Name_____ Hour____

Study Guide: Physics: 1st Semester - 2018

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	precision
Accuracy	significant figures
Scientific notation	
Displacement	Average speed
Average velocity	Instantaneous velocity
Average acceleration	Instantaneous acceleration
Kinematic equations	Free fall
Graphs of d – t, v – t, a – t	Coordinate system

1. Name the basic units of the SI system Velocity = m/s, Acceleration = m/s^2, time = sec, distance = m, mass = kg
2. In the SI system, what does the prefix milli-, micro-, nano-, kilo-, mega-, giga- mean?

3. Convert the following:
   a. 25.0 miles to km. 40.3 km b. 15 days to seconds. 1,296,000 sec c. 6 miles, 551 yards into meters. 10159.8 m
   d. 465 g to kg .456 kg e. 18.65 km into mm 1.865×10^7 mm

4. Write 23,401 in scientific notation 2.3401×10^4

5. What is the best representation in standard form of 8.50×10^{-3} .0085

6. How many significant figures in the number 1090? 3

7. Calculate a) 16.2+5.008-13.48 7.7 b) 6.21 X 4.7 29

8. What are the units for distance m, displacement m, velocity m/s, speed m/s, acceleration m/s^2, and time sec?

9. How are distance, velocity, and acceleration related to each other graphically? Position vs. time graph, flat line or linear = constant velocity or no acceleration, curved line = acceleration

10. The slope of a velocity versus time graph gives what quantity? acceleration

11. The slope of a distance versus time graph gives what quantity? velocity

12. Draw x vs t, v vs t, and a vs t graphs that shows constant, positive, non-zero velocity

13. Draw x vs t, v vs t, and a vs t graphs that shows zero velocity

14. Draw x vs t, v vs t, and a vs t graphs that shows a linearly increasing velocity

15. Draw x vs t, v vs t, and a vs t graphs that shows a constant, negative, non-zero velocity

16. What is the acceleration of a car that travels in a straight line at a constant speed of 100 m/s? zero

17. For a ball thrown straight up into the air, what is the ball's velocity at the top of the path? 0 m/s

18. 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? Same time

19. For all ball thrown straight up into the air, what is the ball's acceleration at the top of the path? $-10\ m/s^2$

20. What is the acceleration due to gravity on earth? $-10\ m/s^2$

21. 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? 0 m/s, $-10\ m/s^2$

22. The ball is falling back towards your hand. What can you say about the ball's velocity and acceleration now? Same velocity magnitude, opposite vector direction, acceleration is constant.

23. 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? $2\ m/s^2$

24. 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? $200 m/s^2$, .5 seconds

25. 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) 4.8 seconds, 28.8 m, -24 m/s, $-10\ m/s^2$

26. 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? $-10\ m/s^2$, -13 m/s, 5 seconds

Unit 2: Chapter 5 Section1 - vectors, Chapter 6 Secction 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
Component
Graphical representation
Vector resolution
Pythagorean Theorem
Vector components
x motion and y motion
Time of Flight (TOF)
Range

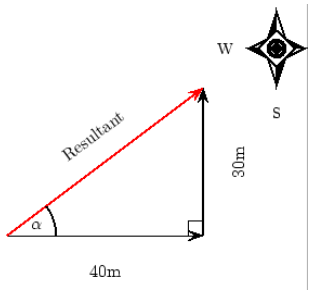
Algebraic representation (of vectors)
Magnitude and direction
Resultant
SOHCAHTOA

Resultant
Projectile motion
Time to Top (TTT)
Maximum height

27. What is the difference between a scalar magnitude and a vector magnitude & direction?

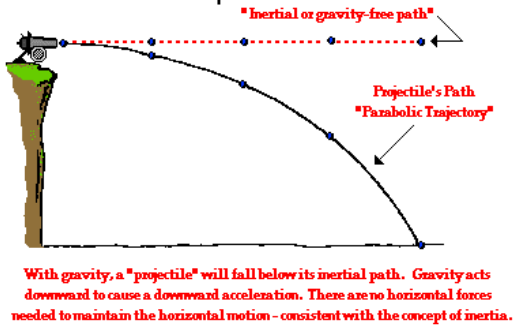
28. What are the components of a vector that has a magnitude of 1.5 m at an angle of 35° with respect to the positive x axis 1.3 (x) & .86 (Y)

29. Draw two vectors. Then draw the resultant vector from adding these two vectors together.

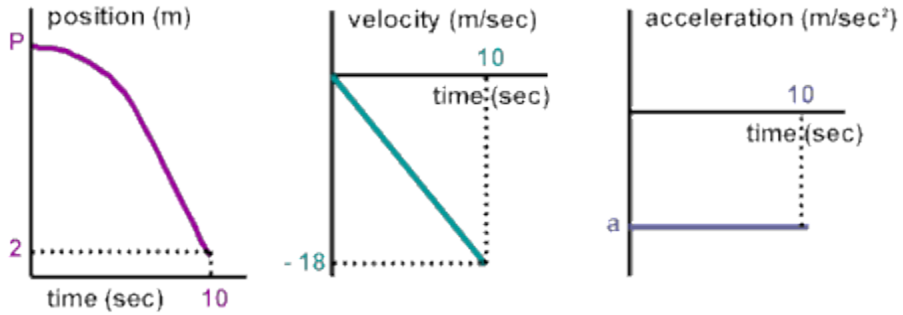


30. You fire a bullet horizontally and drop a golf ball from the same height. Which hits the ground first? Why? Same, only gravity accelerates both down.

