Variations of "g" Due to Various Factors (in Hindi)

LESSON 5 OF 5

27.8k
views

4.8
★

Saurabh Maurya

Educator since February 2018

•IIT BHU - Physics Passionate.
•Resonace (Kota) Faculty of Physics.
•YouTuber-JEE Prep Saurabh (6k+ subs & 5 lakh Views)....

992 Followers
6 Following
19 Courses

Edit profile

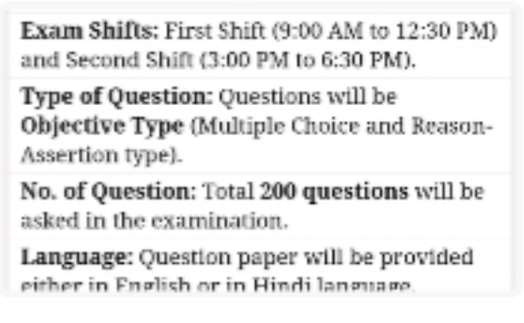
All courses

(Hindi) Electrostatic : JEE/ BOARDS/NEET

5★ (4 ratings)

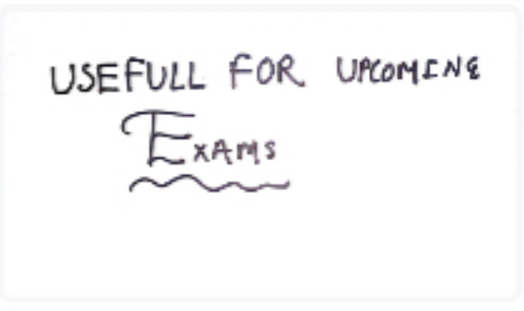
(Hindi) Physics Crash Course for JEE Advanced & AIIMS

5★ (13 ratings)



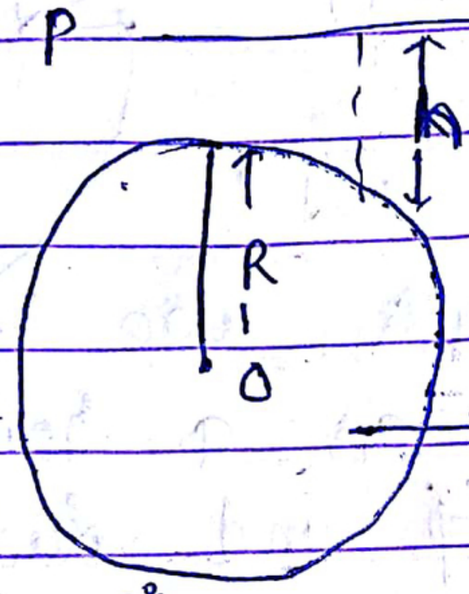
(Hindi) NEET 2018 Solutions and Analysis

5★ (3 ratings)



Variation of Acceleration Due to Gravity

A) Acceleration due to 'Gravity' above the surface of Earth :-



Soln $g = \frac{GM}{R^2}$ —(i)

Now at 'h' height above

$$g_h = \frac{GM}{(R+h)^2} \text{ —(ii)}$$

Dividing (ii) by (i)

$$\frac{g_h}{g} = \frac{GM}{(R+h)^2} \times \frac{R^2}{GM}$$

$$\boxed{g_h = g\left(\frac{1}{1+\frac{h}{R}}\right)^{-2}}$$

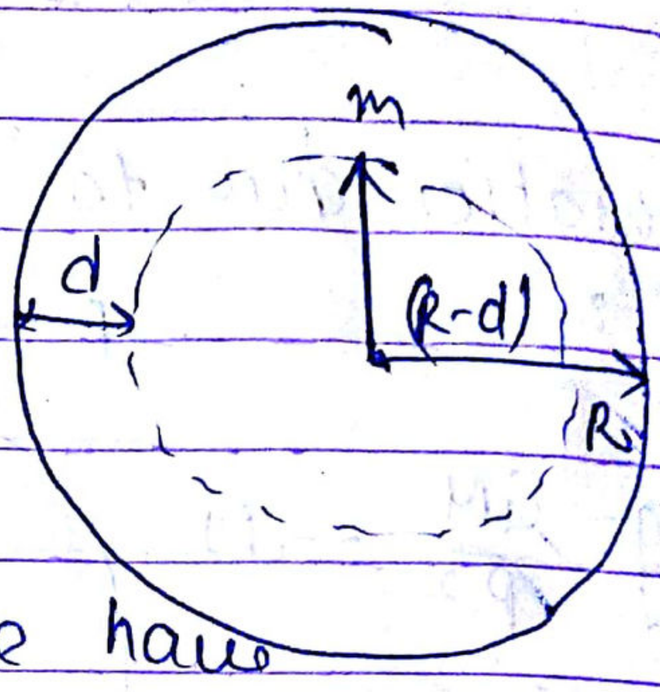
If $h << R$

$$\boxed{g_h = g\left(1-\frac{2h}{R}\right)} \rightarrow \text{from Binomial}$$

B) Acceleration due to gravity Earth:

Soln

$$g = \frac{GM}{R^2} \quad \text{—(i)}$$



If we go down 'd' depth into earth, we have to suppose earth as a homogenous sphere of uniform density 'ρ' and Radius (R).

