

Newton's Laws Review

A) Newton' First Law

1. State Newton's first Law

An object at rest stays at rest and an object at a constant velocity stays at a constant velocity unless acted upon by a net force.

2. What is a net force?

A net force is an unbalanced set of forces that do not cancel out.

3. What is inertia and how is it measured?

Inertia is an objects resistance to changes in its state of motion. Mass id the measurement of inertia.

4. Be able to explain the demonstrations from class. For example, why the coins fell straight into the jar when the ring was pulled from under them.

B) Newton's Second Law

1. Be able to draw free body diagrams for many situations. For example, an elevator moving upward at a constant velocity or accelerating up or down or a car with its brakes applied

2. Be able to write Fnet equations from your free body diagrams and solve for unknowns

3. Solve problems where you use the following equations: $F_{net}=ma$ & V_i, V_f, D, a, t

4. A 2.800 Kg cart starts from rest and accelerates through a distance of 5.2 m in 3.5 s. What is the net force acting on the cart?

$$\begin{aligned} V_i &= 0 \\ V_f &= * \\ d &= 5.2 \\ a &= \\ t &= 3.5 \end{aligned}$$

#3

$$d = \frac{1}{2} a t^2$$

$$5.2 = \frac{1}{2} a (3.5)^2$$

$$5.2 = 6.125 a$$

$$a = 5.2 / 6.125 = 0.849$$

$$F_{NET} = ma$$

$$F_{NET} = 2.8(0.849)$$

$$= 2.38 N$$

5. A 4.5 kg cart is moving at 5.5 m/s when a net force of 2.5 N acts in the direction of movement. How fast will the cart be traveling after 15.0 s?

$$\begin{aligned} V_i &= 5.5 \\ V_f &= ? \\ d &= * \\ a &= \\ t &= 15 \end{aligned}$$

NEED TO FIND
acceleration first

$$F = ma \Rightarrow a = F/m$$

$$a = 2.5 / 4.5 = 0.56$$

#1

$$V_f = V_i + a t$$

$$V_f = 5.5 + 0.56(15)$$

$$V_f = 13.8 m/s$$

6. Understand what terminal velocity is and how it is reached.

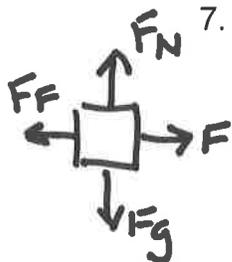
- a. Who would be going faster when terminal velocity is reached (assuming the same surface area). Mr. Strzyinski 66 kg or Andre the Giant 300 kg. (why)

Andre

- b. Which ~~is~~^{it} any would have a higher terminal velocity, a sky diver falling head down or one falling spread eagle and why.

Head down \Rightarrow Less air Resistance

7. A book is pushed across a table. If $\mu = 0.30$ find the force of friction between a book and the table. ($m_{\text{book}} = 5 \text{ kg}$, $m_{\text{table}} = 40 \text{ kg}$)



$$F_N = F_g = mg$$

$$F_N = 5(9.8) = 49 \text{ N}$$

$$F_f = \mu F_N = (0.3)49$$

$$F_f = 14.7 \text{ N}$$

- a. What force is required to keep the book moving at constant velocity?

$$F_{\text{NET}} = 0 \quad F - F_f = 0 \Rightarrow F = F_f = 14.7 \text{ N}$$

- b. What force is required to accelerate the book at 1.75 m/s^2

$$F_{\text{NET}} = ma, \quad F - F_f = ma, \quad F - 14.7 = 5(1.75), \quad F = 23.5 \text{ N}$$

- c. Find the new force of friction if you place a 2 kg mass on top of the book.

$$F_N = 7(9.8) = 68.6 \Rightarrow F_f = \mu F_N = 0.3(68.6) =$$

$$20.6 \text{ N}$$

8. What is the difference between weight and the force of gravity?

They are the same thing

- a. How much does a 588 N person weigh?

$$588 \text{ N}$$

- b. What is the mass of a 588 N person?

$$F_g = mg \Rightarrow m = F_g/g = 588/9.8 = 60 \text{ kg}$$

- c. What is the mass of the same person on the moon?

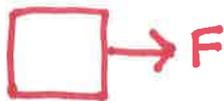
$$60 \text{ kg}$$

- d. What is the force of gravity of the same person on the moon where $g = 1.6 \text{ m/s}^2$

$$F_g = mg = 60(1.6) = 96 \text{ N}$$

7. A 45 kg astronaut pushes off a 340 kg satellite for a time of 2.0 seconds. Afterwards, the satellite is moving 0.5 m/s, what is the velocity of the astronaut?

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Force on the
Satellite:

$$F = ma$$

$$F = 340(.25) = 85 \text{ N}$$

Force on astronaut = Force on Satellite

$$F_{\text{net}} = ma$$

$$85 = 45a \Rightarrow a = \frac{85}{45} = 1.89 \text{ m/s}^2$$

$$v_i : 0$$

$$v_f : ?$$

$$d : *$$

$$a : 1.89$$

$$t : 2$$

$$v_f = v_i + a t$$

$$v_f = 0 + 1.89(2)$$

$$v_f = 3.8 \text{ m/s}$$