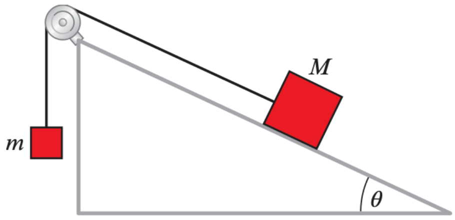
Shreeji Education
We respect your ability

1.

A block of mass M rests on a rough inclined plane. The coefficient of static friction between the block and the incline is μ. The plane makes an angle θ with the horizontal. The block is connected to a hanging block of mass m through a string that goes over a pulley.

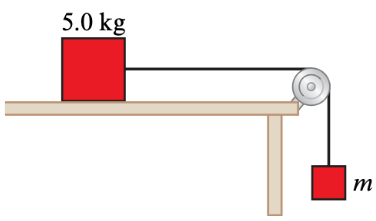


What is the minimum and maximum value of m for which we have equilibrium?

	Minimum m	Maximum m
A	$M(\sin\theta - \mu\cos\theta)$	$M(\sin\theta + \mu\cos\theta)$
B	$M(\sin\theta - \mu\cos\theta)$	$M(\cos\theta + \mu\sin\theta)$
C	$M(\cos\theta - \mu\sin\theta)$	$M(\sin\theta + \mu\cos\theta)$
D	$M(\cos\theta - \mu\sin\theta)$	$M(\cos\theta + \mu\sin\theta)$

2

A block of mass 5.0 kg rests on a rough horizontal table. The static coefficient of friction between the block and the table is 0.40, and the kinetic coefficient is 0.30. The block is connected by a string that goes over a pulley to a hanging block of mass m.

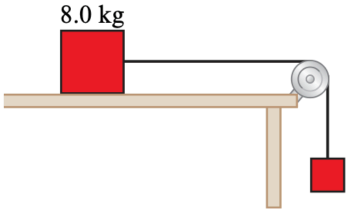


What is the largest value of m for which equilibrium holds?

A 1.5 kg
B 2.0 kg
C 5.0 kg
D 7.0 kg

3

A block of mass 8.0 kg rests on a rough horizontal table. The block is connected by a string that goes over a pulley to another block. The largest mass of the hanging block for which equilibrium holds is 2.0 kg.



Three statements are made for this situation:

I The frictional force on the 8.0 kg block is 20 N.
II The frictional force is the maximum frictional force.
III The static coefficient of friction is 0.25.

Which is correct?

A I and II
B I and III
C II and III
D I, II and III.

4

A body of mass 5.0 kg falls vertically. The body experiences a constant air resistance force of 30 N. What is the acceleration of the body?

A 0
B 4.0 m s^{-2}
C 6.0 m s^{-2}
D 10 m s^{-2}

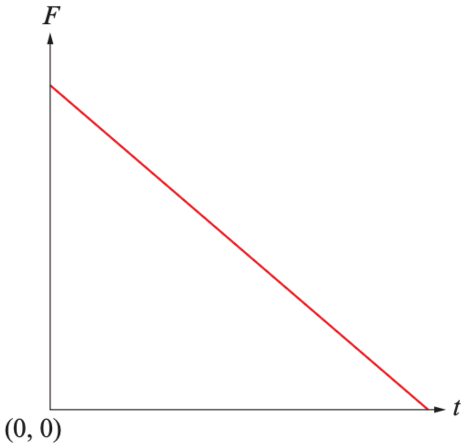
5

A man of mass 70 kg stands in an elevator that moves downwards with deceleration 2.0 m s^{-2}. What is the force exerted on the man by the elevator floor?

A 0 N
B 140 N
C 560 N
D 840 N

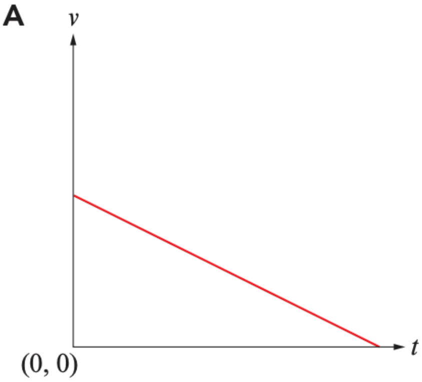
6

The graph shows how the net force on a body varies with time. The body has an initial velocity in the direction of the force.

