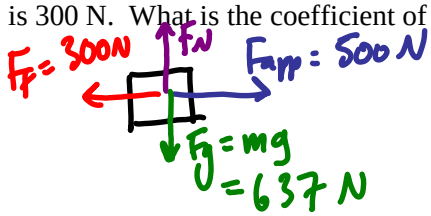
1. Unless acted on by an external net force, an object will stay at rest or

   A. come to rest.
   B. decelerate at a constant rate.
   C. slow down from a given speed.
   D. continue to move in a straight line at a constant speed.

Newton's 1st

2. A 65.0 kg block is being accelerated along a level surface. The applied force is 500 N and the friction force is 300 N. What is the coefficient of friction between the block and the surface?

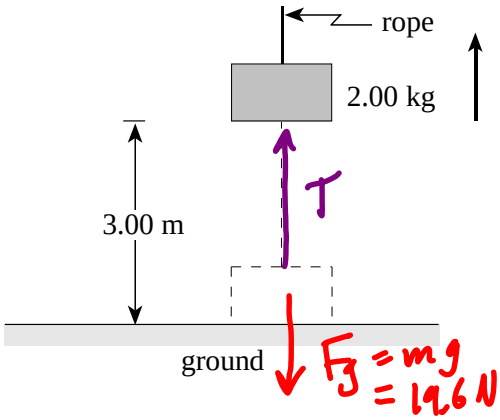
   A. 0.31
   B. 0.47
   C. 0.78
   D. 1.30



$F_f = \mu F_N = \mu mg$

$\mu = \frac{F_f}{mg} = \frac{300}{637} = 0.471$

3. A 2.00 kg object, initially at rest on the ground, is accelerated vertically by a rope, as shown. The object reaches a height of 3.00 m in 1.50 s.



$d = v_0 t + \frac{1}{2} a t^2$

$a = \frac{2d}{t^2} = \frac{2(3.00)}{(1.50)^2}$

$= 2.667 \text{ m/s}^2$

$F_{net} = T - F_g = ma$

$T = ma + F_g$

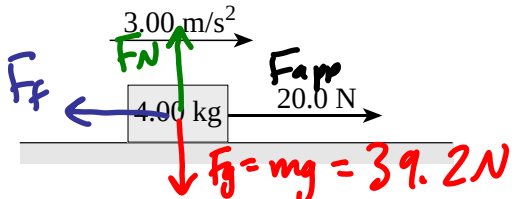
$= (2.00)(2.667) + 19.6$

$= 24.9 \text{ N}$

What is the tension in the rope during the acceleration?

   A. 5.33 N
   B. 14.3 N
   C. 23.6 N
   D. 24.9 N

4. A 4.00 kg block is accelerated along a level surface at 3.00 m/s^2. The applied force is 20.0 N.



$F_{net} = F_{app} - F_f = ma$

$F_f = F_{app} - ma$

$= (20.0) - (4.00)(3.00)$

$= 8.00 \text{ N}$

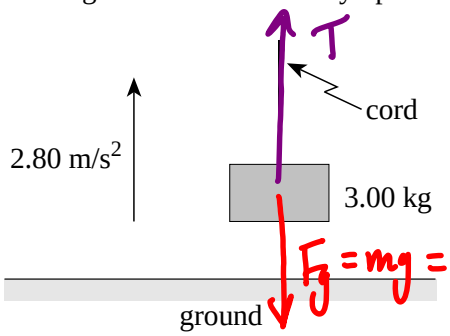
What is the coefficient of friction between the block and the surface?

   A. 0.20
   B. 0.31
   C. 0.51
   D. 0.67

$F_f = \mu F_N = \mu F_g$

$\mu = \frac{F_f}{F_g} = \frac{8.00 \text{ N}}{39.2 \text{ N}} = 0.20$

5. A 3.00 kg object is being accelerated vertically upwards at 2.80 m/s^2, as shown.



$F_g = mg = 29.4\ N$

$F_{net} = T - F_g = ma$

$T = ma + F_g$

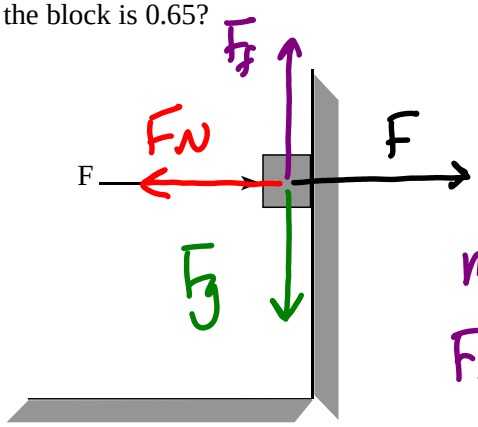
$= (3.00)(2.80) + (29.4)$

$= 37.8\ N$

What is the tension in the cord?

A. 8.40 N
B. 21.0 N
C. 29.4 N
D. 37.8 N

6. What minimum horizontal force F will just prevent the 5.0 kg block from sliding if the coefficient of friction between the wall and the block is 0.65?



$F = F_N$

$F_g = F_f$

$mg = \mu F_N$

$F_N = \frac{mg}{\mu} = \frac{(5.0)(9.80)}{0.65}$

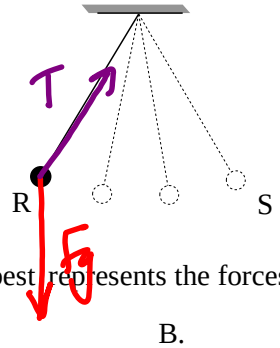
$= 75.38\ N$

A. 6.4 N
B. 32 N
C. 49 N
D. 75 N

7. An object is sliding down a smooth incline. If friction is negligible, the object has

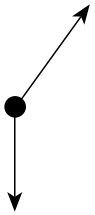
A. constant velocity. ← both the same answer..
B. constant momentum.
C. constant acceleration.
D. constant displacement. ← not moving?

8. A pendulum is swinging freely between points R and S as shown in the diagram below.

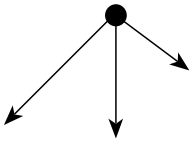


Which of the following diagrams best represents the forces acting on the pendulum bob at point R?

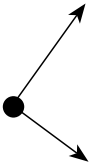
A.



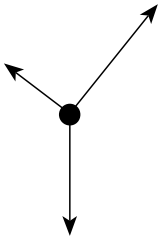
B.



