PHYS 101: General Physics 1 | KOÇ UNIVERSITY | Fall Semester 2013

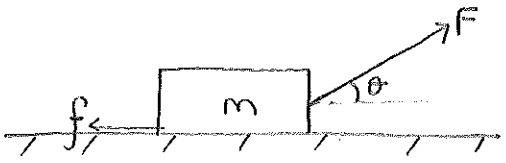
College of Sciences

Section 1 | Quiz 4 | 24 October 2013

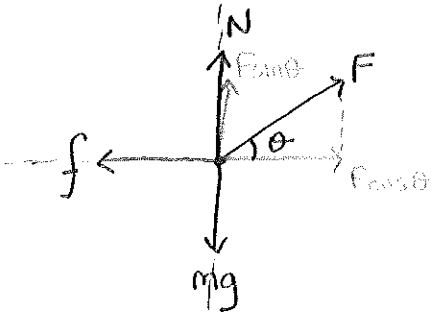
Closed book. No calculators are to be used for this quiz.
Quiz duration: 10 minutes

Name: Student ID: Signature:

A block of mass m is pulled by force of magnitude F that makes an angle of θ with the horizontal surface. The block moves with a constant acceleration a on the rough surface. Assume there is friction force f on the block by the surface. Find the normal force exerted by the surface on the block. Express your answer in terms of m, F, θ and the gravitational acceleration g.



Free-Body Diagram :



Apply Newton's 2nd Law on y-coordinate:

$\Sigma F_y = ma_y = 0$ (Since there is no acceleration on the y-axis)

$N + F\sin\theta - mg = 0$

$\boxed{N = mg - F\sin\theta}$

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Quiz 4

Fall Semester 2013

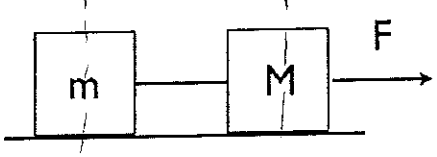
Section 2

24 October 2013

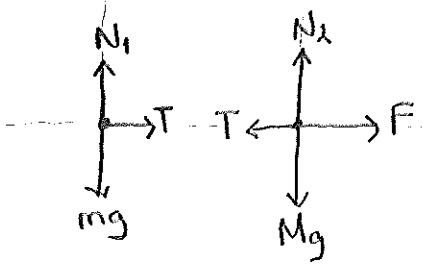
Closed book. No calculators are to be used for this quiz.
Quiz duration: 10 minutes

Name: Student ID: Signature:

A force of magnitude F pulls two blocks of mass m and M, connected to each other with a massless cord, with an acceleration of a. Find the tension in the cord.



Free-Body Diagrams:



Apply Newton's 2nd Law on the x-coordinate for each blocks.

For block with mass m: $\Sigma F_x = m.a_x$

$$T = ma$$

For block with mass M: $\Sigma F_x = Ma_x$

$$F - T = Ma$$

$$F - ma = Ma$$

$$F = (M+m)a$$

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

$$T = \frac{Fm}{M+m}$$

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Section 3 | Quiz 4 | 24 October 2013

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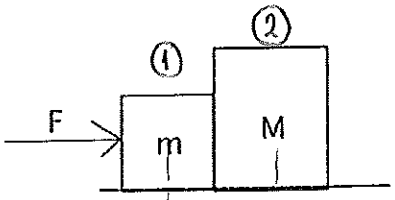
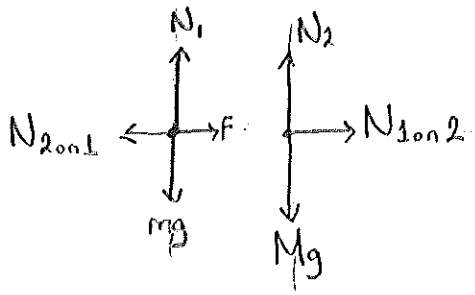
Quiz duration: 10 minutes

Name: Student ID: Signature:

2 blocks of are lined up on a frictionless table, as shown in the figure below. A force of magnitude F is applied to the left block. What force does it exert on the right one? Express your answer in terms of m, M and F.



Free-Body Diagrams:



From Newton's 3rd Law, $|\vec{N}_{1on2}| = |\vec{N}_{2on1}|$.

Apply Newton's 2nd Law on x-coordinate for each objects.

$\Sigma F_{1x} = ma_x$ $\quad$ $\Sigma F_{2x} = Ma_x$

$F - N_{2on1} = ma$ $\quad$ $N_{1on2} = Ma$

$F - Ma = ma$

$F = (M+m).a$

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

$\Rightarrow \boxed{N_{1on2} = \frac{F.M}{M+m}}$

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Section 4 | Quiz 4 | 24 October 2013

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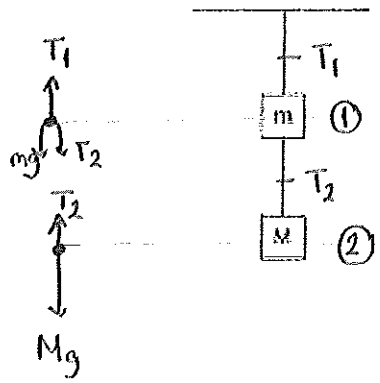
Quiz duration: 10 minutes

Name: Student ID: Signature:

Two masses, m and M are connected to each other and attached to a ceiling by massless strings as shown in the figure. Find the tension in <u>both</u> strings in terms of m, M and the gravitational acceleration g.



Free-Body Diagrams:

Apply Newton's 2nd Law for each objects:

$\Sigma F_1 = ma = 0$ $\quad$ $\Sigma F_2 = Ma = 0$

$T_1 - mg - T_2 = 0$ $\quad$ $T_2 - Mg = 0$

$\boxed{T_1 = (M+m)g}$ $\quad$ $\boxed{T_2 = Mg}$

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Section 5 | Quiz 4 | 24 October 2013

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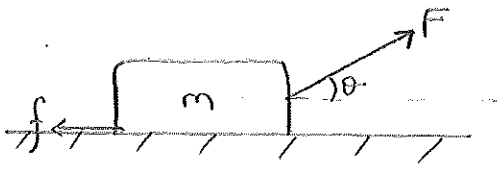
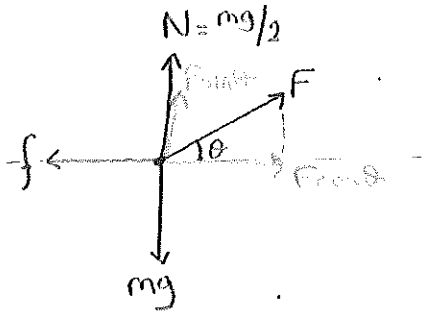
Quiz duration: 10 minutes

Name: Student ID: Signature:

A block of mass m is being pulled on a rough surface with constant speed by a force F that is at an angle of 0 above the horizontal. If the magnitude of the normal force exerted on the block is N = mg/2, what are (i) the magnitudes of the force F and (ii) the friction force f(express your answer in terms of m,g and 0)?



Free-Body Diagram:



constant speed means no acceleration.

Apply Newton's 2nd Law for -x and -y coordinates:

i) $\Sigma F_y = ma_y = 0$

$\frac{mg}{2} + F\sin\theta - mg = 0$

$\boxed{F = \frac{mg}{2\sin\theta}}$

ii) $\Sigma F_x = ma_x = 0$

$F\cos\theta - f = 0$

$f = F\cos\theta = \frac{mg}{2\sin\theta} \cdot \cos\theta$

$\boxed{f = \frac{mg \cdot \cot\theta}{2}}$