, including vernier calipers, dial calipers digital calipers etc.

11. Diameter of a still ball is measured using a vernier calipers which has divisions of 0.1 cm on its main scale (MS) and 10 division of its vernier scale (VS) match 9 division on the main scale. three such measurements for a ball are given as : –

Serial No	MS Divisions	VS divisions
1	0.5	8
2	0.5	4
3	0.5	6

If the zero error is – 0.03 cm, then mean corrected diameter is –

(a) 0.53 cm (b) 0.56 cm
(c) 0.59 cm (d) 0.52 cm

Ans. (c) : MSD = 0.1 cm

$VSD = \frac{9}{10} MSD = 0.9 \times 0.1 = 0.09$ cm

Least count = MSD – VSD = 0.1 – 0.09 = 0.01 cm

Total reading = main scale Reading + Vernier coincidence × Least count

1st reading = 0.5 + 8 × 0.01 = 0.58 cm

2nd reading = 0.5 + 4 × 0.01 = 0.54 cm

3rd reading = 0.5 + 6 × 0.01 = 0.56 cm

Average reading = (0.58 + 0.54 + 0.56) / 3 = 0 .56 cm

Corrected reading = Reading – zero error = 0.56 – (– 0.03) = 0.59 cm

12. In a vernier calipers, one main scale division in x cm and n division of the vernier scale coincide with (n–1) division of the main scale. The least count (in cm) of the calipers is –

(a) $\left(\frac{n-1}{n}\right)x$ (b) $\frac{nx}{(n-1)}$

(c) $\frac{x}{n}$ (d) $\frac{x}{(n-1)}$

Ans. (c) : Solution :

MSD = x cm ; MSD = Main scale division

nVSD = (n – 1) MSD ; VSD = Vernier scale division

$\Rightarrow VSD = \left(\frac{n-1}{n}\right) \times MSD = \frac{n-1}{n}x$

Least count error = $MSD - VSD = x - \frac{(n-1)x}{n} = \frac{x}{n}$

13. Vernier calipers has 1 mm marks on the main scale. It has 20 equal division on the vernier scale which match with 16 main scale division for this vernier calipers the least count is :

(a) 0.02 mm (b) 0.05 mm
(c) 0.1 mm (d) 0.2 mm

Ans. (d) : MSD = 1 mm

20 VSD = 16 MSD

$VSD = \frac{16}{20} MSD = 0.8 MSD = 0.8 mm$

$\therefore$ Least count error = MSD – VSD = 1 – 0.8 = 0.2 mm

14. In a vernier calliper, there are 10 division on the vernier scale and 1 cm on main scale is divided in 10 parts. While measuring a length, the zero of the vernier scale lies just ahead of 1.8 cm mark and 4th division of vernier scale coincides with a main scale division. The value of length is :

(a) 1.804 cm (b) 1.840 cm
(c) 1.800 cm (d) None of these

Ans. (b) : Length of one main scale division

$= \frac{1}{10} = 0.1$cm Number of vernier scale division = 10

Main scale reading = 1.8 cm

coinciding vernier scale division = 4th

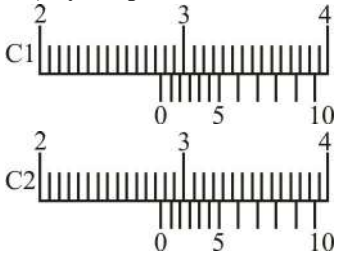
Least count = Length of smallest main scale divisional/ no. of vernier scale division.

= 0.1/10 = 0.01 cm.

$\therefore$ Length = Main scale reading + coinciding vernier scale division × Least count

= 1.8 + 4 × 0.01 = 1.8 + 0.04 = 1.84 cm

15. There are two vernier calipers both of which have 1 cm divided into 10 equal division on the main scale. The vernier scale of one of the calipers (C1) has 10 equal divisions that correspond to 9 main scale divisions. The vernier scale of the other caliper (C2) has 10 equal division that correspond to 11 main scale division. The readings of the two calipers are shown in the figure. The measured values (in cm) by calipers C1 and C2, respectively are :



(a) 2.87 and 2.86 (b) 2.85and 2.82
(c) 2.87 and 2.87 (d) 2.87 and 2.83

Ans. (d) : $MSD = \frac{1}{10}$ cm = 0.1 cm

For first vernier caliper,

10 VSD = 9 MSD

$\Rightarrow VSD = \frac{9}{10} MSD = 0.9 \times 0.1 = 0.09$ cm

Reading = Main scale reading upto coinciding main scale division – n × VSD

= 3.5 – 7 × 0.09 = 3.5 – 0.63 = 2.87 cm

For second vernier caliper,

10 VSD = 11 MSD

$\Rightarrow VSD = \frac{11}{10} MSD = 1.1 \times 0.1 = 0.11$ cm

Reading = 3.6 – 7 × 0.11 = 3.6 – 0.77 = 2.83 cm

16. In an experiment, the angles are required to be measured using an instrument 29 division of the main scale exactly coincide with the 30 division of the vernier scall. If the smallest division of the main scale is half-a-degree (=0.5°) then the least count of the instrument is :

(a) One minute (b) Half minute
(c) One degree (d) Half degree

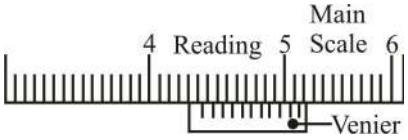
Ans. (a) : MSD = 0.5°
30 VSD = 29 MSD
Least count = Length of 1 main scale division/No of division of vernier scale
= 0.5°/30 = 0.5 × 60/30 = 1 minute

17. The formula of zero error is given by–

(a) Actual reading = Main Scale – (Zero error)
(b) Actual reading = Main scale + vernier scale – (Zero error)
(c) Actual reading = Main scale + vernier scale + (zero error)
(d) Actual reading = Main scale × Vernier scale – (Zero error)

Ans. (b) : Actual reading = Main scale + vernier scale – (Zero error)

18. The diagram below shows part of the main scale and vernier scale of a vernier caliper, which is used to measure the diameter of a metal ball. Find the least count and the radius of the ball.



(a) 0.01 cm, 2.18 cm (b) 0.02 cm, 2.18 cm
(c) 0.01 cm, 2.17 cm (d) 0.02 cm, 2.17 cm

Ans. (a) : $\text{Least Count} = \frac{\text{Value of one main scale division}}{\text{Number of division on vernier scale}}$

$= \frac{1\text{mm}}{10} = \frac{0.1\text{cm}}{10}$

$= 0.01$ cm

Redding (diameter) = MS reading + (coinciding Vernier scale reading × Least count)
Reading = 4.3 cm + (7 × 0.01) = 4.3 + 0.07 = 4.37 cm
Diameter = 4.37 cm

$\therefore$ Radius $= \frac{4.37}{2} = 2.185$cm.

19. The Vernier scale on a Vernier calipers allows for _____ measurement precision.

(a) Lower (b) Higher
(c) No change in (d) Variable

Ans. (b) : A vernier callipers is a precision measuring instrument that is used to measure the dimensions of a soled object. The Vernier scale provides higher measurement precision than the main scale alone.

20. Which of the following is a type of Vernier calipers used to measure the depth of small holes or recesses?

(a) Inside Vernier calipers
(b) Outside Vernier calipers
(c) Depth Vernier calipers
(d) Height Vernier calipers

Ans. (c) : A depth Vernier calipers is used to measure the depth of holes or recesses.

21. Vernier calipers are commonly used in which fields or industries?

(a) Medicine (b) Construction
(c) Automotive (d) All of the above

Ans. (d) : Vernier calipers are used in various fields, including medicine, construction, and automotive.

22. When measuring an object with a Vernier calipers, the jaws should be applied _____ to the object's surface.

(a) Perpendicular (b) Parallel
(c) Diagonal (d) Tangential

Ans. (a) : The jaws of the Vernier calipers should be applied perpendicular to the object's surface. The upper jaws are used to measure internal diameter and lower jaw are used to measure length eternal diameter.

23. Which property of Vernier calipers allows them to measure both internal and external dimensions?

(a) Interchangeable jaws
(b) Telescopic arms
(c) Digital display
(d) Magnetic attraction

Ans. (a) : Vernier calipers have interchangeable jaws that allow them to measure both internal and external dimensions.