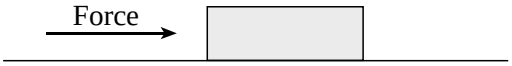
C.



D.



9. A constant force is applied to an object on a frictionless surface, as shown in the diagram below.



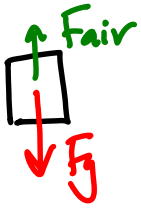
The resulting motion has

A. constant velocity.
B. constant momentum.
C. constant acceleration.
D. constant kinetic energy.

Newton's 2nd

10. What is the frictional force due to air resistance on a 0.50 kg object falling vertically with an acceleration of 8.5 m/s^2?

A. 0.65 N
B. 4.3 N
C. 4.9 N
D. 9.2 N



$F_{net} = F_g - F_{air} = ma$

$F_{air} = F_g - ma$

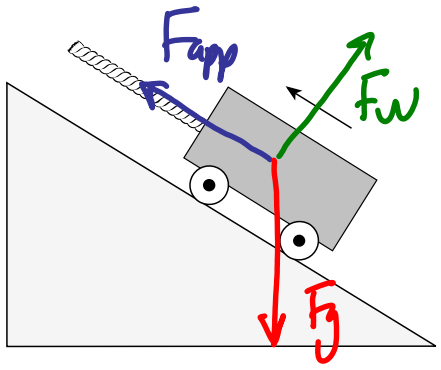
$= mg - ma$

$= m(g - a)$

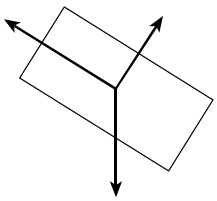
$= (0.50)(9.80 - 8.5)$

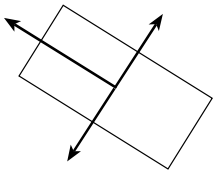
$= 0.65N$

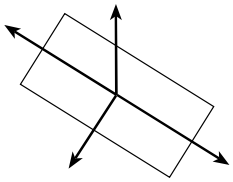
11. The diagram below shows a cart being pulled up a frictionless slope by a rope.

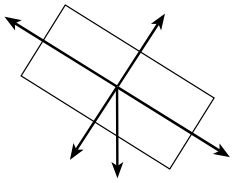


Which of the following best represents the free body diagram for the cart?

A. 

B. 

C. 

D. 

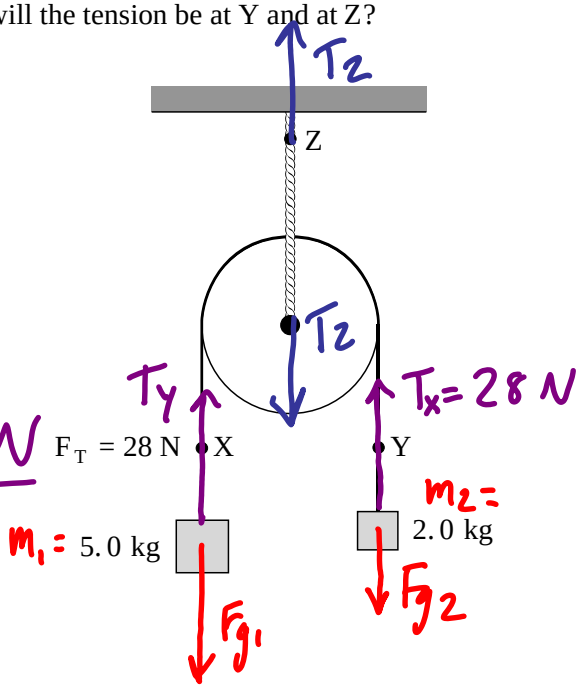
12. A massless, frictionless pulley is suspended by a rope. When the masses are allowed to accelerate, the tension in the string joining them is 28 N at X . What will the tension be at Y and at Z?

	TENSION AT Y	TENSION AT Z
A.	20 N	48 N
B.	20 N	69 N
C.	28 N	56 N
D.	28 N	69 N

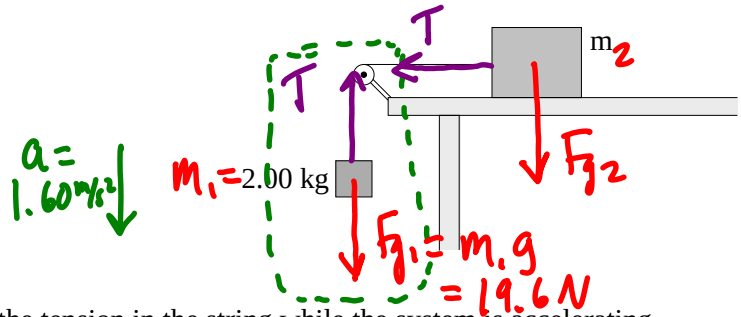
$T_x = T_y = 28\,N$

$T_2 = T_x + T_y$

$= 56\,N$



13. The frictionless system shown below accelerates at 1.60 m/s^2 when released.



$F_{net} = F_{g_1} - T = m_1 a$

$T = F_{g_1} - m_1 a$

$= (19.6) - (2.00)(1.60)$

$= 16.4\ N$

Find the tension in the string while the system is accelerating.

A. 3.20 N
B. 16.4 N
C. 19.6 N
D. 22.8 N

14. Force F gives mass m_1 an acceleration of 4.0 m/s^2. The same force F gives mass m_2 an acceleration of 2.0 m/s^2. What acceleration would force F give to the two masses m_1 and m_2 if they were glued together?

$F = m_1 a_1$ $\quad F = m_2 a_2$ $\quad F = (m_1 + m_2) a_3$

$F = 4 m_1$ $\quad F = 2 m_2$ $\quad = (m_1 + 2m_1) a_3$

$F = 3 m_1 a_3$

$\therefore\ 4m_1 = 2m_2$

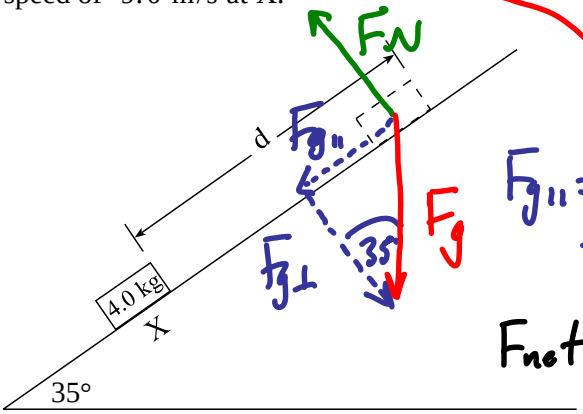
$2m_1 = m_2$

$4m_1 = 3m_1 a_3$

$a_3 = \frac{4m_1}{3m_1} = 1.3\ m/s^2$

A. 1.0 m/s^2
B. 1.3 m/s^2
C. 3.0 m/s^2
D. 6.0 m/s^2

15. A 4.0 kg block has a speed of 9.0 m/s at X.



$F_{g_{||}} = mg \sin 35°$

$= 22.48\ N$

$F_{net} = F_{g_{||}} = ma$

$a = \frac{F_{g_{||}}}{m} = \frac{22.48\ N}{4.0\ kg}$

$= 5.621\ m/s^2$

What is the maximum distance, d, travelled by the block? Ignore friction.

