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جامعة بيرزيت
BIRZEIT UNIVERSITY

Physics 141

Fall 2022-2023 | First Hour Exam | Time: 90 minutes

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هام: يرجى قراءة هذه التعليمات بتمعن قبل بدء الامتحان

يمنع منعاً باتاً استخدام الهاتف النقال ووضع سماعات أذن أثناء الامتحان، ويجب إطفاء الهاتف ووضعه داخل الحقيبة، علماً أن عدم الالتزام بذلك يعتبر غشاً أكاديمياً ويتعرض فاعله للعقوبة الأكاديمية حسب أنظمة وقوانين الجامعة.

1. أكتب اسمك ورقمك الجامعي في المكانين المخصصين لذلك أعلاه.
2. ضع دائرة حول رقم حصة النقاش المسجل بها في الجدول التالي.

Instructor	Discussion No.	Instructor	Discussion No.
Ismael Badran	1, 3	Shayma' Salama	11
Hana' Bashir	2, 16, 18, 20	Rula Bakeer	14, 17, 19
Tareq Afaneh	4, 8, 13	Nour Maraytah	6, 7, 15
Aziz Shawabkeh	5, 10, 12	Rand Aqra	9

3. يحتوي الامتحان على 20 سؤال اختيار من متعدد، أنقل أجوبة الأسئلة في الجدول المرفق وذلك بوضع إشارة (X) بقلم الحبر في الخانة المناسبة.
4. عند انتهاء الامتحان، سلم جميع أوراق الامتحان كاملة إلى المراقب.

، لا يسمح باستخدام أوراق خارجية للحل، ويوجد ورقتين إضافيتين في آخر الامتحان لهذا الغرض.

Answer Sheet (Multiple Choice)

A /Q #	1	2	3	4	5	6	7	8	9	10
(a)	X					X				
(b)				X				X		
(c)							X			X
(d)			X		X					
(e)		X							X	
A /Q #	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
(a)				X	X					
(b)							X			X
(c)	X					X				
(d)			X						X	
(e)		X						X		

USEFUL CONSTANTS AND FORMULA

$g = 10\ m/s^2$

Kinematics equations in linear motion

1. $v = v_0 + at$
2. $x = x_0 + v_0 t + \frac{1}{2}at^2$
3. $v^2 = {v_0}^2 + 2a\Delta x$
4. $\bar{v} = \frac{1}{2}(v_1 + v_2)$

Vector algebra

5. $\vec{A} \cdot \vec{B} = ABcos(\theta)$
6. $\vec{A} \times \vec{B} = \hat{n}ABsin(\theta)$
7. $\vec{A} \times \vec{B} = \begin{vmatrix} \hat{\imath} & \hat{\jmath} & \hat{k} \\ A_x & A_y & A_z \\ B_x & B_y & B_z \end{vmatrix}$

Relative motion

8. $\vec{v}_{AB} = \vec{v}_{AC} + \vec{v}_{CB}$

Projectile motion

9. Range: $R = v^2 \sin(2\theta)\,/g$
10. Maximum height: $H = v^2\, sin^2(\theta)\,/2g$
11. Equation of the projectile path: $y = x\tan(\theta) - gx^2/2v_0^2 cos^2(\theta)$

Circular motion

12. $F = m\frac{v^2}{r}$

1. Given the two vector $\vec{A} = 2\hat{\imath} - 6\hat{\jmath}$ and $\vec{B} = \hat{\imath} + 2\hat{\jmath}$. The area of the triangle which has these two vectors as edges (أضلاع) is

(a) 5 m²
(b) 4 m²
(c) 2 m²
(d) 3 m²
(e) 6 m²

2. An object has a position vector given by $\vec{r} = 3.0t\hat{\imath} - 2.0\,t^2\hat{\jmath}$, where all quantities are in SI units. What is the magnitude of the average velocity of the object during the first 3 seconds of motion?

(a) 5.00 m/s
(b) 10.00 m/s
(c) 8.54 m/s
(d) 12.00 m/s
(e) 6.71 m/s

3. A boat trying to cross a river is able to move through still water at 2.5 m/s. Water flows from West to East at 4.0 m/s. The boat is headed 37 degrees west of north. If the river is 120 meter wide, how long does it take the boat to cross the river?

