Government Degree College for Women,

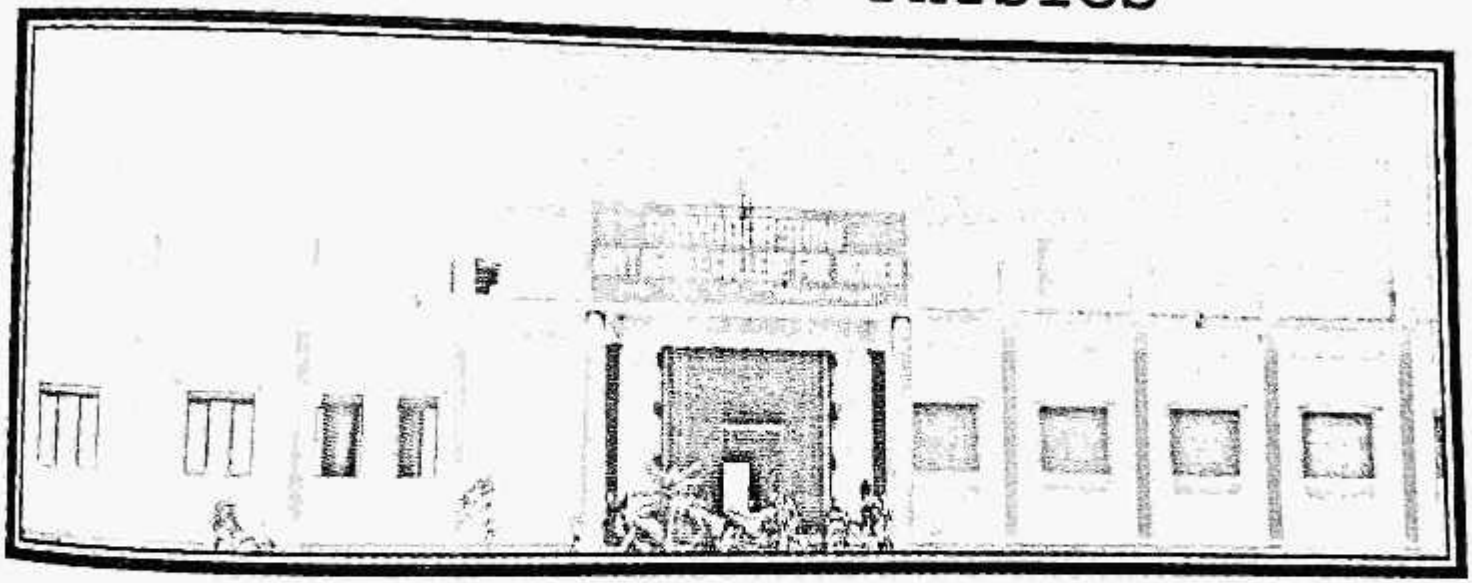
Gadwal -509125

Jogulamba Gadwal Dist. Telangana

Affiliated to Palamuru University

project work 2020-21

DEPARTMENT OF PHYSICS



Academic Year - 2020-21.

Priyadarshini Govt degree College for Women

Name of the Students:- Bindu, Vijaya Laxmi

HT.NO :- 200330114680003, 200330114410002.

Class :- Degree - first year

Group :- BSc (MPC.)

Subject :- Physics.

Experiment name:

:- Compound Pendulum :-

PRINCIPAL
Govt. Degree College for Women
GADWAL - 509125

** Compound pendulum **

→ Compound pendulum debination :-

Any rigid body which is making oscillations through a point in it about a horizontally vector plane is called Compound pendulum.

→ Explaination :-

Using Simple pendulum, the gravitational acceleration of the place can be determined easily But due to errors in the experiment, accurate value of "g" can not be determined, they are.

1) The System of metallic bob together with the thread can not be treated as a point mass.

2) The motion of metallic bob is not Completely linear, The bob will have rotational motion in Addition to the Vibrational motion.