A. 0.92 m
B. 1.6 m
C. 4.1 m
D. 7.2 m

$V = 0$

$V_0 = 9.0\ m/s$

$a = -5.621\ m/s^2$ (must be negative!)

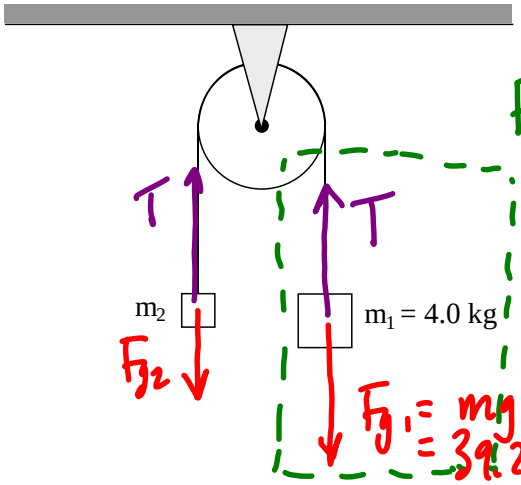
$d = ?$

$t =$

$V^2 = V_0^2 + 2ad$ (0)

$d = \frac{-V_0^2}{2a} = \frac{-(9.0)^2}{2(-5.621)} = 7.2\ m$

16. The tension in the string shown is 12 N. Find the acceleration of mass m_1.



$F_{net} = F_{g_1} - T = m_1 a$

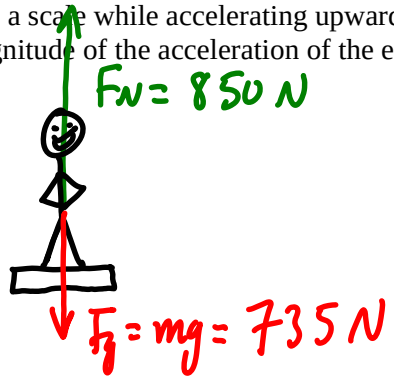
$a_1 = \frac{F_{g_1} - T}{m_1}$

$= \frac{39.2 - 12}{4.0}$

$= 6.8\ m/s^2$

A. $3.0\ m/s^2$
B. $6.4\ m/s^2$
C. $6.8\ m/s^2$
D. $13\ m/s^2$

17. A 75 kg man stands on a scale while accelerating upwards in an elevator. If the scale reads 850 N, what is the magnitude of the acceleration of the elevator?



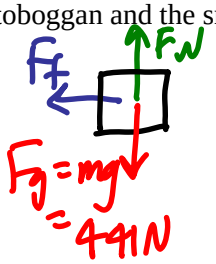
$F_{net} = F_N - F_g = ma$

$a = \frac{F_N - F_g}{m} = \frac{850 - 735}{75}$

$= 1.53\ m/s^2$

A. $1.2\ m/s^2$
B. $1.5\ m/s^2$
C. $9.8\ m/s^2$
D. $11\ m/s^2$

18. A 45 kg toboggan and rider decelerate on level snow at $0.53\ m/s^2$. What is the coefficient of friction between the toboggan and the snow?



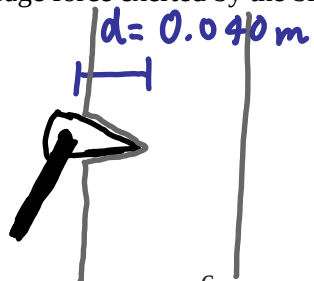
$F_{net} = F_f = ma = (45)(0.53)$

$= 23.85\ N$

$F_f = \mu F_N = \mu F_g \quad \mu = \frac{F_f}{F_g} = 0.054$

A. 0.012
B. 0.054
C. 0.22
D. 0.53

19. The 2.0 kg head of an axe strikes a tree horizontally at 40 m/s. The blade penetrates 0.040 m into the tree. What is the average force exerted by the blade on this tree?



$F_{net} = ma$

$= (2.0)(20000)$

$= 4.0 \times 10^4\ N$

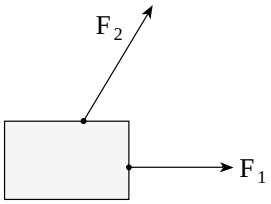
$V = 0$
$V_0 = 40\ m/s$
$a = ?$
$d = 0.40\ m$

$V^2 = V_0^2 + 2ad$

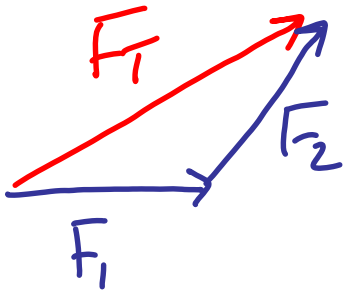
$a = \frac{-V_0^2}{2d} = 20000\ m/s^2$

A. 2.0×10^1 N
B. 2.0×10^3 N
C. 2.0×10^4 N
D. 4.0×10^4 N

20. Two forces act on an object as shown in the diagram.

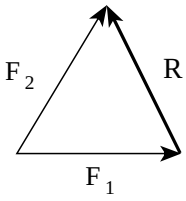


$\vec{F}_T = \vec{F}_1 + \vec{F}_2$

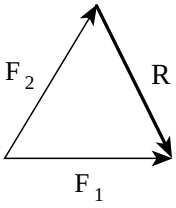


Which of the following best shows the resultant R of these forces?

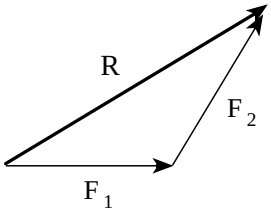
A.



