

Name _____

Movement Answer Key

1. Since the car is traveling at a constant velocity, the net force acting on it is zero.
2. According to Newton's second law ($F = ma$), the acceleration can be calculated as $a = F/m = 50 \text{ N} / 10 \text{ kg} = 5 \text{ m/s}^2$.
3. Using Newton's second law ($F = ma$), the acceleration can be calculated as $a = F/m = 20 \text{ N} / 2 \text{ kg} = 10 \text{ m/s}^2$.
4. The frictional force can be calculated as $F_{\text{friction}} = \mu * F_{\text{normal}}$, where F_{normal} is the normal force. Assuming the box is on a horizontal surface, the normal force is equal to the weight of the box, which is $F_{\text{normal}} = m * g$. Therefore, $F_{\text{friction}} = 0.5 * (30 \text{ N}) = 15 \text{ N}$.
5. The maximum height can be determined using the kinematic equation: $v^2 = u^2 - 2as$, where $v = 0 \text{ m/s}$ (at the maximum height), $u = 20 \text{ m/s}$, $a = -9.8 \text{ m/s}^2$ (acceleration due to gravity), and s is the maximum height. Rearranging the equation, $s = (u^2 - v^2) / (2a) = (20 \text{ m/s})^2 / (2 * -9.8 \text{ m/s}^2) \approx 20.4 \text{ m}$.
6. The average acceleration can be calculated using the equation $a = (v - u) / t$, where $v = 25 \text{ m/s}$ (final velocity), $u = 0 \text{ m/s}$ (initial velocity), and $t = 10 \text{ s}$ (time). Therefore, $a = (25 \text{ m/s} - 0 \text{ m/s}) / 10 \text{ s} = 2.5 \text{ m/s}^2$.
7. Using Newton's second law ($F = ma$), the mass can be calculated as $m = F / a = 100 \text{ N} / 5 \text{ m/s}^2 = 20 \text{ kg}$.
8. The time it takes for the ball to hit the ground can be determined using the equation: $h = (1/2) * g * t^2$, where h is the initial height (2 meters), g is the acceleration due to gravity (approximately 9.8 m/s^2), and t is the time. Solving for t , we get $t = \sqrt{(2h/g)} = \sqrt{(2 * 2 / 9.8)} \approx 0.64 \text{ seconds}$.

Since the ball is thrown horizontally, its horizontal velocity remains constant throughout its flight. Therefore, the horizontal distance traveled can be calculated using the equation: $d = v * t$, where v is the horizontal velocity (15 m/s) and t is the time (0.64 seconds). Thus, $d = 15 \text{ m/s} * 0.64 \text{ s} \approx 9.6 \text{ meters}$.

9. Using Newton's second law ($F = ma$), we can calculate the mass of the object as $m = F / a = 500 \text{ N} / 8 \text{ m/s}^2 = 62.5 \text{ kg}$. To find the force required to double the acceleration, we multiply the mass by the new acceleration: $F = m * a = 62.5 \text{ kg} * (2 * 8 \text{ m/s}^2) = 1000 \text{ N}$.

10. Using Newton's second law ($F = ma$), we can calculate the acceleration of the object as $a = F / m = 10 \text{ N} / 2 \text{ kg} = 5 \text{ m/s}^2$. The final velocity can be determined using the equation: $v = u + at$, where u is the initial velocity (0 m/s), a is the acceleration (5 m/s^2), and t is the time (5 seconds). Thus, $v = 0 \text{ m/s} + 5 \text{ m/s}^2 * 5 \text{ s} = 25 \text{ m/s}$.