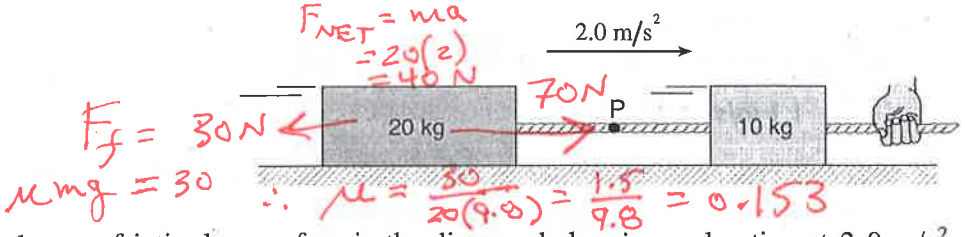
SIMONSON

Physics 12 Dynamics Practice Problems — Two Bodies

1. The system of masses shown below is accelerating to the right at 2.0 m/s^2. If the tension in the rope at point P is 70 N, what is the coefficient of friction between the masses and the surface?

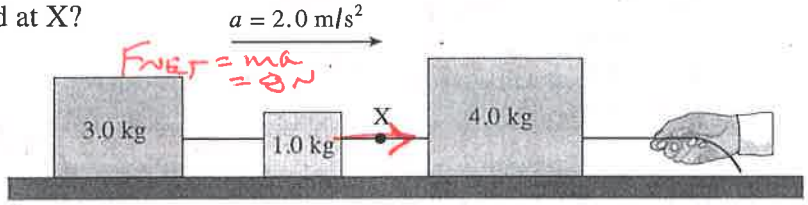
A. 0.15
B. 0.20
C. 0.43
D. 0.57



$F_{NET} = ma$
$= 20(2)$
$= 40$ N
$70 - F_f = 40$
$F_f = 30$ N
$\mu mg = 30$
$\therefore \mu = \frac{30}{20(9.8)} = \frac{1.5}{9.8} = 0.153$

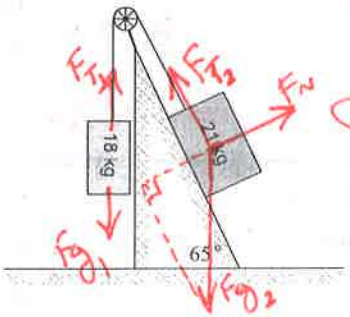
2. The system of blocks on a frictionless surface in the diagram below is accelerating at 2.0 m/s^2. What is the tension in the cord at X?

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



$F_{NET} = ma$
$= 8$ N

3. Two masses are connected together by a rope and pulley on a frictionless inclined plane as shown.
When the system is released, what is the initial acceleration of the 21 kg mass?

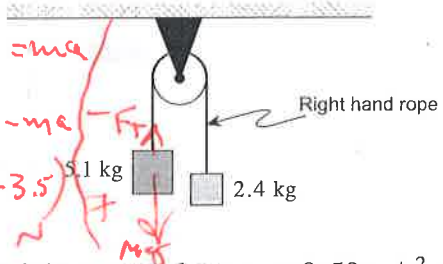


	MAGNITUDE OF THE ACCELERATION	DIRECTION THE MASS WILL TRAVEL
A.	0.26 m/s^2	up the incline
B.	0.26 m/s^2	down the incline
C.	0.48 m/s^2	up the incline
D.	0.48 m/s^2	down the incline

$a = \frac{m_2 g \sin 65° - m_1 g}{m_T} = \frac{21(9.8)\sin 65° - 18(9.8)}{39}$

4. A frictionless pulley is set up with two hanging masses as shown below.
What is the tension in the right hand rope while the masses move freely?

