DPP - Daily Practice Problems

Name : _____ Date : _____

Start Time : _____ End Time : _____

PHYSICS 31

SYLLABUS : Practical Physics - 1

Max. Marks : 120 **Time : 60 min.**

GENERAL INSTRUCTIONS

- The Daily Practice Problem Sheet contains 30 MCQ's. For each question only one option is correct. Darken the correct circle/ bubble in the Response Grid provided on each page.
- You have to evaluate your Response Grids yourself with the help of solution booklet.
- Each correct answer will get you 4 marks and 1 mark shall be deduced for each incorrect answer. No mark will be given/ deducted if no bubble is filled. Keep a timer in front of you and stop immediately at the end of 60 min.
- The sheet follows a particular syllabus. Do not attempt the sheet before you have completed your preparation for that syllabus. Refer syllabus sheet in the starting of the book for the syllabus of all the DPP sheets.
- After completing the sheet check your answers with the solution booklet and complete the Result Grid. Finally spend time to analyse your performance and revise the areas which emerge out as weak in your evaluation.

DIRECTIONS (Q.1-Q.24) : There are 24 multiple choice questions. Each question has 4 choices (a), (b), (c) and (d), out of which **ONLY ONE** choice is correct.

Q.1 One cm on the main scale of a vernier callipers is divided into ten equal parts. If 20 divisions of vernier scale coincide with 8 small divisions of the main scale. What will be the least count of callipers ?

(a) 0.05 cm (b) 0.06 cm
(c) 0.04 cm (d) 0.01 cm

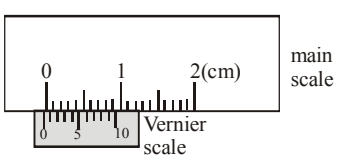
Q.2 The shape of stress vs strain graph within elastic limit is :

(a) parabolic (b) curve line
(c) straight line (d) ellipse

Q.3 In a vernier calliper N divisions of vernier scale coincides with N – 1 divisions of main scale (in which length of one division is 1 mm). The least count of the instrument should be

(a) N (b) N – 1 (c) 1/10 N (d) 1/N – 1

Q.4 The figure shows a situation when the jaws of vernier are touching each other. Each main scale division is of 1 mm. Find zero correction.



(a) – 0.5 mm
(b) + 0.5 mm
(c) – 0.4 mm
(d) + 0.4 mm

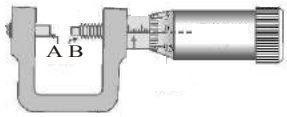
Q.5 In an experiment for measurement of young's modulus, following readings are taken. Load = 3.00 kg, length = 2.820 m, diameter = 0.041 cm and extension = 0.87. Determine the percentage error in the measurement of Y.

(a) ±5% (b) ±6.5%
(c) ±5.5% (d) ±15%

RESPONSE GRID	1. ⓐⓑⓒⓓ	2. ⓐⓑⓒⓓ	3. ⓐⓑⓒⓓ	4. ⓐⓑⓒⓓ	5. ⓐⓑⓒⓓ

Space for Rough Work

Q.6 When the zero of the circular scale of a screw gauge coincides with the zero of the main scale before A and B come in contact then the instrument has



(a) positive zero error
(b) negative zero error
(c) no zero error
(d) can't be said anything

Q.7 If h be the elevation or depression of a spherical surface from the plane glass plate and c be the mean distance between two consecutive points corresponding to the impressions made by the three legs of a spherometer then the radius of curvature is

(a) $\frac{c^2}{6h}-\frac{h}{2}$ (b) $\frac{c^2}{6h}+\frac{h^2}{2}$ (c) $\frac{c^2}{6h}+\frac{h}{2}$ (d) $\frac{c^2}{6h}+\frac{2}{h}$

Q.8 The least count of a spherometer is given by

(a) pitch × no. of circular divisions

(b) $\frac{\text{pitch}}{\text{no. of circular divisions}}$

(c) $\frac{\text{no. of circular divisions}}{\text{pitch}}$

(d) $\frac{\text{pitch}}{\text{mean distance between two consecutive legs of the spherometer}}$

Q.9 The specific heat of a solid is determined by the method known as

(a) the method of fusion
(b) the method of mixture
(c) the method of vaporisation
(d) the method of cooling

Q.10 Which principle is involved in the experiment to determine the specific heat of a liquid by the method of mixture ?

