1.- $W = -\Delta E_p$

$$E_p = -G\frac{M m}{r}$$

$$W = -(E_{pf} - E_{pi})$$

a) VERDADEIRA

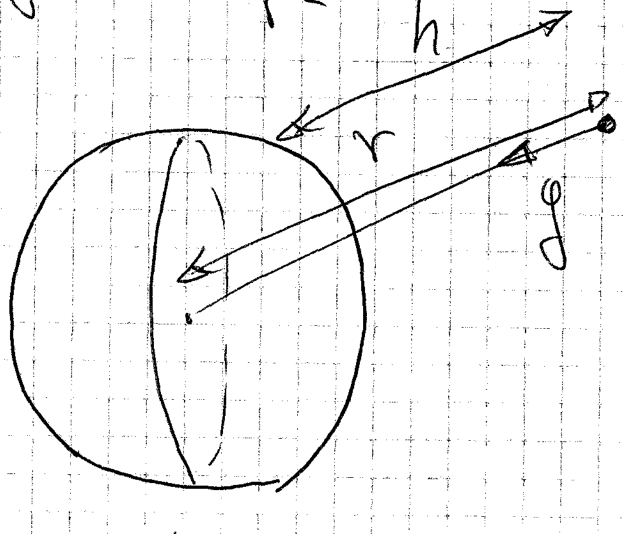
2.-

Peso $= m \cdot g$

↓

campo gravitatorio

$$|g| = G\frac{M}{r^2}$$



r aumenta $\Rightarrow$ g diminue

h aumenta $\Rightarrow$ P diminue

3.-

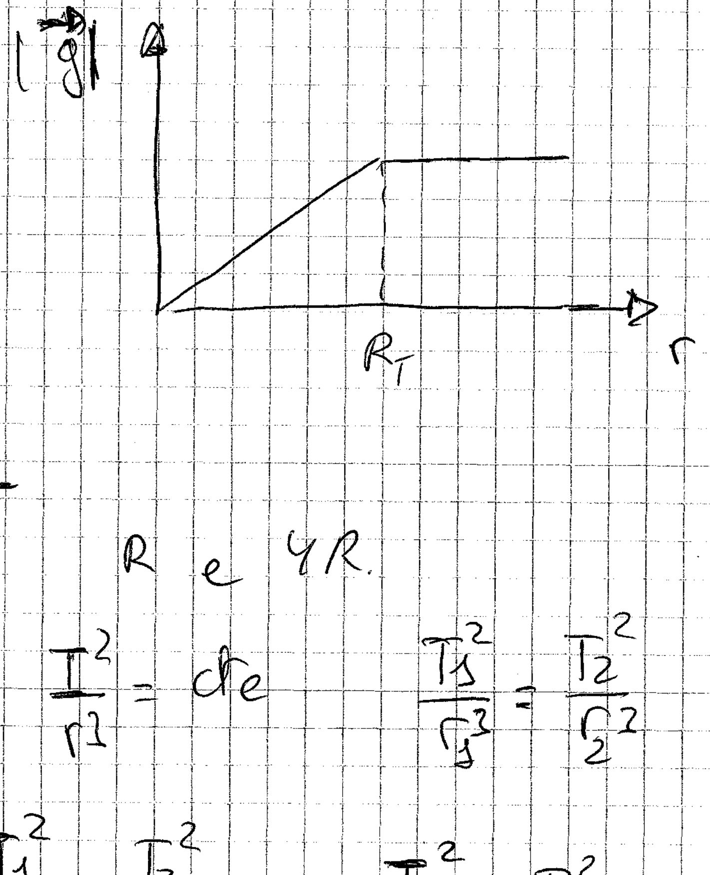
$$|\vec{g}| = G\frac{M}{r^2} \Rightarrow \rho = \frac{M}{V}$$ ← masa da Terra, ← volume da Terra

ρ ↑ densidade

$M =$

$$V = \frac{4}{3}\pi r^3$$

$$|\vec{g}| = \frac{G\rho\frac{4}{3}\pi r^3}{r^2} = G\rho\frac{4\pi}{r}$$



4.-

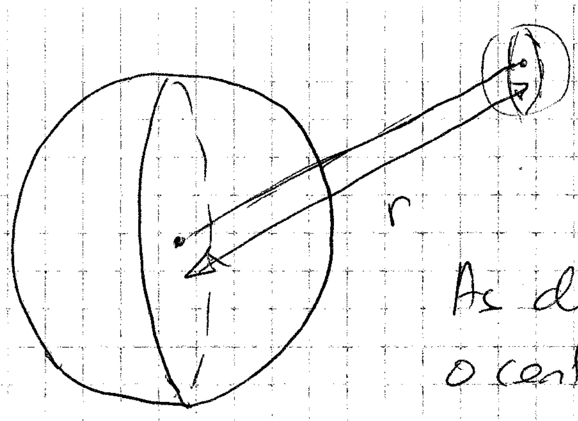
R e 4R

$$\frac{T^2}{r^3} = cte \qquad \frac{T_1^2}{r_1^3} = \frac{T_2^2}{r_2^3}$$

$$\frac{T_1^2}{R^3} = \frac{T_2^2}{(4R)^3} \Rightarrow \frac{T_1^2}{R^3} = \frac{T_2^2}{64R^3} \Rightarrow 64T_1^2 = T_2^2$$

$$T_2 = 8T_1$$

$\vec{S}_0$ -



As distancias tomanse desde o centro dos planetas

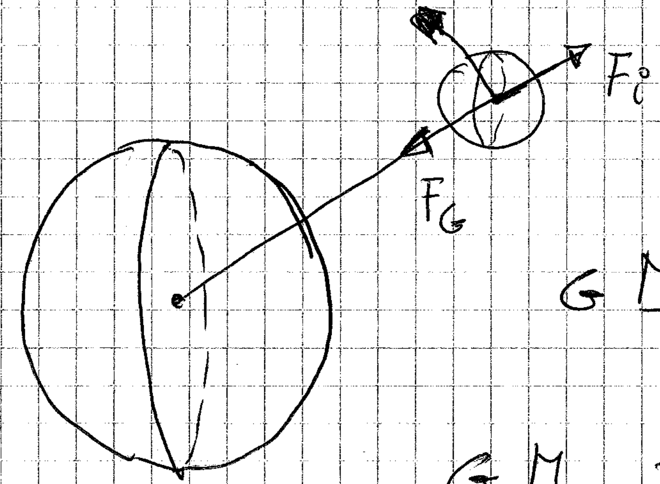
a) o mesmo

6.-

$m_A > m_B$

$r_A < r_B$

a)



$$G\frac{M \cdot m}{r^2} = m\frac{v^2}{r}$$

$$G\frac{M}{r^2} = \frac{v^2}{r} \Rightarrow v^2 = \frac{GM}{r}$$

$$\left.\begin{array}{l} v_A^2 = G\dfrac{M}{r_A} \\ v_B^2 = G\dfrac{M}{r_B} \end{array}\right\} r_A < r_B \Rightarrow v_A^2 > v_B$$

SI

b) $v^2 = \frac{GM}{r}$; $\omega^2 \cdot r^2 = \frac{GM}{r} \Rightarrow \frac{4\pi^2}{T^2} \cdot r^2 = \frac{GM}{r}$

$$\frac{4\pi^2 r^3}{GM} = T^2$$

$$T_A^2 = \frac{4\pi^2 r_A^2}{GM}$$

$$T_B^2 = \frac{4\pi^2 r_B^2}{GM}$$

$r_A < r_B \Rightarrow T_A < T_B$

NON

Páx 4.

c) Enerxía mecánica $E_m = E_c + E_p$

$$E_c = \frac{1}{2} m v^2 \; ; \; E_p = -G\frac{Mm}{r}$$

$$G\frac{M \cdot m}{r^{\cancel{2}}} = \frac{m \cdot v^2}{\cancel{r}}$$

$$E_c = \frac{1}{2} m v^2 = \frac{1}{2} G \frac{M \cdot m}{r}$$

$$E_m = E_c + E_p = \frac{1}{2} G\frac{Mm}{r} + \left(-G\frac{Mm}{r}\right)$$

$$E_m = G\frac{Mm}{r}\left(\frac{1}{2} - 1\right) = -\frac{1}{2} G\frac{M \cdot m}{r}$$

$$(E_m)_A = -\frac{1}{2} G \frac{M m_A}{r_A}$$

$$(E_m)_B = -\frac{1}{2} G \frac{M \cdot m_B}{r_B}$$

NON

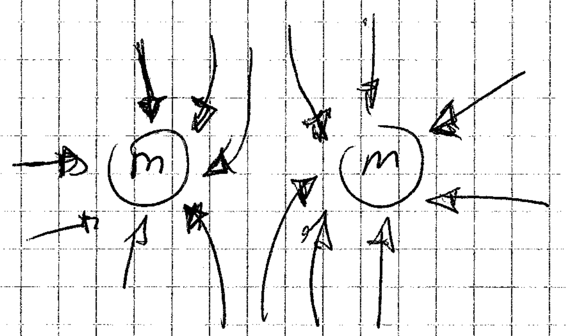
7.-

a) O campo gravitatorio é un campo conservativo, o traballo non depende da traxectoria. Como consecuencia de ser conservativo

$$W = -\Delta E_p$$

FALSA

b) As liñas de campo gravitatorio nunca se poden cortar



O campo solo ten un valor para cada punto do espacio

FALSA.