A. 8.5 N
B. 24 N
C. 26 N
D. 32 N

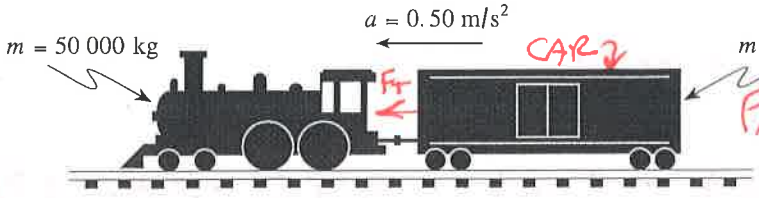


$F_g - F_T = ma$
$F_T = mg - ma$
$F_T = 5.1(9.8 - 3.5)$
$= 31.98$ N

$a = \frac{(5.1 - 2.4)9.8}{(5.1 + 2.4)}$
$a = 3.528 \frac{m}{s^2}$

5. A locomotive pulling a freight car accelerates at 0.50 m/s^2 as shown in the diagram.
What is the tension in the coupling linking the locomotive and car? (Ignore friction.)

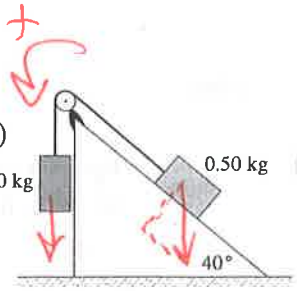
A. 5 000 N
B. 25 000 N
C. 30 000 N
D. 390 000 N



ON CAR
$F_{NET} = 5000$ N

6. Two masses are connected by a string as shown in the diagram.

What is the magnitude of the acceleration of these masses? (Ignore friction.)



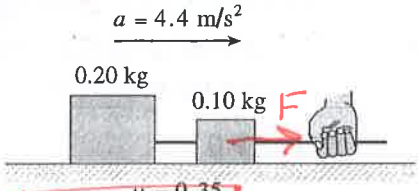
A. 0.11 m/s^2
B. 0.19 m/s^2
C. 0.86 m/s^2
D. 1.1 m/s^2

$.4(9.8) - .5(9.8)\sin 40° = ma$

$a = 0.8559 \frac{m}{s^2}$

7. 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?



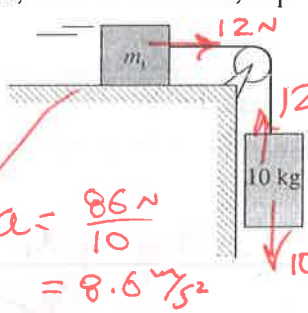
A. 0.3 N
B. 1.0 N
C. 1.3 N
D. 2.3 N

$F_{NET} = ma$

$F - F_f = ma$

$F = (0.3)(4.4) + 0.35(0.3)(9.8) = 2.349$ N

8. If the tension in the line joining the two masses shown below is 12 N, what is the mass, m_1? (Ignore surface friction.)



A. 1.1 kg
B. 1.4 kg
C. 2.0 kg
D. 10 kg

(2) $F_{NET_1} = m_1 a$

$m_1 = \frac{F_{NET_1}}{a} = \frac{12}{8.6} =$

$m_1 = 1.4$ kg

(1) $F_{NET} = 98 - 12 = 86 = ma$

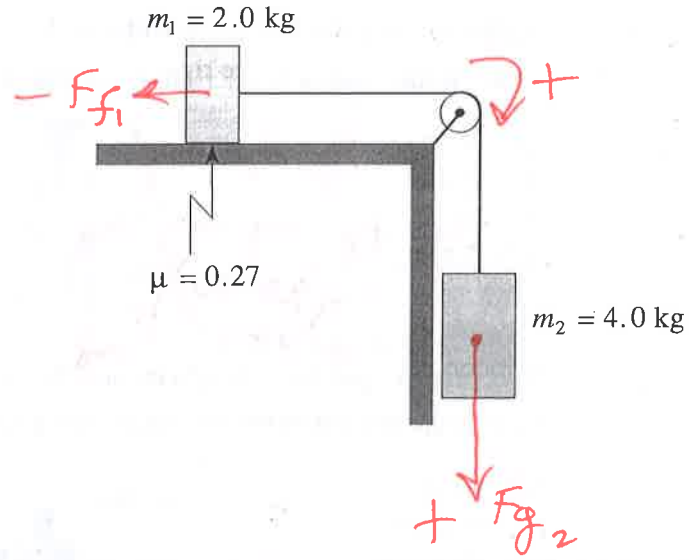
$a = \frac{86 N}{10} = 8.6 \frac{m}{s^2}$

