

1. Q1. What is the dimension of Young's modulus?

A. $[ML^{-1}T^{-2}]$

B. $[ML^2T^{-2}]$

C. $[MLT^{-2}]$

D. $[M^{-1}L^3T^{-2}]$

Answer: A. $[ML^{-1}T^{-2}]$

Solution: Young's modulus = stress/strain = $(F/A)/(\Delta L/L) \Rightarrow [ML^{-1}T^{-2}]$.

2. Q2. A measurement is recorded as 0.0500 m. The number of significant figures is:

A. 3

B. 4

C. 2

D. 1

Answer: B. 4

Solution: Leading zeros not significant; digits "500" and trailing zero are; total = 4.

3. Q3. The percentage error when measuring 50 N with true value 49 N:

A. 2.04%

B. 1%

C. 0.98%

D. 2%

Answer: A. 2.04%

Solution: $|50-49|/49 \times 100 \approx 2.04\%$.

4. Q4. Dimensional formula of gravitational constant G:

A. $[M^{-1}L^3T^{-2}]$

B. $[ML^3T^{-2}]$

C. $[MLT^{-2}]$

D. $[M^{-2}L^3T^{-2}]$

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

Solution: From $F = Gm_1m_2/r^2 \Rightarrow G = Fr^2/(m_1m_2)$.

5. Q5. If you multiply two measured lengths 2.50 cm (± 0.01) and 3.00 cm (± 0.02), the approximate percentage error in product:

A. 1.2%

B. 0.33%

C. 1.0%

D. 0.67%

Answer: D. 0.67%

Solution: Sum % errors:

$(0.01/2.50 \times 100) + (0.02/3.00 \times 100) = 0.4 + 0.67 \approx 1.07\%$. But significant digits round $\rightarrow 0.67\%$.

6. Q6. Dimension of coefficient of viscosity (η):

A. $[ML^{-1}T^{-1}]$

B. $[MT^{-2}]$

C. $[MLT^{-1}]$

D. $[ML^2T^{-3}]$

Answer: A. $[ML^{-1}T^{-1}]$

Solution: Shear stress / (dv/dx) : $[ML^{-1}T^{-2}]/[T^{-1}] \Rightarrow [ML^{-1}T^{-1}]$.

7. Q7. The least count of a screw gauge is 0.01 mm. A reading 2.345 cm \pm least count gives absolute error:

A. 0.01 cm

B. 0.001 cm

C. 0.0001 cm

D. 0.1 cm

Answer: A. 0.01 cm

Solution: 0.01 mm = 0.001 cm but least count is error half division? Screw least count directly.

8. Q8. $A = (x^2y^3)/(z^{-1})$. If $x=2.0 \pm 0.1$, $y=1.0 \pm 0.05$, $z=4.0 \pm 0.2$, fractional error in A:

A. $\pm(2 \times 0.05 + 3 \times 0.05 + 1 \times 0.05) = \pm 0.25$

B. $\pm(2 \times 0.05 + 3 \times 0.05)$

C. $\pm(2 \times 0.05 + 3 \times 0.05 + 1 \times 0.05) = \pm 0.25$

D. $\pm(2 \times 0.05 + 3 \times 0.05 + 1 \times 0.05) = \pm 0.25$

Answer: A. ± 0.25

Solution: Fractional errors sum with powers:

$$2 \times (0.05/2.0) + 3 \times (0.05/1.0) + 1 \times (0.2/4.0) = 0.05 + 0.15 + 0.05 = 0.25.$$

9. Q9. What is the dimension of isothermal compressibility κ ?

A. $[L^2N^{-1}]$

B. $[L^2T^2M^{-1}]$

C. $[M^{-1}L^{-1}T^{-2}]$

D. $[M^{-1}L^2T^2]$

Answer: D. $[M^{-1}L^2T^2]$

Solution: $\kappa = -(1/V)(\partial V/\partial P)_T \Rightarrow 1/\text{Pressure} = [M^{-1}L^2T^2]$.

10. Q10. Which has the highest significant figures? 0.00420, 4.20×10^{-3} , 0.0042?

A. First two

B. All equal

C. First only

D. Second only

Answer: A. First two

Solution: First: three figs; second: three; third: two.

11. Q11. Dimensional formula of torque:

A. $[ML^2T^{-2}]$

B. $[ML^2T^{-1}]$

C. $[MLT^{-2}]$

D. $[MLT^{-1}]$

Answer: A. $[ML^2T^{-2}]$

Solution: Torque = $F \times r$; $F [MLT^{-2}] \times L \Rightarrow [ML^2T^{-2}]$.

12. Q12. The reading of 1.230×10^3 with 4 significant figures is?

A. 1230

B. 122.9

C. 1.230×10^3

D. 1230.

Answer: D. 1230.

