Physics 100
Spool Car Analysis Homework Problem

Name: Answers

Formulas: $a = \frac{\Delta v}{\Delta t}$ $F_{Net} = ma$ $w = mg$

Part 1: Data Collection (Pretend that you did this)

1. Measure the mass of your spool car using one of the balances in the classroom.

   Spool Car Mass = 130g

2. Video your car speeding up, slowing down, and coming to a stop. Then use video analysis to find your car's top speed, time to reach top speed, and total travel time.

   Top speed = 4.2m/s Time to reach Top Speed = 1.9s Total Travel Time = 5.2s

Part 2: Calculations and Finding Forces

3. Convert the mass of your spool car to **kg**. 1kg = 1,000g.

   Spool Tractor Mass = 0.13kg $130g\left(\frac{1kg}{1000g}\right) = 0.13kg$

4. Calculate the weight of your spool car, in **Newtons**.

   Spool Tractor Weight = 1.3N $w = mg = 0.13kg(10m/s^2) = 1.3N$

5. Calculate your spool car's average acceleration during the "speeding up" phase.

   Acceleration during Speeding Up Phase = 2.21m/s^2 $a = \frac{\Delta v}{\Delta t} = \frac{4.2m/s}{1.9s} = 2.21 m/s^2$

6. Calculate the average net force acting on your car while it is speeding up.

   F_{Net} = 0.287N $\Sigma F = ma = (0.13kg)(2.21m/s^2) = 0.287N$

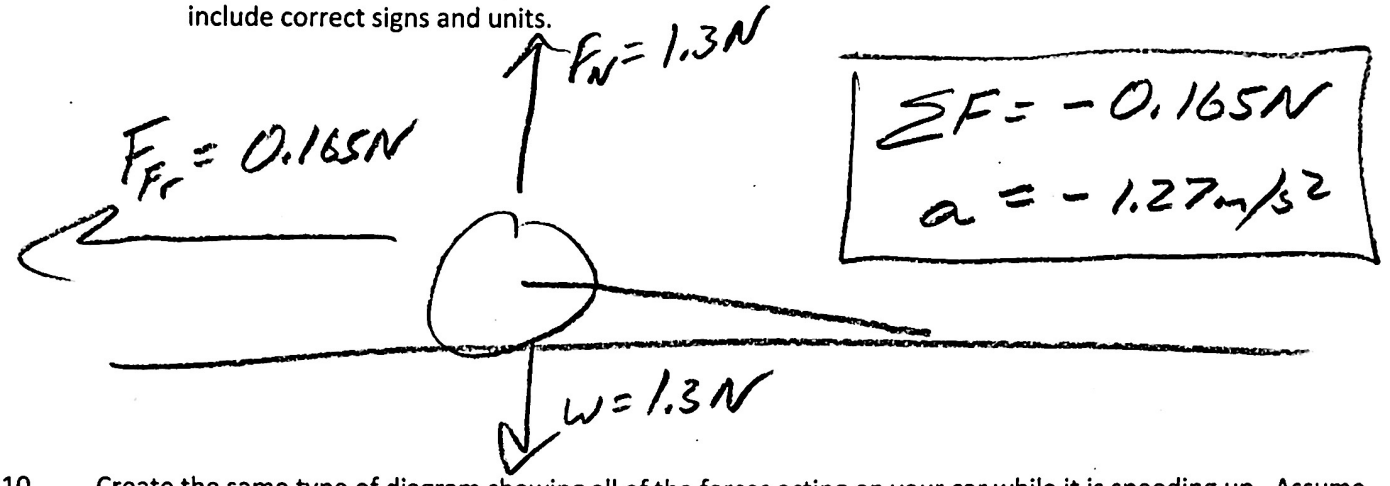
7. Calculate your spool car's acceleration during the "slowing down" phase.

