

Arts & Science 2D06

Quiz #2 2007 Oct 19

Name:

NB: Mark values are given in brackets [] beside each problem. Write all your answers on the quiz paper. No books or notes allowed. Time to write quiz: 50 minutes.

Solution for quadratic equation: $x = (-b \pm \sqrt{b^2 - 4ac})/2a$

Equations of motion for uniform acceleration: $x = x_0 + v_0t + \frac{1}{2}at^2$, $v^2 = v_0^2 + 2ax$

$g = 9.8 \text{ m/s}^2$ centripetal $a_c = v^2/r$ linear K.E. = $(1/2)mv^2$

Gravitational potential energy: $U = mgy$ Spring potential energy: $U = (1/2)kx^2$

1. [2] A hockey puck slides on ice at constant velocity. The net force acting on the puck:

- (a) is more than its weight
- (b) is equal to its weight
- (c) is less than its weight but more than zero
- (d) depends on the speed of the puck
- (e) is zero

2. [3] Two rocks A and B of equal mass are tied to strings and whirled in horizontal circles at constant speed. The radius of B's circle is twice that of A's. If both rocks take the same time to go around once, what is the tension in B's string (T_B) compared to the tension in A's string (T_A)? Explain/derive your choice in the space below.

- (a) $T_B = 1/4 T_A$
- (b) $T_B = 1/2 T_A$
- (c) $T_B = T_A$
- (d) $T_B = 2 T_A$
- (e) $T_B = 4 T_A$

3. [3+2] A box of mass 1 kg is pushed up an incline of angle 25° by a force of 8.0 N, directed parallel to the incline's surface. The surface is not frictionless, and the box moves up the incline with an acceleration of 0.5 m/s^2 .

(a) Find the force of friction opposing the motion.

(b) Calculate the coefficient of kinetic friction of the surface.

4. [3+2] A block of mass 9.5 kg and initial speed of 5.2 m/s is moving along a horizontal surface and encounters an uncompressed spring with $k = 2.2 \times 10^3$ N/m. The block is slowed down as it compresses the spring.

(a) After the block starts to slow down, what is the potential energy in the spring when the block is moving at half its initial speed?

(b) By how much is the spring compressed at that time?

5. [3+2] A brick is pushed horizontally along the positive x -direction by a force that changes with position. The force is given by the expression $F = 2x + 1$ (N). Before the force is applied, the brick is at rest and located at $x = 0$. (Ignore friction for this problem.)

(a) What is the work done by this applied force in taking the block to $x = 5$ m?

(b) What is the kinetic energy of the brick when its position is $x = 5$ m?