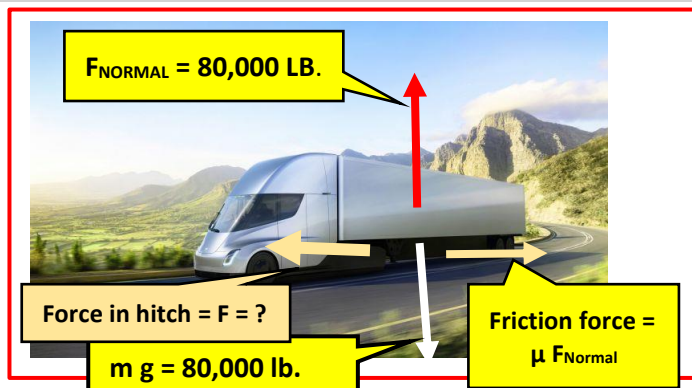


# NEWTON'S 2<sup>ND</sup>. LAW, $F_{NET} = m a$

Units 6 & 7 Dr. John P. Cise, Professor of Physics, "Thee" Austin Com. College, Austin Tx. , [jpcise@austincc.edu](mailto:jpcise@austincc.edu) , & New York Times Nov. 16.2017, by Neil E Boudette

## Tesla Unveils an Electric Rival to Semi Trucks



Elon Musk, chief executive of Tesla, revealed the company's new electric semi truck at a Thursday night presentation in Hawthorne, Calif.

HAWTHORNE, Calif. — Tesla has aimed to reinvent the automobile and the way electricity is generated for homes. With those efforts still in progress, it is setting out on another quest: to remake the multibillion-dollar trucking industry.

In an elaborately produced nighttime presentation by its chief executive, **Elon Musk, Tesla on Thursday unveiled a prototype for a battery-powered, nearly self-driving semi truck** that the company said would prove more efficient and less costly to operate than the diesel trucks that now haul goods across the country. And of course, **it will emit no exhaust**. He said the truck would be no less groundbreaking, claiming it would have a **single-charge range** of 500 miles, greater than many analysts had expected and enough to

serve in many typical trucking routes. **The truck can go from zero to 60 miles per hour in five seconds without a trailer, and in 20 seconds when carrying a maximum load of 80,000 pounds**, less than a third of the time required for a diesel truck, he said. **Mr. Musk said Tesla expects to begin producing the truck by the end of 2019**.

He gave no price but hinted that it would be costly. "Tesla stuff is expensive," Mr. Musk said, drawing another cheer from the crowd, gathered at an airfield outside of Los Angeles.

But he also said the electric truck would be less expensive to operate, in part because it has fewer components that require regular maintenance (no engine, transmission or drive shaft). Instead, the truck, called the **Tesla Semi, is powered by a giant battery beneath the cab. It has two rear axles, each outfitted with two electric motors, one for each wheel**. Its acceleration and uphill speeds will allow it to cover more distance in less time than diesel trucks, he added.

**INTRODUCTION:** The final goal for this application is to find the force forward ( $F$ ) on trailer causing it to accelerate from  $v = 60$  mph in 20s.

**QUESTIONS:** (a) Find acceleration of this Tesla Electric Truck from 0 – 60 mph in 20 s?, (b) Find mass of truck trailer in units of slugs?, (c) Find frictional force( $f$ ) on trailer ? Take coefficient of rolling friction to be  $\mu = 0.01$ . (d) Find NET force on trailer ?, (e) Find force ( $F$ ) on trailer by truck causing the trailer to accelerate? (f) How far does this Electric Truck and trailer to go while going from 0 – 60 mph?

**HINTS:** 60 mph = 88 ft./s. , weight = (mass)(gravity) ,  $W = m g$  ,  $g = 32 \text{ ft./s.}^2$  ,  $F_{NET} = m a$  ,  $x = v_0 t + \frac{1}{2} a t^2$  ,  $X = V_{AVERAGE} t$  ,  $V_{AVERAGE} = [V + V_0]/2$  ,

**ANSWERS:** (a)  $a = 4.4 \text{ ft./s.}$  , (b)  $m = 2,500 \text{ slugs}$  , (c)  $f = 800 \text{ lb.}$  , (d)  $F_{NET \text{ ON TRAILER}} = 11,000 \text{ lb.}$  , (e)  $F = 11,800 \text{ lb.}$  (f)  $x = 880 \text{ ft.}$