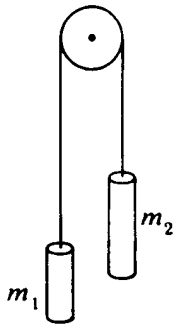
Energy Review Questions



A system consists of two objects having masses m_l and m_2 ($m_l < m_2$). The objects are connected by a massless string, hung over a pulley as shown above, and then released.

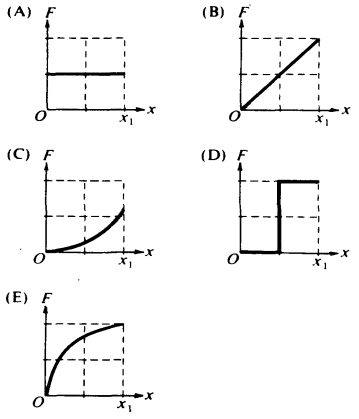
1. When the object of mass m_2 has descended a distance h, the potential energy of the system has decreased by
   (A) $(m_2 - m_l)gh$ (B) m_2gh (C) $(m_1 + m_2)gh$ (D) $\frac{1}{2}(m_l + m_2)gh$ (E) 0

2. Which of the following is true for a system consisting of a mass oscillating on the end of an ideal spring?
   (A) The kinetic and potential energies are equal at all times.
   (B) The kinetic and potential energies are both constant.
   (C) The maximum potential energy is achieved when the mass passes through its equilibrium position.
   (D) The maximum kinetic energy and maximum potential energy are equal, but occur at different times.
   (E) The maximum kinetic energy occurs at maximum displacement of the mass from its equilibrium position.

3. If a particle moves in such a way that its position x is described as a function of time t by $x = t^{3/2}$, then its kinetic energy is proportional to
   (A) t^2 (B) $t^{3/2}$ (C) t (D) $t^{1/2}$ (E) t° (i.e., kinetic energy is constant)

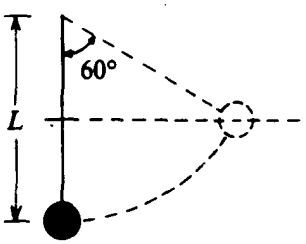
4. An object of mass m is lifted at constant velocity a vertical distance H in time T. The power supplied by the lifting force is (A) mgHT (B) mgH/T (C) mg/HT (D) mgT/H (E) zero

5. The following graphs, all drawn to the same scale, represent the net force F as a function of displacement x for an object that moves along a straight line. Which graph represents the force that will cause the greatest change in the kinetic energy of the object from $x = 0$ to $x = x_1$?



6. A person pushes a box across a horizontal surface at a constant speed of 0.5 meter per second. The box has a mass of 40 kilograms, and the coefficient of sliding friction is 0.25. The power supplied to the box by the person is (A) 0.2 W (B) 5 W (C) 50 W (D) 100 W (E) 200 W

7. From the top of a 70-meter-high building, a l-kilogram ball is thrown directly downward with an initial speed of 10 meters per second. If the ball reaches the ground with a speed of 30 meters per second, the energy lost to friction is most nearly (A) 0J (B) 100 J (C) 300 J (D) 400 J (E) 700 J



8. A pendulum consists of a ball of mass m suspended at the end of a massless cord of length L as shown above. The pendulum is drawn aside through an angle of 60. with the vertical and released. At the low point of its swing, the speed of the pendulum ball is
(A) $\sqrt{gL}$ (B) $\sqrt{2gL}$ (C) ½gL (D) gL (E) 2gL

9. A rock is lifted for a certain time by a force F that is greater in magnitude than the rock's weight W. The change in kinetic energy of the rock during this time is equal to the
(A) work done by the net force (F - W) (B) work done by F alone
(C) work done by W alone (D) difference in the momentum of the rock before and after this time (E) difference in the potential energy of the rock before and after this time.

10. A 10-kilogram body is constrained to move along the x-axis. The potential energy U of the body in joules is given as a function of its position x in meters by
$U(x) = 6x^2 - 4x + 3$
The force on the particle at x = 3 meters is
(A) 32 N in +x direction (B) 32N in -x direction (C) 45 N in +x direction (D) 45 N in -x direction
(E) 98 N in +x direction

11. During a certain time interval, a constant force delivers an average power of 4 watts to an object. If the object has an average speed of 2 meters per second and the force acts in the direction of motion of the object, the magnitude of the force is
(A) 16 N (B) 8 N (C) 6 N (D) 4N (E) 2N

12. A weight lifter lifts a mass m at constant speed to a height h in time t How much work is done by the weight lifter?
(A) mg (B) mh (C) mgh (D) mght (E) mgh/t

1A
2D
3C
4B
5E
6C
7C
8D
9A
10B
11E
12C

Boy!… Energy is Work!

1. A 65.0-kg woman climbs a flight of 20 stairs, each 23.0 cm high. How much work does she do against the force of gravity?

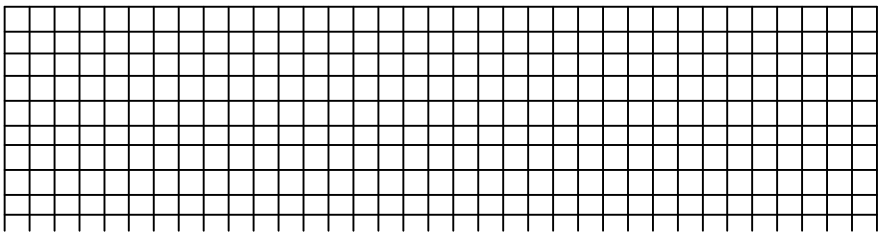
W = 2930 J

2. As a particle moves from the origin to (3**x** – 4**y**) meters, it is acted upon by a force (4**x** – 5**y**) Newtons. Calculate the work done on the particle by this force as the particle moves through the given displacement, and also determine the angle between the displacement and force vectors.

W = 32 J
$\theta = 1.79°$

3. The force acting on a particle is given by $F_x = (8.0x - 16)$ N, where x is in meters.

   a) Make a plot of this force versus x from x = 0 to x = 3.0 m.



   b) From your graph, find the net work done by this force as the particle moves from x = 0 to x = 3.0 m.

W = -12J

4. If an applied force varies with position according to $F_x = 3.0x^3 - 5.0$, where x is in meters, how much work is done by this force on an object that moves from x = 4.0 m to x = 7.0 m?

W = 1594 J

5. A 65.0-kg athlete runs 600 m up a mountain inclined at 20.0° to the horizontal. He performs this feat in 80.0 seconds. Neglecting air resistance…

   a) How much work does he perform?

   $W = 131$ kJ

   b) What is his power output during the run?

   $P = 1634$ W

6. A 15-kg box is dragged at uniform speed up an incline that is 8.00 m long and makes a 15° angle with the horizontal. If the coefficient of friction between the box and incline is 0.40, how much work is done by…

   a) the applied force?

   $W_a = 759$ J

   b) the normal force?

   $W_N = 0$ J

   c) the gravitational force (weight)?

   $W_{mg} = -304$ J

   d) How much energy is lost due to friction?

   $W_f = -454$ J