(a) 40 seconds
(b) 50 seconds
(c) 25 seconds
(d) 60 seconds
(e) 20 seconds

4. A rotating disk completes one revolution in π seconds. If the centripetal acceleration of the disk is 1.0 m/s², the radius of the disk is

(a) 10 cm
(b) 25 cm
(c) 30 cm
(d) 75 cm
(e) 50 cm

5. The number of times your heart beats (يدق) in a lifetime is of the order of

(a) 10^{15}
(b) 10^{11}
(c) 10^{7}
(d) 10^{9}
(e) 10^{5}

6. The equation of motion of an object is given by $\vec{r}(t) = \vec{a} + \vec{b}t + \vec{c}t^3$, where $\vec{r}(t)$ is in meters, t in seconds. $\vec{a}$, $\vec{b}$ and $\vec{c}$ are constants. The units of $\vec{a}$ and $\vec{c}$ must be respectively

(a) m, m/s³
(b) m.s, m/s³
(c) m/s, m/s³
(d) m/s², m/s
(e) m, m/s²

7. A particle moving along the x-axis has a position given by $x(t) = 5te^{-2t}$, where x is measured in meters and t in seconds. How far is the particle from the origin when it stops?

(a) 3.6 m
(b) 1.8 m
(c) 0.9 m
(d) 4.2 m
(e) 6.0 m

8. A passenger in a train noticed that a small object hanging by a string from the ceiling of the train cabinet is tilted (يميل) at an angle of 30 degrees from the vertical. The acceleration of the train is

(a) 7.5 m/s²
(b) 5.8 m/s²
(c) 3.6 m/s²
(d) 2.5 m/s²
(e) 1.0 m/s²

9. The angle between vector $\vec{A} = 3\hat{i} + 2\hat{j} + \sqrt{3}\hat{k}$ and the y- axis is

(a) 30 degree
(b) 37 degree
(c) 64 degree
(d) 41 degree
(e) 60 degree

10. A stone is released freely from a building 180 m high. Find the distance covered (المسافة المقطوعة) by the stone during the last second of motion.

(a) 35 m
(b) 80 m
(c) 55 m
(d) 10 m
(e) 45 m

11. The acceleration of an object moving along the x-axis is given by $a = 2t + 1$, where t is in seconds. If the object starts from rest, what is the speed of the object at t = 3.0 s?

(a) 20.0 m/s
(b) 24.0 m/s
(c) 12.0 m/s
(d) 16.0 m/s
(e) 30.0 m/s

$V_0 = 0$ $a = 2t + 1$ $V = t^2 + t$ $9 + 3 = 12$ $t^2 + t$ $9 + 3 = 12$

12. A 1500 kg car moving at a speed of 72 km/hr when applied the brakes, stopped in a distance of 200 m. If the car applied a constant deceleration during the stopping process, what is the net force acting on the car during stopping?

(a) 1000 N
(b) 1200 N
(c) 800 N
(d) 900 N
(e) 1500 N

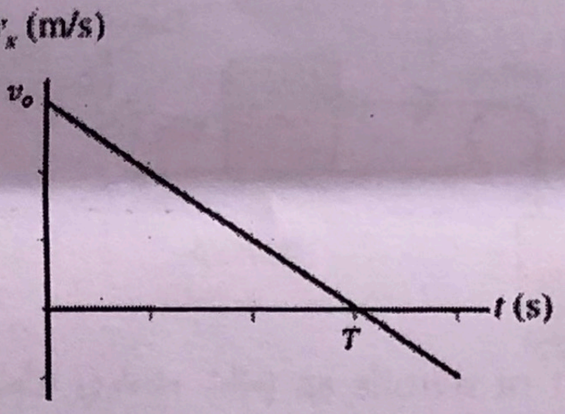
1500kg $V_0 = 20 m/s$ $\Delta X = 200 m$ $V_2 = 0$ $F = ma$ $= -1500 \times 1$ $= -$

$20 m/s = V_0$ $200 m = \Delta X$ $V_2 = 0$ $V_2^2 = V_0^2 + 2a\Delta x$ $0 = 400 + 2 \times a \times 200$ $-400 = 400a$ $-1 m/s^2 = a$ $0 = 400 + 2 \times a \times 200$ $\frac{-400}{400} = -1 m/s^2$ $F = ma$