24. The accuracy of Vernier calipers depends on:

(a) The material they are made of
(b) The length of the object being measured
(c) The skill of the operator
(d) The number of decimal places on the Vernier scale

Ans. (c) : The accuracy of Vernier caliper measurements depends on the skill of the operator in reading and using the instrument.

25. The "zero error" of a Vernier calipers can be positive or negative, depending on whether the zero mark of the Vernier scale is to the _____ or _____ of the main scale zero mark.

(a) Left, right (b) Right, left
(c) Above, below (d) Inside, outside

Ans. (b) : The zero error can be positive or negative depending on the relative positions of the Vernier scale zero mark and the main scale zero mark.

26. Which of the following is NOT a common unit of measurement for Vernier calipers?

(a) Inches (b) Millimeters
(c) Centimeters (d) Meters

Ans. (d) : Vernier calipers are typically used to measure in inches, millimeters, or centimeters, but not in meters.

27. When measuring an external diameter with a Vernier calipers, the jaws should be placed _____ the object.

(a) Inside (b) Outside
(c) Above (d) Below

Ans. (b) : When measuring an external diameter, the jaws should be placed outside the object.

28. Which of the following factors can affect the accuracy of Vernier calipers measurements?

(a) Temperature (b) Color of the object
(c) Ambient light (d) Shape of the object

Ans. (a) : Temperature can affect the dimensions of an object and, consequently, the accuracy of Vernier calipers measurements.

29. In a metric Vernier calipers, how many divisions are typically found on the Vernier scale?

(a) 10 divisions (b) 20 divisions
(c) 25 divisions (d) 50 divisions

Ans. (c) : In a metric Vernier calipers, the Vernier scale typically has 25 divisions.

30. Which of the following is NOT a type of Vernier calipers?

(a) Vernier height gauge
(b) Vernier depth gauge
(c) Vernier micrometer
(d) Vernier caliper gauge

Ans. (d) : There is no such thing as a "Vernier caliper gauge." The other options are valid types of Vernier measuring instruments.

31. Which component of a Vernier calipers directly contacts the object being measured?

(a) Main scale (b) Vernier scale
(c) Depth rod (d) Jaws

Ans. (d) : The jaws of a Vernier calipers are the parts that directly contact the object being measured.

32. What is the name of the phenomenon where the Vernier scale aligns perfectly with the main scale, indicating a precise measurement?

(a) Vernier effect (b) Parallax error
(c) Zero error (d) Coincidence error

Ans. (d) : When the Vernier scale aligns perfectly with the main scale, it is called a "coincidence error."

33. Which type of Vernier calipers is used to measure the height of an object or the thickness of a flat surface?

(a) Inside Vernier calipers
(b) Outside Vernier calipers
(c) Height Vernier calipers
(d) Depth Vernier calipers

Ans. (c) : A height Vernier calipers is used to measure the height or thickness of an object.

34. What is the function of the locking screw on a Vernier calipers?

(a) To increase measurement accuracy
(b) To hold the object firmly in place
(c) To prevent the jaws from closing
(d) To prevent damage to the Vernier scale

Ans. (b) : The locking screw is used to hold the jaws in place and secure the object being measured. So this part helps to mate proper measurement.

35. Which part of a Vernier calipers is responsible for measuring internal diameters precisely?

(a) Vernier scale (b) Depth rod
(c) Inside jaws (d) Main scale

Ans. (c) : The inside jaws of a Vernier caliper are used to measure internal diameters accurately.

36. What is the purpose of the depth rod on a Vernier calipers?

(a) To measure the depth of holes and recesses
(b) To measure the external diameter of objects
(c) To provide stability to the calipers
(d) To assist in reading the Vernier scale

Ans. (a) : The depth rod is used to measure the depth of holes and recesses. It can be measured by inserting the depth rod into the hole.

37. Which of the following is an advantage of Vernier calipers over other measuring instruments like rulers?

(a) Greater length (b) Greater precision
(c) Digital display (d) Magnetic properties

Ans. (b) : Vernier calipers offer greater precision compared to simple rulers.

38. What does the term "least count" refer to in the context of Vernier calipers?

(a) The smallest measurement that can be made with the calipers
(b) The smallest division on the Vernier scale
(c) The total length of the Vernier scale
(d) The largest measurement the calipers can make

Ans. (b) : The least count of a Vernier calipers is the smallest division on the Vernier scale, which determines its precision.

39. When using a Vernier calipers, how is the Positive zero error corrected if it is present?

(a) By ignoring it
(b) By adding it to the measurement
(c) By subtracting it from the measurement
(d) By adjusting the main scale

Ans. (c) : Positive zero-error correction is done by subtracting the positive zero-error form the actual reading. Negative zero-error correction is done by adding the negative zero-error from the actual recoding

40. What should you do before making measurements with a Vernier calipers to ensure accuracy?

(a) Calibrate the Vernier scale
(b) Wipe the calipers with a dry cloth
(c) Apply lubricant to the jaws
(d) Adjust the locking screw

Ans. (b) : Wiping the caliper with a dry cloth helps ensure that there are no debris or contaminants that could affect measurements and accuracy.

41. Which material is commonly used to make the jaws of Vernier calipers due to its hardness and wear resistance?

(a) Aluminum (b) Plastic
(c) Steel (d) Brass

Ans. (c) : Steel is commonly used to make the jaws of Vernier calipers because of its hardness and wear resistance.

42. What is the main advantage of using Vernier calipers with a fine-adjustment screw?

(a) Increased measurement range
(b) Enhanced precision during measurement
(c) Improved readability of the scales
(d) Reduced need for calibration

Ans. (b) : A fine-adjustment screw in Vernier calipers allows for precise adjustments and enhances measurement precision.

43. In a Vernier caliper, the Vernier scale moves in relation to the:

(a) Main scale
(b) Depth rod
(c) Locking screw
(d) Thumbwheel

Ans. (a) : The Vernier scale moves in relation to the main scale to determine the measurement. The main function of the vernier scale is to provide accuracy to the main scale reading by deciding the reading in to smaller increments.

44. When measuring an object with a Vernier calipers, the zero on the Vernier scale should align with a mark on the main scale to get an accurate reading. This alignment is known as:

(a) Coincidence error
(b) Parallax error
(c) Vernier effect
(d) Calibration error

Ans. (a) : Aligning the zero on the Vernier scale with a mark on the main scale is known as "coincidence error."

45. Which type of Vernier calipers is suitable for measuring the thickness of a thin sheet of paper?

(a) Inside Vernier calipers
(b) Outside Vernier calipers
(c) Height Vernier calipers
(d) Micrometercalipers

Ans. (b) : An outside Vernier caliper can be used to measure the thickness of a thin sheet of paper.

46. What is the primary limitation of Vernier calipers compared to micrometers for precision measurements?

(a) Vernier calipers are less durable
(b) Vernier calipers are less versatile
(c) Vernier calipers are less accurate
(d) Vernier calipers are slower to use

Ans. (c) : Vernier calipers are generally less accurate than micrometers for precision measurements. Micrometers offer a measuring range of around O " to 6", whereas calipers offer a O " to 2" range.

47. Which type of Vernier calipers is used for measuring the thickness of coins or small objects?

(a) Inside Vernier calipers
(b) Outside Vernier calipers
(c) Height Vernier calipers
(d) Coin Vernier calipers

Ans. (d) : A specialized type of Vernier calipers known as a "coin Vernier calipers" is used for measuring the thickness of coins and small objects.

48. Which term describes the measurement error that occurs when the line of sight is not perpendicular to the scale, leading to inaccurate readings ?

(a) Zero error
(b) Parallax error
(c) Calibration error
(d) Vernier effect

Ans. (b) : Parallax error occurs when the line of sight is not perpendicular to the scale, leading to inaccurate readings in Vernier calipers.

49. What is the primary advantage of using Vernier calipers over simple rulers or tape measures?

(a) Greater length capacity
(b) Lower cost
(c) Higher precision
(d) Digital display

Ans. (c) : Vernier calipers offer higher precision compared to simple rulers or tape measures. Vernier callipers provide accurate and precise measurements over a large range.

