•

-1

-

-

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

$\vec{F}_{B/A}$ B $\vec{F}_{A/B}$ B A

-2

( ) -

226 -

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-1

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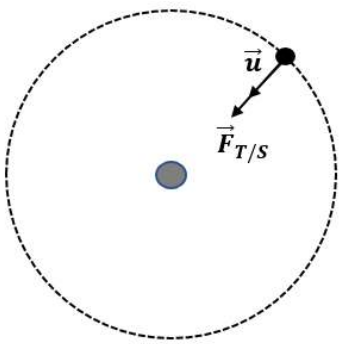
-

$T = \frac{2\pi r}{v}$ -2

$a_N = \frac{v^2}{r}$ -3

$F = G\frac{Mm}{r^2}$ -4

-5



$\sum \vec{F} = m\vec{a} \Longrightarrow \vec{F}_{T/S} = m\vec{a} \Longrightarrow G\frac{Mm}{r^2}\vec{u} = m\vec{a}$

$\Longrightarrow \vec{a} = \frac{GM}{r^2}\vec{u}$

-6

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$$\sum \vec{F} = m\vec{a} \implies \vec{F}_{T/S} = m\vec{a}$$

$$F_{T/S} = ma_N \implies G\frac{Mm}{r^2} = m\frac{v^2}{r} \implies v^2 = \frac{GM}{r} \implies v = \sqrt{\frac{GM}{r}}$$

-7

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

-8

h -

$$g = a = \frac{GM}{r^2} = \frac{GM}{(R_T + h)^2}$$

$h = 0$ -

$$g_0 = \frac{GM}{{R_T}^2}$$

g_0 g -

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

-9

-

-

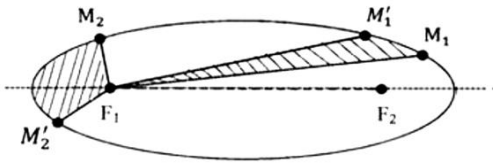
-

-10

-

-

-



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

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2009 1

(R) (h) (m_s)

1

2

R h M_T (G) (v^2) 3

(v) (h) 4

5

T≃24h

R = 6400 km ; $m_s = 2\times10^3$ kg ; $M_T = 5{,}97\times10^{24}$ kg ; $G = 6{,}67\times10^{-11}$ $Nm^2.kg^{-2}$

GPS (Giove-A)

m = 700 kg (Giove-A)

h = $23{,}6\times10^3$ km (O) (Giove-A)

1

(Giove-A) 2

(Giove-A) 3

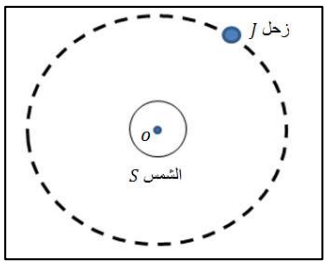
(Giove-A) T 4

(Giove-A) 5

$M_T = 5{,}98\times10^{24}$ kg G = $6{,}67\times10^{-11}$ SI

$R_T = 6{,}38\times10^3$ km

2008 3



	$M_s = 2\times10^{30}kg$
	$r = 7.8\times10^{8}km$
	$G = 6.67\times10^{-11}SI$

(O)

-

-

a

r M_s G v

v r T

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(r) (m)

r G m M_T 1

G m M_T

r

(SI) (G) 2

$v = \sqrt{\frac{G.M_T}{r}}$ (v) 3

T T r (v) 4

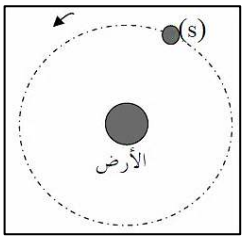
r G M_T 5

$(\frac{T^2}{r^3})$ 6

(SI)

$r = 2{,}66\times10^4$ km

$\pi^2 = 10$ $M_T = 5{,}97\times10^{24}$ kg $G = 6{,}67\times10^{-11}$ SI



m_s (S)