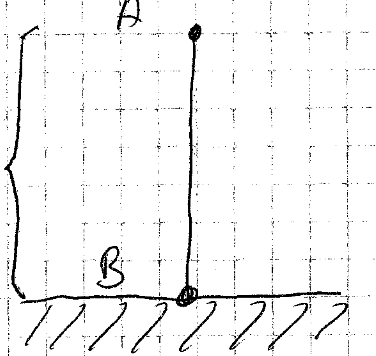
c) En un campo conservativo conservase a enerxía mecánica

$$(E_c)_A = (E_p)_B$$

VERDADEIRA.

8.- O campo gravitatorio é un campo conser-
vativo, polo tanto

$$(E_p)_A = (E_c)_B$$



$$\underbrace{mgh_A = \frac{1}{2} m v_B^2}$$

só válido para alturas cercanas a Terra.

c) As dúas o mesmo tempo

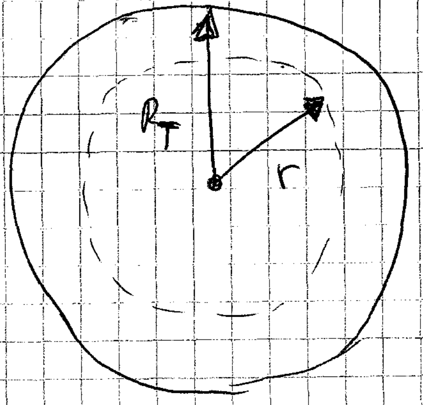
9.- Como varía g coa distancia o centro da Terra o coa altura

$$g = G \frac{M}{r^2}$$

para a superficie da Terra $g_T = G \frac{M_T}{r_T^2}$

tamén $g_0 = G \frac{M_T}{r_T^2}$ (para a Terra)

Cando estamos no interior da Terra a masa non é a masa total da Terra senón moito menor.



$$g = G \frac{\text{masa}}{r^2}$$

masa para radio r ?

$$d = \frac{m}{V}$$

volume dunha esfera $\frac{4}{3}\pi r^3$

$m = \rho V$

↳ densidade da Terra suposta constante

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

$$g = G \rho \frac{\frac{4}{3}\pi r^3}{r^2} \; ; \; g = G \rho \frac{4}{3}\pi r$$

Dentro do interior da Terra g crece coa distancia ó centro

$$g_0 = G \frac{M_T}{R_T^2} \; ; \; M_T = \rho \frac{4}{3}\pi R_T^3$$

$$g_0 = G \rho \frac{4\pi R_T^{\cancel{3}}}{3 \cancel{R_T^2}} \; ; \; g_0 = G\rho \frac{4\pi R_T}{3}$$

$$g = G \rho \frac{4\pi r^3}{3 r^2} \; ; \; g = G\rho \frac{4\pi r}{3}$$

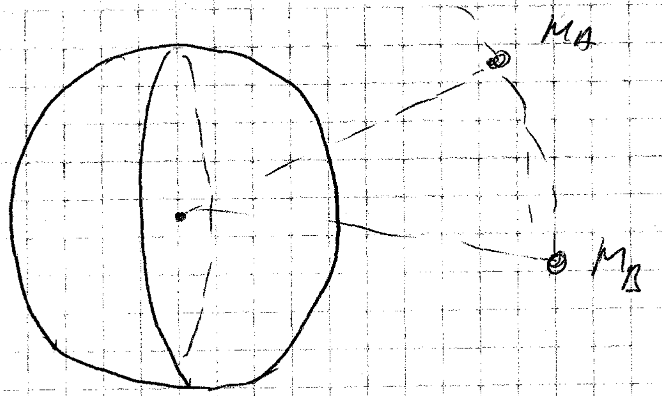
$$G\rho = \frac{3 g_0}{4\pi R_T}$$

$$g = \frac{\cancel{3} g_0}{\cancel{4\pi} R_T} \frac{\cancel{4\pi} r}{\cancel{3}} \; ; \; g = \frac{g_0 r}{R_T}$$

10.-

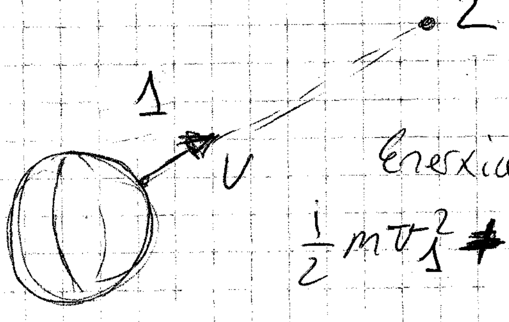
$m_A = 2 m_B$

R



$m_A = 2 m_B$

a) velocidade de escape, o lugar onde xa non son atraídos pola Terra



Enerxia A = Enerxia B

$$\frac{1}{2} m v_1^2 + \left(-G \frac{M \cdot m}{r_1}\right) = 0$$

Enerxia en 2 = 0 porque non ten velocidade para seguirse movendo, non esta sometido a forza de atracción.

$$\frac{1}{2} m v^2 = G \frac{M \cdot m}{r_1} \; ; \; v_1 = \frac{2 G M}{r}$$

non depende da masa. VERDADEIRA

b) periodo de rotación

$$G\frac{Mm}{r^2}=m\frac{v^2}{r} \Longrightarrow G\frac{M}{r^2}=\frac{v^2}{r}$$

$$G\frac{M}{r^2}=\frac{\omega^2 r^{\cancel{2}}}{\cancel{r}} ; \quad G\frac{M}{r^2}=\frac{4\pi^2}{T^2}$$

$$T^2=\frac{4\pi^2 r^2}{GM}$$

o periodo de rotación non depende da masa

FALSO

c) $$E_m=\frac{1}{2}mv^2+\left(-G\frac{Mm}{r}\right)$$

$$E_m=-\frac{1}{2}G\frac{M.m}{r}$$

$$E_{m_1}=-\frac{1}{2}G\frac{M.m_1}{r}$$

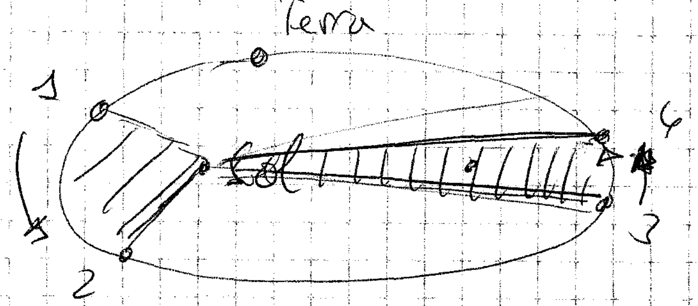
$$E_{m_2}=-\frac{1}{2}G\frac{M.m_2}{r}$$

teñen diferente enerxía mecánica.

11.-

$\vec{p} = m\vec{v}$ momento linear

$\vec{L} = \vec{r} \wedge \vec{p}$ momento angular



Velocidade diferente

$\vec{p} \neq$ constante

$$\frac{d\vec{L}}{dt} = \frac{d\vec{r}}{dt} \wedge \vec{p} + \vec{r} \wedge \frac{d}{dt}\vec{p}$$

$$\frac{d\vec{L}}{dt} = \frac{d\vec{r}}{dt} \wedge m\vec{v} + \vec{r} \wedge m\frac{d\vec{v}}{dt}$$

$$\frac{d\vec{L}}{dt} = \vec{v} \wedge m\vec{v} + \vec{r} \wedge m\vec{a}$$

0 $\qquad\qquad$ $\downarrow$

$\operatorname{sen} 0^\circ = 0$ $\qquad$ $\vec{r} \wedge \vec{F}$

$\downarrow$

forza central a gravitatoria, o vector de posición e a forza teñen a mesma dirección.

$\vec{r} \wedge \vec{F} = 0 \qquad \operatorname{sen} 0^\circ = 0$

$\vec{p} \neq cte$

$L = cte$

c) VERDADEIRA

12.-

$T_1 = 3'66 \; 10^2$ días

$T_2 = 4'32 \; 10^2$ días

$R_1 = 1'49 \cdot 10^{11} m$ $\qquad R_2$?

$$\frac{T^2}{R^3} = cte$$

$$\frac{T_1^2}{R_1^3} = \frac{T_2^2}{R_2^3} \; ;$$

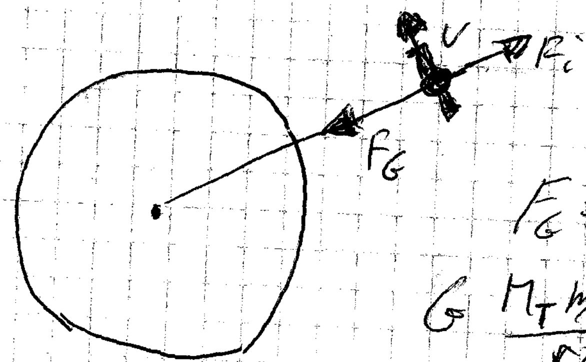
$$R_2^3 = R_1^3 \; \frac{T_2^2}{T_1^2}$$

$$T_2 > T_1 \implies \frac{T_2^2}{T_1^2} > 1.$$

$$R_2 > R_1$$

Cuestión nº 13

Satélite xeoestacionario $T = 24h$



$F_G = F_c$

$$G \frac{M_T \cancel{m}}{r^{\cancel{2}}} = \cancel{m} \frac{v^2}{\cancel{r}}$$

$$G \frac{M_T}{r} = \omega^2 r^2 \Rightarrow G \frac{M_T}{r} = \frac{4\pi^2}{T^2} r^2$$

$$G \frac{M_T T^2}{4\pi^2} = r^3$$

$$r = \left(\frac{T^2 G M_T}{4\pi^2} \right)^{1/3}$$

a) SI

b) en función de g_0

$$g_0 = \frac{G M_T}{r_T^2}$$

$$r = \left(\frac{g_0 r_T^2 T^2}{4\pi^2} \right)^{1/3}$$ NON

r_T en lugar de r_T^2

c) NON

Cuestion nº14.