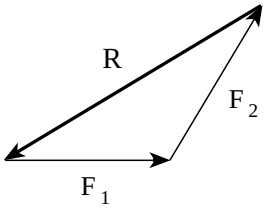
B.



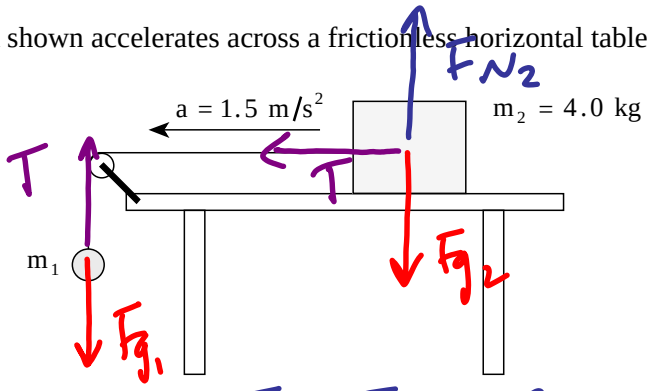
C.



D.



21. The 4.0 kg block shown accelerates across a frictionless horizontal table at 1.5 m/s^2.



$T = m_2 g$
$= (4.0)(1.5)$
$= 6.0\ N$

Find the mass of object m_1.

A. 0.61 kg
B. 0.72 kg
C. 6.0 kg
D. 26 kg

$F_{g_1} - T = m_1 a$
$m_1 g - T = m_1 a$
$m_1 g - m_1 a = T$

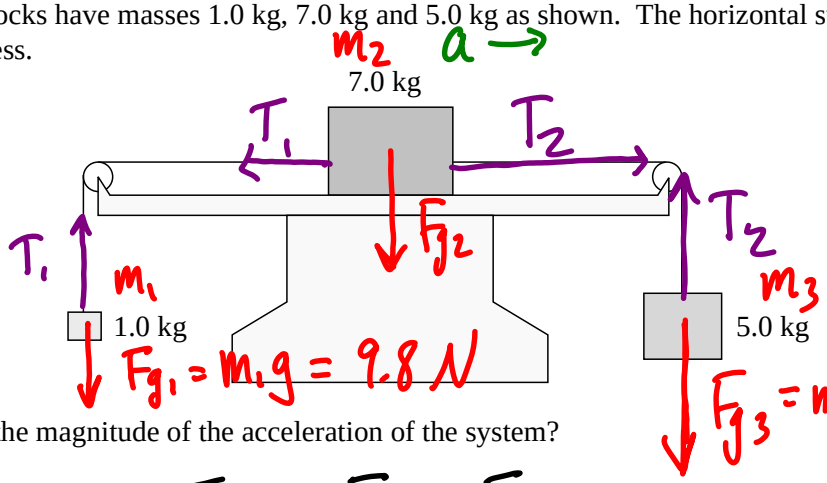
$m_1 (g - a) = T$
$m_1 = \frac{T}{(g-a)} = \frac{6.0}{(9.80 - 1.5)}$
$= 0.72\ kg$

22. Which of the following is not a statement of one of Newton's laws of motion?

A. For every action force, there is an equal and opposite reaction force.
B. If no net force acts on an object, the object will remain at rest, or continue to move at a constant velocity.
C. The acceleration of freely falling objects is proportional to their mass.
D. If a net force does act on an object, the object will accelerate in the direction of the net force.

Newton's 3rd
Newton's 1st
Do heavier objects fall faster?
Ya right!
Newton's 2nd

23. Three blocks have masses 1.0 kg, 7.0 kg and 5.0 kg as shown. The horizontal surface is frictionless.



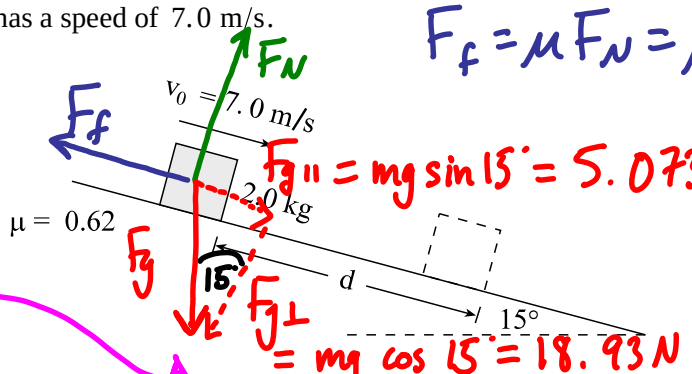
What is the magnitude of the acceleration of the system?

A. 3.0 m/s^2
B. 3.8 m/s^2
C. 6.5 m/s^2
D. 7.8 m/s^2

$$F_{net} = F_{g3} - F_{g1} = m_{total}\, a$$

$$a = \frac{F_{g3} - F_{g1}}{m_{total}} = \frac{49 - 9.8}{(1.0 + 7.0 + 5.0)} = 3.0\ m/s^2$$

24. A 2.0 kg block is sliding down a 15° incline. The coefficient of friction is 0.62. At some position the block has a speed of 7.0 m/s.



$F_f = \mu F_N = \mu F_{g\perp} = (0.62)(18.93) = 11.74\ N$

$F_{g\parallel} = mg\sin 15° = 5.073\ N$

$F_{g\perp} = mg\cos 15° = 18.93\ N$

Since $F_f > F_{g\parallel}$

What distance d will this block move before coming to rest?

A. 2.5 m
B. 4.0 m
C. 4.2 m
D. 7.4 m

$$F_{net} = F_f - F_{g\parallel} = ma \qquad a = \frac{F_f - F_{g\parallel}}{m}$$

$$= \frac{(11.74 - 5.073)}{2.0}$$

$$= 3.33\ m/s^2$$

must be negative

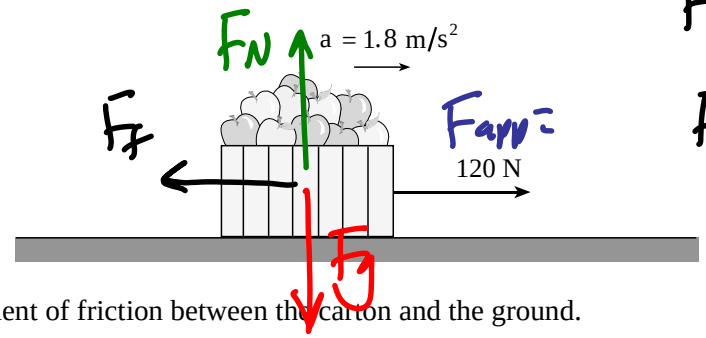
$v = 0$ m/s
$v_0 = 7.0$ m/s
$a = -3.33$ m/s^2
$d = ?$

$$v^2 = v_0^2 + 2ad$$

$$d = \frac{-v_0^2}{2a}$$

$$= 7.35\ m$$

25. A student exerts a 120 N horizontal force on a 25 kg carton of apples, causing it to accelerate over level ground at 1.8 m/s^2.



