

Units and Measurements — NEET Physics PYQ (2005-2021)

Class 11 Physics · 24 real NEET & AIPMT questions, year-tagged · answers checked by RankUp

NEET 2021

1. If force [F], acceleration [A] and time [T] are chosen as the fundamental physical quantities. Find the dimensions of energy.

- (A) [F] [A] [T]
- (B) [F] [A] [T²]
- (C) [F] [A] [T⁻¹]
- (D) [F] [A⁻¹] [T]

NEET 2021

2. A screw gauge gives the following readings when used to measure 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 on the circular scale.

The diameter of the wire from the above data is :

- (A) 0.52 cm
- (B) 0.026 cm
- (C) 0.26 cm
- (D) 0.052 cm

NEET 2021

3. If E and G respectively denote energy and gravitational constant, then E/G has the dimensions of :

- (A) [M²] [L⁻¹] [T⁰]
- (B) [M] [L⁻¹] [T⁻¹]
- (C) [M] [L⁰] [T⁰]
- (D) [M²] [L⁻²] [T⁻¹]

NEET 2020 · Q146

4. A screw gauge has least count of 0.01 mm and there are 50 divisions in its circular scale. The pitch of the screw gauge is :

- (A) 0.01 mm
- (B) 0.25 mm
- (C) 0.5 mm
- (D) 1.0 mm

NEET 2020 · Q167

5. Dimensions of stress are :

- (A) [MLT⁻²]
- (B) [ML²T⁻²]
- (C) [ML⁰T⁻²]
- (D) [ML⁻¹T⁻²]

NEET 2020 · Q176

6. Taking into account of the significant figures, what is the value of 9.99 m – 0.0099 m ?

- (A) 9.9801 m
- (B) 9.98 m
- (C) 9.980 m
- (D) 9.9 m

NEET 2019 · Q44

7. In an experiment, the percentage of error occurred in the measurement of physical quantities A, B, C and D are 1%, 2%, 3% and 4% respectively. Then the maximum percentage of error in the measurement X, where $X = A^2 B^{(1/2)} / (C^{(1/3)} D^3)$, will be:

- (A) $(3/13)\%$
- (B) 16%
- (C) -10%
- (D) 10%

NEET 2018 · Q37

8. A student measured the diameter of a small steel ball using a screw gauge of least count 0.001 cm. The main scale reading is 5 mm and zero of circular scale division coincides with 25 divisions above the reference level. If screw gauge has a zero error of -0.004 cm, the correct diameter of the ball is

- (A) 0.053 cm
- (B) 0.525 cm
- (C) 0.521 cm
- (D) 0.529 cm

NEET 2017 · Q163

9. A physical quantity of the dimensions of length can be formed out of c, G and $e^2/4\pi\epsilon_0$ is [c is velocity of light, G is universal constant of gravitation, e is charge]:

- (A) $(1/c^2)[G e^2/4\pi\epsilon_0]^{1/2}$
- (B) $c^2[G e^2/4\pi\epsilon_0]^{1/2}$
- (C) $(1/c^2)[e^2/(G 4\pi\epsilon_0)]^{1/2}$
- (D) $(1/c) G e^2/4\pi\epsilon_0$

NEET 2017 (Gujarati paper) · Q180

10. A student performs an experiment of measuring the thickness of a slab with a vernier calliper whose 50 divisions of the vernier scale are equal to 49 divisions of the main scale. He noted that zero of the vernier scale is between 7.00 cm and 7.05 cm mark of the main scale and 23rd division of the vernier scale exactly coincides with the main scale. The measured value of the thickness of the given slab using the calliper will be:

- (A) 7.23 cm
- (B) 7.023 cm
- (C) 7.073 cm
- (D) 7.73 cm

NEET 2016 Phase 2 · Q1

11. Planck's constant (h), speed of light in vacuum (c) and Newton's gravitational constant (G) are three fundamental constants. Which of the following combinations of these has the dimension of length?

