Physics: 1st Semester Exam
Review Questions

The focus of the exam is breadth of material more so than depth. However, take the time to carefully review the main emphasis of each chapter.

Mathematical Toolkit

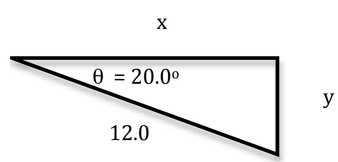
Ideas:

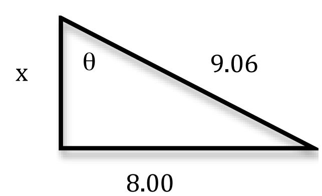
1. What are the two kinds of vector representations? What information is given in each kind?
2. What are the differences between vectors and scalars? (Think of some examples of each)

How many significant figures are in each number?

3. ________ 210
4. ________ 2.100
5. ________ 0.008750

Find any missing values for the triangles below.

6. 

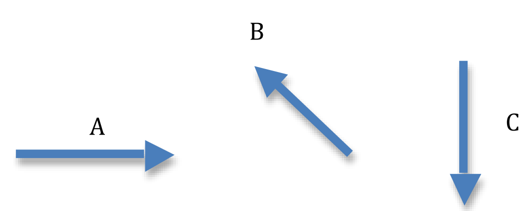
7. 

Change the following coordinates from polar coordinates to rectangular or vice-versa

8. (6.00, -3.00)
9. (5.34, 110°)

Based on the vectors (A, B, and C) given to the right, sketch the following combinations.

10. A + B
11. B + 2C – A
12. C - 2B
13. C – A – B - C



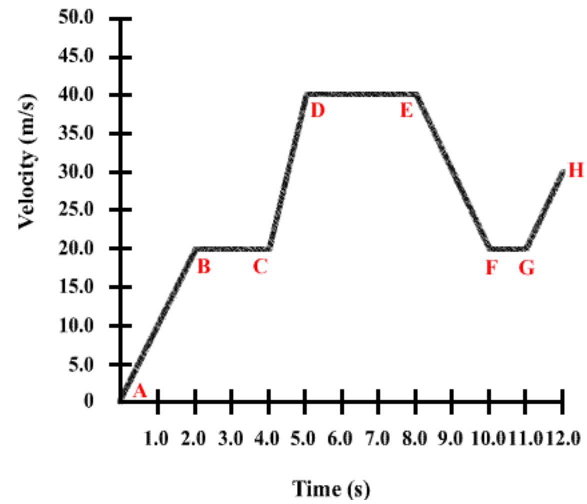
Kinematics in One-Dimension

Ideas

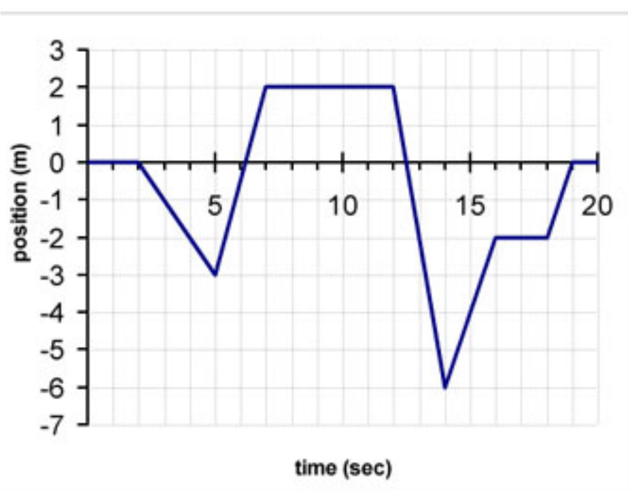
14. What is the difference between speed and velocity, distance and displacement?
15. *What information can be gained by graphical analysis? (Look back at the 'Fancy E')
16. Velocity/Acceleration Combinations. Specifically, what motion is produced if you have negative velocity, positive acceleration or negative velocity, negative acceleration?
17. If you throw an object straight into the air, what is zero at the highest point of the object's path?

Graphical Analysis 1

Use the Velocity vs. Time graph to the right to answer questions 18 - 20



18. In which segments is the velocity constant?
19. In which segments does the object have a negative acceleration?
20. In which segments is the acceleration the same?



Graphical Analysis 2

Using the Position vs. Time graph to the left to answer questions 21 - 23

21. During which segments is the velocity zero?
22. What is the velocity of the object from t = 12 to t = 14 seconds?
23. Which segment shows a larger, positive velocity? (From t = 5 s to t = 7 s OR t = 18 s to t = 19 s)

Kinematics

24. A runner moves with an average velocity of 6.02 m/s. What is his or her displacement after 137 seconds?
25. A bicycle can brake with an acceleration of -0.50 m/s^2. How far will this bike travel before coming to a stop if it has an initial velocity of 13.5 m/s?
26. A ball is thrown upwards with an initial velocity of 25.0 m/s. How long will it take for the ball to reach the highest point of its motion? What values go to zero at the highest point?
27. A flowerpot falls from rest from a height of 25.0 m above the ground. How long does it take the flowerpot to hit the ground?

