PHYSICS 191/193
REVIEW QUESTIONS
MIDTERM TEST

1. The brakes on your car can slow you at a rate of 5.2 m/s^2. If you are going 137 km/h and suddenly see a radar trap, what is the minimum time in which you can get your car under the 90 km/h speed limit? (The answer reveals the futility of braking to keep your high speed from being detected with a radar or laser gun.)

2. In the figure below, a red car and a green car, identical except for the color, move toward each other in adjacent lanes and parallel to an *x* axis. At time $t = 0$, the red car is at $x_{red} = 0$ and the green car is at $x_{green} = 220$ m. If the red car has a constant velocity of 20 km/h, the cars pass each other at x = 44.5 m; if the red car has a constant velocity of 40 km/h, they pass each other at x = 76.6 m. What are: (a) the initial velocity and (b) the acceleration of the green car?

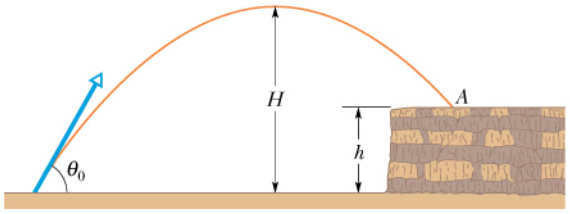
3. A hot-air balloon is ascending at the rate of 12 m/s and is 80 m above the ground when a package is dropped over the side.
(a) How long does the package take to reach the ground?
(b) With what speed does it hit the ground?

4. In the sum $\vec{A} + \vec{B} = \vec{C}$, $\vec{A}$ has a magnitude of 12.0 m and is angled 40.0° counterclockwise from the + *x* direction, and $\vec{C}$ has a magnitude of 15.0 m and is angled 20.0° counterclockwise from the –*x* direction. What are: (a) the magnitude; and (b) the angle (relative to +*x*) of $\vec{B}$?

5. Two vectors are given by $\vec{A} = 3.0\,\hat{i} + 5.0\,\hat{j}$ and $\vec{B} = 2.0\,\hat{i} + 4.0\,\hat{j}$. Find: (a) $\vec{A} \times \vec{B}$; (b) $\vec{A} \bullet \vec{B}$; (c) $\left(\vec{A} + \vec{B}\right) \bullet \vec{B}$; and, (d) the component of $\vec{A}$ along the direction of $\vec{B}$.

6. An ion's position vector is initially $\vec{r} = 5.0\hat{i} - 6.0\hat{j} + 2.0\hat{k}$, and 10 sec later it is $\vec{r} = -2.0\hat{i} + 8.0\hat{j} - 2.0\hat{k}$, all in meters. In unit-vector notation, what is its $\langle\vec{v}\rangle$ during the 10 seconds?

7. In the figure below, a stone is projected at a cliff of height *h* with an initial speed of 42.0 m/s directed at angle $\theta = 60.0^{o}$ above the horizontal. The stone strikes at point A, 5.50 sec after launching. Find: (a) the height *h* on the cliff, (b) the speed of the stone just before impact at A, and (c) the maximum height *H* reached above the ground.

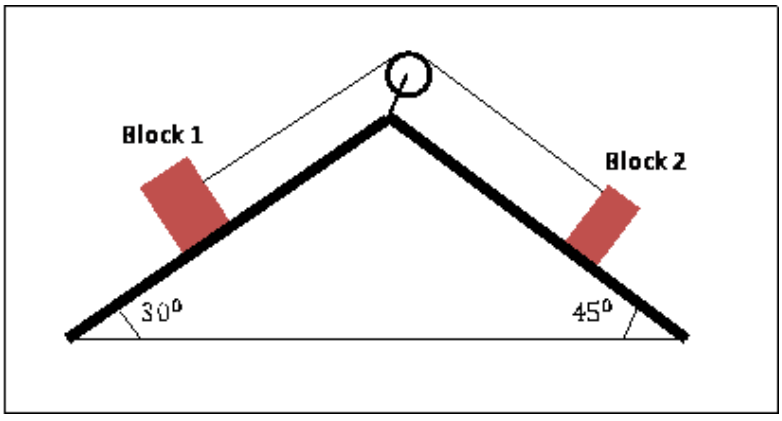


8. A rifle that shoots bullets at 460 m/s is to be aimed at a target 45.7 m away. If the center of the target is level with the rifle, how high above the center of the target must the rifle barrel be pointed so that the bullet hits dead center?

