1.- $W = -\Delta E_p$

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

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

a) VERDADEIRA

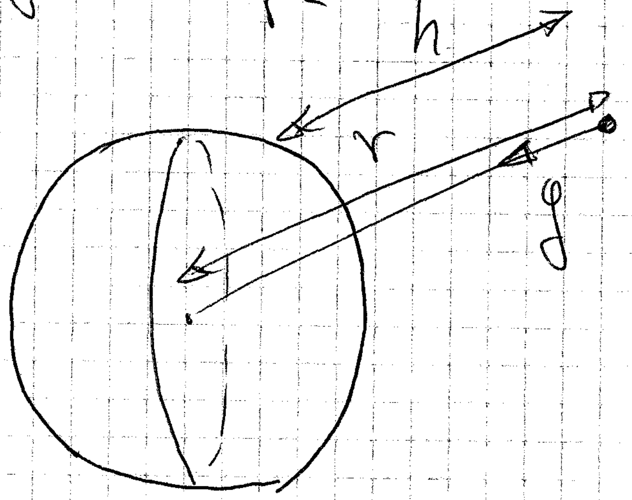
2.-

$$Peso = m \cdot g$$

$\downarrow$

campo gravitatorio

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



r aumenta $\Rightarrow$ g diminue

h aumenta $\Rightarrow$ P diminue

3.-

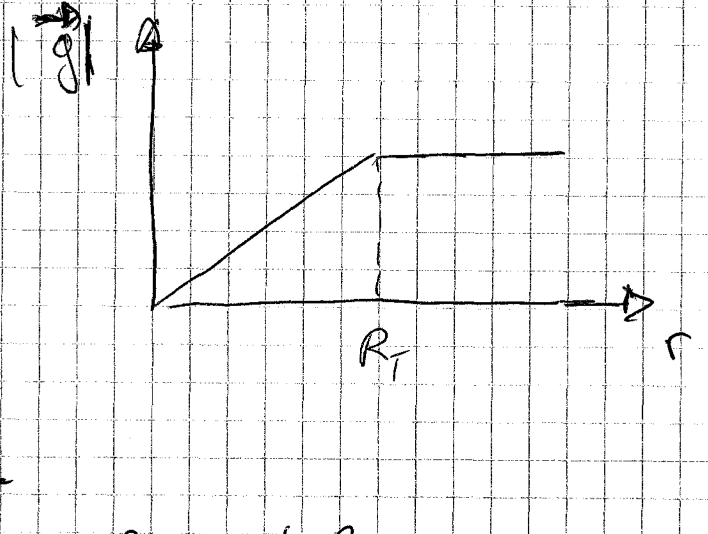
$$|\vec{g}| = G\frac{M}{r^2} \Rightarrow \rho = \frac{M}{V}$$ ← masa da Terra, ← volume da Terra