$F_{net} = F_{app} - F_f = ma$

$F_f = F_{app} - ma$

$= (120) - (25)(1.8)$

$= \underline{75\ N}$

Find the coefficient of friction between the carton and the ground.

(A) 0.31
B. 0.38
C. 0.49
D. 0.67

$F_f = \mu F_N = \mu mg$

$\mu = \frac{F_f}{mg} = \frac{75N}{(25)(9.8)} = 0.31$

26. A net force F acts on an object of mass m, causing it to accelerate at 4.0 m/s^2. If the same net force F acts on an object of mass 2m, its acceleration will be

A. 1.0 m/s^2
(B.) 2.0 m/s^2
C. 4.0 m/s^2
D. 8.0 m/s^2

$F = ma$

$a = \frac{F}{m}$

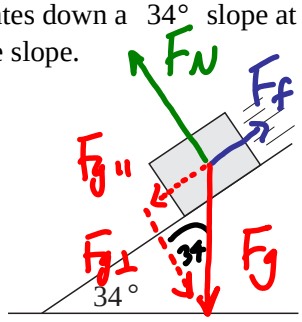
$\therefore a \propto \frac{1}{m}$ $\therefore 2m \Rightarrow \frac{1}{2}a = 2.0\ m/s^2$

$\left[a_1 = \frac{F}{m} = 4\ m/s^2 \right.$

$\left. a_2 = \frac{F}{2m} = 2\ m/s^2 \right]$

27. A 5.0 kg concrete block accelerates down a 34° slope at 4.2 m/s^2. Find the coefficient of friction between the block and the slope.

Assuming $F_{g\parallel} > F_f$



$F_{g\parallel} = mg \sin 34 = 27.4\ N$

$F_{g\perp} = mg \cos 34 = 40.6\ N$

A. 0.13
(B.) 0.16
C. 0.43
D. 0.67

$F_{net} = F_{g\parallel} - F_f = ma$

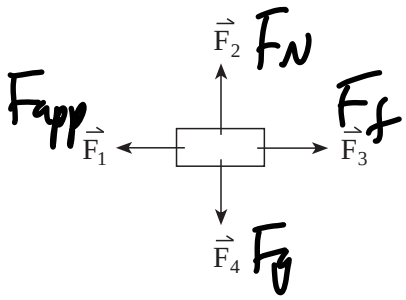
$F_f = F_{g\parallel} - ma = 27.4 - (5.0)(4.2)$

$= 6.4\ N$ (Assumption was correct)

$F_f = \mu F_N = \mu F_{g\perp}$

$\mu = \frac{F_f}{F_{g\perp}} = \frac{6.4\ N}{40.6\ N} = 0.157$

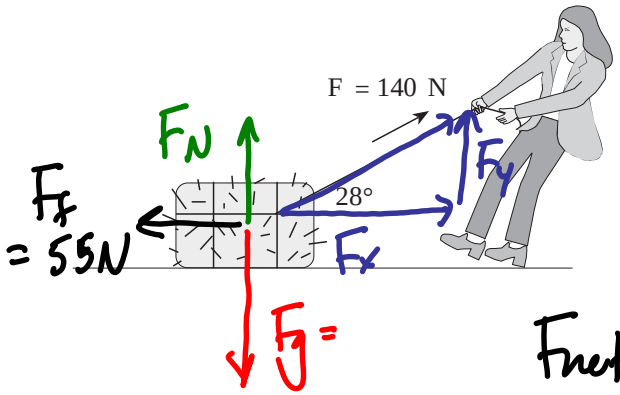
28. The free body diagram shown below represents a crate being dragged over a rough surface.



Which of the vectors represent the normal force and the friction force acting on the crate?

	NORMAL FORCE	FRICTION FORCE
A.	$\vec{F}_1$	$\vec{F}_2$
B	$\vec{F}_2$	$\vec{F}_3$
C.	$\vec{F}_3$	$\vec{F}_4$
D.	$\vec{F}_4$	$\vec{F}_1$

29. A girl applies a 140 N force to a 35 kg bale of hay at an angle of 28° above horizontal. The friction force acting on the bale is 55 N. What will be the horizontal acceleration of the bale?



$F_x = 140 \cos 28°$
$= 123.6\ N$

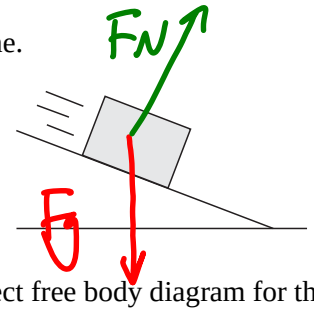
A. 0.31 m/s^2
B 2.0 m/s^2
C. 2.4 m/s^2
D. 2.6 m/s^2

$F_{net} = F_x - F_f = ma$

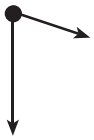
$a = \frac{F_x - F_f}{m} = \frac{123.6 - 55}{35}$

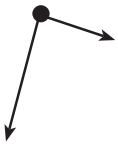
$= 1.96\ m/s^2$

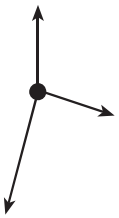
30. A block is on a frictionless incline.

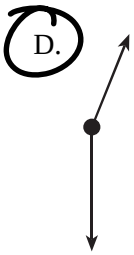


Which of the following is a correct free body diagram for the block?

