JEE Mains PYQs Units and measurement (Physics Master Academy)

QUESTIONS

SECTIONS

1. Section A - 35 Questions

Section 1 : Section A - 35 Questions

SECTION INSTRUCTIONS

This section contains 35 questions. All qs are compulsary. 4 marks for correct answer and - 1 for every incorrect answer.

1 If E and H represents the intensity of electric keld and magnetizing kled respectively, then the unit of E/H will be

○ Ohm

○ Mho

○ Joule

○ Newton

Correct: +4 · Incorrect: -1

2 The density of a material in SI unit is 128 kg m^{-3}. In certain units in which the unit of length is 25cm and the unit of mass is 50g, the numerical value of density of the material is

○ 40

○ 16

○ 640

○ 410

Correct: +4 · Incorrect: -1

3   Match List I with List II

List I		List II
(A) Torque		(i) MLT^{-1}
(B) Impulse		(ii) MT^{-2}
(C) Tension		(iii) ML^2T^{-2}
(D) Surface tension		(iv) MLT^{-2}

Chose the most appropriate answer from the option given below:

- ○ A-iii, B-i, C-iv, D-ii

- ○ A-ii, B-i, C-iv, D-iii

- ○ A-i, B-iii, C-iv, D-ii

- ○ A-iii, B-iv, C-i, D-ii

Correct: +4 · Incorrect: -1

4   If velocity [V] , time [T] and force [F] are chosen as the base quantities, the dimensions of the mass will be

- ○ $[FT^{-1}V^{-1}]$

- ○ $[FTV^{-1}]$

- ○ $[FT^2V]$

- ○ $[FVT^{-1}]$

Correct: +4 · Incorrect: -1

5   Which of the following is not a dimensionless quantity?

- ○ Relative magnetic permeability (μ_r)

- ○ Power factor

- ○ Permeability of free space (μ_0)

- ○ Quality factor

Correct: +4 · Incorrect: -1

6   If force (F), Length (L) and time (T) are taken as the fundamental quantities. Then what will be the dimension of density?

- ○ $[FL^{-4}T^2]$

- ○ $[FL^{-3}T^2]$

○ $[FL^{-5}T^2]$

○ $[FL^{-3}T^3]$

7 If F, L, M and G denote the quantities as energy, angular momentum, mass and constant of gravitation respectively, then the dimensions of P in the formula $P = EL^2M^{-5}G^{-2}$ are

○ $[M^0L^1T^0]$

○ $[M^{-1}L^{-1}T^1]$

○ $[M^1L^1T^{-2}]$

○ $[M^0L^0T^0]$

8 The time (t), velocity (v) and angular momentum (l) are taken as the fundamental units. Then the dimensions of mass (m) in terms of t, v and l is

○ $[t^{-1}v^1l^{-2}]$

○ $[t^1v^2l^{-1}]$

○ $[t^{-2}v^{-1}l^1]$

○ $[t^{-1}v^{-2}l^1]$

9
  If e is the electronic charge, c is the speed of light in free space and h is Planck's constant, the quantity $\dfrac{1}{4\pi\varepsilon_0}\dfrac{\dot{c}\,e\,\dot{c}^2}{hc}$ has dimensions of

○ $[MLT^{-1}]$

○ $[MLT^0]$

○ $[LC^{-1}]$

○ $[M^0L^0T^0]$

10 Dimensional formula for thermal conductivity is (here K denotes the temperature):

○ $MLT^{-2}K$

○ $MLT^{-2}K^{-2}$

○ $MLT^{-3}K$

○ $MLT^{-3}K^{-1}$

11   Amount of solar energy received on the earth's surface per unit area per unit time is dekned as solar constant. Dimension of solar constant is

○ ML^2T^{-2}

○ ML^0T^{-2}

○ $M^2L^0T^{-1}$

○ MLT^{-2}

12   If speed V, area A and force F are chosen as fundamental units, then the dimension of Young's modulus will be

○ FA^2V^{-1}

○ FA^2V^{-3}

○ FA^2V^{-2}

○ $FA^{-1}V^0$

13   Which of the following combinations has the dimension of electrical resistance (ε_0 is the permittivity of vacuum and μ_0 is the permeability of vacuum)?