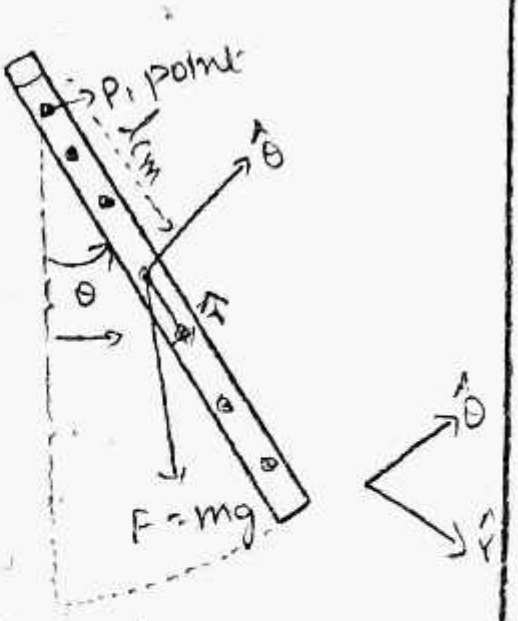
3) Due to frictional force of Air and buoyancy forces on the bob the energy dissipation occurs.

Therefore g - value can not be determined correctly using : Single Compound pendulum, By making correction to the above errors, the Compound pendulum is used to determine the g - value.

Any rigid body which is making oscillations through a point in it about a horizontally vertical plane is called as Compound pendulum.

A body is hanged about a point "O" of the pendulum 'l' is the distance between centre of gravity and point of suspension when the pendulum displaced by small angle from its mean position. it will make oscillations At an Angular displacement of "θ" torque acting on the oscillator is $\vec{T} = -mg \times l \sin\theta$

→ theory :-



$F_H = mg\cos\theta\,\hat{r}$

$F_V = mg\sin\theta\,\hat{\theta}$

$F = mg\cos\theta\,\hat{r} - mg\sin\theta\,\hat{\theta}$

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

$= l\hat{r} \times (mg\cos\theta\,\hat{r} - mg\sin\theta\,\hat{\theta})$

$= mgl\cos\theta.\hat{r}\times\hat{r} - mgl\sin\theta\,\hat{r}\times\hat{\theta}$

$\tau = -mgl\sin\theta.$

Linear motion		Circular motion.
mass "m"	⟶	momentum of Inertia - I_0
displacement "s"	⟶	Angular displacement - θ
velocity "v"	⟶	Angular velocity - ω
acceleration "a"	⟶	Angular acceleration - α
force "f"	⟶	Torque - τ
($F = ma$)		($\tau = I_0\alpha$)

$$\tau = -mgl_{cm}\sin\theta$$

$$\tau = I_0\alpha$$

$$I_0\alpha = -mgl_{cm}\sin\theta$$

$$I_0\frac{d^2\theta}{dt^2} = -mgl_{cm}\sin\theta$$

$$I_0\frac{d^2\theta}{dt^2} + mgl_{cm}\sin\theta = 0$$

$$\frac{d^2\theta}{dt^2} + \frac{mgl_{cm}\sin\theta}{I_0} = 0$$

$$\frac{d^2\theta}{dt^2} + \frac{mgl_{cm}\theta}{I_0} = 0 \qquad (\because \sin\theta = \theta, \text{ in this } \sin\theta \text{ is very small})$$