50. In Vernier calipers, what is the function of the Vernier scale?

(a) To magnify the main scale reading
(b) To provide a digital display of measurements
(c) To measure depths accurately
(d) To provide fine adjustment

Ans. (d) : The Vernier scale provides fine adjustment for precise measurements.

51. What is the name of the error that occurs when the zero mark of the Vernier scale is to the left of the main scale zero mark?

(a) Positive zero error
(b) Negative zero error
(c) Coincidence error
(d) Parallax error

Ans. (b) : When the zero mark of the Vernier scale is to the left of the main scale zero mark, it is a negative zero error.

52. When measuring an internal diameter with Vernier calipers, what part of the calipers should be used?

(a) Vernier scale (b) Depth rod
(c) Inside jaws (d) Outside jaws

Ans. (c) : The inside jaws of Vernier calipers are used for measuring internal diameters.

53. What is the primary advantage of digital Vernier calipers over traditional Vernier calipers?

(a) Lower cost
(b) Ease of reading
(c) Greater measurement range
(d) Increased durability

Ans. (b) : Digital Vernier calipers are easier to read compared to traditional Vernier calipers. Digital vernier calipers are often equipped with additional features, such as a memory function and a data transfer port. They can be more accurate than vernier calipers for very small measurements.

54. What should you do if you encounter a positive zero error when using Vernier calipers?

(a) Add the error to the measurement
(b) Subtract the error from the measurement
(c) Ignore the error
(d) Adjust the locking screw

Ans. (b) : Positive zero error concoction is done by subtracting the positive zero error from the actual reading So, option (b) is correct.

55. What is the primary function of the locking screw on Vernier calipers?

(a) To adjust the zero mark
(b) To measure depths accurately
(c) To secure the jaws in place during measurement
(d) To move the Vernier scale

Ans. (c) : The locking screw on Vernier calipers is used to secure the jaws in place during measurement to prevent any movement or changes in the reading.

56. What is the main advantage of using Vernier calipers with a fine-adjustment screw?

(a) Increased measurement range
(b) Enhanced precision during measurement
(c) Improved readability of the scales
(d) Reduced need for calibration

Ans. (b) : A fine-adjustment screw in Vernier calipers allows for precise adjustments and enhances measurement precision.

57. What is the purpose of the thumbwheel on some Vernier calipers?

(a) To lock the jaws in place
(b) To adjust the position of the Vernier scale
(c) To move the jaws quickly
(d) To provide a comfortable grip

Ans. (c) : The thumbwheel on Vernier calipers is used to move the jaws quickly and make coarse adjustments.

58. In a Vernier calipers, the Vernier scale moves in relation to the:

(a) Main scale
(b) Depth rod
(c) Locking screw
(d) Thumbwheel

Ans. (a) : The Vernier scale moves in relation to the main scale to determine the measurement.

59. Which term describes the measurement error that occurs when the line of sight is not perpendicular to the scale, leading to inaccurate readings?

(a) Zero error
(b) Parallax error
(c) Calibration error
(d) Vernier effect

Ans. (b) : Parallax error occurs when the line of sight is not perpendicular to the scale, leading to inaccurate readings in Vernier calipers.

60. What is the name of the error that occurs when the zero mark of the Vernier scale is to the left of the main scale zero mark?

(a) Positive zero error
(b) Negative zero error
(c) Coincidence error
(d) Parallax error

Ans. (b) : When the zero mark of the Vernier scale is to the left of the main scale zero mark, it is a negative zero error.

61. When measuring an internal diameter with Vernier calipers, what part of the calipers should be used?

(a) Vernier scale
(b) Depth rod
(c) Inside jaws
(d) Outside jaws

Ans. (c) : The inside jaws of Vernier calipers are used for measuring internal diameters.

62. What is the primary function of the locking screw on Vernier calipers?

(a) To adjust the zero mark
(b) To measure depths accurately
(c) To secure the jaws in place during measurement
(d) To move the Vernier scale

Ans. (c) : The locking screw on Vernier calipers is used to secure the jaws in place during measurement to prevent any movement or changes in the reading.

Unit-2

Screw gauge-its use to determine thickness/ diameter of thin sheet/wire

63. In which situation would a "micrometer screw gauge" be more suitable than a meter scale for length measurements?

(a) Measuring the length of a football field
(b) Measuring the thickness of a sheet of paper
(c) Measuring the height of a tree
(d) Measuring the volume of a liquid

Ans. (b) : A micrometer screw gauge is more suitable for precise measurements of small thicknesses, such as a sheet of paper.

64. What is the primary purpose of a screw gauge?

(a) Measuring length
(b) Measuring mass
(c) Measuring volume
(d) Measuring temperature

Ans. (a) : Screw gauges are primarily used for measuring the length or thickness of small objects with high precision.

65. Which part of a screw gauge is responsible for making fine measurements?

(a) Thimble (b) Sleeve
(c) Main scale (d) Frame

Ans. (a) : The thimble is the rotating part of the screw gauge that allows for fine adjustments and precise measurements.

66. What is the standard unit of measurement for screw gauges in the metric system?

(a) Inches (b) Millimeters
(c) Centimeters (d) Meters

Ans. (b) : Screw gauge measurements are typically expressed in millimeters.

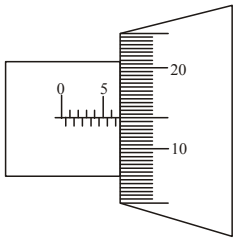
67. Which of the following is NOT a part of a screw gauge?

(a) Vernier scale (b) Pitch scale
(c) Spindle (d) Anvil

Ans. (a) : Screw gauges consist of a a pitch scale, spindle, anvil, and frame, but not vernier scale.

68. The main scale of a screw gauge has $\frac{1}{2}$ mm mark for complete rotation the screw advances by $\frac{1}{2}$ mm.

Read the screw gauge in which the markings are shown blow–



(a) 0.14 mm (b) 6.64 mm
(c) 6.5 mm (d) 5.64 mm

Ans. (b) : According to Diagram
PSR = 6.5 mm
Considering H.S.D = 14th divion
H.S.R = H.S.D × L.C. = 14 × 0.01 = 0.14
Object thickness = 6.5 + 0.14 = 6.64 mm
∵ PSR = Pitch / Main Scale reading
HSR = Circular / Head Scale Reading
L.C. = Least Count

69. The Pitch of a screw gauge is 1 mm and there are 100 divisions on circular scale. While measuring the diameter of a wire the linear scale reads 1 mm and 47th division on the circular scale coincides with the reference line. The length of the wire is 5.6 cm. Find the curved surface area (in cm) of the wire in appropriate number of significant figures.

(a) 2.16 cm^2 (b) 2.58 cm^2
(c) 1.56 cm^2 (d) 8.56 cm^2

Ans. (a) : The distance moved on the linear scale when circular scale makes one complete rotation is p = 1 mm (Pitch).
∴ One division on the circular scale is, Least count

$$= \frac{P}{N} = \frac{1}{100} = 0.01\text{mm}$$

The linear scale reading (LSR) is 1 mm and the circular scale reading (CSR) is 47.
∴ Diameter d = LSR + CSR × LC = 1 + 47 × 0.01
d = 1.47 mm
= 0.147 cm
The curved surface area of the cylinder is, A = πdl
A = 3.14 × 0.147 × 5.6
= 2.5848 cm^2

70. The density of a solid ball is to be determined in an experiment. The diameter of the ball is measured with a screw gauge, whose pitch is 0.5 and there are 50 divisions on the circular scale. The reading on the main scale is 2.5 mm and that on the circular scale is 20 divisions.
If the measured mass of the ball has relative error of 2%, the percentage error in density is–

(a) 0.9% (b) 2.4%
(c) 3.1% (d) 4.2%

Ans. (c) : As we Know,
The density of a ball of mass m and diameter D is given by $\rho = \frac{6m}{(\pi D^3)}$
Differentiate to get,

$$\therefore \quad d\rho = \frac{6}{\pi}\left(\frac{D^3 dm - 3mD^2 dD}{D^6}\right)$$

Divide the second equation by the first to get

$$\frac{d\rho}{\rho}=\frac{dm}{m}-\frac{3dD}{D}$$

In error analysis, measured and actual mass are related by–

actual = measured + DM,

Where DM is a small positive number representing measurement error. Let DM and DD be the measurement errors (both positive) in m and d.

