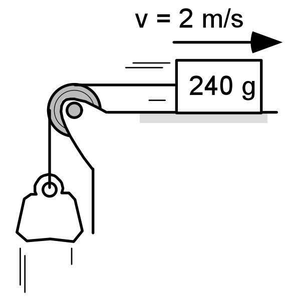
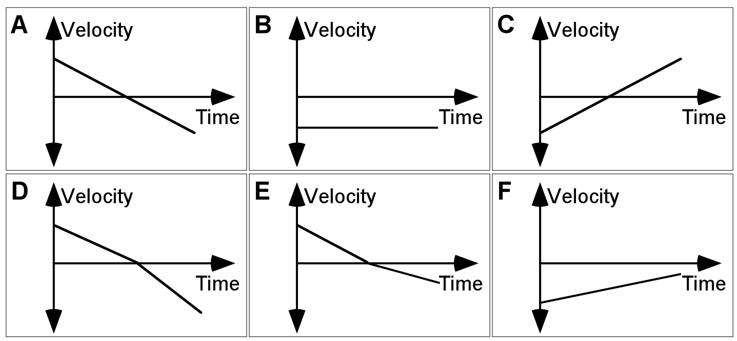
Review Packet

Name: ____________________

1. A box is sliding to the right along a horizontal surface with a velocity of 2 m/s. There is friction between the box and the horizontal surface. The box is tied to a hanging stone by a massless rope running over a massless, frictionless pulley. The mass of the stone is larger than the mass of the box. The box will slow down, come to rest at an instant, and then move to the left with increasing speed. Assume that a positive velocity represents motion to the right.

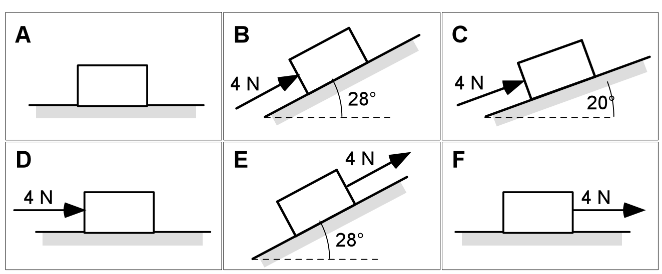


Which, if any, of the velocity versus time graphs below represent the movement of the sliding box?



Explain.

The figures below show six situations where the same block, which has a mass of 5 kg, remains at rest on either a horizontal or an inclined surface. The surfaces are all made of the same material. In all cases except Case A, a 4 N force acts on the block parallel to the surface as indicated by the arrow in the diagram.



Rank these situations on the basis of the magnitude of the frictional force on the block.

Greatest 1 _______ 2 _______ 3 _______ 4 _______ 5 _______ 6 _______ Least

OR, The magnitude of the frictional force is the same but not zero for all these cases. ___

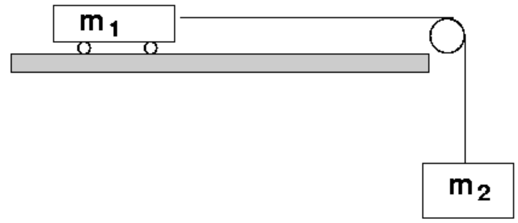
OR, The magnitude of the frictional force is zero for all these cases. ___

OR, We cannot determine the ranking for the magnitude of these frictional forces. ___

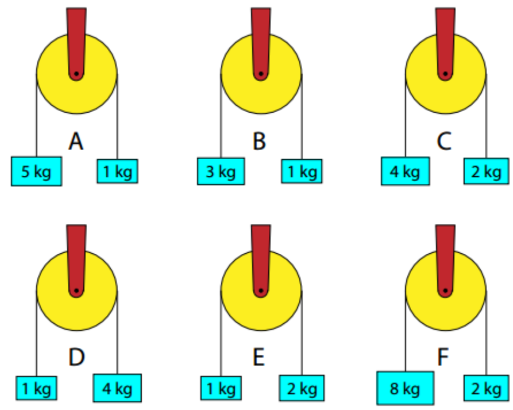
Please explain your reasoning.

Pulley problems

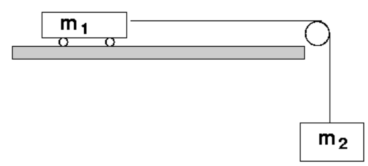
2. Find what affects the acceleration of the system. If the mass of both carts is doubled, what happens to the acceleration?



3. Two masses are hung from a light string over an ideal frictionless massless pulley. The masses are shown in various scenarios in the diagram at right. Rank the acceleration of the masses from greatest to least.



4. You hold a block on a horizontal, frictionless surface as seen to the right. After releasing the block is the acceleration greater than g, less than g, or equal to g? Explain.