densidade

$M =$

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

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



4.-

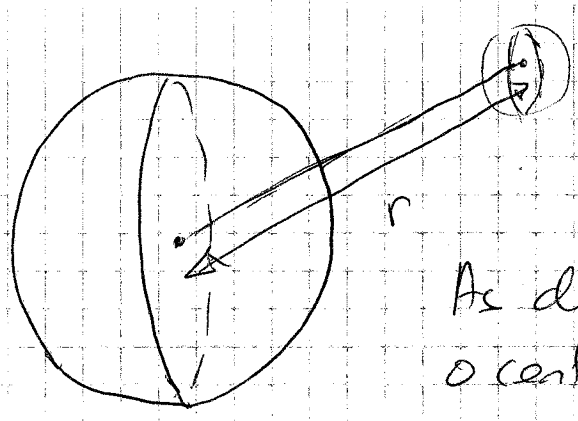
R e 4R

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

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

$$T_2 = 8T_1$$

$\vec{5}.$ -



As distancias tómanse desde o centro dos planetas

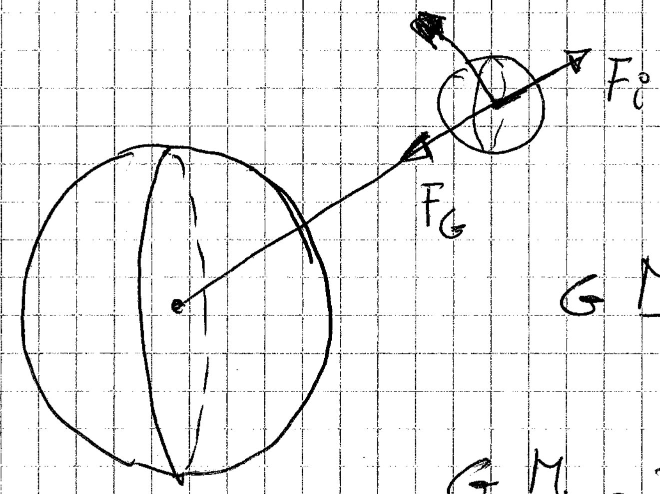
a) o mesmo

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

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

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

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

$r_A < r_B \Rightarrow T_A < T_B$

NON

Páx 4.

c) Enerxía mecánica $E_m = E_c + E_p$

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

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

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

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

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

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

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

NON

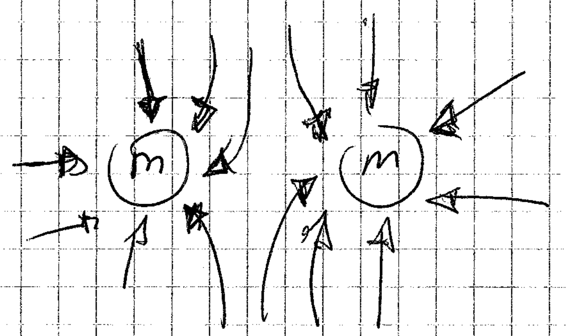
7.-

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

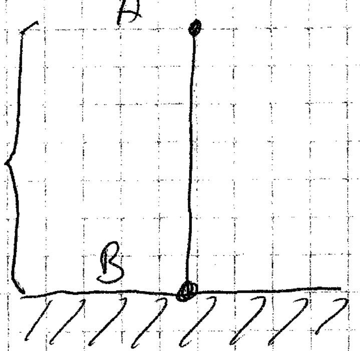
$$(E_c)_A = (E_p)_B$$

VERDADEIRA.

8.- O campo gravitatorio é un campo conservativo, polo tanto

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

A



B

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

so válido para alturas cercanas a Terra.

c) As dúas o mesmo tempo

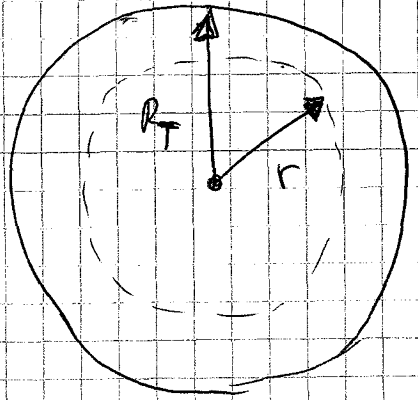
9.- Como varía g coa distancia ó centro da Terra o coa altura

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

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 senon 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

