Phys 201, Spring 2009 – Exam II*

Short answers: 1. The \( \hat{x} \) component of the velocity is constant, and gravity only affects the \( \hat{y} \) direction. If the projectile is shot straight upwards, the maximum height is when all the kinetic energy has been converted to gravitational potential; if shot at an angle, because the \( \hat{x} \) component of the velocity is non-zero, the kinetic energy doesn’t go to zero and it won’t reach the same maximum height.

2. This is incorrect. From Newton’s Law of gravitation, the apple pulls the Earth with the same force that the Earth pulls the apple. The fact that the Earth is so much more massive means that the acceleration experienced by the apple is much greater than the Earth’s (from Newton’s 2nd Law, \( F = ma \)).

3. The answer is: (e) \( x = A\sqrt{2/3} \).

4. (a) Yes, since \( K_{\text{tot}} \) can only equal zero if \( v_1 = v_2 = 0 \); thus \( p_{\text{tot}} \) would also have to be zero.
   (b) Yes, since \( p_{\text{tot}} = m_1v_1 \).
   (c) No, since \( p_{\text{tot}} = m_1v_1 + m_2v_2 \) could sum to zero while \( K_{\text{tot}} = \frac{1}{2}(m_1v_1^2 + m_2v_2^2) \) could be finite.

Problem 1: (a) \( T = 2.03 \text{ hrs} \)  (b) \( a = 6.02 \text{ m/s}^2 \)  (c) \( h = 1765 \text{ km} \)

Problem 2: (a) \( v_{\text{max}} = 1.41 \text{ m/s} \)  (b) \( v(x = -0.02 \text{ m}) = 1.30 \text{ m/s} \)  (c) \( a_{\text{max}} = 40.0 \text{ m/s}^2 \)
   (d) \( a(x = -0.02 \text{ m}) = 16.0 \text{ m/s}^2 \)  (e) \( E_{\text{tot}} = 0.500 \text{ J} \)

Problem 3: (a) \( U_{\text{grav}} = 114 \text{ J} \)  (b) \( v_{\text{max}} = 3.02 \text{ m/s} \)  (c) It does no work since force is always perpendicular to motion  (d) \( T = 349 \text{ N} \)

Problem 4: (a) \( v_f = 5.94 \text{ m/s} \)  (b) \( v_{\text{max}} = 5.20 \text{ m/s} \)  (c) \( \Delta K = -73.3 \text{ kJ} \)