Exam 3--PHYS 201--F14--Chapters 5 & 6

Multiple Choice
Identify the choice that best completes the statement or answers the question.

1. Which of these following is a conservative force?
   a. Air resistance
   b. Convection
   c. Gravity
   d. Friction

2. A massless spring initially compressed by a displacement of 2 centimeters is now compressed by 4 centimeters. How has the potential energy of this system changed?
   a. The potential energy has not changed.
   b. The potential energy has increased by 2 joules.
   c. The potential energy has quadrupled.
   d. The potential energy has doubled.

3. When an increase in speed doubles the kinetic energy of a moving body, its momentum
   a. increases, but less than doubles.
   b. doubles.
   c. more than doubles.
   d. depends on factors not stated.

4. When an increase in speed doubles the momentum of a moving body, its kinetic energy
   a. increases, but less than doubles.
   b. doubles.
   c. more than doubles.
   d. depends on factors not stated.

5. These four blocks are all moving to the right. Which of the forces is doing zero work on the block?
   a. a
   b. b
   c. c
   d. d
   e. more than one is doing zero work

6. Two trailers, X with mass 500 kg and Y with mass 2000 kg, are being pulled at the same speed. The ratio of the kinetic energy of Y to that of X is (ie. KE_Y:KE_X):
   a. 1:1
   b. 2:1
   c. 4:1
   d. 9:1
   e. 16:1

7. A force of 100 N acts on a 100 kg boulder for 2 seconds; the same force acts on a 1 kg stone for 2 seconds. Which experiences the larger change in momentum?
   a. the boulder
   b. the stone
   c. both the same

8. Which of these statements is true?
   a. energy is a vector; momentum is scalar
   b. energy is a scalar quantity; momentum is a vector
   c. both energy and momentum are vector quantities
   d. both energy and momentum are scalar quantities

9. In which of these collisions is energy conserved?
   a. cars colliding
   b. people colliding
   c. gas particles colliding
   d. all of these

10. An inelastic collision is one in which
   a. only momentum is conserved
   b. only energy is conserved
   c. both energy and momentum are conserved
   d. neither energy or momentum are conserved
11. A system of particles has an energy of zero. Which of these statements is true about the momentum of the system?
   a. the momentum is zero
   b. the momentum is negative
   c. the momentum is positive
   d. not enough information

12. Which of these bodies has the largest momentum?
   I. Mass 3M and speed V
   II. Mass M and speed 4V
   III. Mass 3M and speed 2V
   IV. Mass 2M and speed 3V
   a. II & III
   b. III & IV
   c. IV alone
   d. I and II
   e. III alone

13. Which of these bodies has the largest energy?
   I. Mass 3M and speed V
   II. Mass M and speed 4V
   III. Mass 3M and speed 2V
   IV. Mass 2M and speed 3V
   a. II & III
   b. III & IV
   c. IV alone
   d. I and II
   e. III alone
Problem

14. (15 pts) A particle is on a frictionless track as shown here. The particle is initially at a height of 10 m and is travelling at 4 m/s. The particle is released.

a) What is the speed of the particle at point (b), which is 2 m high?
b) What is the speed of the particle at point (c), which is at ground level?
c) On the right hand side, how high does the particle travel when it comes to rest?
15. (20 pts) A spring has a spring constant of 100 N/m; the mass of the block is 2 kg. You compress the spring by 10 cm as in this figure. The spring causes the block to move to the right; then the block leaves the spring and continues along on a frictionless surface.

a) What is the velocity of the block after it leaves the spring?

b) Now, consider that a force acts on the block after it leaves the spring. The force is dependent on the position and follows this function:

\[ F = -\frac{1}{2}x \]

How far does the block travel when acted upon by this force?
16. (15 pts) An object is initially at rest and has mass=2 kg. The object is acted on by a force $\vec{F} = 3\hat{i} - 5\hat{j}$ N over a displacement $\vec{d} = 2\hat{i} + 1\hat{j}$ m.

a) How much work is done on the object by the force?

b) What is the object’s speed at $\vec{d} = 2\hat{i} + 1\hat{j}$ m?

c) Is the x-component of the force doing positive or negative work on the object?

d) Is the y-component of the force doing positive or negative work on the object?
17. (15 pts) Two particles collide as in this figure. What is the final velocity, in vector notation, of the second particle?

Before collision

\[ \vec{v}_{1,i} = (4\hat{i} - 1\hat{j}) \frac{m}{s} \quad \vec{v}_{2,i} = 0 \frac{m}{s} \]

\[ m_1 = 1 \text{ kg} \quad m_2 = 3 \text{ kg} \]

After collision

\[ \vec{v}_{1,f} = (-3\hat{i} - 2\hat{j}) \frac{m}{s} \quad \vec{v}_{2,f} = \frac{m}{s} \]
18. (5 pts) Alex throws a 0.15-kg rubber ball down onto the floor. The ball’s speed just before impact is 6.5 m/s, and just after is 3.5 m/s. The impact lasts for 0.1 s. What is the magnitude of the force acting on the ball?
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Answer Section

MULTIPLE CHOICE

1. ANS: C  PTS: 1
2. ANS: C  PTS: 1
3. ANS: A  PTS: 1
4. ANS: C  PTS: 1
5. ANS: A  PTS: 1
6. ANS: C  PTS: 1
7. ANS: C  PTS: 1
8. ANS: B  PTS: 1
9. ANS: C  PTS: 1
10. ANS: A  PTS: 1
11. ANS: A  PTS: 1
12. ANS: B  PTS: 1
13. ANS: C  PTS: 1

PROBLEM

14. ANS:
    .
    PTS: 1
15. ANS:
    .
    PTS: 1
16. ANS:
    .
    PTS: 1
17. ANS:
    .
    PTS: 1
18. ANS:
    15 N
    PTS: 1