52) 1) Moment of Inertia $I = mr^2 \rightarrow [M^1L^2T^0]$
Moment of Force $\tau = F \times r \rightarrow [M^1L^2T^{-2}]$ } not equal. [1]

2) WORK $W = F \times s \rightarrow [M^1L^2T^{-2}]$
Torque $\tau = F \times d \rightarrow [M^1L^2T^{-2}]$ } equal

3) Angular Momentum $L = mvr \rightarrow [M^1L^2T^{-1}]$
Planck constant $h = \frac{E}{\nu} \rightarrow [M^1L^2T^{-1}]$ } equal.

4) Impulse $I = F \times t \rightarrow [M^1L^1T^{-1}]$
Momentum $P = m \times v \rightarrow [M^1L^1T^{-1}]$ } equal.

51) Parsec is the unit of distance used in Astrology. [2]
1 parsec = 3.26 light years.

53) [4]

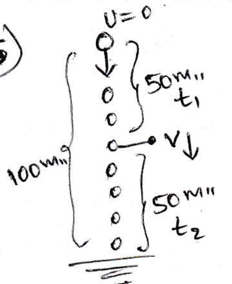
$P = F$ $\quad R = \sqrt{P^2+Q^2+2PQ\cos\theta}$
$Q = 2F$ $\quad 2F = \sqrt{F^2+4F^2+4F^2\cos\theta}$ $\rightarrow \cos\theta = \frac{-1}{4} \rightarrow \theta = \cos^{-1}\left(\frac{-1}{4}\right)$
$R = 2F$ $\quad 4F^2 = 5F^2+4F^2\cos\theta$
$\theta = ?$

54) [2]

Co-planar $\rightarrow \det|\bar{A}| = 0 \rightarrow \begin{vmatrix} 1 & -2 & 3 \\ x & 0 & 3 \\ 7 & 3 & -11 \end{vmatrix} = 0$

$1(0-9) + 2(-11x-21) + 3(3x-0) = 0$ $\rightarrow 13x = -51$
$-9 - 22x - 42 + 9x = 0$ $\quad x = -51/13$

55) [2]

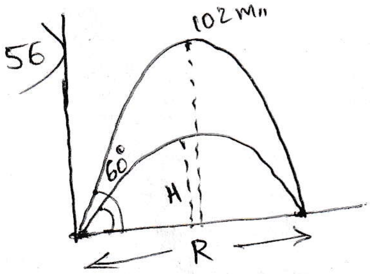


In Free fall case velocity increases 9.8 m/sec per every sec.
$v = \frac{d}{t}$ $\quad v\uparrow$ so $t\downarrow$
for 1st half distance (50m) $\rightarrow t_1$ v (high)
2nd half " " $\rightarrow t_2$, v increas (very high)
clearly $t_2 < t_1$ (or) $t_1 > t_2$.

(OR)

$U=0,\ S = Ut + \frac{1}{2}at^2$, $t = t_1 + t_2$
$100 = \frac{1}{2}gt^2 \rightarrow t = \sqrt{20} = 4.47$ sec.
$50 = \frac{1}{2}gt_1^2 \rightarrow t_1 = \sqrt{10} = 3.17$ sec. } $t_1 > t_2$.
$t_2 = t - t_1 = 1.3$ sec.

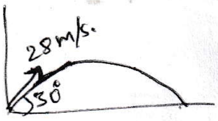
56) [4]



Range $R = \frac{U^2\sin 2\theta}{g}$, $\sin 2(60^\circ) = \sqrt{3}/2$, $\sin 2(30^\circ) = \sqrt{3}/2$ } same Range
So, angle for 2nd body is 30°.
and $H = \frac{U_1^2\sin^2\theta}{g} \rightarrow 102 = \frac{U_1^2\sin^2 60^\circ}{10} \rightarrow U_1^2 = \frac{1020}{3/4}$
$\rightarrow U_1^2 = 1360$.

