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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:

$$x = 10 \text{ cm} \cdot \frac{1 \text{ m}}{100 \text{ cm}} = 0,1 \text{ m}$$

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

$$k = \frac{350 \text{ N}}{0,1 \text{ m}} = 3500 \text{ N/m}$$

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:

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

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

$$F = 21000000 \text{ N/m} \cdot 0,01 \text{ m} = 210000 \text{ N}$$

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:

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

$$x = \frac{0,25 \text{ N}}{0,50 \text{ N/m}} = 0,5 \text{ m} \cdot \frac{100 \text{ cm}}{1 \text{ m}} = 50 \text{ cm}$$

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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:

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

$$F = 9,1 \text{ kg} \cdot 1,79 \text{ m/s}^2 = 16,29 \text{ N}$$

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:

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

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

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

3,5 points

SOLUTION:

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

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

7) An object has a mass of 45 kg. How much does it weigh on Earth if the acceleration due to gravity is $9,81 \text{ m/s}^2$?

5 points

SOLUTION:

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$$W = m \cdot g$$

$$W = 45 \text{ kg} \cdot 9,81 \text{ m/s}^2 = 441,45 \text{ N}$$

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

5 points

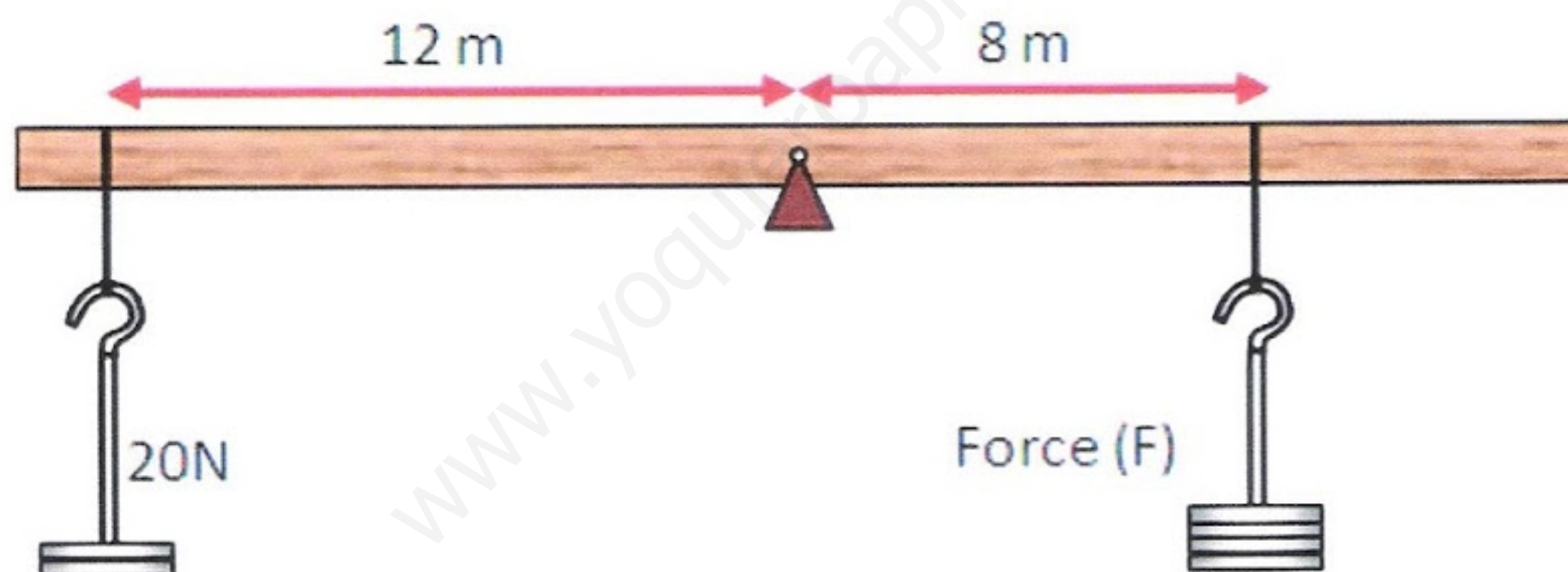
SOLUTION:

$$W = m \cdot g \Rightarrow m = \frac{W}{g}$$

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

9) Find the force needed to balance the lever.

10 points

SOLUTION:

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

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

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