him: 93
Ave: 72

PHYS 201 Fall 2015 Test #1 Name: KEY

A. Select the correct answer for the following multiple choice questions and write your answer in the line next to the question number. (2.0 pts each)

e 1. Today, the standard kilogram is defined in terms of
b 2. Today, the standard meter is defined in terms of
Answers for 1 & 2

a. the distance from the earth's equator to the north pole.
b. the length traveled by light in vacuum during the time interval of 1/299792458 of a second.
c. the electromagnetic waves emitted by cesium atoms
d. the standard bar made of platinum-iridium alloy
e. the standard cylinder made of platinum-iridium alloy
f. the speed of sound

e 3. The number of base units in SI:
a. 3 b. 4 c. 5 d. 6 e. 7 f. 8

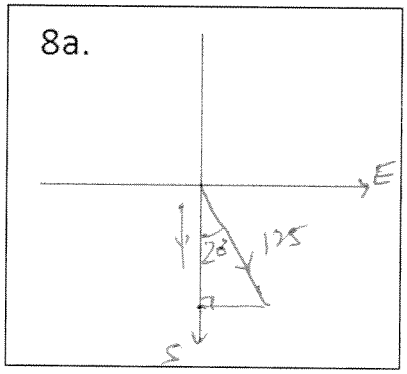
d 4. Which one of the following is not a SI base unit?
a. second b. ampere c. killogram d. killometer e. mole

d 5. What does a car speedometer measure?
c 6. What does a car odometer measure?
Answers for 5 & 6

a. average velocity b. average speed c. distance
d. instantaneous speed e. instantaneous velocity f. displacement

c 7. A particle travels along a curved path between two points P and Q as shown. The displacement of the particle does *not* depend on

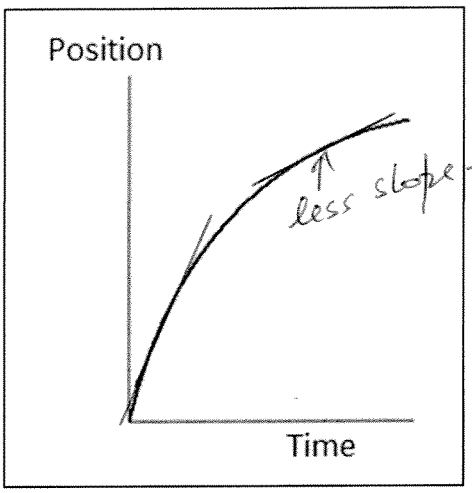
A) the location of P.
B) the location of Q.
C) the distance traveled from P to Q.
D) the shortest distance between P and Q.
E) the direction of Q from P.



e 8b. A jogger runs 125 m in a direction 20.0° east of south. Draw this vector inside the box above. What is the y-component of this displacement vector?
a. 125 m b. 118 m c. 42.8 m d. -125 m e. -118 m f. -42.8 m

e 9. The slope of the position *versus* time graph gives,
a. time b. displacement c. acceleration d. position e. velocity

b 10. For the motion described in the graph, decide whether the moving object is
a) accelerating
b) decelerating
c) moving at a constant velocity
d) moving at a constant speed
.



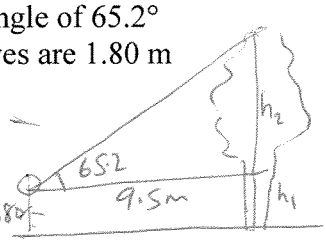
11-12) In a marathon race Chad is out in front, running due north at a speed of 4.5 m/s. John is 95 m behind him, running due north at a speed of 4.9 m/s.

d 11. What is the velocity of John relative to Chad?
a. 4.5 m/s due north b. 4.9 m/s due north c. 9.4 m/s due north d. 0.4 m/s due north

d 12. How long does it take for John to pass Chad?
a. 10.1 s b. 19.4 s c. 21.1 s d. 238 s e. 268 s

E 13. A park ranger wanted to measure the height of a tall tree. The ranger stood 9.50 m from the base of the tree; and he observed that his line of sight made an angle of 65.2° above the horizontal as he looked at the top of the tree. The park ranger's eyes are 1.80 m above the ground. What is the height of the tree?
A) 5.84 m B) 8.77 m C) 11.7 m D) 17.3 m E) 22.4 m

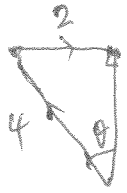
$\tan 65.2 = \frac{h_2}{9.5}$
$h_2 = 9.5 \tan 65.2$
$h_2 = 20.56$
$h = h_1 + h_2 = 22.4$



b 14. Which one of the following is a vector?
a. Distance b. Displacement c. Speed d. Time e. Mass

b 15. Which pair of the following physical quantities are zero at the highest point of the trajectory of a two dimensional projectile motion?
a. horizontal velocity and vertical velocity
b. horizontal acceleration and vertical velocity
c. vertical acceleration and vertical velocity
d. horizontal velocity and horizontal acceleration

