Answer Key to Newton's Laws Practice Items

1. D

With no net forces acting upon it, a body moves with constant velocity. If there is con stant velocity, there will also be constant speed, which is the magnitude of velocity.

2. B

The friction force is depends on the weight of the block acting at right angles to the incline. This gets smaller as the angle increases.

3. D

The man appears "weightless" in this situation.

4. A

5. B

The normal force from the floor normally prevents the man from accelerating at 10 m/s^2 due to gravity. Here the floor itself is accelerating at 6 m/s^2 downwards. So the floor provides a force preventing the man from accelerating the other 4 m/s^2. We know then that the man's mass must be 100 kg and his normal weight 1000-N.

6. D

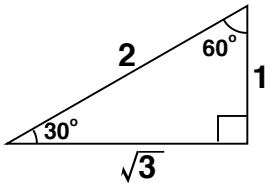
A change in velocity of 20 m/s in 10 seconds indicates an acceleration of 2 m/s^2. F = ma. Therefore, the force is 4 N.

7. B

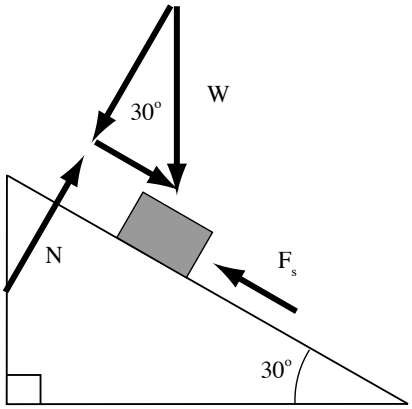
The firing of the bullets will produce a reaction force that will cause a negative acceleration on the airplane.

8. D

Remember from the 30 60 90 right triangle that the sin 30^o equals 1/2 (far leg over hypotenuse) and the cos 30^o is half the square root of 3 (near leg over hypotenuse).



So the the component of the weight parallel to the plane equals the product of sin 30^o and the weight, and the component of the weight perpendicular to the plane equals the product of cos 30^o and the weight. mg cos 30^o also equals the normal force.



For sliding to happen a force of half the weight must be able to overcome the force of static friction. The maximum value of the force of static friction is equal to the product of μ_s (the coefficient of static friction) and the normal force, which equals in magnitude the component of the block's weight perpendicular to the plane. This perpendicular component is equal to the product of cos 30^o and the weight. In other words, the following is the condition of sliding:

Sliding happens if:

$$W_{parallel} > F_s$$

$$mg \sin 30^o > \mu_s \, mg \cos 30^o$$

$$0.58 < \mu_s$$

For any value of the coefficient of static friction above about .6, the block will remain stationary. Therefore, **D** is the correct answer.