(a) Heat gained by solid = Heat lost by calorimeter and liquid.
(b) Heat lost by solid = Heat gained by calorimeter and liquid.
(c) Heat lost by solid and liquid = Heat gained by calorimeter.
(d) Heat gained by solid and calorimeter = Heat lost by liquid.

Q.11 Two full turns of the circular scale of a screw gauge cover a distance of 1mm on its main scale. The total number of divisions on the circular scale is 50. Further, it is found that the screw gauge has a zero error of – 0.03 mm. While measuring the diameter of a thin wire, a student notes the main scale reading of 3 mm and the number of circular scale divisions in line with the main scale as 35. The diameter of the wire is

(a) 3.32 mm (b) 3.73 mm
(c) 3.67 mm (d) 3.38 mm

Q.12 In an experiment the angles are required to be measured using an instrument, 29 divisions of the main scale exactly coincide with the 30 divisions of the vernier scale. If the smallest division of the main scale is half- a degree (= 0.5°), then the least count of the instrument is :

(a) half minute (b) one degree
(c) half degree (d) one minute

Q.13 In a screw gauge, the zero of main scale coincides with fifth division of circular scale in figure (i). The circular divisions of screw gauge are 50. It moves 0.5 mm on main scale in one rotation. The diameter of the ball in figure (ii) is

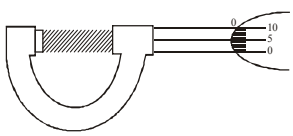


Figure (i)

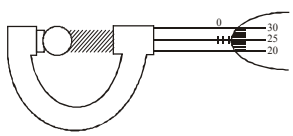


Figure (ii)

(a) 2.25 mm (b) 2.20 mm
(c) 1.20 mm (d) 1.25 mm

Q.14 A student performs an experiment for determination of $g\left(=\frac{4\pi^2\ell}{T^2}\right)$. The error in length ℓ is $\Delta\ell$ and in time T is ΔT and n is number of times the reading is taken. The measurement of g is most accurate for

	$\Delta\ell$	ΔT	n
(a)	5 mm	0.2 sec	10
(b)	5 mm	0.2 sec	20
(c)	5 mm	0.1 sec	10
(d)	1 mm	0.1 sec	50

RESPONSE GRID					
	6. ⓐⓑⓒⓓ	7. ⓐⓑⓒⓓ	8. ⓐⓑⓒⓓ	9. ⓐⓑⓒⓓ	10. ⓐⓑⓒⓓ
	11. ⓐⓑⓒⓓ	12. ⓐⓑⓒⓓ	13. ⓐⓑⓒⓓ	14. ⓐⓑⓒⓓ	

Space for Rough Work

Q.15 A student performs an experiment to determine the Young's modulus of a wire, exactly 2 m long, by Searle's method. In a particular reading, the student measures the extension in the length of the wire to be 0.8 mm with an uncertainty of ± 0.05 mm at a load of exactly 1.0 kg. The student also measures the diameter of the wire to be 0.4 mm with an uncertainty of ± 0.01 mm. Take $g = 9.8$ m/s^2 (exact). The Young's modulus obtained from the reading is

(a) $(2.0\pm0.3)\times10^{11}$ N/m^2 (b) $(2.0 \pm 0.2) \times 10^{11}$ N/m^2

(c) $(2.0\pm0.1)\times10^{11}$ N/m^2 (d) $(2.0 \pm 0.05) \times 10^{11}$ N/m^2

Q.16 Students I, II and III perform an experiment for measuring the acceleration due to gravity (g) using a simple pendulum. They use different lengths of the pendulum and /or record time for different number of oscillations. The observations are shown in the table.

