

## NEWTON'S 3<sup>RD</sup> LAW CONCEPTUAL PRACTICE ANSWER KEY

**Instructions:** Use complete sentences and your knowledge of Newton's 3<sup>rd</sup> Law to answer the following questions completely in your journal.

1. When thinking about Newton's 3<sup>rd</sup> Law:
  - a. Why do we say that forces only occur in **pairs**?  
*Every action has a reaction counterpart.*
  - b. If each action has an equal and opposite reaction, why don't the forces **cancel out**?  
*The action and reaction forces act on different objects!*
  
2. A hammer interacts with a nail:
  - a. Which object exerts a **force** on which?  
*Each exerts a force on the other (hammer on nail AND nail on hammer)*
  - b. How does the **magnitude** of the force the hammer exerts on the nail compare to the force the nail exerts on the hammer?  
*Both have the same magnitude, but their directions are opposite.*
  
3. **Identify the reaction forces** for the situations below:
  - a. When swimming, you push the water backwards (action).  
*The reaction force is the water pushing you forward*
  - b. A bowstring acts on an arrow  
*The reaction force is the arrow acting on the bowstring*
  - c. When you walk on the floor, what force pushes you along?  
*You are pushing on the floor, so the reaction force from the floor pushes you along.*
  - d. When you hit a wall with a force of 200 N (action - include the magnitude of the reaction force)  
*The wall acts on you with a force of 200 N.*
  
4. **Compare the magnitudes** of the **forces** and the **accelerations** in the following situations:
  - a. A rifle fires a bullet.  
*The forces have the same magnitude, but the bullet has a larger acceleration because it has a smaller mass (Newton's 2<sup>nd</sup> Law).*
  - b. A bicycle and a big rig truck have a head on collision.  
*The forces have the same magnitude, but the bike has a greater acceleration.*
  
5. You (safely) jump off of a small cliff.
  - a. You accelerate towards the Earth, but does it **accelerate** towards you?  
*Yes, the Earth accelerates towards you.*
  - b. **Why** don't we notice the Earth's acceleration?  
*Because the Earth has a VERY large mass, its acceleration is tiny!*

6. A satellite is in low Earth orbit:
- What is the reaction counterpart to a force of 1000 N exerted by the Earth on a satellite (include the magnitude of the reaction force)?  
*The satellite exerts a 1000 N force on the Earth.*
  - If action equals reaction, why isn't the Earth pulled into orbit around the satellite?  
*The Earth is too massive for a comparable acceleration by a force of equal magnitude.*
7. People used to think that a rocket could not reach the Moon because it would have no air to push against once it left Earth's atmosphere. Now we know this idea is incorrect, but what exactly is the force that propels a rocket in the vacuum of space?  
*The exhaust exerts a reaction propelling force on the rocket which moves it in the opposite direction the rockets are fired.*