

Chapter 7

Use with Section 4

ENRICHMENT

● Describing Motion

Jupiter Furniture Design

Your mother works for NASA and has told you that we are very close to colonizing Jupiter. She tells you this is top secret and that you shouldn't tell anyone else. You always have been an entrepreneur and immediately begin thinking about ways you could profit from this newly divulged information.

As you sit at your desk and stare around your bedroom, you realize that furniture will be needed if people are going to colonize Jupiter. As quickly as your excitement builds, however, it disappears. You are certain that there are enough furniture designers in the world already.

Your father comes home and calls you down for dinner. As your dad sits in his chair, it collapses. Everyone in the family begins to laugh, including your father. He continues to laugh and jokes about needing to lose weight as he gets another chair. All of a sudden it hits you—your dad's mass and the gravity acting on it caused the chair to break. On Jupiter, the gravity is about 2.5 times that of Earth's, and there is no possible way current furniture designs could support people's weight.

After dinner you dig out your science book and get to work. You go directly to the section on Newton's laws of motion and refresh your memory. It appears that Newton's third law will help you. It states that, "an action force has an equal, but opposite, reaction force."

On Earth, gravity is measured at 9.8 m/s^2 down. That means that when someone sits in a chair, they are applying a force equal to their mass multiplied by the force of gravity. This can be written as $\text{Force} = \text{Mass} \times \text{Gravity}$, or mg . When you calculate the weight of an object, you write your answer in newtons (N).

Using the information given above, solve these problems.

- Your father used to weigh 484 N. What was his mass (to the nearest tenth)?

- Your father gained 30 N, which caused his chair to break. What was his new mass? How much force was acting on the chair? How much force was reacting?

- How much force will your father exert on Jupiter?

- What will be the reaction force necessary to hold your father up and keep his chair from collapsing on Jupiter?

- Explain what these problems have to do with Newton's third law.