   Acceleration during Slowing Down Phase = -1.27m/s^2 $a = \frac{\Delta v}{\Delta t} = \frac{-4.2m/s}{(5.2s - 1.9s)} = -1.27 m/s^2$

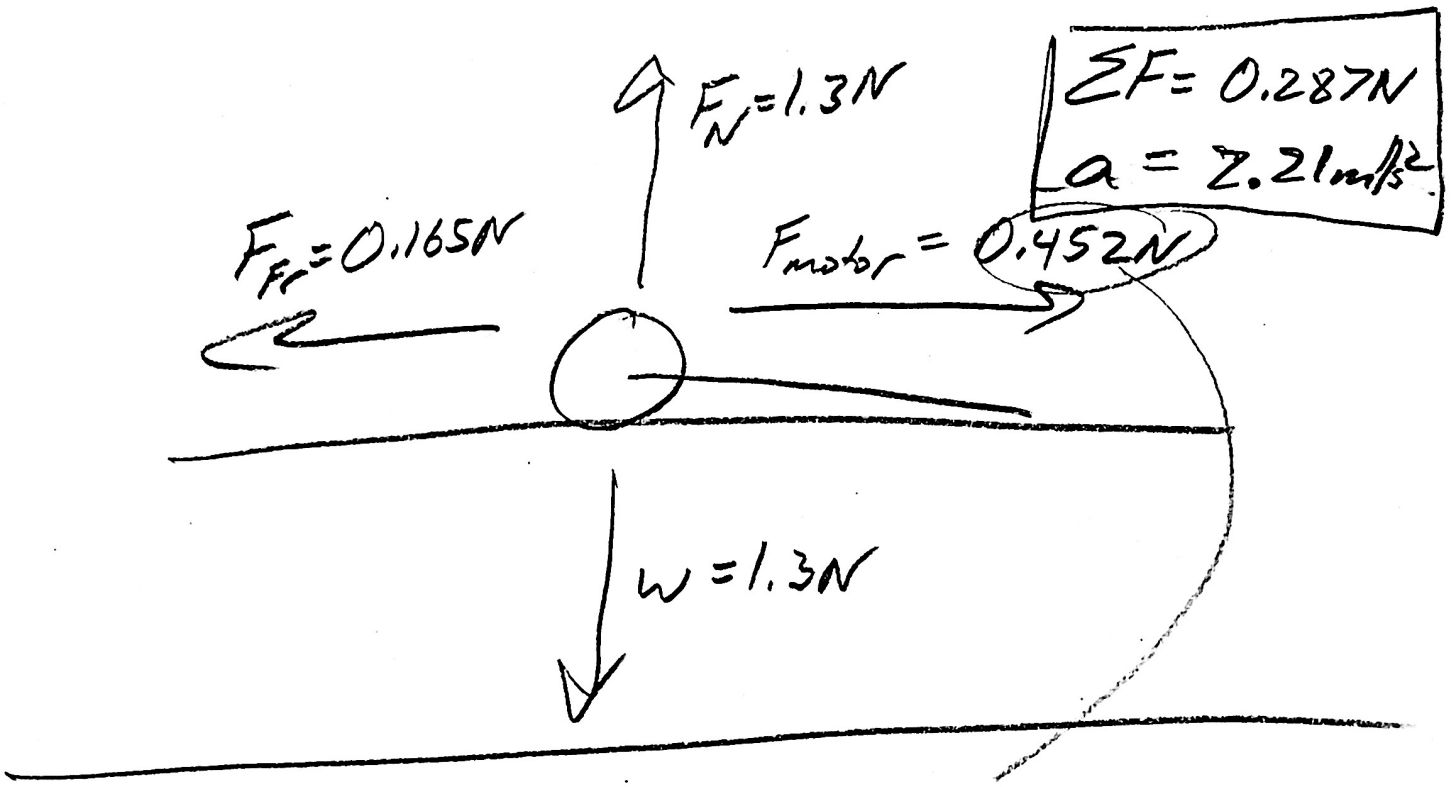
8. Calculate the average net force acting on your car while it is slowing down. Show your work.

   F_{Net} = -0.165N $\Sigma F = ma = 0.13kg(-1.27m/s^2) = -0.165N$

9. Create a diagram showing all of the forces acting on your car while it is slowing down.
   A. Draw your car traveling rightward.
   B. Label your car with its mass in kilograms.
   C. Use arrows to show every individual force that is acting on the car.
   D. Label each individual force with correct units and its correct name.
   E. Off to the side somewhere, write the Net force and acceleration. Don't use arrows for these. Just include correct signs and units.



10. Create the same type of diagram showing all of the forces acting on your car while it is speeding up. Assume here that the force of friction is the same when the car is speeding up and slowing down.



$$\Sigma F = F_{motor} - 0.165N = 0.287N$$

$$F_{motor} = 0.452N$$