PHYSICS – CLASS XI

Chapter 1 : Units and Measurement

PRACTICE PAPER (Chapter-wise Test)

Time : 1½ Hours **Max. Marks : 35**

General Instructions

(a) All questions are compulsory.

(b) There are 17 questions in total. Section A: Q. 1 to 8 carry 1 mark each. Section B: Q. 9 to 12 carry 2 marks each. Section C: Q. 13 to 15 carry 3 marks each. Section D: Q. 16 and 17 carry 5 marks each.

(c) There is no overall choice. An internal choice is given in one 2-mark question (Q. 11), one 3-mark question (Q. 14) and both 5-mark questions (Q. 16, Q. 17). Attempt only one of the given choices.

(d) Use of calculators is not permitted. Take π = 3.14 wherever required.

(e) Figures are schematic and not drawn to scale. In numerical answers, take care of significant figures and write the unit.

SECTION A

Questions 1 to 8 carry 1 mark each.

1. Which one of the following is **not** one of the seven SI base quantities? **(1)**

(a) Amount of substance
(b) Luminous intensity
(c) Plane angle
(d) Thermodynamic temperature

2. The number of significant figures in the measured length 0.003050 m is **(1)**

(a) 2
(b) 3
(c) 4
(d) 6

3. Which of the following pairs of physical quantities has the **same** dimensional formula? **(1)**

(a) Work and power
(b) Torque and energy
(c) Momentum and force
(d) Pressure and force

4. **Assertion (A):** An equation that is dimensionally correct must also be physically correct. **(1)**

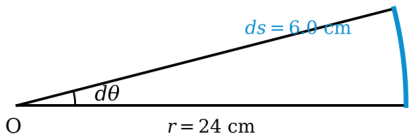
Reason (R): An equation that fails the dimensional-consistency test must be wrong.

(a) Both A and R are true and R is the correct explanation of A.
(b) Both A and R are true but R is not the correct explanation of A.
(c) A is true but R is false.
(d) A is false but R is true.

5. The mass of an electron is 9.11×10^{-31} kg. The order of magnitude of this mass (the exponent of 10) is **(1)**

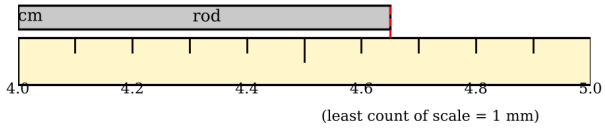
(a) −31
(b) −30
(c) −32
(d) 9

6. Refer to the figure. A circular arc of length ds = 6.0 cm is drawn with radius r = 24 cm. Find the angle $d\theta$ in radian subtended by the arc at O. **(1)**



7. Write the dimensional formula of Planck's constant h, given that the energy of a photon is $E = h\nu$, where ν is its frequency. **(1)**

8. The figure shows a rod placed against a scale whose smallest division is 1 mm. The right end of the rod lies midway between the 4.6 cm and 4.7 cm marks. Which of the following is the most appropriate way to report the length? **(1)**

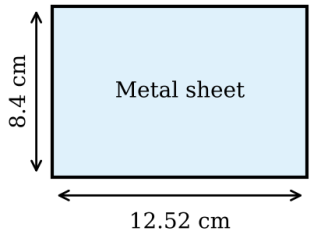


(a) 4.6 cm
(b) 4.65 cm
(c) 4.650 cm
(d) 4.7 cm

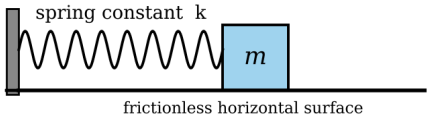
SECTION B

Questions 9 to 12 carry 2 marks each.

