JEE MAIN ANSWER KEY & SOLUTIONS

SUBJECT :- PHYSICS

CLASS :- 11th **PAPER CODE :- CWT-1**

CHAPTER :-PHYSICAL WORLD,UNIT & MEASURMENT

ANSWER KEY

1.	(B)	**2.**	(D)	**3.**	(B)	**4.**	(C)	**5.**	(A)	**6.**	(A)	**7.**	(C)
8.	(C)	**9.**	(A)	**10.**	(A)	**11.**	(C)	**12.**	(B)	**13.**	(B)	**14.**	(C)
15.	(B)	**16.**	(D)	**17.**	(D)	**18.**	(A)	**19.**	(D)	**20.**	(B)	**21.**	3
22.	14	**23.**	9	**24.**	3	**25.**	3	**26.**	4	**27.**	3	**28.**	3
29.	2	**30.**	6										

SOLUTIONS

1. (B)

Sol. Velocity depends on length and time, so cannot be taken as base quantities.

2. (D)

Sol. 29 division of main scale coincides with 30 divisions of vernier scale

Hence one division of vernier scale = $\frac{29}{30}$

of main scale = $\frac{29}{30} \times 0.5°$

So least count = 1 MSD – 1 VSD = 0.5° – $\frac{29}{30} \times 0.5° = \frac{1}{30} \times 0.5° = \frac{1}{30} \times 0.5 \times 60$ min = 1 min.

3. (B)

Sol. $[v] = [k]\,[\lambda^a \rho^b g^c]$

$\Rightarrow \quad LT^{-1} = L^a M^b L^{-3b} L^c T^{-2c}$

$\Rightarrow \quad LT^{-1} = M^b L^{a-3b+c} T^{-2c}$

$\Rightarrow \quad a = ½,\ b = 0,\ c = ½$

so, $v^2 = kg\lambda$

4. (C)

Sol. For vernier C_1

10 VSD = 9 MSD = 9 mm

1 VSD = 0.9 mm

$\Rightarrow$ LC = 1MSD – 1VSD = 1mm – 0.9 mm = 0.1 mm

Reading of C_1 = MSR + (VSR)(L.C.) = 28mm + (7)(0.1)

Reaing of C_1 = 28.7 mm = 2.87 cm

For vernier C_2 : the vernier C_2 is abnormal,

So we have to find the reading from basics.

The point where both of the marks are matching :

distance measured from main scale = distance measured from vernier scale

28mm + (1mm)(8) = (28 mm + x) + (1.1 mm) (7)

solving x = 0.3 mm

So reading of C_2 = 28 mm + 0.3 mm = 2.83 cm

5. (A)

Sol. $G = 6.67 \times 10^{-11}\ N\ m^2\ (kg)^{-2}$

$= 6.67 \times 10^{-11} \times 10^5$ dyne $\times 100^2\ cm^2 / (10^3)^2\ g^2 = 6.67 \times 10^{-8}$ dyne-cm^2-g^{-2}

6. (A)

Sol. $\Delta L = \frac{\text{Pitch}}{4} = \frac{1}{4} \times 10^{-3}$

$y = \frac{F}{A} \cdot \frac{L}{\Delta L} = \frac{500}{10^{-5}} \times \frac{3 \times 4}{10^{-3}}$

$Y = 5 \times 12 \times 10^{10} \Rightarrow 6 \times 10^{11}\ N/m^2$

7. (C)

Sol. All the terms in the equation must have the dimension of force

$\therefore \quad [A \sin C\,t] = MLT^{-2}$

$\Rightarrow \quad [A]\,[M^0L^0T^0] = MLT^{-2}$

$\Rightarrow \quad [A] = MLT^{-2}$

Similarly, $[B] = MLT^{-2}$

$\therefore \quad \frac{[A]}{[B]} = M^0L^0T^0$

Again $[Ct] = M^0L^0T^0 \Rightarrow [C] = T^{-1}$

$[Dx] = M^0L^0T^0 \Rightarrow [D] = L^{-1}$

$\Rightarrow \quad \frac{[C]}{[D]} = M^0L^1T^{-1}$.