Kinematics in Two Dimensions (Projectile Motion)

Ideas

28. One ball is dropped and the other thrown horizontally outwards with an initial velocity, but if they begin at the same height, which will hit the ground first?
29. What things can be assumed in any projectile motion problem?
30. What can be assumed about the initial velocity of a ½ projectile?
31. How is a ½ projectile different from a full projectile?
32. What happens to the velocity of a full projectile at the highest point of its motion?

½ Projectiles

33. A movie stunt driver speeds horizontally off a 50.0 m tall cliff. The car lands 90.0 m horizontally from the base of the cliff.
    A. What was the initial velocity of the car? (Consider, what kind or kinds of velocity does a ½ projectile initially have?)

34. A stone is thrown horizontally with a velocity of 5.00 m/s from the top of a cliff that is 78.4 m high.
    A. How long does it take the stone to reach the bottom of the cliff?
    B. How far from the base of the cliff does the stone hit the ground?

Full Projectile

35. A football is kicked with an initial velocity (v_o) of 23.5 m/s at an angle of 66.0^o above the horizontal. Find the following:
    A. The initial x- and y-velocities
    B. The maximum height
    C. The hang time or time of flight
    D. The range

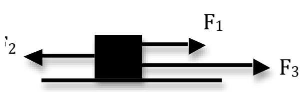
Forces and Newton's Three Laws of Motion:

Ideas

36. What is inertia?
37. What are Newton's Three Laws of Motion?
38. What is the difference between equilibrium and non-equilibrium? How can an object be in equilibrium?
39. What is the difference between mass and weight?
40. How is static friction different than kinetic friction?

Forces:

41. A 7.5 kg box is given an acceleration of 1.2 m/s^2. What was the value of the force applied?



42. A 5.00 kg toy is being pulled by several different children as shown in the figure to the left. One child pulls with a force F_1 = 3.7 N. A second child pulls with a force F_2 = 4.4 N. And finally a third child pulls with a force F_3 = 6.1 N. Based on all acting forces, what would be the acceleration of the toy?

43. A little boy is pulling on a toy train that drags behind him at a **constant velocity.** The mass of the toy is 6.50 kg and the boy is pulling with a force of 44.0 N directed upwards by 33.0°.

    Equilibrium or Non-equilibrium ΣF_x: ____________________

    Equilibrium or Non-equilibrium ΣF_y: ____________________

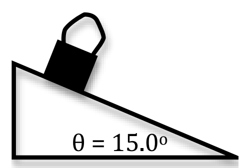
    A. What is the normal force?
    B. What is the coefficient of kinetic friction?

44. A 5.4 kg bag of groceries sits at rest on a ramp inclined by 15.0°.

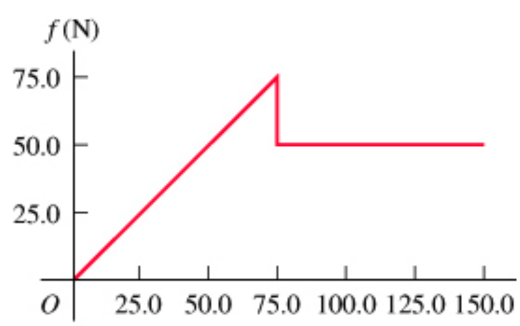
    Equilibrium or Non-equilibrium ΣF_x: ____________________

    Equilibrium or Non-equilibrium ΣF_y: ____________________

    A. Draw the FBD and the 'adjusted' FDB
    B. Calculate the force of gravity as well as the x- and y- components of the force of gravity.
    C. What is the value of the normal force?
    D. What is the value of the force of friction keeping the bag from sliding?
    E. What kind of friction is present? (Static or Kinetic)



45. Label the friction graph below indicating the region or regions that display static, maximum static, and kinetic friction. How might an object transition between these different kinds of friction?



Work, Power, and Energy

Ideas

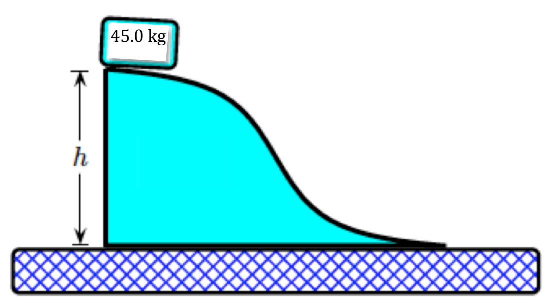
46. What does work tell us about a force?
47. What does power tell us about a force?
48. In what scenario is work positive? In what scenario is it negative? Or zero?
49. What is the difference between kinetic energy and gravitational potential energy?
50. What does it mean that energy is conserved?