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

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

Dentro do interior da Terra g crece coa distancia o centro

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

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

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

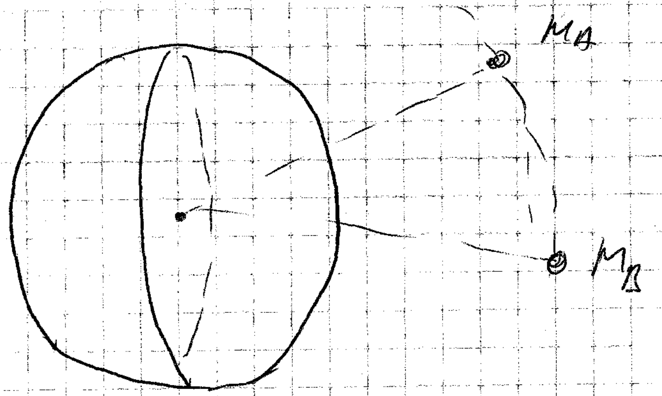
$$G\rho = \frac{3 g_0}{4\pi R_T}$$

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

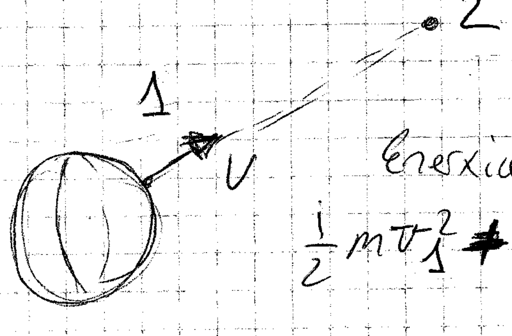
10.-

$M_A = 2M_B$

R



a) velocidade de escape, o lugar onde xa non son atraidos 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 3 = 0 porque non ten velocidade para seguirse movendo, non esta sometido a forza de atracción.

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

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)

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

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

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

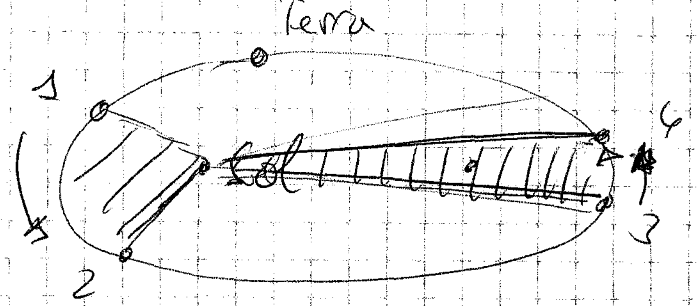
$$E_{m_2} = -\frac{1}{2}G\frac{M.m_2}{r}$$

teñen diferente enerxía mecánica.

11.-

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

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

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

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

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

$\vec{p} \neq cte$

$L = cte$

c) VERDADEIRA

12.-

$T_1 = 3'66\ 10^2$ días

$T_2 = 4'32\ 10^2$ días

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

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

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

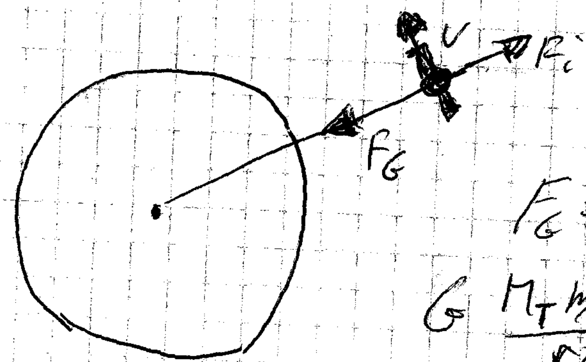
$$R_2^3 = R_1^3\ \frac{T_2^2}{T_1^2}$$

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

$$R_2 > R_1$$

Cuestión nº 13

Satelite 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 nº 14.

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

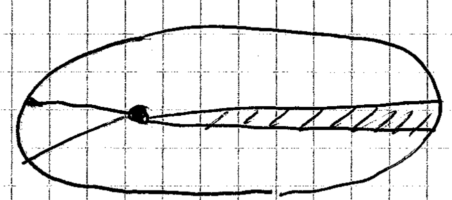
$$F_G = F_c \; ; \; G\frac{M_T m}{r^{\cancel{2}}} = m\frac{v^2}{\cancel{r}} \; ; \; G\frac{M_T \cancel{m}}{r} = \cancel{m}\frac{4\pi^2}{T^2}r^2$$

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

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

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

$\vec{v} \neq cte$

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

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

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

$\vec{v} \wedge m\vec{v} = |\vec{v}||m\vec{v}|\, \text{seno}\, 0^\circ = 0$

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

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

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

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

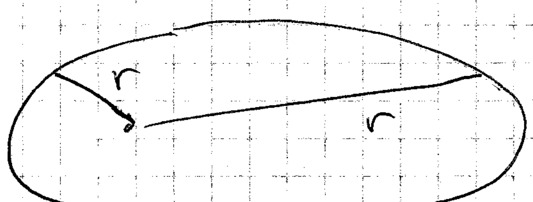
a) $\vec{p} \neq cte$ NON

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

c)

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

r varía $\Rightarrow$ E_p varía.



