جامعة جدة
University of Jeddah

PHYS 101

Ch. 5

Applying Newton's Laws

Physics Department

Using Newton's 1st Law: Par. in Equ.

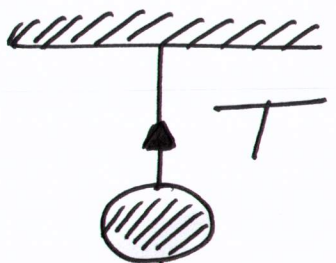
Example 1:

A cable hold a ball of weight 250 N in static equilibrium. The tension in the cord is:

Solution:

(A) zero
(B) 9.8 N
(C) 250 N
(D) 500 N

(C)



$T = w = 250\ N$

Using Newton's 2nd Law: Dy. of Par.

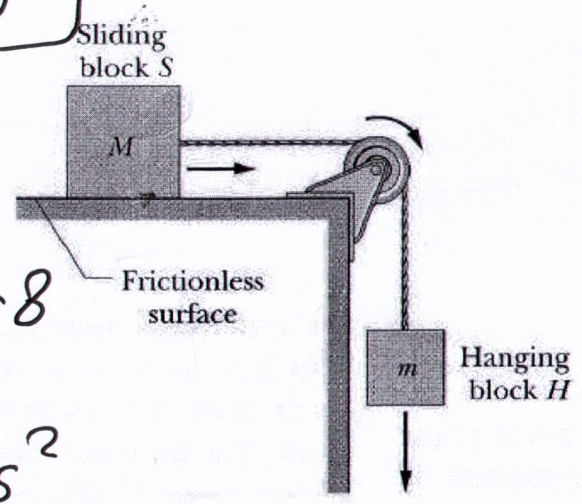
Example 2:

In the figure, M=2.5 kg is on a horizontal frictionless surface and m=1.5 kg is hanging. The acceleration of the blocks is:

Solution:

$$a = \frac{m}{m_1 + m_2} \times g$$

(B)



(A) 36.75 m/s²
(B) 3.675 m/s²
(C) 0.367 m/s²
(D) Zero

$$a = \frac{1.5}{2.5 + 1.5} \times 9.8$$

$$a = 3.675 \ m/s^2$$

Using Newton's 2nd Law: Dy. of Par.

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Example 3:

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Refer to Example 2, the tension in the cord is:

Solution:

(C)

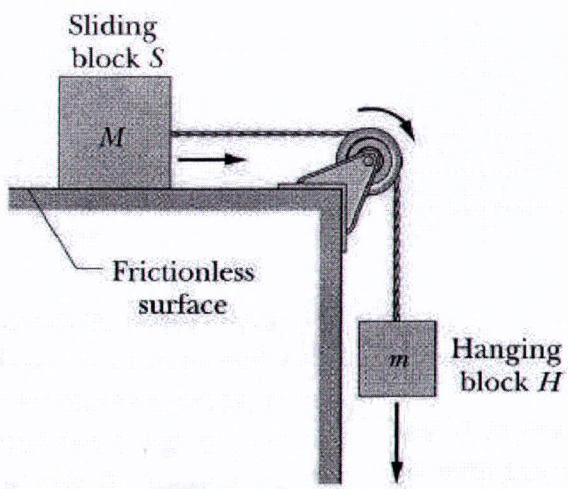
(A) Zero
(B) 91.9 N
(C) 9.19 N
(D) 0.91 N

الأفقية

$T = Ma$

$T = 2.5 \times 3.675$

$= 9.19 \ N$



Using Newton's 2nd Law: Dy. of Par.

Example 4:

In the figure, two blocks connected together with cord over a pulley where m_1=2 kg and m_2 =3 kg. The acceleration of the blocks is:

Solution:

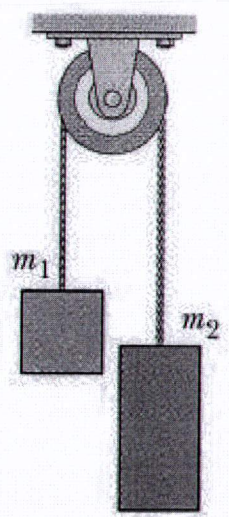
$$a = \frac{m_2 - m_1}{m_1 + m_2} \times g$$

(B)

(A) 19.6 m/s^2
(B) 1.96 m/s^2
(C) 0.19 m/s^2
(D) zero

$$a = \frac{3-2}{3+2} \times 9.8$$

$$a = 1.96 \ m/s^2$$



Using Newton's 2nd Law: Dy. of Par.

