18 Week Study Guide Chapter 3, 4, 5 and 7

Example Questions:

1. A certain force gives a body an acceleration of 4 m/s2. If the force were tripled and the mass stayed the same, what would happen to the acceleration?

Force is directly proportional to acceleration, so the acceleration is tripled. A=12 m/s2

1. A certain force gives a body an acceleration of 4 m/s2. If the mass were somehow doubled while the force remained the same, what would happen to the acceleration?

Acceleration is inversely proportional to mass, so the acceleration is halved. A=2 m/s2

1. A truck speeding down the road collides with a stationary car. Which has the greater force acting on it? Which undergoes the greater change in momentum? Which undergoes the greater acceleration?

Newton’s third law says the force is the same. Since the force is the same, the change in momentum is the same. Since the car is lighter (less mass), its acceleration is greater.

1. A bowling ball is rolling down the frictionless hallway which is 100 m long. If it is initially moving at 5 m/s, how fast is it moving at the end of the hallway?

Newton’s first law states that a body in motion continues with constant velocity unless an outside force acts on it. Therefore, the velocity at the end of the hall is 5 m/s.

1. How is the inertia of an object found? How is momentum found? Which has more inertia, a 100 kg man standing at rest or a 50 kg boy moving at 3 m/s? Which has more momentum?

Inertia is measured by the object’s mass. Momentum is mass times velocity. The 100 kg man has more inertia. The 50 kg boy has more momentum.

1. A 500 kg car is rolling down the street at 10 m/s when it hits a stationary 700 kg car at rest. The cars stick together and move down the street. After the inelastic collision, what is the momentum of the 2 cars that have stuck together? Are the cars moving faster, slower or the same speed as the original 1 car?

Total momentum before = (500 kg) x (10 m/s) + (700 kg) x (0 m/s) = 5000 kg m/s

Therefore, total momentum after the collision = 5000 kg m/s (momentum is conserved)

The cars would move slower because they have the same momentum with more mass so the speed must be slower.

1. What makes a collision elastic? What makes it inelastic? Is there any collision that is perfectly elastic?

Elastic Collision is a collision where there is no lasting deformation and no sound or heat is generated. Inelastic collisions generate heat, sound and may or may not deform. Perfectly inelastic collisions produce deformations as the objects stick together. No collision is perfectly elastic.

1. A golfer applies a force of 1000 Newtons to a 1 kg golf ball. If the ball leaves the club at 45 m/s, how long was the club in contact with the ball?

T=mv/F=(1 kg) (45 m/s)/(1000 N)= .045 s

1. How much Impulse is needed to stop a 50 kg person running down the hallway at 4 m/s? If it takes .5 seconds to stop him, how much force is needed?

I= mv = (50 kg) (4 m/s)= 200 Ns F=I/t = 200 Ns/.5s = 400 Newtons

1. A astronaut in outer space has a mass of 150 kg. If he throws a 15 kg ball at 20 m/s, what happens to the astronaut? Will either of them either come to rest? Why or why not?

Astronaut moves backward at 2 m/s (momentum is conserved). They will never come to rest because there is no outside force in outer space to slow them down. Newton’s first law says they will move forever at a constant velocity.