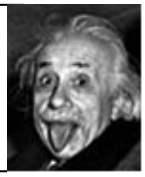
Dynamics



1. A force of *9000 N* is used to stop a *1500 kg* car traveling at *20 m/s*. What *braking distance* is needed to bring the car to a halt? ***Resp.: 33.3 m.***

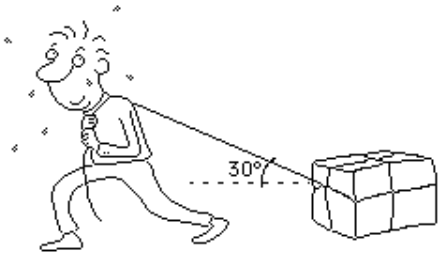
2. A force of *40 N* accelerates a *5 kg* block at *6 m/s*^{2} along a horizontal surface. a) How large is the *friction force*? b) What is the *coefficient of friction*? ***Resp.: a) 10 N. b) 0.2.***

3. A horizontal force of *50 N* is required to pull an *8.0 kg* block of aluminum at a *uniform velocity* across a horizontal wooden desk. What is the *coefficient of kinetic friction*? ***Resp.: 0.64***

4. A *2.1·10*$^{-4}$ *kg* spider is suspended from a thin strand of spiderweb. The *greatest tension* the strand can withstand without breaking is *2.2·10*$^{-3}$ *N*. What is the *maximum acceleration* with which the spider can climb up the *strand*? ***Resp.: .....***

5. A helicopter is rising with an acceleration of *2 m/s*^{2} while carrying a person of *mass 90 kg* hanging by a cable. Find the *tension* in the cable. ***Resp.: 1062 N.***

6. A *70 kg box* is pulled by a *400 N* force at an angle of *30°* to the horizontal. The force of *friction* is *75 N*. The *force of gravity* acting on the mass is *700 N*. What is the *acceleration* of the box? ***Resp.: 3.7 m/s*^{2}.**

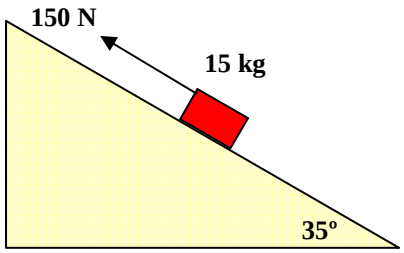


7. Lucy pulls her *18 kg* suitcase at a constant speed by pulling on a handle that makes an angle α with the horizontal. The *frictional force* on the suitcase is *27 N* and *Lucy exerts a 43 N* force on the handle. a) What *angle* does the handle make with the horizontal? b) What is the *normal force exerted* on the suitcase? ***Resp.: a) 51º. b) 143 N.***

8. A boy on a toboggan is sliding down a snow-covered hillside. The boy and toboggan together have a mass of *50 kg*, and the *slope* is at an angle of *30º* to the horizontal. Find the boy's *acceleration* if the coefficient of *kinetic friction is 0.15*. ***Resp.: 3.6 m/s*^{2}.**

9. A box is *sliding down* an incline set at *40°* to the *horizontal*. If the *coefficient of friction of the incline is 0.20* and the incline is *20 meters* long, *how long* will it take the box to reach the bottom? ***Resp.: .....***

10. Assume that the ramp is *frictionless*. The force of gravity acting on the block is *150 N*. What is the *acceleration of the block*? ***Resp.:***



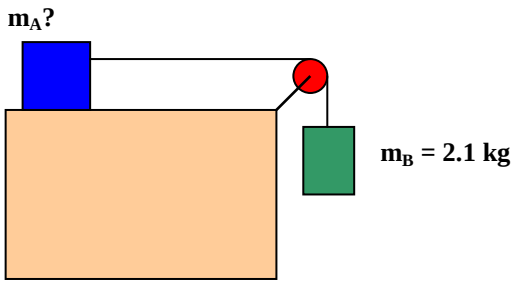
11. Repeat *problem 10*, except now, assume that the *frictional force* acting on the block on the ramp is *25 N*. ***Resp.: .....***