Example 5:

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Refer to Example 4, the tension in the cord is:

Solution:

(A) 23.52 N
(B) 2.352 N
(C) 0.235 N
(D) 0.023 N

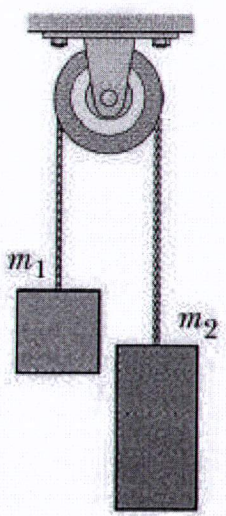
(A)

$$T = m_1(g + a)$$

$$T = 2(9.8 + 1.96)$$

$$T = 23.52\ N$$

A



Using Newton's 2nd Law: Dy. of Par.

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Example 6:

In the figure a 10 kg box is pushed at a constant speed (سرعة ثابتة) up the frictionless ramp by a horizontal force F. the magnitude of F is:

Solution:

(A) 24.5 N
(B) 98 N
(C) 49 N
(D) 28.3 N

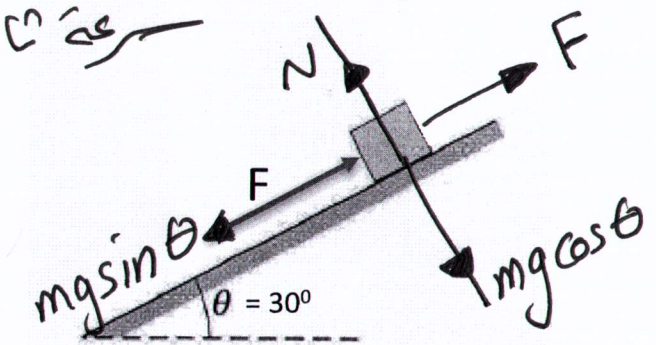
(C)

* constant speed (سرعة ثابتة)

$$F = mg\sin\theta$$

$$= 10 \times 9.8 \sin(30)$$

$$= 49\ N$$



Using Newton's 2nd Law: Dy. of Par.

Example 7:

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Refer to Example 6, the normal force on the box is:

Solution:

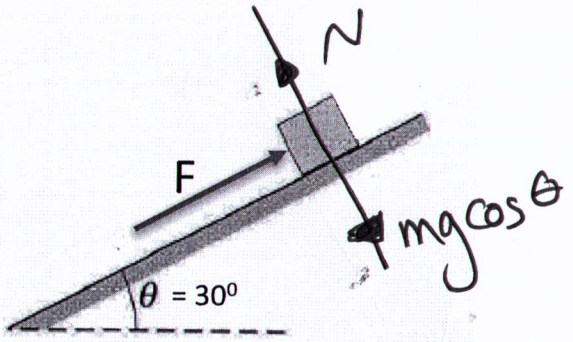
(B)

(A) 49 N
(B) 84.87 N
(C) Zero N
(D) 98 N

$N = mg\cos\theta$

$= 10 \times 9.8 \cos(30)$

$N = 84.87\ N$



Using Newton's 2nd Law: Dy. of Par.

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Example 8:

A 1000 kg elevator is moving up with acceleration 3 m/s^2. The tension in the cable is:

Solution:

* up لأعلى

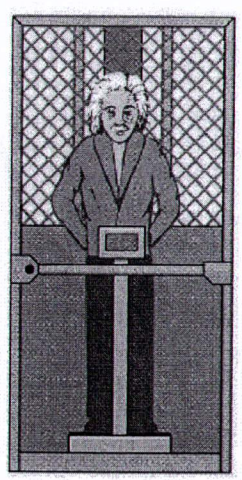
(D)

$$T = m(g+a)$$

$$T = 1000(9.8+3)$$

$$T = 12800\ N$$

(A) 9800 N
(B) 6800 N
(C) zero N
(D) 12800 N



Using Newton's 2nd Law: Dy. of Par.

