Exam 2--PHYS 201--F15

Multiple Choice
Identify the choice that best completes the statement or answers the question.

1. Consider these vectors. What is \( \mathbf{A} - \mathbf{B} \)?

\[ \mathbf{A} - \mathbf{B} = ? \]

<table>
<thead>
<tr>
<th>a)</th>
<th>b)</th>
<th>c)</th>
<th>d)</th>
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</thead>
<tbody>
<tr>
<td>( \mathbf{A} )</td>
<td>( \mathbf{B} )</td>
<td>( \mathbf{A} )</td>
<td>( \mathbf{B} )</td>
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2. Which of these are vector quantities?
I. mass
II. distance
III. velocity
IV. acceleration

a. III & IV
b. I & III
c. I
d. II, III, & IV
e. all of these

3. Vector \( \mathbf{A} \) lies in the x-y plane. At what angle, from the +x axis, will the vector \( \mathbf{A} \) have negative x- and y-components?

a. 210°
b. 120°
c. 290°
d. 30°

4. If vector \( \mathbf{A} \) has a magnitude of 12 m and vector \( \mathbf{B} \) has a magnitude of 25 m, which of these is a possible solution for the sum \( \mathbf{A} + \mathbf{B} \)?

a. 32 m
b. 9 m
c. 38 m
d. 55 m

5. A vector has a magnitude of 12 m and is 20.0 degrees above the x-axis. What is the x-component of the vector?

a. 20 m
b. 4.4 m
c. 11 m
d. 4.1 m

6. A projectile is fired at 25° above the horizontal. At the highest point in its trajectory, its speed is 100 m/s. If air resistance is ignored, the initial velocity had a horizontal component of

a. \( \frac{100}{\sin(25°)} \) m/s.
b. 100 cos(25°) m/s.
c. 100 sin(25°) m/s.
d. 100 m/s.
e. 0 m/s.

7. Two shells are fired simultaneously from the same battleship at two targets. The shells follow the trajectories shown here. Which target will be hit first?

a. More information is needed to work out the answer.
b. Target 1
c. Both targets will be hit at the same time.
d. Target 2
8. A pilot drops a package of food and water supplies from a plane that is flying horizontally at constant speed. When the package reaches the ground, the plane’s horizontal position relative to the package
a. is behind the package.
b. is unknown; more information is needed to work out the answer.
c. is in front of the package.
d. depends on the mass of the package.
e. is directly above the package.

9. A stone is thrown horizontally and follows the path XYZ shown. The direction of the velocity of the stone at point Y is shown by which of the vectors A-E?

10. An object is moving at constant velocity. Which statement is always true?
   a. There are no forces acting on the object.
   b. There is only one force acting on the object.
   c. The net force on the object is zero.
   d. There must be more than one force acting on the object.

11. The fact that a dime pulls upward on the Earth with a force equal to the weight of the dime is an example of
   a. Newton’s first law.
   b. Newton’s second law.
   c. Newton’s third law.
   d. none of the above.

12. Two objects, A and B, experience the same net force. Object A accelerates at twice the rate of object B. Therefore the
   a. mass of A is twice that of the mass of B.
   b. mass of A is four times that of the mass of B.
   c. mass of A is half that of the mass of B.
   d. mass of A is one-quarter that of the mass of B.

13. Consider this figure. The block is stationary; static friction is holding it on the plane. Which of the following equations is correct?
   I. \( F_{w \cos 60} - f_s = 0 \)
   II. \( F_w - F_N = ma \)
   III. \( F_w \cos 60 = ma_x \)
   IV. \( F_w \sin 60 = F_N \)
   a. I & IV
   b. none are correct
   c. IV only
   d. I, II, and III

14. Consider a block that is at rest on an inclined plane. The only forces acting on the block are the frictional, normal, and gravitational forces. Which of these statements best describe the normal force acting on the block?
   a. \( N > mg \)
   b. \( N < mg \)
   c. \( N = mg \)
   d. it depends on the weight of the block
Problem

15. (15 pts) A Nicholls soccer player kicks a ball with an initial speed of 20.0 m/s (50 mph) at some angle from the horizontal. The ball travels a horizontal distance of 39.5 m in 2.58 seconds. What is the maximum height of the ball?

16. (15 pts) An object with a mass of 3.4 kg has 2 forces acting on it.

   Force #1 is 12 N at 25 degrees above the +x-axis
   Force #2 is 22 N along the -y axis.

   a) Draw a freebody diagram with the forces resolved on the x- and y-axes.
   b) What is the acceleration of this object?
   c) A third force brings the object into static equilibrium. What must the magnitude and direction of that force be?
17. (25 pts) These two blocks are connected by a massless rod that is parallel to the inclined plane. The coefficient of kinetic friction between the surface and $m_1$ is 0.20; for $m_2$, the coefficient of kinetic friction is 0.10.

![Diagram of two blocks and a massless rod](image)

a) Draw free-body diagrams for both blocks with all resolved vectors. (Please draw on these axes.)

b) What is the frictional force for the first block, $m_1$?
c) What is the frictional force for the second block, $m_2$?
d) What is the tension in the rod?
e) What is the acceleration of the 2-block system?
Extra credit (5pts): Solve parts (d) and (e) by Gaussian elimination.
(Additional space on next page if necessary.)
18. (15 pts) Consider this block of 5.0 kg on a horizontal surface. The coefficient of kinetic friction is 0.1; the coefficient of static friction is 0.2.

a) Draw a freebody diagram with all resolved vectors.
b) What is the normal force acting on the block?
c) Does the object move (yes or no)? (Show your work for credit.)
d) Imagine the surface is frictionless. What is the acceleration of the block?
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Answer Section

MULTIPLE CHOICE

1. ANS: A PTS: 1
2. ANS: A PTS: 1
3. ANS: A
   HW
   PTS: 1
4. ANS: A PTS: 1
5. ANS: C PTS: 1 REF: F15-WWP
6. ANS: D PTS: 1 REF: F15-both
7. ANS: B PTS: 1 REF: F15
8. ANS: E PTS: 0 REF: F15
9. ANS: B PTS: 1
10. ANS: C PTS: 0 REF: F15
11. ANS: C PTS: 1 REF: F15
12. ANS: C PTS: 1 REF: F15
13. ANS: A PTS: 1
14. ANS: B PTS: 1 REF: F15

PROBLEM

15. ANS:
   8.26 m
   PTS: 1
16. ANS:
   .
   PTS: 1
17. ANS:
   .
   PTS: 1
18. ANS:
   .
   PTS: 1