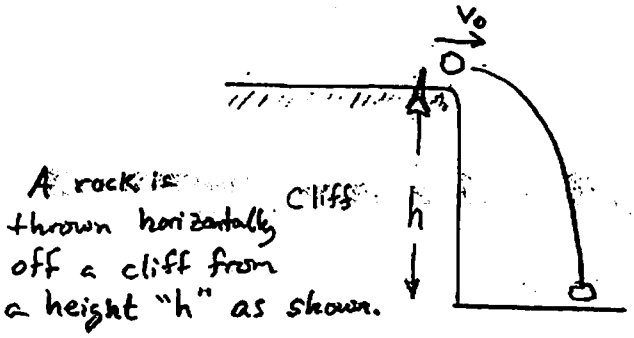
# Work, Energy, Power

1) A solid metal ball and a hollow plastic ball of the same external radius are released from rest in a large vacuum chamber. When each has fallen 1 m, they both have the same

(A) inertia
(B) speed
(C) momentum
(D) kinetic energy
(E) change in potential energy




What is the kinetic energy of the rock just before it hits the ground?

(A) $mgh$

(B) $\frac{1}{2}mv_0^2$

(C) $\frac{1}{2}mv_0^2 - mgh$

(D) $\frac{1}{2}mv_0^2 + mgh$

(E) $mgh - \frac{1}{2}mv_0^2$

3) What is the kinetic energy of a satellite of mass $m$ that orbits the Earth, of mass $M$, in a circular orbit of radius $R$?

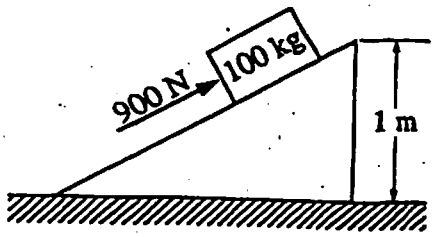
(A) Zero

(B) $\frac{1}{2}\frac{GMm}{R}$

(C) $\frac{1}{4}\frac{GMm}{R}$

(D) $\frac{1}{2}\frac{GMm}{R^2}$

(E) $\frac{GMm}{R^2}$




4) A constant force of 900 N pushes a 100 kg mass up the inclined plane shown above at a uniform speed of 4 m/s. The power developed by the 900 N force is most nearly

(A) 400 W
(B) 800 W
(C) 900 W
(D) 1000 W
(E) 3600 W

5) A child pushes horizontally on a box of mass $m$ which moves with constant speed $v$ across a horizontal floor. The coefficient of friction between the box and the floor is $\mu$. At what rate does the child do work on the box?

(A) $\mu mgv$
(B) $mgv$
(C) $v/\mu mg$
(D) $\mu mg/v$
(E) $\mu mv^2$

6) A student weighing 700 N climbs at constant speed to the top of an 8 m vertical rope in 10 s. The average power expended by the student to overcome gravity is most nearly

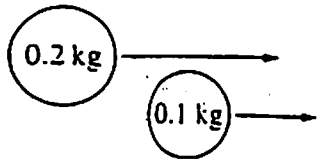
(A) 1.1 W
(B) 87.5 W
(C) 560 W
(D) 875 W
(E) 5.600 W

7) Units of power include which of the following?

I. Watt
II. Joule per second
III. Kilowatt-hour

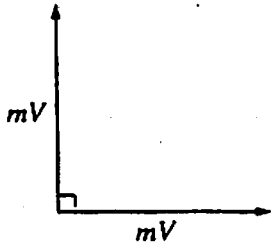
(A) I only
(B) III only
(C) I and II only
(D) II and III only
(E) I, II, and III

# Momentum (FR.3)




13) Two objects of mass 0.2 kg and 0.1 kg, respectively, move parallel to the $x$-axis, as shown above. The 0.2 kg object overtakes and collides with the 0.1 kg object. Immediately after the collision, the $y$-component of the velocity of the 0.2 kg object is 1 m/s upward. What is the $y$-component of the velocity of the 0.1 kg object immediately after the collision?

(A) 2 m/s downward
(B) 0.5 m/s downward
(C) 0 m/s
(D) 0.5 m/s upward
(E) 2 m/s upward

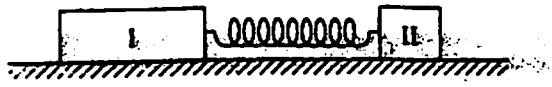



14) A stationary object explodes, breaking into three pieces of masses $m$, $m$, and $3m$. The two pieces of mass $m$ move off at right angles to each other with the same magnitude of momentum $mV$, as shown in the diagram above. What are the magnitude and direction of the velocity of the piece having mass $3m$ ?

| | Magnitude | Direction |
|---|---|---|
| (A) | $\frac{V}{\sqrt{3}}$ | ↖ |
| (B) | $\frac{V}{\sqrt{3}}$ | ↙ |
| (C) | $\frac{\sqrt{2}\,V}{3}$ | ↗ |
| (D) | $\frac{\sqrt{2}\,V}{3}$ | ↙ |
| (E) | $\sqrt{2}\,V$ | ↙ |

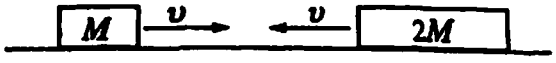
15) Two objects having the same mass travel toward each other on a flat surface, each with a speed of 1.0 meter per second relative to the surface. The objects collide head-on and are reported to rebound after the collision, each with a speed of 2.0 meters per second relative to the surface. Which of the following assessments of this report is most accurate?

(A) Momentum was not conserved, therefore the report is false.
(B) If potential energy was released to the objects during the collision, the report could be true.
(C) If the objects had different masses, the report could be true.
(D) If the surface was inclined, the report could be true.
(E) If there was no friction between the objects and the surface, the report could be true.

16) 


Two pucks are attached by a stretched spring and are initially held at rest on a frictionless surface, as shown above. The pucks are then released simultaneously. If puck I has three times the mass of puck II, which of the following quantities is the same for both pucks as the spring pulls the two pucks toward each other?

(A) Speed
(B) Velocity
(C) Acceleration
(D) Kinetic energy
(E) Magnitude of momentum




17) **The two blocks of masses $M$ and $2M$ shown above initially travel at the same speed $v$ but in opposite directions. They collide and stick together. How much mechanical energy is lost to other forms of energy during the collision?**

**(A) Zero**

**(B) $\frac{1}{2}Mv^2$**

**(C) $\frac{3}{4}Mv^2$**

**(D) $\frac{4}{3}Mv^2$**

**(E) $\frac{3}{2}Mv^2$**