O radio da orbita dun satelite que xira arredor da Terra é:

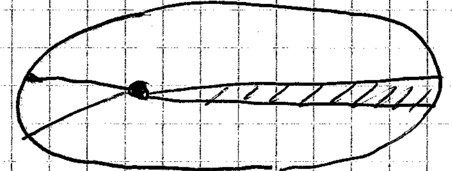
$$F_G = F_c \; ; \; G\frac{M_T m}{r^{\cancel{2}}} = m\frac{v^2}{\cancel{r}} \; ; \; G\frac{M_T \cancel{m}}{r} = \cancel{m}\frac{4\pi^2}{T^2}r^2$$

$$r^3 = \frac{G M_T T^2}{4\pi^2}$$

$$r = \frac{G M_T}{v^2}$$

reduce a súa velocidade o radio aumenta.

Cuestión 15



$$\vec{p} = m\cdot\vec{v}$$

2ª lei de Kepler

O planeta varre areas iguais en tempos iguais

$\vec{v} \neq cte$

$$\vec{L} = \vec{r} \wedge \vec{p} \; ; \; \vec{L} = \vec{r} \wedge m\vec{v}$$

$$\frac{d\vec{L}}{dt} = \frac{d}{dt}(\vec{r} \wedge m\vec{v}) = \frac{d\vec{r}}{dt} \wedge m\vec{v} + \vec{r} \wedge m\frac{d\vec{v}}{dt}$$

$$= \vec{v} \wedge m\vec{v} + \vec{r} \wedge m\vec{a}$$

$\vec{v} \wedge m\vec{v} = |\vec{v}||m\vec{v}| \operatorname{sen} 0^\circ = 0$

$\vec{r} \wedge m\vec{a} = \vec{r} \wedge \vec{F}$

A forza gravitatoria é unha forza central, unha forza o vector de posición e a forza teñen a mesma dirección

$$|\vec{r} \wedge \vec{F}| = |\vec{r}||\vec{F}| \operatorname{sen}\alpha = 0$$

$$\frac{d\vec{L}}{dt} = 0$$

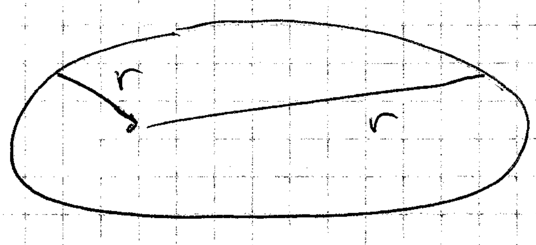
a) $\vec{p} \neq cte$ NON

b) $\vec{L} = cte$ SI

c)

$$E_p = -G\frac{M \cdot m}{r}$$

r varia $\Rightarrow E_p$ varía.



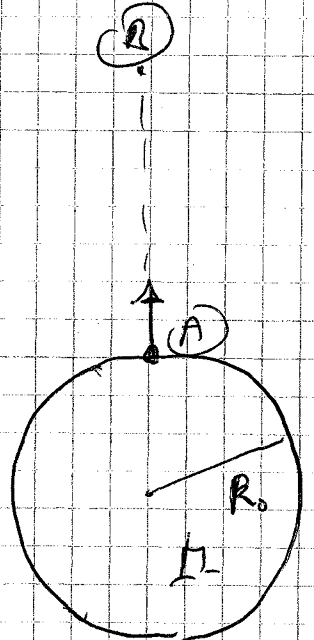
Cuestión nº 16

Forzas centrais $\vec{F}$ e $\vec{r}$ teñen a mesma dirección

$$\frac{d\vec{L}}{dt} = \frac{d(\vec{r} \wedge m\vec{v})}{dt} = \frac{d\vec{r}}{dt} \wedge m\vec{v} + \vec{r} \wedge m\frac{d\vec{v}}{dt}$$

$$= \vec{v} \wedge m\vec{v} + \vec{r} \wedge m\vec{a} = 0$$

Cuestión nº 17.



Enerxía (A) = Enerxía B

$(E_p)_A + (E_c)_A = 0$

$$-G\frac{Mm}{R_0} + \frac{1}{2} m v_A^2 = 0$$

$$G\frac{M}{R_0} = \frac{1}{2} v_A^2$$

$$v_A = \left(2\frac{GM}{R_0}\right)^{1/2}$$

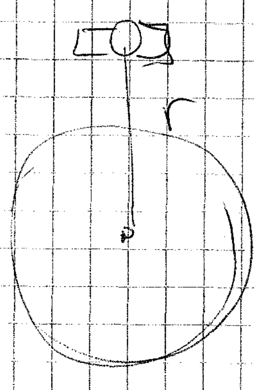
$$g_0 = G\frac{M}{R_0^2}$$

$$v_A = \left(2 g_0 R_0\right)^{1/2}$$

maior o igual $v_A = \left(2\frac{GM}{R_0}\right)^{1/2}$

Cuestión nº 18.

a)



$$g = G\frac{M}{R^2}$$

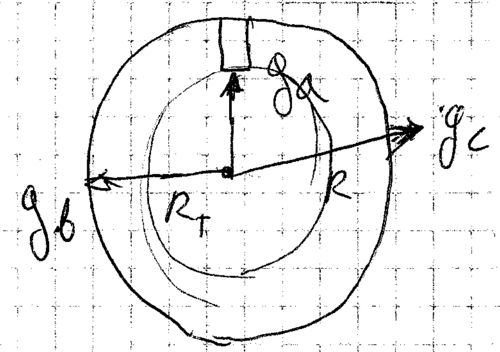
hai gravidade, menor que na terra pero hai gravidade.

FALSA

b) SI HAI ATMÓSFERA, Respiran. FALSA

c) $F_i = F_G$ VERDADEIRA

Cuestión nº 19.-



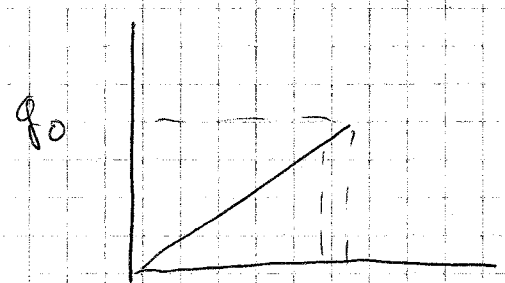
$$g_b = G\frac{M_T}{R_T^2}$$

$$g_c = G\frac{M_T}{(R_T+h)^2}$$

$g_c < g_b$

ga?

$$g_a = G\,\frac{\rho\,\frac{4}{3}\pi r^3}{r^2} = G\rho\,\tfrac{4}{3}\pi r$$

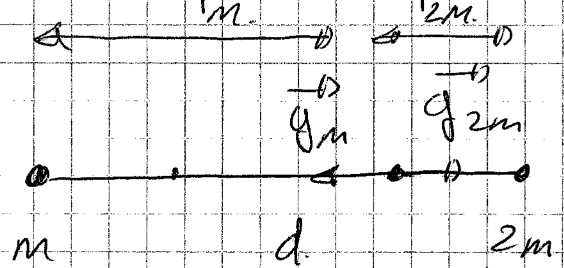


$g_a < g_b$.

NO ECUADOR

Cuestión nº 20

a)

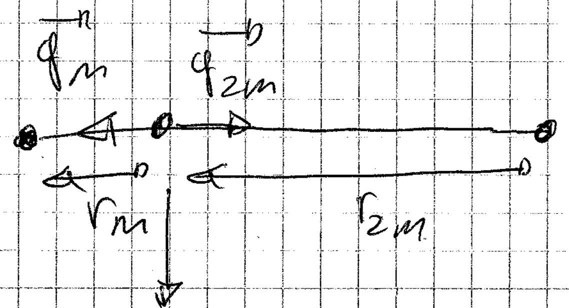


$\vec{g}_m = \vec{g}_{2m}$

$|g_m| = G \dfrac{m}{r_m}$ iguales.

