PC1221 Fundamentals of Physics 1

Semester-1, AY10/11

Tutorial 3

Week-7: T6, T7, T8, T9, T10.
Week-8: T1, T2, T3, T4, T5.

All the tutorial classes for PC1221 are conducted at S11-03-01 for all the groups.

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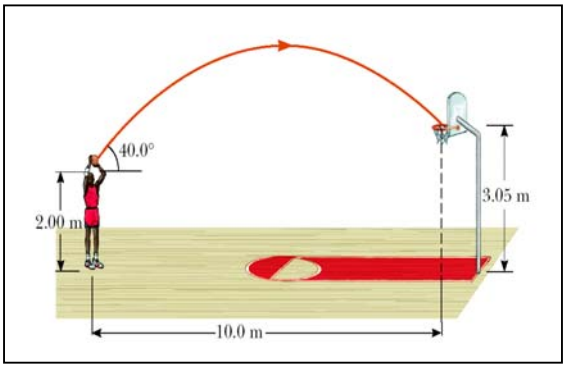
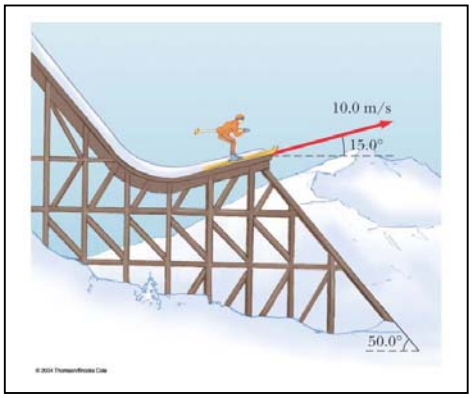
1. A 2.00-m-tall basketball player is standing on the floor 10.0 m from the basket as shown in the figure. The height of the basket is 3.05 m. If he shoots the ball at a 40.0° angle with the horizontal, at what initial speed must he throw the basketball so that it goes through the hoop without striking the backboard?



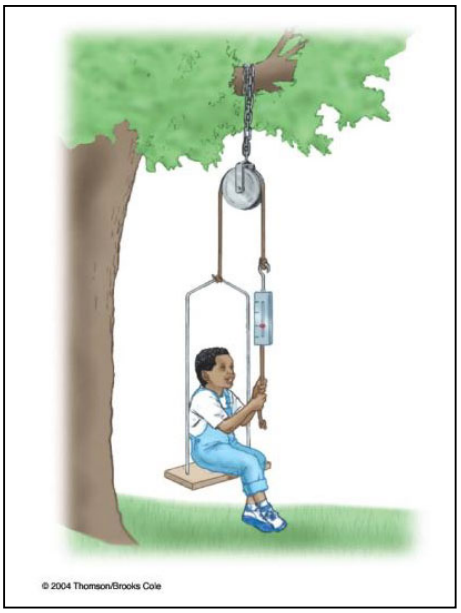
2. A skier leaves the ramp of a ski jump with a velocity of 10.0 m/s, 15.0° above the horizontal, as in figure. The slopes of ramp and hill are both inclined at 50.0° and they are joined seamlessly. Air resistance is negligible. Find (a) the distance from the ramp's leaving point to where the jumper lands and (b) the velocity components just before the landing. (a) the distance on the slope from the ramp's leaving point to where the jumper lands and (b) the velocity components just before the landing. (How do you think the results might be affected if air resistance were included? Note that jumpers lean forward in the shape of an airfoil, with their hands at their sides, to increase their distance. Why does this work?)



3. A woman at an airport is towing her 20.0-kg suitcase at constant speed by pulling on a strap at an angle θ above the horizontal as shown in Figure. She pulls on the strap with a 35.0-N force, and the friction force on the suitcase is 20.0 N. Draw a free-body diagram of the suitcase. (a) What angle does the strap make with the horizontal? (b) What normal force does

the ground exert on the suitcase?

4. An inventive child named Pat wants to reach an apple in a tree without climbing the tree. Sitting in a chair connected to a rope that passes over a frictionless pulley shown in figure, Pat pulls on the loose end of the rope with such a force that the spring scale reads 250 N. Pat's true weight is 320 N, and the chair weighs 160 N. (a) Draw free-body diagrams for Pat and the chair considered as separate systems, and another diagram for Pat and the chair considered as one system. (b) Show that the acceleration of the system is *upward* and find its magnitude. (c) Find the force Pat exerts on the chair.



5. An amusement park ride consists of a large vertical cylinder that spins about its axis fast enough that any person inside is held up against the wall when the floor drops away as shown in figure. The coefficient of static friction between person and wall is μ_s, and the radius of the cylinder is R. (a) Show that the optimal period of revolution necessary to keep the person from falling is $T = (4\pi^2 R\mu_s/g)^{1/2}$ (the revolution rate cannot be too high from the optimal value as this will add force on the person (can cause breathlessness). The revolution also cannot be less that the optimal value because the person will not be held up against the wall.). (b) Obtain a numerical value for T if R = 4.00 m and μ_s = 0.400. How many revolutions per minute does the cylinder make?