

Name: _____ Date: _____

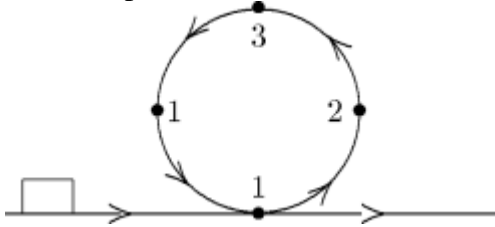
1. An inelastic collision is one in which:
 - A) momentum is not conserved but kinetic energy is conserved
 - B) total mass is not conserved but momentum is conserved
 - C) neither kinetic energy nor momentum is conserved
 - D) momentum is conserved but kinetic energy is not conserved
 - E) the total impulse is equal to the change in kinetic energy

2. Whenever an object strikes a stationary object of equal mass:
 - A) the two objects cannot stick together
 - B) the collision must be elastic
 - C) the first object must stop
 - D) momentum is not necessarily conserved
 - E) none of the above

3. Objects A and B interact with each other via both conservative and nonconservative forces. Let K_A and K_B be the kinetic energies, U be the potential energy, and E^{thermal} be the thermal energy. If no external agent does work on the objects then:
 - A) $K_A + U$ is conserved
 - B) $K_A + U + E^{\text{thermal}}$ is conserved
 - C) $K_A + K_B + E^{\text{thermal}}$ is conserved
 - D) $K_A + K_B + U$ is conserved
 - E) $K_A + K_B + U + E^{\text{thermal}}$ is conserved

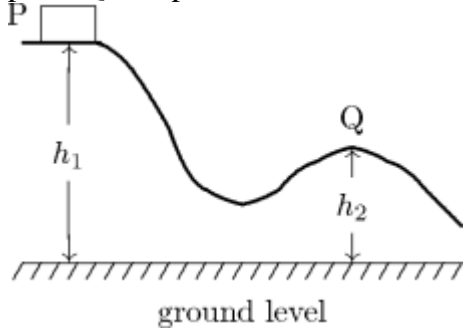
Write the letter for the correct answer on the answer sheet. Write clearly.

4. A rectangular block is moving along a frictionless path when it encounters the circular loop as shown. The block passes points 1, 2, 3, 4, 1 before returning to the horizontal track. At point 3:



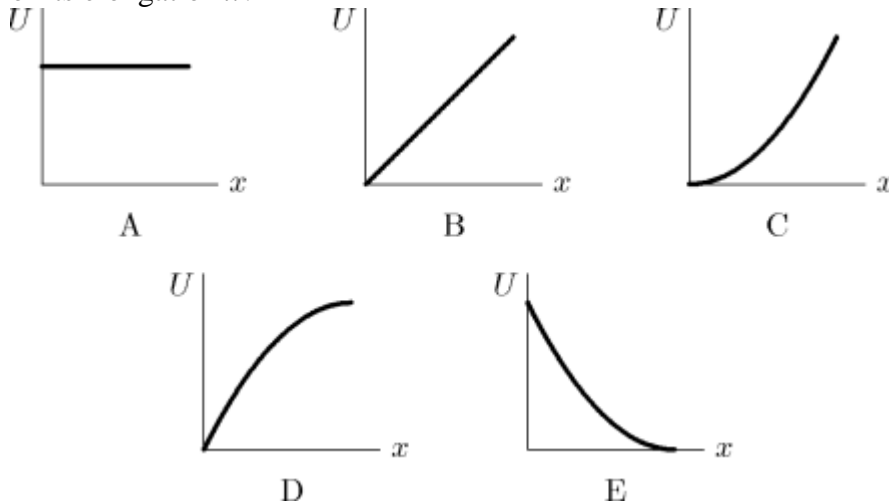
- A) its mechanical energy is a minimum
 B) the forces on it sum to zero
 C) it is not accelerating
 D) its speed is a minimum
 E) it experiences a net upward force
5. A 0.75-kg block slides on a rough horizontal table top. Just before it hits a horizontal ideal spring its speed is 3.5 m/s. It compresses the spring 5.7 cm before coming to rest. If the spring constant is 1200 N/m, the thermal energy of the block and the table top must have:
- A) not changed
 B) decreased by 1.9 J
 C) decreased by 2.6 J
 D) increased by 1.9 J
 E) increased by 2.6 J

6. A block is released from rest at point P and slides along the frictionless track shown. At point Q, its speed is:



- A) $2g\sqrt{h_1 - h_2}$
 B) $2g(h_1 - h_2)$
 C) $(h_1 - h_2)/2g$
 D) $\sqrt{2g(h_1 - h_2)}$
 E) $(h_1 - h_2)^2/2g$

