Physics 211
Exam II
Spring 2005

NAME: _______________________

Useful Constants and Data

$g = 9.81 \text{ m/s}^2$

Part I
Multiple Choice
(4 points. ea.)

Read each question carefully, and choose the best answer.

___ 1. The acceleration of a falling body is measured in an elevator which is moving upward at a constant speed of 9.81 m/s. The value of the acceleration will be

(A) 0.
(B) 9.81 m/s$^2$.
(C) 19.6 m/s$^2$.
(D) 4.91 m/s$^2$.
(E) the answer will depend upon the mass of the falling body.

___ 2. The mass of an object

(A) is the quantity of matter it contains.
(B) is a measure of its inertia.
(C) does not change if the object is on the surface of the earth or on the moon.
(D) all of the above.
(E) is the force with which it is attracted to the earth.

___ 3. A large crate is suspended from the end of a vertical rope. The tension in the rope is greatest when

(A) the crate is at rest.
(B) the crate is moving upwards at constant speed.
(C) the crate is moving upward at an increasing speed.
(D) the crate is moving upward at a decreasing speed.
(E) all of the above cases will have the same tension.

___ 4. The net force exerted on an object undergoing uniform circular motion (motion in a circle at constant speed)

(A) is directed towards the center of the circle.
(B) is directed along the circle in the direction of the object's velocity.
(C) is zero, because acceleration is zero since speed is constant.
(D) is directed away from the center of the circle.
(E) is perpendicular to the circle as determined by the Right Hand Rule.

___ 5. To start an object in motion (overcoming static friction) is usually

(A) no force.
(B) more force than required to keep the object moving (against kinetic friction).
(C) the same force as required to keep the object moving (against kinetic friction).
(D) less force than required to keep the object moving (against kinetic friction).
(E) none of the above.
6. In general, Kinetic Energy can be considered as
(A) the work done by friction as a block slides down an inclined plane.
(B) the net work required to accelerate an object from rest to its current state of motion.
(C) a useless quantity, only of trivial interest to physics teachers.
(D) the work done by gravity.
(E) the amount of work converted to thermal energy during an object's motion.

7. Suppose there is a constant force acting on an object that goes through a displacement. The net work done by that force will be zero
(A) only if the magnitude of that force is zero.
(B) if the direction of the force and displacement are parallel.
(C) if the direction of the force and displacement are anti-parallel.
(D) if the direction of the force and displacement are perpendicular.
(E) only if the displacement is a full circle.

8. The work done in moving an object from point A to point B against a nonconservative force
(A) can not be recovered by moving it from point B to point A.
(B) does depend upon the path the object takes moving from point A to point B.
(C) can not be written as a change in potential energy.
(D) all of the above.
(E) none of the above.

Questions 9 and 10 refer to the following graph of potential energy versus position.

9. Points (a) and (b) on the graph are
(A) points of stable and unstable equilibrium, respectively.
(B) points of unstable and stable equilibrium, respectively.
(C) points of non equilibrium and equilibrium, respectively.
(D) points of positive and negative energy, respectively.
(E) arbitrary points, of no particular physical significance.

10. The minimum Kinetic Energy a particle would need to move from point (b) to point (a) is
(A) 30 J.
(B) 20 J.
(C) 10 J.
(D) an infinite amount.
(E) 0 J.
1. Three boxes lined left to right have masses 2.50 kg, 3.50 kg and 10.0 kg all lying on a horizontal surface with coefficient of kinetic friction between the boxes and surface of .300. A 30.0 N force is applied from the left on the 2.5 kg box.

(A) What is the acceleration of the boxes?
(B) What is the magnitude of the contact force between the 2.5 kg box and the 3.5 kg box?
(C) What is the magnitude of the contact force between the 3.5 kg box and the 10 kg box?
2. A tether ball has been replaced with a 6.00 kg bowling ball. As the ball swings at the end of the 3.00 m long rope, the rope makes a 30.0º angle with respect to the vertical, and goes around the central post in a horizontal circle.

(A) Draw a free body diagram of the ball, indicating all forces acting on the ball. Also indicate the direction of the ball's acceleration.

(B) Determine the radius of the circle that the ball traverses.

(C) What is the tension in the rope?

(D) What is the centripetal acceleration of the ball?

(E) What is the speed of the ball?
3. Object A lies on a horizontal surface. The coefficient of kinetic friction is .400 between the Object A and the surface. Object A has a mass of 5.00 kg. Object B has a mass of 2.50 kg and hangs vertically from a string that goes over a frictionless pulley and is then attached to object A.
Suppose both objects are initially at rest and B drops by 0.500 m.
(A) What is the change in the gravitational potential energy of B?
(B) What is the magnitude of the force of sliding friction exerted on A?
(C) What is the work done by the force of friction on A?
(D) Do any other external forces do work on either A or B?
(E) What is the final kinetic energy of the system?
(F) What is the speed of A and B at the end of the 0.500 m drop?
4. A .200 kg block that is initially at rest on a frictionless inclined plane (30º) rests against a compressed spring as shown. The spring has been compressed by 5.00 cm (5.00E-2 m) and has a spring constant of 60.0 N/m. The mass is then released allowing the spring to uncompress to its equilibrium position.

(A) How much potential energy is initially stored in the spring?

(B) What is the change in the gravitational potential energy of the block as the spring expands to its equilibrium position?

(C) What is the kinetic energy of the block as the spring reaches its equilibrium position?

At the equilibrium position, the block (unattached to the spring) continues to slide up the ramp until it momentarily comes to rest.

(D) What must be the additional change in the gravitational potential energy as the block moves from the spring's equilibrium position to its maximum displacement up the ramp?

(E) How far up the ramp does the block go before (momentarily) coming to rest?

(F) What is the maximum amount the spring be compressed when the block slides back down the ramp?