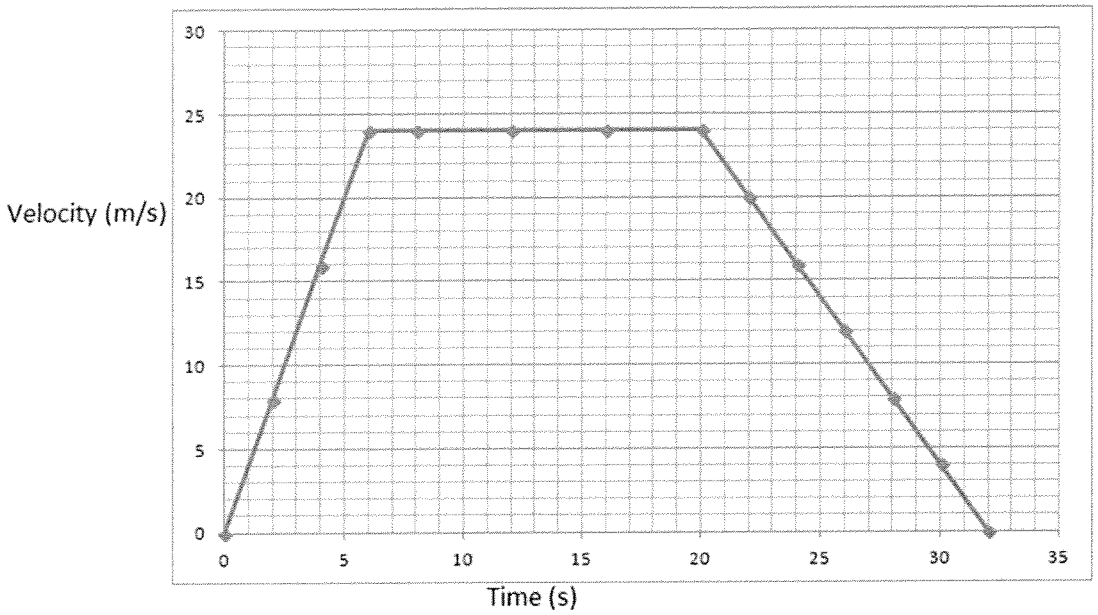
b 16. A boat that can travel at 4.0 km/h in still water crosses a river with a current of 2.0 km/h. At what angle must the boat be pointed upstream (that is, relative to its actual path) to go straight across the river?
A) 27° B) 30° C) 60° D) 63° E) 90°



$\sin\theta = \frac{2}{4} = 0.5$
$\theta = 30°$

$V_{BG} = V_{BR} + V_{RG}$
$V_{RG} = 2\ km/h \rightarrow$
$V_{BG} = 4\ km/h \uparrow$

17-23) Deal with the one-dimensional motion of an object, which is graphed below.



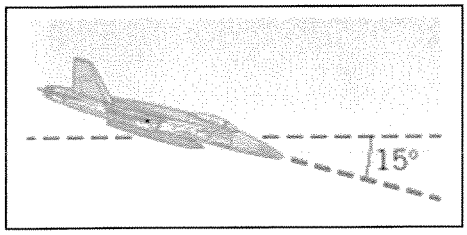
b 17. The above graph is,
a. time *versus* velocity b. velocity *versus* time

b 18. What is the instantaneous velocity of the object at 6 s?
a. 20 m/s b. 24 m/s c. 25 m/s d. 30 m/s e. 38 m/s

e 19. What is the instantaneous acceleration of the object at 5 s?
a 20. What is the instantaneous acceleration of the object at 15 s?
h 21. What is the instantaneous acceleration of the object at 25 s?
Answers for 19-21
a. 0 m/s^2 b. 1.0 m/s^2 c. 2.0 m/s^2 d. 3.0 m/s^2 e. 4.0 m/s^2
f. -0.5 m/s^2 g. -1.0 m/s^2 h. -2.0 m/s^2 i. -3.0 m/s^2 j. -4.0 m/s^2

a 22. How far the object travels during the first 6 s?
d 23. How far the object travels during the entire trip?
Answers for 22-23
a. 72 m b. 144 m c. 336 m d. 552 m e. 768 m

24-25) A plane is diving as shown below with a velocity of 120 m/s at an angle of 15^0 below horizontal, as shown.
e 24. What is the horizontal component of the plane's velocity?
b 25. What is the vertical component of the plane's velocity?
a. 31 m/s, up b. 31 m/s, down
c. 116 m/s, up d. 116 m/s, down
e. 116 m/s, East f. 116 m/s, West



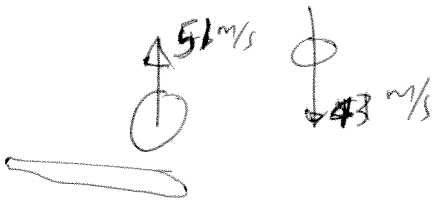
Equations of Kinematics for constant acceleration are given below:

1.	2.	3.	4.
$v = v_0 + at$	$x = \frac{1}{2}(v + v_0)t$	$x = v_0 t + \frac{1}{2}at^2$	$v^2 = v_0^{\,2} + 2ax$

3 B. Distinguish kinematics from dynamics.

Kinematics deals with the description of motion.
Dynamics deals with the effect that forces have on motion.

