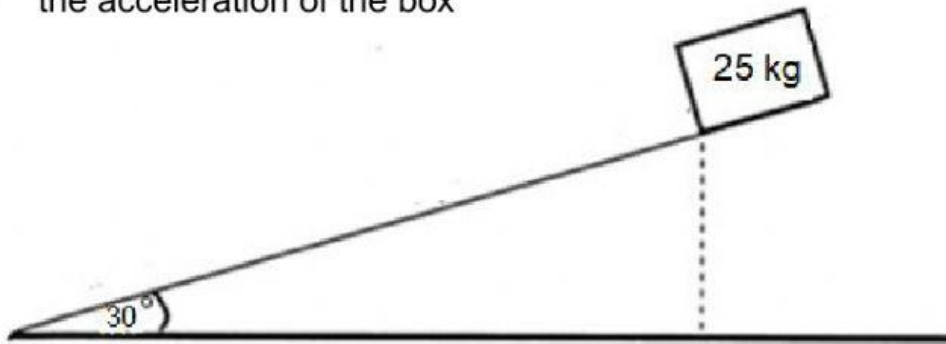


# Newton laws worksheet 17

Eg 5. The coefficient of kinetic friction on the box is 0,14

Calculate

- 5.1 the friction on the box
- 5.2 the force of gravity acting parallel to the slope
- 5.3 the acceleration of the box



$$f_k = \mu_k \cdot F_N$$

Thus we need the normal force

$$5.1 \quad F_N = F_g \perp$$

$$F_N = F_g \cdot \cos \Theta$$

$$F_N = m \cdot g \cdot \cos \Theta$$

$$= 25(9,8) \cdot \cos 30$$

$$F_N = 212,176 \text{ N}$$

$$f_k = \mu_k \cdot F_N$$

$$= 0,14 (212,176)$$

$$= 29,70 \text{ N}$$

$$5.2 \quad F_{g\parallel} = F_g \cdot \sin \Theta$$

$$= m \cdot g \cdot \sin \Theta$$

$$= (25)(9,8) \cdot \sin 30$$

$$= 122,5 \text{ N}$$

5.3  $F_{\text{net}} = m \cdot a$

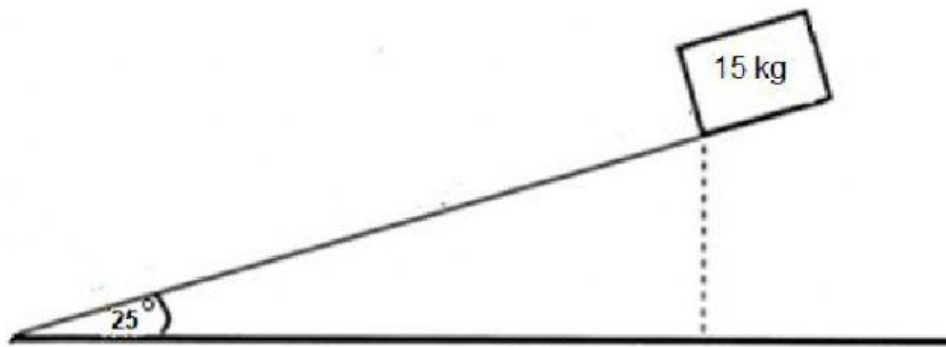
\*The  $F_{\text{g}\parallel}$  is bigger than the  $f_k$

$$F_{\text{g}\parallel} - f_k = 25 \cdot a$$

$$122,5 - 29,07 = 25 \cdot a$$

$$a = 3,74 \text{ m} \cdot \text{s}^{-2} \text{ down the slope}$$

6.



The coefficient of kinetic friction on the box is 0,21

Calculate the acceleration of the block

**Step 1: find normal force**

$$f_k = \mu_k \cdot F_N$$

Thus we need the normal force and the coefficient of friction

$$F_N = F_{\text{g}\perp}$$

$$F_N = F_g \cdot \cos \theta$$

$$F_N = m \cdot g \cdot \cos \theta$$

$$= 15(9,8) \cdot \cos 25$$

$$= 133,23 \text{ N}$$

The normal force equals to  $F_{\text{g}\perp}$  on a slope

**Step 2: find kinetic friction**

$$f_k = \mu_k \cdot F_N$$

$$= 0,21(133,23)$$

$$= 27,98 \text{ N}$$

**Step 3: Find  $F_{gl}$** 

$$\begin{aligned}F_{gl} &= F_g \sin \Theta \\&= m \cdot g \cdot \sin \Theta \\&= (15)(9,8) \cdot \sin 25 \\&= 62,12 \text{ N}\end{aligned}$$

