General Physics I **Exam 1 - Chs. 1,2,3 - Motion** **Sep. 17, 2008**

Name Rec. Instr. Rec. Time

For full credit, make your work clear to the grader. Show the formulas you use, the essential steps, and results with correct units and correct number of significant figures. Partial credit is available if your work is clear. Point values are given in parenthesis. Use g = 9.80 m/s^2. Exact conversions: 1 inch = 2.54 cm, 1 ft = 12 in., 1 mile = 5280 ft. Prefixes: p=10^{-12}, n=10^{-9}, $\mu = 10^{-6}$, m=10^{-3}, c=10^{-2}, k=10^3, M=10^6, G=10^9, T=10^{12}.

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1. (2) Which of the following is true for any scientific theory?

a) The theory, once developed, never changes.
b) The theory can be proven correct, by some experiments.
c) The theory comes from someone's creative ideas and imagination.
d) All of the above.
e) None of the above.

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2. (8) Using a ruler, Elaine measures a rectangular sheet of paper, and finds it to have a width of 21.5 cm and a height of 27.9 cm. The uncertainties for each number are ±0.1 cm.

a) (4) How large is the percent uncertainty in the measurement of the width of the paper?

b) (4) How large is the area of the paper, in cm^2? Give your answer using scientific notation, with the correct number of significant figures.

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3. (6) There are many mountain peaks in Colorado as high as 14,500 feet above sea level. Using the exact conversions, 1 inch = 2.54 cm, 1 foot = 12 inches, how high are those mountains, in meters?

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4. (6) A U.S. gallon is a volume of 3.78 liters, where 1000 liters = 1000 L = 1 m^3. How many gallons would it take to fill up a water tank that is a circular cylinder of height 2.00 m and radius 0.500 m? [Hint: The volume of the cylinder is $V = \pi R^2 H$.]

5. (12) Jim (21 years old) is going to run a marathon (about 42 km or 26 miles). Make order of magnitude (rough) estimates of

a) (6) The number of strides he will make during the whole race: (lifting a foot, bringing it forward and back to the ground is a stride)

b) (6) The volume of air (in liters) that he will breathe in during the race.

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6. (12) A long freight train travelling at 120 km/h (towards the east on a straight track) needs a distance of 1.6 km to brake to a stop.

a) (6) Find the acceleration that is required, in m/s^2 (also give its direction).

b) (6) How much time does it take for the train to stop?

Name_____ Rec. Instr._____, Rec. Time_____

7. (14) On a straight highway, a car is moving initially at speed of 26.0 m/s. To pass another car, it accelerates at 3.80 m/s^2 for 5.00 s, and then decelerates at -3.80 m/s^2 for 5.00 s to get back to the original speed.

a) (6) What was the top speed of the car while passing?

b) (8) How far down the highway did the car travel during the entire 10.00 s it took to pass? [Hint: The average velocity could be helpful.]

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8. (14) In a large desert, a hiker first sets out walking due south at 5.0 km/h for 2.0 hours. Then he turns to the east and walks at 4.0 km/h for 3.0 hours.

a) (6) Find the magnitude (in km) of the hiker's net displacement from his starting position.

b) (4) Give the direction of his net displacement using the compass directions, like "32° W of N."

8. c) (4) What was the hiker's average **speed**, in km/h?

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9. (26) A baseball player is practicing to strengthen her throwing arm. She throws a ball up at some angle above the horizontal, so that its initial velocity has components (v_{x0}, v_{y0}). She then runs 22.0 m forward on level ground to catch the ball 2.90 s later at the same altitude it was released from.

a) (2) During the 2.90 s, which has the greater magnitude average **velocity**?

a. The ball. b. The player. c. Neither. Their average velocity magnitudes are the same.

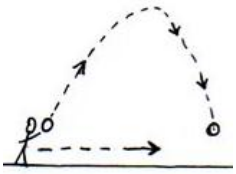
b) (2) During the 2.90 s, which has the greater average **speed**?

a. The ball. b. The player. c. Neither. Their average speeds are the same.

c) (2) **T** **F** During the ball's flight, its acceleration is constant.

d) (2) **T** **F** At its peak altitude, the ball's velocity is zero.

e) (6) How high above the release point did the ball go?



f) (6) What was the horizontal component of the ball's initial velocity, v_{x0}?

g) (6) What was the vertical component of the ball's initial velocity, v_{y0}?