Chap8

1. Test Bank, Question 9

A force on a particle is conservative if:

- its work equals the change in the kinetic energy of the particle
- it obeys Newton's second law
- it obeys Newton's third law
- its work depends on the end points of the motion, not this the path between
- it is not a frictional force

2. Test Bank, Question 10

Two particles interact by conservative forces. This 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 total kinetic energy of the two-particle system
- the potential energy of the two-particle system
- the mechanical energy of the two-particle system
- the total linear momentum of the two-particle system
- none of the above

3. Test Bank, Question 20

A ball is held at a height $H$ above a floor. It is then released and falls to the floor. If air resistance can be ignored, which of the five graphs below correctly gives the mechanical energy $E$ of the Earth-ball system as a function of the altitude $y$ of the ball?
4. Test Bank, Question 41

A ball of mass $m$, at one end of a string of length $L$, rotates in a vertical circle just fast enough to prevent the string from going slack at the top of the circle. The speed of the ball at the bottom of the circle is:

$$v = \sqrt{2gL}$$

A) $\sqrt{2gL}$
B) $\sqrt{3gL}$
C) $\sqrt{4gL}$
D) $\sqrt{5gL}$
E) $\sqrt{7gL}$

D

5. *Chapter 8, Problem 104

A 17 kg object is acted on by a conservative force given by $F = -3.1x - 5.0x^2$, with $F$ in newtons and $x$ in meters. Take the potential energy associated with the force to be zero when the object is at $x = 0$. (a) What is the potential energy of the system associated with the force when the object is at $x = 2.5$ m? (b) If the object has a velocity of 5.3 m/s in the negative direction of the $x$ axis when it is at $x = 5.9$ m, what is its speed when it passes through the origin? What are the answers to (c) (a) and (d) (b) if the potential energy of the system is taken to be -12 J when the object is at $x = 0$?

(a) Number 35.7291666667 Units J
(b) Number 8.64384640245 Units m/s
(c) Number 23.7291666667 Units J
(d) Number 8.64384640245 Units m/s

6. *Chapter 8, Problem 55

In Fig. 8-51, a block of mass $m = 3.5$ kg slides head on into a spring of spring constant $k = 340$ N/m. When the block stops, it has compressed the spring by 8.6 cm. The coefficient of kinetic friction between block and floor is 0.14. While the block is in contact with the spring and being brought to rest, what are (a) the work done by the spring force and (b) the increase in thermal energy of the block-floor system? (c) What is the block's speed just as the block reaches the...
(a) Number 1.25732 Units J
(b) Number 0.412972 Units J
(c) Number 0.976960885311 Units m/s

7. Test Bank, Question 55

Three identical blocks move either on a horizontal surface, up a plane, or down a plane, as shown below. They all start with the same speed and continue to move until brought to rest by friction. Rank the three situations according to the mechanical energy dissipated by friction, least to greatest.

- 2, 1, 3
- 1, then 2 and 3 tie
- 1, 2, 3
- The same for all cases
- 3, 2, 1

8. *Chapter 8, Problem 17

In Fig. 8-31, a small block of mass \( m = 0.014 \) kg can slide along the frictionless loop-the-loop, with loop radius \( R = 13 \) cm. The block is released from rest at point \( P \), at height \( h = 5R \) above the bottom of the loop. What are the magnitudes of (a) the horizontal component and (b) the vertical component of the net force acting on the block at point \( Q \)? (c) At what height \( h \) should the block be released from rest so that it is on the verge of losing contact with the track at the top of the loop? (On the verge of losing contact means that the normal force on the block from the track has just then become zero).
Problem 17.

(a) Number \(1.0976\) Units N
(b) Number \(0.1372\) Units N
(c) Number \(0.325\) Units m

9. *Chapter 8, Problem 21

Figure 8-32 shows a pendulum of length \(L = 2.6\) m. Its bob (which effectively has all the mass) has speed \(v_0\) when the cord makes an angle \(\theta_0 = 41^\circ\) with the vertical. (a) What is the speed of the bob when it is in its lowest position if \(v_0 = 7.2\) m/s? What is the least value that \(v_0\) can have if the pendulum is to swing down and then up (b) to a horizontal position, and (c) to a vertical position with the cord remaining straight?

Fig. 8-32

Problem 21.

(a) Number \(8.021221839087\) Units m/s
(b) Number \(6.201612710268\) Units m/s
(c) Number \(10.719141766399\) Units m/s

10. *Chapter 8, Problem 24

A block of mass \(m = 3.8\) kg is dropped from height \(h = 63\) cm onto a spring of spring constant \(k = 1800\) N/m (Fig. 8-37). Find the maximum distance the spring is compressed.
**Problem 24.**

The boy in the figure here is initially seated on the top of a hemispherical ice mound of radius $R = 13.7$ m. He begins to slide down the ice, with a negligible initial speed. Approximate the ice as being frictionless. At what height does the boy lose contact with the ice?

![Image of a boy sliding down a hemispherical ice mound](image)

**Chapter 8, Problem 34**

The boy in the figure here is initially seated on the top of a hemispherical ice mound of radius $R = 13.7$ m. He begins to slide down the ice, with a negligible initial speed. Approximate the ice as being frictionless. At what height does the boy lose contact with the ice?

