MASS AND WEIGHT and FREE-BODY PRACTICE

Mass vs. Weight – What's the Difference? The mass of an object is amount of matter that an object consists of. The WEIGHT of an object is the gravitational force that the Earth exerts on the object. The two (on Earth) are related by the following equation:

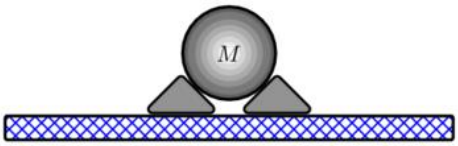
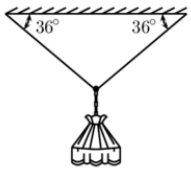
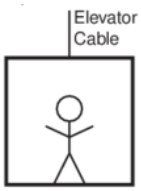
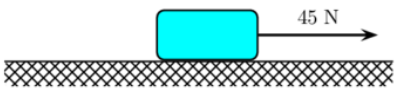
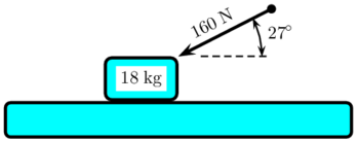
$$F_g = m\,g$$

In the following table, use the equation to solve for the unknown masses and weights:

Object	Elephant	Package of Frozen Peas	Bowling Ball	US Rice Production in a Year	Trash Produced by NYC Daily
Mass (kg)		0.454 kg	5.44 kg	1.005×10^{10} kg	
Weight on Earth (N)	100,000 N				1.2×10^{8} N
Weight on Mars (N)		1.70 N			

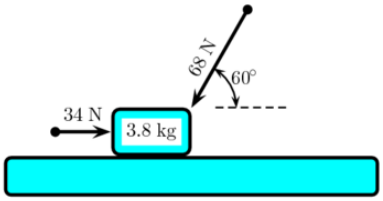
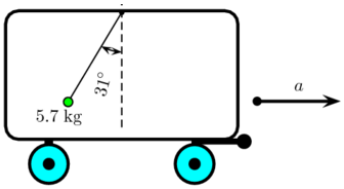
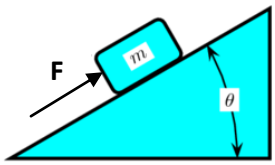
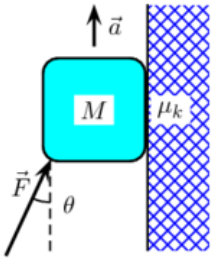
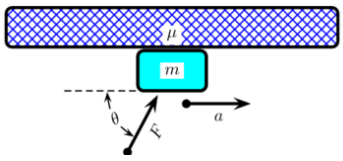
ANSWER THIS: Calculate the acceleration due to gravity on Mars:

FREE BODY DIAGRAMS – NEWTON'S LITTLE HELPER

Scenario	Free-Body Diagram	Questions
A ball of mass M resting on two triangular wedges, as shown. 		Is there a NET force acting on the ball? Provide evidence to support your answer.
A lamp of mass m is suspended from two cables attached to the ceiling, as shown: 		What is the vector sum of the forces acting on the lamp? Provide evidence to support your answer.
An elevator and passenger of mass M accelerated upward by a cable, as shown: 		What is the direction of the net force acting on the elevator? Provide evidence to support your answer.
A box of mass 25 kg being dragged across a frictionless surface by a force, as shown: 		What is the net force acting on the box? What can you say about the sum of the vertical forces acting on the box?
A box of mass 18 kg pushed by a single force across a horizontal frictionless surface, as shown: 		What is the direction of the box's acceleration? What can you say about the sum of the vertical forces acting on the box?

MASS AND WEIGHT and FREE-BODY PRACTICE

For each Scenario, construct the appropriate free-body diagram AND label each force. Then, answer the accompanying questions

Scenario	Free-Body Diagram	Questions
A box of mass 3.8 kg pushed by two forces across a horizontal frictionless surface, as shown: 		What is the direction of the box's acceleration? What can you say about the sum of the vertical forces acting on the box?
A 5.7 kg mass is suspended from the ceiling of a boxcar by a string. The boxcar is accelerating to the right, as shown: 		What is the direction of the mass' acceleration? What force is responsible for this acceleration? Be specific:
A crate of mass m is pushed up a frictionless surface by a horizontal force F, as shown: 		What is the direction of the crate's acceleration? What can you say about the sum of the forces perpendicular to the incline?
A box of mass M is pushed up a rough surface (i.e., there's friction) by a force F as shown: 		What is the direction of the box's acceleration? What can you say about the sum of the forces perpendicular to the wall?
A box of mass m is pushed by force F across the rough ceiling, as shown: 		What is the direction of the box's acceleration? What can you say about the sum of the forces perpendicular to the incline?
A crate weighing 87.4 N is wedged and not moving between two vertical surfaces, as shown: 		What is the type of force that keeps the crate from sliding?

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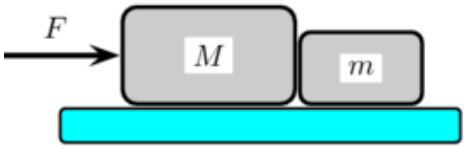
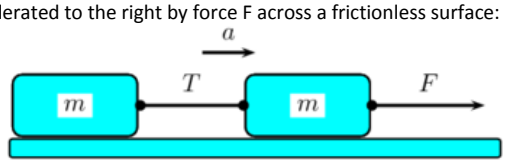
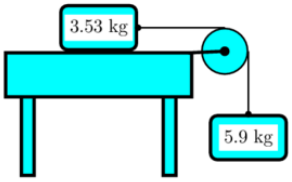
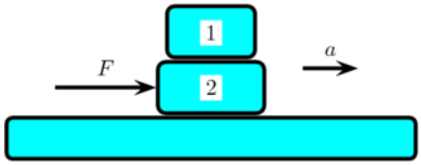
<table>
<tr><td colspan="3">Each of the Following Scenarios Involves Multiple Objects – Draw a Free-Body Diagram for EACH Object</td></tr>
<tr><td>Two boxes, of masses M and m are pushed across a horizontal surface by a force F, as shown:
 
</td><td></td><td rowspan="4">For each scenario, do the two objects have the same acceleration? Use evidence to support your answer:</td></tr>
<tr><td>Two boxes, each of mass m, are connected by a string and are accelerated to the right by force F across a frictionless surface:
 
</td><td></td></tr>
<tr><td>A 3.53 kg box is connected by a lightweight string to a 5.9 kg mass suspended over a pulley. The box slides without friction across the table as the suspended mass descends:
 
</td><td></td></tr>
<tr><td>Box 1 of mass m is stacked on top of box 2 of mass M. Box 2 is pushed across a frictionless surface by force F, and box 1 does NOT slide:
 
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