$|g_{2m}| = G \dfrac{2m}{r_{2m}}$

$r_{2m} > r_m$ DEBUXO SUPERIOR MAL!



potencial $-G \dfrac{m m'}{r_m} + \left(- G \dfrac{2m m'}{r_{2m}}\right) = -$ negativo

FALSA

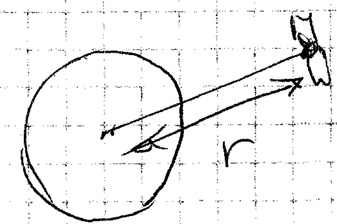
b)

VERDADEIRA

c) O POTENCIAL NUNCA É POSITIVO, PODE SELO A DIFERENCIA ENTRE O POTENCIAL EN DOUS PUNTOS

Cuestión nº 21

a) Non hai gravidade, si HAI, menor que na Terra pero si hai



$$g = G\frac{M_T}{r}$$

c) Non hai atmosfera, si teñen osixeno para respirar

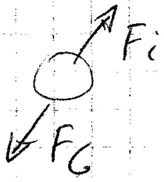
a) VERDADEIRA ¿!

Cuestión nº 22

Enerxia → que enerxia?

↓

A mecanica.



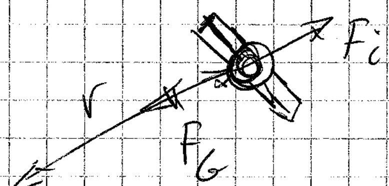
$$G\frac{M_T m}{r^2} = m\frac{v^2}{r}; \quad mv^2 = G\frac{M_T m}{r}$$

$$E_m = -G\frac{Mm}{r^2} + \frac{1}{2}mv^2 = -\frac{1}{2}G\frac{Mm}{r}$$

$$r = -\frac{1}{2}\frac{GMm}{E_m}; \quad r = \left|-\frac{1}{2}\frac{GMm}{E_m}\right|$$

$E_m \downarrow \Rightarrow r \uparrow$
$|E_m| \uparrow \Rightarrow r \downarrow$ mellor } b?

Cuestión nº 23



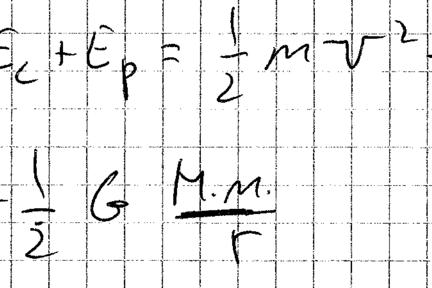
$$G \frac{Mm}{r^2} = m \frac{v^2}{r} \Rightarrow mv^2 =$$

$$E_m = E_c + E_p = \frac{1}{2} m v^2 - G \frac{Mm}{r}$$

$$E_m = -\frac{1}{2} G \frac{M \cdot m}{r}$$

Resposta b

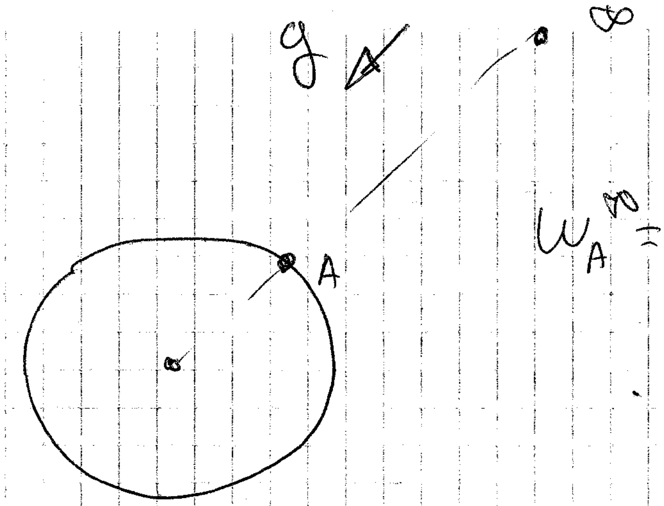
Cuestión nº 24



$$W = -\Delta E_p$$

$$W = -\left[-400 J - (-200 J)\right]$$

$$W = 200 J$$



$W_A^{\infty} = -(E_{p\infty} - E_{pA})$

$\Downarrow$

$E_{pA} = -$

$W_A^{\infty} = -$

CONTRA EL CAMPO.

$W = +$ na dirección do campo

Cuestión nº 25

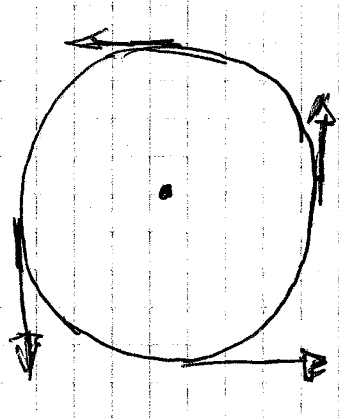
$F = m.a$

$a = \frac{F}{m}$

inversamente proporcional.

Cuestión nº 26.

$|v| = w.r.$

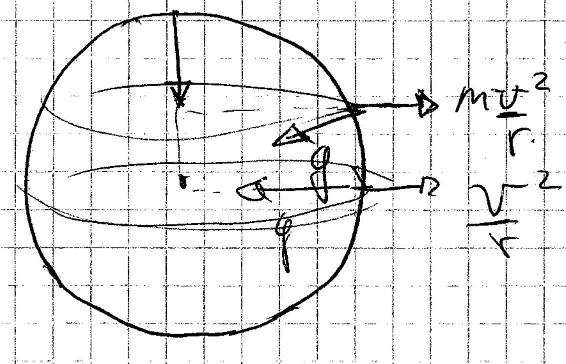


cambia a dirección polo tanto hai aceleración

$\frac{v^2}{r}$

Resposta a)

Cuestión nº27.



g varía coa latitude!

g, onde é máxima?

nos polos

Cuestión nº 28

a) $W = -\Delta E_p$

FORZAS CONSERVATIVAS, NON DEPENDEN DA TRAXECTORIA!!

29.-

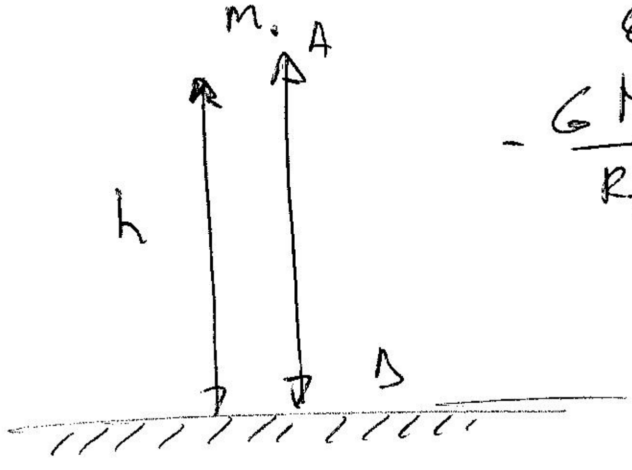
a) Campo gravitacional é un campo conservativo

$$W = -\Delta E_p$$ NON

b) A enerxia conservase, posa de cinetica a potencial, pero non hai perdas nos se considera rozamento.

c) Pode aumentar a enerxia cinética polo tanto NON

30.-



Enerxia Ⓐ = Enerxia B

$$-\frac{GMm}{R_T+h} = -\frac{GMm}{R_T} + \frac{1}{2}mv^2$$

eliminamos m.

$$-\frac{GM}{R_T+h} = -\frac{GM}{R_T} + \frac{1}{2}v^2$$

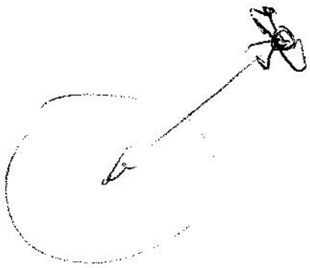
v non depende do valor de m

31.-

$m_A < m_B$

a)

$E_m = E_c + E_p$



$$E_p = -G\frac{M\cdot m}{R} \quad ; \quad E_c = \frac{1}{2} m v^2$$

o rotar en torno a terra, temos:

$$G\frac{M\cancel{m}}{R^{\cancel{2}}} = \cancel{m}\frac{v^2}{\cancel{R}} \Rightarrow v^2 = \frac{GM}{R}$$

$$E_m = -G\frac{Mm}{R} + \frac{1}{2} m \frac{GM}{R} \Rightarrow E_m = -\frac{1}{2}\frac{GMm}{R}$$

aparece m, non teñen a mesma enerxía mecánica

b) $m_A < m_B \Rightarrow \left|(E_m)_A\right| < \left|(E_m)_B\right|$ ← VALOR ABSOLUTO

$$(E_m)_A > (E_m)_B$$ menos negativa

$$\left.\begin{array}{l} E_{pA} = -\dfrac{GMm_A}{R} \\ E_{pB} = -\dfrac{GMm_B}{R} \end{array}\right| \Rightarrow \left|E_{pA}\right| < \left|E_{pB}\right| \Rightarrow (E_p)_A > (E_p)_B$$

↑ VALOR ABSOLUTO

$$(E_c)_A = \frac{1}{2} m v_A^2$$

$$(E_c)_B = \frac{1}{2} m v_B^2$$

$$v_A = v_B$$

$$\Downarrow$$

$$v = \frac{GM}{r} \text{ (apartado a)}$$

$$(E_c)_A < (E_c)_B$$

NON

c) SI, razoamento anterior.

32.-

a)

$$\frac{T^2}{R^3} = cte$$

R dende o centro da Terra.