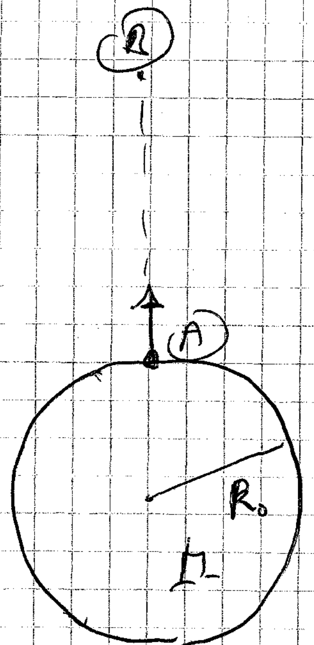
Cuestión nº 16

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

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

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

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

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

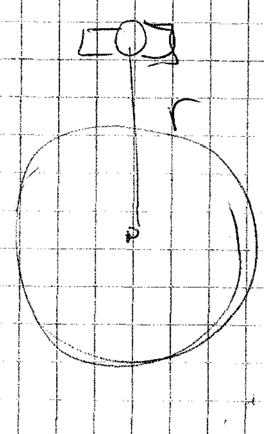
$$g_0 = G\frac{M}{R_0^2}$$

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

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

Cuestión nº 18.

a)



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

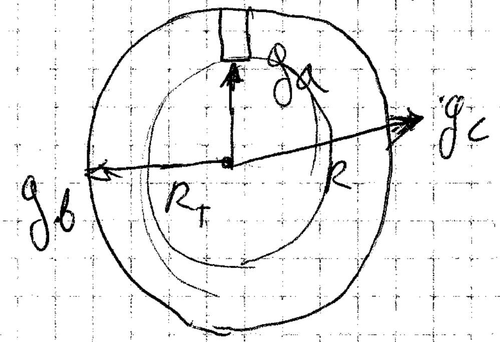
hai gravidade, menor que na terra pero hai gravidade.

FALSA

b) SI HAI ATMÓSFERA, Respiran. FALSA

c) $F_i = F_G$ VERDADEIRA

Cuestión nº 19.-



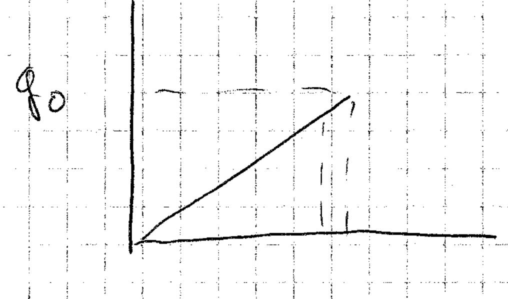
$$g_b = G\frac{M_T}{R_T^2}$$

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

$\left.\right\}$ $g_c < g_b$

g_a ?

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

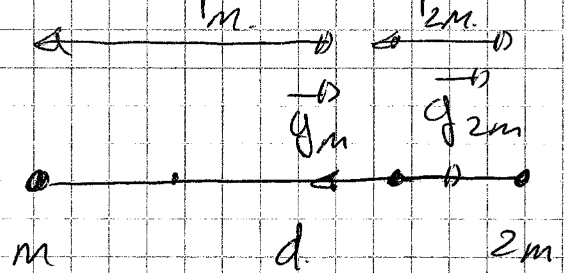


$g_a < g_b$.

