

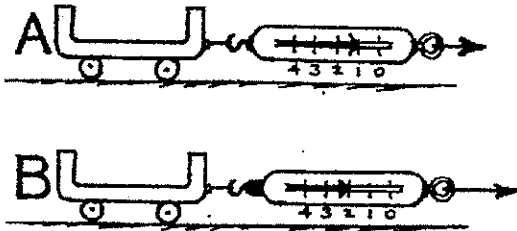
CONCEPTUAL *Physics* PRACTICE PAGE

Chapter 4 Newton's Second Law of Motion Racing Day with $a = F/m$

In each situation below, Cart A has a mass of 1 kg. Circle the correct answers (A, B, or Same for both).

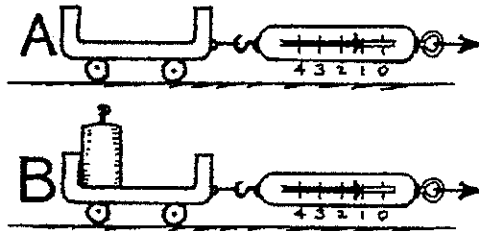
1. Cart A is pulled with a force of 1 N.
Cart B also has a mass of 1 kg and is pulled with a force of 2 N.
Which undergoes the greater acceleration?

[A] [B] [Same for both]



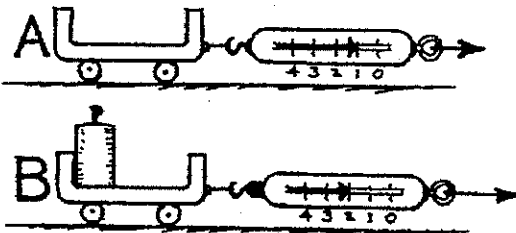
2. Cart A is pulled with a force of 1 N.
Cart B has a mass of 2 kg and is also pulled with a force of 1 N.
Which undergoes the greater acceleration?

[A] [B] [Same for both]



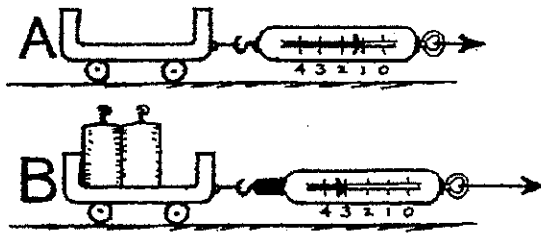
3. Cart A is pulled with a force of 1 N.
Cart B has a mass of 2 kg and is pulled with a force of 2 N.
Which undergoes the greater acceleration?

[A] [B] [Same for both]



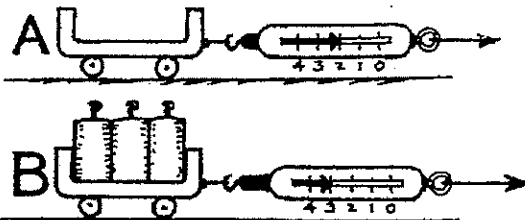
4. Cart A is pulled with a force of 1 N.
Cart B has a mass of 3 kg and is pulled with a force of 3 N.
Which undergoes the greater acceleration?

[A] [B] [Same for both]



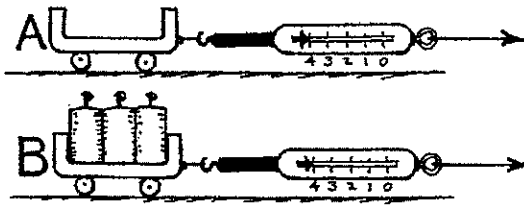
5. This time Cart A is pulled with a force of 4 N. Cart B has a mass of 4 kg and is pulled with a force of 4 N.
Which undergoes the greater acceleration?

[A] [B] [Same for both]



6. Cart A is pulled with a force of 2 N.
Cart B has a mass of 4 kg and is pulled with a force of 3 N.
Which undergoes the greater acceleration?

