Study Guide (Physics 2014, Midterm I)

Important points to remember

- Maximum Points: 100; Duration: One hour (5:30-6:30 pm, Feb 10th (Thursday), 2005)
- Contributes 12% of the COURSE GRADE
- Rooms: PS 141, 101, and 110
- THE TEST MAY consist of Multiple choice, fill in the blanks, True/False type questions, and problems similar to your homeworks

Formula sheet, constants, and conversion factors if any, necessary to evaluate the quantities will be provided to you. YOU SHOULD KNOW HOW TO USE THEM. You should be conversant with relations not given in the formula sheet, but used in class. The formula sheet to be given to you in the TEST is available to you on the course web page http://physics.okstate.edu/babu/2014

Chapter 1: Concepts of Motion

- Motion diagrams - construction of both physical and pictorial representations
- Be sure that you can interpret a given motion diagram
- Be able to define vectors and scalars and distinguish them
- Be able to define and distinguish between motion variables such as position, displacement, velocity and acceleration
- You should be comfortable with changing units and handling significant figures
- Be aware of orders of magnitude

Chapter 2: Kinematic Equations of Motion

- Distinguish between uniform and nonuniform motion
- Importance of instantaneous velocity and its mathematical representation
• Be able to read and interpret graphs (Position versus time graph and velocity versus time graph)

• Finding velocity from a position-time graph

• Finding displacement from a velocity-time graph

• Define uniform and nonuniform accelerations

• The three kinematic equations of motion

• Be conversant with using the kinematic equations of motion in determining displacement($\vec{s}$), velocity($\vec{v}$), acceleration($\vec{a}$), and time ($t$)

• Define instantaneous acceleration

• Finding acceleration from velocity-time graph

• Finding velocity from acceleration-time graph

Chapter 3: Vectors and Coordinate Systems

• Difference between component vectors, and components of a vector

• Decomposition of a vector into its components

• Graphical addition of vectors

• Addition of vectors by their components

• Determining both magnitude and direction of the resultant of two vectors

• Law of cosines

Sample Problems

Chapter 1

Q1: A weight lifter can bench press 120 kg. How many milligrams (mg) is this?
A) 1.20 ×10⁸ mg B)1.20 ×10⁹ mg C)1.20 ×10⁷ mg D)1.20 ×10⁶ mg
Q2: A car is traveling at 35.0 mph. What is its speed in m/s?
A) 15.6 m/s B) 9.8 m/s C) 24.5 m/s D) 37.1 m/s

Q3: \((1.7 \times 10^6)^{-\frac{1}{2}}\) expressed in scientific notation
A) \(7.7 \times 10^{-1}\) B) \(1.3 \times 10^3\) C) \(1.3 \times 10^{-5}\) D) \(1.3 \times 10^4\)

Q4: What is \(\frac{0.365}{0.49}\) to the proper number of significant figures?
A) 0.74 B) 0.745 C) 0.7449 D) 0.7

Q5: A weather rocket was shot up in the air. It reached 1000 m high before stopping completely. Draw the physical representation of the problem statement. Also draw the corresponding pictorial representation.

Q5: Estimate the number of characters (typed letters or numbers) in a 125 page book? Assume double space text.
(NOTE: You also need to guess an average word length to solve this problem)

Q6: Derivative of position at an instant of time is ____________

Chapter 2

Q1: If the fastest you can safely drive is 65 mph, what is the longest time you can stop for dinner if you must travel 510 mi in 10.5 h total?
A) 2.7 h B) 3.0 h C) 2.2 h D) Need more data

Q2: The position of the object is given by the equation \(x = 4.1t^3 - 2.2t^2 + 1.7t\) where \(x\) is measured in meters and \(t\) in seconds. Find the instantaneous velocity, and instantaneous acceleration at \(t = 2.8s\).

Q3: Negative acceleration is called deceleration because the object is slowing down (True/False)

Q4: The acceleration is always the slope of the “velocity versus time” graph and the velocity is always the slope of the “position versus time” graph (True/False)

Q5: Your car speedometer indicates ______ speed of your car

Q6: On a graph that shows position on the vertical axis and time on the horizontal axis, a straight line with a positive slope represents A) a constant positive acceleration
B) a constant negative acceleration (or deceleration)
C) zero velocity
D) a constant positive velocity
E) a constant negative velocity

Q7: A ball is thrown straight up from an initial position \( x_0 = 1.00 \text{ m} \) above the ground level with an initial velocity \( v_0 \). It reaches the maximum height after 2.00 s, and then drops down to the ground. The value of free fall acceleration is \( g = 9.80 \text{ m/s}^2 \).
(a) What is the condition on the velocity at maximum height of the ball?
(b) Determine the initial velocity of the ball.
(c) Calculate the maximum height the ball would raise to.
(d) How much time did the ball spend in the air?

Q8: An object starts from rest and runs down a sloping track section onto a second level as shown below. Which velocity-time graph below best represents the motion of the object on both sections? (see Figure 1)

Q9: The velocity-time graph is shown (see Figure 2) for a particle having initial position \( x_0 = 0 \text{ m} \) at \( t_0 = 0 \text{ s} \).
(a) At what time or times is the particle found at \( x = 35 \text{ m} \)? Work with the geometry of the graph, not the kinematic equations.
(b) Draw a motion diagram for the particle.
(c) Using kinematic equations, calculate time or times at which the particle can be found at \( x = 35 \text{ m} \).

Chapter 3

Q1: If you walk 42 m north, then make a turn of 60° North of East and walk another 45 m, determine the direction of your displacement? Make sure that you give the magnitude and direction (relative to the East).

Q2: Let \( \vec{A} = 3\hat{i} + 4\hat{j} - 2\hat{k} \) and \( \vec{B} = 2\hat{i} + 2\hat{j} + 2\hat{k} \). Which of the following corresponds to \( \vec{C} \) such that \( \vec{A} - 5\vec{B} + \vec{C} = 0 \)
A) \( 7\hat{i} + 6\hat{j} + 12\hat{k} \)
B) \( 6\hat{i} - 8\hat{j} + 3\hat{k} \)
C) \( 12\hat{i} - 8\hat{j} + 3\hat{k} \)
D) \( 12\hat{i} - 3\hat{j} - 2\hat{k} \)

Q3: What are the x- and y- components \( C_x \) and \( C_y \) of vector \( \vec{C} \) in the figure (see Figure 3)?
Figure 1

(A) (B) (C) (D)