Practice Exam II

Note: Show all your work. Give your answers with the proper units. Max. points - 60. No formula sheets are allowed. Total time: 1h 20 min.

Problem 1. (6 pt) A child while on a merry-go-round has a centripetal acceleration of 0.5 m/s². If the child moves with a speed of 1.25 m/s, how far from the center of the merry-go-round is the child sitting? Ans. 3.125 m/s²

Problem 2. (6 pt) The radius of the Moon is \( R = 1737.4 \text{ km} \), and the mass is \( M = 7.34 \times 10^{22} \text{ kg} \). What is the gravitational acceleration on the Moon? Ans. 1.62 m/s²

Problem 3. (6 pt) How much work is required to speed a 1000-kg car from rest to 20 m/s? Ans. \( 2.0 \times 10^3 \text{ J} \)

Problem 4. (6 pt) A 1400-kg sports car accelerates from rest to 95 km/h in 7.4 s. What is the average power delivered by the engine? Ans. \( 6.6 \times 10^4 \text{ W} \)

Problem 5. (6 pt) A 2.3-kg rock is dropped from a height 5 m starting at rest. After \( \Delta t = 1.5 \text{ s} \), its velocity is 14.7 m/s. What is the impulse of the gravitational force. Ignore air resistance. Ans. 33.81 kg.m/s²

Problem 6. (6 pt) The comet Halley appears in the sky approximately every 76 years. What is its average distance from the Sun? Ans. \( 2.7 \times 10^9 \text{ km} \)

Problem 7. (6 pt) A 1200-kg car rolling on a horizontal surface has speed \( v = 18.5 \text{ m/s} \) when it strikes a horizontal coiled spring with a stiffness \( k = 10^5 \text{ N/m} \) and is brought to rest. By how much does the spring compress? Ans. 2.03 m

Problem 8. (6 pt) A diving person jumps from a high cliff with a speed of 2.4 m/s at a 30° angle measured from the horizontal. What is the diver's speed just before hitting the water surface 10 meters below? Ans. 14.2 m/s
Problem 9 (6 pt) A tennis ball of mass \( m = 0.060 \text{ kg} \) and speed of \( v = 25 \text{ m/s} \) strikes a wall at a 60° angle and rebounds with the same speed at 60°. What is the change of the momentum of the ball? (Ignore gravity and air resistance)

\[ \Delta p_y = -2.3 \text{ kg.m/s} \quad \Delta p_x = 0 \text{ kg.m/s} \]

Problem 10. (4 pt) A 12-gram bullet traveling 190 m/s penetrates a 2.0-kg block of wood and remains there. What is the velocity of the block after the collision? \textbf{Ans.} 1.13 \text{ m/s}

Problem 11. (4 pt) Find the location of the Center of Mass of the system shown below relative to the first ball on the left.

\textbf{Ans.} 1.6 m to the right of the 2-kg particle