Elevator Ride Interactive

Background:
Imagine being in an elevator and riding from the 1st floor to 20th floor. You start from rest, speed up (maybe for a floor or two) until you get up to cruising speed. Then you cruise for several floors until you are nearing your destination. As you near your destination, you slow down from cruising speed to a final stopping position (i.e., a zero speed). What would you feel during this time and why would you feel it?

Purpose:
The purpose of this activity is to relate physics principles - Newton's second law and free-body diagrams to the often-experienced motion of slowing down, moving at a constant speed, and speeding up on an elevator ride.

To Do:
Ride the elevator from the 1st floor to the 20th floor (or the 10th floor). Ride it back down. Repeat several times while making observations of the acceleration values, the free-body diagrams, and the rider's sensations. Record observations in the Data section below. Repeat the process for a ride from the 20th floor to the 1st floor.

Data:

Ride from 1st floor to 20th floor.

State of Motion	Acceleration	Rider Sensation (circle one)	Force Comparison (use >, < or =)
Speeding up from Floor _____ to Floor _____	Value: _____ m/s/s Dir'n: _____	heavy normal light	F_{grav} _____ F_{norm}
Constant speed from Floor _____ to Floor _____	Value: _____ m/s/s Dir'n: _____	heavy normal light	F_{grav} _____ F_{norm}
Slowing down from Floor _____ to Floor _____	Value: _____ m/s/s Dir'n: _____	heavy normal light	F_{grav} _____ F_{norm}

Ride from 20th floor to 1st floor:

State of Motion	**Acceleration**	**Rider Sensation** (circle one)	**Force Comparison** (use >, < or =)
Speeding up from Floor _____ to Floor _____	Value: _____ m/s/s Dir'n: _____	heavy normal light	F_{grav} _____ F_{norm}
Constant speed from Floor _____ to Floor _____	Value: _____ m/s/s Dir'n: _____	heavy normal light	F_{grav} _____ F_{norm}
Slowing down from Floor _____ to Floor _____	Value: _____ m/s/s Dir'n: _____	heavy normal light	F_{grav} _____ F_{norm}

Conceptual Analysis:

Use your observations to answer the following questions using complete sentences and complete thoughts.

1. How do the individual forces compare when the rider experiences a normal sensation of weight? What is the acceleration value when this occurs?

2. How do the individual forces compare when the rider experiences a sensation of being lighter than his normal weight? What is the acceleration direction when this occurs?

3. How do the individual forces compare when the rider experiences a sensation of being heavier than his normal weight? What is the acceleration direction when this occurs?

For Questions #4 - #6, read especially closely, think deeply and answer intelligently. As should always be the case, referencing your data will help.

4. **True** or **False**:

   A person will feel less than the normal weight whenever they are moving upward.

   If False, explain why the statement is false.

5. **True** or **False**:

   A fast-moving person will feel very heavy - at least much heavier than normal.

   If False, explain why the statement is false.

6. **True** or **False**:

   Sensations of heaviness and lightness are always associated with changes in a person's weight. A person who feels light has lost weight and a person who feels heavy has gained weight.

   If False, explain why the statement is false.

Thinking Quantitatively:
Use Newton's second law of motion and a free-body diagram to ...

1. ... calculate the normal force acting upon a 50-kg passenger who accelerates upward at a rate of 3.0 m/s/s.

2. ... calculate the normal force acting upon a 50-kg passenger who accelerates downward at a rate of 3.0 m/s/s.

Conclusion:
Write a conclusion to this lab in which you discuss when a person on a roller coaster ride would have *sensations of weightlessness* and when they would have *sensations of weightiness*. In your discussion, talk about accelerations and forces. Then finish off your conclusion by using Newton's second law to explain why such accelerations and force conditions cause these sensations.