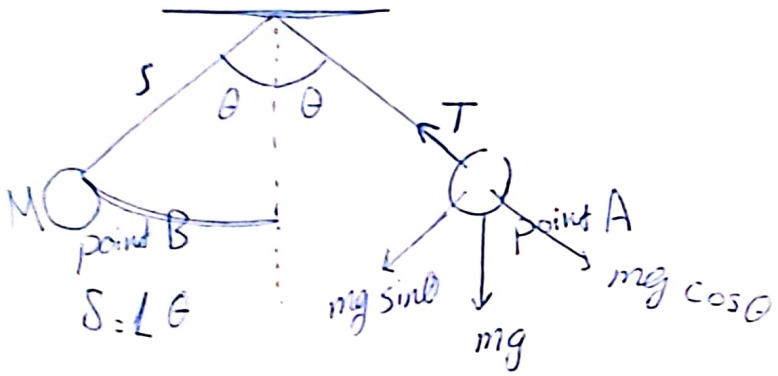
Exp 7 : Measuring of g at BZU

The aim : To find the acceleration of gravity at Birzeit University

Theory :-



L : String length

$L = S + \frac{d}{2}$

$\sum F = ma_c$ $\quad a_c = \frac{v^2}{R}$

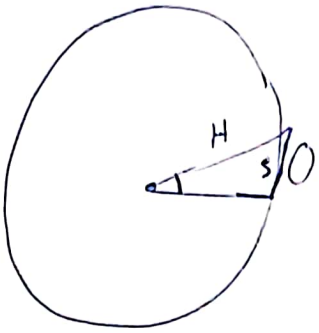
① $\boxed{T - mg\cos\theta = M\frac{v^2}{L}}$

② $-Mg\sin\theta = Ma$ $\quad a = \frac{d^2S}{dt^2}$

$-Mg\sin\theta = M\frac{d^2S}{dt^2}$

③ $\boxed{\frac{d^2S}{dt^2} + g\sin\theta = 0}$

for small angle



$\sin\theta = \frac{O}{H}$

$S = r\theta \rightarrow r \approx H$

$\theta = \frac{S}{H} \quad S \approx O$ ⟶

$\sin\theta \approx \frac{S}{H} \approx \theta$

② تربيعيا

$\frac{d^2S}{dt^2} + g\theta \approx 0$

$S = L\theta$

$\theta = \frac{L}{S}$

$\frac{d^2S}{dt^2} + \frac{g}{L}S \approx 0$ seconed order differential equation.

the solution ⟶

$S(t) = S_0 \sin(\omega t + \delta)$

$\omega^2 = \frac{g}{L}$ angular freq

$T = \frac{2\pi}{\omega} = \frac{2\pi}{\sqrt{g/L}} = 2\pi\sqrt{\frac{L}{g}}$

$T^2 = \frac{4\pi^2}{g} L$

$m = \frac{4\pi^2}{g}$

$b = 0$

Procedure :-

- Start with length = 40 cm.
- measure the time needed to do 10 periods using a stop-watch
- repeat step 1 (6 times) L = 50, 60, ... cm

S : length of the string

$L = S + \frac{d}{2}$

d = Calculate it by the caliper

→ using the method of least square fit find the best slope m, Δm, b, Δb