International University of Business Agriculture & Technology

Mid Term Home Assignment

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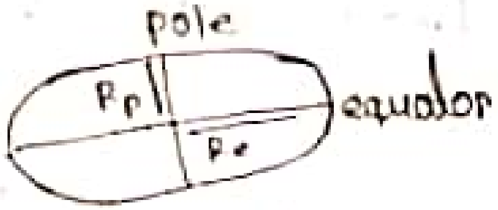
Answer to the question No - 1

The acceleration due gravity g changes

(1) when we go from the one place to another on the surface of earth due to two causes

a. Variation of g due to shape of Earth

The earth is an oblate shperoid. It's radiuns near the equator is more than its radius near poles.



we know that

$$g = \frac{GM_{earth}}{R_{earth}^2}$$

$$\therefore g_p = \frac{GM_{earth}}{R_p^2} \text{ \& } g_e = \frac{GM_{earth}}{R_e^2}$$

$$\frac{g_e}{g_p} = \frac{GM_{earth}}{R_e^2} \times \frac{R_p^2}{GM_{earth}}$$

$$\frac{g_e}{g_p} = \frac{R_p^2}{R_e^2} \quad \text{as } R_p < R_e$$

$$\therefore g_e < g_p$$

So if a person moves from the equator to the poles his weight will be decrease as the value g is decreases.

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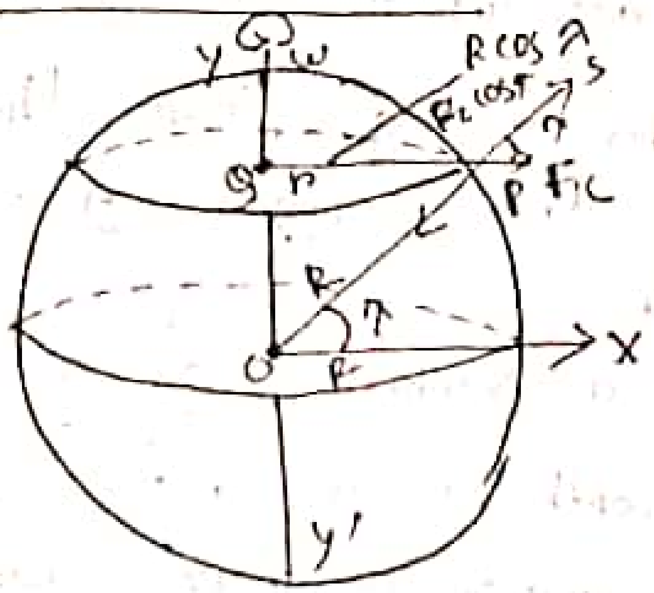
(11) Variation of g due to rotation of earth:



In the direction of po the gravitational force

$F = mg$

$= m\frac{GM}{R^2}$

But at p point in the direction of ps the force is

$$F_{c\lambda} = F_c \cos\lambda$$

So at p point the gravitational force in m mass is

$$F_\lambda = F - F_{c\lambda}$$

$$\Rightarrow mg_\lambda = mg - F_c\cos\lambda$$

$$\Rightarrow mg_\lambda = mg - \frac{mv^2}{r}\cos\lambda \quad \left[\text{centrifugal force } F_c = \frac{mv^2}{r}\right.$$

$$\Rightarrow g_\lambda = g - \frac{v^2}{r}\cos\lambda$$

Here $r = R\cos\lambda$ and $v = \omega r = \omega R\cos\lambda$

$$\therefore g_\lambda = g - \frac{\omega^2 R^2 \cos^2\lambda}{R\cos\lambda}\cos\lambda$$

$$\Rightarrow g_\lambda = g - \omega^2 R\cos^2\lambda$$

on the equator $\lambda = 0°$; $\cos\lambda = 1$

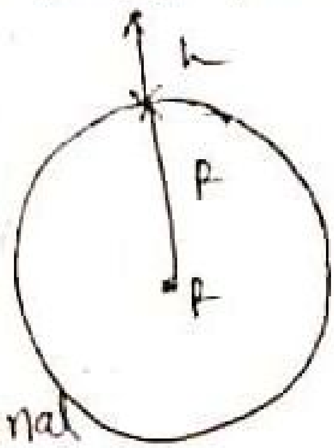
$$\therefore \quad g_0 = g - \omega^2 R$$

In polar region $\lambda = 90°$; $\cos\lambda = 0$

$$\therefore \quad g_{90} = g$$

For these two reason the value of acceleration due gravity change, when we go from one place to another on the surface of earth.