Na terceira lei de Kepler non aparece la masa. NON

b)

$$T = 2\pi \sqrt{\frac{l}{g}} \qquad g = G \frac{M}{R^2}$$

$$g = \frac{GM}{R^2} \; ; \; g' = \frac{GM}{\frac{R^2}{4}} \Rightarrow g' = \frac{4GM}{R^2}$$

$\hookrightarrow R' = \frac{R}{2}$

$$T' = 2\pi \sqrt{\frac{l}{g'}} \; ; \; T' = 2\pi \sqrt{\frac{l}{\frac{4GM}{R^2}}}$$

$$T = 2\pi \sqrt{\frac{l}{g}} \; ; \; T = 2\pi \sqrt{\frac{l}{\frac{GM}{R^2}}}$$

$$T' = \frac{T}{2}$$

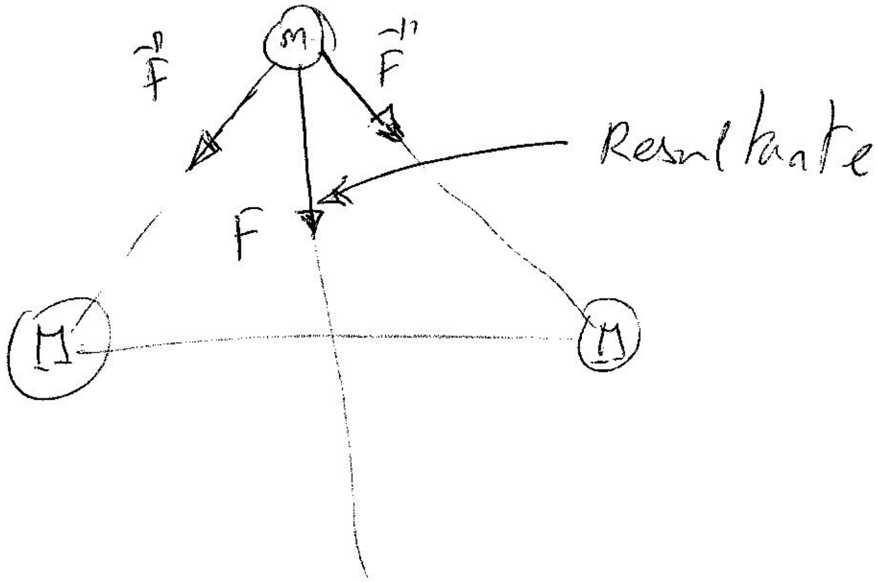
<u>SI</u>

c) Peso $= mg$

$$g = \frac{GM}{R^2} \; ; \; g' = \frac{GM}{\frac{R^2}{4}} \Rightarrow g' = \frac{4GM}{R^2}$$

<u>NON</u>

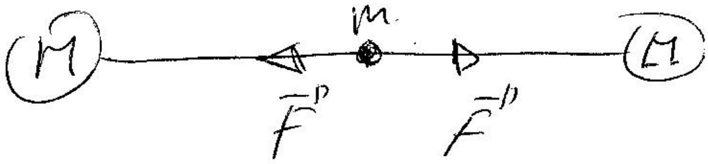
33 -



Si hai fuerza hai aceleración

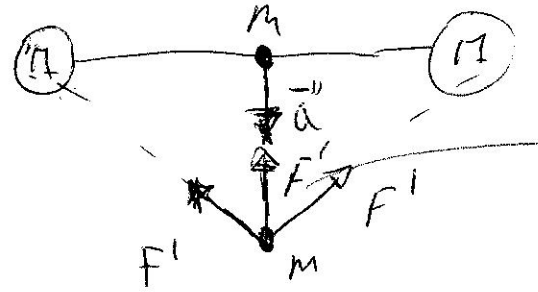
$$\vec{a} = \frac{F}{m}$$

O chegar o punto (0,0)



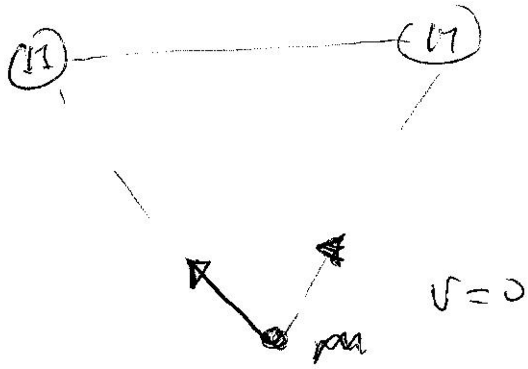
a resultante e cero

Pero leva velocidade, porque estivo sometida a aceleración



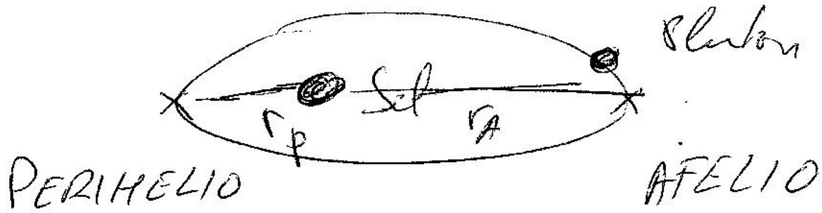
$\rightarrow$ resultante $a' = \frac{F'}{m}$

Como consecuencia de estar na posición da figura está sometido a unha aceleración cara o punto (0,0) que irá restando ca aceleración que tiña no punto (0,0)



parase o movemento e comenza a ir cara o punto (0,0).

34.-



a) Momento angular

$$\vec{L} = \vec{r} \wedge \vec{p}$$

$$\vec{L} = \vec{r} \wedge m\vec{v}$$

$$\frac{d\vec{L}}{dt} = \frac{d(\vec{r} \wedge \vec{p})}{dt} = \frac{d\vec{r}}{dt} \wedge m\vec{v} + \vec{r} \wedge \frac{d(m\vec{v})}{dt}$$

$$= \vec{v} \wedge m\vec{v} + \vec{r} \wedge m\frac{d\vec{v}}{dt} = \vec{v} \wedge m\vec{v} + \vec{r} \wedge m\vec{a}$$

$$|\vec{v} \wedge m\vec{v}| = |\vec{v}|\,|m\vec{v}|\,\text{sen}\,\theta \Rightarrow \text{sen}\,0^\circ = 0$$

$$\vec{r} \wedge m\vec{a} = \vec{r} \wedge \vec{F} \,;\; |\vec{r} \wedge \vec{F}| = |\vec{r}|\,|\vec{F}|\,\text{sen}\,\alpha \,;\; \alpha = 0$$

Forza gravitatoria, forza central. $\vec{F}$ e $\vec{r}$ teñen a mesma dirección.

b)

$$\vec{p} = m\vec{v}$$

$$\vec{v}_A < v_p$$

$$\vec{p}_A < \vec{p}_p$$

NON: FALSA

c)

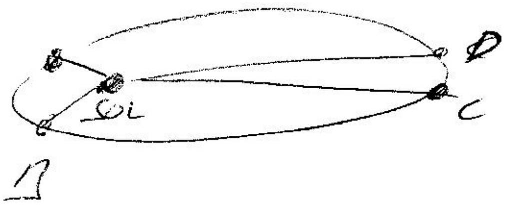
$$U = -G\frac{Mm}{r} \,;\; \begin{cases} U_A = -G\dfrac{Mm}{r_A} \\ U_p = -G\dfrac{Mm}{r_p} \end{cases}$$

$$|U_p| < |U_A| \Rightarrow U_A > U_p$$

VERDADEIRA

35.-

a) $E_c = \frac{1}{2} m v^2$



Varre areas iguais en tempos iguais no punto mais preto do Sol vai mais rapido

$v \neq cte$

$E_c \neq 0$

FALSA

b) $\vec{L} = \vec{r} \wedge \vec{p}$ VERDADEIRA

$\vec{L} = \vec{r} \wedge m\vec{v} \Rightarrow \frac{d\vec{L}}{dt} = 0$

$$\frac{d\vec{L}}{dt} = \frac{d(\vec{r} \wedge m\vec{v})}{dt} = \frac{d\vec{r}}{dt} \wedge m\vec{v} + \vec{r} \wedge m\frac{d\vec{v}}{dt}$$

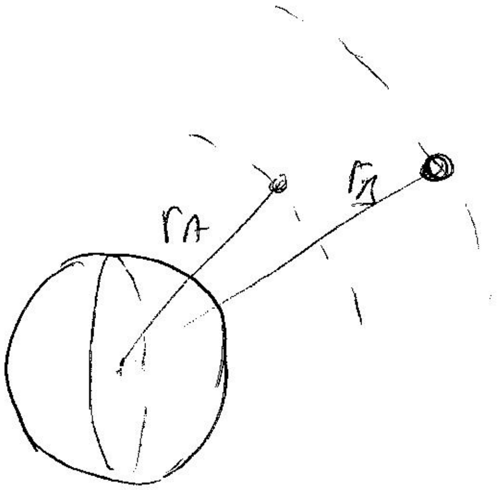
$\vec{v} \wedge m\vec{v} + \vec{r} \wedge \vec{F} = 0 \Rightarrow$ o primeiro termo por ser un producto vectorial e o segundo por ser forças centrais.

