

INSTRUCTIONS:

For the multiple choice questions on pages 1–3, you will be graded on the basis of your answer only. You will get full credit for a correct answer, zero credit for incorrect answers, zero credit for choosing multiple answers even if one of them is the correct response. There is only one correct answer for each multiple choice question.

For the problems on pages 4 and 5, you may receive partial credit for steps taken in the direction of the correct solution. So, show all your work.

No books or notes are permitted in this examination. Writing instruments and a calculator are the only items that you will need.

**** READ THE QUESTIONS CAREFULLY ****

SCORE BOX	
Page 1	(8)
Page 2	(16)
Page 3	(12)
Page 4	(15)
Page 5	(24)
Total	(75)

$$v = v_0 + at \quad x - x_0 = \left(\frac{v_0 + v}{2}\right)t \quad x - x_0 = v_0 t + \frac{1}{2}at^2 \quad v^2 = v_0^2 + 2a(x - x_0) \quad g = +9.80 \text{ m/s}^2$$

1. When a rock thrown straight upwards gets to the highest point of its path, its

- (a) velocity and acceleration are both nonzero.
- (b) acceleration is nonzero, but its velocity is zero.
- (c) velocity and acceleration are both zero.
- (d) velocity is nonzero but its acceleration is zero

ANSWER[]

(score)	(4)
---------	-----

2. Packages A and B are dropped from the same height simultaneously. Package A is dropped from an airplane that is flying due east at constant speed. Package B is dropped from rest from a helicopter hovering in a stationary position above the ground. Ignoring air friction effects, which of the following statements is true?

- (a) A and B reach the ground at different times because B has a greater velocity in both the horizontal and vertical directions.
- (b) A and B reach the ground at different times; and they have the same velocity in the vertical direction.
- (c) A reaches the ground first because it falls straight down, while B has to travel much further than A.
- (d) A and B reach the ground at the same time, but B has a greater velocity in the vertical direction.
- (e) A and B reach the ground at the same time; and they have the same velocity in the vertical direction.

ANSWER[]

(score)	(4)
---------	-----

3. A toy rocket, launched from the ground, rises vertically with a constant acceleration of 14.3 m/s^2 for 2.0 s when it runs out of fuel. Disregarding air resistance, to what maximum height will the rocket rise before falling back to the ground?

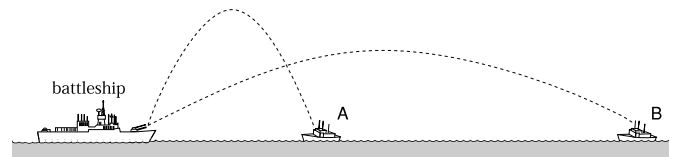
- (a) 30 m
- (b) 40 m
- (c) 61 m
- (d) 70 m
- (e) 122 m

ANSWER[]

(score)	(4)
---------	-----

4. A battleship simultaneously fires two shells at enemy ships. If the shells follow the parabolic trajectories shown in the figure, which ship gets hit first?

- (a) A
- (b) B
- (c) both at the same time
- (d) need more information



ANSWER[]

(score)	(4)
---------	-----

5. A cannon directed straight upward launches a ball with an initial speed v . The ball reaches a maximum height h in a time t . Then, the same cannon is used to launch a second ball straight upward at a speed $2v$. In terms of h and t , what is the maximum height the second ball reaches and how long does it take to reach that height?

- (a) h, t
- (b) $2h, t$
- (c) $2h, 4t$
- (d) $2h, 2t$
- (e) $4h, 2t$

ANSWER[]

