1. $g' = g\left(\frac{R}{R+h}\right)^2$

$\left[h = R/2\right]$

$\therefore W' = W\left[2/3\right]^2$

2. 2

Tension of B decreases and therefore frequency of B decreases

$|n_A - n_B| = 6$

$\therefore\ n_B = n_A \pm 6 = 530 \pm 6$

$\therefore n_B = 524\ or\ 536$

As per given data,

$|n_A - n_B'| = 7$

$\therefore\ \ n_B' = n_A \pm 7$

$= 530 \pm 7$

$= 523$ or 537

& $n_B' < n_B$

$\therefore\ n_B'$ must be 523 Hz

and n_B must be 524 Hz

3. 3

$C_{air} = \frac{A\varepsilon_0}{d}$

$C_{med} = \frac{A\varepsilon_0 k}{d} = \frac{A\varepsilon}{d}$

$\therefore\ \frac{C_{air}}{C_{med}} = \frac{\varepsilon_0}{\varepsilon}$

$\therefore \frac{6}{30} = \frac{8.85\times10^{-12}}{\varepsilon}$

$\therefore \varepsilon = 8.85\times5\times10^{-12}$

$= 44 \times 10^{-12}$

$= 0.44 \times 10^{-10}$

4. 3

$L.C = \frac{pitch}{no.of\ \ div\ an\ circular\ \ scale}$

$0.01\,mm = \frac{pitch}{50}$

$\therefore\ pitch = 0.5\,mm$

5. $V = \frac{1}{4\pi\varepsilon_0}\times\frac{P\cos^2 45}{r^2}$

$= \frac{9\times10^9\times16\times10^{-9}\times 1/2}{\left(6\times10^{-1}\right)^2}$

$V = \frac{9\times8}{6\times6}\times10^2$

V = 200V

6. 3

e = 0

$\therefore r_2 = 0$

$r_1 + r_2 = A$

$\therefore r_1 = A$

$\mu = \frac{\sin i}{\sin r_1} = \frac{i}{r_1}$ ($\therefore$ angle are very small and expressed in radians)

$\therefore \mu = \frac{i}{A}$

$\therefore i = \mu\, A$

7. $E = \frac{1}{4\pi\varepsilon_0}\frac{q}{r^2}$

$= \frac{9\times10^9\times3.2\times10^{-3}}{15\times15\times10^{-4}}$

$= \frac{9.6}{5\times15}\times100\times10^4$

$= \frac{192}{15}\times10^4$

$= 12.8 \times 10^4$

8. 4 (Theory)

9. Stress $= F/A = \dfrac{M^1 L^1 T^{-2}}{L^2}$

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

10. 1

$E = \dfrac{dv}{dr} = 0$

($\because$ potential is const)

11. ${}^{235}_{92}U + {}^{1}_{0}n = {}^{89}_{36}kr + 3{}^{1}_{0}n + {}^{p}_{q}X$

[235 + 1] = [89 + 3 = P]

$\therefore$ P = 144

& [92] = [36 + q]

q = 56

${}^{144}_{56}Ba$

12. 2 (Theory)

13. 3

$v^2 = u^2 + 2as$

$80^2 = 20^2 + 2 \times 10 \times s$

6400 – 400 = 205

20s = 6000

S = 300m

14. $Q = mc\Delta Q$

$Q = \dfrac{4}{3}\pi r^3 \rho c \Delta Q$

$\therefore Q \propto r^3$

$\dfrac{Q_1}{Q_2} = \left(\dfrac{r_1}{r_2}\right)^3$

$\dfrac{Q_1}{Q_2} = \left(\dfrac{3}{2}\right)^3 = \dfrac{27}{8}$

15. Pv = nRT

$\therefore Pv = \dfrac{M}{M_0} \times RT$

$\therefore P = \dfrac{P}{M_0} RT$

$\therefore P = \dfrac{249 \times 10^3 \times 2}{8.3 \times 300}$

P = 0.2 Kg/m^s

16. 4 (Theory)

17. 4

$y = \dfrac{FL}{A\ell} = \dfrac{mgL}{A(L_1 - L)}$

18. 3 (Theory)

19. 1

$x = A\sin\omega t$; $y = A\omega\cos\omega t$

$a = -A\omega^2 \sin\omega t$

$\therefore \Delta\phi = \pi\ rad$

20. 3

$I = \dfrac{E}{At}$

$\dfrac{20}{10^{-4}} = \dfrac{E}{20 \times 10^{-4} \times 60}$

E = 20 × 20 × 60 = 24 × 10^{3}J

21. For Electromagnetic waves,

$E/B = C$ But energy is equally distributed in $\overline{E}$ & $\overline{B}$ field

1 : 1

22. 3

$$X = \frac{\lambda D}{d}$$

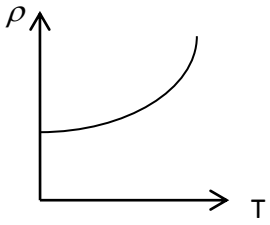
$$X' = \frac{\lambda(2D)}{d/2}$$

= 4X

23. $\lambda = \frac{12.27A^0}{\sqrt{V}}$

V = 10^4 volt

24. 1



For metals almost linear at high temp but nonlinear at low.

