Force

1. Here on Earth, there is a 104 kg person who goes by "Dan". In preparation to the one-way mission to Mars, Dan is told he will weigh significantly less than he does now when he gets to Mars. Dan is excited about losing weight, as it has been a long-term goal of his. The acceleration due to gravity on Mars is 3.711 m/s^2. How much will Dan's mass change? How much will he weigh on Mars? Convert his Mars-weight into pounds. Explain why Dan should or should not be excited about weighing less once he gets to Mars.

2. We encounter external and internal forces throughout our every day life. Which of the aforementioned forces can accelerate the whole-body center of mass? Identify one internal force, and two external forces that are experienced every day. Finally, considering that we can only generate internal forces, why/how are we able to acceleration our whole-body center of mass?

3. You decide to rearrange your living room. The couch weighs 115 kg and it must be moved 2 meters to the left of where it currently sits. The coefficient of static friction between the couch and the carpet is 0.8, and the coefficient of dynamic friction is 0.65. How much force must you apply horizontally to get the couch to start moving? Once the couch starts moving at a constant velocity, how much force must you apply to maintain that constant velocity? You decide to that the couch looked better where it was 2 meters to the right. This time you apply the force in a direction that is 30 degrees below the horizontal, how much force must you apply to start moving the couch back to where it was?

4. A weightlifter lifts a 25 kg barbell over his head. When the barbell stops above the lifter's head, the vertical ground reaction force is 957 N. What is the mass of the weightlifter, if they are in static equilibrium?

5. Walking around campus one day, you see some kids fighting over a toy. One boy pulls on the toy with 50 N North, another pulls 25 N 23 degrees W of N, a third boy pulls 60 N 60 degrees E of N, and the last boy pulls with 70 N 10 degrees W of S. What is the resultant magnitude and direction of the force on the toy?

Force Answers

1. Here on Earth, there is a 104 kg person who goes by "Dan". In preparation to the one-way mission to Mars, Dan is told he will weigh significantly less than he does now when he gets to Mars. Dan is excited about losing weight, as it has been a long-term goal of his. The acceleration due to gravity on Mars is 3.711 m/s^2. How much will Dan's mass change? How much will he weigh on Mars? Convert his Mars-weight into pounds. Explain why Dan should or should not be excited about weighing less once he gets to Mars.

   No change in mass.
   He weighs 385.944 N on Mars (F=ma)
   Equivalent to 86.7 lbs.
   He should not be excited about his weight loss, as it is not due to a reduction in mass, but rather a reduction in gravity pulling him down. Understand that mass and weight are not the same thing

2. We encounter external and internal forces throughout our every day life. Which of the aforementioned forces can accelerate the whole-body center of mass? Identify one internal force, and two external forces that are experienced every day. Finally, considering that we can only generate internal forces, why/how are we able to acceleration our whole-body center of mass?

   External forces can cause an acceleration of the whole body center of mass.

   Muscle force (internal)
   Friction and normal force (external)

   Using our muscles, we can apply force to our skeletal system. Our skeletal system can apply for the environment (e.g., the ground). Newton's third law explains that for our internally produced force, the ground will apply an external reaction force that is equal and opposite in magnitude and direction. So, the ground, via the ground reaction force, might propel us forward or keep us standing up.

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    902 N
    733.3 N
    1936.6 N

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    72.6 kg

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    ~45 N and 41 Degrees E of N