From above expression, dρ is maximum when dm = Dm and dD = – DD.

Thus the error in ρ is –

$$=\frac{D\rho}{\rho}=\frac{DM}{M}+\frac{3DD}{D}$$

Least count of a screw gauge,

$$L.C.=\frac{\text{Pitch number}}{\text{number of division}}=\frac{P}{N}=\frac{0.5}{50}$$

LC = 0.01 mm.

Least count is error in measurement of the all diameter D, i.e. DD = 0.14 mm.

The measured diameter for the given main scale reading (MSR) and circular scale reading (n) is–

D = MSR + (n) LC = 2.5 + (20) × 0.01

D = 2.70 mm

Given,

$$\frac{Dm}{m}=\frac{2}{100}=0.02$$

$$\therefore\quad \frac{D\rho}{\rho}=0.02+3\times\frac{0.01}{2.70}=0.031=3.1\%$$

71. Consider a vernier calipers in which each 1 cm on the main scale is divided into 8 equal division and a screw gauge with 100 division on its circular scale. In the vernier calipers, 5 division of the veanier scale coincide with 4 division on the main scale and in the screw gauge, one complete rotation of the circular scale moves it by two division on the linear scale, Then, –

(a) If the pitch of the screw gauge is twice the least count of the vernier calipers, the least count of the screw gauge is 0.01 mm.

(b) If the pitch of the screw gauge is twice the least count of the vernier calipers, the least count of the screw gauge is 0.005 mm.

(c) If the least count of the linear scale of the screw gauge is twice the least count of the vernier calipers, the least count of the screw gauge is 0.01cm.

(d) If the least count of the linear scale of the screw guage is twice the least count of the vernier calipers the least count of the screw gauge is 0.005 mm.

Ans. (b) : For vernier caliper :

Each 1 cm on the main scale is divided into 8 equal divisions. This means each division on the main scale is

$\frac{1}{8}=0.125$cm.

Also, 5 division of the vernier scale coincide with 4 division on the main scale

$$\text{Least count of vernier scale}=\frac{0.125}{5}=0.025\text{cm}$$

In case of screw gauge,

One complete rotation = 2 division and 100 division on the circular scale = 2 × 100 = 200 division on the linear scale.

$$\therefore\ \text{Least count of screw gauge}=\frac{200}{100}=2\text{ divisions.}$$

Let's see option (b)

Pitch of screw gauge is twice the least count of vernier calipers, 0.025 × 10 = 0.25 mm.

⇒ 2 × 0.25 = 0.50 mm

= 0.50 × 1000 = 500μm

∴ Least count of screw gauge is 0.005 mm.

72. The circular scale of a screw gauge has 50 divisions. It is spindle moved by 2 mm or sleeve as of complete 4 rotations. Then its pitch will be–

(a) 2 mm (b) 2.4 mm

(c) 8.8 mm (d) 0.5 mm

Ans. (d) : Pitch of a screw gauge = Distance moved in one complete rotation

$$\therefore\ \text{Pitch}=\frac{2\text{mm}}{4}=0.5\text{mm}$$

73. The least count of the snain scale of a screw gauge is 1 mm. The minimum number of divisions on its circular scale required to measures 5 μm diameter of wire is –

(a) 50 (b) 100

(c) 200 (d) 500

Ans. (c) : ∵ 1mm = 1000 μm

$\therefore$ 5μm = 5×10^{-3} mm

$\therefore$ The least count of the screw gauge is 1 mm = 1×10^{3}μm

$$\Rightarrow\ \frac{1\times10^{3}\text{ micrometers}}{5\times10^{-3}\text{ millimeters}}=\frac{1\times10^{+3-6}}{5\times10^{-3}\times10^{-3}}$$

$$=\frac{1\times1000}{5}=200$$

74. In a screw gauge, there are 100 division on the thimble scale and screw advances 1 mm in a complete rotation of the screw cap. In another screw gauge, there 200 divisions on the thimble scale and screw advances 1 mm in a complete rotation of the screw cap. Who is more precise in measurement?

(a) 2 mm (b) 0.05 mm

(c) 0.05 mm (d) 5 mm

Ans. () : The least count for the first screw gauge is

$$LC_1=\frac{\text{pitch}}{\text{division in the thimble scale}}=\frac{1\text{mm}}{100}=0.01\text{mm}$$

Similarly, $LC_2=\frac{1\text{mm}}{200}=0.005\text{mm}$

$\therefore$ Here, $LC_2 < LC_1$.

So, the second screw gauge is more precise in measurement.

75. In a screw gauge, when the anvil and spindle are touching each other the zero mark on the thimble scale matches with the zero mark of the main scale. There are 100 divisions on the thimble scale and screw advances 1 mm in a complete rotation of the screw cap. A rod of 3 in main scale reading and 15 on the thimble scale. What is the value of D ?

(a) 4.5 mm (b) 3.15 mm
(c) 3 mm (d) 2.15 mm

Ans. (b) : The least count is

$$LC = \frac{\text{Pitch}}{\text{Division in the thimble scale}}$$

$$= \frac{1\text{mm}}{100} = 0.01\text{mm}$$

The zero mark in thimble scale matches with the datum line when the spindle and the anvil touch each other. So, no zero error exits.

$\therefore Z = LC \times 0 = 0$ mm

$D = MSR + X.LC - Z$

$= 3 + 15 \times 0.01 - 0$

$= 3.15$ mm

76. In a screw gauge, the screw advances 1 mm in one complete rotation of the thimble scale cope. There are 100 divisions in the thimble scale. The least count is –

(a) 0.01 mm (b) 0.02 mm
(c) 0.1 mm (d) 0.2 mm

Ans. (a) : Since, the screw advances 1 mm in one complete rotation of the thimble scale, and there are 100 division on the thimble scale.

Therefore, each division on the thimble scale corresponds to a liner displacement of $= \frac{1\text{mm}}{100} = 0.01\text{mm}.$

$\therefore$ The least count of the screw gauge is 0.01 mm.

77. A 4.92 mm diameter wire when measured by a faculty screw gauge gives a reading of 5.01 mm. What will be the reading while measuring a 5.01 mm diameter rod?

(a) 4.92 mm (b) 5.01 mm
(c) 5.10 mm (d) None of these

Ans. (c) : Given, diameter of the wire = 4.92 mm

measured value = 5.01 mm

Also, the difference in the readings is due to the zero error of the screw gauge.

$\therefore$ Zero error = (5.01 – 4.92) mm = 0.09 mm

Correct reading value = Measured value + zero error

= 5.01 + 0.099 = 5.10 mm

78. A screw gauge gives the following reading when used to measured the diameter of a wire.

Main scale reading : 0 mm

Circular scale reading : 52 divisions

Given that 1 mm on main scale corresponds to 100 divisions of the circular scale. The diameter of wire from the above data is :–

(a) 0.026 cm (b) 0.05 cm
(c) 0.52 cm (d) 0.052 cm

Ans. (d) : MSR = 0 mm

C.S.R. = 52 divisions.

$$L.C. = \frac{\text{Pitch of MCR}}{\text{No of division on V.S.}} = \frac{1\text{mm}}{100} = 0.01\text{mm}$$

$\therefore$ Reading = MSR + L.C. × C.S.R = 0+0.01 × 52

= 0.52 mm

= 0.052 cm

79. In a screw gauge, what is the purpose of the ratchet stop?

(a) To measure temperature
(b) To prevent over-tightening
(c) To adjust the pitch
(d) To align the thimble and sleeve

Ans. (b) : The ratchet stop prevents over-tightening of the object being measured, ensuring accuracy. It ensures uniform pressure between the measuring surfaces.

80. What is the smallest division on the main scale of a screw gauge called?

(a) Pitch (b) Least count
(c) Vernier scale (d) Frame

Ans. (b) : The least count is the smallest division on the main scale and is used to make precise measurements.