c) $\vec{p} = m\vec{v}$

$\vec{v} \neq cte \Rightarrow \vec{p} \neq cte$

FALSA

36.-



a) $E_c = \frac{1}{2} m v^2$

$E_p = -G \frac{Mm}{r}$

o igualar a forza gravitatoria a de inercia

$$G \frac{M\cancel{m}}{r^{\cancel{2}}} = \cancel{m} \frac{v^2}{\cancel{r}}$$

$$E_m = E_c + E_p = -\frac{1}{2} G \frac{Mm}{r}$$

$v_A = \frac{GM}{r_A}$

$v_B = \frac{GM}{r_B}$

$r_A < r_B \quad v_A > v_B$

NON FALSA

b) $(E_p)_B = -\frac{GMm}{r_B}$

$(E_p)_A = -\frac{GMm}{r_A}$

$r_A < r_B \; ; (E_p)_B > (E_p)_A$

VERDADEIRA

c) $E_m = -\frac{1}{2} \frac{GM}{r}$ diferente r_A r_B FALSA

3.7. -

a)

No tramo (1) ten maior velocidade lineal que no (2). Terceira lei de Kepler, o radiovector con eixe no Sol varre areas iguais en tempos iguais.

b) Varre areas iguais en tempos iguais significa ter velocidade areolar constante.

c) $E_c = \frac{1}{2} m v^2$

a velocidade lineal varía o largo da elipse

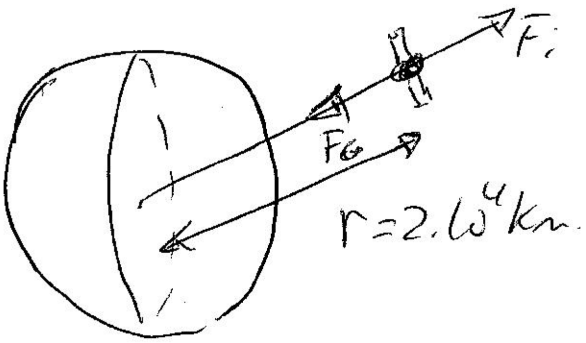
27.-

$m = 500 Kg$

$r = 2.10^4 Km$

a) v? e T? b) E_p e E_m

DATOS: $g_0 = 9'8\ m.s^{-2}$ $R_T = 6370\ Km$



$$F_i = m\frac{v^2}{r} \; ; \; F_G = G\frac{M_T m}{r^2}$$

$$\cancel{m}\frac{v^2}{\cancel{r}} = \frac{G M_T \cancel{m}}{r^{\cancel{2}}} \Rightarrow v^2 = \frac{G M_T}{r}$$

$$g_0 = G\frac{M_T}{R_T^2} \Rightarrow G M_T = g_0 R_T^2$$

$$v^2 = \frac{g_0 R_T^2}{r} \; ; \; v^2 = \frac{9'8 m/s^2 \cdot (6'37\,10^6 m)^2}{2\,10^7 m}$$

$$v = 4'46\,10^3\ m/s$$

$$v = \omega . r \Rightarrow v = \frac{2\pi}{T} . r \Rightarrow T = \frac{2\pi r}{v}$$

$$T = \frac{2.\pi\, 2.10^7 m}{4'46.10^3 m/s} = 2'82\,10^4\ s.$$

b) $E_m = -\frac{1}{2}\frac{GM_Tm}{r}$

$E_p = -G\frac{M_Tm}{r} \Rightarrow E_p = -\frac{g_0 R_T^2 m}{r}$

$E_p = -\frac{9'8\,m/s^2 \cdot (6'37\,10^6 m)^2 \cdot 500\,kg}{2.10^7 m} = -9'94.10^9\,J$

$\Rightarrow E_m$ a metade $-4'97.10^9\,J$

c) $E_m = -\frac{1}{2}G\frac{M_Tm}{r}$

Se perde enerxia non varia G, M_T e m polo tanto o radio diminue

PERDA DE ENERXIA SIGNIFICA SIGNO NEGATIVO

$\Delta E_m = -$

$\Delta E_m = -\frac{1}{2}GM_Tm\left(\frac{1}{r_f} - \frac{1}{r_i}\right)$

$r_f < r_i$ O radio diminue.

$v^2 = \frac{GM_T}{r}$ si diminue o radio v aumenta

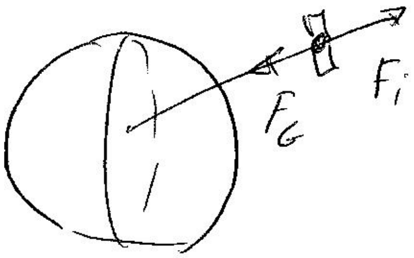
28.-

$m = 200\,Kg$

$h = 600\,Km.$

a) v?   b) T?   c) E_m?

DATOS: $R_T = 6.400\,Km$; $g_0 = 9'8\,m/s^2$



$F_G = F_i$

$$G\frac{M_T \cancel{m}}{r^{\cancel{2}}} = \cancel{m}\frac{v^2}{\cancel{r}}$$

$$v^2 = \frac{GM_T}{r} = \frac{GM_T}{(R_T+h)}$$

$$g_0 = \frac{GM_T}{R_T^2} \Rightarrow g_0 R_T^2 = GM_T$$

$$v^2 = \frac{g_0 R_T^2}{(R_T+h)}$$

b/ T?

$$\omega^2 r^2 = \frac{g \cdot R_T^2}{\underbrace{(R_T+h)}_{r}} \; ; \; \frac{4\pi^2}{T^2} = \frac{g R_T^2}{(R_T+h)^3}$$

$$T^2 = \frac{4\pi^2 (R_T+h)^3}{g \cdot R_T^2} \; ; \; T^2 = \frac{4\pi^2 (7 \cdot 10^6 m)^3}{9'8\frac{m}{s^2} (6'4 \cdot 10^6 m)^2}$$

$T = 5'81\,10^3\,s$

c)
$$E_m = -\frac{1}{2}\frac{G M_T m}{r} = -\frac{1}{2}\frac{g_0 R_T^2 \cdot m}{(R_T+h)}$$

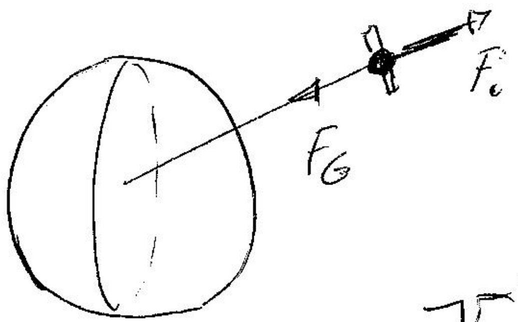
$$E_m = -\frac{1}{2}\frac{9'8\,m/s \cdot (6'4\,10^6\,m)^2 \cdot 200\,Kg}{(7\,10^6\,m)} = -5'73\,10^9\,J$$

29.-

$m = 200\,Kg$ | a) v ? T ? b) E_m ? c) $g_T/g_{SATELITE}$

$h = 650\,Km$

$M_T = 5'98\,10^{24}\,Kg$; $R_T = 6'37\,10^6\,m$; $G = 6'67\,10^{-11}$ $\frac{N \cdot m^2}{Kg^2}$



$$G\frac{M_T \cancel{m}}{r^{\cancel{2}}} = \cancel{m}\frac{v^2}{\cancel{r}}$$

$$v^2 = \frac{G M_T}{r}$$

$$v^2 = \frac{6'67 \cdot 10^{-11}\,N \cdot m^2/Kg^2 \cdot 5'98 \cdot 10^{24}\,Kg}{(6'37 + 0'650) \cdot 10^6\,m} = 5'68 \cdot 10^7\,m^2/s^2$$

$$v = 7'54\,10^3\,m/s$$

$$v = w \cdot r \Rightarrow v = \frac{2\pi}{T} \cdot r \Rightarrow T = \frac{2\pi \cdot r}{v}$$

$$T = \frac{2 \cdot \pi \cdot 7'02 \cdot 10^6\,m}{7'54\,10^3\,m/s} = 5'85\,10^3\,s$$

b)

$$E_M = -\frac{1}{2} G \frac{M_T m}{r}$$

$$E_m = -\frac{1}{2} 6'67 \cdot 10^{-11} \frac{N \cdot m^2}{Kg^2} \cdot \frac{5'98 \cdot 10^{24} Kg \cdot 200 Kg}{7'02 \cdot 10^6 m} = -5'68 \cdot 10^9 J$$

c)

$$g_0 = G \frac{M_T}{R_T^2}$$

$$g_{SATE} = G \frac{M_T}{R_{SATELITE}^2}$$

$$\frac{g_{SATELITE}}{g_0} = \frac{\cancel{G} \frac{M_T}{R_S^2}}{\cancel{G} \frac{M_T}{R_T^2}}$$

$$\frac{g_S}{g_0} = \frac{R_T^2}{R_S^2} ; \quad \frac{g_S}{g_0} = \left(\frac{R_T}{R_S}\right)^2$$

$$\frac{g_S}{g_0} = \left(\frac{6'37}{7'02}\right)^2 ; \quad \frac{g_S}{g_0} = 0'823$$

