Multiple choice questions. Circle the correct answer. No work needs to be shown and no partial credit will be given.

(6 pts) 1. A block with mass 10.0 kg is sliding due east on a horizontal surface. The forces on the block are gravity, the normal force exerted on the block by the surface and the kinetic friction force exerted by the surface. Point B is 5.0 m due east of point A. At point A the block has speed 6.0 m/s and at point B the block has speed 4.0 m/s. The work done on the block by the friction force as the block moved from A to B was

(a) 100 J
(b) −100 J
(c) 135 J
(d) −135 J
(e) 160 J
(f) −160 J
(g) none of the above answers

(6 pts) 2. Blocks A and B are initially at rest on a horizontal frictionless surface with a spring of negligible mass compressed between them. Block A has mass 5.0 kg and block B has mass 20.0 kg. The spring is released and the blocks move off in opposite directions. After the blocks have moved away from the spring,

(a) the magnitude of the momentum of block A is the same as the magnitude of the momentum of block B
(b) the magnitude of the momentum of block A is less than the magnitude of the momentum of block B
(c) the magnitude of the momentum of block A is greater than the magnitude of the momentum of block B

(6 pts) 3. Blocks A and B are moving toward each other on a horizontal frictionless surface. Block A has mass 5.0 kg and is moving to the right with speed 8.0 m/s. Block B has mass 15.0 kg and is moving to the left with speed 4.0 m/s. The two blocks collide and stick together. After the collision the combined object (mass 20.0 kg) has velocity

(a) 0.50 m/s to the left
(b) 0.50 m/s to the right
(c) 1.0 m/s to the left
(d) 1.0 m/s to the right
(e) 2.5 m/s to the left
(f) 2.5 m/s to the right
(g) none of the above answers
4. A block with mass 2.0 kg is on a horizontal frictionless surface and is placed against a compressed spring that has force constant 128 N/m. The spring is released and the block moves along the surface away from the spring. If the spring was initially compressed 0.20 m, what is the speed of the block after it has left the spring?

(a) 1.6 m/s
(b) 2.4 m/s
(c) 3.2 m/s
(d) 12.8 m/s
(e) 19.2 m/s
(f) 25.6 m/s
(g) none of the above answers

On the following problems show all your work. Partial credit will be given, if earned. Write your answers in the blanks provided. All answers must include the correct plus or minus sign and the correct units.

5. Planet Sec is spherical and has uniform density. Its radius is \( R = 5.00 \times 10^6 \) m and its mass is \( M = 4.00 \times 10^{22} \) kg.

a) A football is in a circular orbit around planet Sec. The speed of the football in the orbit is 400 m/s. What is the radius of the orbit of the football, measured from the center of the planet?

Ans. 

b) A rock is released from rest from a height of 20.0 m above the surface of the planet. How many seconds does it take the rock to reach the surface of the planet? Air resistance can be neglected.

Ans. 

(20 pts) 6. A block of mass 10.0 kg slides 16.0 m down a 36.9° incline, from point A at the top of the incline to point B at the bottom. As the block moves from point A to point B, the surface of the incline exerts a constant friction force that has magnitude 42.0 N.

a) As the block moves from A to B, how much work is done on it by the friction force? (Be sure to indicate whether the work is positive or negative).

Ans. ______________________

b) As the block moves from A to B, how much work is done on it by the gravity force? (Be sure to indicate whether the work is positive or negative).

Ans. ______________________

c) If the block has an initial speed of 8.0 m/s at point A, what is the speed of the block when it reaches point B?

Ans. ______________________
7. One end of a 5.0 m long light string is attached to the ceiling and a small rock of mass $m$ is attached to the other end of the string. The rock swings in a horizontal circle at constant speed. The angle between the string and the vertical direction is a constant 36.9° and the tension in the string is 32.0 N.

a) What is the mass $m$ of the rock? 

Ans. ________________

b) What is the magnitude of the acceleration of the rock as it moves in the horizontal circle?

Ans. ________________

c) How long does it take the rock to complete one revolution?

Ans. ________________
(18 pts) 8. Block $A$ with mass 0.050 kg is released from rest at the rim of a frictionless hemispherical bowl that has radius $R = 0.600$ m. Block $A$ slides down the side of the bowl and strikes block $B$, which has mass 0.150 kg and that is sitting at rest at the bottom of the bowl, and the two blocks stick together.

a) What is the speed of the combined object (blocks $A$ and $B$ stuck together) immediately after the collision?

Ans. ________________

b) What maximum vertical distance above the bottom of the bowl will the combined object reach after the collision?

Ans. ________________