AP Physics 1 **2-D Motion Practice Test** **Name**_____

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

1) The magnitude of the resultant of two vectors cannot be less than the magnitude of either of those two vectors.
A) True B) False

2) The sum of two vectors of fixed magnitudes has the greatest magnitude when the angle between these two vectors is
A) 270° B) 0° C) 90° D) 180° E) 60°

3) The sum of two vectors of fixed magnitudes has its minimum magnitude when the angle between these vectors is
A) 180° B) 90° C) 270° D) 0° E) 360°

4) If a vector $\vec{\mathbf{A}}$ has components $A_x < 0$, and $A_y > 0$, then the angle that this vector makes with the positive x–axis must be in the range
A) 90° to 180°
B) 270° to 360°
C) 0° to 90°
D) 180° to 270°
E) It cannot be determined without additional information.

5) If a vector $\vec{\mathbf{A}}$ has components $A_x < 0$, and $A_y < 0$, then the angle that this vector makes with the positive x–axis must be in the range
A) 0° to 90°
B) 90° to 180°
C) 270° to 360°
D) 180° to 270°
E) cannot be determined without additional information

6) The eastward component of vector $\vec{\mathbf{A}}$ is equal to the westward component of vector $\vec{\mathbf{B}}$ and their northward components are equal. Which one of the following statements must be correct for these two vectors?
A) The magnitude of vector $\vec{\mathbf{A}}$ must be equal to the magnitude of vector $\vec{\mathbf{B}}$.
B) The angle between vector $\vec{\mathbf{A}}$ and vector $\vec{\mathbf{B}}$ must be 90°.
C) Vector $\vec{\mathbf{A}}$ is parallel to vector $\vec{\mathbf{B}}$.
D) Vector $\vec{\mathbf{A}}$ must be perpendicular to vector $\vec{\mathbf{B}}$.
E) Vector $\vec{\mathbf{A}}$ is antiparallel (in the opposite direction) to vector $\vec{\mathbf{B}}$.

7) In an air–free chamber, a pebble is thrown horizontally, and at the same instant a second pebble is dropped from the same height. Compare the times of fall of the two pebbles.
A) They hit at the same time.
B) The thrown pebble hits first.
C) The dropped pebble hits first.
D) We cannot tell without knowing which pebble is heavier.

8) Which of the following statements are true about an object in two–dimensional projectile motion with no air resistance? (There could be more than one correct choice.)
A) The acceleration of the object is $+g$ when the object is rising and $-g$ when it is falling.
B) The speed of the object is constant but its velocity is not constant.
C) The speed of the object is zero at its highest point.
D) The horizontal acceleration is always zero and the vertical acceleration is always a non–zero constant downward.
E) The acceleration of the object is zero at its highest point.

9) For general projectile motion with no air resistance, the horizontal component of a projectile's acceleration
A) is always zero.
B) continuously decreases.
C) first decreases and then increases.
D) continuously increases.
E) remains a non–zero constant.

10) For general projectile motion with no air resistance, the horizontal component of a projectile's velocity
A) continuously decreases.
B) first decreases and then increases.
C) remains zero.
D) remains a non–zero constant.
E) continuously increases.

11) A pilot drops a package from a plane flying horizontally at a constant speed. Neglecting air resistance, when the package hits the ground the horizontal location of the plane will
A) be behind the package.
B) be in front of the package.
C) be directly over the package.
D) depend on the speed of the plane when the package was released.

12) A player kicks a soccer ball in a high arc toward the opponent's goal. At the highest point in its trajectory
A) the ball's velocity points downward.
B) both the velocity and the acceleration of the soccer ball are zero.
C) neither the ball's velocity nor its acceleration are zero.
D) the ball's acceleration points upward.
E) the ball's acceleration is zero but its velocity is not zero.

13) Mary and Debra stand on a snow–covered roof. They both throw snowballs with the same initial speed, but in different directions. Mary throws her snowball downward, at 30° below the horizontal; Debra throws her snowball upward, at 30° above the horizontal. Which of the following statements are true about just before the snowballs reach the ground below? (There could be more than one correct choice.)

