



# Weightlessness

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# Measuring Weight

- When you step on a scale, gravity presses you down on the scale with a force equal to your weight.
- The scale measures the force.
- According to Newton's third law, the scale presses back.
- You feel your own weight because of the reaction force of the scale (or other surface on which you're standing).



# Measuring Zero Weight

Suppose you are in an elevator on the scale and the elevator is falling with you and the scale.

- Gravity is moving you and the scale together.
- The scale is not pushing up on you.
- According to Newton's third law, you are not pushing down on the scale.
- The scale measures your weight to be zero.
- You feel weightless because nothing is pushing up on you.



# Being in Orbit

- An object in orbit is falling towards the earth.
- It doesn't crash into earth because it is also moving away from the earth (at a right angle).
- As a result, it orbits.

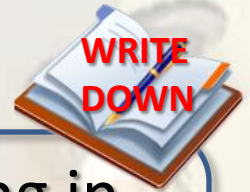


# Weightlessness in Orbit



- All the objects in a space craft in orbit are doing the same thing as the space craft, . . . falling towards the earth while moving away from the earth (at a right angle).
- This makes them like an object in a falling elevator.
- As a result, they feel weightless.

# Summary



The experience of ***weightlessness*** is a result of being in freefall.

- The force of gravity is not zero during freefall. (Gravity causes freefall.)
- Since weight is caused by the pull of gravity, the falling object still has weight, but has no *apparent weight*.
- Apparent weight is caused by the reaction force from the surface on which object is resting.
- In the absence of this reaction force, an object would be in free-fall.
- A person in freefall would experience weightlessness.