- (A) $\sqrt{(hG)/c^{(3/2)}}$
- (B) $\sqrt{(hG)/c^{(5/2)}}$
- (C) $\sqrt{(hc/G)}$
- (D) $\sqrt{(Gc/h^{(3/2)})}$

AIPMT 2015

12. If energy (E), velocity (V) and time (T) are chosen as the fundamental quantities, the dimensional formula of surface tension will be:

- (A) $[E^{-2} V^{-1} T^{-3}]$
- (B) $[E V^{-2} T^{-1}]$
- (C) $[E V^{-1} T^{-2}]$
- (D) $[E V^{-2} T^{-2}]$

AIPMT 2014

13. If force (F), velocity (V) and time (T) are taken as fundamental units, then the dimensions of mass are:

- (A) $[F V T^{-2}]$
- (B) $[F V^{-1} T^{-1}]$
- (C) $[F V^{-1} T]$
- (D) $[F V T^{-1}]$

NEET 2013

14. In an experiment four quantities a, b, c and d are measured with percentage error 1%, 2%, 3% and 4% respectively. Quantity P is calculated as follows: $P = a^3 b^2 / (cd)$. % error in P is

- (A) 14%
- (B) 10%
- (C) 7%
- (D) 4%

AIPMT 2012 Prelims

15. The damping force on an oscillator is directly proportional to the velocity. The units of the constant of proportionality are

- (A) kg s
- (B) kg m s⁻¹
- (C) kg m s⁻²
- (D) kg s⁻¹

AIPMT 2011 Mains

16. The density of a material in CGS system of units is 4 g/cm³. In a system of units in which unit of length is 10 cm and unit of mass is 100 g, the value of density of material will be

- (A) 400
- (B) 0.04
- (C) 0.4
- (D) 40

AIPMT 2010 Mains · Q65

17. A student measures the distance traversed in free fall of a body, initially at rest in a given time. He uses this data to estimate g, the acceleration due to gravity. If the maximum percentage errors in measurement of the distance and the time are e₁ and e₂ respectively, the percentage error in the estimation of g is

- (A) e₂ – e₁
- (B) e₁ + 2e₂
- (C) e₁ + e₂
- (D) e₁ – 2e₂

AIPMT 2010 Prelims · Q1

18. The dimension of $(1/2)\epsilon_0 E^2$, where ϵ_0 is permittivity of free space and E is electric field, is

- (A) MLT⁻¹
- (B) ML²T⁻²
- (C) ML⁻¹T⁻²
- (D) ML²T⁻¹

19. If the dimensions of a physical quantity are given by $M^a L^b T^c$, then the physical quantity will be:

- (A) Velocity if $a = 1, b = 0, c = -1$
- (B) Acceleration if $a = 1, b = 1, c = -2$
- (C) Force if $a = 0, b = -1, c = -2$
- (D) Pressure if $a = 1, b = -1, c = -2$

20. Which two of the following five physical parameters have the same dimensions?

- (a) energy density
- (b) refractive index
- (c) dielectric constant
- (d) Young's modulus
- (e) magnetic field

- (A) (a) and (e)
- (B) (b) and (d)
- (C) (c) and (e)
- (D) (a) and (d)

21. If the error in the measurement of radius of a sphere is 2%, then the error in the determination of volume of the sphere will be

- (A) 2%
- (B) 4%
- (C) 6%
- (D) 8%

22. Dimensions of resistance in an electrical circuit, in terms of dimension of mass M , of length L , of time T and of current I , would be

- (A) ML^2T^{-2}
- (B) $ML^2T^{-1}I^{-1}$
- (C) $ML^2T^{-3}I^{-2}$
- (D) $ML^2T^{-3}I^{-1}$

23. The velocity v of a particle at time t is given by $v = at + b/(t + c)$, where a , b and c are constants. The dimensions of a , b and c are respectively :

- (A) $[LT^{-2}]$, $[L]$ and $[T]$
- (B) $[L]$, $[T]$ and $[LT^2]$
- (C) $[L^2T^2]$, $[LT]$ and $[L]$
- (D) $[L]$, $[LT]$ and $[T^2]$

24. The ratio of the dimensions of Planck's constant and that of the moment of inertia is the dimension of :

- (A) frequency
- (B) velocity
- (C) angular momentum
- (D) time

Answer key and explanations

1. Answer: (B) [F] [A] [T²]

Energy = force $\times$ displacement, and displacement has the dimensions of acceleration $\times$ time². Hence $[E] = [F][A][T^2]$. Writing $[F][A][T]$ forgets that distance needs time squared.