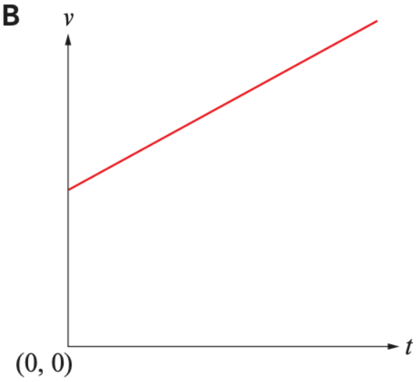


Which graph shows the variation with time of the velocity of the body?

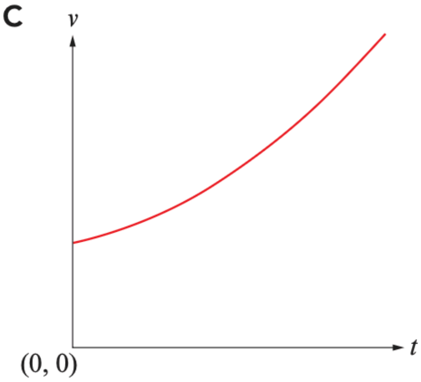
A



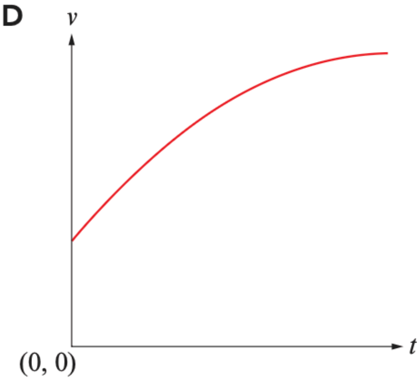
B



C

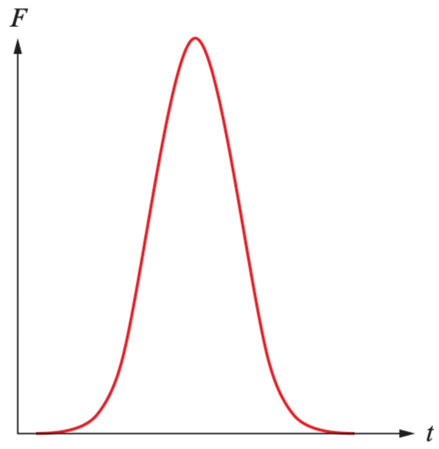


D

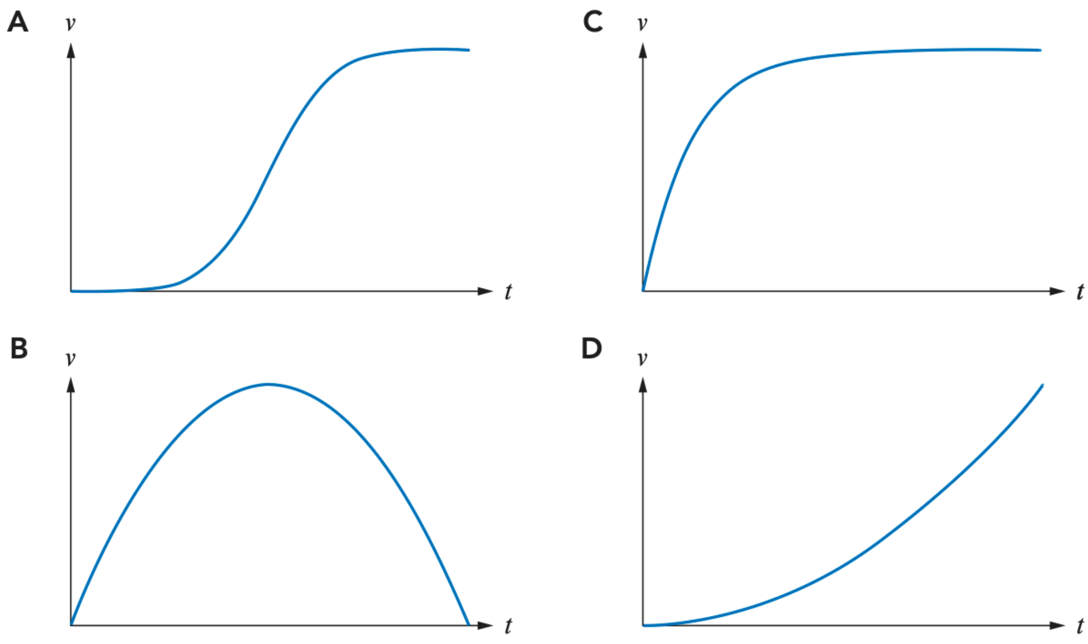


7

The graph shows how the net force on a body varies with time. The body is initially at rest.

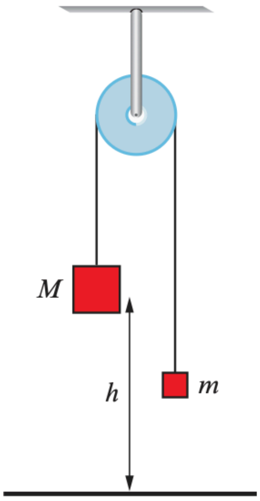


Which is the correct variation with time of the speed of the body?



8

Two blocks of mass M and m are connected by a string that goes over a pulley. The heavier block is at a height h from the ground.



The blocks are held in place and then released.
What is the speed with which the block of mass M strikes the ground?