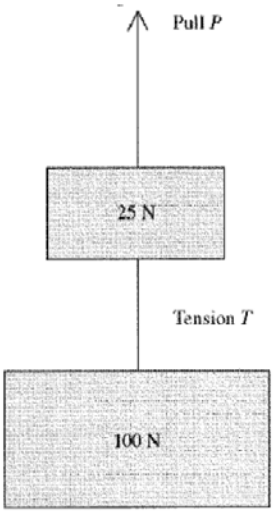
9. The two masses shown below can slide on a fixed, double-inclined wedge. If the mass of Block 1 is M_1=6 kg and the mass of Block 2 is M_2= 5 kg,

a) What are the accelerations of each block assuming no friction?

b) Now assume that friction exists on all of the surfaces of contact. If the coefficient of static friction is the same for both blocks, what is the minimum value of μ_s that will prevent the blocks from slipping?



10. Two weights are connected by massless strings and pulled upward with a constant speed of 1.50 m/s by a vertical pull P. The tension in the wire is T (see figure below).

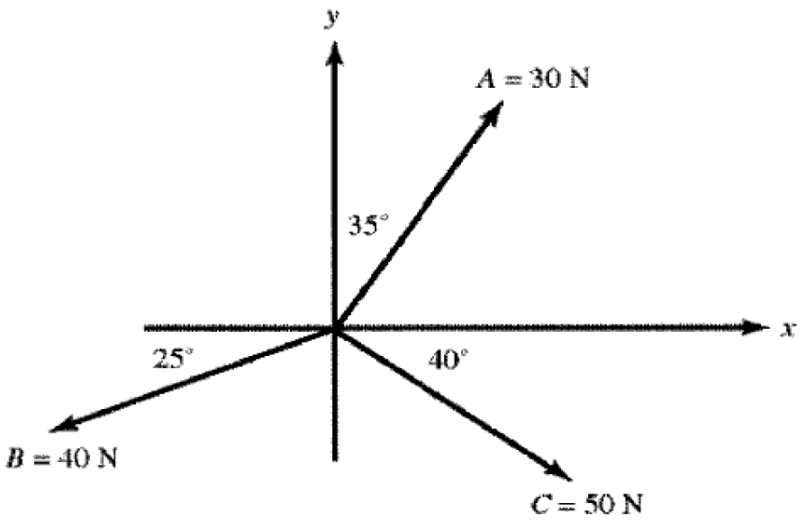


11. Which of the following statements is true?

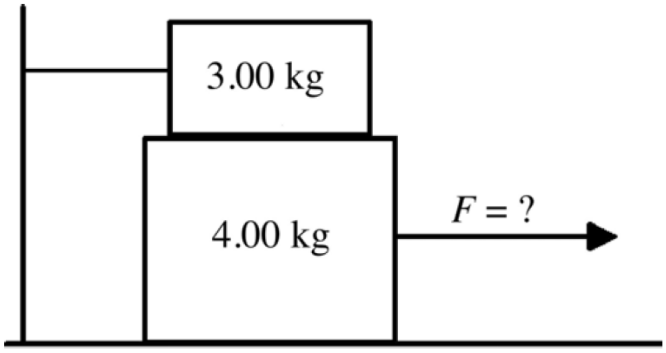
a) T > P
b) T = P
c) P + T = 125 N
d) P = T + 25 N
e) P = T + 100 N

. Three forces $\vec{A}$, $\vec{B}$, and $\vec{C}$ act on a body as shown in the figure . A fourth force $\vec{F}$ is required to keep the body in equilibrium. In the figure on the next page, the x-component of force $\vec{F}$ is closest to:

a) -19 N b) +28 N c) +32 N d) -28 N e) -32 N

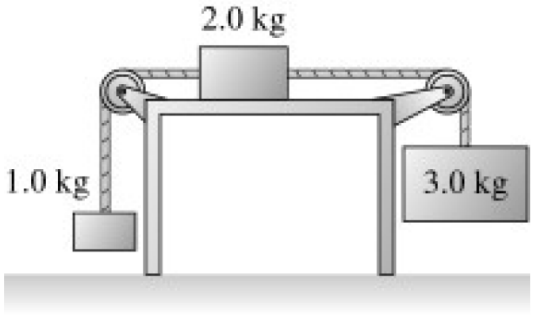


12. A 4.00-kg block rests between the floor and a 3.00-kg block as shown in the figure below. The 3.00-kg block is tied to a wall by a horizontal rope. If the coefficient of static friction is 0.800 between each pair of surfaces in contact, what horizontal force F must be applied to the 4.00-kg block to make it move?



a) 16.2 N
b) 54.9 N
c) 21.1 N
d) 23.5 N
e) 78.4 N

13. Three objects are connected as shown in the figure. The strings and frictionless pulleys have negligible masses, and the coefficient of kinetic friction between the 2.0-kg block and the table is 0.25. What is the acceleration of the 2.0-kg block?



a) 2.5 m/s^2
b) 1.7 m/s^2
c) 3.2 m/s^2
d) 4.0 m/s^2
e) 6.4 m/s^2