Mass of earth (M) = V x D

$$M = \frac{4}{3}\pi r^3 \times \rho$$

$$\Rightarrow g = \frac{g \times \frac{4}{3}\pi R^3 \rho}{R^2}, \qquad g = \frac{4}{3}\pi G R \rho$$

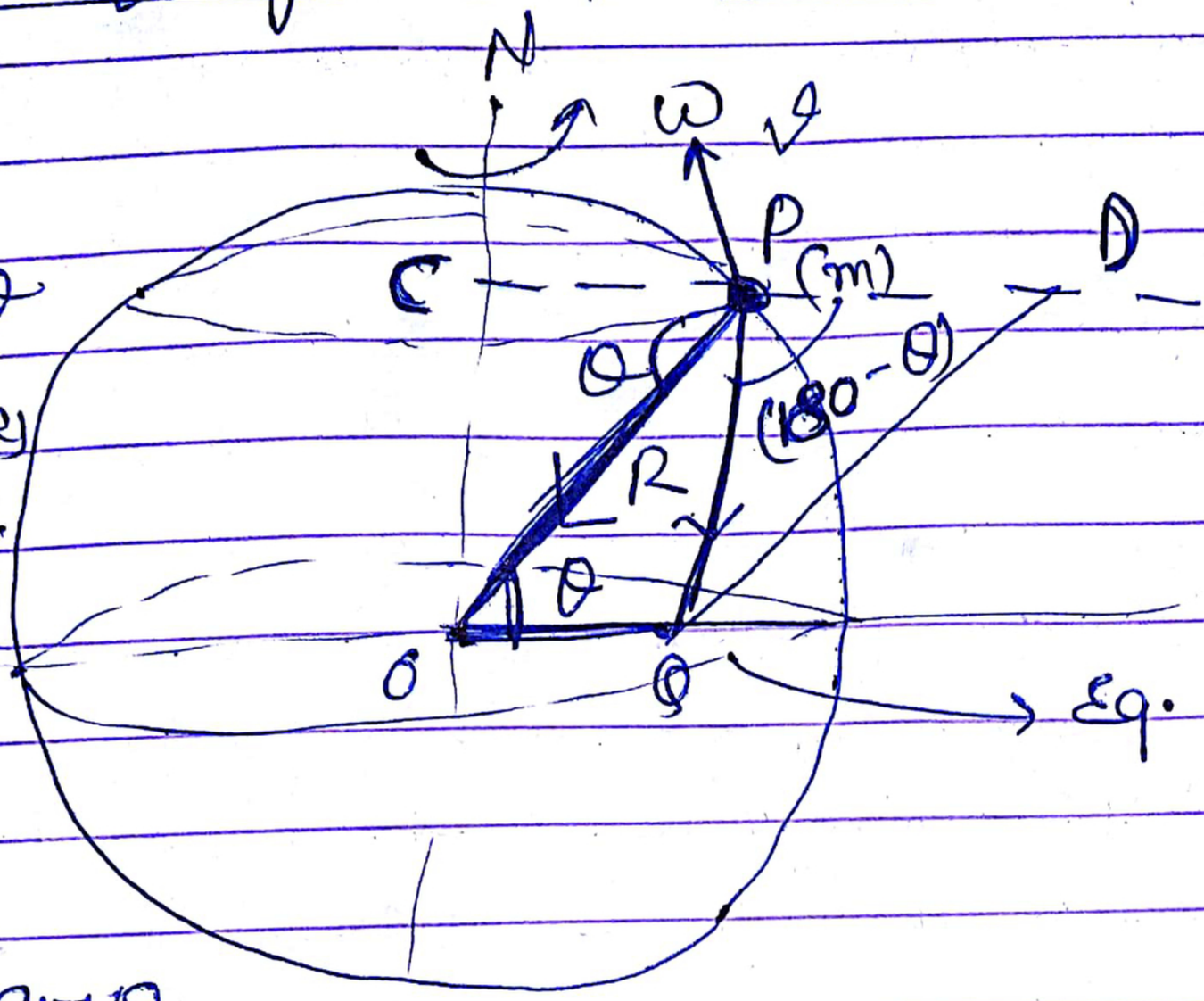
जब 'g' depth आ जाएगा,

$$g_d = \frac{4}{3}\pi G (R-d)\rho \quad \text{—(iii)}$$

Dividing (iii) by (ii).

$$g_d = g\left(1 - \frac{d}{R}\right)$$

iii) Variation of 'g' with Rotation of Earth



$V = (PC)\omega$

Earth rotates and compl. 1 rev in 24 Hours.

$PC = PO \cos\theta$

$PC = R\cos\theta$

$\boxed{v = R\omega\cos\theta}$

, Centrifugal force acting on 'm'

$f_c = \frac{mv^2}{r} = \frac{m(R\omega\cos\theta)^2}{R\cos\theta}$

$\boxed{f_c = m\omega^2 R\cos\theta}$

$$g' = g\left[1 - \frac{R\omega^2\cos^2\theta}{g}\right]$$

at Poles: $\theta = 90^\circ$, $\boxed{g_{pole} = g}$

at equator: $\theta = 0^\circ$, $\boxed{g_{eq} = g\left[1 - \frac{R\omega^2}{g}\right]}$