

Provide the **best answer** to the following questions and problems. Watch your sig figs.

1) In everyday usage, we often use the word model. . . in physics, a **model** is a \_\_\_\_\_ version of a physical system that would be too \_\_\_\_\_ to analyze in full without the \_\_\_\_\_. (4 pts)

- a) small, messy, smallness                      b) simplified, complicated, simplifications  
c) complicated, simplistic, complications    d) representative, large, complications

2) How many **sig figs** does each number contain? (4 pts)

- 1) 0.00200    2) 2000    3)  $2.0 \times 10^{-6}$     4) 1.02560    5) 2150    6) 700 billion    7)  $700 \times 10^9$     8) 0.00005
- \_\_\_\_\_

3) Complete the calculations by using the **prefixes** of the units. (6 pts)

- 1) nano x Tera = \_\_\_\_\_              2) milli / pico = \_\_\_\_\_              3) Giga x micro = \_\_\_\_\_  
4) Mega / micro = \_\_\_\_\_              5)  $10^9 \times 10^5 =$  \_\_\_\_\_              6)  $10^4 / 10^{-6} =$  \_\_\_\_\_

4) The number of **meaningful digits** in a number is called the number of \_\_\_\_\_. When numbers are multiplied or divided, the number of these digits in the result is no \_\_\_\_\_ than the in the factor with the \_\_\_\_\_ of these. When you \_\_\_\_\_, the answer can have no more decimal places than the term with the \_\_\_\_\_ decimal places. (4 pts)

- a) significant digits, greater, most, add or subtract, fewest  
b) significant digits, least, fewest, multiply or divide, least  
c) precision figures, greater, most, multiply or divide, least  
d) significant digits, greater, fewest, add or subtract, fewest

5) **Trigonometry** is the mathematics that deals with the \_\_\_\_\_ of the \_\_\_\_\_ of the sides of a right triangle. The sides have names: the \_\_\_\_\_ which is opposite / the hypotenuse, the cosine which is the \_\_\_\_\_ / by the hypotenuse and the tangent which is the \_\_\_\_\_ / the adjacent. (4 pts)

- a) ratios, lengths, sine, adjacent, opposite    b) lengths, ratios, sine, adjacent, opposite  
c) ratios, lengths, sine, opposite, adjacent    d) lengths, ratios, sine, opposite, adjacent

6) Do the calculations (watch your sig figs) (3 pts)

- 1)  $\sin 73.3^\circ =$  \_\_\_\_\_              2)  $\tan^{-1}(56/34) =$  \_\_\_\_\_              3)  $1550 \sin 30^\circ =$  \_\_\_\_\_

7) How tall is a flagpole, if I am standing 20 meters from the base of the pole and sighting the top with a protractor at an angle of  $38^\circ$ ? (4 pts)

8) If vector **B** has components  $B_x$  and  $B_y$  and makes an angle  $\theta$  with the x-axis, then (4 pts)

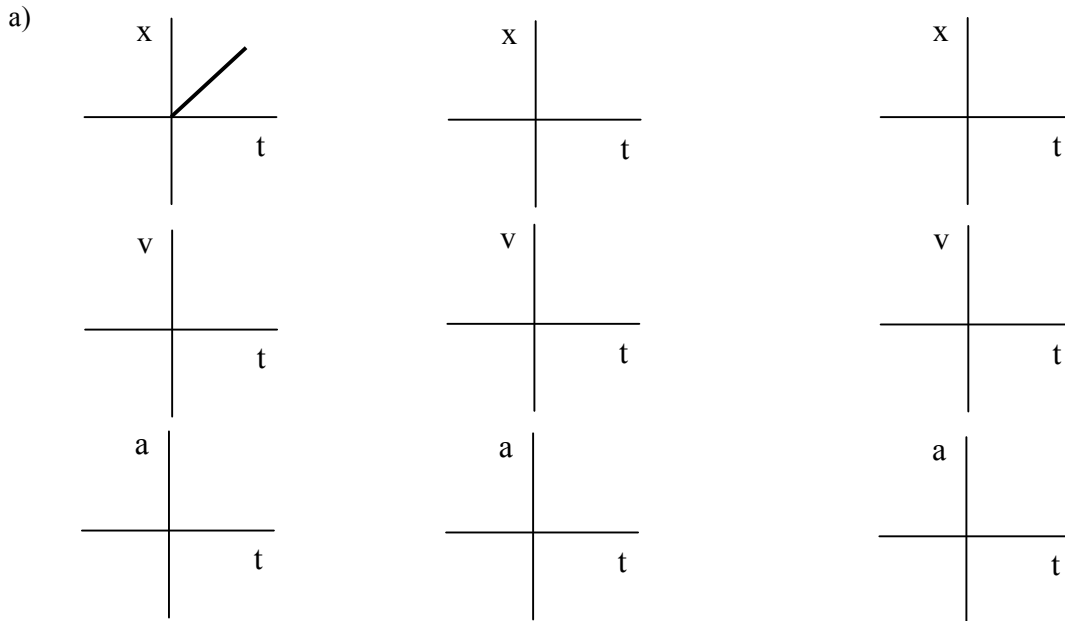
a)  $\theta = B_y/B_x$

b)  $\tan \theta = B_x/B_y$

c)  $B = B_x + B_y$  (where B is the magnitude of B)