9. The length and breadth of a metal sheet are measured as shown in the figure. Using the rules for significant figures, find (i) the area and (ii) the perimeter of the sheet. **(2)**



10. A block of mass m attached to a spring of force constant k (force per unit extension) oscillates on a frictionless surface (figure). A student writes the time period as $T = 2\pi\sqrt{(m/k)}$. Check, by the method of dimensions, whether this relation is dimensionally consistent. **(2)**



11. State the number of significant figures in each of the following: **(2)**

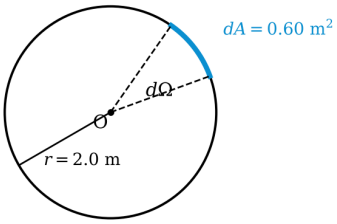
(a) 6.0200×10^{-4} kg (b) 0.0830 m (c) 4500 m (d) 100.05 s

OR

Round off each of the following to **three** significant figures:

(a) 4.865 (b) 4.875 (c) 6.0251 (d) 0.083949

12. The figure shows a small patch of area $dA = 0.60$ m² on the surface of a sphere of radius $r = 2.0$ m, with centre O. Calculate the solid angle $d\Omega$ subtended by the patch at O. Write its SI unit and its dimensional formula. **(2)**

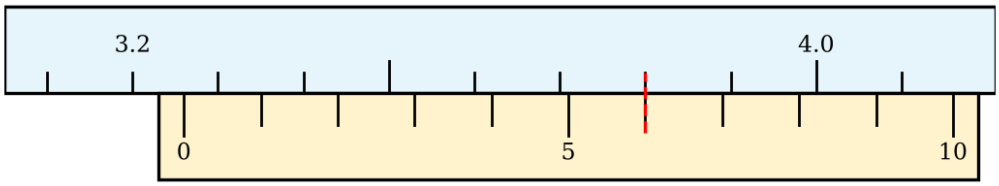


SECTION C

Questions 13 to 15 carry 3 marks each.

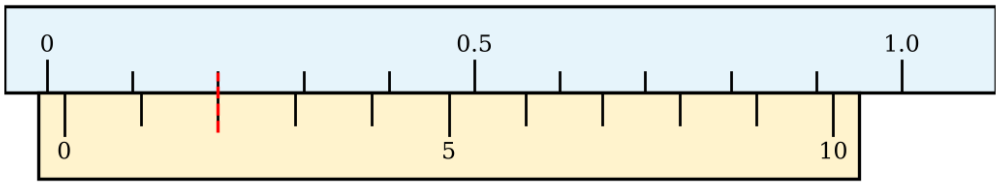
13. A vernier callipers has the main scale marked in millimetres, and 10 divisions of its vernier scale coincide with 9 divisions of the main scale. Figure (i) shows the callipers holding a rod and figure (ii) shows the reading when the jaws are closed. **(3)**

(i) Measuring the length of a rod (numbers on main scale in cm)



main scale: 1 division = 1 mm; 10 vernier divisions = 9 main-scale divisions

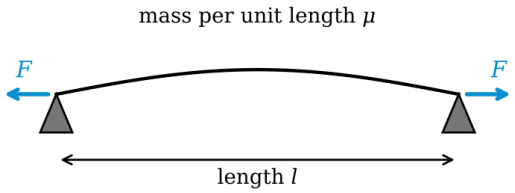
(ii) Jaws closed (numbers on main scale in cm)



main scale: 1 division = 1 mm; 10 vernier divisions = 9 main-scale divisions

(a) Find the least count of the callipers. (b) Read the observed length from fig. (i) and the zero error from fig. (ii). (c) Hence give the corrected length of the rod in cm.

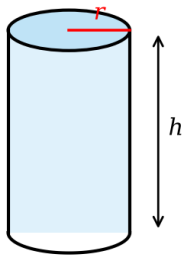
14. The frequency f of vibration of a stretched string (figure) depends on its length l, the tension F in it and its mass per unit length μ. Using the method of dimensions, derive an expression for f. Can the dimensionless constant in the expression be found by this method? **(3)**



OR

The time period T of oscillation of a liquid drop depends on its density ρ, radius r and surface tension S (force per unit length). Using dimensional analysis, derive the expression for T.