(S) .1

(S) .2

M_T G .3

h R_T

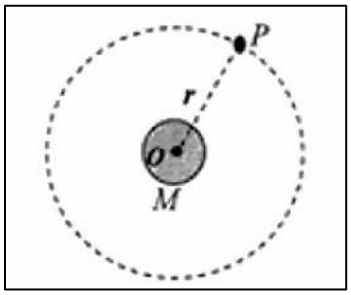
M_T h G R_T .4

k $\frac{T^2}{(R_T+h)^3} = k$ .5

$G = 6.67\times10^{11}\,(SI)$ $M_T = 6\times10^{24}kg$ $R_T = 6380km$ $h = 35800km$ $\pi^2 = 10$

M

Phobos (P)



$G = 6{,}67\times10^{-11}$ N.m^2.kg^{-2}

$r = 9{,}38\times10^3$ km P M

$m_M = 6{,}44\times10^{23}$ kg

T_M = 24 h 37 min 22 s m_P Phobos

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O

P Phobos M 1

2

P

m_M G r T_P 3

T_P $\frac{T_P^2}{r^3} = 9{,}21 \times 10^{-13}\ S^2.m^{-3}$ 4

T_S S 5

R M_T

$\vec{F}_{T/S}$

-

h m_s R M_T G $\vec{F}_{T/S}$

$\vec{a}$

القمر الاصطناعي	*Alsat1*	*Astra*
$T\,(s)\times10^3$	5,964	86,160
$h(m)\times10^6$	0,70	35,65

-

-

g -

( ) $24h$ -

المعطيات: $G = 6{,}67\times10^{-11}\ N\cdot m^2\cdot kg^{-2}$ ، $R = 6380\ km$ ، $1\ jour = 23h\ 56\min$

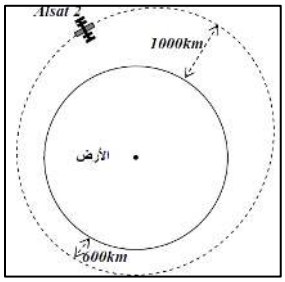
تسارع الجاذبية عند سطح الأرض: $g_0 = 9{,}8\,m\cdot s^{-2}$.

(S) *Alsat*2 2010 12

$1000km$ $600km$

(S) (S) .1

$T_T = 24h$ $M_T = 6\times10^{24}kg$ $R_T = 6400km$



-

(S) -

$h = 800km$ (S) .2

(S) -

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$m = 130kg$ -

.3

(S)

(S)

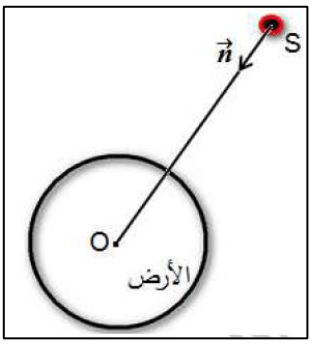
z .4

z -

14.55 $h = 700km$ (S)

(S) a .

n r v (S) a .



.

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

(S) T_S r T_S .

$\frac{T_S}{r^3} = 9.85 \times 10^{-14} s^2.m^{-3}$.

M_T .

$R_T = 6400km$ $G = 6.67 \times 10^{11} (SI)$

---

1 **2** **1**

$h = 670km$

2

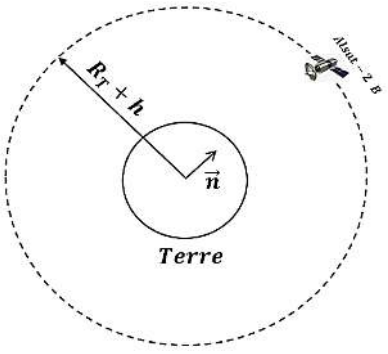
-1

2 -2

$\vec{n}$ G h R_T m M_T **2** -3

G -4

$\vec{a}$ -5



$$v = \sqrt{\frac{GM}{R_T + h}}$$ -6

-7

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-8

	$h(km)$	$T(s)$	$r^3(m^3)$	$T^2(s^2)$
GLONASS	$19{,}1 \times 10^3$	$4{,}02 \times 10^4$		
Giove − A	23.6×10^3	$5{,}19 \times 10^4$		
Astra	35.65×10^3	$8{,}61 \times 10^4$		