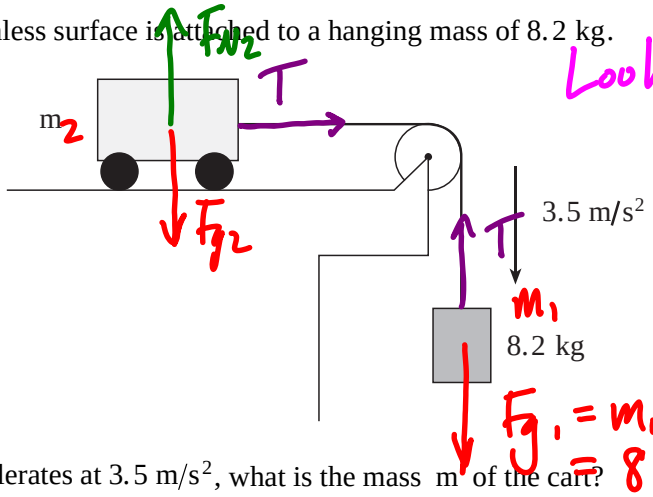
A. 

B. 

C. 

D. 

31. A cart on a frictionless surface is attached to a hanging mass of 8.2 kg.



Look at total system

$F_{net} = F_{g1} = m_t a$

$m_t = \frac{F_{g1}}{a} = \frac{80.4}{3.5}$

$= 22.97 kg$

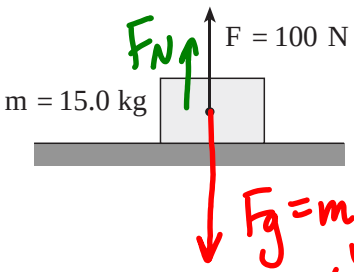
If this system accelerates at 3.5 m/s^2, what is the mass m of the cart?

A. 6.0 kg
B. 15 kg
C. 23 kg
D. 31 kg

$m_t = m_1 + m_2$

$m_2 = m_t - m_1 = 22.97 - 8.2 kg = 14.77 kg$

32. A 15 kg block on a horizontal surface has a 100 N force acting on it as shown.



$F_g - F_N - F = 0$

$\therefore F_g = F_N + F$

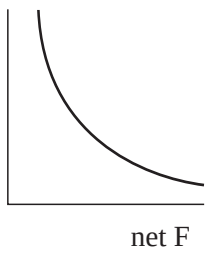
$F_N = F_g - F$

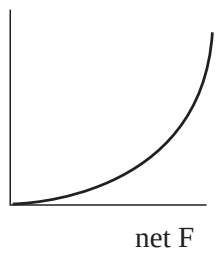
$= 47 N$

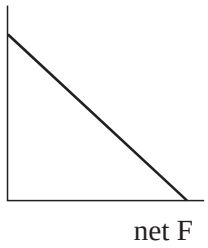
What is the normal force?

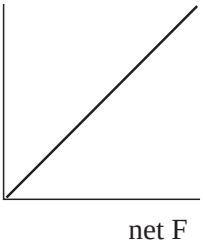
A. 47 N
B. 100 N
C. 147 N
D. 247 N

33. Which of the following graphs shows the relationship between acceleration and net force?

A. 

B. 

C. 

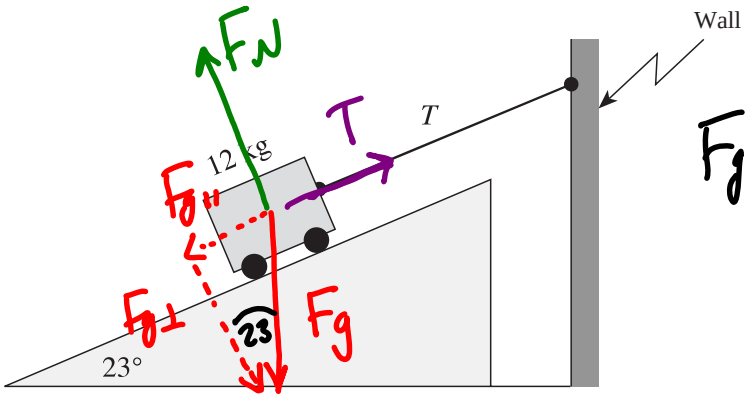
D. 

$F_{net} = ma$

$F_{net} \propto a$

$a \propto F_{net}$

34. A 12 kg cart on a 23° frictionless incline is connected to a wall as shown.



$F_{g\parallel} = T$

$= mg \sin 23$

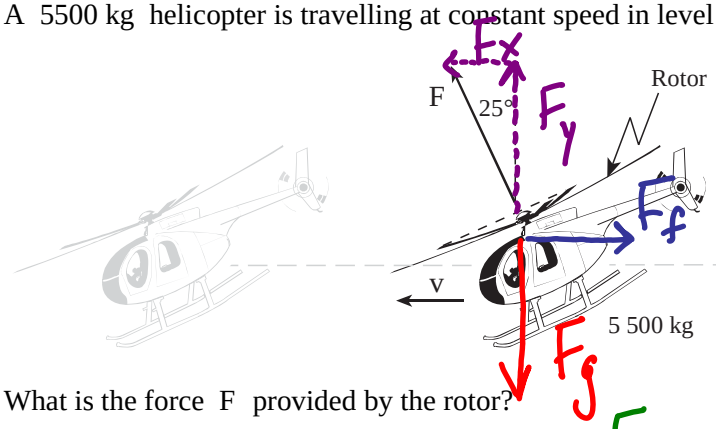
$= (12)(980) \sin 23$

$= 45.9\ N$

What is the tension T in the cord?

A. 46 N
B. 50 N
C. 110 N
D. 120 N

35. A 5500 kg helicopter is travelling at constant speed in level flight.



since $\vec{v}$ is const.
then $\vec{a} = 0$
$\therefore F_{net} = 0$
$\therefore F_y = F_g = mg$
$= (5500)(9.80)$
$= 53900\,N$

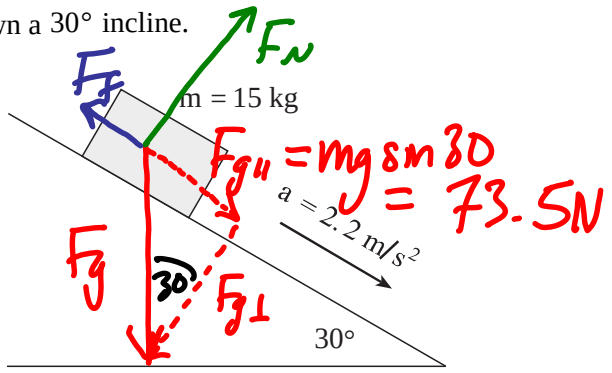
What is the force F provided by the rotor?

