

STUDYNEST | CLASS 11 PHYSICS QUESTION PAPER 1

Chapter 1: Units and Measurements

Maximum Marks: 40 | Suggested time: 60 minutes

Instructions: Answer all questions. Show calculation steps and units. Original practice paper, not an official examination.

Section A 1-mark questions - $8 \times 1 = 8$ marks

1. How many SI base quantities? [1]
2. SI unit of temperature? [1]
3. Significant figures in 0.00450? [1]
4. Dimensions of speed? [1]
5. Dimensions of force? [1]
6. Is length/length dimensionless? [1]
7. Can dimensional analysis determine π ? [1]
8. SI unit of pressure? [1]

Section B 2-mark questions - $6 \times 2 = 12$ marks

9. Round 12.486 to 3 significant figures. [2]
10. Dimensions of momentum mv ? [2]
11. Check $s=ut+at^2$ dimensionally. [2]
12. Convert 72 km/h to m/s. [2]
13. Significant figures in 5.070×10^3 ? [2]
14. Why can't dimensions distinguish work and torque? [2]

Section C 3-mark questions - $4 \times 3 = 12$ marks

15. Derive pendulum period dependence T proportional to $l^a g^b$. [3]
16. Sphere radius 2.00 cm: volume to 3 s.f.? [3]
17. Dimensions of G from $F=Gm_1m_2/r^2$? [3]
18. 15.2 cm x 3.4 cm: area with correct precision? [3]

Section D 4-mark questions - $2 \times 4 = 8$ marks

19. Spring-mass period T proportional to $m^a k^b$, $[k]=MT^{-2}$. Find exponents. [4]
20. Calculated volume is 18.237 cm^3 , least precise input 3 s.f. What is reported? [4]

End of question paper.

FORMULA AND EQUATION REFERENCE

Chapter-specific equations worth knowing

- Speed: $v = \text{distance}/\text{time}$; velocity: $v = \text{displacement}/\text{time}$; acceleration: $a = \Delta v / \Delta t$.
- Dimensions: $[v] = LT^{-1}$; $[a] = LT^{-2}$; $[F] = MLT^{-2}$; $[\text{momentum}] = MLT^{-1}$; $[\text{pressure}] = ML^{-1}T^{-2}$; $[G] = M^{-1}L^3T^{-2}$.
- Dimensional check: every term in an equation must have identical dimensions.
- Dimensional method for T proportional to $l^a g^b$: $[T] = L^a(LT^{-2})^b$, so $a+b=0$ and $-2b=1$.
- Spring period dependence: T proportional to $m^a k^b$ with $[k] = MT^{-2}$; compare mass and time powers.
- Sphere volume $V = (4/3) \pi r^3$; rectangle area $A = \text{length} \times \text{breadth}$.
- Unit conversion: $1 \text{ m/s} = 3.6 \text{ km/h}$; $1 \text{ km/h} = 5/18 \text{ m/s}$.
- Rounding: keep the requested significant figures; for multiplication/division, report to the least precise input's significant figures.

Use each equation only when its assumptions apply; keep units consistent.

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STEP-BY-STEP SOLUTIONS

Solutions are grouped here after the question paper and formula reference.

Question 1

Principle / definition: Recall the relevant definition or equation from the formula reference.

Apply it to this question: Seven.

Final answer: Seven.

Question 2

Principle / definition: Recall the relevant definition or equation from the formula reference.

Apply it to this question: kelvin (K).

Final answer: kelvin (K).

Question 3

Principle / definition: Recall the relevant definition or equation from the formula reference.

Apply it to this question: Three.

Final answer: Three.

Question 4

Principle / definition: Recall the relevant definition or equation from the formula reference.

Apply it to this question: $[LT^{-1}]$.

Final answer: $[LT^{-1}]$.

Question 5

Principle / definition: Recall the relevant definition or equation from the formula reference.

Apply it to this question: $[MLT^{-2}]$.

Final answer: $[MLT^{-2}]$.

Question 6

Principle / definition: Recall the relevant definition or equation from the formula reference.

Apply it to this question: Yes.

Final answer: Yes.

Question 7

Principle / definition: Recall the relevant definition or equation from the formula reference.

Apply it to this question: No.

Final answer: No.

Question 8

Principle / definition: Recall the relevant definition or equation from the formula reference.

Apply it to this question: pascal (Pa).

Final answer: pascal (Pa).

Question 9

Working: Keep the first three significant digits: 1, 2, 4. The next digit is 8, so round 12.4 upward to 12.5.

Final answer: 12.5.

Question 10

Working: Momentum $p=mv$. Therefore $[p]=M \times LT^{-1} = MLT^{-1}$.

Final answer: $[MLT^{-1}]$.

Question 11

Working: $[s]=L$. Also $[ut]=LT^{-1} \times T=L$, and $[at^2]=LT^{-2} \times T^2=L$. Every term has dimension L, so the equation is homogeneous.

Final answer: ut and at^2 both have dimension L; homogeneous.

Question 12

Working: $72 \text{ km/h} \times (1000 \text{ m/1 km}) \times (1 \text{ h/3600 s}) = 72/3.6 = 20 \text{ m/s}$.

Final answer: 20 m s^{-1} .

Question 13

Working: In 5.070×10^3 , the digits 5, 0, 7 and the final 0 are significant. Answer: 4 significant figures.

Final answer: Four.

Question 14

Working: Work = force $\times$ displacement; torque = force $\times$ perpendicular distance. Both have dimensions $M L^2 T^{-2}$, so dimensional analysis alone cannot distinguish their physical meanings.

Final answer: Both are $[ML^2T^{-2}]$.

Question 15

Working: Assume T proportional to $l^a g^b$. Then T dimension = $L^a(LT^{-2})^b = L^{(a+b)}T^{(-2b)}$. Equate powers: $a+b=0$ and $-2b=1$. Hence $b=-1/2$ and $a=1/2$, so T proportional to $\sqrt{l/g}$.

Final answer: Equating dimensions gives $a=$, $b=-$, so T proportional to $\sqrt{l/g}$.

Question 16

Working: $V = \frac{4}{3}\pi r^3 = \frac{4}{3}\pi (2.00 \text{ cm})^3 = 33.510\dots \text{ cm}^3$. To 3 significant figures, $V = 33.5 \text{ cm}^3$.

Final answer: $\frac{4\pi r^3}{3} = 33.5 \text{ cm}^3$.

Question 17

Working: From $F = Gm_1m_2/r^2$, $G = Fr^2/(m_1m_2)$. Dimensions: $(MLT^{-2})L^2/M^2 = M^{-1}L^3T^{-2}$.

Final answer: $[M^{-1}L^3T^{-2}]$.

Question 18

Working: Area = $15.2 \times 3.4 = 51.68 \text{ cm}^2$. The least precise factor has 2 significant figures, so report 52 cm^2 .

Final answer: 51.68 cm^2 rounds to 52 cm^2 .

Question 19

Working: Assume T proportional to $m^a k^b$. Since $[k] = MT^{-2}$, $[T] = M^{(a+b)}T^{(-2b)}$. Set $a+b=0$ and $-2b=1$: $b=-1/2$, $a=1/2$. Thus T proportional to $\sqrt{m/k}$.

Final answer: $a=$, $b=-$; T proportional to $\sqrt{m/k}$.

Question 20

Working: Round 18.237 to 3 significant figures: retain 1, 8, 2; the next digit is 3, so the result is 18.2 cm^3 .

Final answer: 18.2 cm^3 ; extra digits are unsupported.

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