Read 4.4

H.W 4 available

Office hours 11:30 - 12:30 today

Newton's Laws

1) Velocity of an object will not change unless it is acted upon by a net external force

2) $\vec{F}_{net} = m\vec{a}$

$F_{net\,(horizontal)} = m a_{horizontal}$

$F_{net\,(vertical)} = m a_{vertical}$

m = mass

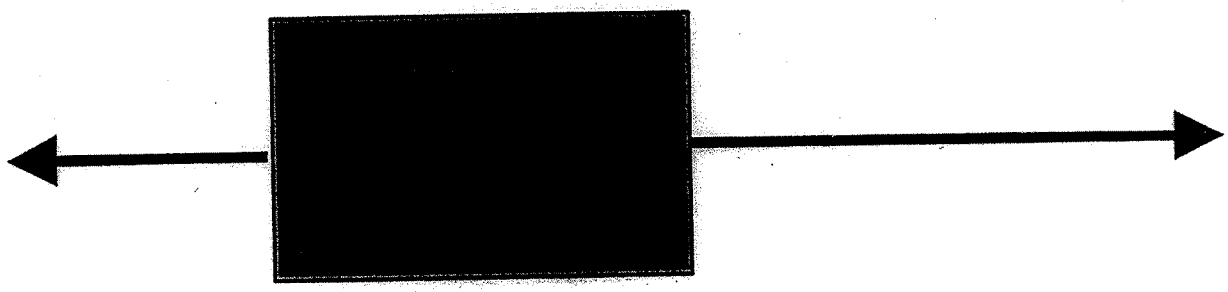
$\vec{a}$ = acceleration

$\vec{F}_{net}$ = <u>total</u> force acting on object of mass m

Interactive Question

B

A box has two forces acting on it as shown by the arrows which have the different lengths and point in opposite directions. What can you say about the motion of this box?



A) It is definitely moving to the right

B) It is definitely accelerating to the right

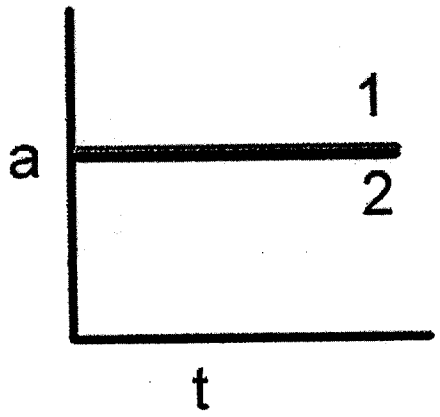
C) Both of the above

D) None of the above

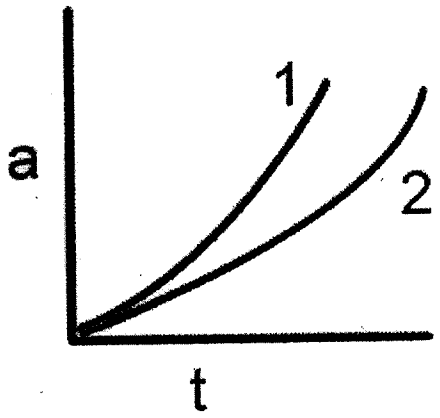
Interactive Question

A constant force F acts on block 1 with mass m and block 2 with mass $2m$. Which graph correctly represents the accelerations of the blocks ?

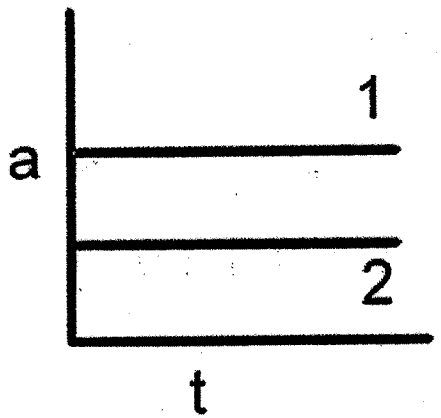
(A)



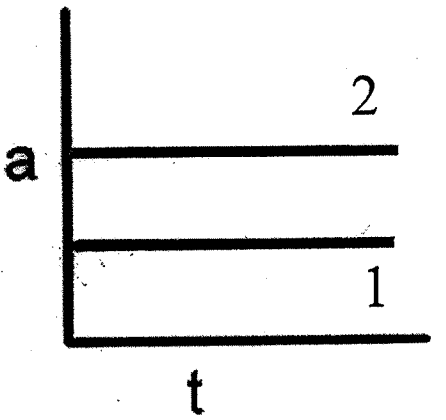
(B)



(C)



(D)



Interactive Question

A net force F is required to give a mass m an acceleration a. If a net force of $6F$ is applied to a mass $2m$, what acceleration results.

A) a
B) $2a$
C) $3a$
D) $4a$
E) $6a$

Problem: You push horizontally on a box with a 40 N force. A 30 N frictional force opposes the motion. The box accelerates at a rate of 2.2 m/s^2. What is the mass of the box?

