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(10)

- Multiple Choice

12) help Newton decide $F_g \sim \frac{1}{r^2}$

b) data on moon's orbit + motion apples

(3)

14) $F_{S \text{ on } E}$ if Sun shrank + was half size + same m

F same m + r mater, not size

- Concept

20) Spacestation ~~doughnut~~ doughnut spins same F_g as Earth How?

computer fill in blank:

"The "artificial gravity" is created by spinning the spacecraft or space station."

"Because of this people experience an inward radial force exerted on them by the outer rim of the spacestation. This process simulates effect of gravity."

- Problems

38) Friend says F_g sun on E > F_g E on sun

(1) a) Disagree

b) N3L - same F opposite direction

41) $F_g = 50\,N$ black hole on ship
$r = 10^{14}\,m$

What is F_g when $\frac{1}{2}$ distance?

(1)
$$F_g = \frac{Gmm}{r^2} = \frac{(1)(1)(1)}{(\frac{1}{2})^2} = 4F$$

$$50N(4) = 200N$$

48) $$\Sigma F = \frac{mv^2}{r}$$

(1)
$$F_g = \frac{mv^2}{r} \qquad \frac{G m_E m_s}{r^2} = \frac{m_s v^2}{r}$$

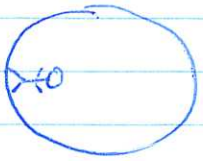
$h = 1.6 \times 10^5 m$
$m_e = 5.97 \times 10^{24} kg$

$$v = \sqrt{\frac{Gm}{r}} = \sqrt{\frac{6.67 \times 10^{-11} \frac{Nm^2}{kg^2} (5.97 \times 10^{24} kg)}{(6.37 \times 10^6 m + 1.6 \times 10^5 m)}}$$

$r = r_E + h$

$= 7800\ m/s$

53) $r_{outer} = 500\,m$



What time interval complete one rotation to give same read as Earth?

$a_c = g$ $\quad a_c = \frac{v^2}{r} = \frac{\left(\frac{2\pi r}{T}\right)^2}{r}$

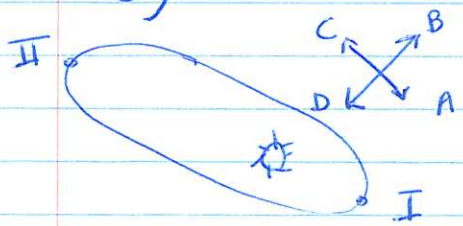
(1) ① $g = v^2/r$ ② $T = \frac{2\pi r}{v} = \frac{2\pi r}{\sqrt{rg}}$

$v = \sqrt{rg}$ $\quad a_c = \frac{4\pi^2 r^2}{T^2 r}$ $\quad T = \sqrt{\frac{4\pi^2 r}{a}} = 2\pi\sqrt{\frac{r}{a_c}}$

$= 2\pi\sqrt{\frac{500\,m}{9.81\,m/s^2}} = \boxed{45\,s}$

- Reading

75) What object exerts force at I?



(1) a) Suns F_g

76) spherical
$r = 5\,km$
a_c on equator

(1) rotates every
$52\,hr = 187200\,s$

$a_c = \frac{v^2}{r} = \frac{\left(\frac{2\pi r}{T}\right)^2}{r}$

$a_c = \frac{4\pi^2 r}{T^2} = \frac{4\pi^2 (5\times10^3\,m)}{(187200\,s)^2}$

$= 5.6\times10^{-6}\,m/s^2$

78) $r = 8.77 \times 10^{16}\ m$ position I

$v_1 = ?$

$F_G = F_C$

$$\frac{GmM}{r^2} = \frac{Mv^2}{r}$$

$$v = \sqrt{\frac{Gm}{r}}$$

(1)

$$= \sqrt{\frac{6.67 \times 10^{-11} \frac{Nm^2}{kg^2} (1.99 \times 10^{30}\ kg)}{8.77 \times 10^{16}\ m}}$$

$$= 39{,}000\ m/s$$

MP: $F_G = F_C$

MP gave 2 numbers

$$\frac{GmM}{r_I^2} = \frac{Mv^2}{r_{curve}}$$

$$v = \sqrt{\frac{Gm\,r_{curve}}{r_I^2}}$$

*Convert km → m