7. Which of the five graphs correctly shows the potential energy of a spring as a function of its elongation x ?

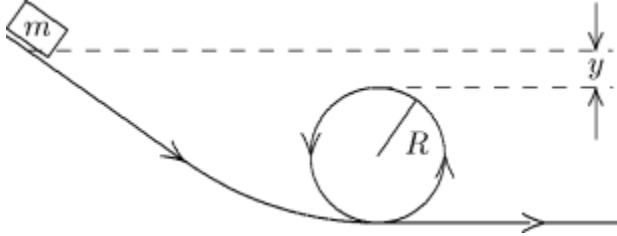


- A) A
 B) B
 C) C
 D) D
 E) E

8. A 25-g ball is released from rest 80 m above the surface of Earth. During the fall the total internal energy of the ball and air increases by 15 J. Just before it hits the surface its speed is
- A) 19 m/s
 - B) 36 m/s
 - C) 40 m/s
 - D) 45 m/s
 - E) 53 m/s
9. A projectile of mass 0.50 kg is fired with an initial speed of 10 m/s at an angle of 60° above the horizontal. The potential energy (relative to that at ground level) of the projectile at its highest point is:
- A) 25 J
 - B) 18.75 J
 - C) 12.5 J
 - D) 6.25 J
 - E) none of these
10. The sum of the kinetic and potential energies of a system of objects is conserved:
- A) only when no external force acts on the objects
 - B) only when the objects move along closed paths
 - C) only when the work done by the resultant external force is zero
 - D) always
 - E) none of the above
11. Two particles interact by conservative forces. In addition, an external force acts on each particle. They complete round trips, ending at the points where they started. Which of the following must have the same values at the beginning and end of this trip?
- A) the total kinetic energy of the two-particle system
 - B) the potential energy of the two-particle system
 - C) the mechanical energy of the two-particle system
 - D) the total linear momentum of the two-particle system
 - E) none of the above

Write the letter for the correct answer on the answer sheet. Write clearly.

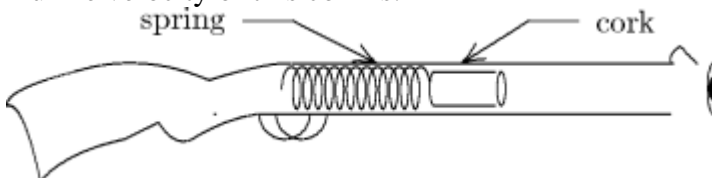
12. A small object of mass m starts from rest at the position shown and slides along the frictionless loop-the-loop track of radius R . What is the smallest value of y such that the object will slide without losing contact with the track?



- A) $R/4$
 B) $R/2$
 C) R
 D) $2R$
 E) zero
13. A very massive object traveling at 10 m/s strikes a very light object, initially at rest, and the light object moves off in the direction of travel of the heavy object. If the collision is elastic, the speed of the lighter object is:

- A) 5.0 m/s
 B) 10 m/s
 C) 15 m/s
 D) 20 m/s
 E) Can't tell from the information given.

14. A toy cork gun contains a spring whose spring constant is 10.0 N/m. The spring is compressed 5.00 cm and then used to propel a 6.00-g cork. The cork, however, sticks to the spring for 1.00 cm beyond its unstretched length before separation occurs. The muzzle velocity of this cork is:



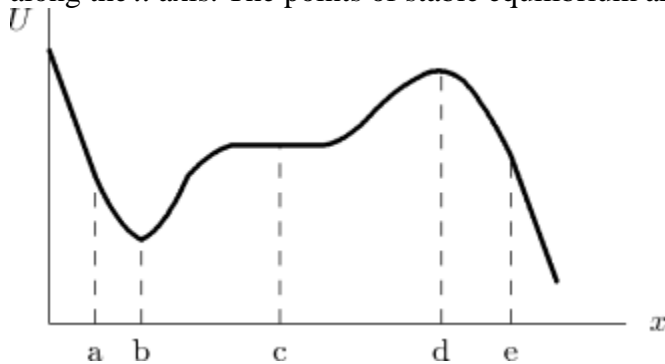
- A) 1.02 m/s
 B) 1.41 m/s
 C) 2.00 m/s
 D) 2.04 m/s
 E) 4.00 m/s