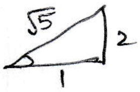
and same Ranges.
$R = R \rightarrow \frac{U_1^2\sin 2(60^\circ)}{g} = \frac{U_2^2\sin 2(30^\circ)}{g} \rightarrow U_1^2 = U_2^2 \rightarrow U_1 = U_2$

$\therefore$ 2nd Height with $\theta = 30^\circ$ is
$H = \frac{U_2^2\sin^2\theta}{g} = \frac{1360 \times \sin^2 30^\circ}{10} = \frac{136}{4} = 34$ metre

57) 

$T = \frac{2u\sin\theta}{g} = \frac{2\times 28\times \sin 30^\circ}{9.8} = \frac{28}{9.8} = 2.857$ [1]

$T = \underline{2.9 \text{ sec}}$.

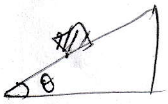
58) $H = \frac{R}{2} \rightarrow \frac{u^2\sin^2\theta}{2g} = \frac{u^2\sin 2\theta}{2g} \rightarrow \sin^2\theta = 2\sin\theta\cos\theta$  [4]

$\rightarrow \tan\theta = 2$ ~~$\theta =$~~

$\rightarrow \sin\theta = 2/\sqrt{5}$, $\cos\theta = \frac{1}{\sqrt{5}}$

$\therefore$ ~~$R = \frac{u^2\sin^2\theta}{2g} = \frac{u^2(2/\sqrt{5})^2}{2g}$~~

$\therefore R = \frac{u^2\sin 2\theta}{g} = \frac{u^2\times 2\sin\theta\cos\theta}{g} = \frac{2u^2\times\frac{2}{\sqrt{5}}\times\frac{1}{\sqrt{5}}}{g} = \frac{4u^2}{5g}$

59) 

$\mu = \frac{1}{\sqrt{3}} = \tan\theta \rightarrow \theta = \tan^{-1}\left(\frac{1}{\sqrt{3}}\right) = 30^\circ$ [1]

60) In equillibrium $\rightarrow$ highest static friction. [1]

$\tan\theta = \mu_s \rightarrow \mu_s = \tan 45^\circ = 1$

61) Work $W = F\times dx$ because $t = \sqrt{x}+3$ [2]

at $t=6$ second. $x = (t-3)^2 = t^2-6t+9$

$dx = [x]_0^6$ velocity $v = \frac{dx}{dt} = 2t-6$

$x = t^2-6t+9$ acceleration $a = \frac{dv}{dt} = 2$

$(x)_{t=0} \rightarrow 0^2-0+9 \rightarrow 9$ m Force $F = ma = 2m$

$(x)_{t=6} \rightarrow 36-36+9 \rightarrow 9$ m $\therefore W = F\times dx = 2m\times 0 = 0$ Joule.

$dx = 9-9 = 0$

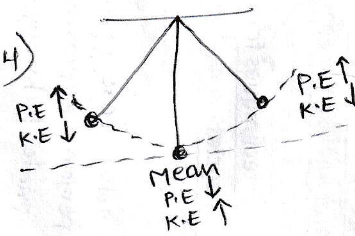
62) Power $P = \bar{F}\cdot\bar{V} = (5\times 10)+(-3\times 10)+(6\times 20)$ [3]

$= 50-30+120 = 140$ watt

63) Solar Energy $\rightarrow$ Energy received by earth from SUN. [2]

$\rightarrow$ SUN (star) releases this energy with Nuclear Fusion of H, He

[2]

64) 

[4]

65) on the surface of earth $T_1 = 2\pi\sqrt{\frac{l}{g}}$

Above the surface of earth at a height R is.

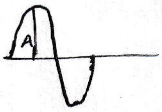
$g' = g\left(\frac{R}{R+h}\right)^2 = g\left(\frac{R}{R+R}\right)^2 = \frac{g}{4} \downarrow$

$\therefore T_2 = 2\pi\sqrt{\frac{l}{g'}} = 2\pi\sqrt{\frac{4l}{g}}$

$T_2 = 2\times 2\pi\sqrt{l/g} = 2T_1$

$\underline{\frac{T_2}{T_1} = 2}$.

66) Sound wave characteristics → Loudness → Amplitude
→ Intensity [3]



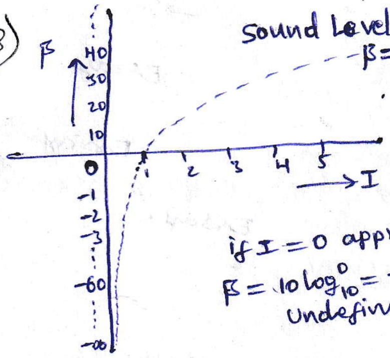
→ Pitch → Frequency.
→ Quality → Rememberance (voice)

Wavelength → not a quantity for sound.