A. 4.9×10^4 N
B. 5.4×10^4 N
C. 5.9×10^4 N
D. 1.2×10^5 N

$\cos 25 = \frac{F_y}{F}$

$F = \frac{F_y}{\cos 25} = \frac{53900}{\cos 25} = 59470\,N$

36. A 15 kg block has a constant acceleration of $2.2\ m/s^2$ down a 30° incline.



What is the magnitude of the friction force on the block?

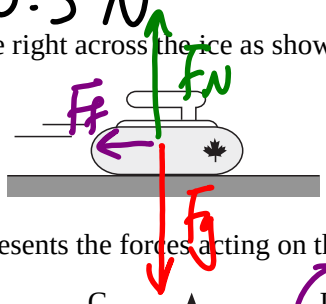
A. 33 N
B. 41 N
C. 74 N
D. 130 N

$F_{net} = F_{g\parallel} - F_f = ma$

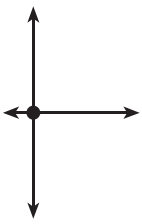
$F_f = F_{g\parallel} - ma$
$= (73.5) - (15)(2.2)$
$= 40.5\,N$

$F_{g\parallel} = mg\sin 30 = 73.5\,N$

37. A curling rock is travelling to the right across the ice as shown in the diagram.



Which of the following best represents the forces acting on the curling rock?

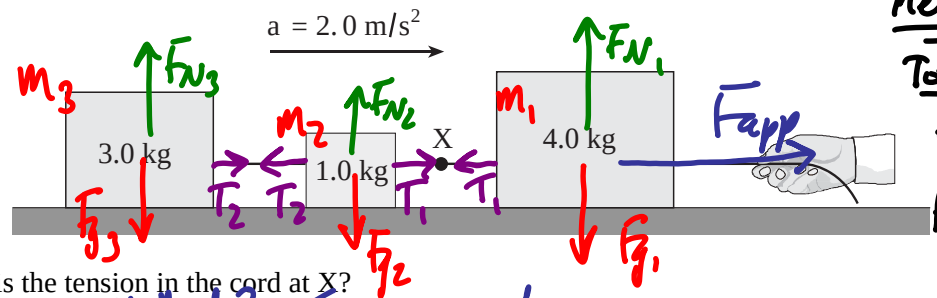
A. 

B. 

C. 

D. 

38. The system of blocks on a frictionless surface in the diagram below is accelerating at $2.0\ m/s^2$.



What is the tension in the cord at X?

A. 2.0 N
B. 6.0 N
C. 8.0 N
D. 16 N

Method 1

Total system

$F_{net} = F_{app} = m_t a$

$F_{app} = (3+1+4)(2.0)$

$= 16.0\ N$

m_1

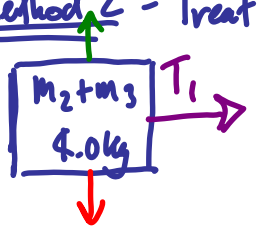
$F_{app} - T_1 = m_1 a$

$T_1 = F_{app} - m_1 a$

$= 16.0 - (4)(2)$

$= 8.0\ N$

Method 2 - Treat m_2 and m_3 as one mass

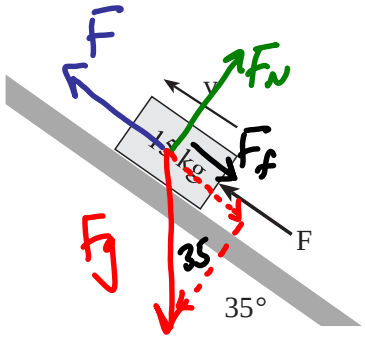


$T_1 = m_{23} a$

$= (4.0)(2.0)$

$= 8.0\ N$

39 A 15 kg block is pushed up a 35° incline. A friction force of 110 N exists between the block and the incline.



$F_{g\parallel} = mg \sin 35$

$= 84.3\ N$

$F_{net} = F - F_{g\parallel} - F_f = ma$ (0)

$\therefore F = F_{g\parallel} + F_f$

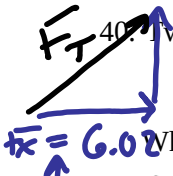
$= 84.3 + 110$

$= 194.3\ N$

What minimum force F, would be necessary to move the block up the incline at a constant speed?

A. 26 N
B. 84 N
C. 150 N
D. 190 N

40. Two forces act at a single point as shown.



$F_T = \sqrt{F_x^2 + F_y^2}$ =

What is the magnitude of the resulting force?

A. 15 N
B. 22 N
C. 27 N
D. 30 N

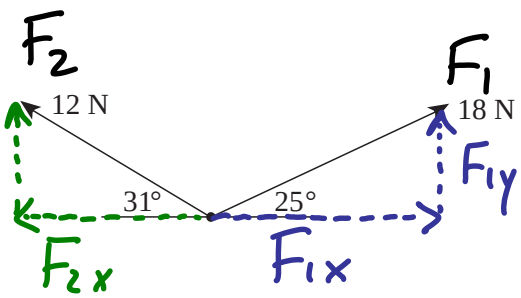
$\sum F_x = -10.29 + 16.31$

$= 6.02\ N$

$\sum F_y = 6.18 + 7.61$

$= 13.79\ N$

must be negative!!!



$F_{2x} = 12 \cos 31$

$= -10.29\ N$

$F_{1x} = 18 \cos 25$

$= 16.31\ N$

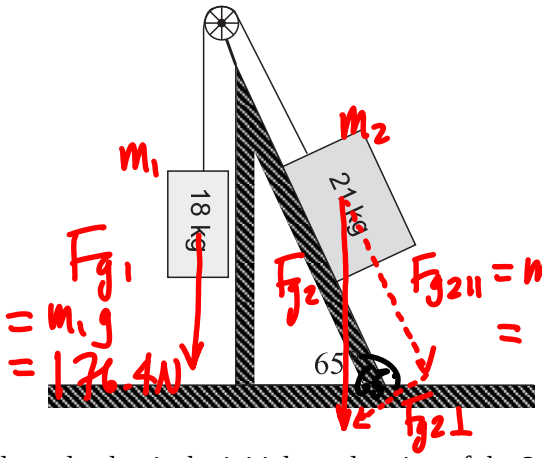
$F_{1x} = 12 \sin 31$

$= 6.18\ N$

$F_{1y} = 18 \sin 25$

$= 7.61\ N$

41. Two masses are connected together by a rope and pulley on a frictionless inclined plane as shown.



$F_{g2\parallel} > F_{g1}$

$\therefore$ m_2 goes down the incline

$F_{g1} = m_1 g = 176.4\ N$

$F_{g2\parallel} = m_2 g \sin 65 = 186.5\ N$

$F_{g2\parallel} - F_{g1} = m_t a$

$a = \dfrac{F_{g2\parallel} - F_{g1}}{m_t} = \dfrac{186.5 - 176.4}{(18+21)} = 0.26\ m/s^2$