8. (C)

Sol. Least count = $\frac{1(\text{main scale})}{N}$

$0.1\ mn = \frac{1(\text{main scale})}{20}$

1 Main scale division = 2mm

9. (A)

Sol. $[\alpha] = \left[\frac{ma}{\beta}\right]$ ....(i)

$\left[\frac{\beta}{ma}\right][\ell] = M^0L^0T^0$

$\Rightarrow \quad \left[\frac{ma}{\beta}\right] = [\alpha] = [\ell] = L$

10. (A)

Sol. Watch 'A' has more significant digit than watch 'B', so, it is more precise.

11. (C)

Sol. (p) $U = \frac{1}{2}kT \Rightarrow ML^2T^{-2} = [k]\ K$

$\Rightarrow [K] = ML^2T^{-2}K^{-1}$

(q) $F = \eta A\frac{dv}{dx} \Rightarrow [\eta] = \frac{MLT^{-2}}{L^2LT^{-1}L^{-1}}$

$= ML^{-1}T^{-1}$

(r) $E = h\nu \Rightarrow ML^2T^2 = [h]\ T^{-1}$

$\Rightarrow [h] = ML^2T^{-1}$

(s) $\frac{dQ}{dt} = \frac{kA\Delta\theta}{\ell}$

$\Rightarrow [k] = \frac{ML^2T^{-3}L}{L^2K} = MLT^{-3}K^{-1}$

12. (B)

Sol. $t = \frac{T}{20}$ $t = \frac{1.27}{20}$ cm = 0.015875 cm

= 0.15875 mm

$\therefore$ t = 0.159 mm

13. (B)

Sol. From F = qvB से

$\Rightarrow [MLT^{-2}] = [C]\ [LT^{-1}]\ [B]$

$\Rightarrow [B] = [MC^{-1}T^{-1}]$

14. (C)

Sol. z = (x – 2.5y + w)

$\Delta z = (\Delta x + 2.5\ \Delta y + \Delta w)$

= (0.12 + 2.5 × (0.2) + 0.16)

= 0.78 ≈ 0.8

z = (4.75 – 2.5 (4.4) + 15.63)

= 9.35 ≈ 9.4

z = 9.4 ± 0.8

15. (B)

Sol. $F = \frac{1}{4\pi\varepsilon_0}\frac{q_1q_2}{R^2}$

$\varepsilon_0 = \frac{q_1q_2}{4\pi FR^2}$

Hence $\varepsilon_0 = \frac{C^2}{N.m^2} = \frac{[AT]^2}{MLT^{-2}.L^2} = [M^{-1}\ L^{-3}\ T^4A^2]$

16. (D)

Sol. Pitch = 200 × 0.005 = 1 mm

Zero error = 0.005 × 5

d = 4 mm + 25 × 0.005 – 0.005 × 5 = 4.10 mm

r = d/2 = 2.05 mm

17. (D)

Sol. Energy stored in inductor

$U = \frac{1}{2}LI^2 \Rightarrow L = \frac{2U}{I^2}$

$[L] = \frac{ML^2T^{-2}}{Q^2/T^2} = \frac{ML^2}{Q^2}$

Since Henry is unit of inductance L

$\therefore$ (D) is correct.