above eqn is Comparing with

$$\frac{d^2\theta}{dt^2} + \omega^2\theta = 0$$

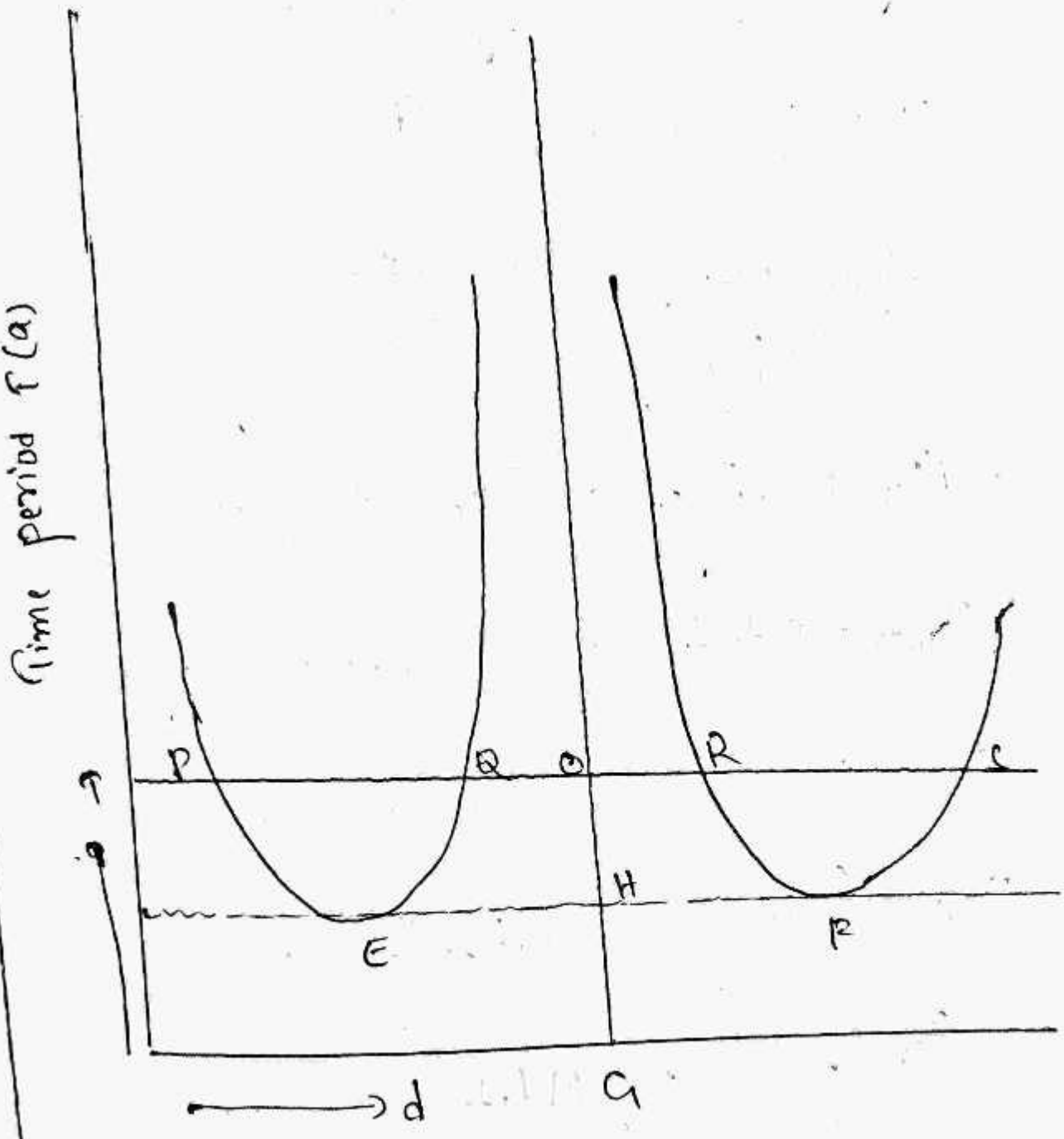
$$\omega = \sqrt{\frac{mgl_{cm}}{I_0}}$$

Time period $= T = \frac{2\pi}{\omega}$.

from parallel axis theorm

$$I = I_{cm} + Ml^2_{cm}.$$

$$T = 2\pi \sqrt{\frac{I_c + Ml^2_{cm}}{Mgl_{cm}}}$$



gyration of $\boxed{K = \sqrt{l_1 l_2}}$

$$T_1 = 2\pi \sqrt{\frac{M l_1 l_2 + M_1 l_1^2}{M g l_1}} = 2\pi \sqrt{\frac{M l_1 (l_1 + l_2)}{M l_1 g}}$$

$$T = 2\pi \sqrt{\frac{l_1 + l_2}{g}}$$

Squaring on both side

$$T^2 = 4\pi^2 \left(\frac{l_1 + l_2}{g}\right)$$

$$\boxed{g = \frac{4\pi^2 (l_1 + l_2)}{T^2}}$$

⟶ the gyration $K = \sqrt{l_1 l_2}$

⟶ the acceleration of gravity $g = \frac{4\pi^2 (l_1 + l_2)}{T^2}$

Closed system :- [సంవృత వ్యవస్థ]

It the mass with in the system is remains constant is called closed system. (or)

A system in which only Energy Transfer takes place between system and surroundings is called closed system.