A $\sqrt{2gh}$

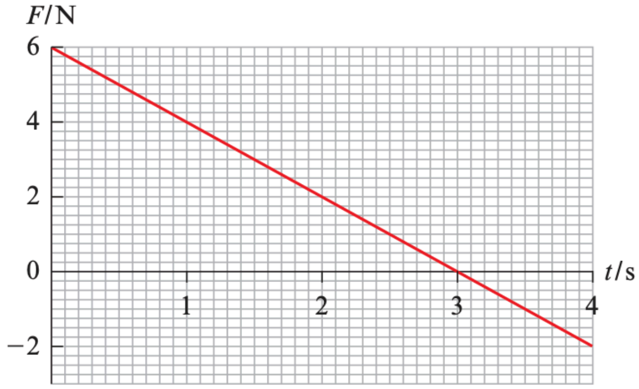
B $\sqrt{\frac{2(M-m)gh}{M+m}}$

C $\sqrt{\frac{2(M+m)gh}{M-m}}$

D $\sqrt{\frac{2Mgh}{M+m}}$

9

The graph shows how the net force on a body of mass 2.0 kg varies with time.



The initial velocity of the body is zero. What is the velocity of the body after 4.0 seconds?

A 4.0 m s^{-1}
B 4.5 m s^{-1}
C 5.0 m s^{-1}
D 12 m s^{-1}

10

A ball of mass 0.50 kg travelling with speed 4.0 m s^{-1} collides with a vertical wall and bounces in the opposite direction with the same speed. What is the magnitude of the change of the momentum of the ball?

A 0
B 2.0 N s
C 4.0 N s
D 8.0 N s

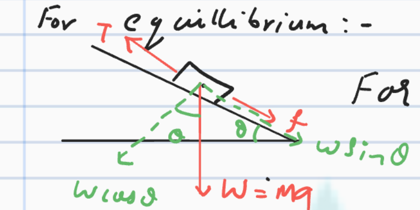
KEY

1	A	6	D
2	B	7	A
3	D	8	B
4	B	9	A
5	D	10	C

SOLUTION

1.