NO ECUADOR

Cuestión nº 20

a)

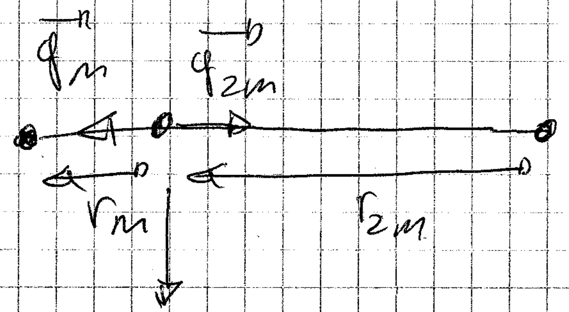


$\vec{g}_m = \vec{g}_{2m}$

$$\left.\begin{array}{l} |g_m| = G \dfrac{m}{r_m} \\ |g_{2m}| = G \dfrac{2m}{r_{2m}} \end{array}\right| \text{ iguales}$$

DEBUXO SUPERIOR MAL!

$r_{2m} > r_m$



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

negativo

FALSA

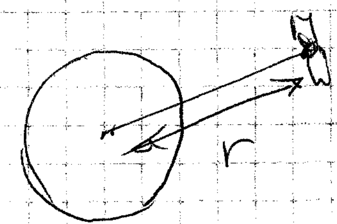
b)

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



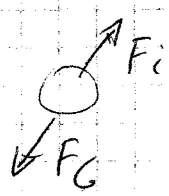
$$g = G\frac{M_T}{r}$$

c) Non hai atmosfera, si teñen osixeno para respirar

a) VERDADEIRA ¿!

Cuestión nº 22

Enerxia → que enerxia?
↓
A mecanica.



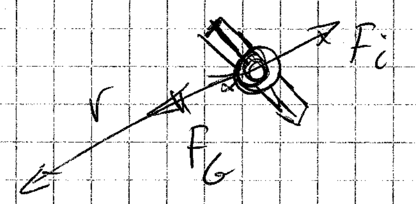
$$G\frac{M_T m}{r^2} = m\frac{v^2}{r} ; \quad mv^2 = G\frac{M_T m}{r}$$

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

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

$$E_m \downarrow \Rightarrow r \uparrow$$
$$|E_m| \uparrow \Rightarrow r \downarrow \quad \underline{\text{mellor}}$$
$\Big\}$ b?

Cuestión nº 23



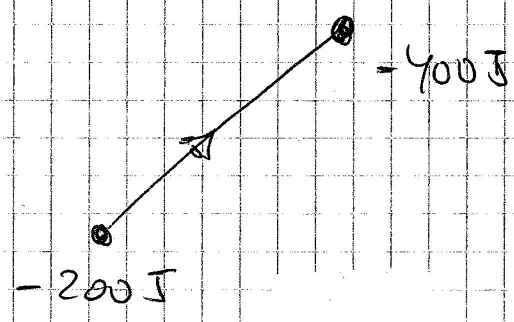
$$G \frac{Mm}{r^2} = m \frac{v^2}{r} \Rightarrow mv^2 =$$

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

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

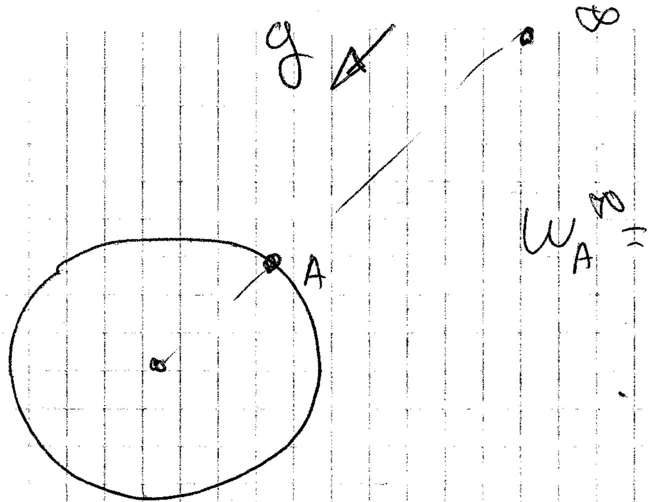
Resposta b

Cuestión nº 24



$$W = -\Delta E_p$$
$$W = -[-400\,J - (-200\,J)]$$

$$W = 200\,J$$



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

$\Downarrow$

$E_{pA} = -$

$W_A^{\infty} = -$

CONTRA EL CAMPO.

