Newton 2nd law lab

Through the following experiment, students will be able to discuss the relationships between the variables in Newton's Second law. (F=ma).

Materials needed:

Dynamics cart and track with pulley	String	Set of masses
Photo gate timer	Index card	tape

Experiment One: Constant Force, Changing Mass

Procedure

1. Attach a length of string to your cart, just long enough so it does not touch the ground when the cart is at the pulley end of the track.
2. Tie a loop in the loose end of the string, place the 50 g mass through the loop and hang the mass over the pulley.
3. Tape an index card so it stands like a sail onto the cart
4. Choose a starting point for you cart that you will use each time at a point where the 50 g mass is almost up at the pulley
5. Put the photo gate in gate mode and place in a position that will measure the movement of your card soon after you release it from the starting point.
6. Record the time it takes your cart to travel 10 cm using different masses to fill in the table below

Trial	Total mass being pulled **(kg)**	Distance traveled **(m)**	Time 1 (s)	Time 2 (s)	Time 3 (s)	Average **(s)**	Acceleration **(m/s^2)**
Cart	500 g						
Cart + 100g							
Cart + 200g							
Cart + 300g							
Cart + 400g							
Cart + 500g							
Cart + Unknown	**Unknown**						

For the acceleration calculation, please use the following: $\mathbf{a = 2d/t^2}$

1. _____ The mass of an object is increased. What affect does this have on the acceleration of the object?
   a. increased. b. decreased. c. not affected.

2. _____ The mass of an object is decreased. What affect does this have on the acceleration of the object?
   a. increased. b. decreased. c. not affected.

3. _____ An object has an acceleration of 12.0 m/s/s. The mass of the object is doubled while the net force on the object is held constant. What will be the new acceleration?
   a. 2.0 m/s/s b. 6.0 m/s/s
   c. 14.0 m/s/s d. 24.0 m/s/s

Experiment Two: Constant Mass, Changing Force

Using a similar set up to experiment one, this time 100 grams will be distributed between the cart and falling. Start with 100 grams on top of the cart. For each trial, hang 20 grams from the cart and put on the end of the string to measure times it takes to go the distance.

Trial	Total mass falling **(kg)**	Force Falling (N)	Distance traveled **(m)**	Time 1 (s)	Time 2 (s)	Time 3 (s)	Average **(s)**	Acceleration **(m/s^2)**
Cart + 80g								
Cart + 60g								
Cart + 40g								
Cart + 20g								
Cart + 0 g								
Cart + 0 g	Unknown	Unknown						

For the acceleration calculation, please use the following: **$a = 2d/t^2$**

4. _____ The net force experienced by an object is increased. What affect does this have on the acceleration of the object?

a. The acceleration is increased.
b. The acceleration is decreased.
c. The acceleration is not affected by this change.

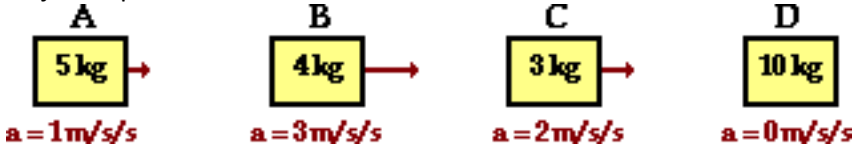
5. _____ The net force experienced by an object is decreased. What affect does this have on the acceleration of the object?

a. The acceleration is increased.
b. The acceleration is decreased.
c. The acceleration is not affected by this change.

6. _____ An object has an acceleration of 12.0 m/s/s. The net force acting on the object is doubled while the mass of the object is held constant. What will be the new acceleration?

a. 2.0 m/s/s b. 6.0 m/s/s
c. 14.0 m/s/s d. 24.0 m/s/s

7. _____ Different forces are applied to objects of varying mass. The resulting accelerations are listed (and represented by the arrow). Which object experiences the smallest net force?



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