SPH3U Vehicle Culminating Activity **Name** Bella Hynes 38/38
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Part A Car Calculation Summary. Show your work on a piece of lined paper, or in the provided spaces. [12]

Quantity	Value	Unit
Acceleration	0.118	m/s^2
Final Velocity	0.60	m/s
Energy consumption to achieve acceleration	0.238	J
Kinetic Energy	5.20×10^{-3}	J
Efficiency	0.008	J
Friction Force	0.044	N

1. Final velocity and acceleration Record your data here. [4]

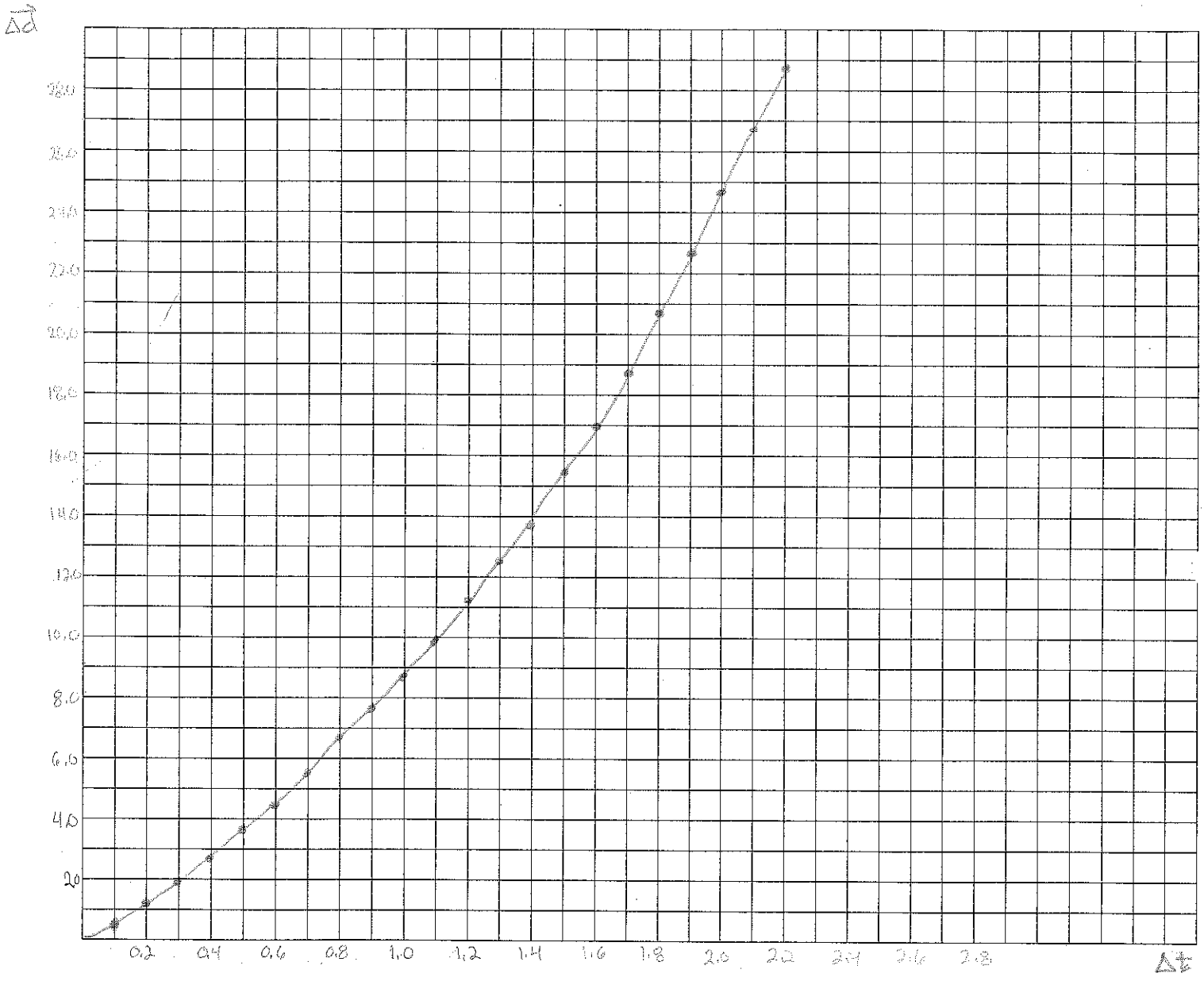
Use a ticker-tape machine to determine the distance or time it takes to get to the final (most typical) velocity. The ticker tape provides a point every 0.02 seconds. Use every five for a time interval of 0.1s. Make sure you start from t = 0.0s!!! Tabulate enough data to be confident that you can determine the interval over which the vehicle is accelerating to its final velocity. A large data table is provided for you. It is not necessary to completely fill it. If you need to increase the time interval to 0.2s (slow acceleration), by all means do!

Time (s)	Ø	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
Δd (cm)	Ø	0.5	1.2	2.0	2.8	3.8	4.6	5.7	6.8	7.8
Time (s)	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9
Δd (cm)	8.8	10.0	11.1	12.5	13.8	15.5	17.0	18.8	20.8	22.8
Time (s)	2.0	2.1	2.2							
Δd (cm)	24.8	26.8	28.8							

The remaining work is to be done by yourself.

Graph the results on the provided grid, or use your own. [6]

Title Distance of the Cart Over a Given Time



Show your work and use your formula sheet to determine the acceleration of the vehicle. Pick a time interval that makes sense, and describe why you picked it. [4]

$\vec{v}_s = \frac{\Delta \vec{d}}{\Delta t}$

$= 20 cm/s$

$\vec{v}_s = 0.20 m/s$

$\vec{a}_{av} = \frac{\vec{v}}{\Delta t}$

$= \frac{20 cm/s}{1.7 s}$

$= 11.76 s$

$\vec{a}_{av} = 0.1176 m/s^2$

This time interval was chosen because the velocity became a constant.

2. Using the power data that you collected for your car (or you can re-do it) and the data in part 1, calculate the energy consumed to achieve the acceleration. Show your work! [4]

$I = 0.1\,mA$
$V = 1.0\,V$
$\Delta t = 1.7\,s$

EQN
$\Delta E = VI\Delta t$

$\Delta E = VI\Delta t$
$= (1.0\,V)(0.1\,mA)(1.7\,s)$
$\Delta E = 0.238\,J$

3. Using the data in part 1, calculate the vehicle's kinetic energy when it reaches final velocity. [4]

$E_K = \frac{mv^2}{2}$
$= \frac{(0.129\,kg)(0.2\,m/s)^2}{2}$
$= \frac{0.00516\,J}{2}$
$E_K = 0.00258\,J$

4. Calculate the efficiency and the energy lost during acceleration [2]

$\%\,eff = \frac{E_{out}}{E_{in}}$
$= \frac{0.00258\,J}{0.2383}$
$= 0.01084\,J$
$= 1.08\,\%$

$E_{lost} = 0.01084\,J - 0.00258\,J$
$= 0.00826\,J$

5. Calculate the friction force of the vehicle [2]

$\Delta d = 0.188\,m$
$\Delta E = 0.00826\,J$

$W = \Delta E$
$\therefore \Delta E = F \cdot \Delta d$
$\therefore F = \frac{\Delta E}{\Delta d}$
$= \frac{0.00826\,J}{0.188\,m}$
$= 0.04394\,N$
$\therefore F_f = 0.04394\,N$