Put the answers to these 15 questions on your SCANTRON sheet. Your answer should be **CLOSEST TO THE GIVEN ANSWERS**. The given answers assume a value of $g = 10 \text{ m/s}^2$.

As a student at NJIT, I (sign) ___________________, will conduct myself in a professional manner and will comply with the provisions of the NJIT Academic Honor Code. I also understand that I must subscribe to the following pledge on major work submitted for credit as described in the NJIT Academic Honor Code: On my honor, I pledge that I have not violated the provisions of the NJIT Academic Honor Code.

1. A 0.2-kg hockey puck sent sliding over the ice is stopped in 15 m by the frictional force on it from the ice. If the initial speed of the puck is 9 m/s what is the coefficient of kinetic friction between the puck and the ice?

(A) 0.12  
(B) 0.42  
(C) 0.18  
(D) 0.05  
(E) 0.27

2. A small 600-kg car travels across the crest of a circular hump of radius 22.5 m. What is the maximum speed at which the car can go over the hump without losing contact with the road?

(A) 15 m/s  
(B) 25 m/s  
(C) 20 m/s  
(D) 10 m/s  
(E) 30 m/s

3. A 2-kg mass swings in a vertical circle at the end of a 0.8 m string at a constant speed of $v = 4 \text{ m/s}$. What is the tension in the string at the bottom of the circle?

(A) 20 N  
(B) 28 N  
(C) 40 N  
(D) 60 N  
(E) 50 N

4. A block is pulled up a frictionless incline by a tension $T = 30 \text{ N}$ at a **constant speed**. What is the mass of the block?

(A) 17 kg  
(B) 6 kg  
(C) 12 kg
5. What is the smallest value of the force $F$ such that the 3.0-kg block will not slide down the wall?

(A) 80 N  
(B) 120 N  
(C) 45 N  
(D) 60 N  
(E) 10 N

6. The 5-kg box sits on the back of the truck traveling at 20 m/s. Determine the minimum stopping distance of the truck so that the box does not slide when truck decelerates.

(A) 40 m  
(B) 50 m  
(C) 15 m  
(D) 25 m  
(E) 88 m

7. A 8-kg block is pulled along a rough horizontal surface ($\mu_k = 0.2$) by a rope that exerts a 30 N tension force directed 30° above the horizontal. What is the magnitude of the friction force on the block?

(A) 73 N  
(B) 58 N  
(C) 45 N  
(D) 20 N  
(E) 13 N

8. The coefficient of static friction between the road and the tires is 0.521. What speed will put the car on the verge of sliding as it makes a turn of radius 120 m? The road is flat.

(A) 10 m/s  
(B) 25 m/s  
(C) 33 m/s  
(D) 43 m/s  
(E) 50 m/s
9. A roller coaster track has a hill with a circular curve of radius \( r = 25 \text{ m} \). What is the normal force on the 60-kg passenger when the roller coaster passes the hill at \( v = 12 \text{ m/s} \)?

(A) 254 N  
(B) 386 N  
(C) 588 N  
(D) 715 N  
(E) 906 N

10. A 10-kg block is connected to a 40-kg block as shown in the figure. The surface on which the blocks slide is frictionless. A force of 50 N pulls the blocks to the right. What is the magnitude of the tension \( T \) in the rope that connects the two blocks?

(A) 0 N  
(B) 10 N  
(C) 20 N  
(D) 40 N  
(E) 50 N

11. A mass \( M = 2.0 \text{ kg} \) is held in equilibrium by two strings. (See Figure). What is the tension in the string 1?

A. 12 N  
B. 40 N  
C. 17 N  
D. 30 N  
E. 35 N

12. A 5-kg ball hangs at one end of a string that is attached to a support on a railroad boxcar. When the boxcar accelerates to the right, the rope makes an angle of 30° with the vertical. The acceleration of gravity is 9.8 m/s² and air resistance is negligible. Find the acceleration of the boxcar.
13. A boy on board a cruise ship drops a 30.0 gram marble into the ocean. If the resistive force proportionality constant is \( b = 0.50 \text{ kg/s} \), what is the terminal speed of the marble in m/s?

\[
\omega_T = \frac{mg}{b} = \frac{0.030 \times 10^{-3} \times 10}{0.50} = 0.6
\]

14. The distance between the Sun and the Earth is about \( 1.5 \times 10^{11} \text{ m} \). What is the acceleration of the Earth in its circular orbit with the Sun at the center? There are about 365 days in a year.

\[
a = \frac{v^2}{r} = \frac{\left(2 \times 10^5 \text{ m/s}\right)^2}{1.5 \times 10^{11}} = 0.006 \text{ m/s}^2 = 6 \times 10^{-3} \text{ m/s}^2
\]

15. Two blocks with the masses of \( m_1 = 8\text{ kg} \) and \( m_2 = 5\text{ kg} \) are connected by a string as shown. Mass \( m_1 \) is large enough so that mass \( m_2 \) on the table moves to the right. The pulley is massless and frictionless. But the table surface has friction with \( \mu_s = 0.3 \) and \( \mu_k = 0.2 \). What is the acceleration of the hanging mass \( m_1 \)?

\[
F_N = m_1 g - m_2 g = (m_1 + m_2) a_x
\]

\[
a_x = \frac{m_1 g - m_2 g}{m_1 + m_2} = \frac{(8 - 0.2 \times 5) \times 10}{8 + 5} = 5.4 \text{ m/s}^2
\]