12. You slide a *325 N* trunk up a *20° inclined plane* with a *constant velocity* by exerting a force of *211 N parallel to the inclined plane*. a) What is the *component of the trunk's weight parallel to the plane*? b) What is the sum of your *applied force, friction, and the parallel component of the trunk's weight*? Why? c) What is the *size* and *direction of the friction force*? d) What is the *coefficient of friction*? ***Resp.: a) 111 N. b) ..... c) 100 N. d) 0.33.***

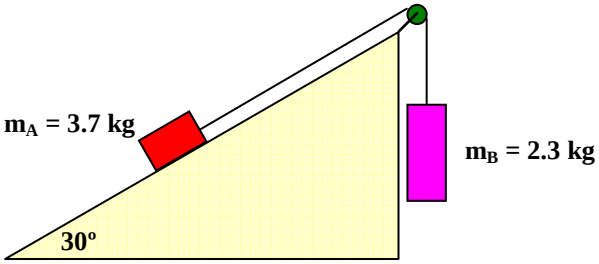
13. What force would you have to exert on the trunk in *Problem 12* so that it would slide down the plane with a *constant velocity*? What would be the *direction* of the force? ***Resp.: 11 N.***

14. In an *Atwood's machine*, the *larger mass is 1.8 kg* and the *smaller mass is 1.2 kg*. a) Ignoring friction, what is the *acceleration* of the masses? b) What is the *tension* in the string? . ***Resp.: a) 1.96 m/s^2. b) T = 14.1 N.***

16. A box of mass m_A sits on a table. It is connected, by a rope drawn through a pulley, to a box $m_B = 2.1$ *kg* that is hanging off the side of the table. The *coefficient of kinetic friction is 0.295*. What *value* of m_A will keep the boxes *moving at constant speed*?. ***Resp.: m_A = 7.1 kg***

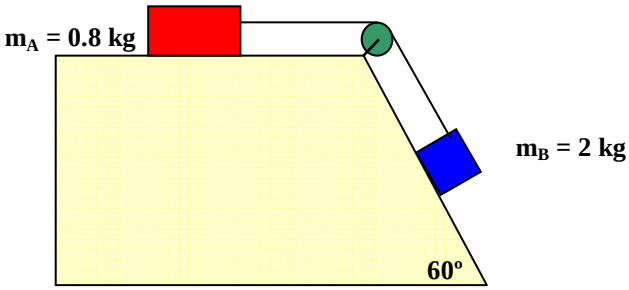


17. A block of mass *3.7 kg* on a frictionless inclined plane of angle *30°* is connected by a cord over a massless, frictionless physics pulley to a *second block of mass 2.3 kg hanging vertically as in the diagram*. What is the *acceleration* of each block? What is the *tension* in the cord? ***Resp.: .....***



18. Repeat *problem 17*, except now, assume that the *coefficient of kinetic friction* acting on the block on the ramp is *0.2*. ***Resp.: .....***

19. Two blocks, one *0.8 kg* and the other *2 kg* are connected by a massless string over a frictionless pulley. The coefficient of *kinetic friction is 0.14*, and the downward ramp angle is *60 degrees*. a) Determine the *acceleration* of the blocks. b) Calculate the *tension* of the string. ***Resp.: a) 5.2 m/s^2. b) 5.2 N.***



20. Two *10 kg masses* are conected by a massless string that passes over a frictionless pulley as shown at the figure. The mass at the right is hanging verticallly *2 meters* above the ground. The *coefficient of kinetic friction* between the left-hand box and the plare is *0.15*. a) What is the *tension T* in the string? b) *How long* will it take the right mass to *reach the ground*? ***Resp.: a) 95 N. b) 3.7 s.***