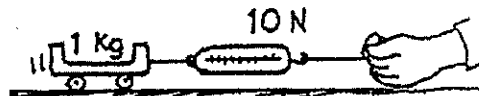
[A] [B] [Same for both]



Chapter 4 Newton's Second Law of Motion
Dropping Masses and Accelerating Cart

1. Consider a 1-kg cart being pulled by a 10-N applied force. According to Newton's Second Law, acceleration of the cart is

$$a = \frac{F}{m} = \frac{10\text{ N}}{1\text{ kg}} = 10\text{ m/s}^2.$$



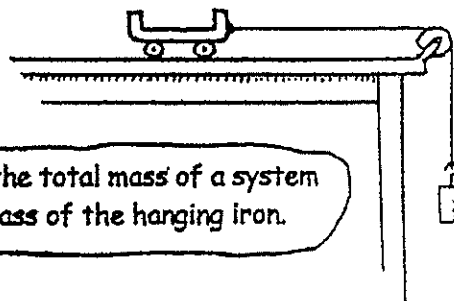
This is the same as the acceleration of free fall, g —because a force equal to the cart's weight accelerates it.



2. Consider the acceleration of the cart when the applied force is due to a 10-N iron weight attached to a string draped over a pulley. Will the cart accelerate as before, at 10 m/s^2 ? The answer is no, because the mass being accelerated is the mass of the cart *plus* the mass of the piece of iron that pulls it. Both masses accelerate. The mass of the 10-N iron weight is 1 kg—so the total mass being accelerated (cart + iron) is 2 kg. Then,

$$a = \frac{F}{m} = \frac{10\text{ N}}{2\text{ kg}} = 5\text{ m/s}^2.$$

The pulley changes only the direction of the force.



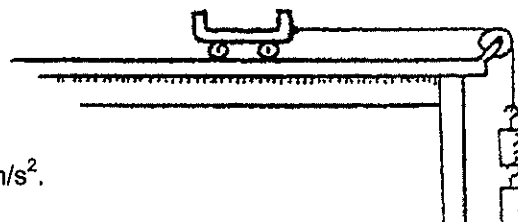
Don't forget; the total mass of a system includes the mass of the hanging iron.



Note this is half the acceleration due to gravity alone, g . So the acceleration of 2 kg produced by the weight of 1 kg is $g/2$.

3. Find the acceleration of the 1-kg cart when two identical 10-N weights are attached to the string.

$$a = \frac{F}{m} = \frac{\text{applied force}}{\text{total mass}} = \text{---} = \text{---} \text{ m/s}^2.$$



Here we simplify and say $g = 10\text{ m/s}^2$.

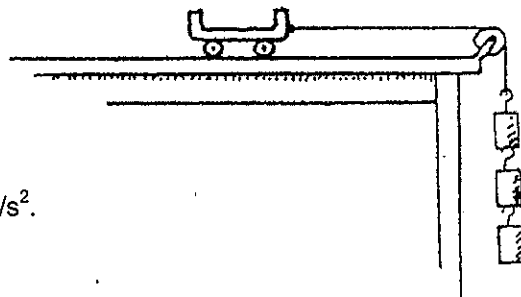


Hewitt
Drew it!

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Chapter 4 Newton's Second Law of Motion Dropping Masses and Accelerating Cart—continued

4. Find the acceleration of the 1-kg cart when the three identical 10-N weights are attached to the string.

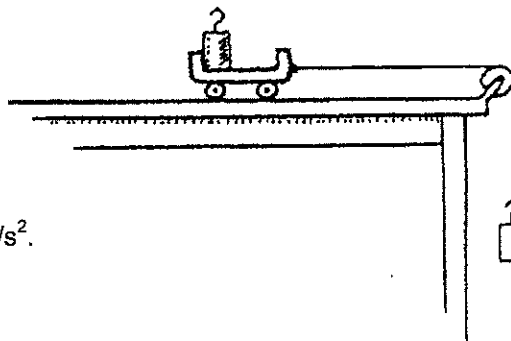


$$a = \frac{F}{m} = \frac{\text{applied force}}{\text{total mass}} = \text{---} = \text{---} \text{ m/s}^2.$$

5. Find the acceleration of the 1-kg cart when four identical 10-N weights (not shown) are attached to the string.

$$a = \frac{F}{m} = \frac{\text{applied force}}{\text{total mass}} = \text{---} = \text{---} \text{ m/s}^2.$$

6. This time 1 kg of iron is added to the cart and only one iron piece dangles from the pulley. Find the acceleration of the cart.