d)  $\cos \theta = \frac{B_x}{\sqrt{B_x^2 + B_y^2}}$

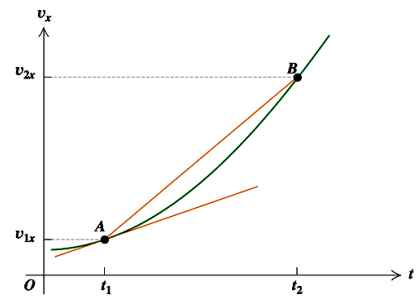
9) Draw the velocity and acceleration graphs associated with the displacement graphs. (6 pts)



10) What do the two slopes represent on the graph? (4pts)

a) \_\_\_\_\_

b) \_\_\_\_\_

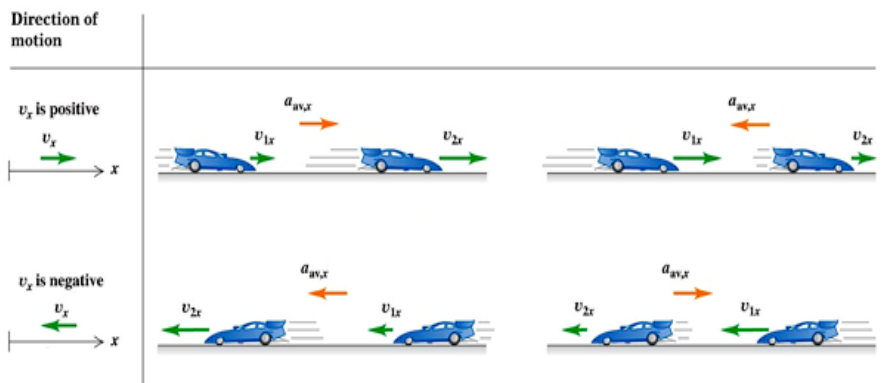


11) Fill in the diagram. (6 pts)

a) Which cars are speeding up or slowing down?

b) What are the signs of the acceleration in each situation?

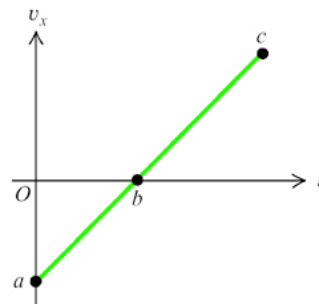
c) What is the overall equation that determines the sign of the acceleration?



12) A wildebeest is running in a straight line, which we shall call the x-axis, with the positive direction to the right. The figure below shows this animal's velocity as a function of time. (4 pts)

Which of the following statements about the animal's motion must be true?

- A. It is moving to the left between a and b and to the right between b and c.
- B. It is moving to the right between a and c.
- C. Its speed is decreasing from a to b and increasing from b to c.
- D. Its acceleration is increasing.



13) A brick is released with no initial speed from the roof of a building and strikes the ground in 1.80 s, encountering no appreciable air drag. How tall, in meters, is the building? How fast is the brick moving just before it reaches the ground? (6 pts)

tall

fast

14) The key to analyzing \_\_\_\_\_ is the fact that we can treat the x and y coordinates \_\_\_\_\_. So we can think of this motion as a combination of \_\_\_\_\_ motion with constant velocity and vertical motion with \_\_\_\_\_. (4 pts)

- a) projectile motion, separately, horizontal, constant velocity
- b) projectile motion, together, horizontal, constant acceleration
- c) freefall motion, together, vertical, constant acceleration
- d) projectile motion, separately, horizontal, constant acceleration

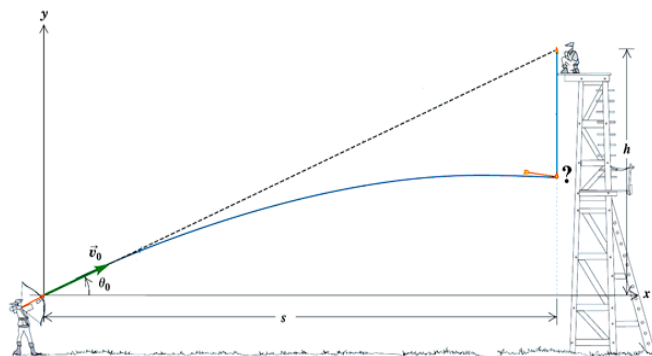
15) Write the two motion equations that describe the two paths in the diagram. (4 pts)

a) \_\_\_\_\_

b) \_\_\_\_\_

16) Why does the arrow hit the apple? (3 pts)

- a) The archer aimed the arrow at the point at which they will collide.
- b) the apple is falling faster in the y-direction but the arrow is traveling in the x-direction faster.
- c) both the arrow and the apple are falling at the same rate.
- d) both the arrow and the apple have the same horizontal velocity.



