Four Common Forces

Pre-Lecture Questions

Problem Set #11 (due next time)

Lecture Outline

1. Weight - The Force of Gravity
2. Tension in Strings
3. The Normal Force from Surfaces
4. The Frictional Force from Surfaces

Pre-Class Summary:

The relationship between the mass of an object and the force of gravity it feels is summarized by the mass/weight rule,

$$F_g = mg$$

The tension in strings, ropes, cables, and the like is transmitted undiminished throughout the string if the mass of the string is small compared to the other masses in the problem.

The normal force is always perpendicular to the surface that is exerting it.

The frictional force is always along the surface that exerts it. Friction will be discussed in more detail in the next section.

Understanding the Rule of Falling Bodies

A car of mass m falls off a cliff. Assume no air resistance.

A. Draw the force of gravity (or weight) acting on the falling car in the sketch at the right. Label it F_g.

B. The acceleration of the car is ________________m/s^2__.

I know this because of ______________________________.

The symbol for this value is _______________.

C. Apply Newton's 2nd Law to the car to get the relationship between the weight of the car and the mass of the car.

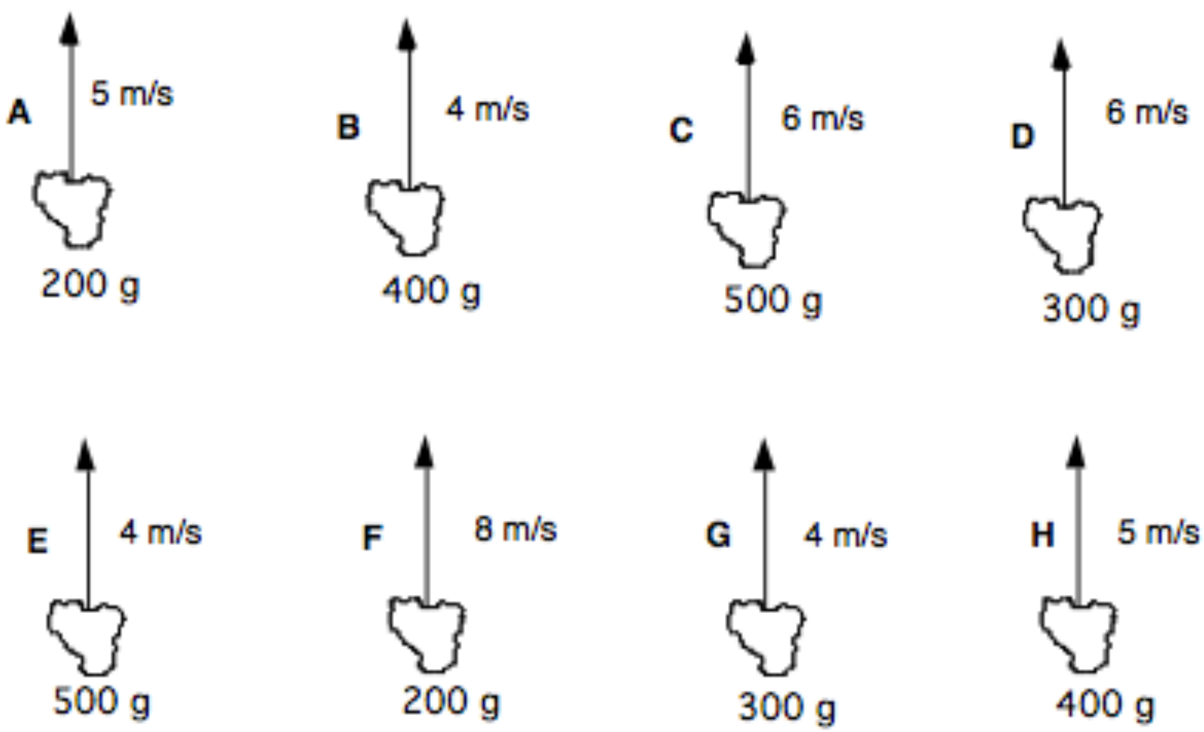
The acceleration due to gravity on Earth is $10 m/s^2$ while on Jupiter it is $25 m/s^2$.

Use your understanding of the laws of motion and the distinction between mass and weight to fill in the table below.