**Step 4: Determine which force is bigger**

$$F_{gl} > f_k$$

Step 5: solve for the acceleration

$$F_{net} = m \cdot a$$

$$F_{gl} - f_k = m \cdot a$$

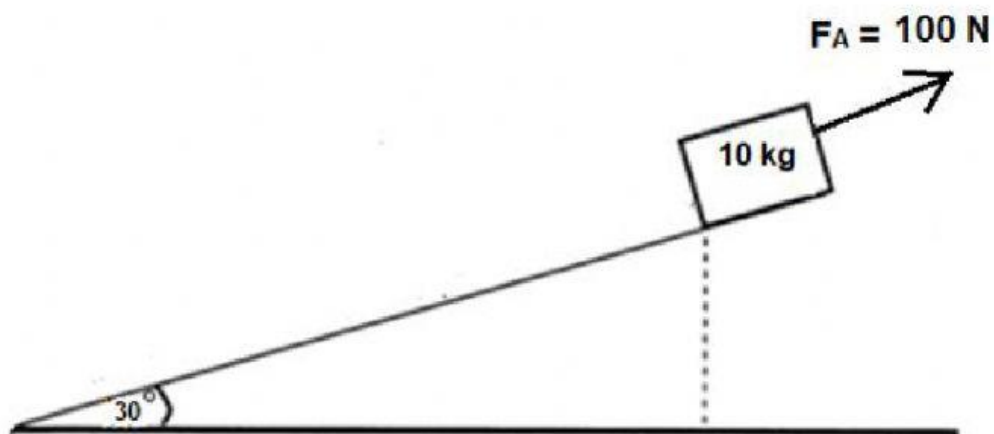
$$62,12 - 27,98 = 15 \cdot a$$

$$a = 2,28 \text{ m} \cdot \text{s}^{-2} \text{ down the slope}$$

**Exercise 16:**

Calculate by following the steps above

1.



If the coefficient of kinetic friction is 0,3, calculate the acceleration of the block up the slope

### Step 1: find normal force

$$f_k = \mu_k \cdot F_N$$

Thus we need the normal force and the coefficient of friction

$$F_N = F_{g\perp}$$

$$= m \cdot g \cdot \cos \Theta$$

$$= \underline{\hspace{2cm}} \quad \{2 \text{ decimal places and leave no spaces between values and units}\}$$

### Step 2: find kinetic friction

$$f_k = \mu_k \cdot F_N$$

$$= \underline{\hspace{2cm}}$$

### Step 3: Find $F_{g\parallel}$

$$F_{g\parallel} = F_g \cdot \sin \Theta$$

$$= \underline{\hspace{2cm}}$$

### Step 4: Determine which force is bigger

Compare  $F_A$  and  $F_{g\parallel}$  only first

Which force is bigger:  $F_A$  or  $F_g$

{we can't even look at friction until we decide this}

In what direction will the box move: up the slope    down the slope

Then you can decide in which direction it moves

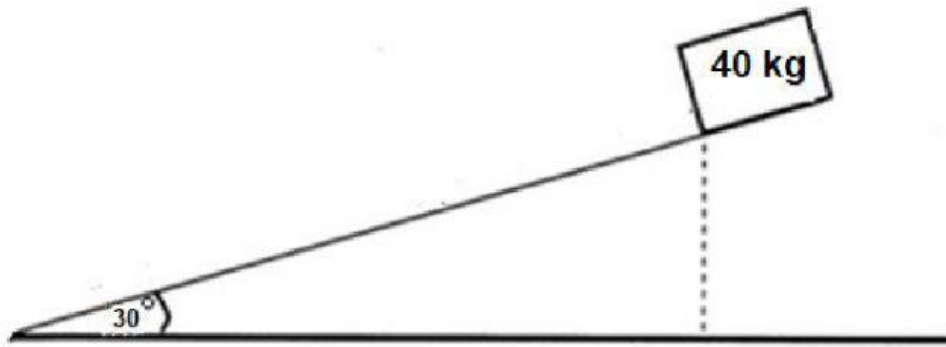
Step 5: solve for the acceleration

$$F_{\text{net}} = m \cdot a$$

$$F_A - F_{g\parallel} - f_k = m \cdot a$$

$$a = \underline{\hspace{2cm}} \text{ m} \cdot \text{s}^{-2} \text{ up the slope}$$

2. If the coefficient of kinetic friction is 0,3, calculate the acceleration of the block



**Step 1: find normal force**

$$f_k = \mu_k \cdot F_N$$

Thus we need the normal force and the coefficient of friction

$$F_N = F_{g\perp}$$

$$F_N = \underline{\hspace{2cm}}$$

**Step 2: find kinetic friction**

$$f_k = \mu_k \cdot F_N$$

$$= \underline{\hspace{2cm}}$$

**Step 3: Find  $F_{g\parallel}$**

$$F_{g\parallel} = F_g \cdot \sin \Theta$$

$$= \underline{\hspace{2cm}}$$

**Step 4: Determine which force is bigger**

Which force is greater:  $f_k$   $F_{g\parallel}$  is greater

In what direction will the box move: up the slope down the slope

Step 5: solve for the acceleration

$$F_{\text{net}} = m \cdot a$$

$$F_{\text{gll}} - f_k = m \cdot a$$

$$a = \underline{\hspace{2cm}} \text{ m.s}^{-2} \text{ down the slope}$$

### **Exercise from booklet**

Refer to the electronic copy of the physics booklet that was emailed to you

Pg 80 Q4

Pg 83 Q2

Pg 87 Q2

Pg 93 Q4