

Spring 2001 Physics 2048 Test 2 solutions

Problem 3 (Essay 10 points)

You may use diagrams and equations but no calculations in your response for this problem.

Explain Newton's laws of motion in your own words. Include a real life example in your explanation of each law.

0th Law: Objects only know what acts directly on them at that specific instant in time. Example: Think about a book placed on top of the table. If a second book is stacked on top of the first, the table at that instant feels a larger force exerted by the lower book. To the table it doesn't matter if there is another book on top of the bottom book or someone pushing down on that bottom book. All the table knows is that the force that the bottom book is exerting on it right now. The table does not remember that shortly before there was a smaller force exerted by the bottom book.

1st Law: An object will move with constant velocity unless there is a net force acting on the object. Example: An air hockey puck will move in a straight line with constant speed between collisions with the walls when there is no net force. However, there is a net force when the puck hits the wall and this causes the puck to change directions and may change it's speed as well.

2nd Law: An object that feels a net force will accelerate and the acceleration will be proportional to the vector sum of forces acting on the object and inversely proportional to the object's mass. In class we used a string running over a pulley and going down to a hanging mass to exert a tension force on a cart. If we pulled with twice as much force, the cart accelerated twice as fast. If we had doubled the mass of the cart and pulled twice as hard, the acceleration would be the same as the original cart with the original tension force.

3rd Law: A force is a two way interaction between two objects. If objects A and B are interacting, then the force that B exerts on A is equal in magnitude, opposite in direction, and of the same type as the force that A exerts on B.

- A book on a table on the earth exerts a normal force downward on the table. The table compresses very slightly like a stiff spring and exerts a normal force upward on the book that has the same magnitude as the downward normal force exerted by the book on the table.*
 - If a bus hits a VW bug, the force that the bug exerts on the bus has the same magnitude as the force that the bus exerts on the bug.*
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