

Closed book. No calculators are to be used for this quiz.

Quiz duration: 10 minutes

Name:

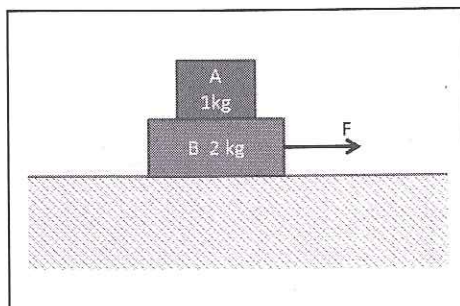
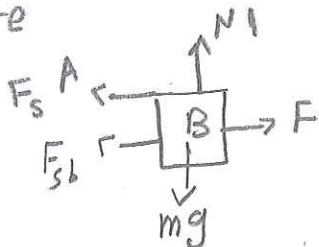
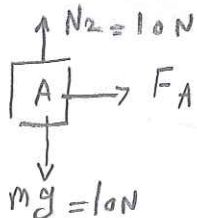
Student ID:

Signature:

A person is pulling two boxes A and B, one on top of the other, by applying a force (F) to the box B. There is friction between the two boxes and also between the surface and box B. The coefficient of friction is 0,1 (Assume that the static and kinetic coefficients are the same).

- Draw a free-body diagram for each box
- Calculate the acceleration of each box when F is F=1 N, F=4 N, F=10 N
- Plot the acceleration as a function of F for for each box

Free-body diagrams are



b)  $F_{SA} = 1 \text{ N}$   $a = 1$  max acceleration  
max

$F = 1 \text{ N}$   $a_A = a_B = 0$   
move together

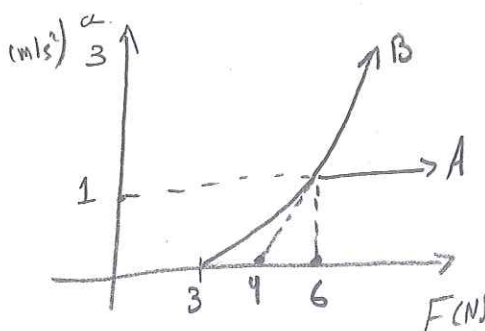
$F = 4 \text{ N}$   $a_A = 1 \text{ m/s}^2$

$\Sigma F = 10 - 4 = 6 = 2a_B$

$a_B = 3 \text{ m/s}^2$

$a = 0.33 \text{ m/s}^2$ ,  $a_A = a_B = 0.33 \text{ m/s}^2$

c)



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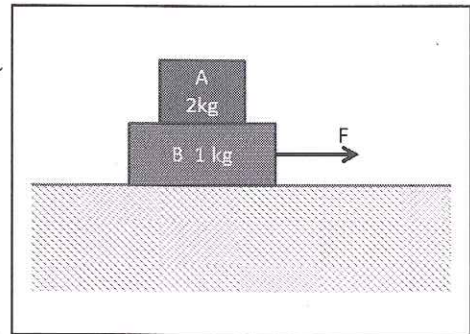
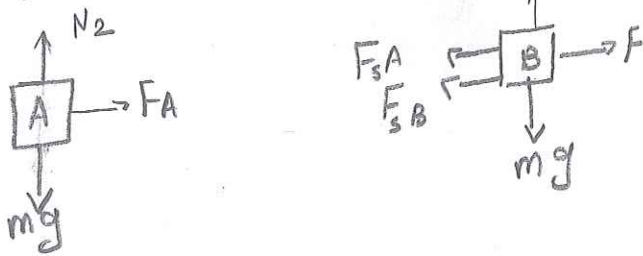
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- Draw a free-body diagram for each box
- Calculate the acceleration of each box when F is F=1 N, F=4 N, F=10 N
- Plot the acceleration as a function of F for for each box

a) Free-body diagrams are:



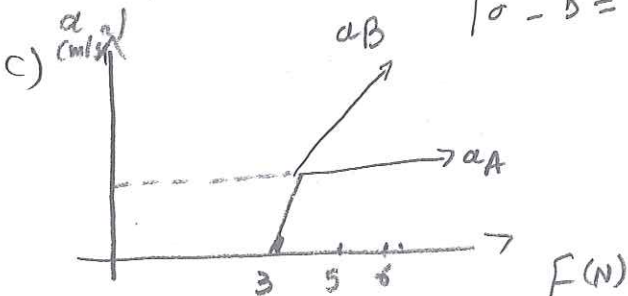
b)  $F_{sA} = 2N$        $2 = 2 \cdot a_{max} \Rightarrow a_{max} = 1 m/s^2$

$F = 1 < F_{sB}$        $a_A = a_B = 0$

$F = 4$        $\Delta F = 4 - 3 = 3 \cdot a$   
 $\Rightarrow a_A = a_B = 0.33 m/s^2$

$F = 10$        $2 = 2 \cdot a_A \Rightarrow a = 1 m/s^2$

$10 - 5 = M_B \cdot a_B \Rightarrow a = 5 m/s^2$



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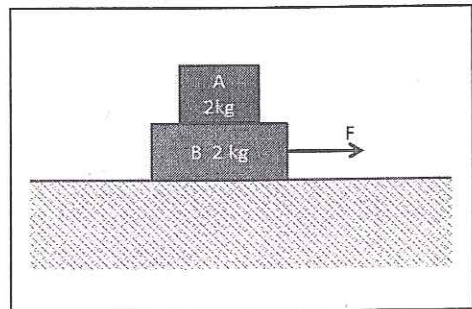
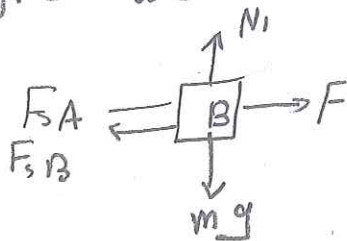
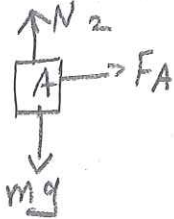
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- a) Draw a free-body diagram for each box
- b) Calculate the acceleration of each box when F is F=1 N, F=5 N, F=10 N
- c) Plot the acceleration as a function of F for for each box

a) Free-body diagrams are:



b)  $a_{max} = \frac{2}{2} = 1$

$F = 1 \text{ N} \quad a_A = a_B = 0$

$F = 5 \text{ N}; \quad \sum F = 5 - 4 = 1 \Rightarrow a_A = a_B = 0.25 \text{ m/s}^2$

$F = 10 \text{ N} \quad ma = 1 \text{ m/s}^2 = 10 - 6 = 4 = 2a \Rightarrow a_B = 2 \text{ m/s}^2$

