(Last) (First)

Physics 201

Exam 3

Write also your name in the appropriate box of the scantron

(Last) (First)

Multiple choice questions [60 points]

Answer all of the following questions. Read each question carefully. **Fill the correct bubble on your scantron sheet**. Each question has exactly one correct answer. All questions are worth the same amount of points.

1. Susana ascends a mountain via a short, steep trail. Sean ascends the same mountain via a long, gentle trail. Which of the following statements is true?

A. Susana gains more gravitational potential energy than Sean.
B. Susana gains less gravitational potential energy than Sean.
C. Susana gains the same gravitational potential energy as Sean.
D. To compare gravitational potential energies, we must know the height of the mountain.
E. To compare gravitational potential energies, we must know the lengths of the two trails.

2.

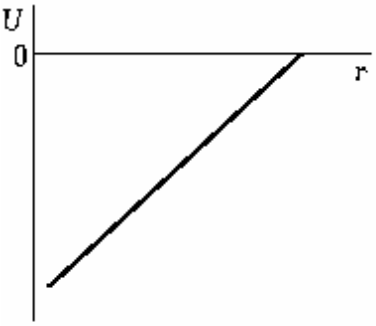


Figure A

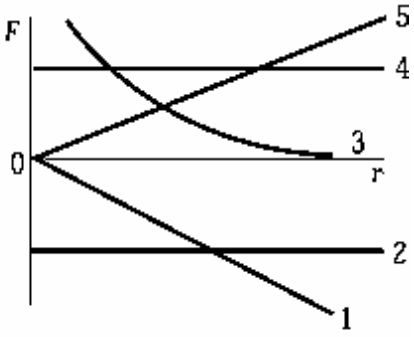
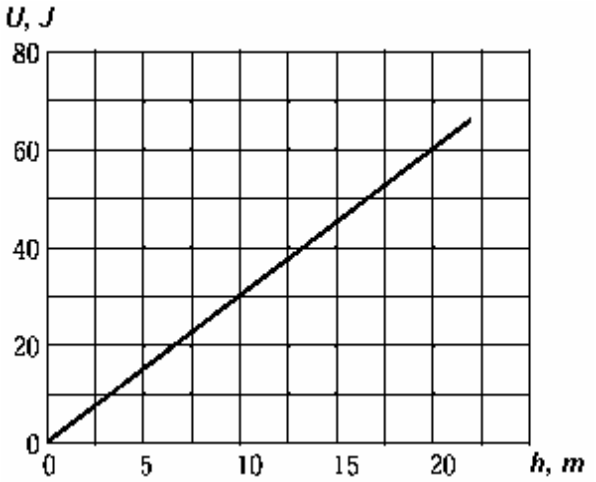


Figure B

When the potential energy *U(r)* is given as in Figure A, then the force is given in Figure B by curve

A. 1
B. 2
C. 3
D. 4
E. 5

(Last) (First)

3. 

The graph shows a plot of the gravitational potential energy U of a 1-kg body as a function of its height h above the surface of a planet. The acceleration due to gravity at the surface of the planet is

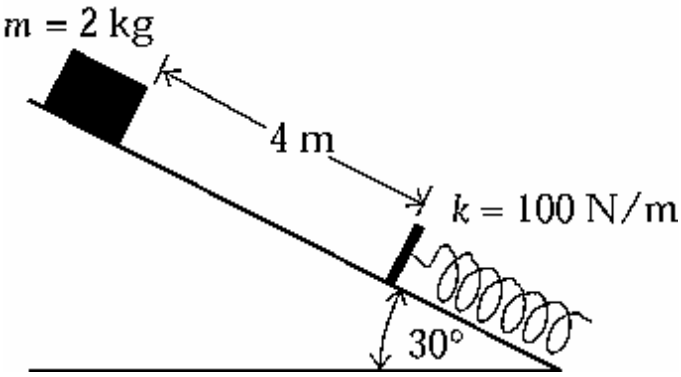
A. **0 m/s^2**
B. **9.8 m/s^2**
C. **6 m/s^2**
D. **3 m/s^2**
E. None of these is correct.

