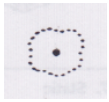
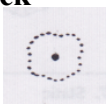
Unit 4 Newton's Laws Review **Name:_____ #:____**

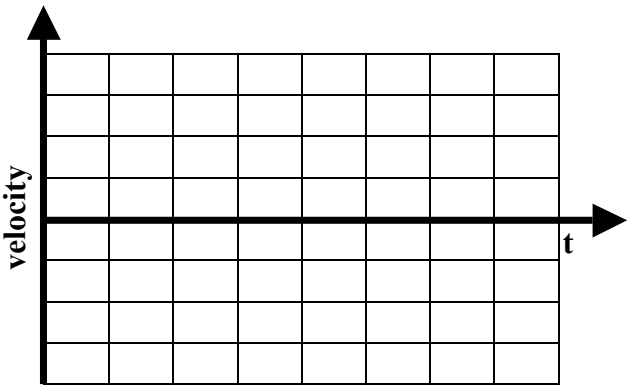
1. Consider a collision between a small car and a heavy truck. In such a collision, how does the size of the force exerted on the car by the truck compare with the size of the force exerted on the truck by the car? **Explain** your reasoning.

Car **Truck**

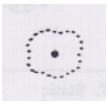




2. a. Draw a velocity-time graph for a ball thrown vertically into the air during its up-and-down motion.



b. Draw a force diagram for the thrown ball when it reaches its highest point.



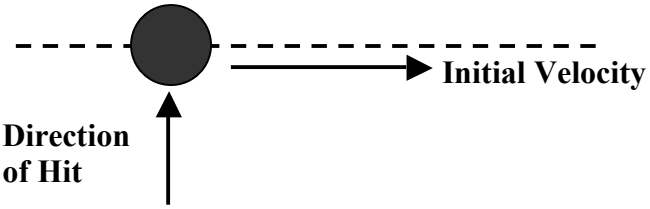
c. At the highest point, is the velocity zero? **Explain**.

d. At the highest point, is the acceleration zero? **Explain**.

e. At the highest point, is the net force zero (i.e. are the forces unbalanced)? **Explain** how you know.

3. The figure below is a snapshot looking down on a bowling ball moving at constant velocity from left to right on a smooth, level floor. At the position shown, the ball is given a short, sharp hit in a direction perpendicular to the ball's initial motion.

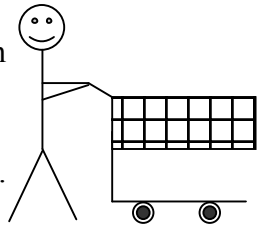
a. On the diagram, draw a path that the ball might follow after the hit. **Explain** your reasoning for the path you drew.



3 b. Immediately after the hit, will the speed of the ball be equal to, greater than, or smaller than the ball's velocity before the hit? **Explain** your reasoning.

c. How will the velocity of the ball behave as time goes by after the blow? That is, will either the magnitude or the direction of the velocity change? If so, how? **Explain** your reasoning.

4. You push a grocery cart along a level floor in the presence of friction effects between the cart and the floor.



a. Draw force diagrams for **you**, the **cart**, and the **floor/earth**. Fully label all vectors.

Shopper

Cart

Floor/Earth

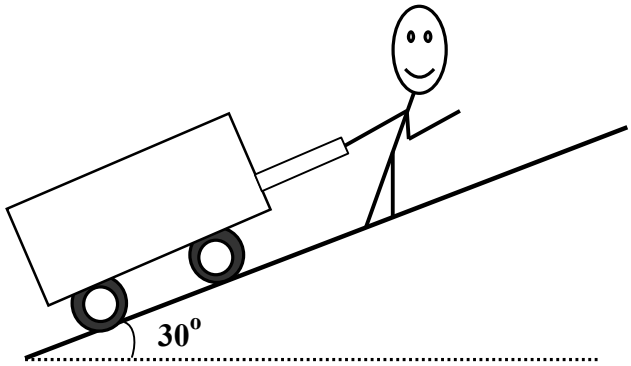
b. While you are making the cart **speed up**, how does the size of the force you apply on the cart compare to the size of the force the cart exerts on you? **Explain**.

c. While you are making the cart **speed up**, how does the size of the frictional force on the *cart* by the floor compare to the frictional force on *you* by the floor?

d. **Identify** all of the Newton's Third Law pairs in your force diagrams. List the pairs below.

5. A 35 kg child pulls a 10 kg wagon up a hill at 0.6 m/s. The wagon exerts 60 N of force on the child.

a. Draw a **quantitative (Hint numbers should be involved…)** force diagram for the **wagon**.



b. **Explain** how you applied Newton's **second** law to make the force diagram quantitative.

c. **Explain** how you applied Newton's **third** law to make the force diagram quantitative.

6. Mr. Ed the talking horse is being hitched to a cart. He refuses to pull the cart due to his understanding of Newton's Third Law. He believes that if he pulls on the cart there is an equal but opposite force that will keep the cart from moving. How do you reason with him? Draw force diagrams to prove your point.