○ $\sqrt{\dfrac{\mu_0}{\varepsilon_0}}$

○ $\dfrac{\mu_0}{\varepsilon_0}$

○

$$\sqrt{\frac{\varepsilon_0}{\mu_0}}$$

○ $\dfrac{\varepsilon_0}{\mu_0}$

14

The dimensions of $\dfrac{B^2}{2\mu_0}$ where B is magnetic keld and μ_0 is the magnetic permeability of vacuum, is

○ MLT^{-2}

○ ML^2T^{--1}

○ ML^2T^{-2}

○ $ML^{-1}T^{-2}$

15 Two resistors R_1 (4 $\pm$ 0.8)Ω and $R_2 = (4 \pm 0.4)\Omega$ are connected in parallel. The equivalent resistance of their parallel combination will be

○ $(4\pm0.4)\Omega$

○ $(2\pm0.4)\Omega$

○ $(2\pm0.3)\Omega$

○ $(4\pm0.3)\Omega$

16 The diameter of a spherical bob is measured using a vernier calipers. 9 divisions of the main scale, in the vernier calipers are equal to 10 divisions of vernier scale. One main scale division is 1mm. The main scale reading is 10 mm and 8th division of vernier scale was found to coincide exactly with one of the main scale division. If the given vernier calipers has positive zero error of 0.04cm then the radius of the bob is_ $\times 10^{-2}$cm

○ 0.1mm

○ 0.1 cm

○ 0.01cm

○ 0.01mm

Correct: +4 · Incorrect: -1

17 In a screw gauge, kfth division of the circular scale coincides with the reference line when the ratchet is closed. There are 50 divisions on the circular scale, and the main scale moves by 0.5mm on a complete rotation. For a particular observation the reading on the main scale is 5mm and the 20th division of the circular scale coincides with reference line. Calculate the true reading.

○ 5.00mm

○ 5.25mm

○ 5.15mm

○ 5.20mm

Correct: +4 · Incorrect: -1

18 If the length of the pendulum in pendulum clock increases by 0.1%, then the error in time per day is

○ 86.4s

○ 4.32s

○ 43.2s

○ 8.64s

Correct: +4 · Incorrect: -1

19 Assertion: If in kve complete rotations of the circular scale, the distance travelled on main scale of the screw gauge is 5mm and there are 50 total divisions on circular scale, then least count is 0.001cm.

Reason: Least count = $\dfrac{Pitch}{Total\,divisions\,on\,circular\,scale}$

In the light of the above statements, chose the most appropriate answer fro the options given below:

○ Assertion is false but reason is true.

○ Both assertion and reason aretrue and reason is the correct[explanation of assertion.]

○ Assertion is true but reason is false

○ Both assertion and reason aretrue but reason is not thecorrect explanation of[assertion.]

Correct: +4 · Incorrect: -1

20 The radius of a sphere is measured to be (7.50 ± 0.85)cm. Suppose the percentage error in its volume is x. The value of x, is _____

○ 30

○ 34

○ 33

○ 32

21 The vernier scale used for measurement has a positive zero error of 0.2mm. If while making a measurement it was noted that '0' on the vernier scale les between 8.5cm and 8.6cm, vernier coincidence is 6, then the correct value of measurement is___cm.

○ 8.54cm

○ 8.36cm

○ 8.56cm

○ 8.58cm

22 One main scale division of a vernier calipers is 'a' cm and n^{th} division of the vernier scale coincide with $(n-1)^{th}$ division of the main scale. The least count of the calipers in mm is

○ $\dfrac{10a}{(n-1)}$

○ $\dfrac{10na}{(n-1)}$

○ $\left(\dfrac{n-1}{10n}\right)a$

○ $\dfrac{10a}{n}$

23 The resistance R = V/I, where V = (50 ± 2)V and I = (20 ± 0.2)A. The percentage error is x. The value of 'x' to the nearest integer is

○ 4.5

○ 5

○ 5.5

○ 4

24   A screw gauge has 50 divisions on its circular scale. The circular scale is 4 units ahead of the pitch scale marking prior to use. Upon one complete rotation of the circular scale, a displacement of 0.5mm is noticed on the pitch scale. The nature of zero error involved, and the least count of the screw gauge, are respectively

○ Negative, 2 μm

○ Positive, 10 μm

○ Positive, 0.1 mm

○ Positive, 0.1 μm

25
A physical quantity z depends on four observables a, b, c and d as $z = \dfrac{a^2 b^{2/3}}{\sqrt{c}\, d^3}$. The percentage error in the measurement of a, b, c and d are 2%, 1.5%, 4% and 2.5% respectively. The percentage error in z is