13. The velocity in m/s of a particle moving along the x-axis is plotted against time in seconds. The displacement of the particle during T seconds is

(a) v_o
(b) $v_o T$
(c) $v_o/2$
(d) $v_o T/2$
(e) $-v_o/T$

$\Delta Y = \frac{1}{2} \times T \times V_0$ $\Delta X = \frac{1}{2} T V_0$ $\frac{TV_0}{2}$



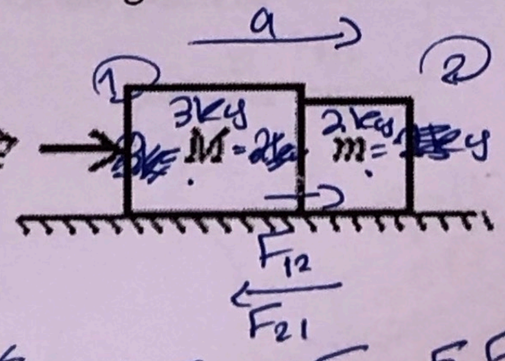
14. if $|\vec{a} \times \vec{b}| = 0.58\, \vec{a} \cdot \vec{b}$, the angle between $\vec{a}$ and $\vec{b}$ is

(a) 30 degree
(b) 37 degree
(c) 45 degree
(d) 53 degree
(e) 20 degree

$|\vec{a}||\vec{b}| \sin\theta = 0{,}58 |\vec{a}||\vec{b}| \cos\theta$ $\tan\theta = 0{,}58$ $|\vec{a}||\vec{b}| \frac{\sin\theta}{\cos\theta} = 0{,}58 |\vec{a}||\vec{b}| \frac{\cos\theta}{\cos\theta}$

15. Two blocks with masses m = 2 kg and M = 3 kg are pushed along a horizontal frictionless surface by a horizontal applied force F = 15 N as shown. The magnitude of the force acting between the two blocks is

(a) 6 N
(b) 2 N
(c) 4 N
(d) 8 N
(e) 12 N



① $15 - F = 3a \rightarrow 1$ $F = 2a$ $\frac{F}{2} = a$ $15 - F = \frac{3 \times F}{2}$ $15 = \frac{5F}{2}$ $6 N$

$15 - F = 3 \frac{F}{2} = \frac{5}{2} F$ $F = 2a$ $\frac{F}{2}$ 6

$x(t) = 2t + t^3$

$V = 2 + 3t^2$

$a = 6t$

16. A toy car travels along the x-axis according to the equation $x(t) = 2t + t^3$, where x is in meters and t in seconds. The acceleration of the car at t = 1.5 seconds is

