Newton's First Law Worksheet SOLUTIONS

1. Fully and clearly state Newton's 1st law.

   An object in motion at a constant velocity (or at rest) will remain in motion at a constant velocity (or at rest) unless acted upon by an unbalanced, external force.

2. An object is at rest. What does the object have that tends to keep it at rest?

   Inertia, the tendency of an object to remain either in motion or at rest.

3. What would it take to force the object to move? Be specific, using Newton's first law.

   An UNBALANCED, EXTERNAL force.

4. An object is moving along at a constant velocity of 100 cm/s. What is the external force acting on the object? Explain using Newton's 1st Law.

   Constant velocity means that the forces are balanced, and thus $F_{net} = 0$. If the forces were unbalanced, the object would not continue in the constant velocity motion, according to Newton's 1st law.

5. An object is sliding with a velocity of 10 m/s [S] along a perfectly frictionless surface. Instantly, a 45 N [N] force acts upon the object. Based on your knowledge of Newon's 1st Law, what do you think will happen? Will the object remain in motion or will its motion change? If the motion changes, what kind of change occurs?

   Since an unbalanced, external force is present, the object will NOT continue in its current motion state. It will slow down because the unbalnced force causes it to accelerate in opposite direction (N) than it was moving (S).

6. An object is sliding with a velocity of 4 m/s [NE] along a perfectly frictionless surface. Instantly, 3 forces act upon the object. The forces are 5N [W], 15N [E], and 10N [W]. Based on your knowledge of Newon's 1st Law, what do you think will happen? Will the object remain in motion or will its motion change? If the motion changes, what kind of change occurs?

   Since the forces are balanced, the object will continue moving in its current motion, at a constant velocity of 4 m/s [NE]. Newton's 1st Law confirms this.

7. An object is at rest on a perfectly frictionless surface. Instantly, a 10 N [W] force acts upon the object. Based on your knowledge of Newon's 1st Law, what do you think will happen? Will the object remain in motion or will its motion change? If the motion changes, what kind of change occurs?

   Since the force is unbalanced, the object will accelerate in the direction of the applied force, or West. Its current motion state (of rest) will thus change.

8. According to Newton's 1st Law, there are two "natural" states of motion that an object tends to be in. What are they?

   At rest AND moving at a constant velocity. Objects naturally like both motion states.

9. Convert 10 N to lbs. Then, convert 85 lbs to Newtons. (recall that 1 N = ____ lbs)

Since 1 lb = 4.45 N → 10N = 2.25 lb, 85 lbs = 378.25 N

10. A car is driving along a straight road. A passenger is sitting in the front-passenger seat, which just so happens to be greased with Crisco. There are no doors on the car and no seatbelts (illegal? Maybe.). The car comes to a hard turn in the road and attempts to complete the turn without slowing down. Explain, using Newton's 1st Law, what will happen to the passenger in the front seat.

The passenger in the car was going straight. He has INERTIA, or a natural tendency to want to continue his current motion. When the car turns, his inertia causes him to continue to do what he was doing before (going straight), and thus he slides out the car door because there is no Unbalanced, External force (like friction between his butt and the seat, a seatbelt, a door, etc) that changes his motion. You can see that this explanation uses both Newton's 1st Law as well as the concept of Inertia, which is why Newton's 1st law is often called the "Law of Inertia".

11. In real-life, objects in motion don't tend to stay in motion. What is the unbalanced force that keeps most objects that are in motion from remaining in motion indefinitely? Give three different examples from everyday life of this type of force.

Friction (in the form of air resistance, rough surfaces, ungreased wheels on carts, etc)

12. The SI unit of Force is the Newton. Since this is not a "base" SI unit but rather a "derived" unit, we must always remember what "base" units make up the Newton. Write 1N in terms of only kg, sec, and m. (look it up on the internet if you need to … google it ☺)

$1\ N = 1\ kg * m/s^2$

13. Give two different examples of "contact" forces. Then, give two different examples of "field" forces.

Contact forces: Push or Pull
Field Forces: Gravitational Forces, Magnetic Forces, Electric Field Forces

14. Find the net force in each situation below. Make sure to give both a magnitude and a direction.

a) 15 N [right] and 42 N [left] b) 65 N [West] and 50 N [North] c) 32 N [E 30 N] and 16 N [South]

27 N [left] 82 N [W 37.6° N] 27.7 N [E]