Least count for length = 0.1 cm

Least count for time = 0.1 s

Student	Length of the pendulum (cm)	No. of oscillations (n)	Total time for (n) oscillations (s)	Time period (s)
I	64.0	8	128.0	16.0
II	64.0	4	64.0	16.0
III	20.0	4	36.0	9.0

If E_I, E_{II} and E_{III} are the percentage errors in g, i.e., $\left(\frac{\Delta g}{g}\times100\right)$ for students I, II and III, respectively, then

(a) $E_I = 0$ (b) E_I is minimum

(c) $E_I = E_{II}$ (d) E_{II} is maximum

Q.17 If the terminal speed of a sphere of gold (density = 19.5 kg/m^3) is 0.2 m/s in a viscous liquid (density = 1.5 kg/m^3), find the terminal speed of a sphere of silver (density = 10.5 kg/m^3) of the same size in the same liquid

(a) 0.4 m/s (b) 0.133 m/s

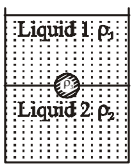
(c) 0.1 m/s (d) 0.2 m/s

Q.18 A spherical solid ball of volume V is made of a material of density ρ_1. It is falling through a liquid of density ρ_2 ($\rho_2 < \rho_1$). Assume that the liquid applies a viscous force on the ball that is proportional to the square of its speed v, i.e., $F_{viscous} = -kv^2$ ($k > 0$). The terminal speed of the ball is

(a) $\sqrt{\frac{Vg(\rho_1-\rho_2)}{k}}$ (b) $\frac{Vg\rho_1}{k}$

(c) $\sqrt{\frac{Vg\rho_1}{k}}$ (d) $\frac{Vg(\rho_1-\rho_2)}{k}$

Q.19 A jar is filled with two non-mixing liquids 1 and 2 having densities ρ_1 and, ρ_2 respectively. A solid ball, made of a material of density ρ_3, is dropped in the jar. It comes to equilibrium in the position shown in the figure. Which of the following is true for ρ_1, ρ_2 and ρ_3?



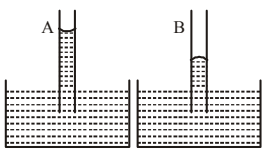
(a) $\rho_3 < \rho_1 < \rho_2$

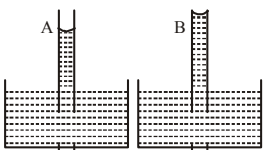
(b) $\rho_1 > \rho_3 > \rho_2$

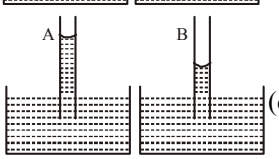
(c) $\rho_1 < \rho_2 < \rho_3$

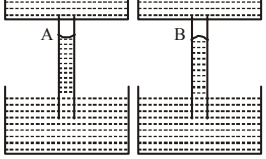
(d) $\rho_1 < \rho_3 < \rho_2$

Q.20 A capillary tube (A) is dipped in water. Another identical tube (B) is dipped in a soap-water solution. Which of the following shows the relative nature of the liquid columns in the two tubes?

(a) 

(b) 

(c) 

(d) 

Q.21 Two wires are made of the same material and have the same volume. However wire 1 has cross-sectional area A and wire 2 has cross-sectional area $3A$. If the length of wire 1 increases by Δx on applying force F, how much force is needed to stretch wire 2 by the same amount of energy?

(a) $4F$ (b) $6F$ (c) $9F$ (d) $1F$

Q.22 The vernier constant of two vernier callipers A and B are 0.01 cm and 0.01 mm respectively. Which one can measure the length of an object more accurately?

(a) Vernier A (b) Vernier B

(c) Accuracy in measurement does not depend on vernier constant

(d) Both A and B are equally accurate.