4. Two unequal masses hang from either end of a massless cord that passes over a frictionless pulley. Which of the following is true about the gravitational potential energy (U) and the kinetic energy (K) of the system consisting of the two masses after the masses are released from rest?

A. $\Delta U < 0$ and $\Delta K > 0$
B. $\Delta U = 0$ and $\Delta K > 0$
C. $\Delta U < 0$ and $\Delta K = 0$
D. $\Delta U = 0$ and $\Delta K = 0$
E. $\Delta U > 0$ and $\Delta K < 0$

(Last) (First)

5.



The surface shown in the figure is frictionless. If the block is released from rest, it will compress the spring at the foot of the incline

Hint: use the conservation of mechanical energy. You will need to solve a quadratic equation.

A. `4.0 m`
B. `3.24 m`
C. `1.57 m`
D. `0.989 m`
E. `0.5 m`

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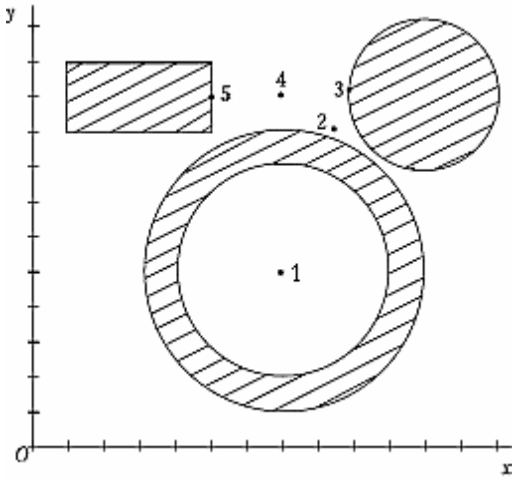
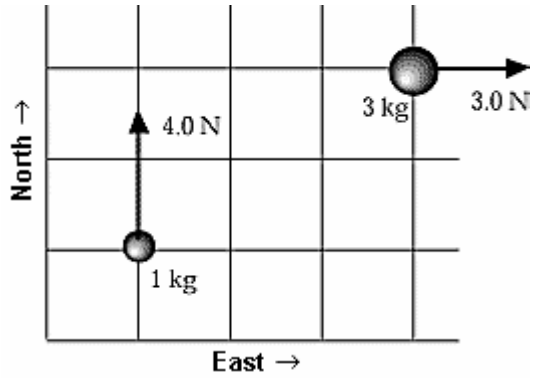
6. 

The mass of the rectangle in the figure is *M,* the mass of the ring is *M,* and the mass of the circle is 3*M.* The center of mass of the system (consisting of the rectangle, the circle and the ring) with respect to the origin *O* is located at point

A. 1
B. 2
C. 3
D. 4
E. 5

(Last) (First)

7.



A 1.0-kg mass is acted on by a net force of 4.0 N and a 3.0-kg mass is acted on by a net force of 3.0 N, in the directions shown. The acceleration of the center of mass of this system is approximately

A. 1.25 m/s^2, 53º N of E
B. 1.85 m/s^2, 45º N of E
C. 4.00 m/s^2, due north
D. 5.30 m/s^2, N of E
E. 7.25 m/s^2, 53º N of E

8. A boy and girl initially at rest on ice skates face each other. The girl has a mass of 20 kg and the boy has a mass of 30 kg. The boy pushes the girl backward at a speed of 3.0 m/s. As a result of the push, the speed of the boy is