$2 + 3t^2$

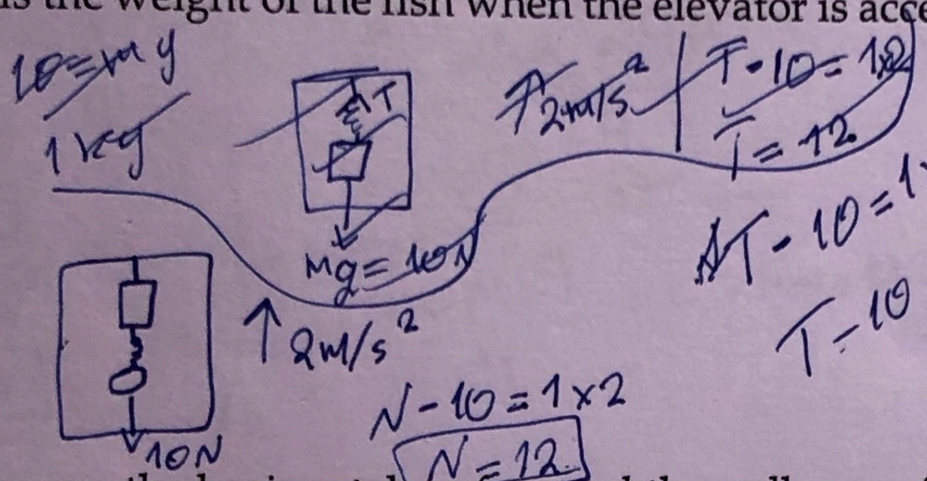
$(6t)$

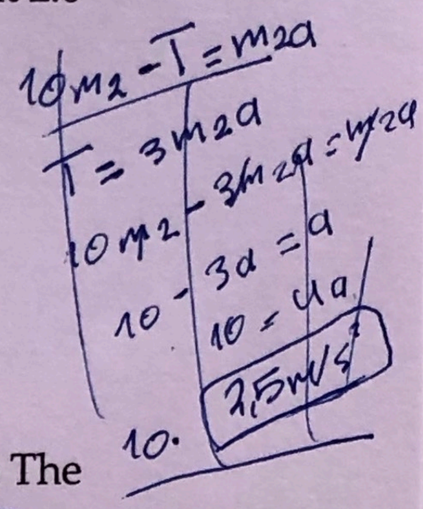
(a) 4.0 m/s²
(b) 12.0 m/s²
(c) 9.0 m/s²
(d) 10.2 m/s²
(e) 6.0 m/s²

17. A fish weighs 10.0 N by a spring scale (ميزان زمبركي) in an elevator moving at constant velocity. What is the weight of the fish when the elevator is accelerating upwards at 2.0 m/s²?

$a=0$

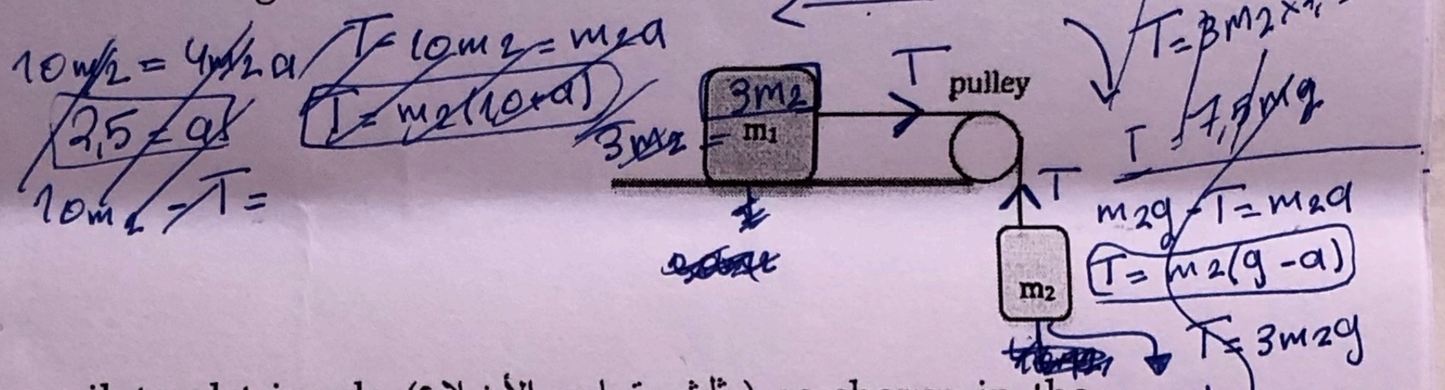
(a) 10.0 N
(b) 12.0 N
(c) 8.0 N
(d) 9.0 N
(e) 11.0 N