For equilibrium :-

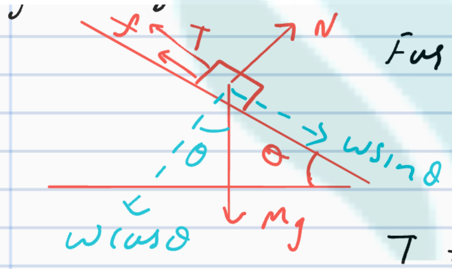


For max T, $m > M$.
block has tendency to move up

$T = f + w\sin\theta$

$T = \mu w\cos\theta + w\sin\theta$

$mg = \mu Mg\cos\theta + Mg\sin\theta$



For min T, $m < M$.

block has tendency to move down

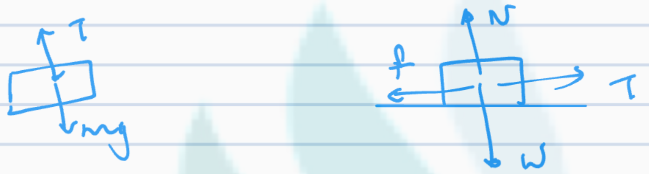
$T + f = w\sin\theta$

$T = w\sin\theta - f$

$m = M\sin\theta - M\mu\cos\theta$

So A

2.



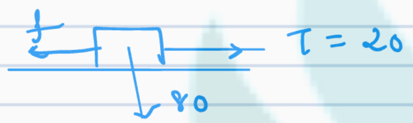
$f = T$

$\mu_s N = mg$ (not moving)

$m = \frac{\mu_s \cdot N}{g} = \frac{0.4 \times 5 \times 10}{10}$ $[N = W]$

$m = 2 \rightarrow$ B

3



$f = \mu N$

$\mu = \frac{f}{N} = \frac{20}{80} = \frac{1}{4} = 0.25$

D

4

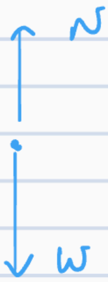
↓ $F = ma$

$F = W - f$

$ma = mg - 30$

$a = \frac{5 \times 10 - 30}{5} = \frac{20}{5} = 4 \rightarrow$ B

5



↓ $F = ma$

$-2\ \text{ms}^{-2}$ (deceleration)

$F = W - N$

$N = W - F$

$N = 700 - 70(-2)$

$= 700 + 140$

$= 840\ \text{N}$

$\rightarrow$ D

6

Area of Δ increases with t

⇒ J increases ⇒ v increases.

F decreases with t so

v will eventually remain

constant. → D.

7

As time increases, Impulse

increases, so v increases.

Also F increases initially and

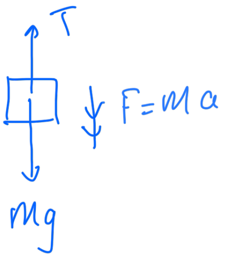
then decreases. So v increases

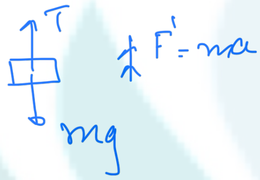
then stays constant

A because of the initial

shape of F 

8





$$F = Mg - T$$
$$Ma = Mg - ma - mg$$
$$Ma + ma = (M-m)g$$
$$a(M+m) = (M-m)g$$

$$F' = T - mg$$
$$T = F' + mg$$
$$T = ma + mg$$

$$a = \frac{(M-m)g}{(M+n)}$$
$$v^2 - u^2 = 2as$$
$$v = \sqrt{\frac{2(M-m)gh}{(M+n)}}$$

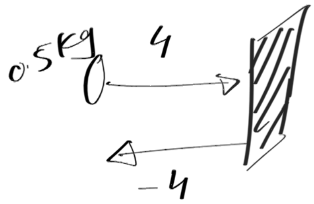
— B

9

$$J = \text{Area under graph}$$
$$= \frac{1}{2}(6)(3) - \frac{1}{2}(1)(2)$$
$$= 9 - 1$$
$$= 8$$
$$J = \Delta P = mv_f - mv_i$$
$$\Rightarrow 8 = 2v_f - 0$$
$$\Rightarrow v_f = 8/2 = 4$$

— A

10



$$\Delta p = mv_f - mv_i$$

$$\Delta p = m(-4) - m(4)$$

$$= m(-8)$$

$$= 0.5(-8) = -4$$

$\therefore$ Magnitude $= 4$ Ns $\rightarrow$ C