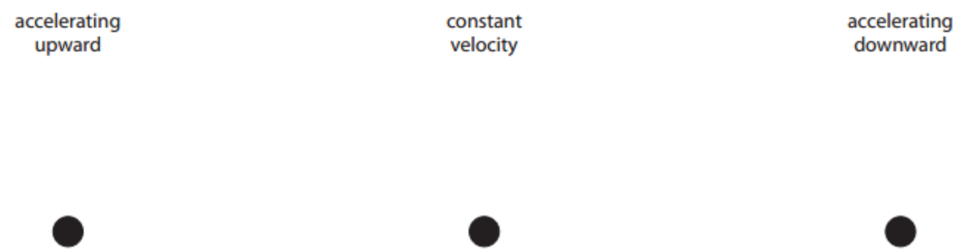


5. In reference to the previous question, what is the magnitude of the force exerted by the string on the horizontal block after it has been released? Is it:

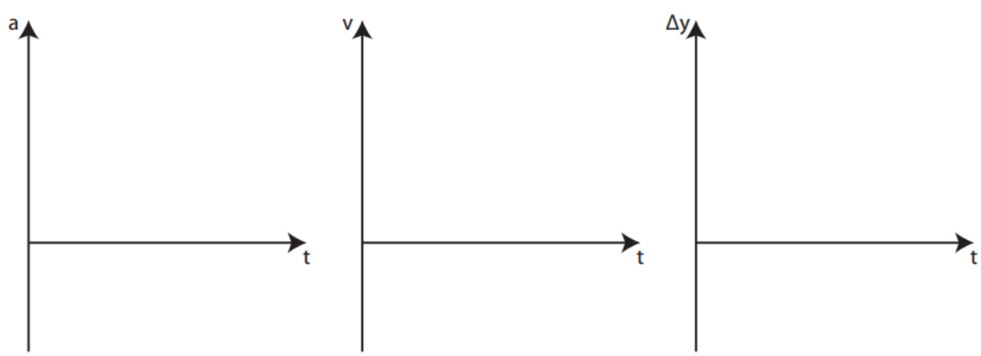
a. Equal to the force that Earth exerts on the hanging block
b. Less than the force that Earth exerts on the hanging block
c. More than the force exerted by Earth on the hanging block.

6. A student, standing on a scale in an elevator at rest, sees that the scale reads 840 N. As the elevator rises, the scale reading increases to 945 N for 2 seconds, then returns to 840 N for 10 seconds. When the elevator slows to a stop at the 10th floor, the scale reading drops to 735 N for 2 seconds while coming to a stop.

a. Draw the free body diagram for the student while the student is accelerating upward, then moving at a constant velocity, and finally accelerating downward at the end. Draw the length of the force vectors to show when forces are balanced or unbalanced.

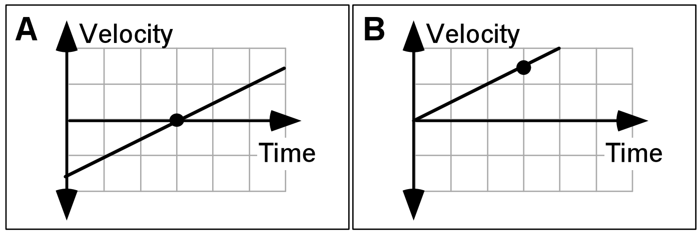


b. Sketch acceleration vs. time, velocity vs. time, and displacement vs. time graphs of the student during the elevator ride.



c. Explain why the apparent weight of the student increased at the beginning of the motion.

7. These graphs below show the velocity versus time for two identical train engines on a straight track. A positive velocity indicates that the engine was traveling east. The scales on both axes are the same for the graphs. On each graph a point is marked with a dot.

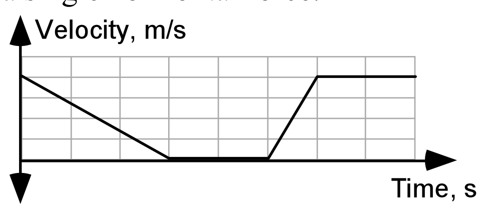


A student who is asked how the net force acting on the engine in graph A at the identified point compares to the net force acting on the engine in graph B states:

"I think that B has the larger net force since the net force on A at the identified point is zero."

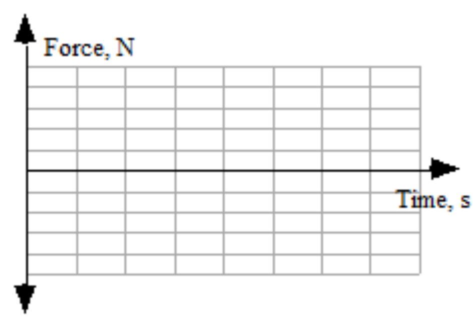
What, if anything, is wrong with this statement? If something is wrong, identify it, and explain how to correct it. If the statement is correct, explain why.

8. Shown is the velocity versus time graph for an object that is moving in one dimension under the (perhaps intermittent) action of a single horizontal force.

