Question 1

Typically, a tennis ball hit during a serve travels away at about 51 m/s. If the ball is at rest mid-air when struck, and it has a mass of 0.058 kg, what is the change in its momentum on leaving the racket?

A) 3000 kg·m/s

- B) 880 kg·m/s
- C) 3.0 kg·m/s
- D) 29 kg⋅m/s

Question 2

A 40,000-kg freight car is coasting at a speed of 5.0 m/s along a straight track when it strikes a 30,000-kg stationary freight car and couples to it. What will be their combined speed after impact?

- A) 6.7 m/s
- B) 2.9 m/s
- C) 2.1 m/s
- D) 5.0 m/s

Question 3

A 1200-kg gun mounted on wheels shoots an 8.00-kg projectile with a muzzle velocity of 600 m/s at an angle of 30.0°; above the horizontal. Find the horizontal recoil speed of the gun.

- A) 4.00 m/s
- B) 2.00 m/s
- C) 3.46 m/s
- D) 600 m/s

Question 4

A 2.0-kg block of wood rests on a tabletop. A 7.0-g bullet is shot straight up through a hole in the table beneath the block. The bullet lodges in the block, and the block flies 25 cm above the tabletop. How fast was the bullet going initially?

- A) 6.3 km/s
- B) 0.63 km/s
- C) 2.2 km/s
- D) 1.4 km/s

Question 5

During a soccer game a ball (of mass 0.425 kg), which is initially at rest, is kicked by one of the players. The ball moves off at a speed of 26 m/s. Given that the impact lasted for 8.0 ms, what was the average force exerted on the ball?

- A) 1.4 kN
- B) 0.088 N
- C) 13.7 kN
- D) 1.38 N

Question 6

(a) What minimum thrust must the engines of a 2.0×105 kg rocket have if the rocket is to be able to rise from the Earth when aimed straight upward? (b) If the engines eject fuel at the rate of 20 kg/s, how fast must the gaseous fuel be moving as it leaves the engines? Neglect the small change in the mass of the rocket due to the ejected fuel.

A) (a) 20 N (b) 10 km/s

B) (a) 20 x 105 N (b) 98 km/s

C) (a) 20 x 103 N (b) 4.0 x 104 km/s

D) (a) 20 x 104 N (b) 1.0 x 10-8 km/s

Question 7

Two bodies of masses 8 kg and 4 kg move along the x-axis in opposite directions with velocities of 11 m/s in the positive x-direction and 7 m/s in the negative x-direction, respectively. They collide and stick together. Find their velocity just after collision.

A) 5.0 m/s - POSITIVE X-DIRECTION

B) 9.7 m/s - POSITIVE X-DIRECTION

C) 5.0 m/s - NEGATIVE X-DIRECTION

D) 7.5 m/s - POSITIVE X-DIRECTION

Question 8

A 2.0-kg block of wood rests on a long tabletop. A 5.0-g bullet moving horizontally with a speed of 150 m/s is shot into the block and sticks in it. The block then slides 270 cm along the table and stops. (a) Find the speed of the block just after impact. (b) Find the friction force between block and table.

A) (a) 370 m/s, (b) 0.00052 N

- B) (a) 150 m/s, (b) 22.6 kN
- C) (a) 0.37 m/s, (b) 0.052 N
- D) (a) 3000 m/s, (b) 0.14 N

Question 9

A 6000-kg truck traveling north at 5.0 m/s collides with a 4000-kg truck moving west at 15 m/s. If the two trucks remain locked together after impact, with what speed and in what direction do they move immediately after the collision?

A) 15.8 m/s at 18° north of west

B) 6.7 m/s at 27° north of west

C) 6.7 m/s at 63° north of west

D) 9.0 m/s at 27° north of west

Question 10

A 90-g ball moving at 100 cm/s collides head-on with a stationary 10-g ball. Determine the speed of each after impact if (a) they stick together, (b) the collision is perfectly elastic

- A) (a) 90 cm/s, (b) 80 cm/s; 1.8 m/s
- B) (a) 100 cm/s, (b) 80 cm/s; 20 cm/s
- C) (a) 900 cm/s, (b) 90 cm/s; 90 cm/s
- D) (a) 50 cm/s, (b) 1110 cm/s; 180 cm/s

Question 11

Two identical balls traveling parallel to the x-axis have speeds of 30 cm/s and are oppositely directed. They collide perfectly elastically. After collision, one ball is moving at an angle of 30°; above the +x-axis. Find its speed and the velocity of the other ball.

A) 30 cm/s, 30 cm/s at 60° below the -x-axis (opposite to the first ball)

B) 15 cm/s, 15 cm/s at 30° above the -x-axis (opposite to the first ball)

C) 30 cm/s, 30 cm/s at 30° below the -x-axis (opposite to the first ball)

D) 30 cm/s, 30 cm/s at 30° along the -x-axis (opposite to the first ball)

Question 12

Two balls of equal mass, moving with speeds of 3 m/s, collide head-on. Find the speed of each after impact if (a) they stick together, (b) the collision is perfectly elastic.

- A) (a) 3 m/s, (b) 0 m/s
- B) (a) 6 m/s, (b) 6 m/s
- C) (a) 0 m/s, (b) each rebounds at 3 m/s
- D) (a) 1.5 m/s, (b) 1.5 m/s