<u>24 BIS.-</u>

$M_L = 0'012 \, M_T$

$R_L = 0'27 \, R_T$

a) g_L

b) velocidade de escape na Lua

c) $T = 2 s \quad T_L = ? \quad T = 2\pi \sqrt{\frac{l}{g}}$

DATOS $g_{0T} = 9'8 \, m \cdot s^{-2}$; $R_L = 1'7 \cdot 10^6 m$

$$g_T = G \frac{M_T}{R_T^2}$$

$$g_L = G \frac{M_L}{R_L^2}$$

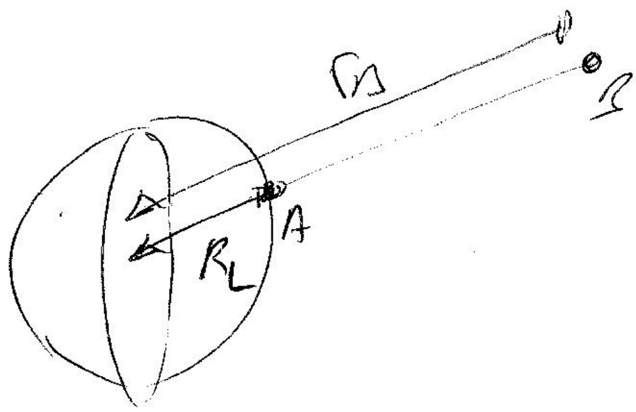
$$\frac{g_L}{g_T} = \frac{R_L^2}{R_T^2}$$

$$\frac{g_L}{g_T} = \frac{G\frac{M_L}{R_L^2}}{G\frac{M_T}{R_T^2}} \Rightarrow \frac{g_L}{g_T} = \frac{M_L \cdot R_T^2}{M_T R_L^2}$$

$$g_L = \frac{M_L R_T^2}{M_T \cdot R_L^2} g_T ; g_L = \frac{0'012 \cancel{M_T} \cdot \cancel{R_T^2}}{\cancel{M_T} (0'27)^2 \cancel{R_T^2}} 9'8 \, m/s^2$$

$$g_L = 1'65 \, 10^{-1} \cdot 9'8 \, m/s^2 = 1'61 \, m/s^2$$

b)



O PUNTO B, É UN PUNTO TAN ALONXADO QUE UN CORPO NON SOFRE NINGUNHA ATRACCIÓN POR PARTE DA LUA.

ENERXÍA (A) = ENERXÍA (B)

$$\frac{1}{2} m v_A^2 + \left(-G \frac{M_L \cdot m}{r_L}\right) = \frac{1}{2} m v_B^2 + \left(-G \frac{M_L m}{r_B}\right)$$

Velocidade de escape

$v_B = 0$ non vai máis lonxe do punto B

$r_B \simeq \infty$ para que non sofra atracción por parte da Lua.

$$\frac{1}{2}\cancel{m}v_A^2 - G\frac{M_L \cancel{m}}{r_L} = 0$$

$$v_A^2 = 2\frac{GM_L}{R_L};$$

$$g_{0T} = \frac{GM_T}{r_T^2} \Rightarrow G = \frac{g_{0T}\, r_T^2}{M_T}$$

$$G = \frac{g_{0T}\left(\frac{R_L}{0'27}\right)^2}{\frac{M_L}{0'012}} = \frac{g_{0T}\, R_L^2 \cdot 0'012}{(0'27)^2 \cdot M_L}$$

$$v_A^2 = 2\,\frac{g_{0T}\, R_L^{\cancel{2}} \cdot 0'012}{(0'27)^2 \cdot \cancel{M_L}} \cdot \frac{\cancel{M_L}}{\cancel{R_L}}$$

$$v_A^2 = \frac{2 \cdot 0'012}{(0'27)^2} \cdot g_{0T} \cdot R_L$$

$$v_A^2 = \frac{2 \cdot 0'012 \cdot 9'8\, m/s^2 \cdot 1'7 \cdot 10^6 m}{(0'27)^2} = 5'48 \cdot 10^6\, m/s$$

$$v_A = 2'34 \cdot 10^3\, m/s$$

c) $T = 2\pi\sqrt{\frac{l}{g}}$; $T_T = 2\pi\sqrt{\frac{l}{g_T}}$; $T_L = 2\pi\sqrt{\frac{l}{g_L}}$

$$\frac{T_L}{T_T} = \frac{2\pi\sqrt{\frac{l}{g_L}}}{2\pi\sqrt{\frac{l}{g_T}}}; \quad \frac{T_L}{T_T} = \sqrt{\frac{g_T}{g_L}}$$

$$T_L = T_T \sqrt{\frac{g_T}{g_L}} \; ; \; T_L = 2s \sqrt{\frac{9'8 \, m/s^2}{1'61 \, m/s^2}}$$

$$T_L = 4'93 \, s$$

30.-

$m = 1 \cdot 10^3 \, Kg$

$r = 2 R_T$

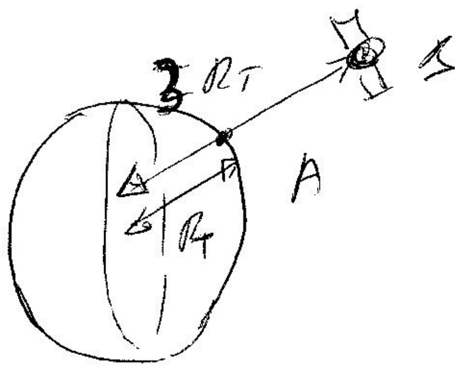
a) Enerxia $\Rightarrow E_c$?

b) F_c (forza centripeta

T ?

DATOS: $g_0 = 9'8 \, m/s^2$; $R_T = 6.370 \, Km$

$h = 2 R_T$



Enerxia A = Enerxia B.

$$\frac{1}{2} m v_A^2 + \left(- G \frac{Mm}{r_T}\right) = \frac{1}{2} m v_B^2 + \left(- G \frac{Mm}{3 r_T}\right)$$

$v_B = 0$ non se despraza máis lonxe.

$$(E_c)_A = G \frac{Mm}{r_T} - \frac{GMm}{3 r_T}$$

$$T_L = T_T \sqrt{\frac{g_T}{g_L}} \; ; \; T_L = 2\,s \sqrt{\frac{9'81\,m/s^2}{1'61\,m/s^2}}$$

$$T_L = 4'93\ s$$

30.-

$m = 10^3\,Kg$

$h = 2\,R_T$

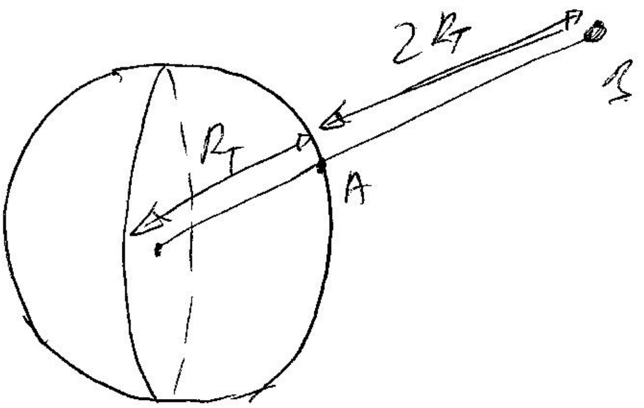
$r = 3\,R_T$

a) Enerxía $\Rightarrow E_c$

b) $F_i \Rightarrow$ Forza centrípeta

c) T ?

DATOS: $g_0 = 9'8\ m.s^{-2}$; $R_T = 6.370\ Km.$



Enerxía A = Enerxía 1

$$\frac{1}{2} m v_A^2 - G\frac{M_T\, m}{r_T} = \frac{1}{2} m \cancel{v_B}^2 - \frac{G M_T m}{3 r_T}$$

$v_1 = 0$ non se desplaza máis lonxe

$$\frac{1}{2} m v_A^2 = \frac{G M_T m}{r_T} - \frac{G M_T m}{3 R_T}$$

$$(E_c)_A = \frac{G M_T m}{R_T}\left(1 - \frac{1}{3}\right) = \frac{2}{3}\,\frac{G M_T m}{r_T}$$

$$g_0 = \frac{G M_T}{R_T^2} \Rightarrow G M_T = g_0 R_T^2$$

$$(E_c)_A = \frac{2}{3}\ \frac{g_0 R_T^{\cancel{2}} m}{\cancel{R_T}} = \frac{2 \cdot 9'8\,m/s^2\ 6'37 \cdot 10^6\,m \cdot 10^3\,Kg}{3}$$

$$(E_c)_A = 4'16 \cdot 10^{10}\ J$$

UNIDADES

$$Kg\ \frac{m^2}{s^2} \Rightarrow Kg\ \frac{m}{s^2} \cdot m = N \cdot m = J$$

b)

$$F_c = m\frac{v^2}{r}$$

$$F_G = F_c\ ;\quad m\frac{v^2}{r} = \frac{G\,M_T \cdot m}{r^2}$$

$$F_c = \frac{G\,M_T m}{r^2}\ ;\quad F_c = \frac{g_0 R_T^2\, m}{(3R_T)^2}\ ;$$

$$F_c = \frac{g_0 \cancel{R_T^2}\, m}{9\cancel{R_T^2}} = \frac{g_0\, m}{9} = \frac{9'8\,m/s^2 \cdot 10^3\,Kg}{9}$$

$$F_c = 1'09 \cdot 10^3\,N$$

c)