- 15.** Blocks A and B are moving toward each other along the x axis. A has a mass of 2.0 kg and a velocity of $(50\text{ m/s})\hat{i}$, while B has a mass of 4.0 kg and a velocity of $-(25\text{ m/s})\hat{i}$. They suffer an elastic collision and move off along the x axis. The kinetic energy transferred from A to B during the collision is:
- A) 0
 - B) 2500 J
 - C) 5000 J
 - D) 7500 J
 - E) 10000 J
- 16.** A 5-kg projectile is fired over level ground with a velocity of 200 m/s at an angle of 25° above the horizontal. Just before it hits the ground its speed is 150 m/s. Over the entire trip the change in the thermal energy of the projectile and air is:
- A) + 19,000 J
 - B) -19,000 J
 - C) + 44,000 J
 - D) - 44,000 J
 - E) 0
- 17.** Two objects interact with each other and with no other objects. Initially object A has a speed of 5 m/s and object B has a speed of 10 m/s. In the course of their motion they return to their initial positions. Then A has a speed of 4 m/s and B has a speed of 7 m/s. We can conclude:
- A) the potential energy changed from the beginning to the end of the trip
 - B) mechanical energy was increased by nonconservative forces
 - C) mechanical energy was decreased by nonconservative forces
 - D) mechanical energy was increased by conservative forces
 - E) mechanical energy was decreased by conservative forces
- 18.** A 0.50-kg block attached to an ideal spring with a spring constant of 80 N/m oscillates on a horizontal frictionless surface. When the spring is 4.0 cm longer than its equilibrium length, the speed of the block is 0.50 m/s. The greatest speed of the block is:
- A) 0.23 m/s
 - B) 0.32 m/s
 - C) 0.55 m/s
 - D) 0.71 m/s
 - E) 0.93 m/s

19. Only if a force acting is conservative is:

- A) its work is zero when the particle moves exactly once around any closed path
- B) its work equals the change in the kinetic energy of the particle
- C) it obeys Newton's second law
- D) it obeys Newton's third law
- E) it is not a frictional force

20. The diagram shows a plot of the potential energy as a function of x for a particle moving along the x axis. The points of stable equilibrium are:

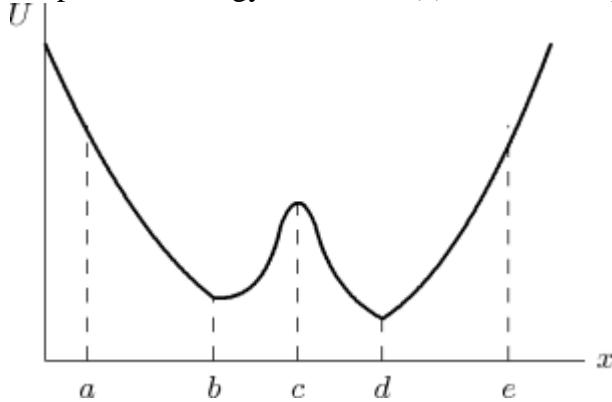


- A) only a
- B) only b
- C) only c
- D) only d
- E) b and d

21. A 700-N man jumps out of a window into a fire net 10 m below. The net stretches 2 m before bringing the man to rest and tossing him back into the air. The maximum potential energy of the net, compared to its unstretched potential energy, is:

- A) 300 J
- B) 710 J
- C) 850 J
- D) 7000 J
- E) 8400 J

22. A particle is released from rest at the point $x = a$ and moves along the x axis subject to the potential energy function $U(x)$ shown. The particle:



- A) moves to $x = e$, stops, and remains at rest
 B) moves to $x = e$, then moves to the left
 C) moves to infinity at varying speed
 D) moves to $x = b$, where it remains at rest
 E) moves to $x = e$ and then to $x = d$, where it remains at rest
23. Two objects, X and Y, are held at rest on a horizontal frictionless surface and a spring is compressed between them. The mass of X is $2/5$ times the mass of Y. Immediately after the spring is released, X has a kinetic energy of 50 J and Y has a kinetic energy of:
- A) 20 J
 B) 8 J
 C) 310 J
 D) 125 J
 E) 50 J
24. An elastic collision is one in which:
- A) momentum is not conserved but kinetic energy is conserved
 B) total mass is not conserved but momentum is conserved
 C) kinetic energy and momentum are both conserved
 D) momentum is conserved but kinetic energy is not conserved
 E) the total impulse is equal to the change in kinetic energy

25. The wound spring of a clock possesses:

- A)** kinetic but no potential energy
- B)** potential but no kinetic energy
- C)** the same potential as kinetic energy
- D)** neither potential nor kinetic energy
- E)** both kinetic and potential energy but more kinetic than potential energy

Write the letter for the correct answer on the answer sheet. Write clearly.

Answer Key

1. D
2. E
3. E
4. D
5. C
6. D
7. C
8. A
9. B
10. E
11. B
12. B
13. D
14. C
15. A
16. C
17. C
18. D
19. A
20. B
21. E
22. B
23. D
24. C
25. B