Level 1

1. $at = LT^{-1}$, $a = [LT^{-2}]$ $c = [T]$ $b = [L]$
2. $1N = nu$ $1[Kgms^{-2}] = n[10g\ 10cm(0.1)^{-2}]$
3. Power is Dimensionless
4. Fundamental quantities shall be independent
5. $S_n = u = [LT^{-1}]$
6. $[M^0L^0T^1] = [L]^x[M]^y[F]^z$
7. $Intensity = \frac{Power}{Area}$
8. $\beta^2 = [ML^{-3}]$ $\alpha = [MLT^{-2}][ML^{-3}] = [M^2L^{-2}T^{-2}]$
9. $P = F/A$
10. $Energy = work = [ML^2T^{-2}]$
11. By using $F = \frac{GM_1M_2}{r^2}$
12. $Electric\ flux = EA = \frac{F}{q}A = \frac{[MLT^{-2}]}{[AT]} \cdot L^2 = [ML^3T^{-3}A^{-1}]$
13. $I = \Delta P$
14. $PT^{-1} = ML^2T^{-2}$ $\Rightarrow$ $P = MLT^{-1} = Momentum$
15. Theoretical
16. $4.2J = nu$ $J = Kgm^2s^{-2}$
$u = \alpha kg\,(m)^2(s)^{-2}$
17. Dimensional formula for coefficient of viscosity $= [ML^{-1}T^{-2}]$
18. $h = ML^2T^{-1}$ $\frac{h}{e} = \frac{ML^2T^{-1}}{AT} = [ML^2T^{-2}A^{-1}]$
19. $B = \frac{F}{Il}$ $C = \frac{q}{V} = \frac{q^2}{N} = \frac{q^2}{Fl}$
$B^2L^2C = \frac{F^2}{I^2l^2} l^2 \cdot \frac{q^2}{Fl} = \frac{F}{q^2T^{-2}L} = \frac{MLT^{-2}}{LT^2} = [M]$
20. Latent heat and gravitational constant has diff dimensions

21. Trailing zeroes are not significant

22. Result of multiplication should posses least significant digit

23. error $= \pm 0.1$ cm

24. Percentage error $= \frac{1/5}{25/20} \times 100$

25. Area $= \pi r^2$

26. $K = \frac{1}{2}mv^2$ $K' = \frac{1}{2}m(1+4y)^2$ $\frac{K'-K}{K} \times 100 = 9\%$

27. $d = ML^{-3}$ $\frac{\Delta d}{d} \times 100 = \frac{\Delta M}{M} \times 100 + 3\frac{\Delta L}{L}$

Level-II

1. Unitless quantity has no dimension

2. Set of fundamental quantity should be independent

3. Dimension domain Some

4. $\beta = [L]$ $\alpha\sqrt{L} = [ML^2T^{-2}][L]$ $\alpha = [ML^{5/2}T^{-2}]$

   $\alpha\beta = [ML^{7/2}T^{-2}]$

5. LHS = RHS

6. d

7. $K = cP^a m^b$ $[ML^2T^{-2}] = [MLT^{-1}]^a[M]^b$

8. $F = \rho AV^2$

(9) $[M^0L^1T^0] = [F]^x[A]^y[T]^z$

(10) $\frac{d}{dx}\left(\frac{1}{\sqrt{x}}\right) = -\frac{1}{2}x^{-\frac{1}{2}-1}$

(11) using chain Rule

12. $\frac{dy}{dx} = 3x^2 - 3x^{-4}$

13. $\frac{dy}{dx} = \cos x^3 (3x^2)$

14. $\frac{dy}{dx} = \frac{1}{2}(4x^2-5)^{-\frac{1}{2}} 8x$

16. $\frac{dy}{dx} = \frac{1}{2}(2x^2+1)^{-\frac{1}{2}} \cdot 4x$

15 $\frac{dy}{dx} = \cos(\ln x) \cdot \frac{1}{x}$

17 $\frac{dy}{dx} = e^{\sqrt{2}x} \cdot \sqrt{2} \cdot \frac{1}{2} \cdot x^{-\frac{1}{2}}$

18. $\frac{dy}{dx} = 4x^3 - 2\cos x - 3\sin x$

19. Product Rule

20 Division Rule

21 $\frac{dV}{dr} = \frac{4}{3}\pi 3r^2 = 4\pi r^2$

22 $x\frac{dy}{dx} + y = 0 \qquad \frac{dy}{dx} = -\frac{y}{x}$

23 $\frac{dx}{dt} = 2at \qquad \frac{dy}{dt} = 2a \qquad \frac{dy}{dx} = \frac{1}{t}$

24. $\int x^{1/5}dx = \frac{x^{1/5+1}}{\frac{1}{5}+1} + c$

25. Substitution Method

26 $\frac{1}{2}\int \sin 2x\,dx = -\frac{1}{4}\cos 2x + c$

27 $x^2 + a^2 = u \qquad \frac{du}{dx} = 2x \qquad x\,dx = \frac{du}{2}$

$$\frac{1}{2}\int \frac{du}{u} = \frac{1}{2}\ln u + c = \frac{1}{2}\ln(x^2+a^2) + c$$

28 $\left[\sin x\right]_{-\pi/2}^{\pi/2}$

29 $1 + \cos x = 1 + 2\cos^2\frac{x}{2} - 1$

30 $\int \sqrt{x}\,dx = -\int x\sqrt{x}\,dx$

31 $\left[-\cos x + \sin x\right]_0^{\pi/2}$