(score)	(4)
---------	-----

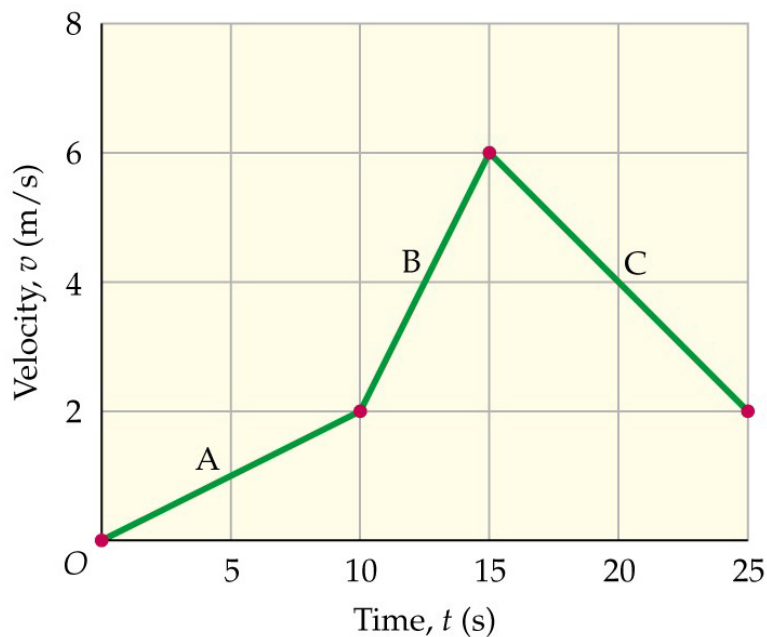
6. Three vectors $\vec{A}$, $\vec{B}$, and $\vec{C}$ add together to yield zero: $\vec{A} + \vec{B} + \vec{C} = \vec{0}$. The vectors $\vec{A}$ and $\vec{C}$ point in opposite directions and their magnitudes are related by the expression: $A = 2C$. Which one of the following conclusions is correct?

- (a) $\vec{B}$ and $\vec{C}$ have equal magnitudes and point in the same direction.
- (b) $\vec{A}$ and $\vec{B}$ point in the same direction, but $\vec{A}$ has twice the magnitude of $\vec{B}$.
- (c) $\vec{B}$ and $\vec{C}$ have equal magnitudes and point in opposite directions.
- (d) $\vec{B}$ and $\vec{C}$ point in the same direction, but $\vec{C}$ has twice the magnitude of $\vec{B}$.
- (e) $\vec{A}$ and $\vec{B}$ have equal magnitudes and point in opposite directions.

ANSWER[]

(score)	(4)
---------	-----

Questions 7–9 refer to the figure below. The figure shows the velocity-versus-time relationship for the motion of a unicyclist.



7. What is the acceleration of the unicyclist at $t = 12.5$ s?

- (a) 0.4 m/s^2
- (b) 0.2 m/s^2
- (c) -0.2 m/s^2
- (d) -0.4 m/s^2
- (e) 0.8 m/s^2

ANSWER[]

(score)	(4)
---------	-----

8. What is the average acceleration of the unicyclist over the first 20 s of motion?

- (a) 0.04 m/s^2
- (b) 0.08 m/s^2
- (c) 0.4 m/s^2
- (d) 0.8 m/s^2
- (e) 0.2 m/s^2

ANSWER[]

(score)	(4)
---------	-----

9. What is the displacement of the unicyclist over the last 15 s period (from 10 s to 25 s)?

- (a) 10 m
- (b) 20 m
- (c) 30 m
- (d) 60 m
- (e) 70 m

ANSWER[]

(score)	(4)
---------	-----

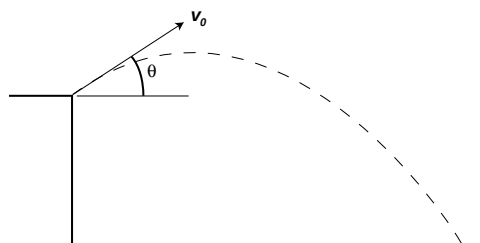
10. The engine of a boat drives it across a river that is 540 m wide. The velocity of the boat relative to the water is 5.0 m/s directed perpendicular to the current. The velocity of the water relative to the shore is 3.0 m/s
- (a) Find is the velocity of the boat relative to the shore. Give the magnitude and the angle relative to an axis parallel to the current.

(score)	(8)
---------	-----

- (b) What distance does the boat travel in the time it takes to cross the river with this velocity?

(score)	(7)
---------	-----

11. A soccer ball is kicked from the edge of a cliff which is 10 meters above a level plain with an initial velocity which is at an angle of 35° above the horizontal. 2.5 seconds later, the ball hits the level plain. Neglect any effects of air resistance.



- (a) What is initial speed of the ball?

(score)	(8)
---------	-----

- (b) What is the highest point of the path of this ball?

(score)	(8)
---------	-----

- (c) How far away from the cliff's base does the ball land?

(score)	(8)
---------	-----