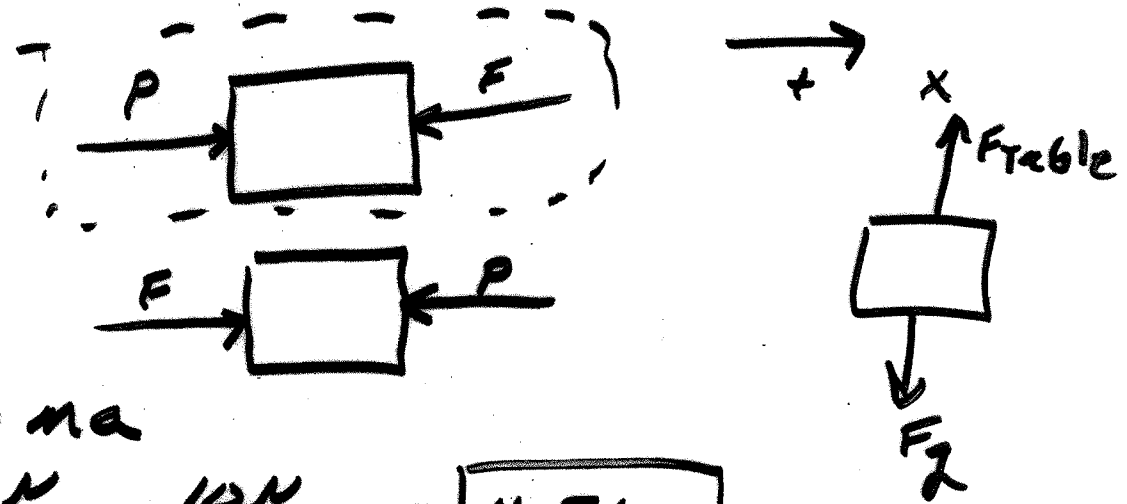
want: m

Given $P = 40N$

$F = 30N$

$a = 2.2 m/s^2$

Free Body diagram



x: $F_{net} = ma$

$P - F = ma$

$40N - 30N = 10N = ma$

$m = \frac{10N}{a} = \frac{10N}{2.2 m/s^2} = \boxed{4.5 kg}$

$N = kg \cdot m/s^2$

Problem: A 12,500 lb truck (which has a mass of 5680 kg) is traveling at 33 mi/hr when it applies its brakes and comes to a stop in 4.5 seconds. What was the average net force stopping the truck (in Newtons)?

Given $v_0 = 33 \text{ mi/hr} = 14.7 \text{ m/s}$

$v = 0 \text{ m/s}$

$t = 4.5 \text{ s}$

$m = 5680 \text{ kg}$

want F_{net}

+ →

How relate givens to force? $F_{net} = ma$

Kinematic eq → find a

$v = v_0 + at$ $\quad a = \frac{v - v_0}{t} = \frac{0 - 14.7 \text{ m/s}}{4.5} = -3.27 \text{ m/s}^2$

→ +

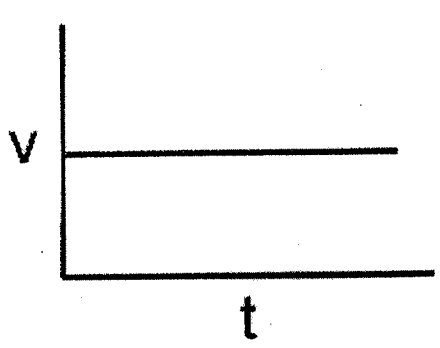
$F_{net} = ma = (5680 \text{ kg})(-3.27 \text{ m/s}^2) = -18{,}600 \text{ N}$

direction magnitude

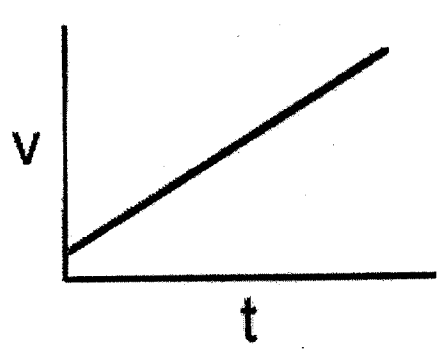
Interactive Question

B

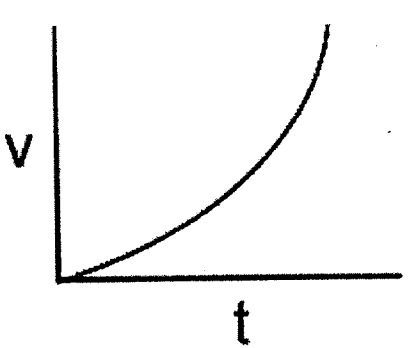
A constant force is acting on an object. Which of these graphs best represents the velocity of the object?



(A)



(B)



(C)

Interactive Question

D

Two equal forces act on an object in the directions shown. If these are the only forces involved, what can you say is definitely true about the motion of the object?

A) It is moving at a constant velocity.
B) It is speeding up
C) It is slowing down
D) It is accelerating
E) Nothing, not enough information