18. (A)

Sol. $n = 365 \times 86400 = 3.1536 \times 10^7$

Error = $\frac{3.15 - 3.14}{3.14} \times 100 \approx 0.5\%$

19. (D)

Sol. $\frac{dQ}{dt} = kA\left(\frac{\Delta T}{L}\right)$

$\frac{dQ}{dt} = \frac{\Delta T}{R}$

$\Rightarrow R = \frac{\Delta t}{\left(\frac{dQ}{dt}\right)} = \frac{\theta}{M^1L^2T^{-3}}$

20. (B)

Sol. 30VS = 29MS and 1 MS = (1/2)°

least count = 1MS – 1VS = 1'

21. 3

Sol. $d = k\ (\rho)^a\ (S)^b\ (f)^c$

$\Rightarrow [L] = \left[\frac{M}{L^3}\right]^a\left[\frac{M^1L^2T^{-2}}{L^2\ T}\right]^b\left[\frac{1}{T}\right]^c$

0 = a + b

1 = –3a $\Rightarrow a = -\frac{1}{3}$ So $b = \frac{1}{3}$

0 = – 3b + c

So n = 3

22. 14

Sol. 20 vernier scale divisions = 19 mm

1 vernier scale division = $\frac{19}{20}$ mm

where least count = (Main scale division - vernier Scale division)

= 1 mm – 19/20 mm (from fig.)

= 0.05 mm

Thickness of the object = (main scale reading) + (vernier scale Reading) (least count)

So thickness of the object = 13 mm + (12) (0.05mm)

= 13.60 mm **Ans.**

23. 9

Sol. volume of man becomes = $(9)^3$ times
weight of man becomes = 9^3 times
Cross section area in leg = 9^2 times

stress = $\frac{\text{weight}}{\text{Area}}$ = 9 times

24. 3

Sol. Least count = $\frac{0.5}{50}$ = 0.01 mm

Diameter of ball D = 2.5 mm + (20)(0.01)
D = 2.7 mm

$\rho = \frac{M}{vol} = \frac{M}{\frac{4}{3}\pi\left(\frac{D}{2}\right)^3}$

$\left(\frac{\Delta\rho}{\rho}\right)_{max} = \frac{\Delta m}{m} + 3\frac{\Delta D}{D}$;

$\left(\frac{\Delta\rho}{\rho}\right)_{max}$ = 2% + $3\left(\frac{0.01}{2.7}\right)\times 100\%$

$\frac{\Delta\rho}{\rho}$ = 3.1%

25. 3

Sol. $\left[\frac{Af}{kT}\right] = L^o$

$\frac{[A]^{-1}T}{ML^2T^{-2}} = L^o$

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

$B = \frac{ML^2T^{-1}}{ML^{-1}T^{-2}} = L^3T^{-1}$

26. 4

Sol. v = u + at
= 12.376 + (2.00 × 1.82)
= 12.376 + (3.64)
= 16.02
$\Rightarrow$ 4sd.

27. 3

Sol. [T]

$= \left[\left(\frac{mgA}{k}\right)^{1/2}\right] = \left[\frac{mgA}{(mv^2)}\right]^{1/2} = \left[\frac{A}{vT}\right]^{1/2} = \left[\frac{A}{L}\right]^{1/2}$

$\Rightarrow$ $[A] = M^0LT^2$

x = 0, y = 1, T = 2

x + y + z = 3

28. 3

Sol. 2.43 + 4.1 + 4.1 + 2.43
$\approx$ 13.1 $\Rightarrow$ 3 significant digits.

29. 2

Sol. $ML^2T^{-5} = MT^{-1}[LT^{-2}]^n$

$L^2T^{-4} = [LT^{-2}]^n$

$\therefore$ n = 2

30. 6

Sol. $V = \frac{4}{3}\pi(R^3 - r^3)$

$\Delta V = \frac{4}{3}\pi(3R^2\Delta R + 3r^2\Delta r) = 4\pi(R\Delta R + r^2\Delta r)$

$\frac{\Delta V}{V} = \frac{3\left(R^2\Delta R + r^2\Delta r\right)}{\left(R^3 - r^3\right)}$

$= \frac{3\times 0.01\times\left(4.23^3 + 3.89^2\right)}{\left((4.23)^3 - (3.89)^3\right)} = \frac{3\times 0.01\times 33}{16.9} \simeq 6\%$