RESPONSE GRID					
	15. ⓐⓑⓒⓓ	16. ⓐⓑⓒⓓ	17. ⓐⓑⓒⓓ	18. ⓐⓑⓒⓓ	19. ⓐⓑⓒⓓ
	20. ⓐⓑⓒⓓ	21. ⓐⓑⓒⓓ	22. ⓐⓑⓒⓓ		

Space for Rough Work

Q.23 The acceleration due to gravity at a place can be determined with the help of a simple pendulum. For this purpose effective length of the pendulum is considered. If 'ℓ' be the length of the string and 'd' the diameter of the bob then the effective length is equal to

(a) $\ell + d$ (b) $\ell + \frac{d}{2}$ (c) $\ell - \frac{d}{2}$ (d) $\ell - d$

Q.24 If x, y, p and q represent the increase in length, the original length of the experimental wire, load applied to the wire and area of cross-section of the wire respectively then Young's modulus of the wire is given by

(a) $\frac{xy}{pq}$ (b) $\frac{xp}{yq}$ (c) $\frac{py}{xq}$ (d) $\frac{pq}{xy}$

DIRECTIONS (Q.25-Q.27) : In the following questions, more than one of the answers given are correct. Select the correct answers and mark it according to the following codes:

Codes :

(a) 1, 2 and 3 are correct **(b)** 1 and 2 are correct
(c) 2 and 4 are correct **(d)** 1 and 3 are correct

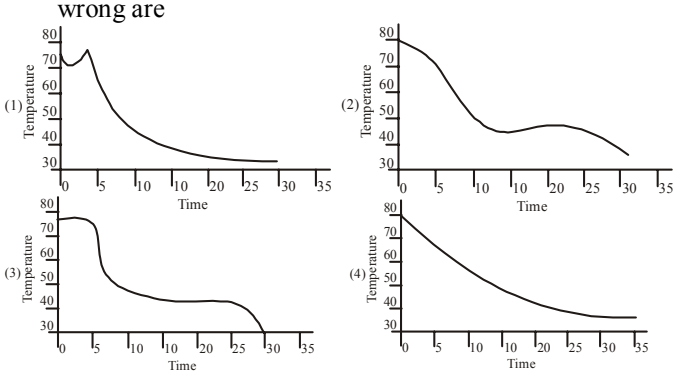
Q.25 What is the function of a screw gauge in the experiment of determining Young's modulus of a wire ?

(1) It measures the extension in the wire.
(2) It measures the load applied.
(3) It measures the length of the wire.
(4) It measures the diameter of the wire.

Q.26 Consider the following statements regarding the experiment to determine the surface tension of water by capillary rise method. Choose the correct statements.

(1) Capillary tube should be clean and liquid should be free from dirt and grease.
(2) Distilled water should be avoided.
(3) Distilled water should be added.
(4) Dirty liquid should be used.

Q.27 The temperature-time variation graphs, as obtained by four students 1, 2, 3 and 4 are as shown. The graphs, likely to be wrong are



DIRECTIONS (Q.28-Q.30) : Read the passage given below and answer the questions that follows :

The internal radius of a 1m long resonance tube is measured as 3 cm. A tuning fork of frequency 2000 Hz is used. The first resonating length is measured as 4.6 cm and the second resonating length is measured as 14.0 cm.

Q.28 Calculate the maximum percentage error in measurement of e.

(a) 3.33% (b) 2.23% (c) 4.33% (d) 5.33%

Q.29 Calculate the speed of sound at the room temperature.

(a) 275 m/s (b) 376 m/s (c) 356 m/s (d) 330 m/s

Q.30 Calculate the end correction.

(a) 0.2 cm (b) 0.3 cm (c) 0.1 cm (d) 0.4 cm

RESPONSE GRID					
	23. ⓐⓑⓒⓓ	**24.** ⓐⓑⓒⓓ	**25.** ⓐⓑⓒⓓ	**26.** ⓐⓑⓒⓓ	**27.** ⓐⓑⓒⓓ
	28. ⓐⓑⓒⓓ	**29.** ⓐⓑⓒⓓ	**30.** ⓐⓑⓒⓓ		

DAILY PRACTICE PROBLEM SHEET 31 - PHYSICS			
Total Questions	30	Total Marks	120
Attempted		Correct	
Incorrect		Net Score	
Cut-off Score	30	Qualifying Score	48
Success Gap = Net Score – Qualifying Score			
Net Score = (Correct × 4) – (Incorrect × 1)			