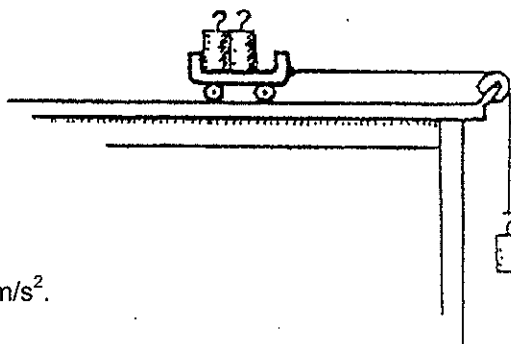


$$a = \frac{F}{m} = \frac{\text{applied force}}{\text{total mass}} = \text{---} = \text{---} \text{ m/s}^2.$$



The force due to gravity on a mass m is mg .
So gravitational force on 1 kg is $(1 \text{ kg})(10 \text{ m/s}^2) = 10 \text{ N}$.

7. Find the acceleration of the cart when it carries two pieces of iron and only one iron piece dangles from the pulley.

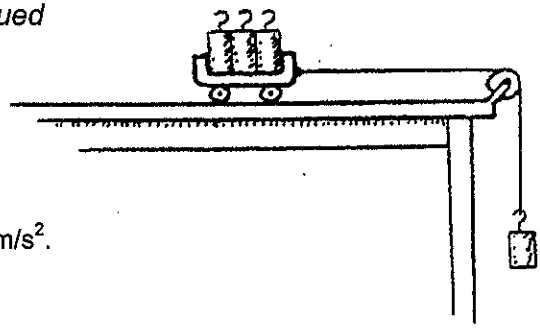


$$a = \frac{F}{m} = \frac{\text{applied force}}{\text{total mass}} = \text{---} = \text{---} \text{ m/s}^2.$$

Hewitt
Drewitt!

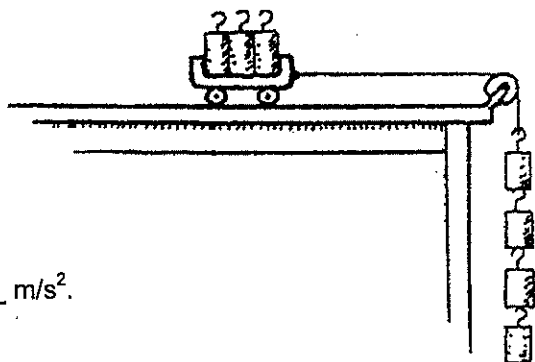
Chapter 4 Newton's Second Law of Motion
Dropping Masses and Accelerating Cart—continued

8. Find the acceleration of the cart when it carries three pieces of iron and only one iron piece dangles from the pulley.



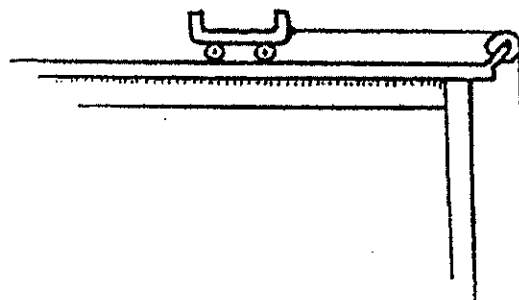
$$a = \frac{F}{m} = \frac{\text{applied force}}{\text{total mass}} = \text{---} = \text{---} \text{ m/s}^2.$$

9. Find the acceleration of the cart when it carries three pieces of iron and four pieces of iron dangle from the pulley.



$$a = \frac{F}{m} = \frac{\text{applied force}}{\text{total mass}} = \text{---} = \text{---} \text{ m/s}^2.$$

10. Draw your own combination of masses and find the acceleration.



$$a = \frac{F}{m} = \frac{\text{applied force}}{\text{total mass}} = \text{---} = \text{---} \text{ m/s}^2.$$

Hewitt
 Draw it!