17) A golf ball is hit into the air, but not straight up, and encounters no significant air resistance. Which statements accurately describe its motion while it is in the air? (4 pts)

- a) Its horizontal velocity does not change once it is in the air, but its vertical velocity does change.
- b) On the way up, both its horizontal and vertical velocity components are decreasing; on the way down, they are both increasing.
- c) On the way up it is accelerating upward, and on the way down it is accelerating downward.
- d) Its vertical acceleration is zero at the highest point.

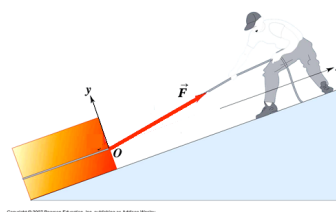
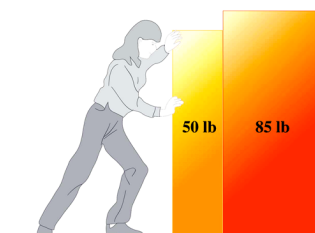
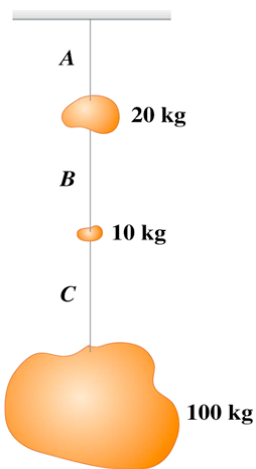
18) A tennis ball rolls off the edge of a tabletop 0.650 m above the floor and strikes the floor at a point 1.20 m horizontally from the edge of the table. Find the time of flight of the ball. Find the magnitude of the initial velocity of the ball. Find the magnitude of the velocity of the ball just before it strikes the floor. (9 pts)

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$v_0$

$V_f$

19) Draw the freebody diagram for each object next to the diagram in the situations below. (6 pts)

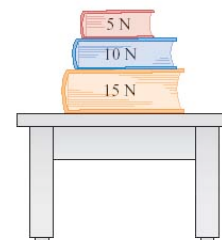


20) Three weights hang by very light wires as shown in the figure in problem 19. What must be true about the tensions in these wires? (4 pts)

- A. The tension in  $C$  is the greatest.
- B. The tension in  $C$  is the least.
- C. All three wires have the same tension because the system is in equilibrium.
- D. The tension in  $A$  is the greatest.

21) Three books are at rest on a horizontal table, as shown in the figure. The *net* force on the middle book is (4 pts)

- a) 15 N upward
- b) 15 N downward
- c) 5 N downward
- d) 0 N

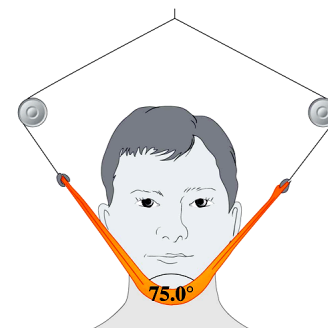


21) A person pushes two boxes with a horizontal 100 N force on a frictionless floor, as shown in the figure. Box  $A$  is heavier than box  $B$ . Which of the following statements about these boxes is correct? (4 pts)

- a) The boxes will not begin to move unless the total weight of the two boxes is less than 100 N.
- b) Box  $A$  pushes on box  $B$  with a force of 100 N, and box  $B$  pushes on box  $A$  with a force of 100 N.
- c) Box  $A$  pushes on box  $B$  harder than box  $B$  pushes on box  $A$ .
- d) Boxes  $A$  and  $B$  push on each other with equal forces of less than 100 N.



23) Due to a jaw injury a patient must wear a strap that produces a net upward force of 6.6N on his chin. The tension in the strap is the same thru-out. To what tension must the strap be adjusted to provide the necessary upward force? (4 pts)



24) **DRS Problem.** Draw a Diagram (5pts), Reason your steps (5pts) and Solve the problem (5pts).

A physics professor did daredevil stunts in his spare time. His last stunt was an attempt to jump across a river on a motorcycle. The takeoff ramp was inclined at  $49.0^\circ$ , the river was 48.0 m wide, and the far bank was 21.0 m lower than the top of the ramp. The river itself was 105 m below the ramp. You can ignore air resistance. What should his speed have been at the top of the ramp for him to have just made it to the edge of the far bank? If his speed was only half the value found in (a), where did he land?