PHYSICS ASSIGNMENT ONE

1. A 50-kilogram student stands in an elevator. How much force does she exert on the elevator floor if:

    a. The elevator is stationary?

    According to Newton, F=mg which is F=(50 kg)(9.81m/s^2) so that

    F=490.5 N

    b. The elevator accelerates upward at 1 meter per second squared (m/s^2)?

    If the elevator is accelerating upward, this reduces the force of gravity by 1m/s^2.

    Thus, g=8.81 m/s^2, and the force exerted by the student becomes F=(50 kg)(8.81m/s^2) and F=440.5 N

2. Answer the following questions:

    a. How long would it take for an object dropped from the Leaning Tower of Pisa (height 54.6 meters) to hit the ground?

    Since gravity is a constant acceleration of 9.81m/s^2, an object that is dropped and freely falling towards earth will move faster each second by an amount proportional to the square of the elapsed time. The equation of distance moved is: $d = 0.5 * g * t^2$

    Solving for t: $t = \sqrt{(d / 4.905)}$

    $t = \sqrt{(54.6 / 4.905)}$

    t = 3.34 seconds

    b. How fast was the object traveling at the moment of impact?

    v = 9.8 m/s2 * 3.34 s = 32.7 m/s

3. Construct a table of values of velocity and total distance fallen at the end of each half-second during the first five seconds for a stone at rest dropped from a very tall building.

    Include columns for time, velocity, and total distance.

Time (seconds)	Velocity (m/s)	Total distance (m)
0.5	4.9	1.225

1.0	9.8	4.9
1.5	14.7	11.025
2.0	19.6	19.6
2.5	24.5	30.625
3.0	29.4	44.1
3.5	34.3	60.025
4.0	38.0	78.4
4.5	44.1	99.25
5.0	49.0	122.5

4. A parachute dropped from a 30-meter-high cliff falls with a constant velocity of 1.5 meters per second. Twenty-two seconds later a stone is dropped from the cliff.

    a. How long does it take for the parachute to hit the ground?

    t = d / v

    t = 30 m / 1.5 m/s

    t = 20 s

    b. How long does it take for the stone to hit the ground?

    t = √ (d / 4.905)

    t = √ (30 / 4.905)

    t = 2.5 s Total time is 22 s + 2.5 s = 24.5 s

    c. Which one will hit the ground first and why?

    The parachute will hit the ground first because it has a constant velocity, and the stone is not dropped for 22 seconds.

5. Galileo used inclined planes to investigate “free fall.” Why did he do that instead of experimenting with velocity by dropping objects?

    Objects freely falling when dropped from a height accelerate too quickly for meaningful observations. The inclined plane slows objects due to friction, giving more time to study their behavior.

6. Explain the following terms:

    a. Linear motion

In linear motion, an object moves along straight line. This type of motion has a velocity and may or may not have acceleration.

b. Constant velocity

Constant velocity is the simplest equation of motion besides one in which the object is at rest. It is an example of straight-line or linear velocity, specifically the non-accelerated type.

c. Accelerated motion

Accelerated motion is motion in which the object is changing its velocity -- this may include changes in speed and/or direction, since velocity is a vector quantity.