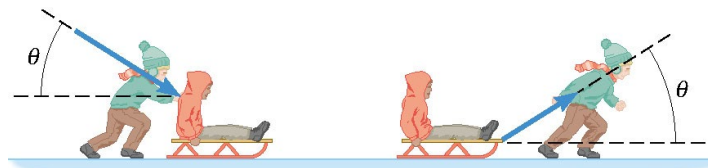


Physics 2A (Fall 2024) Midterm Review Questions and Problems

Q1) If a Mack truck and Ford Escort have a head-on collision, which vehicle will experience the greater force? Which vehicle will experience the greater acceleration? Explain each answer using one of Newton's laws.

Q2) A person has a choice of either pushing or pulling a sled at constant velocity, as the drawing illustrates. Friction is present. If the angle θ is the same in both cases, does it require less force to push or pull? *Account for your answer.*



Q3) A leopard jumps upward with an initial speed v_i at an angle θ with respect to the horizontal. The minimum speed of the leopard while it is in the air is $2/3 v_i$. What is θ ?

Q4) Can an object have zero velocity and nonzero acceleration simultaneously? Can an object have zero acceleration and nonzero velocity simultaneously?

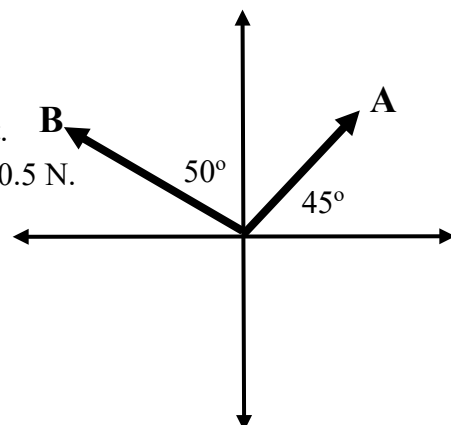
Q5) An object is held in place by friction on an inclined surface. The angle of the incline is increased until the object starts moving. If the incline is kept at this angle, what happens to the object?

Q6) When is the normal force on an object equal to its weight?

P1) Two force vectors, \vec{A} and \vec{B} , are shown in the figure to the right. Force \vec{A} has a magnitude of 8.5 N and force \vec{B} has a magnitude of 10.5 N.

a) What are the magnitude and direction of the sum of $\vec{A} + \vec{B}$?
(Answer: 13 N at $\theta = 99^\circ$)

b) Check your answer to part a by adding the vectors graphically.
(No rulers necessary – just a quick sketch is fine.)



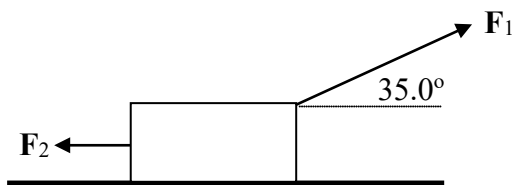
P2) A bullet with a mass of 60.0 g is traveling at 355 m/s when it hits a 2.50 kg wooden block that is initially at rest. The bullet becomes imbedded in the block and together they slide across the floor.

a) What is the speed of the block and bullet immediately after the collision? (**Answer: 8.32 m/s**)

b) If the coefficient of kinetic friction between the block and the floor is 0.55, how far will the block (and bullet) slide before coming to rest? (**Answer: 6.42 m**)

P3) A rocket is fired at a speed of 75.0 m/s from ground level, at an angle of 60.0° above the horizontal. The rocket is fired toward a 105.0 m high wall, which is located 300.0 m away. By how much does the rocket clear the top of the wall? (**Answer: 101 m**)

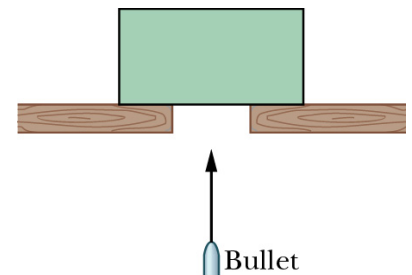
P4) A 50.0 kg crate is initially at rest on a floor. Two forces act on the crate, \vec{F}_1 of magnitude 400.0 N at a 35.0° angle and \vec{F}_2 which acts to the left as shown in the figure below. The coefficient of kinetic friction between the crate and the floor is 0.25. Calculate the magnitude of \vec{F}_2 if the crate travels a distance of 11.3 m in 3.00 s. (**Answer: 137 N**)



P5) A 50.0 g bullet moving directly upward at 1050 m/s strikes and passes through the center of a 3.0 kg block initially at rest. The bullet emerges from the block moving upward at 450 m/s.

a) What is the velocity of the block right after the bullet leaves it? (**Answer: 1.0×10^1 m/s**)

b) How high does the block rise? (**Answer: 5.1 m**)



P6) A vertically moving projectile reaches a maximum height of 23 m above its starting position.

a) What was the projectile's initial speed? (**Answer: 21 m/s**)

b) How fast is the projectile moving when it is 11.5 m above its starting point? (**Answer: 15 m/s**)

P7) A 5.0-kg block is set into motion up an inclined plane (30°) with an initial speed of 8.0 m/s. The block comes to rest after traveling 3.0 m along the plane. *What is the coefficient of kinetic friction?* (**Answer: 0.68**)