81. What is the purpose of the vernier scale on a screw gauge?

(a) To measure temperature
(b) To determine the pitch
(c) To calculate the least count
(d) To improve measurement accuracy

Ans. (d) : The vernier scale helps in obtaining more accurate measurements by reading the position of the thimble relative to the main scale.

82. Which type of screw gauge is used to measure the diameter of thin wires?

(a) Micrometer screw gauge
(b) Vernier screw gauge
(c) Dial screw gauge
(d) Pitch screw gauge

Ans. (a) : Micrometer screw gauges are commonly used for measuring small diameters with high precision.

83. How does an increase in the pitch affect the least count of a screw gauge?

(a) Decreases the least count
(b) Increases the least count
(c) No effect on the least count
(d) Makes the least count negative

Ans. (b) : A larger pitch results in a larger least count, reducing the precision of the screw gauge.

84. Which part of the screw gauge comes in direct contact with the object being measured?

(a) Thimble (b) Sleeve
(c) Anvil (d) Frame

Ans. (c) : The anvil is the stationary part of the screw gauge that makes contact with the object being measured.

85. What is the advantage of using a Vernier screw gauge over a simple screw gauge?

(a) Vernier screw gauges are cheaper

(b) Vernier screw gauges are easier to use
(c) Vernier screw gauges have a smaller least count
(d) Vernier screw gauges cannot measure small objects

Ans. (c) : Vernier screw gauges offer greater precision due to their smaller least count.

86. When reading a screw gauge, how is the main scale aligned with the vernier scale?
(a) By adjusting the frame
(b) By aligning the zero of both scales
(c) By rotating the anvil
(d) By using the pitch scale

Ans. (b) : The main scale and vernier scale are aligned by making their zeros coincide.

87. Which of the following objects can be accurately measured using a screw gauge?
(a) Length of a building
(b) Diameter of a planet
(c) Thickness of a sheet of paper
(d) Weight of a car

Ans. (c) : Screw gauges are suitable for measuring small dimensions with high precision, such as the thickness of paper.

88. What is the primary application of a dial screw gauge?
(a) Measuring length
(b) Measuring mass
(c) Measuring angles
(d) Measuring temperature

Ans. (c) : Dial screw gauges are commonly used for measuring angles or the runout of cylindrical objects.

89. Which material is often used to manufacture the spindle of a screw gauge due to its low coefficient of thermal expansion?
(a) Steel (b) Aluminum
(c) Brass (d) Plastic

Ans. (c) : Brass is used for the spindle because it has a low coefficient of thermal expansion, ensuring measurement accuracy.

90. What is the formula for calculating the least count of a screw gauge?
(a) Least count = Pitch / Total number of divisions on thimble
(b) Least count = Pitch x Total number of divisions on thimble
(c) Least count = Total number of divisions on main scale / Pitch
(d) Least count = Total number of divisions on main scale x Pitch

Ans. (a) : The least count is determined by dividing the pitch by the total number of divisions on the thimble.

91. Which component of a screw gauge helps in obtaining precise measurements by aligning the main scale and vernier scale?
(a) Sleeve (b) Ratchet stop
(c) Thimble (d) Frame

Ans. (a) : The sleeve is responsible for aligning the main scale and vernier scale to ensure accurate readings.

92. What is the function of the ratchet stop in a screw gauge?
(a) To prevent damage to the object being measured
(b) To measure temperature
(c) To adjust the pitch
(d) To align the main scale and vernier scale

Ans. (a) : The ratchet stop prevents over-tightening, which could damage the object being measured.

93. In a screw gauge, which part moves when measurements are taken?
(a) Sleeve (b) Anvil
(c) Thimble (d) Frame

Ans. (c) : The thimble is the rotating part that moves when measurements are taken.

94. Which type of screw gauge is used for measuring the internal diameter of a cylindrical object?
(a) Outside micrometer screw gauge
(b) Vernier screw gauge
(c) Dial screw gauge
(d) Pitch screw gauge

Ans. (a) : An outside micrometer screw gauge is used to measure the external dimensions of objects.

95. How is the least count of a screw gauge related to the number of divisions on the thimble?
(a) Directly proportional
(b) Inversely proportional
(c) Not related
(d) Equal

Ans. (b) : The least count is inversely proportional to the number of divisions on the thimble; as the number of divisions increases, the least count decreases.

96. What is the purpose of the main scale on a screw gauge?
(a) To provide a reference for rough measurements
(b) To measure temperature
(c) To align the thimble
(d) To adjust the pitch

Ans. (a) : The main scale serves as a reference for rough measurements before fine adjustments are made using the vernier scale.

97. Which type of screw gauge is commonly used in mechanical workshops for various measurements?
(a) Vernier screw gauge (b) Dial screw gauge
(c) Pitch screw gauge (d) Digital screw gauge

Ans. (b) : Dial screw gauges are versatile and commonly used in mechanical workshops.

98. What is the least count of a screw gauge with 100 divisions on the circular scale and a pitch of 1 mm?
(a) 0.01 mm (b) 0.1 mm
(c) 1 mm (d) 10 mm

Ans. (b) : The least count is calculated as pitch divided by the total number of divisions on the thimble (1 mm / 100 divisions = 0.1 mm).

99. Which property of screw gauges makes them suitable for measuring objects with small dimensions?

(a) Large pitch (b) Large anvil
(c) Small least count (d) Small spindle

Ans. (c) : Screw gauges are designed with small least counts to measure small dimensions with precision.

100. What is the purpose of the pitch scale on some screw gauges?

(a) To measure temperature
(b) To adjust the ratchet stop
(c) To determine the pitch of the screw
(d) To check the alignment of the thimble

Ans. (c) : The pitch scale helps users determine the pitch of the screw for calibration and measurement purposes.

101. Which type of screw gauge is commonly used in industries for automated measurements?

(a) Vernier screw gauge
(b) Dial screw gauge
(c) Pitch screw gauge
(d) Digital screw gauge

Ans. (d) : Digital screw gauges provide quick and automated measurements in industrial settings.

102. What is the primary application of a pitch screw gauge?

(a) Measuring length
(b) Measuring angles
(c) Measuring internal diameters
(d) Measuring temperature

Ans. (c) : Pitch screw gauges are designed for measuring the internal diameters of objects.

103. Which material is commonly used for the frame of a screw gauge due to its strength and stability?

(a) Aluminium (b) Plastic
(c) Steel (d) Wood

Ans. (c) : Steel is often used for the frame of a screw gauge due to its strength and stability.

104. What is the least count of a screw gauge with 50 divisions on the circular scale and a pitch of 0.5 mm?

(a) 0.05 mm (b) 0.5 mm
(c) 1 mm (d) 10 mm

Ans. (a) : The least count is calculated as pitch divided by the total number of divisions on the thimble (0.5 mm / 50 divisions = 0.05 mm).

105. In a vernier screw gauge, what is the purpose of the vernier scale?

(a) To provide a reference for rough measurements
(b) To measure temperature
(c) To determine the pitch of the screw
(d) To improve measurement accuracy

Ans. (d) : The vernier scale on a screw gauge allows for more precise measurements by reading the position of the thimble relative to the main scale.

106. Which part of a screw gauge is responsible for housing the other components and providing stability?

(a) Thimble (b) Sleeve
(c) Frame (d) Anvil

Ans. (c) : The frame provides the structure and stability for the other components of the screw gauge.

107. What is the primary advantage of using a micrometer screw gauge over a vernier screw gauge?

(a) Micrometer screw gauges are cheaper
(b) Micrometer screw gauges have a larger least count
(c) Micrometer screw gauges offer greater precision
(d) Micrometer screw gauges are easier to use

Ans. (c) : Micrometer screw gauges provide higher precision measurements compared to vernier screw gauges.

108. Which part of a screw gauge helps in preventing parallax error during measurements?

(a) Frame (b) Sleeve
(c) Ratchet stop (d) Vernier scale

Ans. (d) : The vernier scale helps prevent parallax error by providing a clear alignment reference.