$W. = +$ na dirección do campo

Cuestión nº 25

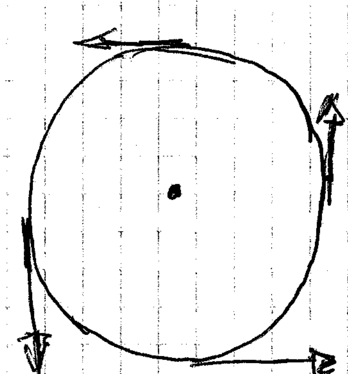
$F = m.a$

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

inversamente proporcional.

Cuestión nº 26.

$|v| = w.r.$

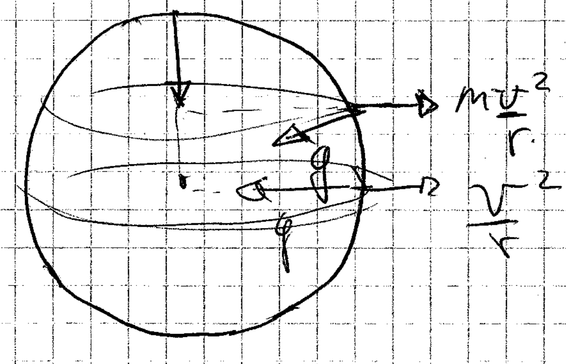


cambia a dirección polo tanto hai aceleración

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

Resposta a)

Cuestión nº27.



g varia coa latitude!

g, onde é máxima?

nos polos

Cuestión nº 28

a) $W = -\Delta E_p$

FORZAS CONSERVATIVAS, NON DEPENDEN DA TRAXECTORIA!!

29.-

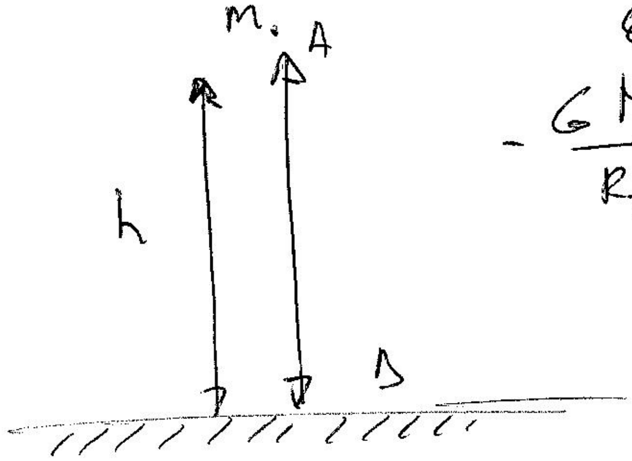
a) Campo gravitacional é un campo conservativo

$$W = -\Delta E_p \qquad \underline{\underline{NON}}$$

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

c) Pode aumentar a enerxia cinética polo tanto $\underline{\underline{NON}}$

30.-



Enerxia Ⓐ = Enerxia B

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

eliminamos m.

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

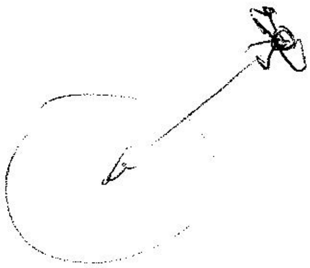
v non depende do valor de m

31.-

$m_A < m_B$

a)

