

NEWTON'S SECOND LAW PRACTICE PROBLEMS

Complete the following table. Use your understanding of the relationship between force, mass and acceleration to first predict, and then calculate the missing values.

$$\text{Force (Newtons)} = \text{mass (kilograms)} \times \text{acceleration (m/s/s)}$$

$$\text{Mass (kilograms)} = \text{Force (Newtons)} / \text{acceleration (m/s/s)}$$

$$\text{Acceleration (m/s/s)} = \text{Force (Newtons)} / \text{Mass (kilograms)}$$

Net Force (Newtons)	Mass (kilograms)	Acceleration (m/s/s)
	1	1
2		2
2	2	
4		2
	3	1
6		2
4	4	
8		2
	5	1
10		2
6	6	
12		2
	7	1
14		2
8	8	
16		2
	9	1
18		2
10	10	
20		2

ANALYSIS

1. What happens to acceleration (mass is held constant) when you double the net force?
2. What happens to acceleration (force is held constant) when you double the mass of the object?
3. What happens to acceleration (force is held constant) when you halve the mass of the object?

4. Newton's 2nd Law states that unbalanced forces cause objects to accelerate with an _____ (mass or acceleration) which is directly proportional to the net force and inversely proportional to the _____ (mass or acceleration).

CALCULATIONS

1. A roller coaster car rapidly picks up speed as it rolls down a slope. As it starts down the slope, its speed is 4 m/s. But 3 seconds later, at the bottom of the slope, its speed is 22 m/s. What is its average acceleration?
2. Assuming the roller coaster has a mass of 15000kg, calculate the force required to accelerate the roller coaster.
3. A 90 kg cyclist riding a 10 kg bike accelerates from 0 m/s to 8 m/s in 3 seconds. What is his acceleration?
4. What force did the cyclist have to apply to the pedals of the bike to accelerate the bike?
5. Assume the cyclist was capable of applying a force equal to 300 N to the pedals of his bike. What would his acceleration be if he applied that force (300 N)?
6. After months of training, the cyclist lost the equivalent of 5 kilograms of body fat. Assuming he can still apply a force equal to 300 N, what would his acceleration be (at 300 N) now that he is 5 kilograms lighter?