

Physics 131

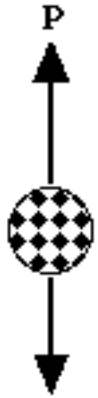
Name: _____

Marion Campus

13 October 1994

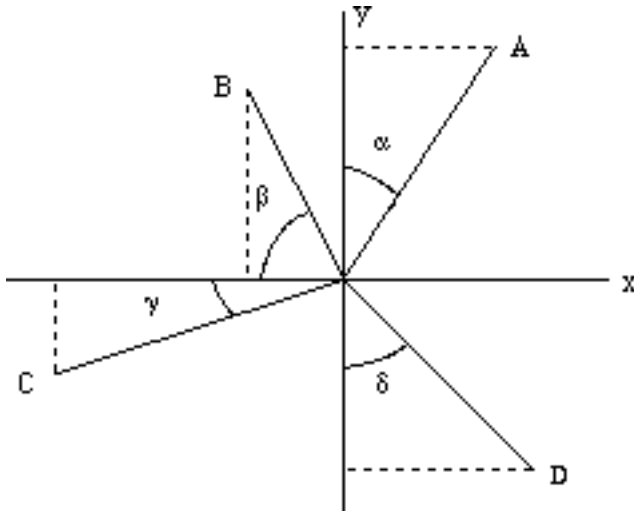
NWNC—No Work, No Credit. You should use $g = 10 \text{ m/s}^2$.

1. Explain in some detail how scientific laws and theories are developed. What are the most important characteristics of theories as opposed to models (or hypotheses)? (10 points)

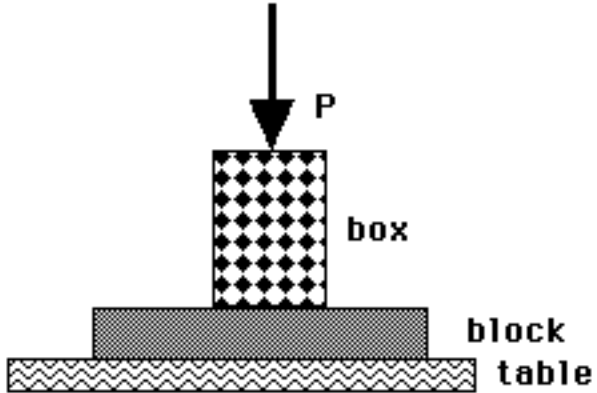


2. **120 N** An upward and a downward force act on the ball shown to the left and above, where the downward force of 120.0 N is different from the ball's weight. The ball's weight is 5.0 N, the ball is not in contact with Earth's surface, and the surface is some distance directly below the ball. (6 points) What must be the magnitude of force P if the ball is to
- remain at rest?
 - travel to the right with uniform motion?
 - travel in the downward direction with uniform motion?

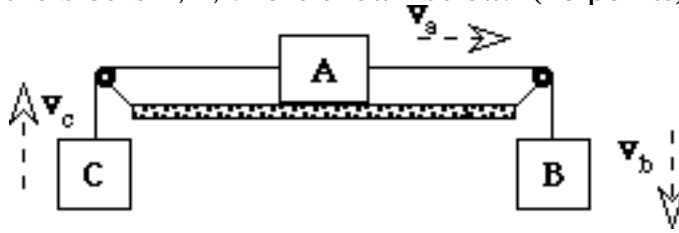
3. Find the sides of the triangles shown in terms of the labeled angles where the corresponding lengths of the hypotenuse of the triangles are $A = 136.0$ m, $B = 113.0$ m, $C = 153.0$ m, $D = 126.0$ m. The angles are $\alpha = 33.3^\circ$, $\beta = 63.4^\circ$, $\gamma = 16.8^\circ$, and $\delta = 48.0^\circ$. What is the vector $\mathbf{A} + \mathbf{B} + \mathbf{C} + \mathbf{D}$? (10 points)



4. A table exerts an upward force of 100.0 N on a block of wood, which weighs 56.0 N. A 34.0-N box sits on the block and a force P is applied downward on the box as shown below. The entire apparatus rests on a table (see below). Find the magnitude of the force P . Identify any Newton's-Third-Law pairs of forces in your explanation. (10 points)