109. What is the primary purpose of the anvil in a screw gauge?

(a) To rotate the spindle
(b) To provide stability to the frame
(c) To make contact with the object being measured
(d) To adjust the pitch

Ans. (c) : The anvil is the part of the screw gauge that comes in direct contact with the object being measured.

110. Which type of screw gauge is commonly used in the aerospace industry for measuring tight tolerances?

(a) Vernier screw gauge
(b) Dial screw gauge
(c) Micrometer screw gauge
(d) Pitch screw gauge

Ans. (c) : Micrometer screw gauges are suitable for measuring tight tolerances in precision industries like aerospace.

111. In a screw gauge, what does the term "zero error" refer to?

(a) The alignment of the main scale and vernier scale
(b) An error in which the zero of the main scale does not coincide with the zero of the vernier scale
(c) The smallest possible measurement that can be made
(d) The pitch of the screw gauge

Ans. (b) : Zero error occurs when the zero point of the main scale is not aligned with the zero point of the vernier scale.

112. Which part of a screw gauge is responsible for controlling the depth of penetration into the object being measured?
(a) Sleeve (b) Ratchet stop
(c) Thimble (d) Frame

Ans. (b) : The ratchet stop controls the depth of penetration to prevent over-tightening and damage to the object.

113. What is the least count of a screw gauge with 60 divisions on the circular scale and a pitch of 0.25 mm?
(a) 0.25 mm (b) 0.5 mm
(c) 0.0125 mm (d) 0.004167 mm

Ans. (d) : The least count is calculated as pitch divided by the total number of divisions on the thimble (0.25 mm / 60 divisions = 0.004167 mm).

114. In a screw gauge, how is the least count affected when the number of divisions on the circular scale increases?
(a) Increases
(b) Decreases
(c) Remains the same
(d) Depends on the pitch

Ans. (b) : As the number of divisions on the circular scale increases, the least count decreases, resulting in higher precision.

$\because$ Least count = $\frac{\text{Pitch}}{\text{Totalumber of divisions on thimble}}$

115. Which type of screw gauge is commonly used in the medical field for measuring small diameters, such as the thickness of a needle?
(a) Vernier screw gauge
(b) Micrometer screw gauge
(c) Dial screw gauge
(d) Pitch screw gauge

Ans. (b) : Micrometer screw gauges are used in the medical field for precise measurements of small diameters, like those of medical needles.

116. Which component of a screw gauge is responsible for providing stability and support to the instrument?
(a) Sleeve (b) Ratchet stop
(c) Frame (d) Thimble

Ans. (c) : The frame provides stability and support to the other components of a screw gauge.

117. What is the main advantage of using a digital screw gauge over traditional screw gauges?
(a) Higher precision
(b) Reduced human error
(c) Lower cost
(d) Simplicity of use

Ans. (b) : Digital screw gauges eliminate the potential for reading errors associated with manual readings.

118. Which type of screw gauge is commonly used for measuring the thickness of a glass plate or a microscope slide?
(a) Vernier screw gauge
(b) Micrometer screw gauge
(c) Dial screw gauge
(d) Pitch screw gauge

Ans. (a) : Vernier screw gauges are suitable for measuring thicknesses of relatively thin objects like glass plates.

119. What is the purpose of the pitch scale on a screw gauge?
(a) To measure temperature
(b) To determine the least count
(c) To check for zero error
(d) To adjust the pitch

Ans. (d) : The pitch scale helps in calibrating the screw gauge and adjusting the pitch when necessary.

120. Which type of screw gauge is commonly used for measuring the thickness of a coin?
(a) Vernier screw gauge
(b) Micrometer screw gauge
(c) Dial screw gauge
(d) Pitch screw gauge

Ans. (a) : Vernier screw gauges are suitable for measuring the thickness of relatively flat objects like coins.

121. In a screw gauge, what is the purpose of the spindle?
(a) To make fine adjustments
(b) To prevent over-tightening
(c) To provide stability
(d) To align the thimble and sleeve

Ans. (a) : The spindle allows for fine adjustments and precise measurements in a screw gauge.

122. What is the least count of a screw gauge with 80 divisions on the circular scale and a pitch of 0.2 mm?
(a) 0.0025 mm (b) 0.025 mm
(c) 0.25 mm (d) 2.5 mm

Ans. (b) : The least count is calculated as pitch divided by the total number of divisions on the thimble. Least count = $\frac{0.2\text{mm}}{80} = 0.025$ mm

123. What is the primary function of the thimble in a screw gauge?
(a) To provide stability to the frame
(b) To make fine adjustments for precise measurements
(c) To align the main scale and vernier scale
(d) To prevent over-tightening

Ans. (b) : The thimble allows for fine adjustments to achieve precise measurements in a screw gauge.

124. Which type of screw gauge is often equipped with a digital display for easy reading?
(a) Vernier screw gauge
(b) Micrometer screw gauge

(c) Dial screw gauge
(d) Pitch screw gauge

Ans. (b) : Micrometer screw gauges are commonly equipped with digital displays for easy and accurate readings.

125. What is the standard unit of measurement for screw gauges in the metric system?
(a) Inches (b) Millimeters
(c) Centimeters (d) Meters

Ans. (b) : Screw gauge measurements are typically expressed in millimeters in the metric system.

126. What does the term "pitch" refer to in the context of a screw gauge?
(a) The number of threads on the screw
(b) The distance moved by the spindle per revolution
(c) The smallest division on the vernier scale
(d) The total number of divisions on the main scale

Ans. (b) : Pitch is the distance the spindle moves with one complete revolution of the screw in a screw gauge.

127. Which type of screw gauge is often used in mechanical engineering for measuring the thickness of metal components?
(a) Vernier screw gauge
(b) Micrometer screw gauge
(c) Dial screw gauge
(d) Pitch screw gauge

Ans. (b) : Micrometer screw gauges are commonly used in mechanical engineering for precision measurements of metal components.

128. What is the primary application of a dial screw gauge?
(a) Measuring angles
(b) Measuring temperature
(c) Measuring length
(d) Measuring mass

Ans. (a) : Dial screw gauges are often used for measuring angles and runout in cylindrical objects.

129. What is the least count of a screw gauge with 120 divisions on the circular scale and a pitch of 0.1 mm?
(a) 0.0125 mm (b) 0.005 mm
(c) 0.00083 mm (d) 0.1 mm

Ans. (b) : The least count is calculated as pitch divided by the total number of divisions on the thimble.

$\therefore$ Least count $= \frac{0.1\text{mm}}{120} = 0.005$ mm

130. Which part of a screw gauge comes in direct contact with the object being measured?
(a) Thimble (b) Sleeve
(c) Anvil (d) Frame

Ans. (c) : The anvil is the stationary part of the screw gauge that makes direct contact with the object being measured.

131. What is the main advantage of using a pitch screw gauge over a Vernier screw gauge?
(a) Higher precision
(b) Smaller size
(c) Easier calibration
(d) Lower cost

Ans. (a) : Pitch screw gauges typically offer higher precision compared to Vernier screw gauges.

132. Which type of screw gauge is commonly used in the automotive industry for measuring engine components?
(a) Vernier screw gauge
(b) Micrometer screw gauge
(c) Dial screw gauge
(d) Pitch screw gauge

Ans. (b) : Micrometer screw gauges are often used in the automotive industry for precision measurements of engine components.

133. Which type of screw gauge is often used in the field of electronics for measuring component dimensions?
(a) Vernier screw gauge
(b) Micrometer screw gauge
(c) Dial screw gauge
(d) Pitch screw gauge

Ans. (b) : Micrometer screw gauges are commonly used in electronics for measuring small component dimensions.

134. What is the least count of a screw gauge with 50 divisions on the circular scale and a pitch of 0.25 mm?
(a) 0.005 mm (b) 0.01 mm
(c) 0.05 mm (d) 0.1 mm

Ans. (b) : The least count is calculated as pitch divided by the total number of divisions on the thimble.

$\therefore$ Least count of screw gouge $= \frac{0.25\text{mm}}{50} = 0.01$ mm

135. In a screw gauge, what does the term "zero error" refer to?
(a) The alignment of the main scale and vernier scale
(b) An error in which the zero of the main scale does not coincide with the zero of the vernier scale
(c) The smallest possible measurement that can be taken
(d) The pitch of the screw gauge

Ans. (b) : Zero error occurs when the zero point of the main scale is not aligned with the zero point of the vernier scale.