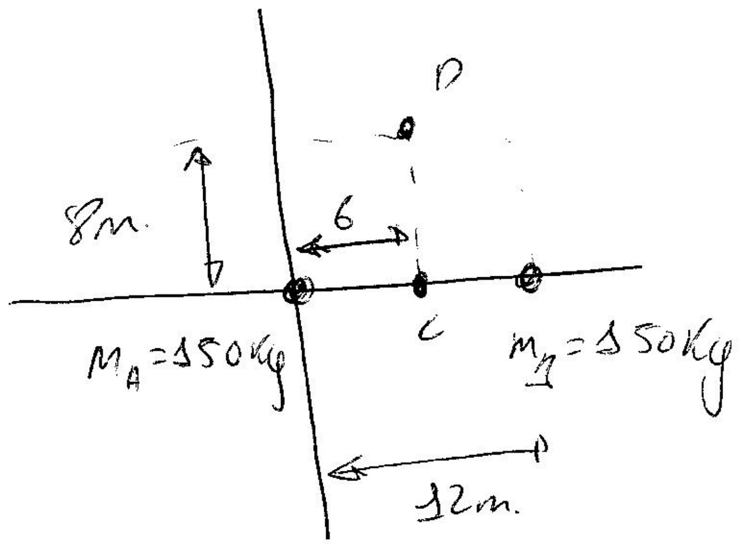
$$\cancel{m}\frac{v^2}{\cancel{r}} = \frac{G\,M_T\,\cancel{m}}{r^{\cancel{2}}}\ ;\quad v^2 = \frac{G\,M_T}{r}$$

$$\frac{4\pi^2}{T^2} \cdot r^2 = \frac{G\,M_T}{r} \Rightarrow T^2 = \frac{4\pi^2 r^3}{G\,M_T}$$

$$T^2 = \frac{4\pi^2 (3R_T)^3}{g_0 R_T^2}\ ;\quad T^2 = \frac{4\pi^2 \cdot 27\, R_T^{\cancel{3}}}{g_0 \cancel{R_T^2}}$$

$$T^2 = \frac{4\pi^2 \cdot 27 \cdot 6'37 \cdot 10^6\,m}{9'8\,\frac{m}{s^2}}\ ;\quad T^2 = 6'93 \cdot 10^8\,s^2\ ;\quad \underline{\underline{T = 2'63 \cdot 10^4\,s}}$$

31 -



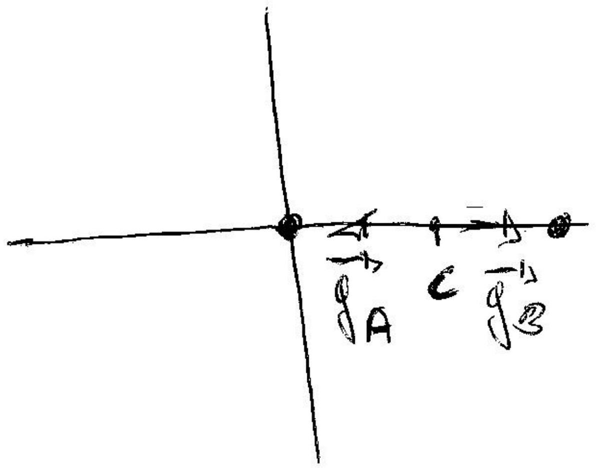
a) $\vec{g}_C$

$\vec{g}_D$

b) $V_D = -10^{-4}\,\vec{j}$ m/s $\quad V_C$?

c) movemento entre C → D
M.R.U.A ou do outro tipo

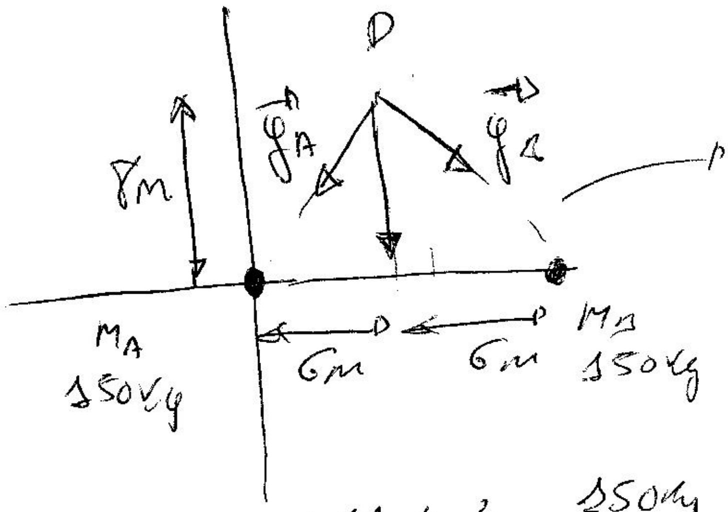
a)



$|\vec{g}_A| = |\vec{g}_B| \Rightarrow$ sentidos opostos

campo gravitatorio en C $\underline{\underline{0}}$

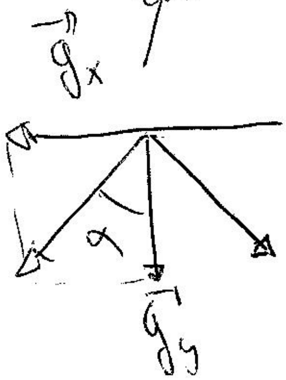
→ faces a partir do 27



$d^2 = (6m)^2 + 8m^2$

$d^2 = 100\ m^2$

$$|\vec{g}_A| = 6'67 \cdot 10^{-11} \frac{N \cdot m^2}{Kg^2} \cdot \frac{150 Kg}{100\ m^2} = 1 \cdot 10^{-10} \frac{N}{Kg}$$



$$\operatorname{sen} \alpha = \frac{\vec{g}_x}{|\vec{g}|}$$

$$\cos \alpha = \frac{\vec{g}_y}{|\vec{g}|}$$

$$\vec{g}_x = |\vec{g}| \cdot 0'6 = 6 \cdot 10^{-11}\ N/Kg$$

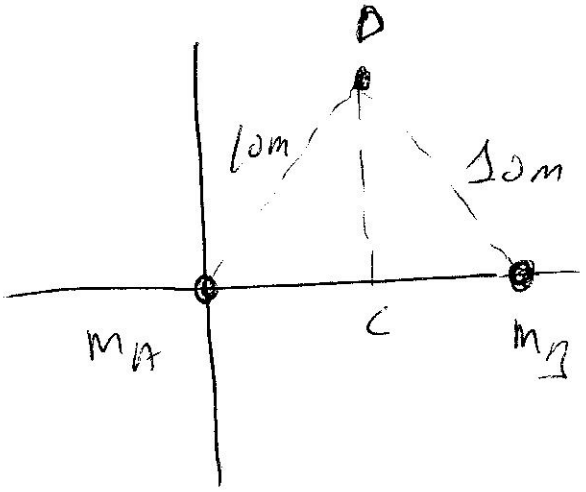
$$\vec{g}_y = |\vec{g}| \cdot 0'8 = 8 \cdot 10^{-11} \frac{N}{Kg}$$

$$\vec{g}_A = -6 \cdot 10^{-11}\ \vec{i} - 8 \cdot 10^{-11}\ \vec{j}\ (N/Kg)$$

$$\vec{g}_A = 6 \cdot 10^{-11}\ \vec{i} - 8 \cdot 10^{-11}\ \vec{j}\ (N/Kg)$$

$$\vec{g}_T = -1'6 \cdot 10^{-10}\ \vec{j}\ (N/Kg)$$

V_D



$V = -\frac{GM}{r}$ en D crean potencial gravitatorio A e B.

$$V_D = -\frac{G M_A}{r} + \left(-\frac{G M_B}{r}\right) = -2\frac{GM}{r}$$

$$V_D = -\frac{2 \cdot 6'67 \cdot 10^{-11} N \cdot m^2/Kg^2 \cdot 150 Kg}{10 m} = -2 \cdot 10^{-9} J/Kg$$

$$V_C = \frac{-2 G M_A}{r'} + \left(-\frac{G M_B}{r'}\right) = -2\frac{GM}{r'}$$

$$V_C = -\frac{2 \cdot 6'67 \cdot 10^{-11} N \cdot m^2/Kg^2 \cdot 150 Kg}{6m} = -3'34 \cdot 10^{-9} J/Kg$$

b) Enerxia D = Enerxia C

$$\frac{1}{2} m v_D^2 + (E_p)_D = \frac{1}{2} m v_C^2 + (E_p)_C$$

$$E_p = V \cdot m$$

$$\frac{1}{2} m v_D^2 + V_D m = \frac{1}{2} m v_C^2 + V_C \cdot m \Rightarrow \frac{1}{2} v_D^2 + V_D = \frac{1}{2} v_C^2 + V_C$$

velocidade

potencial

$$v_c^2 = v_D^2 + 2(V_D - V_c)$$

$$v_c^2 = \left(1 \cdot 10^{-4} m/s\right)^2 + 2\left(-2 \cdot 10^{-9} J/kg - \left(-3'34 \cdot 10^{-9} J/kg\right)\right)$$

$$v_c^2 = 1 \cdot 10^{-8} \frac{m^2}{s^2} + 2'68 \cdot 10^{-9} \frac{m^2}{s^2}$$

$$v_c^2 = 1'27 \cdot 10^{-8} \frac{m^2}{s^2} \Rightarrow v_c = 1'13 \cdot 10^{-4} m/s$$

c) Rectilineo si, uniformemente acelerado non porque a aceleración varia