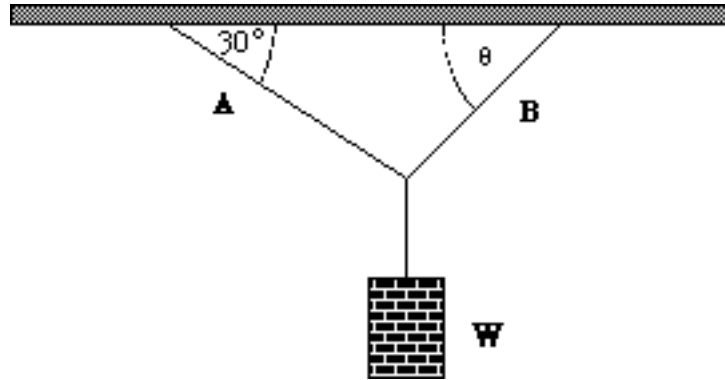


5. Consider the blocks A, B, and C shown below. (10 points)



The masses of A, B, and C are 12.0 kg, 10.0 kg, and 20.0 kg, respectively. The coefficient of kinetic friction is 0.250. Find the acceleration of A as it travels to the right.

6. A weight W hangs as shown in the picture supported by two strings, which have tensions $A = 725 \text{ N}$ and $B = 850 \text{ N}$. (10 points)
- Draw a free body diagram of this system.
 - Find the weight W and the angle θ .



7. Prof. Fizz Icks sits on his desk in front of the physics class. Prof. Icks weighs 800 N. Answer the following questions and fill in the blanks as appropriate. (15 points)

- a. A downward force of magnitude 800 N is exerted on Prof. Icks by _____.
- b. An upward force of magnitude _____ is exerted on _____ by the desk.
- c. The "reaction" to the force [the force determined by Newton's 3rd Law] in a. is a force with magnitude _____ and direction _____ exerted on _____ by _____.
- d. The "reaction" to the force in (b.) is a force with magnitude _____ and direction _____ exerted on _____ by _____.
- e. The relation between the forces in (a.) and (b.) is a consequence of Newton's _____.
- f. The relation between the forces in (b.) and (d.) is a consequence of Newton's _____.
- g. How many forces act on Prof. Icks altogether? Explain your answer.
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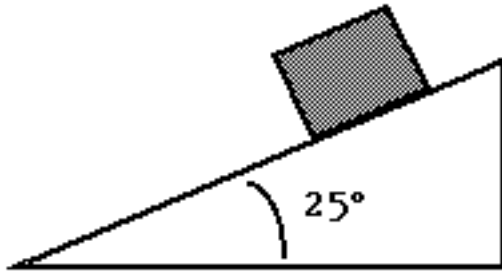
h. Prof. Icks jumps into the air from the desk. While he is in the air, what agent(s) is (are) responsible for the force(s) acting on him?

8. Use the vectors below to find the magnitude and direction of

a) $\mathbf{C} - \mathbf{D}$ b) $-\mathbf{A} + \mathbf{B}$ c) $5\mathbf{B} + \mathbf{D}$

(12 points)

$\mathbf{A}: (23.0, 59.0)$ $\mathbf{B}: (90.0, -150.0)$ $\mathbf{C}: (-360.0, 410.0)$ $\mathbf{D}: (-500.0, -125.0)$



9. What is the coefficient of kinetic friction if the block slides down the incline at a constant speed? Do you need to know the block's weight to answer this question? Explain. (7 points)

10. Three cars travel in the same direction along the same stretch of straight highway. During a certain time interval, car A slows from 35 km/h to 25 km/h, car B speeds up from 30 km/h to 40 km/h, while car C moves steadily at 32 km/h. A fourth car D sits on the side of the road during this interval. Describe the motion of the cars. (5 points)

11. An object travels at a uniform rate along the entire extent of each of these curves shown. Along which part(s) does the object experience an unbalanced force? (5 points)



c)