Space for Rough Work

DAILY PRACTICE PROBLEMS

PHYSICS SOLUTIONS

31

1. (b)

20 division of vernier scale = 8 div. of main scale

$$\Rightarrow \text{ 1 V.S.D.} = \left(\frac{8}{20}\right) \text{M.S.D.} = \left(\frac{2}{5}\right) \text{M.S.D.}$$

Least count

$$= 1 \text{ M.S.D} - 1 \text{ V.S.D.} = 1 \text{ M.S.D.} - \left(\frac{2}{5}\right) \text{ M.S.D}$$

$$= \left(1 - \frac{2}{5}\right) \text{M.S.D.} = \left(\frac{3}{5}\right) \text{M.S.D.} = \frac{3}{5} \times 0.1 \text{ cm.} = 0.06 \text{ cm.}$$

$$\left(\because \text{ 1 M.S.D.} = \frac{1}{10} \text{ cm.} = 0.1 \text{ cm.}\right)$$

Directly we can use

$$\text{L.C.} = \text{M} - \text{V} = \left(\frac{b-a}{b}\right) \text{M}$$

$$= \left(\frac{20-8}{20}\right)\left(\frac{1}{10}\right) \text{cm.} = \frac{3}{50} \text{cm.} = 0.06 \text{ cm.}$$

2. (c) Within elastic limit it obeys Hooke's Law i.e., stress $\propto$ strain.

3. (c) Least count $= \frac{1}{N} \times \frac{1}{10} \text{cm} = \frac{1}{10N}$

4. (b) 5th division of vernier scale coincides with a main scale division. L.C. $= \frac{1}{10} = 0.1\text{mm}$

$\therefore$ Zero error $= -5 \times 0.1 = -0.5$ mm

This error is to be subtracted from the reading taken for measurement. Also, zero correction $= +0.5$ mm.

5. (b) If Y = Young's modulus of wire, M = mass of wire, g = acceleration due to gravity, x = extension in the wire, A= Area of cross-section of the wire, ℓ = length of the wire.

$$Y = \frac{Mgx}{A\ell} \Rightarrow \frac{\Delta Y}{Y} = \frac{\Delta M}{M} + \frac{\Delta x}{x} + \frac{\Delta A}{A} + \frac{\Delta \ell}{\ell}$$

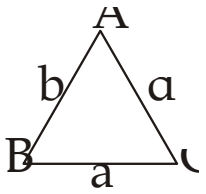
$$\Rightarrow \frac{\Delta Y}{Y} = \frac{0.01}{3.00} + \frac{0.01}{0.87} + \frac{2 \times 0.001}{0.041} + \frac{0.001}{2.820} = 0.065$$

$$\text{or } \frac{\Delta Y}{Y} \times 100 = \pm 6.5\%$$

6. (b) The instrument has negative zero error.

7. (c) If A, B and C be the points corresponding to the impressions made by the legs of a spherometer then

$$c = \frac{a+b+c}{3}$$



If h is the depression or elevation then the radius of curvature is given by $r = \frac{c^2}{6h} + \frac{h}{2}$

8. (b) $\text{L.C.} = \frac{\text{Pitch}}{\text{No. of circular divisions}}$

9. (b) The specific heat of a solid is determined by the method of mixture.

10. (a)

11. (d) Least count of screw gauge $= \frac{0.5}{50} \text{mm} = 0.01\text{mm}$

$\therefore$ Reading = [Main scale reading + circular scale reading $\times$ L.C] – (zero error)

$= [3 + 35 \times 0.01] - (-0.03) = 3.38$ mm

12. (d) 30 Divisions of vernier scale coincide with 29 divisions of main scales

Therefore 1 V.S.D $= \frac{29}{30}$ MSD

Least count = 1 MSD – 1VSD

$$= 1 \text{ MSD} - \frac{29}{30} \text{ MSD}$$

$$= \frac{1}{30} \text{MSD}$$

$$= \frac{1}{30} \times 0.5^\circ = 1 \text{ minute.}$$

13. (c) Least count $= \frac{0.5}{50} = 0.01\text{mm}$

Zero error $= 5 \times L.C$

$= 5 \times 0.01$ mm

$= 0.05$ mm

Diameter of ball = [Reading on main scale] + [Reading on circular scale $\times$ $L.C$] – Zero error

