# PHYSICS NOT ON ICE FOR 3U NAME: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Activities and Questions: Learning Your Principles (physics that is!)**

Please answer using complete sentences and try to use concepts of physics in your answer. Use your textbook to help answer these questions. Note: An explanation involving a law or principle does NOT consist of just restating that principle. Use the principle, talk about the forces and motion etc.

1. **Newton’s first law: Inertia**
2. Write out Newton's First law of Motion (see Chapter 4).
3. Consider the act of shovelling snow. When you stop the shovel, what happens to the snow? Explain this motion in terms of Newton's First Law.
4. Draw a diagram of the forces on the lump of snow (free-body diagram) once it is free of the shovel and sailing through the air. Use the co-ordinate system below. Label forces clearly (eg. Fgravity)

Coordinate

system

UP

RIGHT

DOWN

1. **Newton’s Second Law: Forces and Motion**
2. Write out Newton's Second Law in words and as a formula.
3. You have two shopping carts.

Case 1: Cart A is smaller than Cart B. If you apply the same force to both of them, which one will have the greater change in velocity (ie. the greater acceleration)?

Case 2: If both carts have the same mass and you apply a greater force to Cart A than to Cart B, which one will have the greater acceleration?

1. **Newton’s Third Law: Action - Reaction**
2. Write out Newton's Third Law.
3. State the action and reaction force statements for the following situations. Hint: see page 49.

|  |  |  |
| --- | --- | --- |
| SITUATION | ACTION FORCE | REACTION FORCE |
| A car accelerates forward. |  |  |
| Student standing on a skateboard throws a brick forward. (The action force is on the brick.) |  |  |
| A helicopter moves upward. |  |  |
| A jet moves forward. |  |  |

**Third Law Continued**

1. Two people (about the same mass and both wearing skates) are facing each other. Person A pushes on person B. Both skaters (A and B) move backward (away from each other). Explain using Newton's Third Law why this happens.
2. When you shoot a ball against a wall, why does the ball bounce back but the wall does not move?
3. NOW use the concepts of **all three** of Newton's laws to explain the motion and forces of a baseball that has been thrown and then is struck by the batter. (see question #3 page 122 for an example).
4. **Static and Kinetic Friction (see chapter 5)**
5. Write out the definitions of static and kinetic friction.
6. When you are pushing a stalled car is it harder to get the car going or keep it going?
7. So which is greater, static or kinetic friction? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
8. Give an example (from your everyday experiences) of

i) Low kinetic friction

ii) High kinetic friction

iii) Low static friction

iv) High static friction

1. **Conservation of Momentum (mass times velocity)**
2. If you are playing pool and you hit ball A directly at ball B which is at rest, ball A stops and ball B moves off with the same velocity as ball A had. If you increase the mass of ball B (still at rest), ball A will bounce backwards when it hits ball B and ball B will move forward at a slower velocity. What do you think will happen if you make the mass of ball A larger than ball B (still at rest to start with)? Hint; think big truck moving towards a parked mini-cooper.
3. If you watch someone spinning on the ice and they start with their arms fully extended, what happens to the speed of their spin when they pull their arms in? Does it increase? decrease? Or stay the same? Explain your answer.
4. **Torque (turning force)**
5. If I want to open a door (make a turning effect) where must I push on the door? Close to the hinge or as far away from the hinge as possible? (Try it!) Explain why.
6. As I move my hand closer to the door handle, it takes less force to cause the same rotation for the door. This tells me that there are two factors that affect torque. What are they?
7. Why is it so difficult to turn a wrench doing repairs outside the International Space Station?