51) mass $m \propto F^x V^y T^z$ [1]

Take dimensions → $[M^1] = [M^1L^1T^{-2}]^x \times [L^1T^{-1}]^y \times [T^1]^z$

$[M^1] = [M^x L^{x+y} T^{-2x-y+z}]$

Comparing powers → $x=1$, $x+y=0$, $-2x-y+z=0$

$y=-1$ $-2+1+z=0$

$z=1$

$\therefore m \rightarrow F^1 V^{-1} T^1$

52) Force → 2F, velocity → 2V, Power → ? [3]

$P = \frac{W}{t} = \frac{F \times S}{t}$

$P_1 = F \times V$ → NOW $P_2 = 2F \times 2V$

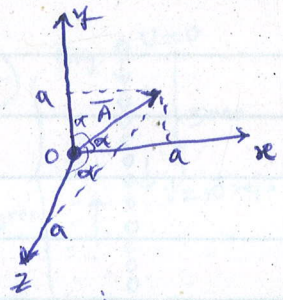
$P_2 = 4P_1$

Quadrupled.

53) $|\bar{A}| = \sqrt{3^2+2^2+12^2}$ [1]

$= \sqrt{9+4+144} = \sqrt{157}$

54) [3]



$\bar{A} = a\hat{i} + a\hat{j} + a\hat{k}$

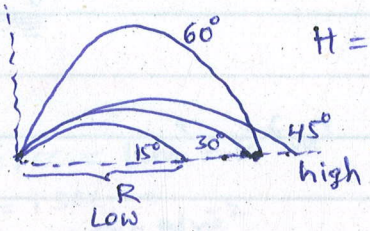
any axis $\bar{B} = a\hat{i}$, $\bar{C} = a\hat{j}$, $\bar{D} = a\hat{k}$

$\rightarrow \cos\alpha = \frac{\bar{A}\cdot\bar{B}}{|\bar{A}||\bar{B}|} = \frac{a^2}{\sqrt{3a^2} \times a}$

$\cos\alpha = \frac{1}{\sqrt{3}}$

$\alpha = \cos^{-1}\left(\frac{1}{\sqrt{3}}\right)$.

55) [2]



$H = \frac{u^2 \sin^2\theta}{2g}$

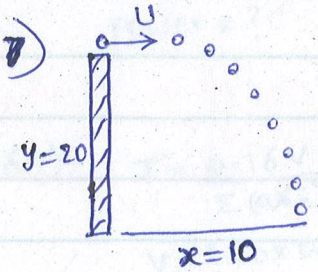
$\theta = 15° \rightarrow H = \frac{1}{2}\left(\frac{u^2}{2g}\right)$ 50% Low

$\theta = 30° \rightarrow H = \frac{\sqrt{3}}{2}\left(\frac{u^2}{2g}\right)$ 86%

$\theta = 45° \rightarrow H = 1\left(\frac{u^2}{2g}\right)$ 100% Max

$\theta = 60° \rightarrow H = \frac{\sqrt{3}}{2}\left(\frac{u^2}{2g}\right)$ 86%

57) [2]



$y = \left(\frac{g}{2u^2}\right)x^2$

$20 = \left(\frac{10}{2u^2}\right) \times 10^2 \Rightarrow u^2 = \frac{1000}{2 \times 20}$

$u^2 = 25$

$u = 5\ ms^{-1}$

58) $F = 10\ N$, $a = 2\ ms^{-2}$, $m = ?$ [4]

$m = \frac{F}{a} = \frac{10}{2} = 5\ kg$.

70) Efficiency $\eta = \frac{W}{Q} = 1 - \frac{T_c}{T_H}$ [3]

T_c = low = 127 + 273 = 400 K

T_H = High = 227 + 273 = 500 K

$\frac{10^4}{Q} = 1 - \frac{400}{500} \rightarrow \frac{10^4}{Q} = \frac{100}{500} \rightarrow Q = 5 \times 10^4 J$

71) $PV^\gamma = \text{constant}$ [1]

$dP V^\gamma + P\gamma V^{\gamma-1} dV = 0$

$\frac{dP}{P} V^\gamma + \gamma \frac{V^\gamma}{V} dV = 0 \rightarrow \frac{dP}{P} = -\gamma \frac{dV}{V}$

72) $dQ = dU + dW$ [1]

400 cal = dU + 1000 Joule

400 × 4.2 Joule = dU + 1000 Joule $\rightarrow$ dU = 1680 − 1000 = 680 J

73) $T_1 = 27 + 273 = 300K$ [2]

$V_2 = 3V_1$

$T_2 = ?$

$\frac{V_1}{T_1} = \frac{V_2}{T_2} \Rightarrow \frac{V_1}{3V_1} = \frac{300}{T_2}$

$\Rightarrow T_2 = 900$ kelvin

74) $W_0 = 10$ eV [1]

$h\gamma = 20$ eV

$\gamma_0 = ?$

$h\gamma = h\gamma_0 + W$

$20 = h\gamma_0 + 10$

$\gamma_0 = \frac{10}{h}$

75)