Work, Power, and Energy

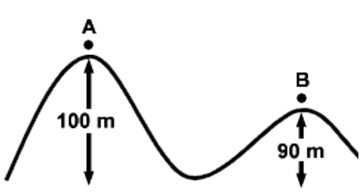
51. You are trying to move a piano that has a mass of 50.0 kg. You push with 100.0 N of force while a frictional force of 48.0 N opposes you. The piano manages to move 3.90 m.
    A. Calculate the work done by your force.
    B. Calculate the work done by friction
    C. Calculate the work done by gravity
    D. Calculate the work done by the normal force
    E. Calculate the net or total work done on the system.

52. You are trying to drag a box of Christmas decorations towards the garage to be put away for the year. You are using 50.0 N of force directed upwards by 30.0°. The box slides 4.0 m horizontally along the floor.
    A. How much work is done by your force?
    B. If all of this happens in 8.25 s, how much power does your force have?

53. A child and sled (combined mass of 45.0 kg) slide down a frictionless hill that is 7.34 m tall. Assuming that energy is conserved and the child begins from rest, what is their velocity at the bottom of the hill?



54. A snowboarder begins at rest at point A, what will be his velocity at point B assuming energy is conserved?



Impulse, Momentum, and Collisions

Ideas

55. If we want to change the momentum of an object, what is needed?
56. How can the Impulse-Momentum Theory be used to explain why we 'tuck and roll' when falling a significant distance?
57. What does the conservation of momentum tell us?
58. What are the three kinds of collisions we studied? What is conserved in each?

Impulse-Momentum Theory

59. A truck (mass = 1,210 kg) has a momentum of 5,600 $kg \cdot \frac{m}{s}$. What is the truck's velocity?

60. A soccer player accelerates a 0.55 kg soccer ball from a velocity of 4.30 m/s to a velocity of 16.7 m/s in a time of 0.25 s.
    A. What is the change of momentum of the soccer ball?
    B. What is the force given to the soccer ball?

61. Charlie (mass = 65.0 kg) is using a spear gun (mass = 2.00 kg) to hunt for fish. Both Charlie and the spear gun are initially at rest. He sees a fish! He shoots the spear, giving it a velocity of 15.0 m/s. How much velocity does Charlie have?

62. Two carts with masses of 10.0 kg and 2.50 kg are both moving to the right. The 10.0 kg cart has an initial velocity of 6.00 m/s and the 2.50 kg cart, 3.00 m/s. The two collide and are stuck together following the collision. What is the common final velocity of the carts?

Numerical Answers:

Mathematical Toolkit

3. Sig Figs = 2
4. Sig Figs = 4
5. Sig Figs = 4

6. x = 11.3
   y = 4.10
7. x = 4.25
   θ = 62.0°

8. (6.00, -3.00) → (6.71, -26.6°)
9. (5.34, 110°) → (-1.83, 5.02)

Kinematics in One-Dimension

18. Segments BC, DE, and FG
19. Segment EF
20. BC, DE, and FG have an acceleration of 0 m/s^2, Segments AB and GH have an acceleration of 10 m/s^2

21. Velocity is zero from (t = 0 to t = 2 s) (t = 7 to t = 12 s) and (t = 16 to t = 18 s)
22. v = -4 m/s
23. The segment from t = 5 to t = 7 s is a larger, positive velocity

24. Displacement = 825 m
25. x ≈ 182 m
26. t = 2.55 s
27. t = 2.26 s

Kinematics in Two-Dimensions

33. There is no initial velocity in the y-direction, v_x = 28.2 m/s
34. A.) t = 4.00 s
    B.) x = 20.0 m
35. A.) v_x = 9.56 m/s and v_{oy} = 21.5 m/s
    B.) y_{max} = 23.6 m
    C.) t = 4.39 s
    D.) x = 42.0 m

Force and Newton's Three Laws of Motion

41. F = 9.0 N
42. A = 1.08 m/s^2
43. ΣF_x = Equilibrium ΣF_y = Equilibrium
    A.) F_N = 39.7 N
    B.) μ_k = 0.93
44. ΣF_x = Equilibrium ΣF_y = Equilibrium
    A.) (FBD and 'adjusted' FBD)
    B.) F_g = 52.9 N
    F_{gx} = 13.7 N F_{gy} = 51.1 N
    C.) F_N = 51.1 N
    D.) F_f = 13.7 N
    E.) Static Friction

Work, Power, and Energy

51. A.) W = 390 J
    B.) W ≈ -187 J
    C.) W = 0 J
    D.) W = 0J
    E.) W_{net} ≈ 203 J
52. A.) W = 173 J
    B.) P = 21.0 W
53. v ≈ 12.0 m/s
54. v = 14 m/s

Impulse, Momentum, and Collisions

59. v = 4.63 m/s
60. A.) $\Delta p = 6.82\ kg\cdot\frac{m}{s}$
    B.) F = 27.3 N
61. v_f = -0.462 m/s
62. v_f = 5.40 m/s