Object	Earth mass (kg)	Earth weight (N)	Jupiter mass (kg)	Jupiter weight (N)
apple		1.0		
professor	62			
textbook			1.5	
watermelon				50

Shown below are eight rocks that have been thrown straight up into the air. The rocks all have the same shape, but they have different masses. The rocks are all thrown straight up, but at different speeds. The masses of the rocks and their speeds when released are given in the figures. (We assume for this situation that the effect of air resistance can be ignored.) All start from the same height.

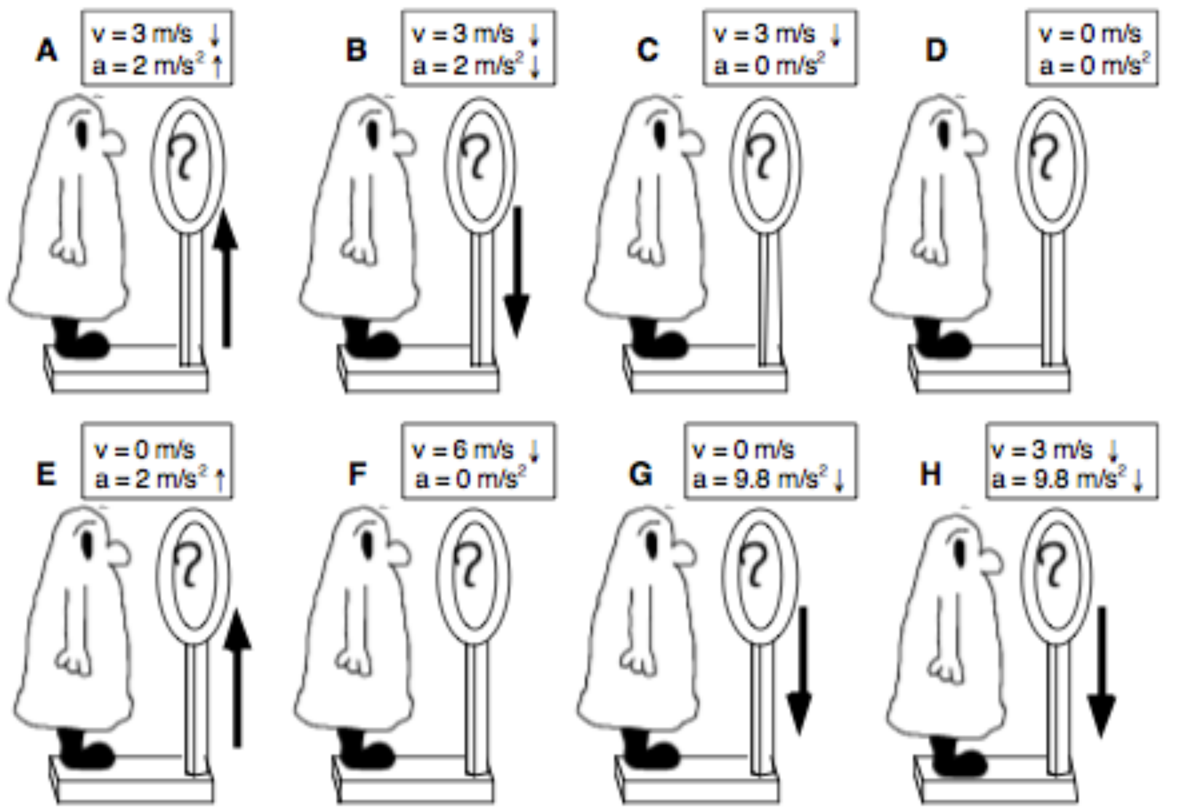
Rank these rocks from greatest to least on the basis of the net force on the rocks after being thrown.



Person in an Elevator Moving Downward—Scale Weight [37]

