

Name\_\_\_\_\_

Hour\_\_\_\_\_

## Study Guide: Physics: 1<sup>st</sup> Semester - 2017

*For the final exam, bring – pencil, calculator, one side of one page of handwritten notes*

### Unit 1: Chapter 1 – A Physics Toolkit, Chapter 2 – Representing Motion, Chapter 3 – Accelerated Motion

Vocabulary (define the following words) Note: You do not have to write these out. Just be sure you know what they are and understand the equations behind any definitions

SI systems and units

Accuracy

Scientific notation

Displacement

Average velocity

Average acceleration

Kinematic equations

Graphs of  $d - t$ ,  $v - t$ ,  $a - t$

precision

significant figures

Average speed

Instantaneous velocity

Instantaneous acceleration

Free fall

Coordinate system

1. Name the basic units of the SI system
2. In the SI system, what does the prefix milli-, micro-, nano-, kilo-, mega-, giga- mean?
3. What is the most basic science?
4. Dr. B tells you that he knows a teacher that is 5 meters tall. You do not believe him. Why?
5. Convert the following:
  - a. 25.0 miles to km.
  - b. 15 days to seconds.
  - c. 6 miles, 551 yards into meters.
  - d. 465 g to kg
  - e. 18.65 km into mm
6. Write 23,401 in scientific notation
7. What is the best representation in standard form of  $8.50 \times 10^{-3}$
8. How many significant figures in the number 1090 ?
9. Calculate
  - a)  $16.2 + 5.008 - 13.48$
  - b)  $6.21 \times 4.7$
10. What are the units for distance, displacement, velocity, speed, acceleration, and time?
11. How are distance, velocity, and acceleration related to each other graphically?
12. The slope of a velocity versus time graph gives what quantity?
13. The slope of a distance versus time graph gives what quantity?

14. Draw  $x$  vs  $t$ ,  $v$  vs  $t$ , and  $a$  vs  $t$  graphs that shows constant, positive, non-zero velocity
  
15. Draw  $x$  vs  $t$ ,  $v$  vs  $t$ , and  $a$  vs  $t$  graphs that shows zero velocity
  
16. Draw  $x$  vs  $t$ ,  $v$  vs  $t$ , and  $a$  vs  $t$  graphs that shows a linearly increasing velocity
  
17. Draw  $x$  vs  $t$ ,  $v$  vs  $t$ , and  $a$  vs  $t$  graphs that shows a constant, negative, non-zero velocity
  
18. What is the acceleration of a car that travels in a straight line at a constant speed of 100 m/s?
  
19. For a ball thrown straight up into the air, what is the ball's velocity at the top of the path?
  
20. If a 2 kg physics book and a 0.02 kg marker pen are both dropped from the same height, ignoring air resistance, which would reach the ground first?
  
21. For all ball thrown straight up into the air, what is the ball's acceleration at the top of the path?
  
22. What is the acceleration due to gravity on earth?
  
23. You are throwing a ball up from the ground. You notice a point where the ball has zero velocity. What can you say about the ball's velocity and acceleration this point?
  
24. The ball is falling back towards your hand. What can you say about the ball's velocity and acceleration now?
  
25. A car goes from 15 m/s to 25 m/s in 5 seconds. What is the acceleration? How far has the car traveled in the 5 seconds?

26. What is the acceleration of an object that starts at rest, and ends up with a velocity of 100 m/s after covering a distance of 25 m? How long, in time, did it take to cover the 25 m?
27. You throw a ball upward with an initial velocity of 24 m/s. How long is it in the air? How high does it get? What is the velocity just before it returns to your hand? At the very top, what is its acceleration? (Assume the ball starts and ends at ground level)
28. You drop a ball from a 125 m tall cliff. Just after you drop it, what is its acceleration? What is the velocity of the ball 1.3 s after you drop it? How long does it take to hit the ground?

**Unit 2: Chapter 5 Section1 - vectors, Chapter 6 Section 1 – projectile motion**

Vocabulary (define the following words) Note: You do not have to write these out. Just be sure you know what they are and understand the equations behind any definitions

Vectors and scalars	Algebraic representation (of vectors)
Component	Magnitude and direction
Graphical representation	Resultant
Vector resolution	SOHCAHTOA
Pythagorean Theorem	Trigonomification (vector resolution)
Vector components	Resultant
x motion and y motion	Projectile motion
Time of Flight (TOF)	Time to Top (TTT)
Range	Maximum height

29. What is the difference between a scalar and a vector?
30. What are the components of a vector that has a magnitude of 1.5 m at an angle of  $35^\circ$  with respect to the positive x axis
31. Draw two vectors. Then draw the resultant vector from adding these two vectors together.
32. You fire a bullet horizontally and drop a golf ball from the same height. Which hits the ground first? Why?
33. What shape best describes the path of a projectile?

34. For a projectile shot horizontally off a cliff, draw an  $x$  vs  $t$ ,  $v_x$  vs  $t$ ,  $a_x$  vs  $t$ ,  $y$  vs  $t$ ,  $v_y$  vs  $t$ , and  $a_y$  vs  $t$  graphs
35. Consider a cannon ball that is fired with an initial velocity of 250 m/s at an angle of  $52^\circ$ . Calculate the cannonball's range, time of flight, and maximum height.
36. Consider throwing your physics book off a 50 m tall cliff. If you throw it with a horizontal speed of 15 m/s, calculate how long until it hits the ground, and how far away from the cliff it will land.