**Test Bank, Question 42**

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:

- ☐ moves to a point to the left of $x = e$, stops and remains at rest
- ☐ moves to a point to $x = e$, then moves to the left
- ☐ moves to infinity at varying speed
- ☐ moves to $x = b$ where it remains at rest
- ☐ moves to $x = e$ and then to $x = d$, where it remains at rest
13. Test Bank, Question 44

The potential energy of a 0.20-kg particle moving along the $x$ axis is given by

$$U(x) = (8.0 \text{J/m}^2)x^2 + (2.0 \text{J/m}^4)x^4.$$ 

When the particle is at $x = 1.0$ m it is traveling in the positive $x$ direction with a speed of 5.0 m/s. It next stops momentarily to turn around at $x = \phantom{0}$

- 0
- 1.1 m
- 1.1 m
- 2.3 m
- 2.3 m

14. Chapter 8, Problem X12

Figure 8-72a shows a molecule consisting of two atoms of masses $m$ and $M$ (with $M >> m$) and separation $r$. Figure 8-72b shows the potential energy $U(r)$ of the molecule as a function of $r$.

(a) Describe the motion of the atoms if the total mechanical energy $E$ of the two-atom system is greater than zero (as is $E_1$).

- The atoms will move apart and permanently separate.
- The distance between the atoms will oscillate, but the atoms will not permanently separate.
- The atoms will remain a fixed distance apart.

(b) Describe the motion of the atoms if the total mechanical energy $E$ of the two-atom system is less than zero (as is $E_2$).

- The distance between the atoms will oscillate, but the atoms will not permanently separate.
- The atoms will remain a fixed distance apart.
- The atoms will move apart and permanently separate.
(c) For $E_1 = 1 \times 10^{-19}$ J and $r = 0.3$ nm, find the potential energy of the system.

- $+2 \times 10^{-19}$ J
- $+1 \times 10^{-19}$ J
- $+0$ J
- $-1 \times 10^{-19}$ J
- $-2 \times 10^{-19}$ J

(d) For $E_1 = 1 \times 10^{-19}$ J and $r = 0.3$ nm, find the total kinetic energy of the system.

- $+2 \times 10^{-19}$ J
- $+1 \times 10^{-19}$ J
- $+0$ J
- $-1 \times 10^{-19}$ J
- $-2 \times 10^{-19}$ J

(e) For $E_1 = 1 \times 10^{-19}$ J and $r = 0.3$ nm, find the force (magnitude and direction) acting on each atom.

- $1 \times 10^{-19}$ J toward the other atom
- $1 \times 10^{-19}$ J away from the other atom
- $0$ N
- $1 \times 10^{-9}$ N toward the other atom
- $1 \times 10^{-9}$ N away from the other atom

(f) For what values of $r$ is the force repulsive?

- $r > 0.2$ nm
- $r = 0.2$ nm
- $r < 0.2$ nm

(g) For what values of $r$ is the force attractive?

- $r > 0.2$ nm
- $r = 0.2$ nm
- $r < 0.2$ nm

(h) For what values of $r$ is the force zero?

- $r > 0.2$ nm
- $r = 0.2$ nm
- $r < 0.2$ nm
15. Test Bank, Question 47

The first graph shows the potential energy $U(x)$ for a particle moving on the $x$ axis. Which of the following five graphs correctly gives the force $F$ exerted on the particle?

![Potential Energy Graphs]

16. Test Bank, Question 51

The potential energy of a body of mass $m$ is given by $U = -mgx + 1/2kx^2$. The corresponding force is:

- $-mgx^2/2 + kx^3/6$
- $mgx^2/2 - kx^3/6$
- $-mg + kx/2$
- $-mg + kx$
- $mg - kx$
17. Chapter 8, Problem X14

Fasten one end of a vertical spring to a ceiling, attach a cabbage to the other end, and then slowly lower the cabbage until the upward force on it from the spring balances the gravitational force on it. What is the relationship between the change of gravitational potential energy of the cabbage–Earth system ($\Delta U_g$) and the change in the spring’s potential energy ($\Delta U_s$)?

- $\Delta U_g = 2 \Delta U_s$
- $\Delta U_g = \Delta U_s$
- $\Delta U_g = 0.5 \Delta U_s$
- $\Delta U_g = -0.5 \Delta U_s$
- $\Delta U_g = -\Delta U_s$
- $\Delta U_g = -2 \Delta U_s$

18. *Chapter 8, Problem 62

In the figure a block slides along a path that is without friction until the block reaches the section of length $L = 0.65$ m, which begins at height $h = 1.1$ m, on a ramp of angle $\theta = 31^\circ$. In that section the coefficient of kinetic friction is 0.480. The block passes through point $A$ with a speed of 8.3 m/s. If the block can reach point $B$ (where the friction ends), what is its speed there, and if it cannot, what is its greatest height above $A$?

Number $5.960424938575$ Unit m/s

* Significant digits are disabled; the tolerance is +/-5%