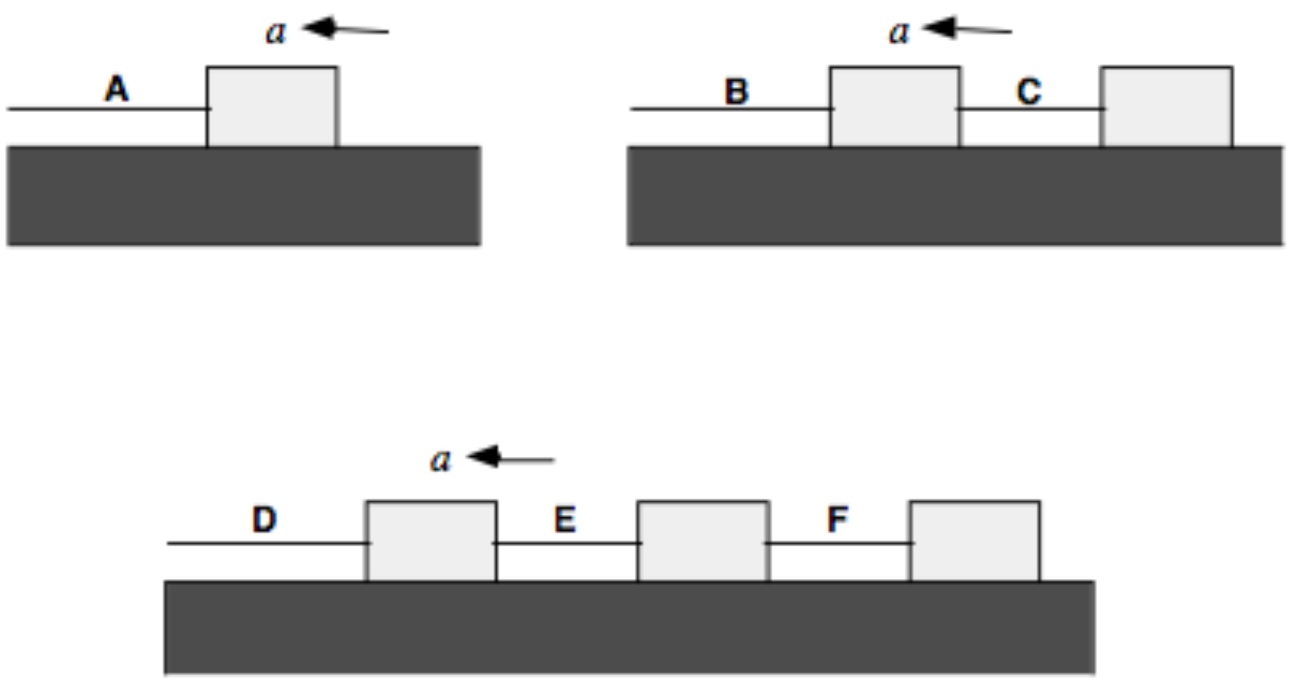
The figures below depict situations where a person is standing on a scale in eight identical elevators. Each person weighs 600 N when the elevators are stationary. Each elevator now moves (accelerates) according to the specified arrow that is drawn next to it. In all cases where the elevator is moving, it is moving downward.

Rank the figures, from greatest to least, on the basis of the *scale weight* of each person as registered on each scale. (Use $g = 9.8\ m/s^2$.)



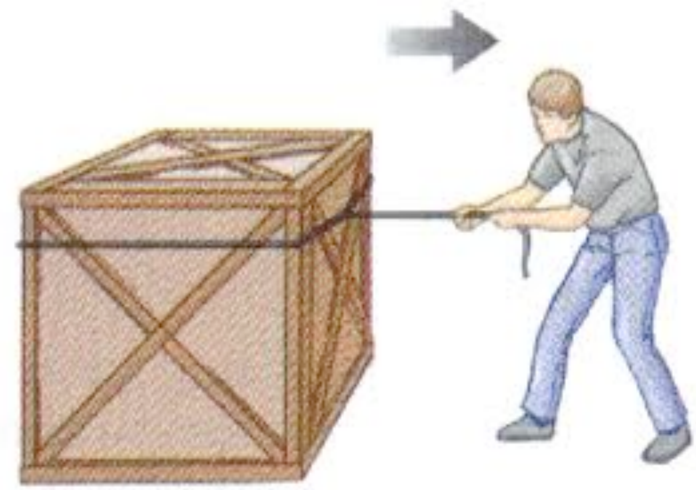
The figures below show boxes that are being pulled by ropes along frictionless surfaces, accelerating toward the left. All of the boxes are identical, and the acceleration is the same in each figure. As you can see, some of the boxes are pulled by ropes attached to the box in front of them.

Rank the ropes from greatest to least on the basis of the tension in the rope.



Example 1: A 2.00kg block on a horizontal table has a horizontal force of 10.0N applied and it still remains at rest. Find the size of the frictional force on the block.

Example 2: A person pulls on a rope connected a 20kg crate with a force of 100N. The crate accelerates to the right at $1.20 m/s^2$. Find the size of each force that acts on the crate.



Lecture 11- Summary

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