Physics | **Name** ____________________
Date ___________ | **Class Period** _______

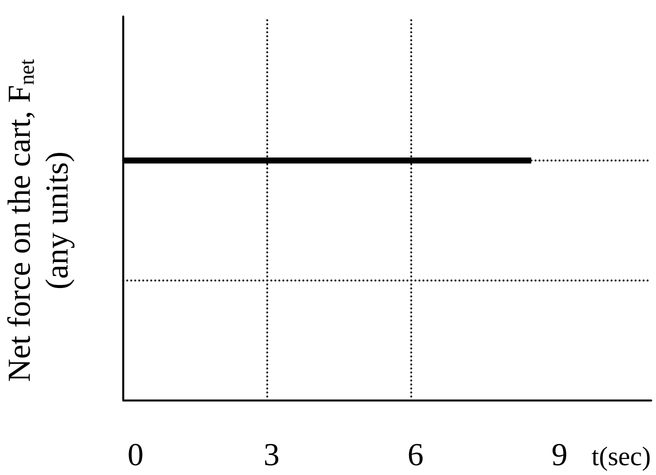
Forces on a Fan Cart

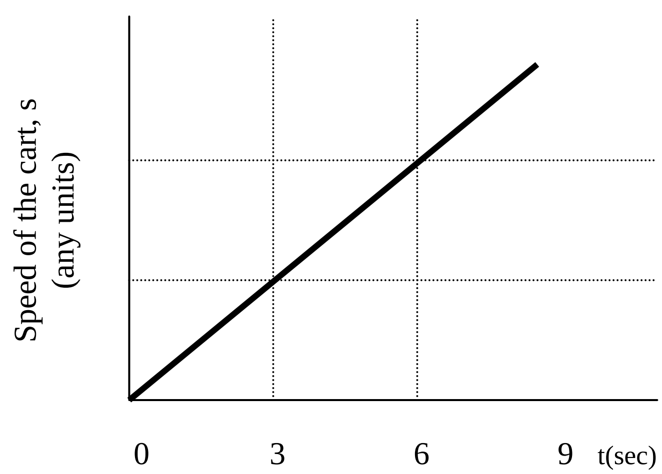
A fan cart is placed at rest on a track, about 1-2 meters away from a towel. Initially, the fan is turned *off*. Then the "start button" was pushed. Two (2) seconds later, the fan turns on. Due to the spinning fan, which blows air to the left (in the figure below), the cart begins to move to the right.

Before the towel, three main forces act on the fan cart: (1) the downward force of gravity, (2) the upward "normal" force of the track, and (3) a rightward force by blowing air. (We neglected tiny forces due to air pressure, air resistance, and surface friction.) The vertical forces (1 and 2) on the fan cart balance (otherwise the cart would rise off the track or sink into it as it moves.) Therefore, the net force on the cart is due entirely to a force on the cart by blowing air, written:

$$F_{net} = F_{on\ cart,\ by\ air}.$$

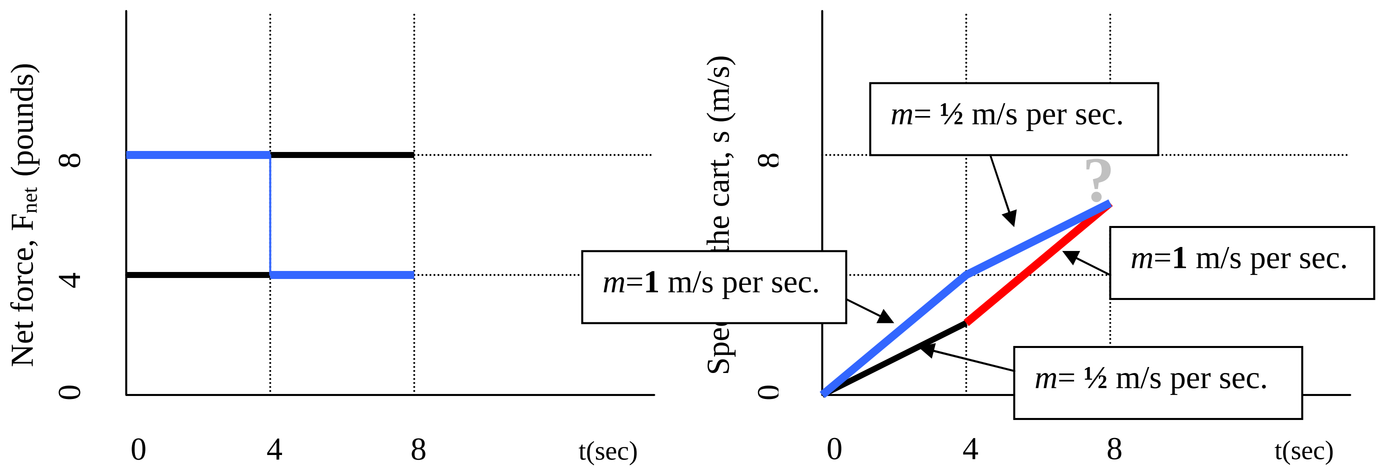
In class, we learned that this net force is a constant force. Further, we learned that such a force produces a steady increase in the speed of the fan cart.