○ 12.25%

○ 16.5%

○ 13.5%

○ 14.5%

26   The least count of the main sale of a vernier calipers is 1mm. Its vernier scale is divided into 10 divisions and coincide with 9 divisions of the main scale. When jaws are touching each other, the 7th division of vernier scale coincides with a division of main scale and the zero of vernier scale is lying right side of the zero of main scale. When its vernier is used to measure length of a cylinder the zero of the vernier scale between 3.1cm and 3.2cm and 4th VSD coincide with a main scale divisions. The length of the cylinder is (VSD is vernier scale division)

○ 3.2cm

○ 3.21cm

○ 3.07cm

○ 2.99cm

27 If the crew gauge is given six rotations, it moves by 3mm on the main scale. If there are 50 divisions on the circular scale the least count of the screw gauge is

○ 0.001cm

○ 0.02mm

○ 0.01cm

○ 0.001mm

28 A simple pendulum is being used to determine the value of gravitational acceleration g at a certain place. The length of the pendulum is 25.0cm and a stop watch with 1s resolutions measures the time taken for 40 oscillations to be 50s. The accuracy in g is

○ 5.40%

○ 3.40%

○ 4.40%

○ 2.40%

29 The area of a square is 5.29cm^2. The area of 7 such squares taking into account the signikcant kgures is

○ 37cm^2

○ 37.030cm^2

○ 37.03cm^2

○ 37.0cm^2

30 In a simple pendulum experiment for determination of acceleration due to gravity (g), time taken for 20 oscillations is measured by using a watch of 1 second least count. The mean value of time taken comes out to be 30s. The length of pendulum is measured by using a meter scale of least count 1mm and the value obtained is 55.0cm. The percentage error in the determination of g is close to

○ 0.7%

○ 0.2%

○ 3.5%

○ 6.8%

Correct: +4 · Incorrect: -1

31 The least count of the main scale of a screw gauge is 1mm. The minimum number of divisions on its circular scale required to measure $5\mu m$ diameter of a wire is

○ 50

○ 200

○ 100

○ 500

Correct: +4 · Incorrect: -1

32 The density of a material in the shape of a cube is determined by measuring three sides of the cube and its mass. If the relative errors in measuring the mass and length are respectively 1.5% and 1%, the maximum error in determining the density is

○ 2.5%

○ 3.5%

○ 4.5%

○ 6%

Correct: +4 · Incorrect: -1

33 The relative error in the determination of the surface area of a sphere is α. Then the relative error in the determination of its volume is

○ $\frac{2}{3}\alpha$

○ $\frac{-2}{3}\alpha$

○ $\frac{3}{2}\alpha$

○ α

Correct: +4 · Incorrect: -1

34   In a screw gauge, 5 complete rotations of the screw cause it to move a linear distance of 0.25cm. There are 100 circular scale divisions. The thickness of a wire measured by this screw gauge gives a reading of 4 main scale divisions and 30 circular scale divisions. Assuming negligible zero error, the thickness of the wire is

○ 0.0430cm

○ 0.3150cm

○ 0.4300cm

○ 0.2150cm

35   A body of mass m = 3.513 kg is moving along the x axis with a sped of 5.00 ms^{-1}. The magnitude of its momentum is recorded as

○ 17.6 kg ms^{-1}

○ 17.565 kg ms^{-1}

kg ms^{-1}

kg ms^{-1}

ANSWERS

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1. Section A - 35 Questions

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1 Ohm

2 40

3 A-iii, B-i, C-iv, D-ii

4 $[FTV^{-1}]$

5 Permeability of free space (μ_0)

6 $[FL^{-4}T^2]$

7 $[M^0L^0T^0]$

8 $[t^{-1}v^{-2}I^1]$

9 $[MLT^0]$

10 $MLT^{-3}K^{-1}$

11 ML^0T^{-2}

12 $FA^{-1}V^0$

13 $\sqrt{\dfrac{\mu_0}{\varepsilon_0}}$

14 $ML^{-1}T^{-2}$

15 $(2 \pm 0.3)\Omega$

16 0.1mm

17 5.15mm

18 43.2s

19 Assertion is false but reason is true.

20 34

21 8.54cm

22 $\dfrac{10\,a}{n}$

23 5

24 Positive, 10 μm

25 14.5%

26 3.07cm

27 0.001cm

28 4.40%

29 37.0cm^2

30 6.8%

31 200

32 4.5%

33 $\frac{3}{2}\alpha$

34 0.2150cm

35 17.6 kg ms^{-1}

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