31. What shape bests describes the path of a projectile?



32. 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



33. Consider a cannon ball that is fired with an initial velocity of 250 m/s at an angle of 52°. Calculate the cannonball's range, time of flight, and maximum height.

Initial velocity (Y) = 197 m/s, 154 m/s (x)

34. 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.

3.2 seconds, 47 meters

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

Contact and non-contact forces	mass
Inertia	N1, N2, and N3
Free body diagram	Weight and mass
F_N (Normal force)	Apparent weight
F_f (Friction)	F_t (Tension)

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

Constant motion with F net = 0, rest or constant motion with constant direction.

36. What is Newton's Second Law? F net = m x a

37. 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. Equal but opposite forces

38. 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 60 N right, .5 m/s^2

39. Which has more inertia, a mouse or an elephant? Elephant

40. On earth, a scale shows your weight to be 585 N. What is your mass? 58.5 kg

41. Using the same information above, what would the scale read, if you were accelerating upward at 4.0 m/s^2? Accelerating downward at 2.5 m/s^2? 819N upwards, 438.8N Downwards

42. Assume you have a mass of 100 kg on earth. On the moon, g_{moon} = 1.67 m/s^2, what is your mass on the moon? What is your weight on the moon? 100 kg, 167 N

43. 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? 100N

44. 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? 25N

45. 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 m/s^2. What is Ms. Seiber's acceleration? (Hint: by N3 they have the same force, use N2 to calculate acceleration) 2.5 m/s^2

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

Stability	balance
Center of mass	
Period of circular motion	velocity for circular motion
Centripetal	centripetal acceleration
Centripetal force	unbanked curves
NULG	Kepler's Laws (K1, K2, and K3)
Circular orbit	
Astronomical Unit (AU)	Orbital period
Orbital radius	geosynchronous orbit

46. Which filing cabinet shown above will topple over? Why? 3rd, center of mass is not over its support.

47. What does the word centripetal mean? Center seeking

48. A 60 kg runner is moving at a speed of 8.8 m/s around a circular track of radius 25 m.
    a. What is the period? 17.8 sec
    b. What is the frequency? .006 Hz
    c. What is the centripetal acceleration of the runner? 3.1 m/s^2
    d. What is the centripetal force acting on the runner? 186N
    e. What specific force is responsible for this force? Friction

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

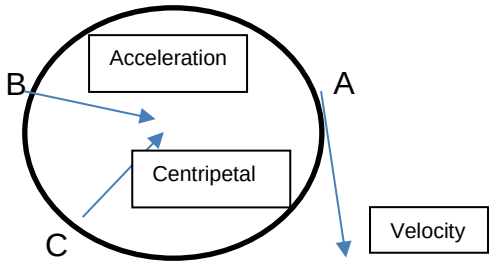
50. What centripetal force is responsible for the earth orbiting the sun? gravity

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

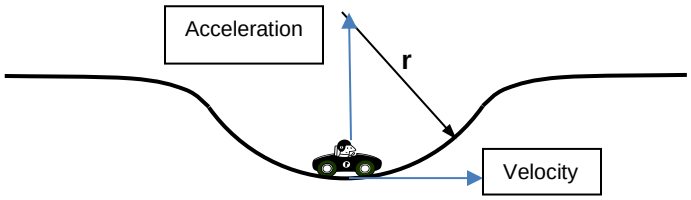
52. What centripetal force is responsible for making the cup of water stay on the board while it is whirling around in a vertical circle? Normal Force

53. 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_{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? 16.1 m/s

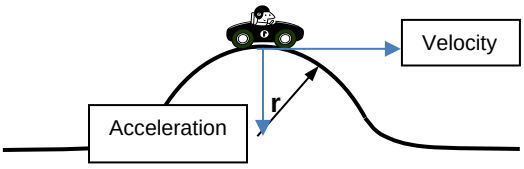
Fg = 24000N
Fn = 24000N
Ff = 19200N



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



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

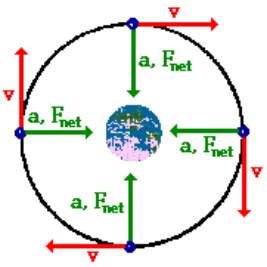


56. Consider a car driving at the peak of a hill as shown above. Indicate on the drawing above the acceleration vector and velocity vector.

Kepler problems

57. What is the shape of planetary orbits? ellepitcal

58. 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.



Satellites encounter inward forces and accelerations and tangential velocities.

59. 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? 2.8 years

60. The planet Xena orbits the sun with a period of 10,500 years. What is its orbital radius
479 au

61. Compare the speed of Halley's comet when it is nearest to the sun and furthest from the sun.
Closer = faster

62. 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.
    a. What is the Kepler constant for this star? .87

    b. What is the mass of this star? 1.75×10^{30}

    c. Planet B, in this pretend solar system has an orbital radius of 7.9 AU. What is Planet B's orbital period? 23.8 years

    d. Planet C, in this pretend solar system has an orbital period of 155 years. What is Planet C's orbital radius? 27 au