

Investigating Newton's 2nd Law

Goal: Use Newton's 2nd law to determine the force of friction on a fancart.

Using a similar approach as we do for some of the problems we solve in class, we will

- 1) find the net force ΣF on the cart.
- 2) directly measure the force of the fan F_{fan} on the cart
- 3) use the force diagram to find the force of friction F_f (which includes air resistance) on the cart.

1. To find the net force ΣF on the cart, we need to know the mass and the acceleration.

a) $m_{cart} =$ _____ kg

b) Run the cart along the track and measure the acceleration by finding the slope of the velocity vs. time graph. Do this 3 times. If one of the acceleration values differs greatly from the other two values, repeat the run.

1) $v_o =$ _____ $t_o =$ _____

$v_f =$ _____ $t_f =$ _____

$$a_{meas} = \frac{v_f - v_o}{t_f - t_o} =$$

2) $v_o =$ _____ $t_o =$ _____

$v_f =$ _____ $t_f =$ _____

$$a_{meas} = \frac{v_f - v_o}{t_f - t_o} =$$

3) $v_o =$ _____ $t_o =$ _____

$v_f =$ _____ $t_f =$ _____

$$a_{meas} = \frac{v_f - v_o}{t_f - t_o} =$$

Actual measured acceleration of the cart (average of the 3 runs):

$a_{meas} =$ _____

c) What is the net force ΣF on the cart?

2. Use a force probe to measure the force of the fan on the cart.

$$F_{\text{fan}} = \underline{\hspace{2cm}} \text{ N}$$

3. Now draw a force diagram for the moving cart with includes (a) the force from the fan, (b) the force of friction, (c) W and F_N and (d) the net force. **Label each force. Draw greater forces with longer arrows.** Assume cart is moving to the right.



Using your values for ΣF and F_{fan} , determine the force of friction on the cart:

$$F_{\text{fr}} = \underline{\hspace{2cm}}$$

(Note: the force of friction in this situation is mostly air resistance.)

Final question: We discussed how the cart is pushed forward, what we have called here F_{fan} .

Explain in your own words (using complete sentences) how the cart is pushed forward by means of the fan.