15. The mass, radius and height of a solid cylinder are measured as shown in the figure. (i) Calculate the density of the material, stating the result to the correct number of significant figures. (ii) Express the density in kg m^{-3} in scientific notation. **(3)**

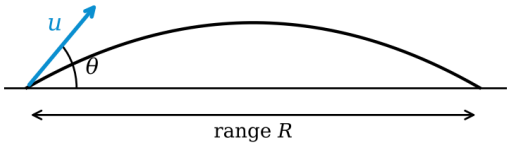


$m = 45.36$ g, $r = 1.25$ cm, $h = 8.4$ cm

SECTION D

Questions 16 and 17 carry 5 marks each.

16. (a) State the principle of homogeneity of dimensions. (1) **(5)**
(b) Two students derive expressions for the horizontal range R of a projectile launched with speed u at an angle θ to the horizontal (figure). Student A writes $R = u^2 \sin 2\theta / g$ and student B writes $R = u \sin 2\theta / g$. Use dimensions to test each expression. (3)
(c) Does the expression that passes the test have to be correct? Justify. (1)



OR

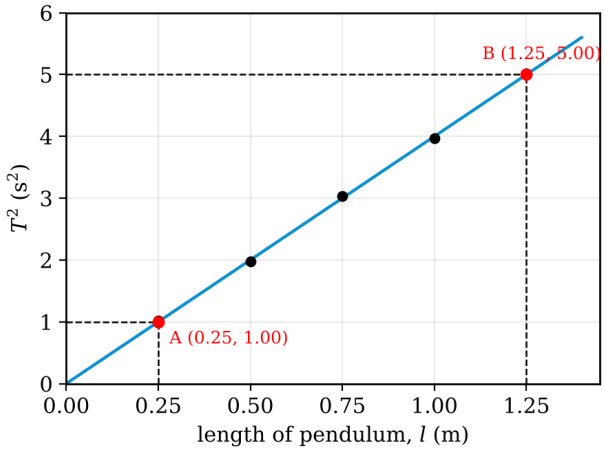
A new system of units has the unit of mass = 20 kg, unit of length = 5 m and unit of time = 2 s.
(i) Find the value of the new unit of energy in joule. (2)
(ii) Express an energy of 625 J in the new unit. (1)
(iii) Express a power of 125 W in the new unit of power. (2)

17. In an experiment to determine the acceleration due to gravity g with a simple pendulum, a student takes five different lengths l and records the corresponding time periods T. The graph of T^2 against l is a straight line through the origin (figure). **(5)**

(a) Assuming that T depends only on l and g, use dimensional analysis to show that $T^2 \propto l$. (2)

(b) Using the points A and B on the best-fit line, find its slope. (2)

(c) Given that $T^2 = (4\pi^2/g)\, l$, calculate g to the correct number of significant figures. (1)

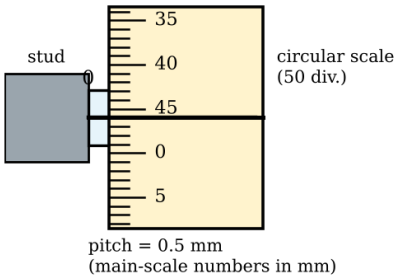


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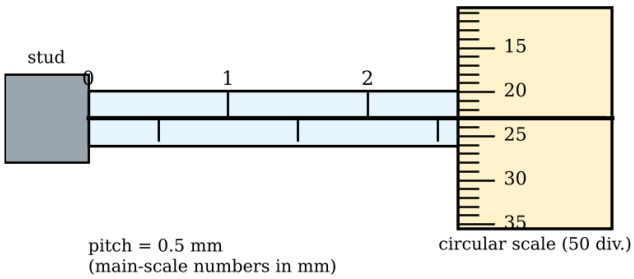
A screw gauge has a pitch of 0.5 mm and 50 divisions on its circular scale. Figure (i) shows the reading when the studs are in contact and figure (ii) shows the reading when a wire is held between the studs.

(a) Find the least count. (1) (b) Find the zero error with its sign. (1) (c) Find the observed reading from fig. (ii). (1) (d) Find the corrected diameter of the wire. (1) (e) Find the cross-sectional area of the wire ($A = \pi d^2/4$) to the correct number of significant figures. (1)

(i) Studs in contact (no wire)



(ii) Wire held between the studs



— END OF QUESTION PAPER —