4 C. A pitcher delivers a fast ball with a velocity of 43 m/s to the south. The batter hits the ball and gives it a velocity of 51 m/s to the north. What was the average acceleration of the ball during the 1.5×10^{-3}s when it was in contact with the bat?



$a = \frac{v - v_0}{t} = \frac{51 - (-43)}{1.5 \times 10^{-3}}$

$a = \frac{(51 + 43)}{1.5 \times 10^{-3}} = 62{,}666\ m/s^2$

4 D. A cheetah is hunting. Its prey runs for 3.0 s at a constant velocity of +9.0 m/s. Starting from rest, what constant acceleration must the cheetah maintain in order to run the same distance as its prey runs in the same time?

Prey: $x = vt = 9\ m/s \times 3\ s = 27\ m$

Cheetah: $v_0 = 0$

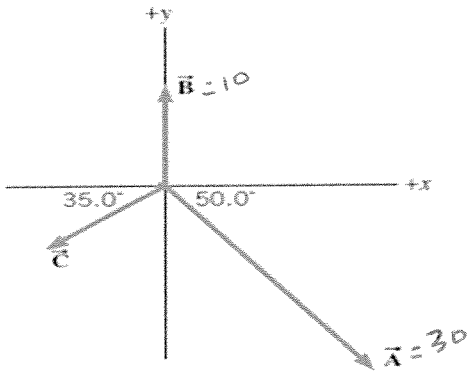
$t = 3$ Sec

$x = v_0 t + \frac{1}{2}at^2$

$27 = 0 + \frac{1}{2} \times a \times 3^2$

$27 = 4.5a \longrightarrow a = \frac{27}{4.5} = 6\ m/s^2$

8 E. For the three vectors shown below, (A = 30, B = 10, C = 15) complete the table:



Vector	X-component	Y-component
A	19.3	−23
B	0	10
C	−12.3	−8.60
A + B + C	7	−21.6

F. Equations of Kinematics for constant acceleration are given below:
(Acceleration due to gravity = 9.8 m/s^2, down. Ignore air resistance).

1.	2.	3.	4.
$v = v_0 + at$	$y = \frac{1}{2}(v + v_0)t$	$y = v_0 t + \frac{1}{2}at^2$	$v^2 = v_0^{\,2} + 2ay$

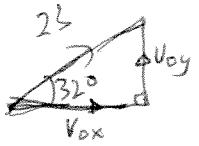
5.5 1. A penny is dropped from rest from the top of a high-rise building, 350-m high. Find the speed at which the penny will strike the ground.

$V_0 = 0$
$y = 350\ m$
$a = 9.8\ m/s^2$
$V = ?$

$V^2 = V_0^2 + 2ay$
$V^2 = 0 + 2 \times 9.8 \times 350$
$V^2 = 6860$
$V = 83\ m/s$

2. A football is kicked with an initial velocity of 23 m/s at an angle of 32^0 above ground.

4 a. What are the horizontal and vertical components of the initial velocity?



$\rightarrow\ 23\cos 32$
$V_{ox} = 19.5\ m/s$

$\uparrow\ 23\sin 32$
$V_{oy} = 12.2\ m/s$

3 b. What is the maximum height reached by the football?

$V_{oy} = 12.2\ m/s$
$V_y = 0$
$a = -9.8$
$y = ?$

$V_y^2 = V_{oy}^2 + 2ay$
$0 = 12.2^2 - 2 \times 9.8\, y$
$12.2^2 = 2 \times 9.8\, y$
$y = \frac{12.2^2}{2 \times 9.8} = 7.6\ m$

3 c. What is the hang-time of the football?

Method I:
$V_{oy} = 12.2\ m/s$
$a = -9.8\ m/s^2$
$y = 0$

$y = V_{oy}t + \frac{1}{2}a_y t^2$
$0 = 12.2t - 4.9t^2$
$4.9t = 12.2$
$t = \frac{12.2}{4.9} = 2.5\ sec$

Method II:
Find t for half
$V_y = V_{oy} + at$
$0 = 12.2 - 9.8t$
$t = \frac{12.2}{9.8} = 1.25\ sec$
hang-time $= 2 \times 1.25 = 2.5\ sec$

3 d. What is the range (horizontal distance) of the football?

$x = V_{ox}t + \frac{1}{2}a_x t^2$
$a_x = 0$
$\rightarrow\ x = V_{ox}t = 19.5 \times 2.5 = 48.5\ m$