$$E_m = E_c + E_p$$



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

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

$$E_{pA} = -\frac{GMm_A}{R} \qquad E_{pB} = -\frac{GMm_B}{R}$$

$$\Rightarrow |E_{pA}| < |E_{pB}| \Rightarrow (E_p)_A > (E_p)_B$$

VALOR ABSOLUTO

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

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

$v_A = v_B$

$\Downarrow$

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

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

NON

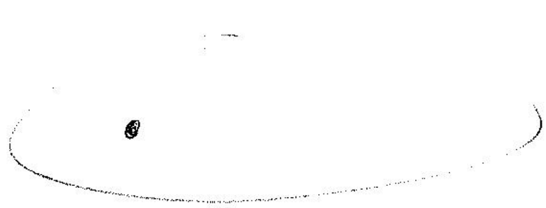
c)

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)

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

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

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

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

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

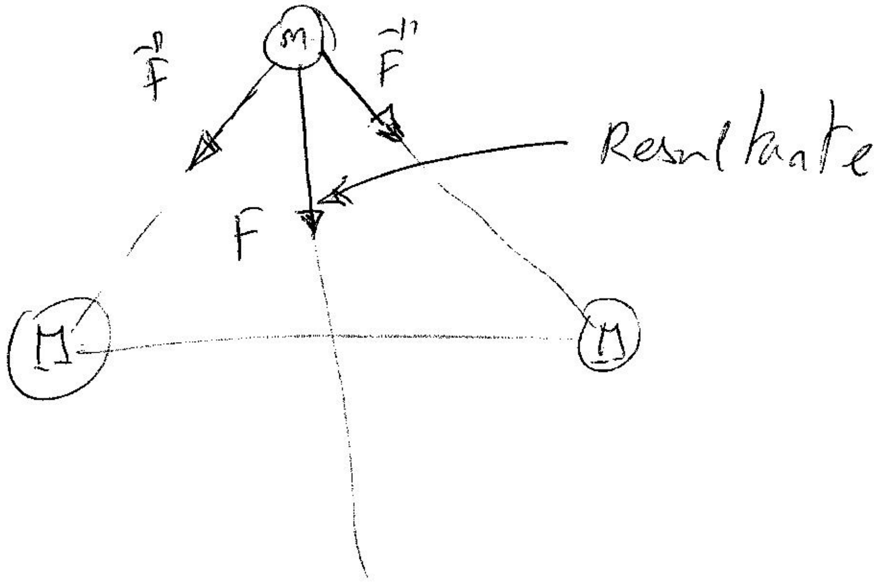
$$T' = \frac{T}{2} \quad \underline{\underline{SI}}$$

c) Peso $= m g$

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

<u>NOW</u>

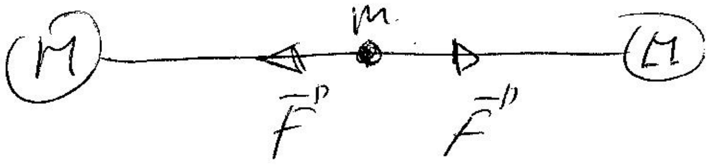
33 -



Si hai fuerza hai aceleración

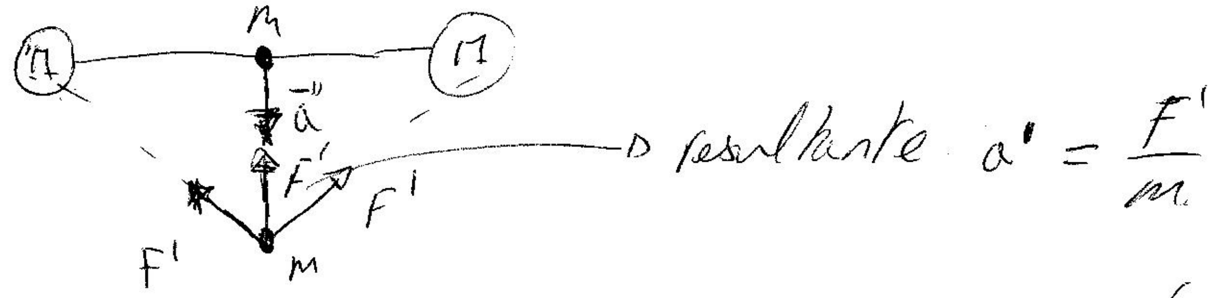
$$\vec{a} = \frac{F}{m}$$

O chegar o punto (0,0)