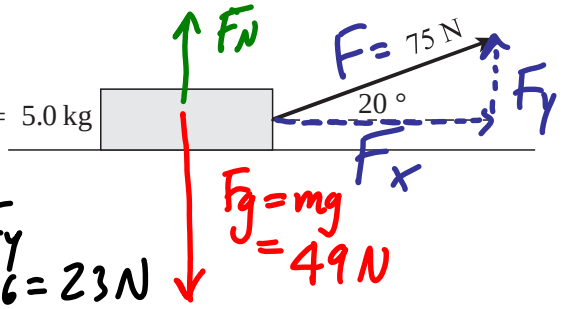
When the system is released, what is the initial acceleration of the 21 kg mass?

	MAGNITUDE OF THE ACCELERATION	DIRECTION THE MASS WILL TRAVEL
A.	0.26 m/s^2	up the incline
(B)	0.26 m/s^2	down the incline
C.	0.48 m/s^2	up the incline
D.	0.48 m/s^2	down the incline

42. A 5.0 kg block is being pulled to the right by a 75 N force.

What is the normal force on this block?

(A) 23 N
B. 26 N
C. 49 N
D. 75 N



$F_y = F \sin 20^\circ = 25.7\ N$

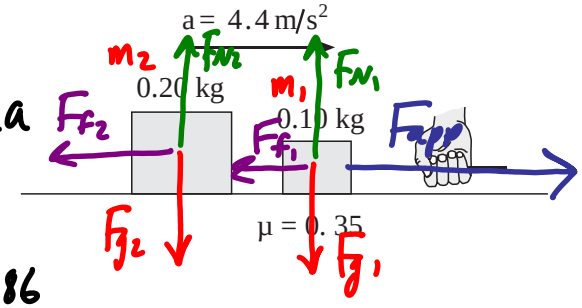
$F_g = F_N + F_y$

$F_N = F_g - F_y = 49 - 26 = 23\ N$

43. The system of blocks shown in the diagram below is being accelerated to the right at 4.4 m/s^2.

What pulling force is applied by the hand?

A. 0.3 N
B. 1.0 N
C. 1.3 N
(D) 2.3 N



$F_{net} = F_{app} - F_{f_1} - F_{f_2} = m_t a$

$F_{app} = m_t a + F_{f_1} + F_{f_2}$

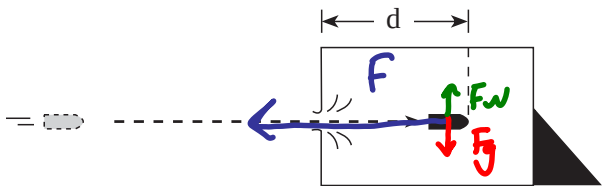
$= (0.30)(4.4) + 0.343 + 0.686$

$= 2.3\ N$

$F_{f_1} = \mu F_{N_1} = \mu m_1 g = 0.343\ N$

$F_{f_2} = \mu F_{N_2} = \mu m_2 g = 0.686\ N$

44. A 0.055 kg bullet was fired at 250 m/s into a block of wood as shown in the diagram below.



$F_{net} = F = ma$

$a = \frac{F}{m} = \frac{9500\,N}{0.055\,kg} = 1.73\times10^5\ m/s^2$

Assuming an average force of 9500 N brings the bullet to rest in the wood, what distance d did the bullet penetrate the block?

A. 1.4×10^{-3} m
B. 1.4×10^{-2} m
C. 1.8×10^{-1} m
D. 3.6×10^{-1} m

negative b/c it is backwards!

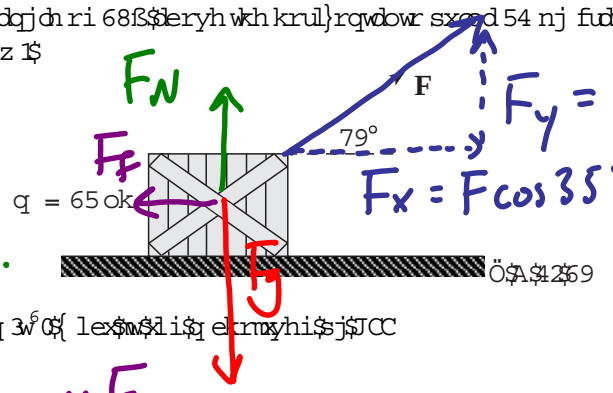
$v = 0$
$v_0 = 250\,m/s$
$a = -1.73\times10^5\ m/s^2$
$d = ?$

$v^2 = v_0^2 + 2ad$

$d = \frac{-v_0^2}{2a} = \frac{-(250)^2}{2(-1.73\times10^5)}$

$= 0.181\,m$

781D irufh**F**$vdssolhg dwdq dqjdn ri 68ß$eryh wkh krul}rqwdowr sxeed54 nj fudwh dfurvvd vsykl$lorrudvvkrz q ehorz 1$



$F_y = F\sin 35°$

$F_x = F\cos 35°$

Uh oh... can't resolve components ... this will get ugly...

$F_g = F_N + F_y$

$F_N = F_g - F_y$

$= mg - F\sin 35°$

Mjliggipivexsr$w$826$q 3w0${ lex$w$li$q ekmxyhi$j$JCC

E2$ 544$R
F2$ 589$R
G2$ 5;4$R
H2$ 64;$R

$F_f = \mu F_N$

$F_f = \mu(mg - F\sin 35°)$

$F_{net} = F_x - F_f = ma$

$= F\cos 35° - \mu(mg - F\sin 35°) = ma$

$F\cos 35 - \mu mg + \mu F\sin 35 = ma$

$F(\cos 35 + \mu\sin 35) = ma + \mu mg$

$F = \frac{ma + \mu mg}{(\cos 35 + \mu\sin 35)}$

$= \frac{(21)(4.2) + (0.25)(21)(9.8)}{\cos 35 + (0.25)\sin 35}$

$=$ N