PHYSICS 12

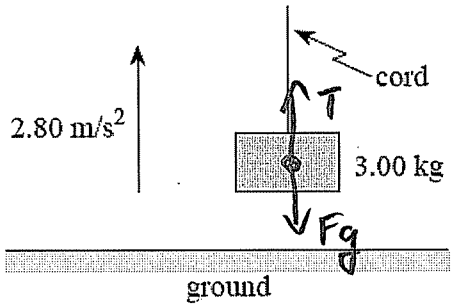
NAME: _____

Action & Reaction

1. A 3.00 kg object is being accelerated vertically upwards at 2.80 m/s^2, as shown. What is the tension in the cord?

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

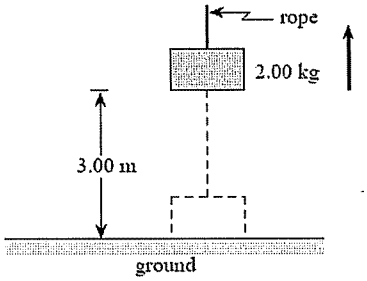
   $F_{net} = T - F_g$ $\quad T = 37.8\,N$
   $ma = T - mg$
   $(3)(2.8) = T - 3(9.8)$



2. 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. 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

   similar to #2, find 'a' first
   $d = v_0 t + \frac{1}{2} a t^2$ $\quad a = 2.7\,m/s^2$
   $3 = 0 + \frac{1}{2} a (1.5)^2$ $\quad F_{net} = T - F_g$
   (follow #1 above)



3. The diagram shows a 4.4 kg mass connected by a string to an unknown mass over a frictionless pulley. The system accelerates at 1.8 m/s^2 in the direction shown.

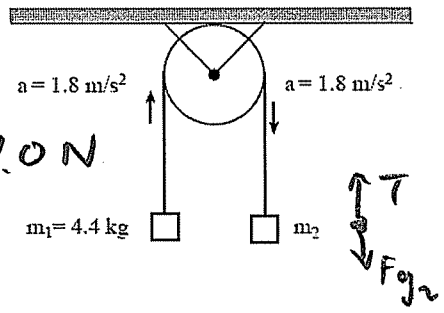
   a) Draw and label a free body diagram for the 4.4 kg mass.

   b) Calculate the tension in the string.

   $F_{net} = T - F_{g_1}$
   $m_1 a = T - m_1 g$
   $4.4(1.8) = T - 4.4(9.8)$ $\quad \rightarrow T = 51.0\,N$

   c) Find mass m_2.

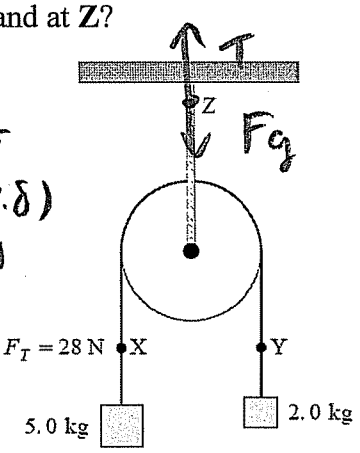
   $F_{net} = F_{g_2} - T$
   $m_2(1.8) = m_2(9.8) - 51\,N$
   $51 = 8 m_2$
   $m_2 = 6.38\,kg$



4. 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

   at Z $F_{net} = F_g - T$
   $0 = F_g - T$
   $T = (7)(9.8)$
   $= 69\,N$

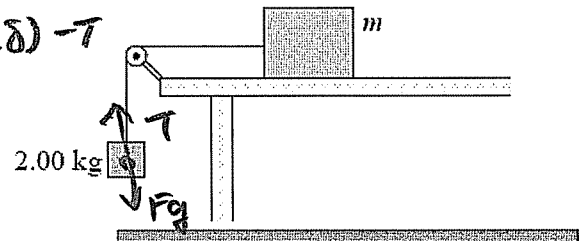


   T at X = T at Y : same cord
   $= 28\,N$

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

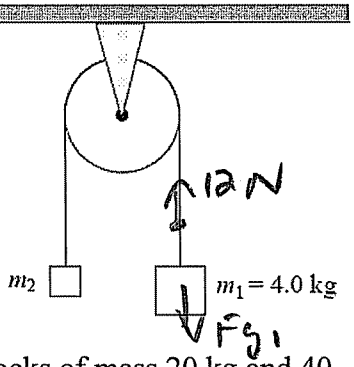
Isolate 2.0kg
$F_{net} = F_g - T$
$ma = mg - T$
$2(1.6) = 2(9.8) - T$
$T = 16.4N$



6. The tension in the string shown is 12 N. Find the acceleration of mass m_2.

A. 3.0 m/s^2
B. 6.4 m/s^2
(C) 6.8 m/s^2
D. 13 m/s^2

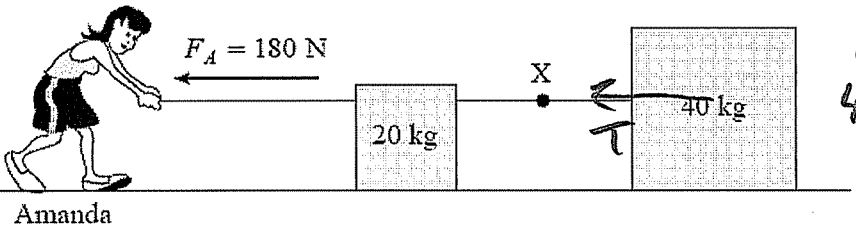
acc of m_2 = acc of m_1
isolate m_1
$F_{net} = F_g - T$
$ma = mg - T$
$4(a) = 4(9.8) - 12$
$4a = 27.2N$
$a = 6.8 m/s^2$