Unit-3

SIMPLE PENDULUM– DISSIPATION OF ENERGY BY PLOTTING A GRAPH BETWEEN THE SQUARE OF DISPLACEMENT AND TIME

136. What is a simple pendulum?

(a) A complex mechanical system
(b) A mass attached to a string or rod that swings freely
(c) A clock mechanism
(d) A type of spring

Ans. (b) : A simple pendulum consists of a mass (bob) attached to a string or rod that can swing freely.

137. What does the term "period" refer to in the context of a simple pendulum?

(a) The length of the pendulum
(b) The mass of the bob
(c) The time it takes for one complete oscillation
(d) The angle of displacement

Ans. (c) : The period of a simple pendulum is the time it takes to complete one full swing or oscillation.

138. In an experiment of simple pendulum time period measured was 50 second for 25 vibrations when the length of the simple pendulum was taken 100 cm. If the least count of stopwatch is 0.1s and that of meter scale is 0.1 cm. Calculate the maximum percentage error in the measurement of value of g.

(a) 0.1% (b) 0.4%
(c) 0.5% (d) None of these

Ans. (c) : Time period of pendulum $T = 2\pi\sqrt{\frac{L}{g}}$

$\Rightarrow \quad g = 4\pi^2 L/T^2$

Maximum possible relative error–

$\Rightarrow \quad \frac{\Delta g}{g} = \frac{\Delta L}{L} + \frac{2\Delta T}{T}$

$\Rightarrow \quad \frac{\Delta g}{g} = \frac{0.1}{100} + 2\times\frac{0.1}{50} = 0.001 + 0.004$

$\Rightarrow \quad \frac{\Delta g}{g}\times 100\% = 0.5\%$

139. The time period of 25 oscillations of a simple pendulum is measured to be 50.0 s by a watch of least count 0.01 s. The percentage error in time is–

(a) 0.2% (b) 0.02%
(c) 0.02% (d) 2%

Ans. (b) : Given, Time period of 25 oscillations = 50.
Least count of watch = 0.01 S

$\therefore \quad$ Error in time $= \frac{\Delta T}{T} = \frac{0.01}{50}\times 100$

%error in time, $\Delta T \times 100\% = 0.02\%$

140. A student performs experiment with simple pendulum and measures time for 10 vibrations. If he measure time for 100 vibrations. The relative error in measurements of time periods will be reduced by–

(a) 10% (b) 90%
(c) 100% (d) 1000%

Ans. (b) : Suppose relative error for 10 vibration in time, $T_1 = \frac{\Delta T}{10}$

Similarly for 100 Vibrations

$$T_2 = \frac{\Delta T}{100} = \frac{T_1}{10}$$

$\therefore$ Reduction in relative error is –

$$\frac{T_2 - T_1}{T_1}\times 100\% = \left(\frac{\frac{T_1}{10} - T_1}{T_1}\right)\times 100\%$$

$$= \frac{9}{10}\times 100\% = 90\%$$

141. The length of a second pendulum is–

(a) 99.8 cm (b) 99 cm
(c) 100 cm (d) None of these

Ans. (a) : $\because$ The time period of simple pendulum

$$T = 2\pi\sqrt{\frac{L}{g}}$$

$\Rightarrow \quad L = \frac{T^2 g}{4\pi^2}$

In case of second pendulum, T = 1 second.

$\therefore \quad L = \frac{1\times 9.81}{4\times 3.14} \sim 0.994$meter

L= 99.4 cm

142. A simple pendulum, suspended from the ceiling of a stationary ran, has time period, T. If the van starts moving with a uniform velocity the period of the pendulum will be–

(a) Less than T (b) Equal to 2T
(c) Greater than T (d) Unchanged

Ans. (d) : When the van moves with a uniform velocity, the motion of the pendulum will not be affected in any way. This is because the pendulum's motion is independent of the motion of the van, as long as there are no external forces acting on the pendulum other than gravity. Therefore, the time periods T of the pendulum remains constant irrespective of the motion of the van.

143. To show that a simple pendulum executes simple harmonic motion, it is necessary to assume that–

(a) Length of the pendulum is small
(b) Mass of the pendulum is small
(c) Amplitude of oscillation is small
(d) Acceleration due to gravity is small.

Ans. (c) : The amplitude of oscillation is small, such that the angle of displacement is small enough for the motion to be nearly linear.

144. A chimpanzee Suringing on a swing in a sitting position, stands up suddenly, the time period will–

(a) Become infinite (b) Remain same
(c) Increase (d) Decrease

Ans. (a) : When the chimpanzee stands up, the moment of inertia a of the system changes affecting the time period. If the standing position alters the distribution of the mass significantly, the time period of the swing will also change. However without specific details about the change in the distribution of mass or length of swing. it's not possible to determine the exact change in time period.

145. A plate oscillated with time period 'T' suddenly, another plate put on the first plate, then time period–

(a) Will decrease (b) Will increase
(c) Mill be same (d) None of these

Ans. (b) : When an addition plate is suddenly place on top of the first oscillating plate, the moment of inertia of the combined system increase.

Since, the time period of an oscillating body is directly proportional to the square root of its moment of inertia the time period of the system will increase as a result of the increased moment of inertia.

$\therefore$ Thus, when another plate is on top of the first oscillating plate the time period will increase.

146. Two pendulums begin to swing simultaneously. If the ratio of the frequency of oscillations of the two is 7 : 8, then the ratio of length of the two pendulums will be–

(a) 7 : 8 (b) 8 : 7
(c) 49 : 64 (d) 64 : 49

Ans. (d) : Time period $T = 2\pi\sqrt{\frac{L}{g}}$

$\because W = \frac{2\pi}{T} = 2\pi f$

$\Rightarrow T = \frac{1}{f}$

$\therefore T^2 \propto L$

$\Rightarrow f^2 \propto \frac{1}{L}$

$\Rightarrow \frac{L_1}{L_2} = \left(\frac{f_2}{f_1}\right)^2 = \left(\frac{8}{7}\right)^2 = 64 : 49$

147. If the length of a pendulum is made 9 times and mass of the bob is made 4 times then the value of time period because–

(a) 3T (b) 3/2T
(c) 4T (d) 2T

Ans. (a) : Time period $T = 2\pi\sqrt{\frac{L}{g}}$

$L = 9$

$\therefore T' = 2\pi\sqrt{\frac{9L}{g}} = 3\left(2\pi\sqrt{\frac{L}{g}}\right)$

$T' = 3T$

148. A simple pendulum has a time period T_1 when on the earth surface and T_2 when taken to a height R above the earth. Surface, where R is the radius of the earth. The value of T_2/T_1 is–

(a) 1 (b) 1/2
(c) 4 (d) 2

Ans. (d) : The acceleration due to gravity at a height R above the earth's surface is,

$$g_2 = \frac{g_1}{\left(1+\frac{R}{R}\right)^2} = \frac{g_1}{(1+1)^2} = \frac{g_1}{4}$$

Where, g_1 is the acceleration due to gravity on the surface of the earth.

Also, $\frac{T_2}{T_1} = \sqrt{\frac{g_1}{g_2}} = \sqrt{\frac{g_1}{g_1/4}} = \sqrt{4} = 2$

149. What effect occurs on the frequency of a pendulum if it is taken from the earth surface to deep into a mine.

(a) Increases
(b) Decreases
(c) First increases then decreases
(d) None of these

Ans. (b) : When a pendulum is taken from the earth's surface to deep into a mine, the acceleration due to gravity changes. At the earth's surface, the acceleration due to gravity is higher compared to the deeper parts of the mine.

Since the frequency of a pendulum is directly proportional to the square root of the acceleration due to gravity the frequency of the pendulum will decreases when it is taken deep into the mine.

150. The velocity of simple pendulum is maximum at

(a) Extremes (b) Half displacement
(c) Mean position (d) Every where

Ans. (c) : The motion of a simple pendulum is characterized by the inter conversion of kinetic energy and potential energy. At the mean position (equilibrium point), the velocity of the pendulum is maximum, and the potential energy is minimum. This is because the pendulum has the maximum displacement at this point resulting in the highest velocity.