$= 0.5 \times 2 + 25 \times 0.01 - 0.05$

$= 1.20$ mm

14. (d) $\frac{\Delta g}{g} = \frac{\Delta \ell}{\ell} + 2\frac{\Delta T}{T}$

$\Delta \ell$ and ΔT are least and number of readings are maximum in option (d), therefore the measurement of g is most accurate with data used in this option.

15. (b) We know that $Y = \dfrac{mg}{\pi\dfrac{D^2}{4}} \times \dfrac{L}{\ell}$

$$\Rightarrow \quad Y = \frac{4mgL}{\pi D^2 \ell} = \frac{4\times1\times9.8\times2}{\pi\left(0.4\times10^{-3}\right)^2\times\left(0.8\times10^{-3}\right)}$$

$$= 2.0\times10^{11}\ \text{N/m}^2$$

Now $\dfrac{\Delta Y}{Y} = \dfrac{2\Delta D}{D} + \dfrac{\Delta\ell}{\ell}$

[$\because$ the value of m, g and L are exact]

$$= 2\times\frac{0.01}{0.4} + \frac{0.05}{0.8} = 2\times0.025 + 0.0625$$

$$= 0.05 + 0.0625 = 0.1125$$

$$\Rightarrow \quad \Delta Y = 2\times10^{11}\times0.1125 = 0.225\times10^{11}$$

$$= 0.2\times10^{11}\ \text{N/m}^2$$

16. (b) The time period of a simple pendulum is given by

$$T = 2\pi\sqrt{\frac{\ell}{g}} \ \therefore T^2 = 4\pi^2\frac{\ell}{g} \Rightarrow g = 4\pi^2\frac{\ell}{T^2}$$

$$\Rightarrow \quad \frac{\Delta g}{g}\times100 = \frac{\Delta\ell}{\ell}\times100 + 2\frac{\Delta T}{T}\times100$$

Case (i)

$\Delta\ell = 0.1$ cm, $\ell = 64$cm, $\Delta T = 0.1$s, $T = 128$s

$$\therefore \frac{\Delta g}{g}\times100 = 0.3125$$

Case (ii)

$\Delta\ell = 0.1$ cm, $\ell = 64$cm, $\Delta T = 0.1$s, $T = 64$s

$$\therefore \frac{\Delta g}{g}\times100 = 0.46875$$

Case (iii)

$\Delta\ell = 0.1$ cm, $\ell = 20$cm, $\Delta T = 0.1$s, $T = 36$s

$$\therefore \frac{\Delta g}{g}\times100 = 1.055$$

Clearly, the value of $\dfrac{\Delta g}{g}\times100$ will be least in case (i)

17. (c) Terminal velocity, $v_T = \dfrac{2r^2(d_1-d_2)g}{9\eta}$

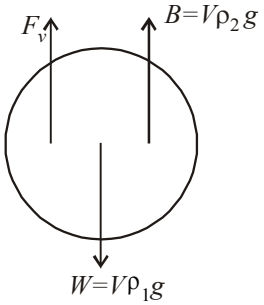
$$\frac{v_{T_2}}{0.2} = \frac{(10.5-1.5)}{(19.5-1.5)} \Rightarrow v_{T_2} = 0.2\times\frac{9}{18}$$

$$\therefore v_{T_2} = 0.1\ m/s$$

$$x\left\{-By\frac{d^2y}{dx^2} - B\left(\frac{dy}{dx}\right)^2\right\} + By\frac{dy}{dx} = 0$$

$$\Rightarrow \quad xy\frac{d^2y}{dx^2} + x\left(\frac{dy}{dx}\right)^2 - y\frac{dy}{dx} = 0$$

18. (a) The condition for terminal speed (v_t) is
Weight = Buoyant force + Viscous force



$$\therefore V\rho_1 g = V\rho_2 g + kv_t^2 \qquad \therefore v_t = \sqrt{\frac{Vg(\rho_1-\rho_1)}{k}}$$

19. (d) From the figure it is clear that liquid 1 floats on liquid 2. The lighter liquid floats over heavier liquid.