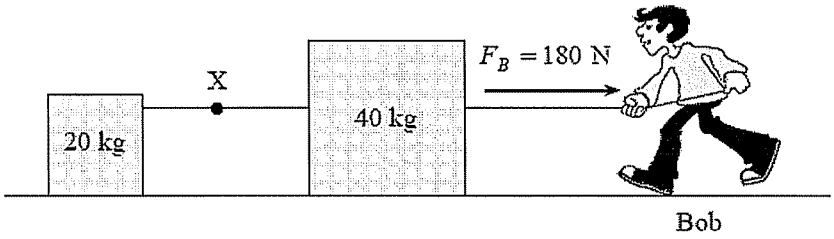
7. Amanda exerts a horizontal force of 180 N on a piece of rope causing two blocks of mass 20 kg and 40 kg to accelerate. Friction on the blocks is negligible.

a) Find the tension force at **X** in the rope joining the two blocks together.

Isolate 40kg
$F_{net} = F_A$
$60(a) = 180 N$
$a = 3 m/s^2$
$F_{net} = T$
$40(3) = T$
$T = 120N$



b) Bob exerts a force of equal magnitude in the opposite direction on an identical pair of blocks.



How does the tension force at **X** compare to the value in part a)? (Circle one.)

i) The tension force is the same.
ii) The tension force is greater than in a).
(iii) The tension force is smaller than in a).

c) Using principles of physics, explain your answer to part b).

second mass is smaller so F_{net} on 20kg will be less so T is less

8. 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?

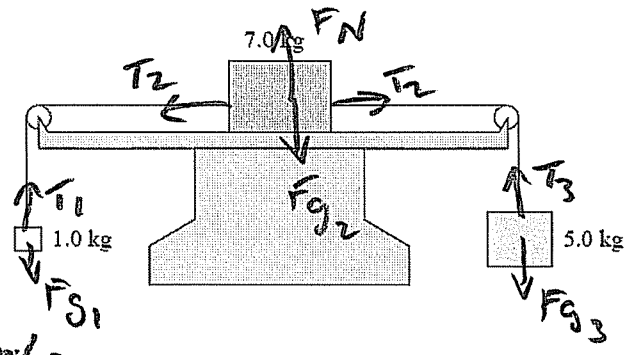
A. 3.0 m/s^2
B. 3.8 m/s^2
C. 6.5 m/s^2
D. 7.8 m/s^2

$F_{net} = F_{g3} - F_{g1}$ (Tension cancels out)

$ma = m_3 g - m_1 g$

$13\text{kg}(a) = 5(9.8) - 1(9.8)$

$13a = 39.2\text{N}$ $a = 3.02\text{ m/s}^2$



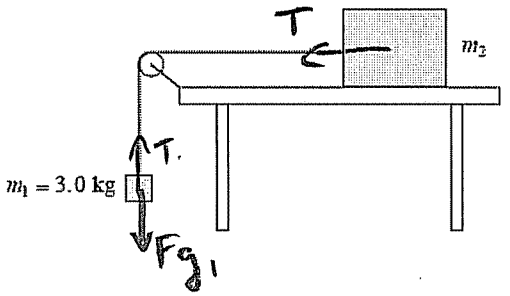
9. The diagram shows two objects connected by a light string over a frictionless pulley. Object m_2 is on a frictionless horizontal table. The tension in the string is 24 N.

a) Find the acceleration of the system.

Isolate 3kg

$F_{net} = F_{g1} - T$ $3a = 5.4\text{N}$

$3(a) = 3(9.8) - 24\text{N}$ $a = 1.8\text{m/s}^2$



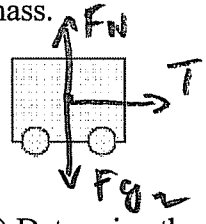
b) Find the mass of m_2.

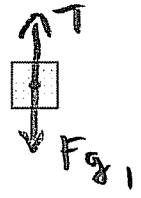
Isolate m_2 $F_{net} = T$ $m = 13.3\text{kg}$

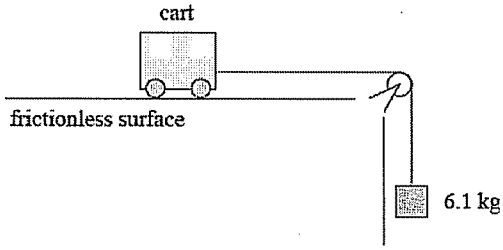
$m(1.8) = 24\text{N}$

10. In the diagram shown, the tension in the cord connecting the hanging mass and cart is 43 N.

a) Draw and label a free body diagram for the cart and the hanging mass.







b) Determine the mass of the cart.

Isolate 6.1kg $a = 2.75\text{m/s}^2$ Isolate cart

$F_{net} = F_{g1} - T$ $F_{net} = T$

$6.1(a) = 6.1(9.8) - 43$ $m(2.75) = 43\text{N}$

$6.1a = 16.8\text{ N}$ $m = 15.6\text{kg}$

11. The 4.0 kg block shown accelerates across a frictionless horizontal table at 1.5 m/s^2. Find the mass of object m_1.

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

Isolate m_2 $F_{net} = T$ $4(1.5) = T$ $T = 6\text{N}$

Isolate m_1 $F_{net} = F_g - T$ $m(1.5) = m(9.8) - 6$ $6\text{N} = 8.3m$ $m = .72\text{kg}$