

## Honors Physics $F=ma$ HW, part 2 (Homework)

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**Include file name:** Physics\_Worksheet\_0048

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1.

A 2.1 kg mass starts from rest and slides down an inclined plane 80 cm long in 0.51 s. What *net force* is acting on the mass along the incline?

2.

A mass,  $m_1 = 4.00$  kg, resting on a frictionless horizontal table is connected to a cable that passes over a pulley and then is fastened to a hanging mass,  $m_2 = 8.0$  kg, as in Figure P4.25. Find the acceleration of each mass and the tension in the cable.

First Mass:

Second Mass:

Tension:

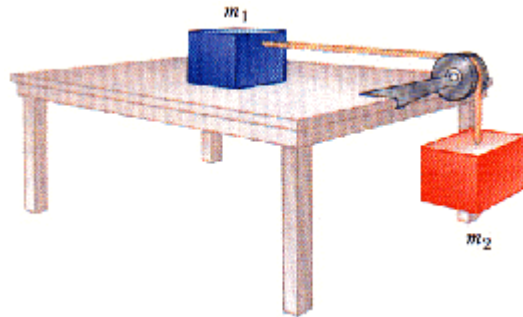


Figure P4.25.

3.

Two blocks are fastened to the ceiling of an elevator as in Figure P4.26. The elevator accelerates upward at  $2.20 \text{ m/s}^2$ . (The blocks both have a mass of 13.0 kg.) Find the tension in each rope.

Top Rope:

Bottom Rope:

4.

Two masses of 4.00 kg and 5.00 kg are connected by a light string that passes over a frictionless pulley as in Figure P4.28. (See figure next page.)

Determine

(a) the tension in the string,

(b) the acceleration of each mass, and

(c) the distance each mass will move in the first second of motion if both masses start from rest.



Figure P4.28.

5.

A dockworker loading crates on a ship finds that a **23 kg** crate, initially at rest on a horizontal surface, requires a **83 N** horizontal force to set it in motion. However, after the crate is in motion, a horizontal force of **50 N** is required to keep it moving with a constant speed. Find the coefficients of static and kinetic friction between crate and floor.

Static Friction:

Kinetic Friction:

6.

A **1300 N** crate is being pushed across a level floor at a constant speed by a force **F** of **400 N** at an angle of  $20^\circ$  below the horizontal as shown in Figure P4.31a.



Figure P4.31a.



Figure P4.31b.

(a) What is the coefficient of kinetic friction between the crate and the floor?

(b) If the **400 N** force is instead pulling the block at an angle of  $20^\circ$  above the horizontal as shown in Figure P4.31b, what will be the acceleration of the crate. Assume that the coefficient of friction is the same as found in (a).

7.

The coefficient of static friction between the **2.80 kg** crate and the  $35.0^\circ$  incline of Figure P4.33 is **0.320**. What minimum force **F** must be applied to the crate perpendicular to the incline to prevent the crate from sliding down the incline? (See figure next page).

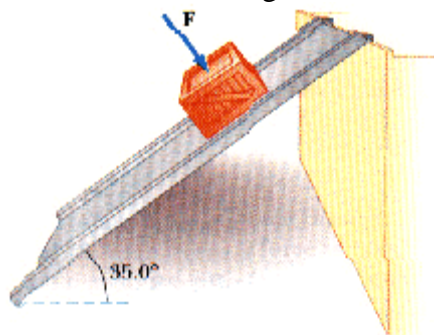


Figure P4.33.

8.

Find the acceleration experienced by each of the two masses shown in Figure P4.41 if the coefficient of kinetic friction between the 7.00 kg mass and the plane is 0.270.

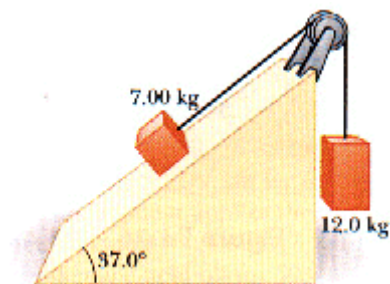


Figure P4.41.

9.

The person in Figure P4.43 weighs 185 lb. The crutches each make an angle of 20.0° with the vertical (as seen from the front). Half of the person's weight is supported by the crutches. The other half is supported by the vertical forces of the ground on his feet.

Assuming the person is at rest and the force of the ground on the crutches acts along the crutches, determine

- (a) the smallest possible coefficient of friction between crutches and ground and
- (b) the magnitude of the compression force supported by each crutch.



Figure P4.43.

10.

A 2.00 kg aluminum block and a 7.00 kg copper block are connected by a light string over a frictionless pulley. They are allowed to move on a fixed steel block-wedge (of angle  $\theta = 35.0^\circ$ ) as shown in Figure P4.51. (See figure next page.)

Making use of Table 4.2, determine

- (a) the acceleration of the two blocks and
- (b) the tension in the string.

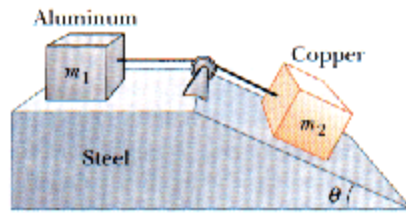


Figure P4.51.

Coefficients of Friction <sup>a</sup>		
	$\mu_s$	$\mu_k$
Steel on steel	0.74	0.57
Aluminum on steel	0.61	0.47
Copper on steel	0.53	0.36
Rubber on concrete	1.0	0.8
Wood on wood	0.25-0.5	0.2
Glass on glass	0.94	0.4
Waxed wood on wet snow	0.14	0.1
Waxed wood on dry snow	-	0.04
Metal on metal (lubricated)	0.15	0.06
Ice on ice	0.1	0.03
Teflon on Teflon	0.04	0.04
Synovial joints in humans	0.01	0.003

<sup>a</sup> All values are approximate.

Table 4.2

11.

The board sandwiched between two other boards in Figure P4.65 weighs **87.0 N**. If the coefficient of friction between the boards is 0.663, what must be the magnitude of the compression forces (assume horizontal) acting on both sides of the center board to keep it from slipping?

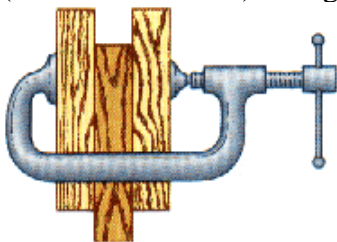


Figure P4.65.