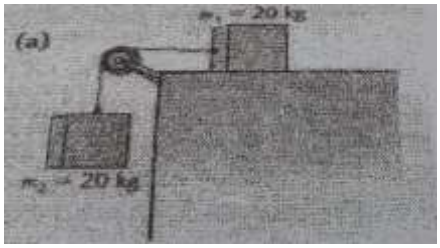
Tutorial 4: Solution

Exercise 1



a) Friction is absent

For M_1

$\sum\vec{F}=m_1a$

$T=m_1a$ ……..(1)

For M_2

$\sum\vec{F}=m_2a$

$M_2g-T=m_2a$ ……..(2)

Add equations 1 and 2

$M_2g=(m_1+m_2)a$

For tension

$T=m_1a=20(4,9)=98N$

b) With friction

We have: $F=\mu N$

For M_1

$\sum\vec{F}=m_1a$

$T-F_f=m_1a$

$T-\mu_k m_1g=m_1a$ ……..(1)

For M_2

$\sum\vec{F}=m_2a$

$T-F_f=m_2a$

$m_2g-T=m_2a$ ……..(2)

Add equations 1 and 2

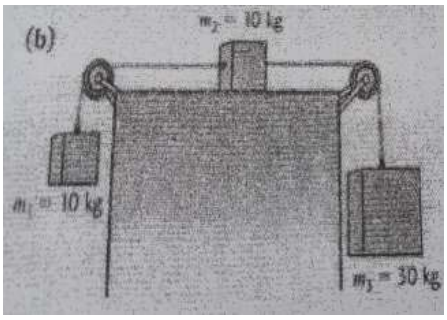
$a\,(m_1+m_2)=g(m_2-\mu_k\, m_1)$

$a = 3{,}9\ m/S^2$

For tension T

$m_2g-T=m_2a$

$T =20(9{,}8-3{,}9)= 118N$



a) Friction is absent

For M_1

$\sum\vec{F}=m_1a$

$T_1-m_1g=m_1a$ ……..(1)

For M_2

$\sum\vec{F}=m_2a$

$T_2-T_1=m_2a$ ……..(2)

For M_3

$\sum\vec{F}=m_3a$

$M_3-gT_2=m_3a$ ……..(3)

Add equations 1,2 and 3

$(m_1+m_2+m_3)a=(m_3-m_1)g$

$a=\frac{(m3-m1)g}{(m1+m2+m3)}=\frac{(30-10)9,8}{10+10+30}=3,9m/s^2$

Find T_1

$T_1-m_1g=m_1a$

$T_1=m_1g+m_1a = 10(3,9+9,8) = 137$ N

T_2 : $M_3-gT_2=m_3a=30(9,8-3,9)=177N$

c) With friction

For M_1

$T_1-m_1g=m_1a$ ……..(1)

For M_2

$T_2-T_1-\mu_k m_2g=m_2a$ ……..(2)

For M_3

$M_3-gT_2=m_3a$ ……..(3)

$(m_1+m_2+m_3)a=(m_3-\mu_k m_2-m_1)g$

$(10+10+10)a=9,8(30-0,2X10-10)$

$a= 3,5m/s^2$

Find T_1

$T_1-m_1g=m_1a$

$10(3,5+9,8)=133N$

T_2

M_3-gT_2 =m_3a

T_2=30(9,8-3,5)=188N

For M ₁

$\sum\vec{F}$=m ₁a

T-mg Sin∝=m_1a ……..(1)

For M_2

$\sum\vec{F}$=m_2a

m_2g-T=m_2a ……..(2)

Add equations 1and 2

(m1+m2)a== =(m2-m1 Sin∝)g

(10+15)a =(15-10Sin25)9,8

a = 4,2 m/s^2

For Tension

m_2g-T =m_2a

T = 15X9,8-15X4,2

T= 84N

b) With Friction

For M ₁

$\sum\vec{F}$=m ₁a

T- m_1g Sin∝ -$\mu_k m_1$g Cos∝ =m_1a ……..(1)

For M_2

$\sum\vec{F}=m_2a$

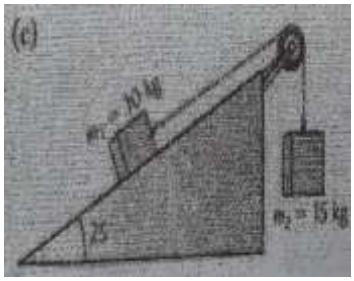
$m_2g-T=m_2a$ ……..(2)

Add equations 1and 2

$(m1+m2)a= m_2g - m_1g \sin\propto -\mu_k m_1g \cos\propto$

$25a = 9,8(15-10\sin25-0,2(10)\cos 25)$

$a =3,5m/s^2$



For M_1

$\sum\vec{F}=m_1a$

$T-F_{PX}=m_1a$

$T- \sin\propto m_1g=m_1a$ ……..(1)

For M_2

$\sum\vec{F}=m_2a$

$T-F_{PX}=m_2a$

$m_2 g- T =m_2a$ ……..(2)

Add equations 1 and 2

$(m1+m2)a= m_2g - m_1g \sin\propto$

$(10+15)a = 9,8(15-10\sin25)$

$a = 4,2m/S^2$

Find T_1

$m_2 g - T = m_2 a$

$T = 15(9,8-4,2) = 84$ N

d) With friction
For M_1

$\sum \vec{F} = m_1 a$

$T - \text{Sin}\propto\ m_1 g - \mu_k m_1 g \text{ Cos}\propto = m_1 a$ ……..(1)

For M_2
$\sum \vec{F} = m_2 a$

$T - F_{PX} = m_2 a$

$m_2 g - T = m_2 a$ ……..(2)

Add equations 1 and 2

$(m1+m2)a = m_2 g - m_1 g \text{ Sin}\propto - \mu_k m_1 g \text{ Cos}\propto$

$(10+15)a = 9,8(15-10\text{Sin}25 - 0,2(10)\text{Cos}25)$

$a = 3,5 \text{ m/S}^2$