AP Physics TEST
Momentum

Name _____
2-3a 3b-4 5-6a 6b-7

Multiple Choice: Choose the one best answer for each of the following questions and mark your answer on your SCANTRON. Write on this test; it is your copy. ***NOTA means "None Of These Answers"***

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

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

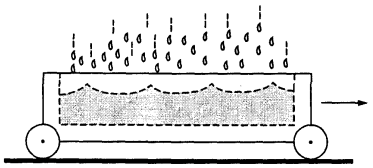
(A) 1.1 W (B) 87.5 W (C) 560 W (D) 875 W (E) 5,600 W

3. A railroad car of mass m is moving at speed u when it collides with a second railroad car of mass M which is at rest. The two cars lock together instantaneously and move along the track. What is the speed of the cars immediately after the collision?

(A) u/2 (B) (mu)/M (C) (Mu)/m (D) u (m + M) / m (E) (mv)/(m + M)

4. An open cart on a level surface is rolling without frictional loss through a vertical downpour of rain, as shown. As the cart rolls, an appreciable amount of rainwater accumulates in the cart. The speed of the cart will:

(A) increase because of conservation of momentum
(B) increase because of conservation of mechanical energy
(C) decrease because of conservation of momentum
(D) decrease because of conservation of mechanical energy
(E) remain the same because the raindrops are falling perpendicular to the direction of the cart's motion



5. 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

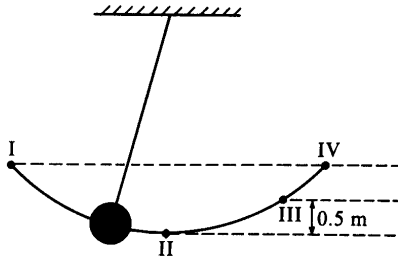
6. Two objects of mass 0.2 kg and 0.1 kg, respectively, move parallel to the x axis. The 0.2 kg object overtakes and collides with the 0.1 kg object. Immediately after the collision, the y component of the velocity of the 0.2 kg object is 1 m/s upward. What is the y component of the velocity of the 0.1 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) NOTA

7. A ball of mass 0.4 kg is initially at rest on the ground. It is kicked and leaves the kicker's foot with a speed of 5.0 m/s in a direction 60° above the horizontal. The magnitude of the impulse imparted by the ball to the foot is most nearly

(A) 1 N•s (B) $\sqrt{3}$ (C) 2 N•s (D) $2/\sqrt{3}$ N•s (E) 4 N•s

(Questions 8 and 9) A ball swings freely back and forth in an arc from point I to point IV, as shown at right. Point II is the lowest point in the path, III is located 0.5 meter above II, and IV is 1 meter above II. Air resistance is negligible.



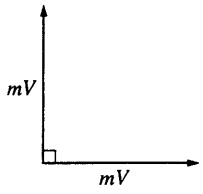
8. If the potential energy is zero at point II, where will the kinetic and potential energies of the ball be equal?

(A) At point II (B) At some point between II and III (C) At point III
(D) At some point between III and IV (E) At point IV

9. The speed of the ball at point II is most nearly

(A) 3.0 m/s (B) 4.5 m/s (C) 9.8 m/s (D) l4 m/s (E) 20 m/s

10. 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. What are the magnitude and direction of the velocity of the piece having mass 3m?

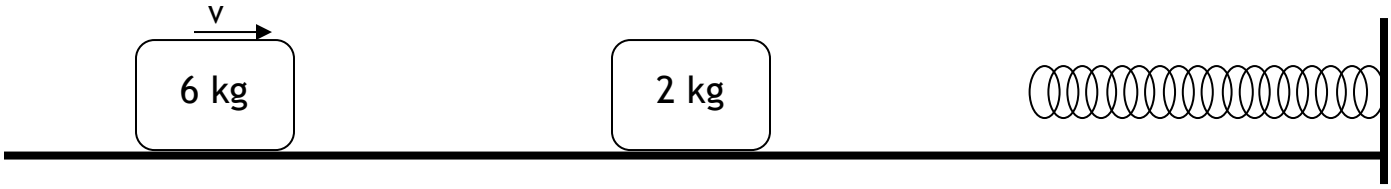


	Magnitude	Direction
(A)	$\frac{V}{\sqrt{3}}$	↗
(B)	$\frac{V}{\sqrt{3}}$	↙
(C)	$\frac{\sqrt{2}\,V}{3}$	↗
(D)	$\frac{\sqrt{2}\,V}{3}$	↙
(E)	$\sqrt{2}\,V$	↙

AP Physics TEST Name _____

2-3a 3b-4 5-6a 6b-7

A block of mass, 6kg, is sliding along a frictionless surface moving at a constant velocity. It then strikes a 2kg block that is resting on the table. The two blocks get stuck together and slide towards a spring of spring constant 50N/m, and compress it a distance of 0.6 m.



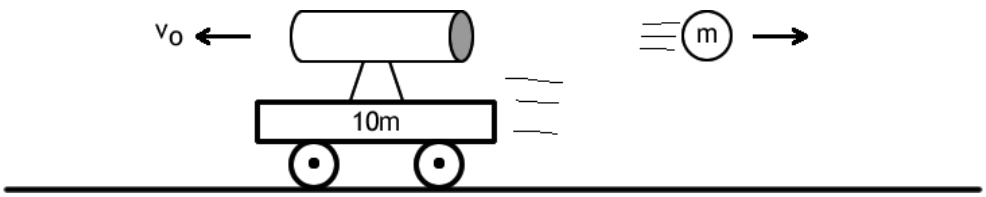
a) How fast was the 6kg block moving when it struck the 2 kg block?

b) How much heat, if any was produced?

c) What would happen to the distance compressed if the spring constant increased? Justify your answer.

_____INCREASE _____DECREASE _____STAY THE SAME

d) If the spring stops the blocks in 0.4 seconds, how powerful was the spring?



A canon, of mass 10m, rolls backward at a velocity of v_o after firing a ball, of mass m.

Express all of your answers in terms of m, v_o, and fundamental constants.

a) How fast does the ball travel when it exits the canon?

b) What impulse is imparted to the ball?

c) How much mechanical energy was released by the explosion?

d) What is the ratio of the bullets kinetic energy compared to the cannons kinetic energy?