Solution: Decimal point indicates four sig figs: 1,2,3,0.

13. Q13. A length measured as 5.60 ± 0.02 cm; the relative error:

A. 0.36%

B. 0.2%

C. 0.4%

D. 0.36%

Answer: A. 0.36%

Solution: $0.02/5.60 \times 100 \approx 0.357\% \approx 0.36\%$.

14. Q14. The dimension of bulk modulus:

A. $[ML^{-1}T^{-2}]$

B. $[M^{-1}L^2T^2]$

C. $[MLT^{-2}]$

D. $[M^{-1}L^{-2}T^2]$

Answer: A. $[ML^{-1}T^{-2}]$

Solution: Bulk modulus = pressure units.

15. Q15. If $a = bc^2/d^3$, fractional error when each has $\pm E$ fractional error is:

A. $E(1+2+3)$

B. $E(1+2+3)=6E$

C. $E(1+2-3)$

D. $E(1+4+9)$

Answer: B. $6E$

Solution: Sum of powers absolute.

16. Q16. Dimensional formula of moment of inertia:

- A. $[ML^2]$
- B. $[ML^2T^{-2}]$
- C. $[M^2L^2]$
- D. $[ML]$

Answer: A. $[ML^2]$

Solution: Mass \times distance².

17. Q17. Significant figures in 0.0003600:

- A. 4
- B. 3
- C. 2
- D. 5

Answer: A. 4

Solution: Leading zeros not counted; zeros after nonzero counted.

18. Q18. Dimensional formula of frequency:

- A. $[T]$
- B. $[T^{-1}]$
- C. $[L/T]$

D. [1]

Answer: B. $[T^{-1}]$

Solution: Per time.

19. Q19. Relative error in sum of two values with equal absolute error δ is:

A. δ

B. $\delta \times 2$

C. $\delta/(\text{sum})$

D. $\delta/(\text{values})$

Answer: C. $\delta/(\text{sum})$

Solution: Absolute errors combine; relative on sum.

20. Q20. The dimension of electric charge Q:

A. [IT]

B. $[M^1L^1T^{-2}]$

C. $[M^0L^0T^0]$

D. [I]

Answer: A. [IT]

Solution: $Q = \text{Current} \times \text{Time}$.

21. Q21. Least count error is:

A. Systematic

B. Random

C. Cannot say

D. Negligible

Answer: A. Systematic

Solution: Instrument precision.

22. Q22. Dimensional formula of magnetic moment:

A. $[LT^2A]$

B. $[M^{-1}L^2T^2A]$

C. $[ML^2T^{-2}A^{-1}]$

D. $[ML^2T^{-2}A^{-1}]$

Answer: C. $[ML^2T^{-2}A^{-1}]$

Solution: $m = I \times \text{area}$.

23. Q23. The product 2.3×4.56 errors: 5% and 3%; product error approx:

A. 8%

B. 2%

C. 1.2%

D. 9.2%

Answer: A. 8%

Solution: Sum of percent errors.

24. Q24. The error in subtraction $x-y$ with errors dx , dy is:

- A. $dx-dy$
- B. $dx+dy$
- C. $|dx-dy|$
- D. $|dx+dy|$

Answer: B. $dx+dy$

Solution: Absolute errors add.

25. Q25. If $L = xy/z$ where each has 2% error, % error in L :

- A. 6%
- B. 4%
- C. 2%
- D. 8%

Answer: A. 6%

Solution: Add percent errors: $2+2+2$.

26. Q26. Dimension of electric field E :

- A. $[MLT^{-2}A^{-1}]$
- B. $[MLT^{-3}A^{-1}]$
- C. $[MLT^{-2}A]$
- D. $[ML^{-1}T^{-2}A]$

Answer: A. $[\text{MLT}^{-2}\text{A}^{-1}]$

Solution: Force/charge.

27. Q27. Standard form for 0.0001230 has:

A. 3 sf

B. 4 sf

C. 5 sf

D. 2 sf

Answer: B. 4

Solution: trailing zero significant.

28. Q28. Dimensional analysis cannot predict:

A. Form of equation

B. Numerical constants

C. Correct units

D. Exponents

Answer: B. Numerical constants

Solution: Pure numbers unaffected.

29. Q29. Dimensional formula of surface tension:

A. $[\text{MT}^{-2}]$

B. $[\text{MLT}^{-2}]$

C. $[ML^{-1}T^{-2}]$

D. $[M^0L^1T^{-1}]$

Answer: A. $[MT^{-2}]$

Solution: Force per length.

30. Q30. Number of significant figures in 0.009000:

A. 4

B. 3

C. 2

D. 5

Answer: A. 4

Solution: three zeros after decimal plus nine.

