Questions on Newton's Laws of Motion

A force of 15 N (delivered by a cue) acts on a 100 g billiard ball for 0.01 s. Find the magnitude of the
(a) acceleration of the ball
(b) final speed of the ball
(c) distance over which the cue was in contact with the ball.

When rolling along the felt on the billiard table, the ball experiences a frictional force of 0.2 N.
(d) What is the deceleration of the ball on the felt?
(e) How far will the ball roll before stopping?
(f) Explain this in terms of Newton's First Law.

A 200 kg piano is suspended by a rope from a high building. (Assume the mass of the rope is zero.)
(a) What is the weight of the piano?
(b) What is the tension in the rope?
(c) The piano is now hoisted up with an initial acceleration of 1 $m\,s^{-2}$. What is the minimum value of the breaking strain of a rope capable of supporting the piano now?

Describe the difference between the quantities, mass and weight. Give a description of two distinctly different ways in which an object's weight can be altered.

A shotgun is fired, propelling a 10 g bullet from rest to 1000 $m\,s^{-1}$ in the length of the barrel, 40 cm.
(a) Find the recoil acceleration of the gun if it has mass 5 kg.
(b) How long did it take the bullet to reach the end of the gun barrel?

A jet fighter with mass 5000 kg accelerates from 360 $km\,hr^{-1}$ to 720 $km\,hr^{-1}$ in 10 s. Compute the minimum thrust required by the jet's engines.

A 10^4 kg train moving at 20 $m\,s^{-1}$ stops in a distance of 500 m. Calculate the force applied by the train's braking system.

An astronaut shoots you in space. Given that the bullet is weightless, could it injure you?

(a) An 80 kg Saint Bernard dog leaps with an acceleration of 2 $m\,s^{-2}$ from a stationary 40 kg canoe to shore. What is the recoil acceleration of the canoe?
(b) If the force lasted for 1.2 s, what speed does the canoe achieve?

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