(ii) The value of acceleration due gravity changes when we go from one ~~place~~ planet to another planet because -



Let, M = Mass of earth
R = radius of earth

$\therefore$ Gravitational force $g = \dfrac{GM}{R^2}$ —— (i)

In the light of h, the gravitational force will be

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

(ii) ÷ (i) =>

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

$$\Rightarrow \frac{g'}{g} = \frac{R^2}{(R+h)^2}$$

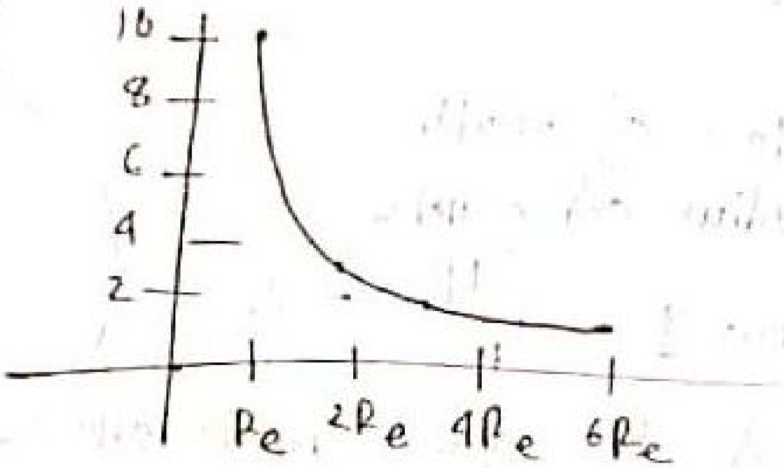
$$\therefore g' = \frac{R^2}{(R+h)^2} \times g$$

$$= \frac{1}{\left(1+\frac{h}{R}\right)^2} g$$ [Dividing by R^2

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

when $h << R$, $g_h = g / \left(1 - \frac{2h}{R}\right)$

the value will decrease



So for this reason g will change when we go from one planet to another planet.

Answer to the quention No-2

Net work done on an object equals the object change it's kinetic energy. By thats way work change the kinetic energy. Now I am explaining it by the mathmatical equation of work energy theorem.

~~We know.~~

if the velocity is v_0, Force is F and mass is m, then the object move a distance of x, then the work will be

$$w = Fx$$

for the force is the acceleration a happend then by the second law of Newton

$$w = max \quad \text{——} \quad (1)$$

But we know.

$$v^2 = v_0^2 + 2ax$$

$$\Rightarrow v^2 - v_0^2 = 2ax$$

$$\Rightarrow ax = \frac{v^2 - v_0^2}{2}$$

from the equation (1).

$$w = max$$

$$= m \times \frac{v^2 - v_0^2}{2}$$

$$= \frac{1}{2}(mv^2 - mv_0^2)$$

$$= \frac{1}{2}mv^2 - \frac{1}{2}mv_0^2$$

$$= K - K_0 \quad \left[K = \frac{1}{2}mv^2\right]$$

$$w = \Delta K$$

work done by the force = the change of kinetic energy.

By that way work change the kinetic energy of an object.

The law of conservation of energy state that Energy can neither be created nor be destroyed. Although it may be transformed from one form to another. That means if I take all forms of energy into account, the total energy of an isolated system always remain constant. All the forms of energy follows the law of conservation of energy. In brief we can say that

A system that is isolated from its surroundings, the total energy of the system is conserved. the amount of energy in a system determined the equation,

$$U_f = U_i + W + Q$$

The change of the internal energy of the system determined the equation

$$\Delta U = W + Q$$

Now I am giving some real life example of the ~~syst~~ law of conservation

- In torch, the chemical energy of the batteries is converted into electrical energy, which is converted into light and heat energy.

- In loudspeaker, electrical energy is converted into sound energy.
- In microphone, sound energy is converted into electrical energy.
- In generator, mechanical energy is converted into electrical energy.
- when fuels are burnt chemical energy is converted into heat and light energy.

Answer to the Q. No - 3

ⓐ Instantaneous speed: At a time interval approaches zero, the distance traveled also approach zero, then the limit of the ratio of distance at a time is non-zero. and is called Instantaneous speed.

we can also say that

Instantaneous speed at any given time is the magnitude of instantaneous velocity at a time.

$\therefore$ Speed(i) = ds/dt [ds = distance, dt = time interval]

Unit: ms^{-1}

quantity: Scalar

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