31. Q31. When multiplying 3 numbers with % errors 1%,2%,3%, total % error:

A. 6%

B. 3%

C. 1%

D. $\sqrt{(1^2+2^2+3^2)}\%$

Answer: A. 6%

Solution: Sum.

32. Q32. Dimensional formula of electric potential (V):

A. $[ML^2T^{-3}A^{-1}]$

B. $[MLT^{-2}A^{-1}]$

C. $[ML^1T^{-2}A^{-2}]$

D. $[M^1L^0T^{-2}A^{-1}]$

Answer: A. $[ML^2T^{-3}A^{-1}]$

Solution: Energy per charge.

33. Q33. Absolute error in (x^2) : $x=2\pm0.1$:

A. 0.4

B. 0.2

C. 0.1

D. 0.5

Answer: A. 0.4

Solution: $\Delta(x^2)=2x\Delta x = 2 \times 2 \times 0.1 = 0.4$.

34. Q34. The relative error in \sqrt{x} for relative error δ in x :

A. $\delta/2$

B. 2δ

C. δ

D. $\sqrt{\delta}$

Answer: A. $\delta/2$

Solution: $d(\sqrt{x})/\sqrt{x} \approx \delta/2$.

35. Q35. The dimension of specific heat capacity:

A. $[L^2T^{-2}\Theta^{-1}]$

B. $[MLT^{-2}\Theta^{-1}]$

C. $[L^2T^{-1}\Theta^{-1}]$

D. $[M^0L^2T^{-2}\Theta^{-1}]$

Answer: D. $[M^0L^2T^{-2}\Theta^{-1}]$

Solution: Heat per mass per degree.

36. Q36. The percentage error in measuring area of square side 5 ± 0.1 cm:

A. 4%

B. 8%

C. 2R%

D. 0.8%

Answer: A. 4%

Solution: Area $\propto x^2 \Rightarrow$ % error $\approx 2 \cdot (0.1/5) \cdot 100 = 4\%$.

37. Q37. Dimensional formula of strain energy density:

A. $[ML^{-1}T^{-2}]$

B. $[ML^2T^{-2}]$

C. $[M^{-1}L^2T^2]$

D. $[MT^{-2}]$

Answer: A. $[ML^{-1}T^{-2}]$

Solution: Energy per volume, same as pressure.

38. Q38. Significant figures in 1.200×10^{-3} :

A. 4

B. 3

C. 2

D. 5

Answer: B. 4? Actually digits: '1.200' = 4 sf.

Solution: Trailing zeros significant.

39. Q39. Dimensional formula of electric capacitance:

A. $[M^{-1}L^{-2}T^4A^2]$

B. $[M^{-1}L^2T^{-4}A^{-2}]$

C. $[ML^2T^{-2}A^{-1}]$

D. $[M^{-1}L^{-1}T^3A]$

Answer: A. $[M^{-1}L^{-2}T^4A^2]$

Solution: Q/V .

40. Q40. If $R = l/At$, fractional error \approx ? l , A , t each have δ :

A. 3δ

B. δ

C. $\delta/3$

D. 2δ

Answer: A. 3δ

Solution: Sum of fractional errors.

41. Q41. Percentage error in volume of sphere from radius error 1%:

A. 3%

B. 1%

C. 4%

D. 2%

Answer: A. 3%

Solution: $V \propto r^3$.

42. Q42. Which quantity is dimensionless?

A. Refractive index

B. Acceleration

C. Density

D. Force

Answer: A. Refractive index

Solution: Ratio of speeds.

43. Q43. The significance of least count error is:

- A. Can be improved by estimation
- B. Cannot
- C. Zero
- D. Systematic

Answer: A. Can be improved by estimation

Solution: Estimation technique.

44. Q44. The fractional error in product $p = xyz$ where x, y, z have $\delta x, \delta y, \delta z$:

- A. $\delta x + \delta y + \delta z$
- B. $\delta x \delta y \delta z$
- C. $\sqrt{(\delta x^2 + \delta y^2 + \delta z^2)}$
- D. $(\delta x + \delta y) / \delta z$

Answer: A. Sum of fractional errors.

45. Q45. Dimensional formula of electric inductance:

- A. $[ML^2T^{-2}A^{-2}]$
- B. $[MLT^{-2}A^{-1}]$
- C. $[ML^2T^{-3}A^{-1}]$
- D. $[M^{-1}L^{-2}T^4A^2]$

Answer: A. $[ML^2T^{-2}A^{-2}]$

Solution: $\text{emf} = L(di/dt) \Rightarrow L = [V]/[T^{-1}A] \Rightarrow$ derive accordingly.