# Apparent Weight This experiment can be performed with many brands of data loggers.

#### Aim:

- i) To examine the apparent change in mass and weight of an object while in an accelerating lift.
- ii) To determine the acceleration of a lift when leaving and arriving at a floor.

### Theory:

When an object accelerates vertically upward, or downward the resultant force is the vector addition of the gravitational force and the applied upward force. If the upward force is greater than the gravitational force the resultant force can be found using the equation

$$F_R = F_{UP} - mg$$
 I

and the resultant acceleration using equation below

$$a = (F_{UP} - mg)/m$$
 II

If the upward force is less than the gravitational force the resultant force can be found using the equation

$$F_R = mg - F_{UP}$$
 III

and the resultant acceleration using equation below

$$a = (mg - F_{UP})/m$$
 IV

In this experiment the upward force is provided by a mass/force sensor attached to a data logger. The mass/force sensor measures the upward force. If this sensor is calibrated in kg then it measures the apparent mass of the object and this value must be multiplied by 9.8 to convert it into N.

### Method:

- I. The equipment should be set up as shown below. Place a mass of approximately 150 200 g
- II. onto the mass/force sensor. Record the value of this mass in the results section.



Equipment: A mass/force sensor attached to a data logger.

III. Take the data logger and sensor into a lift. Select an appropriate sampling rate (10 s<sup>-1</sup>). While

the lift is stationary start the logger.

- IV. Continue logging until the lift stops at the next floor. If possible, allow the lift to travel through several floors before stopping.
- V. Repeat for the downward journey

## Analysis:

I. Upload your data to your computer. Your data will be similar to that shown below.



- II. The graph above shows the complete journey from ground to top floor and back.
- III. Print a copy of the graph and label the sections as shown above indicating when the lift was accelerating upward, moving with constant velocity, accelerating downward and stationary.
- IV. Using the data in your graph determine the average force during the upward acceleration from the start floor and use equation I) in the theory to determine the acceleration of the lift.
- V. Determine the average force during the downward acceleration to the last floor and use equation II) in the theory to determine the acceleration of the lift.
- VI. Using the value for force determined in parts II and III find and record the apparent mass of the object for each of the upward and downward cases.
- VII. Repeat steps II, III and IV for the downward direction.

### **Discussion:**

When was the apparent mass (or weight) less than the actual mass (or weight). When was the apparent mass (or weight) greater than the actual mass (or weight).

### **Conclusion:**

Write your own conclusion ensuring that it relates to the aim as stated above.