Course: Physics 401, 2004
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Homework 3

Due: Thursday, June 3, 2004 11:59 PM EDT

About this assignment

Last Saved work
Saved on: Friday, May, 28 2004 04:21 PM EDT

1. [CJ6 4.P.004.] Scientists are experimenting with a kind of gun that may eventually be used to fire payloads directly into orbit. In one test, this gun accelerates a 5.0 kg projectile from rest to a speed of 3.3 $\times 10^3$ m/s. The net force accelerating the projectile is 5.3 $\times 10^5$ N. How much time is required for the projectile to come up to speed?

_____ s

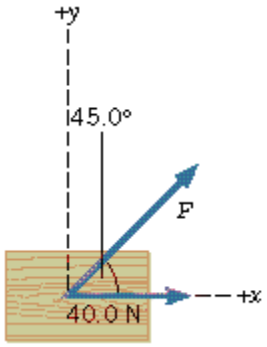
2. [CJ6 4.P.006.] Interactive LearningWare 4.1 at www.wiley.com/college/cutnell reviews the approach taken in problems such as this one. A 1270 kg car is traveling with a speed of 15.0 m/s. What is the magnitude of the horizontal net force that is required to bring the car to a halt in a distance of 54.0 m?

_____ N

3. [CJ6 4.P.013.] Only two forces act on an object (mass = 4.20 kg), as in the drawing. (F = 71.0 N.) Find the magnitude and direction (relative to the x axis) of the acceleration of the object.

_____ m/s^2

_____ ° (counterclockwise from the +x axis)



4. [CJ6 4.P.016.] At a time when mining asteroids has become feasible, astronauts have connected a line between their 3540 kg space tug and a 6200 kg asteroid. Using their ship's engine, they pull on the asteroid with a force of 490 N.

Initially the tug and the asteroid are at rest, 480 m apart. How much time does it take for the ship and the asteroid to meet?

[ ] s

5. [CJ6 4.P.018.] A bowling ball (mass = 7.2 kg, radius = 0.12 m) and a billiard ball (mass = 0.50 kg, radius = 0.028 m) may each be treated as uniform spheres. What is the magnitude of the maximum gravitational force that each can exert on the other?

[ ] N

6. [CJ6 4.P.026.] The weight of an object is the same on two different planets. The mass of planet A is only fifty percent that of planet B. Find r_A/r_B, which is the ratio of the radii of the planets.

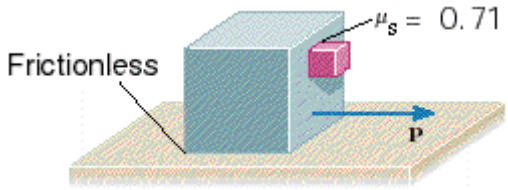
[ ]

7. [CJ6 4.P.038.] A cup of coffee is sitting on a table in an airplane that is flying at a constant altitude and a constant velocity. The coefficient of static friction between the cup and the table is 0.32. Suddenly, the plane accelerates, its altitude remaining constant. What is the maximum acceleration that the plane can have without the cup sliding backward on the table?

[ ] m/s^2

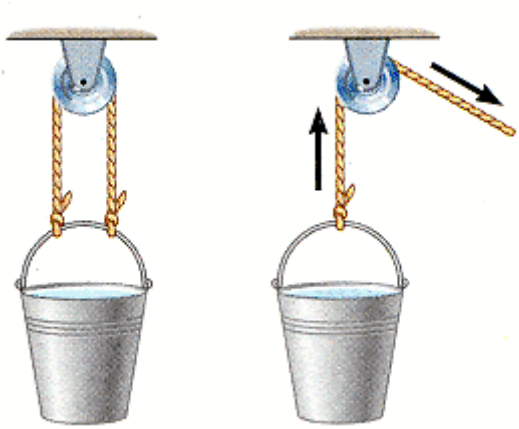
8. [CJ6 4.P.044.] The drawing shows a large cube (mass = 44 kg) being accelerated across a horizontal frictionless surface by a horizontal force **P**. A small cube (mass = 3.8 kg) is in contact with the front surface of the large cube and will slide downward unless **P** is sufficiently large. The coefficient of static friction between the cubes is 0.71. What is the smallest magnitude that **P** can have in order to keep the small cube from sliding downward?

[ ] N



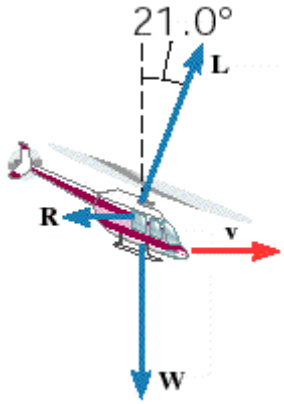
9. [CJ6 4.P.046.] Part *a* of the drawing shows a bucket of water suspended from the pulley of a well; the tension in the rope is 110.0 N. Part *b* shows the same bucket of water being pulled up from the well at a constant velocity. What is the tension in the rope in part *b*?

[ ] N



(a) (b)

10. [CJ6 4.P.048.] The helicopter in the drawing is moving horizontally to the right at a constant velocity. The weight of the helicopter is W = 56500 N. The lift force **L** generated by the rotating blade makes an angle of 21.0° with respect to the vertical.



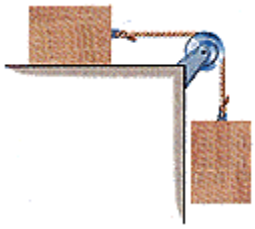
(a) What is the magnitude of the lift force?

[ ] N

(b) Determine the magnitude of the air resistance **R** that opposes the motion.

[ ] N

11. [CJ6 4.P.067.] In the drawing, the weight of the block on the table is 470 N and that of the hanging block is 175 N. Ignore all frictional effects, and assume the pulley to be massless.



(a) Find the acceleration of the two blocks.

[ ] m/s^2

(b) Find the tension in the cord

[ ] N

12. [CJ6 4.P.072.] A rocket of mass 4.50×10^5 kg is in flight. its thrust is directed at an angle of 62.5° above the horizontal and has a magnitude of 7.70×10^6 N. Find the magnitude and direction of the rockets acceleration. Give the direction as an angle above the horizonal.

Magnitude

[ ] m/s^2

Direction

° above horizontal

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