$T^2 = f\,(r^3)$

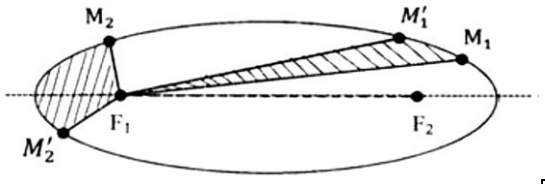
G

g **2**

$M_T = 5.97 \times 10^{24} kg$, $R_T = 6.38 \times 10^3 km$

2016 11

Δt P -1



$M_2M'_2$ $M_1M'_1$

r -2

	$r \times 10^6 Km$	T	$\frac{T^2}{r^3}(s^2.m^{-3})$
	108,2	$224j\ \ 16h$	
	149,6	$365j\ \ 6h$	
	227,9	$686j\ \ 22h$	

P -

P r M_S G

r M_S G T -

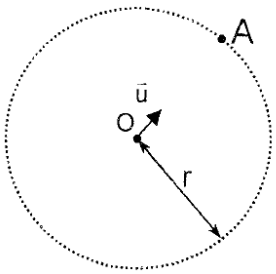
-

M_S -

r $T = 314j\ \ 11h$ -

$G = 6.67 \times 10^{-11} SI$

2015 12



O

M_S r

$\vec{F}_{S/P}$ -1

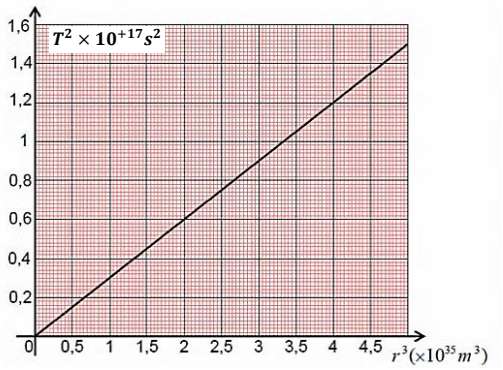
A m_p

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$\vec{u}$ r m_p M_S G $\vec{F}_{S/P}$ -3

G A $\vec{F}_{S/P}$ -4

r M_S



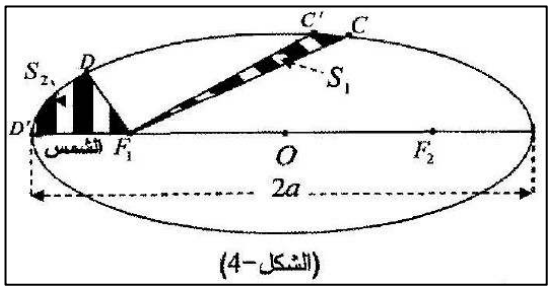
-5

-6

-

M_S $\frac{T^2}{r^3} = 3 \times 10^{-19}(SI)$ -

$G = 6.67 \times 10^{-11} SI$



(الشكل-4)

D C' C 4

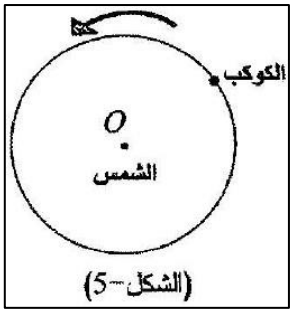
Δt D'

F_1 1

F_2 F_1

S_2 S_1 2

D' D C' C 3



(الشكل-5)

O

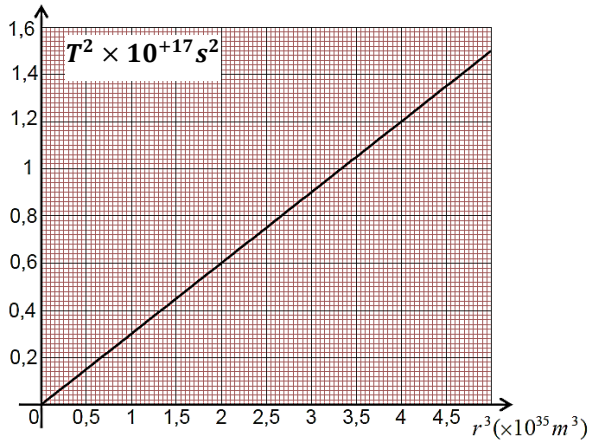
5 r

M $F = G\frac{mM}{r^2}$ $\vec{F}$

$G = 6{,}67\times10^{-11}$ SI G m

« satellite »

T 6 $T^2=f(r^3)$



1

2

G r T v

M

r^3 T^2 3

r^3 T^2 4

M 5

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