2. Answer: (D) 0.052 cm

Least count = $1 \text{ mm}/100 = 0.01 \text{ mm}$. Diameter = $0 + 52 \times 0.01 \text{ mm} = 0.52 \text{ mm} = 0.052 \text{ cm}$. The trap 0.52 cm forgets the mm-to-cm conversion.

3. Answer: (A) $[M^2] [L^{-1}] [T^0]$

$[E] = ML^2T^{-2}$ and $[G] = M^{-1}L^3T^{-2}$. So $E/G = M^2L^{-1}T^0$. Forgetting that G carries M^{-1} would give a single power of mass.

4. Answer: (C) 0.5 mm

Least count = pitch / number of circular scale divisions, so pitch = $0.01 \text{ mm} \times 50 = 0.5 \text{ mm}$. The least count itself is not the pitch.

5. Answer: (D) $[ML^{-1}T^{-2}]$

Stress is force per area: $[MLT^{-2}]/[L^2] = [ML^{-1}T^{-2}]$, the same as pressure. $[MLT^{-2}]$ is force itself and $[ML^2T^{-2}]$ is energy.

6. Answer: (B) 9.98 m

$9.99 - 0.0099 = 9.9801 \text{ m}$, but in subtraction the result keeps as many decimal places as the least precise term; 9.99 has two decimal places, so the answer is 9.98 m. 9.9801 m reports more precision than the data justify.

7. Answer: (B) 16%

Maximum relative errors add regardless of whether the quantity is in the numerator or denominator: $2 \times 1\% + \frac{1}{2} \times 2\% + \frac{1}{3} \times 3\% + 3 \times 4\% = 2 + 1 + 1 + 12 = 16\%$. Subtracting the denominator errors gives the wrong -10% .

8. Answer: (D) 0.529 cm

Observed reading = $0.5 \text{ cm} + 25 \times 0.001 \text{ cm} = 0.525 \text{ cm}$. Correct reading = observed – zero error = $0.525 - (-0.004) = 0.529 \text{ cm}$. Adding the negative zero error with the wrong sign gives 0.521 cm.

9. Answer: (A) $(1/c^2)[G e^2/4\pi\epsilon_0]^{\frac{1}{2}}$

$e^2/4\pi\epsilon_0 = F r^2$ has dimensions $[M L^3 T^{-2}]$ and G has $[M^{-1} L^3 T^{-2}]$, so $G e^2/4\pi\epsilon_0$ has $[L^6 T^{-4}]$; its square root is $[L^3 T^{-2}]$. Dividing by $c^2 [L^2 T^{-2}]$ leaves $[L]$. Multiplying by c^2 instead gives $L^5 T^{-4}$.

10. Answer: (B) 7.023 cm

One main scale division is 0.05 cm (the marks are at 7.00 and 7.05 cm), so the least count = 1 MSD – 1 VSD = $0.05/50 = 0.001 \text{ cm}$. Reading = $7.00 + 23 \times 0.001 = 7.023 \text{ cm}$. 7.23 cm would wrongly take the least count as 0.01 cm.

11. Answer: (A) $\sqrt{(hG)/c^3}$

Using $[h] = ML^2T^{-1}$, $[G] = M^{-1}L^3T^{-2}$, $[c] = LT^{-1}$: hG has dimensions L^5T^{-3} and c^3 has L^3T^{-3} , so $hG/c^3 = L^2$ and $\sqrt{(hG)/c^3} = L$ (the Planck length). With $c^{5/2}$ in the denominator the result would be T, not L.