151. The length of a simple pendulum is increased by 44%. What is the percentage increase in its time period?

(a) 10% (b) 20%
(c) 40% (d) 44%

Ans. (b) : Since the length of a simple pendulum is increased by 44%
i.e. L' = 1.44L

$$\therefore\ T' = 2\pi\sqrt{\frac{1.44L}{g}} = 1.2 \times T$$

Therefore, the time period increase by 20% when the length of the simple pendulum is increased by 44%.

152. A pendulum suspended from the wiling of a train has period T1 when the train is at rest. When the train is accelerating with a uniform acceleration a, the period of oscillation will–

(a) Increase (b) Decrease
(c) Remain Unaffected (d) Become Infinite

Ans. (a) : Since, the effective acceleration acting on the pendulum changes the time period of the pendulum will also change. The period of the pendulum will increase when the train is accelerating with a uniform. acceleration.

153. Which of the following statements is not true? In the case of a simple pendulum for small amplitudes the period of oscillation is–

(a) Directly Proportional to square root of the length of the pendulum.
(b) Inversely proportional to the square root of the acceleration due to gravity.
(c) Dependent on the mass size and materials of the bob.
(d) Independent of the amplitude.

Ans. (c) : Time period $T = 2\pi\sqrt{\frac{l}{g}}$

$\Rightarrow T \propto \sqrt{l}$ and $T \propto \frac{1}{\sqrt{g}}$

Thus, the time period of pendulum is independent of the amplitude as well as mass.

154. The length of the second pendulum on the surface of earth is m. The length of seconds pendulum on the surface of moon, where g is 1/6th value of g on the surface of earth, is–

(a) $\frac{1}{6}$m (b) 6 m
(c) $\frac{1}{36}$ m (d) 36 m

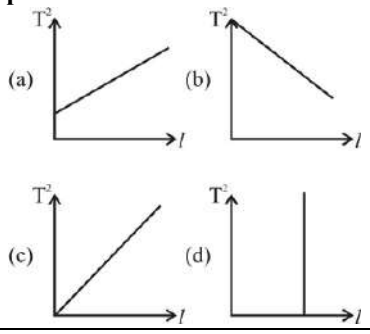
Ans. (a) : Time period on earth = T_E
Time period on moon = T_M
Since, $T_E = T_M$

$$2\pi\sqrt{\frac{L_E}{g_E}} = 2\pi\sqrt{\frac{L_M}{g_M}}$$

$\because\quad g_m = \frac{g}{6}; g_E = g$

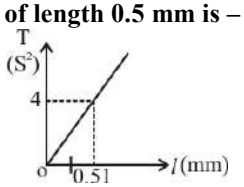
$\therefore\quad L_m = \frac{m}{6}$

155. Which of one of the following represents simple pendulum characteristics?



Ans. (c) : The characteristic curve of T^2 versue l is linear. That is represented by given graph c.

156. The $l - T^2$ graph of a simple pendulum is shown in the figure. The time period of the pendulum of length 0.5 mm is –



(a) 1s (b) 25
(c) $\sqrt{2}$s (d) $1/\sqrt{2}$s

Ans. (c) : $\frac{T^2}{l} = \text{Constant}$

$\Rightarrow\quad \frac{4}{1} = \frac{T^2}{0.5}$

$\Rightarrow\quad T^2 = 2,$

$\Rightarrow\quad T = \sqrt{2}s$

157. For a simple pendulum, the graph between length and time period will be a –

(a) Hyperbola (b) Parabola
(c) Straight line (d) None of these

Ans. (b) : $T = 2\pi\sqrt{\frac{l}{g}}$

$\Rightarrow\quad T^2 = \left(\frac{4\pi^2}{g}\right)l.$

158. According to the laws of physics, what factor does the period of a simple pendulum depend on?

(a) Mass of the bob
(b) Length of the pendulum
(c) Amplitude of oscillation
(d) All of the above

Ans. (b) : The period of a simple pendulum depends solely on the length of the pendulum.

159. How is the frequency of a simple pendulum related to its period?

(a) Inversely proportional
(b) Directly proportional
(c) No relation
(d) It depends on the mass of the bob

Ans. (a) : Frequency and period are inversely proportional; as the period increases, the frequency decreases, and vice versa.

$\therefore \text{Frequency} = \frac{1}{\text{Time}}\ \text{Period}$

160. What is the primary source of energy in a simple pendulum?

(a) Kinetic energy (b) Potential energy
(c) Thermal energy (d) Electrical energy

Ans. (b) : In a simple pendulum, the primary source of energy is potential energy due to its height above the lowest point.

161. What happens to the total mechanical energy of a simple pendulum as it oscillates?

(a) It remains constant
(b) It increases
(c) It decreases
(d) It depends on the length of the string

Ans. (a) : In the absence of external forces, the total mechanical energy of a simple pendulum remains constant.

162. When does a simple pendulum experience maximum kinetic energy during its oscillations?

(a) At the highest point
(b) At the lowest point
(c) At the midpoint of its swing
(d) It has the same kinetic energy at all points

Ans. (b) : The pendulum experiences maximum kinetic energy at the lowest point of its swing, where it has maximum velocity.

163. Which energy is dissipated in a simple pendulum due to air resistance and other non-conservative forces?

(a) Kinetic energy (b) Potential energy
(c) Thermal energy (d) Electrical energy

Ans. (c) : Energy is dissipated as thermal energy due to air resistance and other non-conservative forces.

164. What type of graph is typically used to represent the square of displacement (x^2) against time (t) for a simple pendulum?

(a) Linear graph (b) Exponential graph
(c) Parabolic graph (d) Hyperbolic graph

Ans. (c) : A graph of square of displacement x^2 against time for a simple pendulum results in a parabolic curve due to the quadratic relationship.

165. In the graph of x^2 against time (t) for a simple pendulum, what does the slope of the curve represent?

(a) The length of the pendulum
(b) The mass of the bob
(c) The amplitude of oscillation
(d) The dissipation rate of energy

Ans. (d) : The slope of the curve in the x^2 vs. time graph represents the rate at which energy is being dissipated.

166. When plotting the graph of x^2 against time for a simple pendulum, what is the shape of the curve?

(a) Straight line (b) Circle
(c) Parabola (d) Sine wave

Ans. (c) : We know that

$T = 2\pi \sqrt{\frac{l}{g}}$

on squaring both sides, we get

$T^2 = \frac{4\pi^2 l}{g}$

$\Rightarrow T^2 \propto l$

The graph of x^2 against time for a simple pendulum results in a parabolic curve.

167. What is the significance of the turning points (maximum and minimum) on the x^2 vs. time graph for a simple pendulum?

(a) They represent points of zero energy dissipation
(b) They indicate the maximum displacement of the pendulum
(c) They correspond to the points of maximum kinetic and potential energy
(d) They have no significance in this graph

Ans. (a) : The turning points on the graph represent points in time where there is no energy dissipation.

168. What happens to the amplitude of oscillation as the pendulum loses energy due to dissipation?

(a) It increases
(b) It decreases
(c) It remains constant
(d) It depends on the length of the pendulum

Ans. (b) : As energy is dissipated, the amplitude of oscillation decreases in a simple pendulum.

169. What is the area under the x^2 vs. t graph for a simple pendulum equal to?

(a) The initial potential energy of the pendulum
(b) The initial kinetic energy of the pendulum
(c) The total mechanical energy of the pendulum
(d) The dissipated energy

Ans. (d) : The area under the x^2 vs. t graph represents the energy dissipated by the pendulum.

170. What does the horizontal line (plateau) on the x^2 vs t graph for a simple pendulum indicate?

(a) The maximum amplitude reached by the pendulum
(b) The period of oscillation
(c) The time it takes for the pendulum to stop completely
(d) The initial energy of the pendulum

Ans. (c) : The plateau on the graph represents the time it takes for the pendulum to come to a complete stop.

171. How can the dissipation rate of energy be determined from the x^2 vs t graph for a simple pendulum?

(a) By finding the slope of the curve
(b) By finding the area under the curve