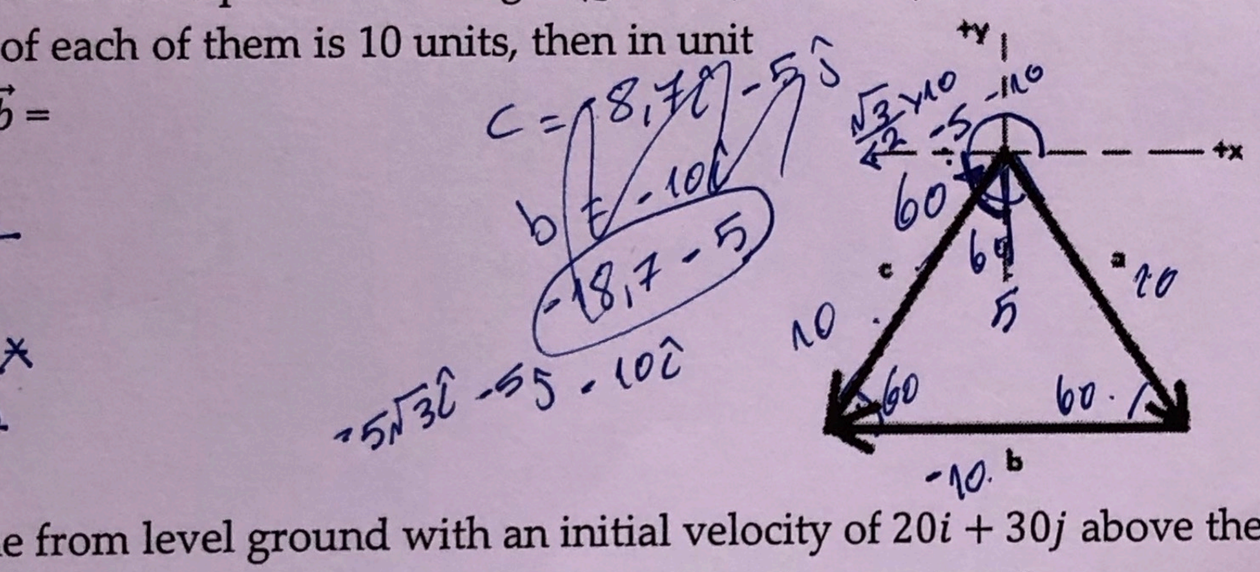
18. In the figure shown, the horizontal surface and the pulley are frictionless. $m_1=3m_2$ The magnitude of the tension force in the string is:

(a) 0.80 $m_2 g$
(b) 0.90 $m_2 g$
(c) 0.67 $m_2 g$
(d) 0.50 $m_2 g$
(e) 0.75 $m_2 g$



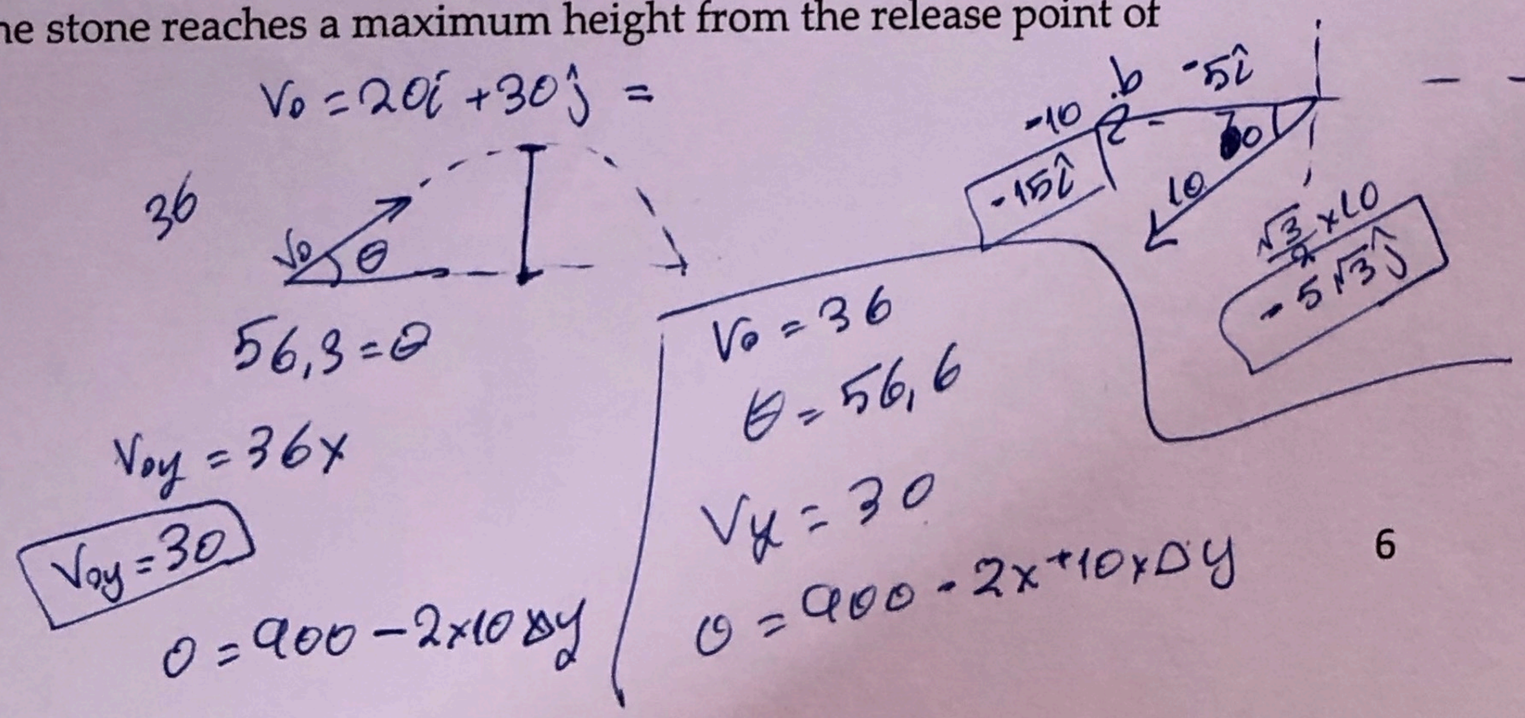
19. Three vectors $\vec{a}, \vec{b}, \vec{c}$ form an equilateral triangle (مثلث متساوي الأضلاع) as shown in the figure. If the length of each of them is 10 units, then in unit vector notation, $\vec{c} + \vec{b} =$