$10(9.8)$

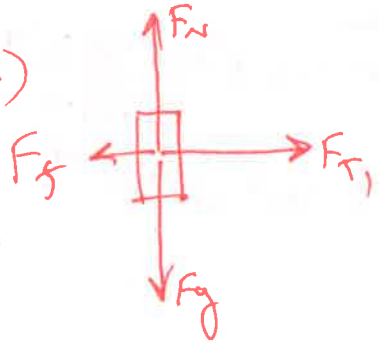
9. Two masses are connected by a light string over a frictionless massless pulley. There is a coefficient of friction of 0.27 between mass m_1 and the horizontal surface.

a) Draw and label a free body diagram showing the forces acting on mass m_1. **(2 marks)**

b) What is the acceleration of mass m_2? **(5 marks)**



(a)



(b) $F_{NET} = ma$

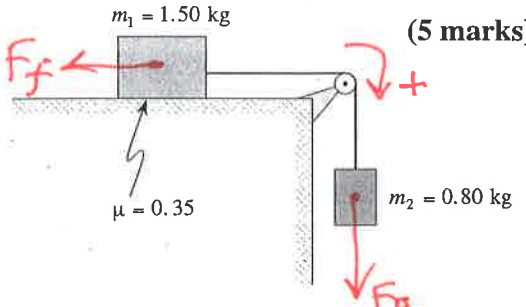
$F_{g_2} - F_{f_1} = m_T a$

$a = \frac{m_2 g - \mu m_1 g}{m_1 + m_2} = \frac{4(9.8) - .27(2)(9.8)}{2 + 4} = 5.65 \frac{m}{s^2}$ [DOWN]

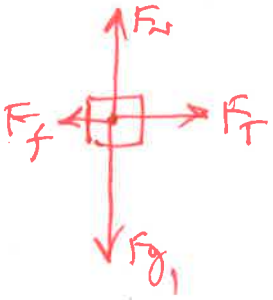
10. Two masses are connected by a light string passing across a frictionless pulley as shown in the diagram below. The coefficient of friction between mass m_1 and the horizontal surface is 0.35.

a) Draw and label a free body diagram showing the forces acting on mass m_1. **(2 marks)**

b) What is the tension in the connecting string? **(5 marks)**



(a)



(b) FIND $\vec{a}$

$F_{g_2} - F_{f_1} = m_1 a$

$a = \dfrac{m_2 g - \mu m_1 g}{m_1 + m_2}$

$= \dfrac{0.80(9.8) - 0.35(1.50)(9.8)}{0.80 + 1.50}$

$= 1.17 \ \frac{m}{s^2}$

ISOLATE m_2

$F_{g_2} - F_T = m_2 a$

$F_T = m_2 g - m_2 a$

$= .8(9.8 - 1.17)$

$= 6.9 \ N$

11. Determine the acceleration of the system of masses shown below when it is released. **(7 marks)**

(I) $F_N = F_{g_1} \cos\theta$

(II) $F_{g_2} - F_f - F_{g_1} \sin\theta = m_1 a$

$a = \dfrac{m_2 g - \mu m_1 g \cos\theta - m_1 g \sin\theta}{m_1 + m_2}$

$a = \dfrac{10(9.8) - (.22)(6)(9.8)\cos 36° - 6(9.8)\sin 36°}{6 + 10}$

$a = 3.3 \ \frac{m}{s^2}$