67) Doppler Effect $n' = \left(\frac{V \pm V_o}{V \mp V_s}\right) n$ [2]
V_o → obeerver velocity
V_s → source velocity
n → Actual frequency → time also

there is no distance.

68)



Sound Level $\beta = 10 \log_{10} I/I_0$, $I = 10^{-12}$ watt/m² → initial vintensity.
(Threshold of Hearing).
if $I = I_0 \rightarrow \beta = 10 \log_{10} 1 = 0$ dB (1000 Hz frequency)
it is the reference level of electronic signals (Amplifiers)
and for human ear.
There is −dB also. scientists tells that, very Quiest sound level.
−60 dB is the starting & very quiest sound level.
$\beta = -60$ dB → $I = 10^{-6} I_0$ → $I = \frac{I_0}{10^6}$ $= 10^{-18}$ W/m²
$I = \frac{\text{initial velocity}}{1000000} = 0.000001\, I_0$
here frequency nearly 20 Hz (starting)

if $I = 0$ approaches
$\beta = 10 \log_{10} 0 = -\infty$
undefined.

[2]

69) $T_1 = 27 + 273 = 300$ K
$V_2 = \frac{8}{27} V_1$
$\gamma = 5/3$
$T_2 = ?$

$TV^{\gamma-1}$ = constant
$T_1 V_1^{\gamma-1} = T_2 V_2^{\gamma-1}$
$300 \times V_1^{\gamma-1} = T_2 \times \left(\frac{8 V_1}{27}\right)^{\gamma-1}$
$300 = T_2 \times \left(\frac{8}{27}\right)^{\frac{5}{3}-1}$
$300 = T_2 \left(\frac{2^3}{3^3}\right)^{2/3} = T_2 \times \left(\frac{2}{3}\right)^2$
$300 = T_2 \times \frac{4}{9} \rightarrow T_2 = 300 \times \frac{9}{4} = 675$ K

rise in temperature $dT = T_2 - T_1 = 675 - 300 = 375$ K

[3]

70) $dQ = dU + dW$
$200\,\text{cal} = dU + 40\,J \rightarrow dU = (200 \times 4.2) - 40$
$= 840 - 40$
$dU = 800$ Joule (+) → increases.

71) $PV = nRT$ Given $P = aT^{-1} \rightarrow a = PT$ [4]
$\underbrace{P\,dV}_{W} + V\,dP = nR\,dT$ $dP = \frac{-a}{T^2} dT$
$dW = nR\,dT - V\,dP$
$= nR\,dT + \frac{aV}{T^2} dT$
$= nR\,dT + \frac{PV}{T} dT$
$dW = nR\,dT + nR\,dT = 2nR\,dT$
$W = \int_T^{4T} 2nR\,dT = 2nR\,(T)_T^{4T} = 2nR\,(4T - T)$
$W = 6nRT$

72) isothermal $\rightarrow$ pressure — P
volume — V/4

$PV = \text{constant}$
$PV = P_1 V_1 \rightarrow P_1 = \frac{PV}{V/4} = 4P$

[3]

Adiabatic $\rightarrow PV^{1.5} = \text{constant}.$
volume — V/4

$PV^{3/2} = P_2 V_2^{3/2}$
$PV^{3/2} = P_2 \times \left(\frac{V}{4}\right)^{3/2}$
$P = P_2 \times \frac{1}{2^3} \rightarrow P_2 = 8P$

$\therefore \frac{P_2}{P_1} = \frac{8P}{4P} = \underline{2}.$

[2]

73) efficiency $\eta = 1 - \frac{T_c}{T_H} = 40\%$

$1 - \frac{T_c}{500} = \frac{40}{100} \rightarrow \frac{T_c}{500} = \frac{60}{100} \rightarrow T_c = 300\ K$

efficiency $\eta = 1 - \frac{T_c}{T_H} = 50\%$

$1 - \frac{300}{T_H} = \frac{50}{100} = \frac{1}{2} \rightarrow \frac{300}{T_H} = 1 - \frac{1}{2} = \frac{1}{2}$

$\rightarrow T_H = 300 \times 2 = \underline{600\ K}.$