Therefore we can conclude that $\rho_1 < \rho_2$

Also $\rho_3 < \rho_2$ otherwise the ball would have sink to the bottom of the jar.

Also $\rho_3 > \rho_1$ otherwise the ball would have floated in liquid 1. From the above discussion we conclude that

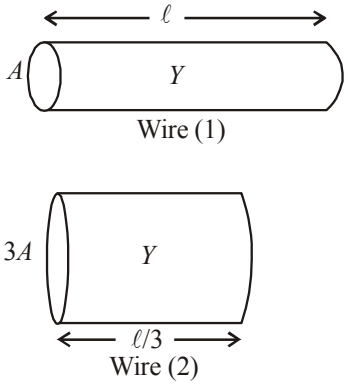
$$\rho_1 < \rho_3 < \rho_2.$$

20. (c) In case of water, the meniscus shape is concave upwards. Also according to ascent formula

$$h = \frac{2T\cos\theta}{r\rho g}$$

The surface tension (T) of soap solution is less than water. Therefore rise of soap solution in the capillary tube is less as compared to water. As in the case of water, the meniscus shape of soap solution is also concave upwards.

21. (c)



As shown in the figure, the wires will have the same Young's modulus (same material) and the length of the wire of area of cross-section $3A$ will be $\ell/3$ (same volume as wire 1).

For wire 1,

$$Y = \frac{F/A}{\Delta x/\ell} \quad \text{...(i)}$$

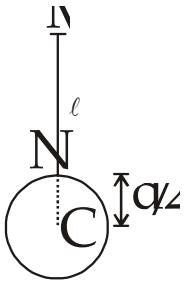
For wire 2 ,

$$Y = \frac{F'/3A}{\Delta x/(\ell/3)} \quad \text{...(ii)}$$

From (i) and (ii) , $\frac{F}{A} \times \frac{\ell}{\Delta x} = \frac{F'}{3A} \times \frac{\ell}{3\Delta x} \Rightarrow F' = 9F$

22. (b) Lower the vernier constant, more accurate measurement is possible by it.

23. (b) Effective length = MC = MN + NC = $\ell + \frac{d}{2}$



24. (c) Here, original length (L) = y,
Extension (ℓ) = x, Force applied (F) = p
Area of cross-section (A) = q

Now, Young's modulus (Y) = $\frac{FL}{AL}$

$$\Rightarrow Y = \frac{yp}{xq}$$

25. (a) Screw gauge is used to measure the diameter (d) of the wire so that the area of cross-section is calculated by the formula

$$A = \frac{\pi d^2}{4}$$

26. (b) Both the statements (1) & (2)are precautions to be taken during the experiment.

27. (a) The liquid cools faster first and slowly later on when its temperature gets close to surrounding temperature.

28. (a) Maximum percentage error in measurement of e, as given by Reyleigh's formula.
(Given error is measurement of radius is 0.1 cm)
$\Delta e = 0.6\,\Delta R = 0.6 \times 0.1 = 0.06$ cm.
Percentage error is

$$\frac{\Delta e}{e} \times 100 = \frac{0.06}{0.6 \times 3} \times 100 = 3.33\%$$

29. (b) Speed of sound at the room temperature.
$\ell_1 = 4.6$ cm, $\ell_2 = 14.0$ cm.,
$\lambda = 2(\ell_2 - \ell_1) = 2(14.0 - 4.6) = 18.8$ cm.

$$v = f\lambda = 2000 \times \frac{18.8}{100} = 376 \text{ m/s}$$

30. (c) End correction obtained in the experiment.

$$e = \frac{\ell_2 - 3\ell_1}{2} = \frac{14.0 - 3 \times 4.6}{2} = 0.1 \text{ cm.}$$