12. Answer: (D) $[E V^{-2} T^{-2}]$

Surface tension has dimensions $[MT^{-2}]$. With $E = [ML^2T^{-2}]$ and $V = [LT^{-1}]$, $M = E V^{-2}$, so $[MT^{-2}] = [E V^{-2} T^{-2}]$.

13. Answer: (C) $[F V^{-1} T]$

$F = ma = m(V/T)$, so $m = FT/V$, i.e. $[F V^{-1} T]$.

14. Answer: (A) 14%

Maximum fractional errors add with powers as weights: $\Delta P/P = 3(1\%) + 2(2\%) + 3\% + 4\% = 3 + 4 + 3 + 4 = 14\%$. Getting 10% comes from ignoring the powers and just adding the four errors.

15. Answer: (D) kg s^{-1}

$F = bv$, so $b = F/v$ with units $(\text{kg m s}^{-2})/(\text{m s}^{-1}) = \text{kg s}^{-1}$. kg m s^{-2} is the unit of force itself, not of the constant.

16. Answer: (D) 40

New unit of density = $100 \text{ g}/(10 \text{ cm})^3 = 0.1 \text{ g/cm}^3$. So $4 \text{ g/cm}^3 = 4/0.1 = 40$ new units. Dividing the wrong way gives 0.4.

17. Answer: (B) $e_1 + 2e_2$

For free fall from rest $h = \frac{1}{2}gt^2$, so $g = 2h/t^2$. Maximum relative errors add with their powers: $\Delta g/g = \Delta h/h + 2\Delta t/t$, giving $e_1 + 2e_2$. Subtracting errors ($e_1 - 2e_2$) is wrong because maximum errors always add.

18. Answer: (C) $ML^{-1}T^{-2}$

$(1/2)\epsilon_0 E^2$ is the energy density of the electric field, i.e. energy per unit volume. Its dimensions are $ML^2T^{-2}/L^3 = ML^{-1}T^{-2}$. ML^2T^{-2} is the dimension of energy itself, which forgets the division by volume.

19. Answer: (D) Pressure if $a = 1$, $b = -1$, $c = -2$

Pressure = force/area = $MLT^{-2}/L^2 = ML^{-1}T^{-2}$, so $a = 1$, $b = -1$, $c = -2$. Velocity has no mass dimension ($a = 0$), acceleration has no mass dimension, and force is MLT^{-2} , so the other pairings are wrong.

20. Answer: (D) (a) and (d)

Energy density is energy per unit volume, $[ML^2T^{-2}]/[L^3] = [ML^{-1}T^{-2}]$, and Young's modulus is stress/strain, also $[ML^{-1}T^{-2}]$. Refractive index and dielectric constant are both dimensionless, but the magnetic field $[MT^{-2}A^{-1}]$ matches neither of them.

21. Answer: (C) 6%

$V = (4/3)\pi r^3$, so $\Delta V/V = 3(\Delta r/r) = 3 \times 2\% = 6\%$. Taking 8% would wrongly cube the error itself instead of multiplying it by the power 3.

22. Answer: (C) $ML^2T^{-3}I^{-2}$

$R = V/I$ and $V = W/q$ has dimensions $ML^2T^{-2}/(IT) = ML^2T^{-3}I^{-1}$, so $R = ML^2T^{-3}I^{-2}$. $ML^2T^{-3}I^{-1}$ is the dimension of potential difference, not resistance.

23. Answer: (A) $[LT^{-2}]$, $[L]$ and $[T]$

Every term must have the dimensions of velocity $[LT^{-1}]$. From at , $a = [LT^{-2}]$. In $b/(t + c)$, c is added to time so $c = [T]$; then $b/[T] = [LT^{-1}]$ gives $b = [L]$. The other choices fail the rule that only like quantities can be added.

24. Answer: (A) frequency

$[h] = ML^2T^{-1}$ and $[I] = ML^2$, so $[h/I] = T^{-1}$, the dimension of frequency. Angular momentum has the dimensions of h itself, not h/I .

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