**Unit 3: Chapter 4 – forces on one dimension, Chapter 5 Section 2 – Friction, Chapter 5 Section 3 – Force and motion in two dimensions**

Vocabulary (define the following words) Note: You do not have to write these out. Just be sure you know what they are and understand the equations behind any definitions

Contact and non-contact forces	mass
Inertia	$N_1$ , $N_2$ , and $N_3$
Free body diagram	Weight and mass
$F_N$ (Normal force)	Apparent weight
$F_f$ (Friction)	static friction
Kinetic friction	$F_t$ (Tension)

37. What is Newton's First Law? Give an example of each part of Newton's First Law

38. What is Newton's Second Law?

39. What is Newton's Third Law? Using Newton's Third Law, identify the action-reaction forces acting on a book that is sitting at rest on a tabletop.

40. Two horizontal forces, 225 N to the right, and 165 N to the left act on a 120 kg object. What is the net force and acceleration on the object

41. Which has more inertia, a mouse or an elephant?
42. On earth, a scale shows your weight to be 585 N. What is your mass?
43. Using the same information above, what would the scale read, if you were accelerating upward at  $4.0 \text{ m/s}^2$ ? Accelerating downward at  $2.5 \text{ m/s}^2$ ?
44. Assume you have a mass of 100 kg on earth. On the moon,  $g_{\text{moon}} = 1.67 \text{ m/s}^2$ , what is your mass on the moon? What is your weight on the moon?
45. You are pushing a 50 kg crate across a rough floor with a force of 100 N and at a constant velocity of 5.0 m/s. What is the frictional force?
46. You throw a ball against a wall and it strikes the wall with a force of 25 N. What force does the wall exert back on the ball?
47. Ms. Sieber, with a mass of 40 kg and Dr. B with a mass of 100 kg, are on a slippery surface. They push off from each other; Dr. B has an acceleration of  $1.0 \text{ m/s}^2$ . What is Ms. Seiber's acceleration? (Hint: by N3 they have the same force, use N2 to calculate acceleration)

## Unit 4: Chapter 6 Section 2 – circular motion, Chapter 7 - Gravitation

Vocabulary (define the following words) Note: You do not have to write these out. Just be sure you know what they are and understand the equations behind any definitions

Stability

Center of mass

Period of circular motion

Centripetal

Centripetal force

NULG

Circular orbit

Astronomical Unit (AU)

Orbital radius

balance

velocity for circular motion

centripetal acceleration

unbanked curves

Kepler's Laws (K1, K2, and K3)

Orbital period

geosynchronous orbit



48. Which filing cabinet shown above will topple over? Why?

49. What does the word centripetal mean?

50. A 60 kg runner is moving at a speed of 8.8 m/s around a circular track of radius 25 m.

- What is the period?
- What is the frequency?
- What is the centripetal acceleration of the runner?
- What is the centripetal force acting on the runner?
- What specific force is responsible for this force?

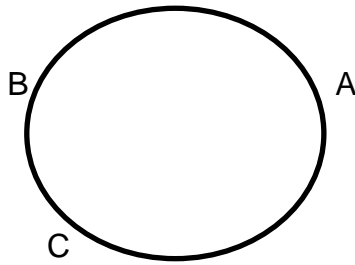
51. What centripetal force is responsible for a car making a turn around a curve?

52. What centripetal force is responsible for the earth orbiting the sun?

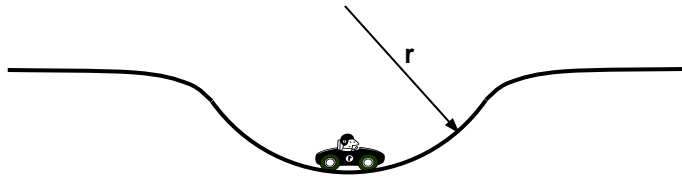
53. What centripetal force is responsible for making a yo-yo whirl around in a circle?

54. What centripetal force is responsible for making the cup of water stay on the board while it is whirling around in a vertical circle?

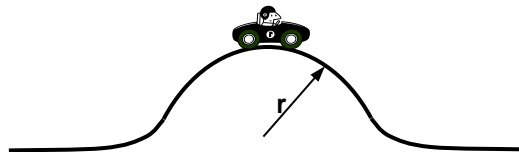
55. A car of mass 2400 kg is moving around a flat curve. Draw a picture of the situation, ID all forces, define a coordinate system, write  $F_{\text{net}}$  equation for all relevant directions. The frictional force is 80% of the car's weight. If the radius of the track is 32.5 m, what is the maximum speed the car can move without sliding off the banked curve?



56. In the above picture, at each point, draw in an acceleration vector and a velocity vector



57. Consider a car driving in the valley as shown above. Indicate on the drawing above the acceleration vector and velocity vector.



58. Consider a car driving at the peak of a hill as shown above. Indicate on the drawing above the acceleration vector and velocity vector.

### Kepler problems

59. What is the shape of planetary orbits?

60. Draw a picture of the earth orbiting the sun. On that picture, draw an arrow that represents the earth's velocity and an arrow that represents the earth's centripetal acceleration.

61. An asteroid revolves around the sun with an average orbital radius equal to 2 AU. What is the period of the asteroid in earth years?
62. The planet Xena orbits the sun with a period of 10,500 years. What is its orbital radius
63. Compare the speed of Halley's comet when it is nearest to the sun and furthest from the sun.
64. Consider a star that is not our sun. In this pretend solar system, Planet A has an orbital radius of 1.76 AU and an orbital period of 2.50 years.
- What is the Kepler constant for this star?
  - What is the mass of this star?
  - Planet B, in this pretend solar system has an orbital radius of 7.9 AU. What is Planet B's orbital period?
  - Planet C, in this pretend solar system has an orbital period of 155 years. What is Planet C's orbital radius?