వ్యవస్థకు, పరిసరాలకు మధ్య శక్తి మాత్రమే బదిలీ అయ్యే వ్యవస్థను సంవృత వ్యవస్థ అంటారు.

ఉదా :- మూసి ఉన్న పాత్రలో మరుగుతున్న నీరు.

Isolated system :- [వియుక్త వ్యవస్థ]

A system in which there is Neither mass nor Energy Transfer across the boundary is called as an "Isolated system"

ఏ వ్యవస్థ అయితే ఆవరణతో శక్తిని కూడా ద్రవ్యరాశిని (పదార్థాన్ని), శక్తిని పరిసరాలలో మార్పిడి చేసుకోకుండా ఉంటుందో ఆ వ్యవస్థను వియుక్త వ్యవస్థ అంటారు.

ఉదా :- ఆవరణతో శక్తిని మూసి ఉన్న పాత్రలో వుంచిన నీరు.

Government Degree College for Women,

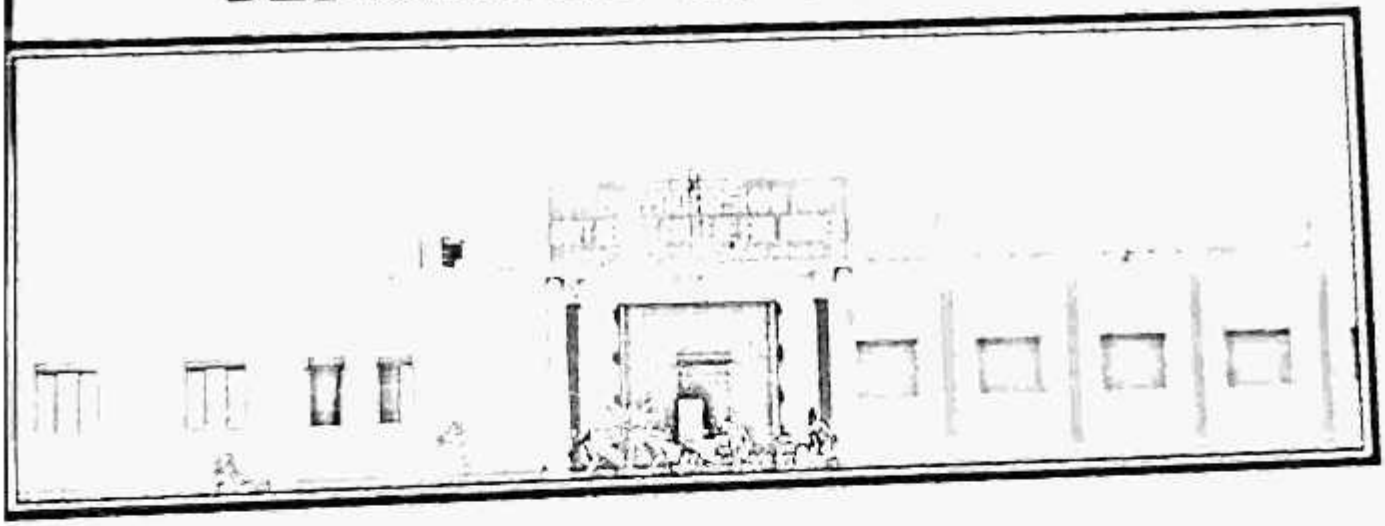
Gadwal -509125

Jogulamba Gadwal Dist. Telangana

Affiliated to Palamuru University

Quiz.

DEPARTMENT OF PHYSICS



Quiz