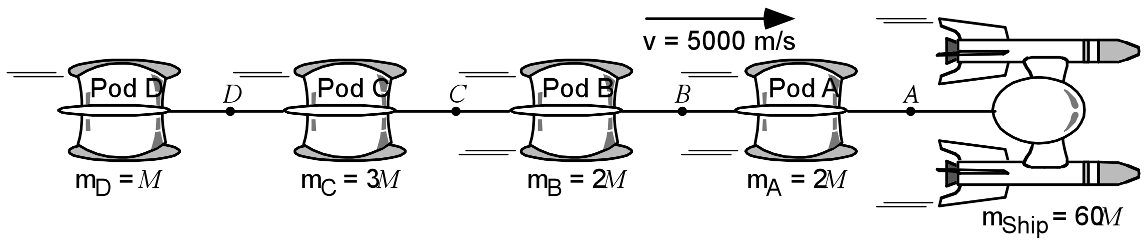


On the axes below draw the horizontal force acting on this object as a function of time.

Explain.



9. Shown is a spaceship pulling four cargo pods at a constant velocity. The pods are connected to each other by rods, and a rod connects Pod A to the spaceship. The velocity of the spaceship and of the pods is 5000 m/s. All masses are given in the diagram in terms of *M,* the mass of an empty pod. (Since this is in space, we can ignore any resistive forces.)



Rank the magnitude of the tension at the labeled points in the rods.

Greatest 1 _______ 2 _______ 3 _______ 4 _______ Least

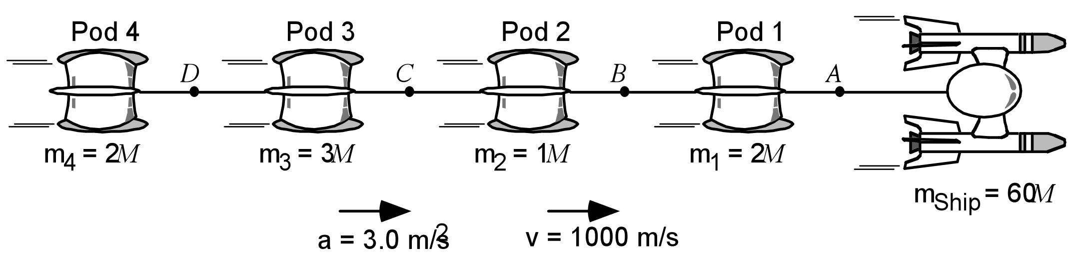
OR, The magnitude of the tension in all the rods is the same but not zero. ___

OR, The magnitude of the tension in all the rods is zero. ___

OR, The ranking for the tensions in the rods cannot be determined. ___

Explain your reasoning.

Now the spaceship is accelerating at 3.0 m/s^2



Rank the magnitude of the tension in the tow rods at the labeled points.

Greatest 1 _______ 2 _______ 3 _______ 4 _______ Least

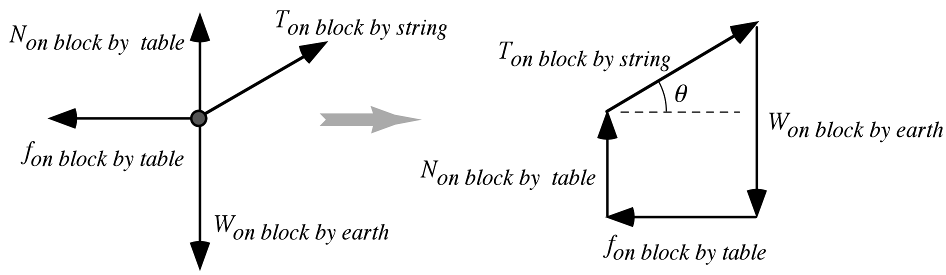
OR, The magnitude of the tension in all the tow rods is the same but not zero. ___

OR, The magnitude of the tension in all the tow rods is zero. ___

OR, The ranking for the tensions in the tow rods cannot be determined. ___

Explain your reasoning.

10. A student uses a string to pull a block across a table at a constant speed of 2 meters per second. The string makes an angle θ with the horizontal. A second student makes a free-body diagram of the block, and then uses this free-body diagram to generate a vector sum diagram as shown.



Three students are comparing the magnitudes of the forces in the vector sum diagram:

Anja: The vector sum diagram allows us to compare the magnitudes of all four forces: The weight is the largest, then the tension, then friction, then the normal force.

Barb: Well, the weight is definitely greater than the normal force. But there should be a net force to the right in the vector sum because that's the way the block is moving, and there isn't. I don't think we can use it to rank the other forces.

Cole: I think we can use it to say that the weight is greater than the normal force. Also, the tension is greater than the friction, since the friction is the same length as the dashed line, and this is equal to the tension times the cosine of theta (θ). But we can't compare the vertical forces with the horizontal ones.

Which, if any, of these students do you agree with?

Anja _____ *Barb* _____ *Cole* _____ None of them______

Please explain your reasoning.