A) Both snowballs will take the same amount of time to hit the ground.
B) Debra's snowball will stay in the air longer than Mary's snowball.
C) Mary's snowball will stay in the air longer than Debra's snowball.
D) Debra's snowball has exactly the same acceleration as Mary's snowball.
E) Mary's snowball has a greater downward acceleration than Debra's snowball.

14) You are trying to cross a river that flows toward the south with a strong current. You start out in your motorboat on the east bank desiring to reach the west bank directly west from your starting point. You should head your motorboat

A) directly toward the north.
B) in a general northwesterly direction.
C) directly toward the west.
D) in a general southwesterly direction.

15) A rock is thrown from the upper edge of a tall cliff at some angle above the horizontal. It reaches its highest point and starts falling down. Which of the following statements about the rock's motion are true just before it hits the ground? (There could be more than one correct choice.)

A) Its vertical velocity component is the same as it was just as it was launched.
B) Its horizontal velocity component is the same as it was just as it was launched.
C) Its speed is the same as it was just as it was launched.
D) Its horizontal velocity component is zero.
E) Its velocity is vertical.

16) The x component of vector $\vec{\mathbf{A}}$ is 8.7 units, and its y component is –6.5 units. The magnitude of $\vec{\mathbf{A}}$ is closest to

A) 9.9 units B) 7.9 units C) 12 units D) 11 units E) 8.9 units

17) The x component of vector $\vec{\mathbf{A}}$ is 5.3 units, and its y component is –2.3 units. The angle that vector $\vec{\mathbf{A}}$ makes with the $+x$–axis is closest to

A) 110° B) 340° C) 250° D) 23° E) 160°

18) When Jeff ran up a hill at 7.0 m/s, the horizontal component of his velocity vector was 5.1 m/s. What was the vertical component of Jeff's velocity?

A) 3.4 m/s B) 4.8 m/s C) 3.8 m/s D) 4.3 m/s

19) When rolled down a mountainside at 7.0 m/s, the horizontal component of its velocity vector was 1.8 m/s. What was the angle of the mountain surface above the horizontal?

A) 75° B) 15° C) 33° D) 57 °

20) A player throws a football 50.0 m at 61.0° north of west. What is the westward component of the displacement of the football?

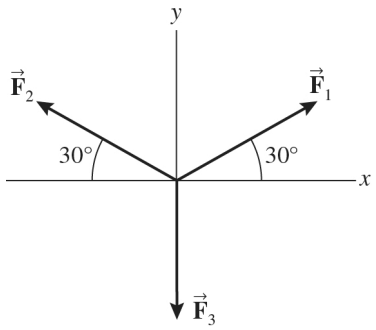
A) 64.7m B) 74.0 m C) 24.2 m D) 55.0 m E) 0.00 m

21) Three vectors, $\vec{S}$, $\vec{T}$, and $\vec{U}$, have the components shown in the table. What is the magnitude of the resultant of these three vectors?

	x component	y component
$\vec{S}$	3.50 m	–4.50 m
$\vec{T}$	2.00 m	0.00 m
$\vec{U}$	–5.50 m	2.50 m

A) 7.00 m B) 11.1 m C) 2.00 m D) 5.50 m E) 13.0 m

22) Three forces, $\vec{F}_1$, $\vec{F}_2$, and $\vec{F}_3$, each of magnitude 70 N, all act on an object as shown in the figure. The magnitude of the resultant force acting on the object is



A) 70 N. B) 210 N. C) 35 N. D) 140 N. E) 0 N.

23) A boy throws a ball with an initial velocity of 25 m/s at an angle of 30° above the horizontal. If air resistance is negligible, how high above the projection point is the ball after 2.0 s?
A) 13 m B) 50 m C) 25 m D) 43 m E) 5.4 m

24) A hockey puck slides off the edge of a horizontal platform with an initial velocity of 28.0 m/s horizontally in a city where the acceleration due to gravity is 9.81 m/s^2. The puck experiences no significant air resistance as it falls. The height of the platform above the ground is 2.00 m. What is the angle below the horizontal of the velocity of the puck just before it hits the ground?
A) 77.2° B) 12.8° C) 12.6° D) 31.8° E) 72.6°

