UNIT-3 DYNAMICS

1 A 100 N force was applied on a box of mass 25 kg to move on the right across a horizontal surface. What is the acceleration produced in the box?
[4 m/s^2]

2 A 20 kg box is pushed with a force of 100 N. If the coefficient of friction between the box and the floor is 0.4, calculate the box's acceleration.
[1.08 m/s^2]

3. The net force acting on a Cessna 172 airplane has a magnitude of 1900 N and points in the positive x direction. If the plane has a mass of 860 kg, what is its acceleration? [2.2 m/s^2]

4. A pitcher throws a 0.45-kg baseball, accelerating it from rest to a speed of about 36 km/h to a distance of 2.0 m. Estimate the force exerted by the pitcher on the ball. [11.25 N]

5 A box of mass m_1 = 12 kg rests on a smooth, horizontal floor in contact with a box of mass m_2 = 5.0 kg. You now push on box 1 with a horizontal force of magnitude F = 34 N. What is the acceleration of the boxes?
[2.0 m/s^2]

6 A helicopter weighs 5880 Newton. Calculate the upward force on it if it is ascending at a rate of 1.5 m/sec^2. What will be the force on the helicopter if it is moving up with the constant speed of 15 m/sec? [6780 N, 5880 N]

7 An electron in a vacuum tube starting from rest is uniformly accelerated by an electric field so that it has a speed of 6×10^6 m/sec. after covering a distance of 1.8 cm. Find the force acting on the electron. Take mass of electron as 9.1×10^{-31} kg.
[9.1×10^{-16} N]

MONETUM, IMPULSE AND LAW OF CONSERVATION OF MOMENTUM

1 A 72.3-kg jogger runs with a speed of 3.13 m/s in the positive x direction. What is the jogger's momentum?
[226 kg m/s]

2 A 0.170-kg hockey puck has momentum with a magnitude of 1.52 kg m/s. What is the speed of the puck? [8.94 m/s]

3 The momentum of an airplane flying with a speed of 85 m/s has a magnitude of 3.5×10^4 kg m/s. What is the mass of the airplane? [412 Kg]

4 A 50 g bullet is fired from a 10 kg gun with a speed of 1000m/s. What is the speed of the recoil of the gun? [- 5 m/s]

5 A 150 g bullet is fired from a 15 Kg gun with a speed of 1500 m/s. What is the speed of the recoil of the gun? [-15 m/s]

6 Find the magnitude of the impulse delivered to a soccer ball when a player kicks it with a force of 1250 N. Assume that the player's foot is in contact with the ball for 5.95×10^{-3} s. [7.4 N m]

7 A hockey puck with a mass of 0.45 kg is sliding on the ice at a velocity of 10 m/s. It collides with a wall and bounces back with a velocity of -8 m/s. The collision lasts for 0.1 seconds. Calculate the impulse experienced by the hockey puck and the change in its momentum.
[P_{iitial} = 4.5 kg m/s, P_{final} = - 3.6 kg m/s, Δp = - 8.1 kg m/s, impulse =Δp= -.81 Nm]

8 A force of 50 N is exerted on an object of mass 0.05 kg for a time duration of 0.1 seconds. If the initial velocity of the object is 2 m/s calculate the final velocity. [12 m/s]

9 A 2 kg is moving at a speed of 6 m/s. How large a force F is needed to stop the block in a time of 0.5 millisecond? [-2.4×10^4 N]

ELASTIC AND INELASTIC COLLISION

1 A 100 gm bullet is fired into a 12 kg block which is suspended by a long cord. If the bullet is embedded in the block and the block rises by 5 cm. What was the speed of the bullet? [119.6 m/s]

2 A 100 gm golf ball at rest moving with a velocity of 20 m/s collide with 8Kg steel ball at rest. If the collision is elastic, computer the velocities of both balls after the collision. [–19.50 m/s, 0.493 m/s]

3 A 0.34 kg glider on a track is moving at 1.5 m/s collides with a 0.51 kg glider that is initially at rest. They collide and stick together. How fast are the two gliders traveling after the collision? [3.85 m/s]

4. A 20 g bullet moving horizontally at 50 m/s strikes a 7.0 kg block resting on a table. The bullet embeds in the block after the collision. Find the speed of the block after collision. [0.14 m/s]

5 Two billiard balls of each mass 20 g move toward each other. Assume that the collision between them is perfectly elastic. If the initial velocities of the balls are 3.0 m/s and 2.0 cm/s, what is the velocity of each ball after the collision?
[$v_1 = 2.0 m/s \quad v_2 = 3.0\ m/s$]

6 A 732-kg car stopped at an intersection is rear-ended by a 1720-kg truck moving with a speed of 15.5 m/s. If the car was in neutral and its brakes were off, so that the collision is approximately elastic, find the final speed of both vehicles after the collision. [$v_1 = 9.25\ m/s \quad v_2 = 6.24\ m/s$]