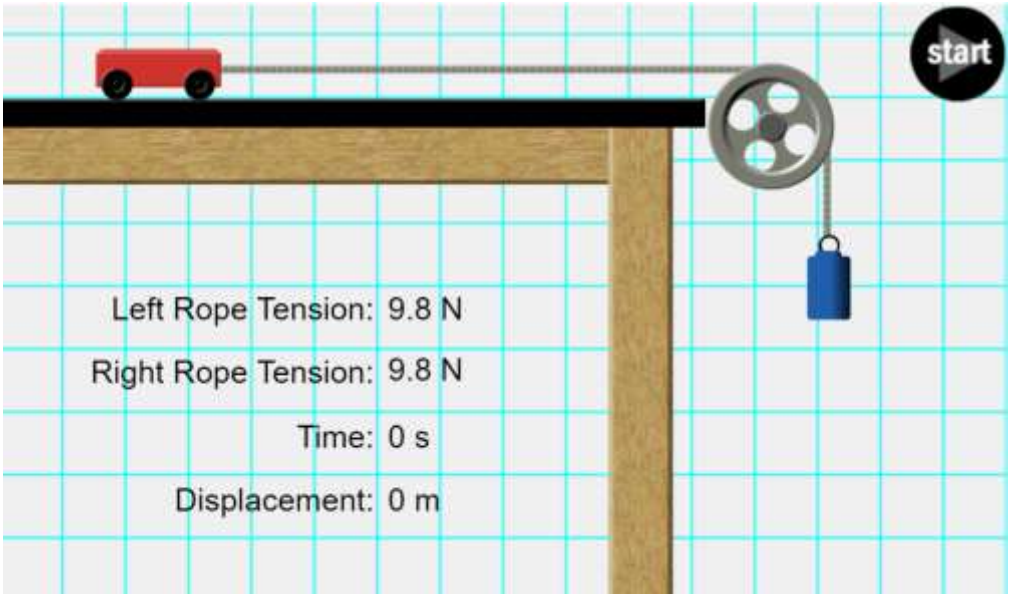
Date _____

Investigation of Newton 2nd Law

Aim: To predict the acceleration of an Atwood Machine by applying Newton's 2nd Law

Material:

- ✓ Online simulator: https://www.physicsclassroom.com/Physics-Interactives/Newtons-Laws/Atwoods-Machine/Atwoods-Machine-Interactive
- ✓ Handout