A. **0 m/s**
B. **2.0 m/s**
C. **3.0 m/s**
D. **4.5 m/s**
E. **9.0 m/s**

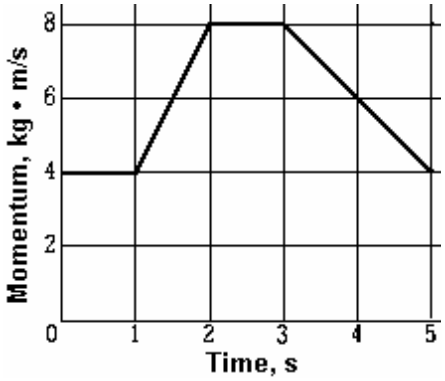
9. If a body moves in such a way that its linear momentum is constant, then

A. its kinetic energy is zero.
B. the sum of all the forces acting on the body is constant and nonzero.
C. its acceleration is greater than zero and is constant.
D. its center of mass remains at rest.
E. the sum of all the forces acting on it must be zero.

10. While in horizontal flight at a speed of 20 m/s, a baseball of mass 0.11 kg is struck by a bat. After leaving the bat, the baseball has a speed of 29 m/s in a direction opposite to its original direction. The magnitude of the impulse given the ball is

A. $0.99\ \text{kg} \cdot \text{m/s}$
B. $3.2\ \text{kg} \cdot \text{m/s}$
C. $2.2\ \text{kg} \cdot \text{m/s}$
D. $5.4\ \text{kg} \cdot \text{m/s}$
E. $0.55\ \text{kg} \cdot \text{m/s}$

11.



The graph shows the momentum of a body as a function of time. The time at which the force acting on the body is greatest is

A. $0.5\ \text{s}$
B. $2.5\ \text{s}$
C. $4.0\ \text{s}$
D. $1.5\ \text{s}$
E. $5.0\ \text{s}$

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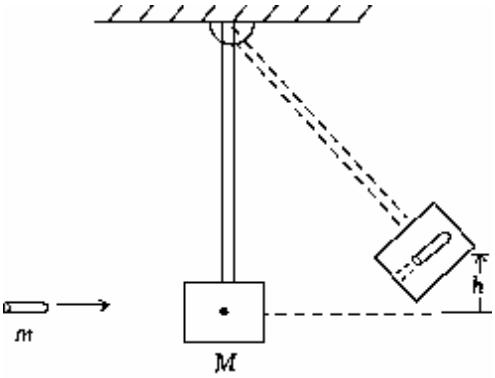
12.



A bullet, m = 0.500 kg, traveling with a velocity v strikes and embeds itself in the bob of a ballistic pendulum, M = 9.50 kg. The combined masses rise to a height h = 1.28 m. The velocity v of the bullet is

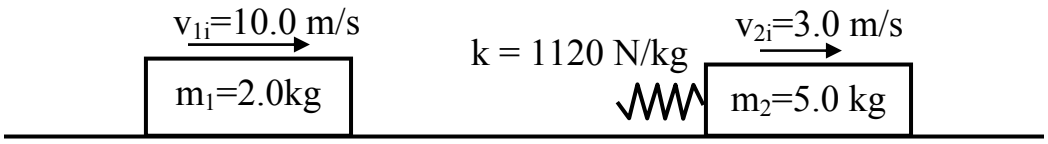
A. 5.00 m/s
B. 50 m/s
C. 100 m/s
D. 250 m/s
E. 275 m/s

Name: _____ Total Points: _____

(Last) (First)

PROBLEM [40 points]

Two masses m_1=2.0 kg and m_2=5.0 kg are on a horizontal frictionless surface. Mass m_1 is moving to the right with velocity $v_{1i} = 10\ m/s$ and m_2 with velocity $v_{2i} = 3.0\ m/s$. As shown in the figure a massless spring of force constant k = 1120 N/kg is attached to m_2.



1). [15 pts] After the masses collide and separate completely from one another, what are the final velocities of the two masses? (Hint: the collision is elastic).

2). [10 pts] What are the final kinetic energies of each of the two masses (K_{1f} and K_{2f})?

3). [15 pts] What is the maximum potential energy stored in the spring during the collision? (Hint: at maximum compression, both masses have the same velocity equal to the center of mass velocity. Use also that the mechanical energy of m_1+spring +m_2 is constant).