Example 9:

Two blocks (A and B) are in contact on a horizontal frictionless surface. A 50 N constant force is applied to B as shown. The tension in the cord is:

Solution:

(C)

(A) 25 N
(B) 20 N
(C) 10 N
(D) 5 N

* قانون نيوتن الثاني

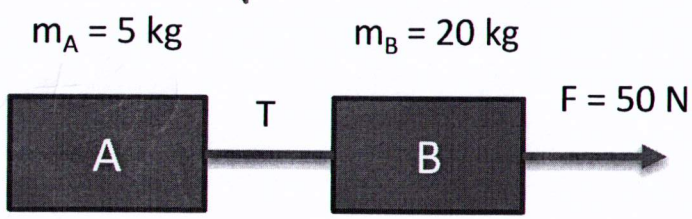
$$F = (m_1 + m_2)\, a$$

$$50 = (5 + 20)\, a$$

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

$$* \ T = m_A \cdot a$$

$$T = 5 \times 2 = 10 \ N$$



Friction Forces

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Example 10:

The fractional force on a moving body is proportional to the:

Solution:

$$f_k = \mu_k \cdot N$$

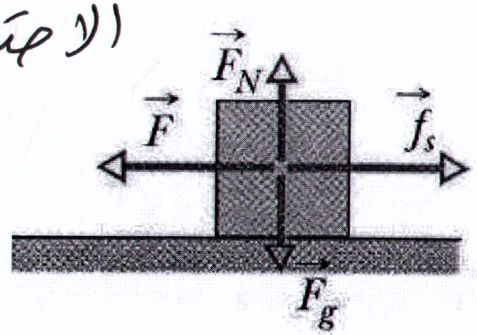
قوة رد الفعل

قوة الاحتكاك

معامل الاحتكاك

(D)

(A) force casing the motion
(B) weight of the body
(C) acceleration of the body
(D) normal force on the body



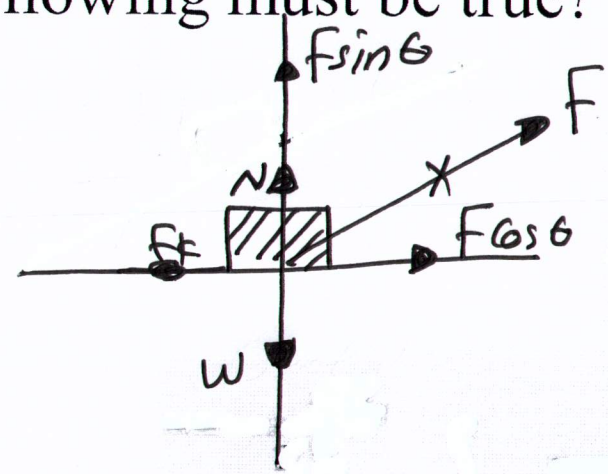
Friction Forces

Example 11:

A boy pulls a wooden box along a rough horizontal floor at constant speed. Which of the following must be true?

Solution:

(D)



(A) $F\cos\theta > f_k$ and $N=W$

(B) $F = f_k$ and $N>W$

(C) $F>f_k$ and $N<W$

(D) $F\cos\theta = f_k$ and $N=W- F\sin\theta$

* $F_k = F\cos\theta$

* $N + F\sin\theta = W$

Friction Forces

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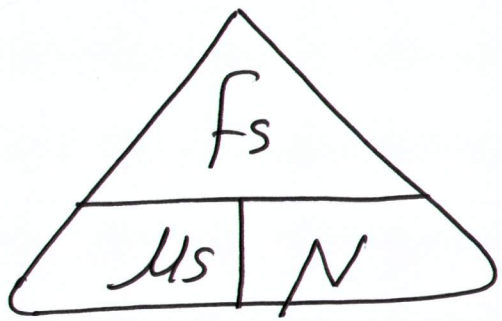
Example 12:

A block slide on a rough surface (see figure). The block start to slide when a parallel force of 30 N is applied. The coefficient of static friction μ_s is:

معامل الاحتكاك



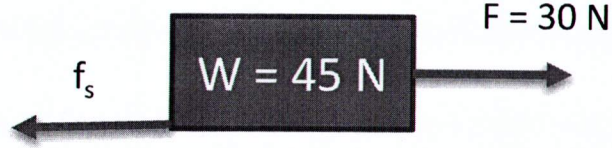
Solution:

(A)

(A) 0.67
(B) 0.33
(C) 0.4
(D) 1

$$\mu_s = \frac{f_s}{N}$$

$$\mu_s = \frac{F}{mg} = \frac{30}{45}$$



$\mu_s = 0.67$ (ليس له وحدة)

Dynamics of Circular Motion

Example 13:

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A car has mass of 1700 kg is moving with a constant speed of 25 m/s in a circular track of a radius 200 m. The car tires static friction coefficient with the road is:

Solution:

(C)

(A) 0.67
(B) 0. 4
(C) 0.32
(D) 1

$$v = \sqrt{\mu_s \times R \times g}$$

$$25 = \sqrt{\mu_s \times 200 \times 9.8}$$

$$\mu_s = 0.32$$