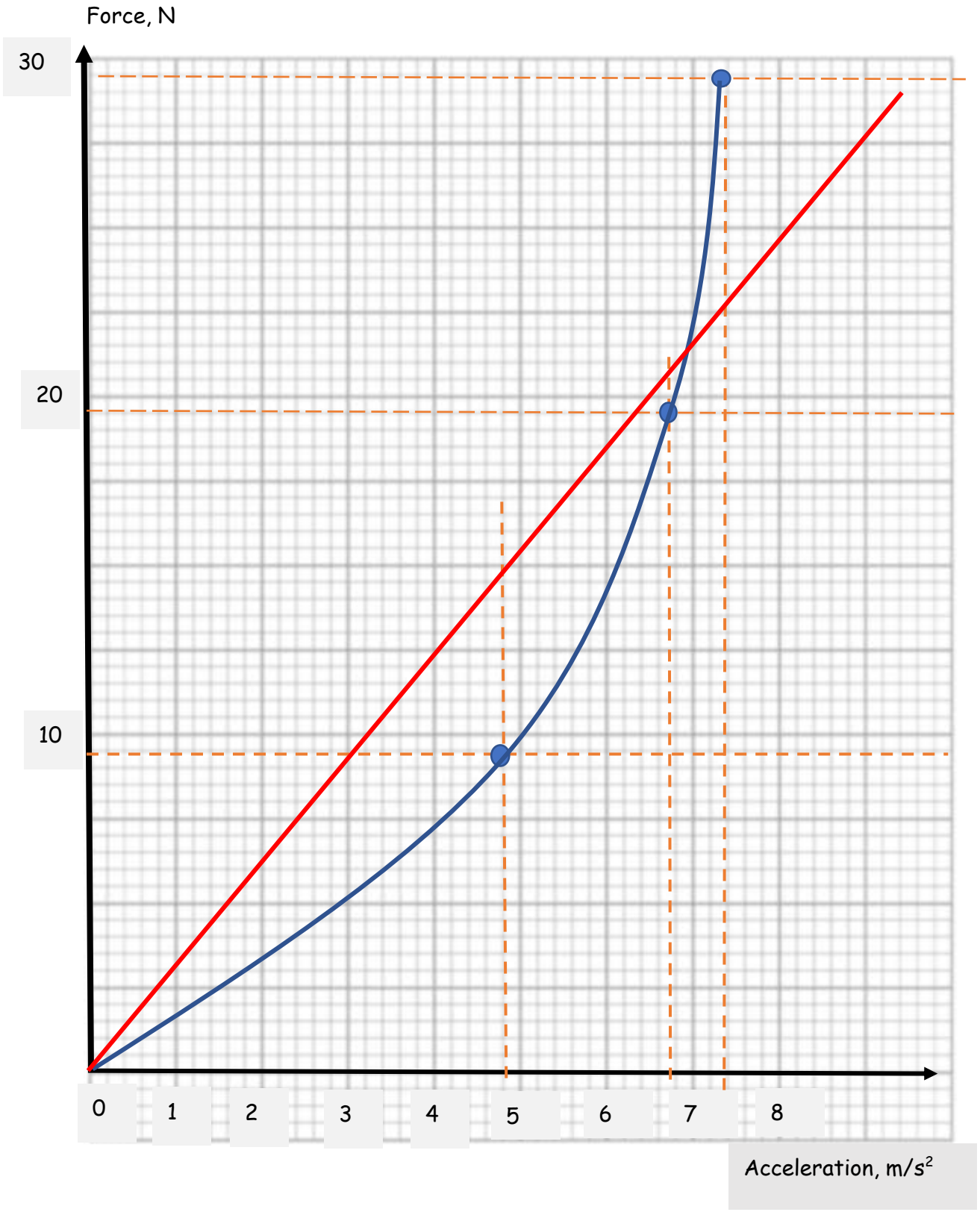
Method:

1. A (low friction) cart with mass m 1 ( ) is connected to a mass m 2 ( ) suspended by a string over a pulley.
2. Select the falling mass to be **10kg (9.8 N)**. Pull the trolley back so that the mass is raised to just below the pulley.
3. Click on start to release the trolley. Observe the measurement for the Time and Displacement of the trolley.
4. A (low friction) cart with mass m 1 ( ) is connected to a mass m 2 ( ) suspended by a string over a pulley.
5. Select the falling mass to be **20kg (19.6 N)**. Pull the trolley back so that the mass is raised to just below the pulley.
6. Click on start to release the trolley. Observe the measurement for the Time and Displacement of the trolley.
7. A (low friction) cart with mass m 1 ( ) is connected to a mass m 2 ( ) suspended by a string over a pulley.

8. Select the falling mass to be **3.0kg (19.6 N)**. Pull the trolley back so that the mass is raised to just below the pulley.
9. Click on start to release the trolley. Observe the measurement for the Time and Displacement of the trolley.
10. Record your observation in the table.
11. Calculate the acceleration using the formula $\mathbf{s = u\,t + {}^{1}/_{2}\,a\,t^{2}}$

Displacement **S (m)**	**Force (N)**	**Time** **t (s)**	**a (m/s^2)** $a = \frac{2S}{t^2}$
2.06	9.8	0.92	4.87
2.06	19.6	0.78	6.77
2.06	29.4	0.75	7.32

Analysis


Force, N
30
20
10
0
1
2
3
4
5
6
7
8
Acceleration, m/s²

Extended:

- ✓ Try to change the distance between the cart and the pulley. Observe if any differences in results.
- ✓ Choose the cart without wheels and investigate how the friction is affecting the acceleration.

Conclusion:

- ✓ On the graph, we can see that is the resultant force is directly proportional to the acceleration. However, the line is not straight enough, which could cause errors in the measurements. It happened because of systematic error.