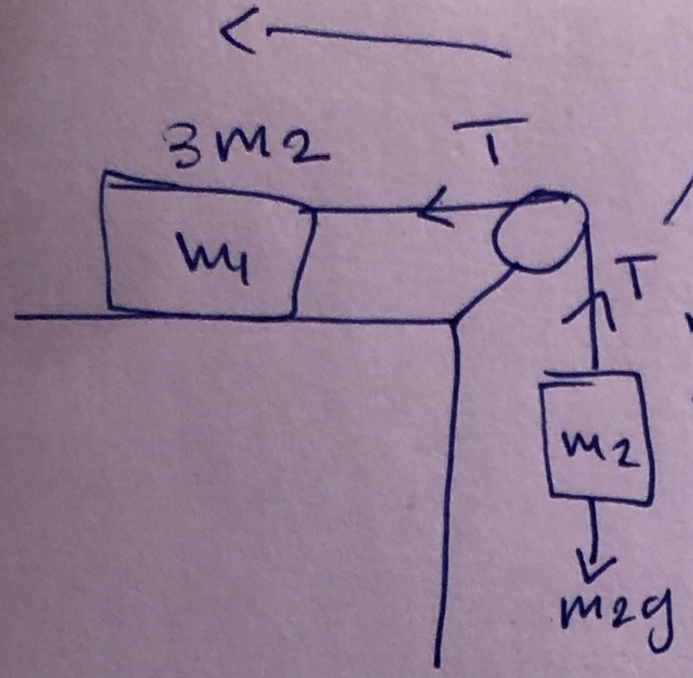
(a) $5\sqrt{3}\hat{i} - 5\hat{j}$
(b) $-5\hat{i} - 5\sqrt{3}\hat{j}$
(c) $15\hat{i} - 5\sqrt{3}\hat{j}$
(d) $-15\hat{i} - 5\sqrt{3}\hat{j}$
(e) $-5\sqrt{3}\hat{i} - 5\hat{j}$



20. A boy throws a stone from level ground with an initial velocity of $20i + 30j$ above the horizontal. The stone reaches a maximum height from the release point of

(a) 90 m
(b) 45 m
(c) 80 m
(d) 20 m
(e) 60 m





$$0 - T = 2m_2a$$

$$+T = 2m_2a$$

$$T - m_2g = m_2a$$

$$2m_2a - m_2g = m_2a$$

$$2a - g = a$$

$$a = g$$

$$F = 2 \times m_2g$$

$$T - m_2g = m_2a$$

$$T = m_2(g+a)$$

$$0 - T = 3m_2a$$

$$-3m_2a = m_2(g+a)$$

$$-3a = g + a$$

$$-4a = g$$

$$a = \frac{10}{4}$$

$$a = 2{,}5$$

$$F = m_2(10 - 2{,}5)$$

$$-T = 3m \times 2{,}5$$

$$m_2g - T = m_2a \rightarrow (1)$$

$$T = 3m_2a$$

$$m_2g - 3m_2a = m_2a$$

$$m_2g = 4m_2a$$

$$\frac{g}{4} = a$$

$$T = \frac{3m_2g}{4} = 0{,}75m_2g$$