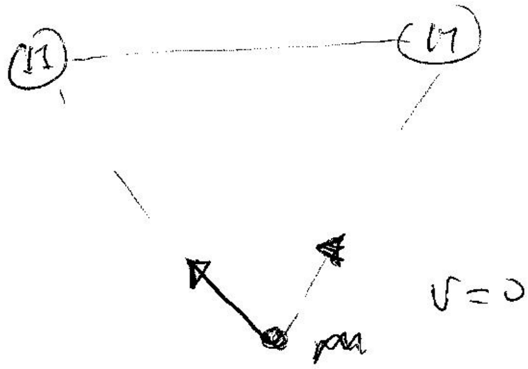


a resultante e cero

Pero leva velocidade, porque estivo sometida a aceleración

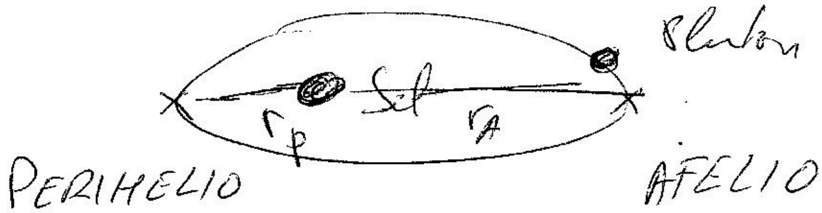


como consecuencia de estar na posición da figura esta sometido a unha aceleración cara o punto (0,0) que ira restando ca aceleración que tiña no punto (0,0)



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)

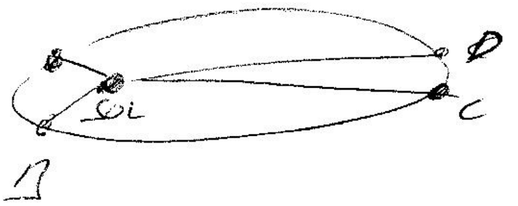
$$U = -G\frac{Mm}{r}\ ; \quad U_A = -G\frac{Mm}{r_A} \qquad U_p = -G\frac{Mm}{r_p}$$

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

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

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

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

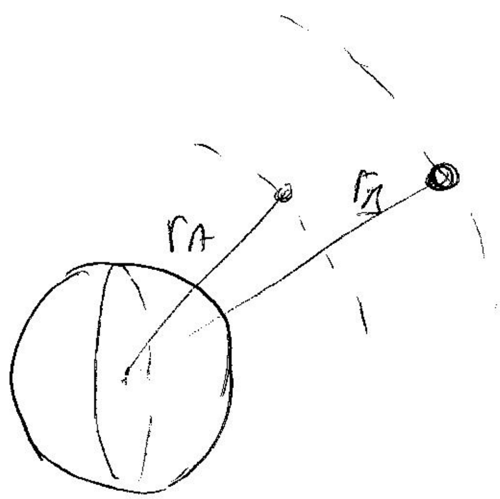
$\vec{v} \wedge m\vec{v} + \vec{r} \wedge \vec{F} = 0 \Rightarrow$ o primeiro termo por ser un producto vectorial e o segundo por ser forzas centrais.

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

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

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

$v_A = \frac{GM}{r_A}$ | $r_A < r_B$ $\quad v_A > v_B$

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

NON FALSA

b) $(E_p)_B = - G \frac{Mm}{r_B}$ | $r_A < r_B$; $(E_p)_B > (E_p)_A$

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

VERDEDIRA

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

3.7. -

a) 

No ramo (1) tem maior velocidade linear que no (2). Terceira lei de Kepler, o radiovector com eixe no Sol varre areas iguais em tempos iguais.

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

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

a velocidade linear varia o largo da elipse