25. 2

Avg Thermal Energy = $\frac{3}{2} K_B T$

Theory Based

26. 1

$B = \mu_0 nI$ (For Solenoid)

$$= \mu_0 \left(\frac{N}{L}\right) I$$

$$= 4\pi \times 10^{-7} \times \frac{100}{50 \times 10^{-2}} \times 2.5$$

B = 6.28 × 10^{-4} T

27. 1

$$\mu = \mu_0 \mu_r$$

$$= \mu_0 (1 + X)$$

$$= 4\pi \times 10^{-7} \times (1 + 599)$$

$$= 24\pi \times 10^{-4}\ TmA^{-1}$$

28. 9.99

- 0.0099

With due consideration of significant figures –

We consider least decimals places

9.98m

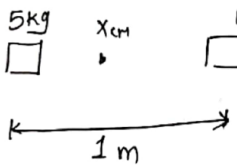
29. $V_d = \mu E$

$$\therefore \mu = Vd/E$$

$$= \frac{7.5 \times 10^{-4}}{3 \times 10^{-10}}$$

= 2.5 × 10^6

30.



$$X_{cm} = \frac{10 \times 1}{5 + 10}$$

$$= \frac{10}{15}$$

= 67 cm

31. 2

Mean free path = $\lambda = \frac{1}{\sqrt{2}\pi d^2 n}$

32. 2

E = mc^2

= 0.5 × 10^{-3} × (3 × 10^8)^2

= 4.5 × 10^{-3} × 10^{16}

= 4.5 × 10^{13} J

33. 3

$$\frac{x}{10} = \frac{3}{2}$$

$$\therefore x = 15\Omega$$

$$R \propto \ell$$

$$\therefore \frac{R_1}{R_2} = \frac{\ell_1}{\ell_2}$$

$$\frac{15}{1} = \frac{1.5}{\ell_2}$$

$$\ell_2 = 10^{-1} m$$

34. $\mu = \tan\left(i_b\right)$

$\therefore i_b = \tan^{-1}\left(\mu\right)$

$\therefore i_b$ can not be lens than 45^0

$\therefore 45 < i_b < 90^0 \ \left(\mu > 1\right)$

35. 3

$M = \pi r^2 \, h\rho$

$\therefore \frac{M_1}{M_2} = \left(\frac{r_1}{r_2}\right)^2 \times \left(\frac{h_1}{h_2}\right)$

But $h \propto \frac{1}{r}$

$\therefore \frac{M_1}{M_2} = \left(\frac{r}{2r}\right)^2 \times \left(\frac{h}{h/2}\right)$

$M_2 = 2M_1 = 10g$

36. $\vec{F} = 3\hat{j}$

$\vec{r} = 2\hat{k}$

$\vec{\tau} = \vec{r} \times \vec{F}$

$= 2\hat{k} \times 3\hat{j}$

$= -6\hat{i}$

37.

$\rightarrow$ After L is removed – R cckt $\phi = \pi/3$

$\therefore \tan\phi = X_c/R \Rightarrow X_c = \sqrt{3}\,R$

$\rightarrow$ After C is removed R – L ckt $\rightarrow \phi = \pi/3$

$\therefore \tan\phi = \frac{X_L}{R} \Rightarrow X_L = \sqrt{3}R$

$\therefore X_L = X_C \rightarrow$ Resonance cand.

$\therefore \phi = 0 \quad \therefore P.F. = \cos\phi = 1$

(As ckt is purely Resistive)

38. 3

1 eV = 1.6×10^{-19} J

$\therefore$ Energy $= \frac{10^{-20}}{1.6 \times 10^{-19}} = \frac{1}{1.6} \times 10^{-1}\ eV$

= 0.06 eV

39. $a_{nct} = \frac{Net\ pulling\ force}{Total\ mass}$

$= \frac{69 - 49}{10}$

$= \frac{29}{10}$

$= \frac{9}{5}$

40. $I_{Rms} = \frac{E_{Rms}}{X_C}$

$= \omega c \, E_{Rms}$

$= 2\pi fc\left(E_{Rms}\right)$

$= \left(2\pi \times 50 \times 40 \times 10^{-6}\right)\left(200\right)$

= 2.512A.

41. 4

Yellow violet Brown Gold

4 7 10^1 ±5%

$470 \pm 5\%$

42. L.R. $= \frac{1.22\,\lambda}{D}$

$= \frac{1.22 \times 600 \times 10^{-9}}{2}$

L.R. = 3.66×10^{-7} rad

43. 2 (Theory)

44. 4

$v = 1.5v_0$

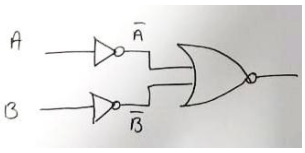
$v^1 = \frac{v}{2} = 0.75v_0$

$\therefore v^1 < v_0$

$\therefore$ No Photoelectric effect takes place.

$\therefore i = 0$

45. 2



$y = \overline{\bar{A} + \bar{B}} = \bar{\bar{A}} . \bar{\bar{B}} = A.B$

It is AND gate