Q1:

Suppose that as the fan cart speeds up the force suddenly doubles (see graph below). For this case complete the missing part of the speed-time graph.



Directions: **For the remaining questions, assume 8 pounds <u>always</u> corresponds to a change in speed (Δs) of 1 m/s in one second.**

Q2:

Now suppose that we reverse the order that the forces (4 pounds and 8 pounds) are applied. That is, suppose 8 pounds is applied (t = 0 to 4 seconds), then 4 pounds.

(a) In the above graphs, represent the force and speed using a **blue**-colored pencil.

(b) Compare the slopes of the line segments for Q1 and Q2.

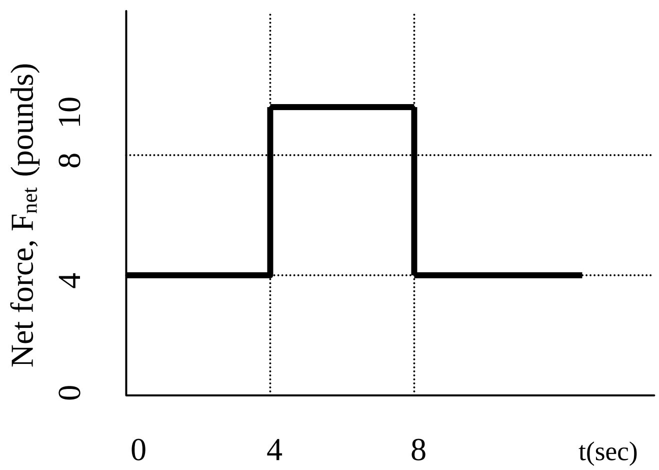
(c) What is the total speed change in both cases? __________

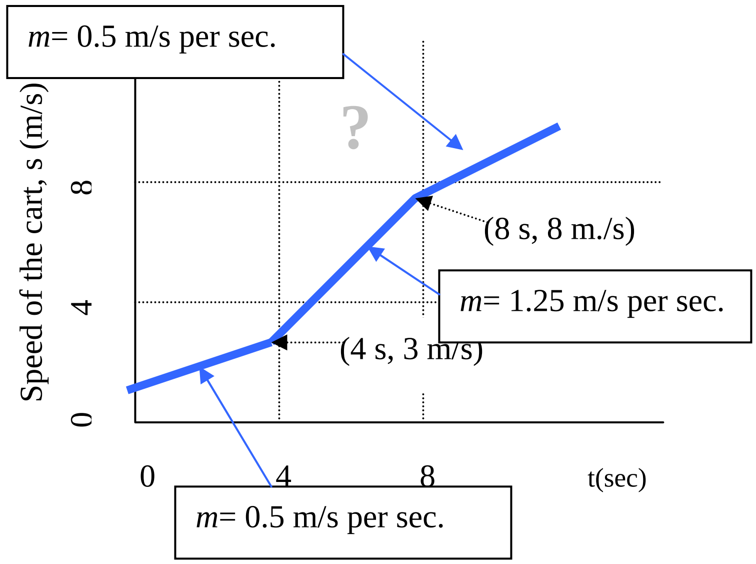
Since cart starts at rest, the total speed change is:

$\Delta s = s_{final} - s_{initial}$ = (6 m/s) – (0 m/s) = 6 m/s (for both trips)

Q3:

For the following case, complete the missing graph. Assume *s* = 1 m/s at *t*=0 seconds.





Remember, 8 pounds corresponds with a Δs of 1 m/s per second. Using ratio reasoning (or cross multiplication), we can show:

4 lbs → Δs=0.5 m/s per sec.
10 lbs → Δs=1.25 m/s per sec.

The following table tells the story:

time (s)	speed (m/s)
0	1.00
1	1.50
2	2.00
3	2.50
4	3.00
5	4.25
6	5.50
7	6.75
8	8.00
9	8.50
10	9.00
11	9.50
12	10.0