1. The same rocket sled drawn in the figure is decelerated at a rate of 191 m/s2.

A picture containing indoor

Description automatically generated

A rocket sled moving toward the right is shown. Underneath the sled are two vectors labeled **N** and **w** respectively. Vector **N** points upward and vector **w** points downward. Toward the bottom right of the rocket is a vector **f** which points to the left.

What force (in N) is necessary to produce this deceleration? Assume that the rockets are off. The mass of the system is 2050 kg. (Enter a number.)  
  N

2. Suppose the mass of a fully loaded module in which astronauts take off from the Moon is 14,300 kg. The thrust of its engines is 25,500 N. (Assume that the gravitational acceleration on the Moon is 1.67 m/s2.)

(a)

Calculate (in m/s2) its magnitude of acceleration in a vertical takeoff from the Moon. (Enter a number.)  
  m/s2

(b)

Could it lift off from Earth? If not, why not?

No, the thrust of the module's engines is equal to its weight on Earth.No, the thrust of the module's engines is less than its weight on Earth.    Yes, the thrust of the module's engines is equal to its weight on Earth.Yes, the thrust of the module's engines is greater than its weight on Earth.

If it could, calculate (in m/s2) the magnitude of its acceleration. (Enter a number. If not possible, enter NONE.)  
  m/s2

3. Tom and his little sister are enjoying an afternoon at the ice rink. They playfully place their hands together and push against each other. Tom's mass is 74 kg and his little sister's mass is 15 kg.

(a)

Which of the following statements is correct?

The force experienced by Tom is less than the force experienced by his sister.The force experienced by the sister is less than the force experienced by Tom.    They both experience the same force.

(b)

Which of the following statements is correct?

Tom's acceleration is less than the sister's acceleration.They both have the same acceleration.    Tom's acceleration is more than the sister's acceleration.

(c)

If the sister's acceleration is 2.7 m/s2 in magnitude, what is the magnitude (in m/s2) of Tom's acceleration? (Enter a number.)  
  m/s2

#### 4. (a)

Calculate the tension (in N) in a vertical strand of spiderweb if a spider of mass 6.00 **✕** 10-5 kg hangs motionless on it. (Enter a number.)  
  N

#### (b)

Calculate the tension (in N) in a horizontal strand of spiderweb if the same spider sits motionless in the middle of it much like the tightrope walker in the figure.

Diagram

Description automatically generated

A nearly horizontal tightrope is supported by two vertical poles. A tightrope walker balances at the center of the tightrope, displacing it slightly downward, so that each side of the rope makes a 5.0° angle with the horizontal. Three arrows are drawn from the point where the tightrope walker's foot meets the rope.

* **T**L points to the left and slightly upward, along the rope.
* **T**R points to the right and slightly upward, along the rope.
* **w**, which is shorter than **T**R and **T**L, points vertically downward.

A small free-body diagram in the corner has three arrows. The +x-axis points rightward and +y-axis points upward.

* **T**L points to the left and slightly upward.
* **T**R points to the right and slightly upward.
* **w**, which is shorter than **T**R and **T**L, points vertically downward.

The strand sags at an angle of 13.0° below the horizontal. (Enter a number.)  
  N

Compare this with the tension in the vertical strand (find their ratio). (Enter a number.)

(tension in horizontal strand)⁄(tension in vertical strand) = 

5. A basketball player jumps straight up for a ball. To do this, he lowers his body 0.280 m and then accelerates through this distance by forcefully straightening his legs. This player leaves the floor with a vertical velocity sufficient to carry him 0.920 m above the floor.

#### (a)

Calculate his velocity (in m/s) when he leaves the floor. (Enter a number.)  
  m/s

#### (b)

Calculate his acceleration (in m/s2) while he is straightening his legs. He goes from zero to the velocity found in part (a) in a distance of 0.280 m. (Enter a number.)  
 \ m/s2

#### (c)

Calculate the force (in N) he exerts on the floor to do this, given that his mass is 108 kg. (Enter a number.)  
  N

6. When landing after a spectacular somersault, a 25.0 kg gymnast decelerates by pushing straight down on the mat. Calculate the force (in N) she must exert if her deceleration is 8.00 times the acceleration of gravity. (Enter a number.)  
  N