

5/15 | Topic: Newton's 2<sup>nd</sup> Law  
 Obtain eq. of motion  
 from free-body  
 diagrams

$F_{\text{net}} = m a$   
 what goes in → what comes out

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## Newton's Second Law Problem-Solving

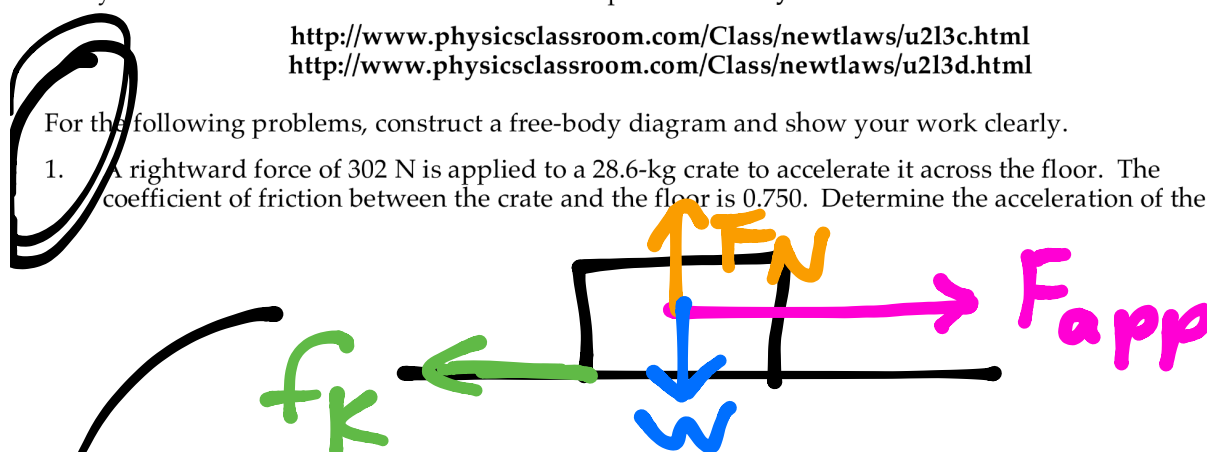
Study from Lessons 3 of the Newton's Laws chapter at The Physics Classroom:

<http://www.physicsclassroom.com/Class/newtlaws/u2l3c.html>

<http://www.physicsclassroom.com/Class/newtlaws/u2l3d.html>

For the following problems, construct a free-body diagram and show your work clearly.

1. A rightward force of 302 N is applied to a 28.6-kg crate to accelerate it across the floor. The coefficient of friction between the crate and the floor is 0.750. Determine the acceleration of the crate.



2. During a football workout, two linemen are pushing the coach on the sled. The combined mass of the sled and the coach is 300. kg. The coefficient of friction between the sled and the grass is 0.800. The sled accelerates at a rate of 0.580 m/s/s. Determine the force applied to the sled by the lineman.

$$F_{\text{net},x} = m a_x$$

$$F_{\text{app}} - f_k = m a$$

$$a = \frac{F_{\text{app}} - f_k}{m}$$

$$F_{\text{net},y} = m a_y = 0$$

$$F_N - W = 0$$

$$\Rightarrow F_N = W = mg$$

$$f_k = \mu_k F_N = \mu_k mg$$

$$\Rightarrow a = \frac{F_{\text{app}} - \mu_k mg}{m}$$

$$= \frac{302 - 0.75(28.6)(9.8)}{28.6}$$

$$= 3.21 \text{ m/s}^2$$

Remember, the LHS  
involves only forces  
acting on the object.  
The RHS is the  
result of the LHS.