#### EXAM B

1) Peter (from Peter and the Wolf fame) is out hunting a possum with his spring loaded rock thrower. He pulls back on the spring with a force of 350 N and it stretches 10 cm. Determine the spring's constant. 3 points

## SOLUTION:

$$x = 10 \text{ cm} \cdot \frac{1 \text{ m}}{100 \text{ cm}} = 0.1 \text{ m}$$

$$F = k \cdot x \text{ (Hooke's Law)} \Longrightarrow k = \frac{F}{x}$$

$$k = \frac{350 \text{ N}}{0.1 \text{ m}} = 3500 \text{ N/m}$$

2) How much force would it take to stretch a steel bar with a spring constant of 21000000 N/m until it is 1,0 cm longer? 3 points

#### SOLUTION:

$$x = 1 \ cm \cdot \frac{1 \ m}{100 \ cm} = 0,01 \ m$$

 $F = k \cdot x$  (Hooke's Law)

 $F = 21000000 \ N/m \cdot 0.01 \ m = 210000 \ N$ 

3) If you use a spring whose constant is 0,50 N/m and hang a 0,25 N load from it, how far will it stretch? Convert your answer to cm. 4 points

## **SOLUTION:**

$$F = k \cdot x$$
 (Hooke's Law)  $\Longrightarrow x = \frac{F}{k}$ 

$$x = \frac{0.25 \, \text{N}}{0.50 \, \text{N/m}} = \frac{0.5 \, \text{m}}{0.50 \, \text{m}} \cdot \frac{100 \, \text{cm}}{1 \, \text{m}} = \frac{50 \, \text{cm}}{1 \, \text{m}}$$

4) Your bicycle has a mass of 9,1 kilograms. You accelerate at a rate of 1,79  $\,\text{m/s}^2$  . Calculate the net force that is accelerating the bicycle.

3 points

## SOLUTION:

F = m · a (Newton's 2nd Law of Motion)

$$F = 9.1 \, kg \cdot 1.79 \, m/s^2 = 16.29 \, N$$

5) Calculate the acceleration of a car if the force on the car is 450 Newtons and the mass is 1300 kilograms. 3,5 points

#### **SOLUTION:**

 $F = m \cdot a$  (Newton's 2nd Law of Motion)  $\Longrightarrow a = \frac{F}{m}$ 

$$a = \frac{450 \, N}{1300 \, kg} = \frac{0,35 \, m/s^2}$$

6) A net force of 15 N is exerted on an encyclopedia to cause it to accelerate at a rate of 5 m/s<sup>2</sup>. Determine the mass of the encyclopedia.

3,5 points

## SOLUTION:

 $F = m \cdot a$  (Newton's 2nd Law of Motion)  $\Longrightarrow m = \frac{F}{a}$ 

$$m = \frac{15 N}{5 m/s^2} = 3 kg$$

7) An object has a mass of 45 kg. How much does it weigh on Earth if the acceleration due to gravity is 9,81 m/s<sup>2</sup>? 5 points

## SOLUTION:

$$W = m \cdot g$$

$$W = 45kg \cdot 9.81 \, m/s^2 = 441.45 \, N$$

8) What is the mass of a person who weighs 500 N on Earth?

5 points

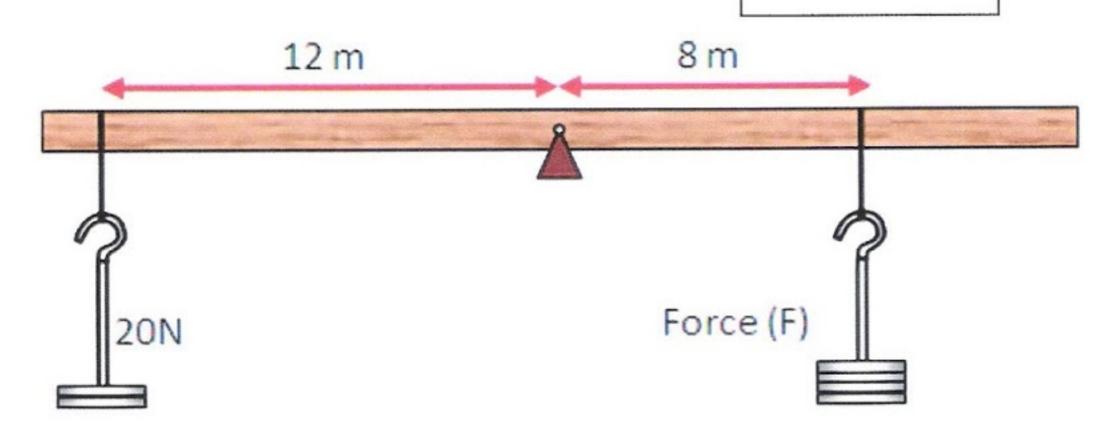
## **SOLUTION:**

$$W = m \cdot g \Longrightarrow m = \frac{w}{g}$$

$$m = \frac{500 \, N}{9,81 \, m/s^2} = 50,97 \, kg$$

9) Find the force needed to balance the lever.

10 points



# SOLUTION:

$$F_1 \cdot d_1 = F_2 \cdot d_2$$

$$\frac{F_1 \cdot d_1}{d_2} = F_2$$

$$F_2 = \frac{20 \ N \cdot 12 \ m}{8 \ m} = \frac{30 \ N}{8 \ m}$$