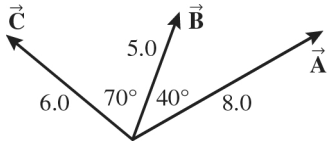
25) A fisherman casts his bait toward the river at an angle of 25° above the horizontal. As the line unravels, he notices that the bait and hook reach a maximum height of 2.9 m. What was the initial velocity he launched the bait with? Assume that the line exerts no appreciable drag force on the bait and hook and that air resistance is negligible.
A) 7.6 m/s B) 6.3 m/s C) 7.9 m/s D) 18 m/s

26) A boy throws a rock with an initial velocity of 3.13 m/s at 30.0° above the horizontal. How long does it take for the rock to reach the maximum height of its trajectory if air resistance is negligibly small and g = 9.80 m/s^2?
A) 0.282 s B) 0.160 s C) 0.441 s D) 0.313 s

27) A stone is thrown horizontally with an initial speed of 10 m/s from the edge of a cliff. A stopwatch measures the stone's trajectory time from the top of the cliff to the bottom to be 4.3 s. What is the height of the cliff if air resistance is negligibly small?

A) 77 m B) 43 m C) 91 m D) 22 m

28) The figure shows three vectors and their magnitudes and relative directions. The magnitude of the resultant of the three vectors is closest to



A) 19 B) 16 C) 7.0 D) 13 E) 10

29) The components of vectors $\vec{B}$ and $\vec{C}$ are given as follows:

$B_x = -9.2$ $C_x = -4.5$
$B_y = -6.1$ $C_y = 4.3$

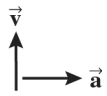
The angle (less than 180°) between vectors $\vec{B}$ and $\vec{C}$ is closest to

A) 84°. B) 77°. C) 170°. D) 10°. E) 103°.

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

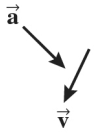
30) Shown below are the velocity and acceleration vectors for an object in several different types of motion. In which case is the object slowing down and turning to its right?

A)



B)

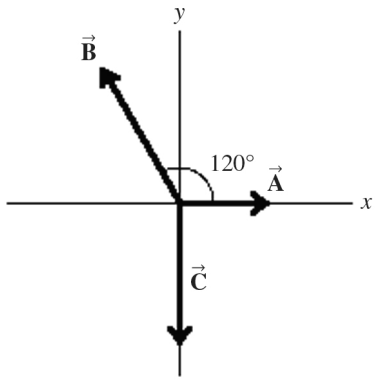
C)



D)

E)

31) Find the magnitude and direction of the resultant of the three force vectors, $\vec{\mathbf{A}}$, $\vec{\mathbf{B}}$, and $\vec{\mathbf{C}}$, shown in the figure. These vectors have the following magnitudes: $A = 5.0$ lb, $B = 7.9$ lb, and $C = 8.0$ lb. Express the direction of the resultant by specifying the angle it makes with the $+x$–axis, with counterclockwise angles taken to be positive.



32) Displacement vector $\vec{\mathbf{A}}$ is 5.5 cm long and points along the $+x$–axis. Displacement vector $\vec{\mathbf{B}}$ is 7.5 cm long and points at +30° to the $-x$–axis.

(a) Determine the x and y components of vector $\vec{\mathbf{A}}$.

(b) Determine the x and y components of vector $\vec{\mathbf{B}}$.

(c) Determine the x and y components of the resultant of these two vectors.

(d) Determine the magnitude and direction of the resultant of these two vectors.

1) B
2) B
3) A
4) A
5) D
6) A
7) A
8) D
9) A
10) D
11) C
12) C
13) B, D
14) B
15) B
16) D
17) B
18) B
19) A
20) C
21) C
22) E
23) E
24) C
25) D
26) B
27) C
28) D
29) B
30) B
31) 1.6 lb, 312°
32) (a) $A_x = 5.5$ cm, $A_y = 0$ cm (b) $B_x = -6.5$ cm, $B_y = 3.8$ cm
(c) $R_x = -1.0$ cm, $R_y = 3.8$ cm (d) 3.9 cm at 75° above the $-x$ axis