Name _____

Inertia = mass (object's resistance to acceleration)

Newton's 2nd Law: $\vec{F}_{net} = m\vec{a}$, where $\vec{F}_{net}$ is the vector sum of all of the forces acting on the object.

Newton's 3rd Law: For every force there is an equal in magnitude and opposite in direction reaction force. $\vec{F}_{AonB} = -\vec{F}_{BonA}$

The force pairs **always** occur between 2 objects. They are NEVER two forces acting on the same object.

Weight: $W = mg$, always directed down (towards center of Earth)

1. Object A and object B experience the same net force, but the mass of A is twice the mass of B. Which one experiences a larger acceleration? **A**, **B**, **C**: Same a

2. Roxie and Tad pull on a rope toy. Roxie pulls with a force of $20N$ in the direction of +x, while Tad pulls with a force of $6N$ in the direction of -x. If the rope toy has a mass of $2kg$, what is the magnitude and direction of the resulting acceleration of the rope toy?

3. A car with a mass of 500kg starts from rest and accelerates to a velocity of $30m/s$ in 10 seconds. What was the net force acting on the car?

   If the force of the car's engine was $2000N$, what was the magnitude of the opposing air resistance and friction forces?

4. Two forces act on an object, $\vec{F}_1$ and $\vec{F}_2$. When $\vec{F}_1$ and $\vec{F}_2$ point in the same direction, they give a 3kg object an acceleration of $2.5m/s^2$. When $\vec{F}_2$ points in the opposite direction, the forces give the same object an acceleration of $1.5m/s^2$ in the same direction as before. Find the magnitudes of $\vec{F}_1$ and $\vec{F}_2$.

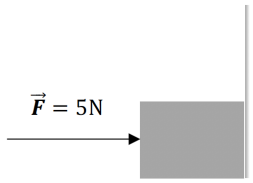
5. A baseball pitcher throws a 100mph fastball to a batter, who hits a 450ft home run. Which force was greater: **A**: the force of the ball on the bat **B**: the force of the bat on the ball, or **C**: are they equal?

6. You are driving along in your car and a bug splatters on your windshield. Which is bigger **A**: the force the bug exerts on your windshield **B**: the force that your windshield exerts on the bug, or **C**: are they equal?

   If the mass of the bug is 0.001kg and the mass of the car is 1000kg, what is the ratio of the acceleration of the bug to the car?

7. According to Newton's third law, forces always occur in pairs that are equal in magnitude and opposite in direction. This means every force pair sums to zero. How can anything ever accelerate?

8. A force of $5N$ is applied to a block which is pressed against a heavy wall so that the block is not moving. Is this the only horizontal force acting on the block? If so, draw any other forces, including their magnitude and direction. What, if any, forces are acting on the wall?



9. According to Newton's 2nd Law, smaller mass objects accelerate more than larger mass objects, if they experience the same force. However, we learned from Galileo that all objects, regardless of mass, accelerate at the same rate, g= $9.8m/s^2$, near the surface of the Earth. Are these two observations in conflict?

10. Calculate your weight in Newtons. (First find your mass in kg: 1kg = 2.2lbs).

11. How much would you weigh on the moon ($g = 1.62m/s^2$)?

12. Would your mass change on the moon? **A**: Yes, it would be less. **B**: Yes, it would be more, **C**: No, it wouldn't change