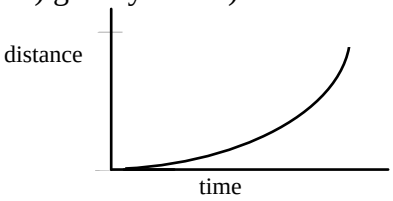
Honors Physics Second Semester Exam Study Packet

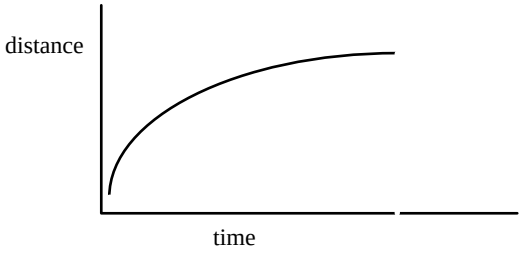
1. What value can be determined from the slope of a distance vs. time graph?
   a) velocity b) acceleration c) gravity d) total distance e) displacement

2. Which of the following defines the line on the graph shown?



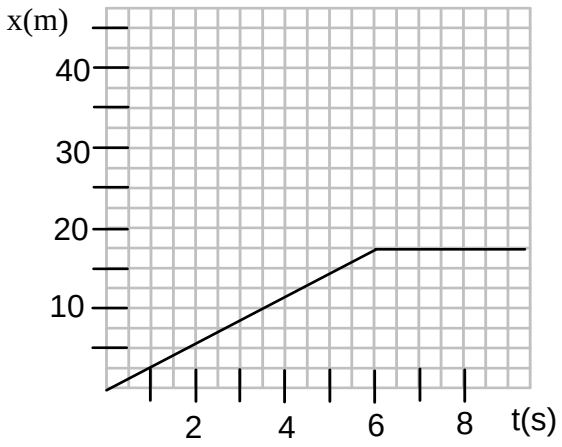
   a) constant velocity
   b) constant acceleration
   c) decreasing velocity
   d) slowing down

3. What does the graph shown indicate about the object in motion?



   a) It has a constant velocity
   b) It is speeding up
   c) It is slowing down
   d) It is not moving
   e) none of these

4. For the following distance vs. time graph:



   a) What is the average velocity between 0 and 6 seconds? (2.9m/s)
   b) What is the average velocity between 6 and 8 seconds? (0m/s)
   c) How far has the object travelled in 5 seconds? (15m)

5. A rocket is launched with an initial velocity of 75 m/s at a 27^o angle.
   a) How high up does the rocket go? (59m)
   b) What is its speed at the peak of its trajectory? (66.8 m/s)
   c) How much time passes before it hits the ground? (6.95s)

6. A ball is thrown horizontally with an initial velocity of 10 m/s off the roof of a building. What time will it take for the ball to reach the ground 20 meters below? (2.02s)

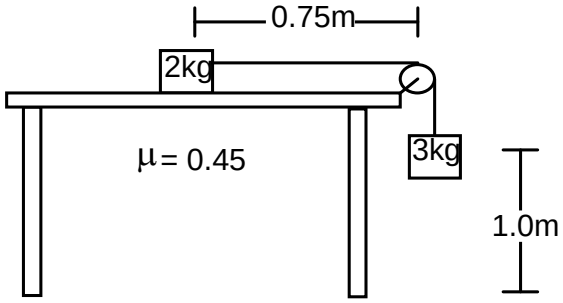
7. What minimum speed must a roller coaster have at the top of a 15 meter loop in order to remain on the track? (12.12m/s)

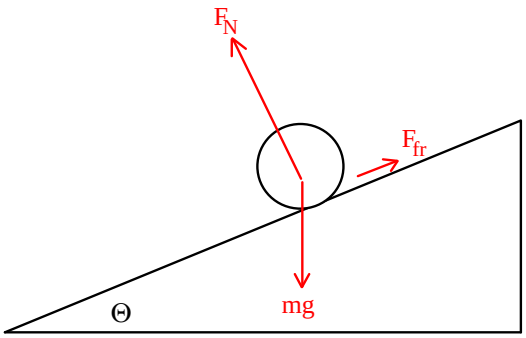
8. A 15 gram dart is pushed into a spring-loaded dart gun and the spring device compressed 5.0 cm before it is shot at a 27^o angle, landing 15 meters away on the same level it was shot.
   a) What was the initial velocity of the dart? (13.5 m/s)
   b) What was the kinetic energy of the dart? (1.37J)
   c) What was the spring constant of the toy gun? (1090 N/m)

9. A 25 kg child runs up a flight of stairs a vertical distance of 3.5 meters in 5 seconds.
   a) How much work did he do? (858 J)
   b) What was his change in potential energy? (858 J)
   c) What power did he generate? (171.5 W)

10. A rock is thrown horizontally off the top of a cliff 120 m high, landing 25 m from the base.
   a) How much time passed before the ball hit the ground? (4.95 s)
   b) What is the initial velocity of the ball in the x and y directions? (5.05 m/s)
   c) What was the initial and final horizontal acceleration of the ball after the throw? (a_x=0)

11. What value can be determined from the slope of a velocity vs. time graph?
    a) velocity b) acceleration c) gravity d) total distance e) displacement
12. What force acts on a 1200 kg car that accelerates from 0 to 25 m/s in 8 seconds? (3750 N)
13. A 65kg junior on a skateboard pushes off an 87kg senior (who remains standing) with a force of 15 N. What was the force of the senior on the junior? (15 N, Newton's 3rd Law)
14. A roller coaster reaches the top of the steepest hill with a velocity of 2.0m/s. It then descends the hill that is angled at an average angle of 48° and is 45 meters long. What will its speed be when it reaches the bottom if the coefficient of kinetic friction between the wheels and the track is 0.12? (24m/s)
15. Consider the system shown:
    a) What causes the system to move? (gravity on the 3kg block)
    b) What resists movement in the system? (friction on the 2kg block)
    c) What is the acceleration of the system? ($4.1\ m/s^2$)
    d) How long does it take the 3kg mass to reach the floor? (0.7 s)





16. Label the forces acting on the ball:
    a) as it rolls down the ramp
    b) as it slides down the ramp
17. 2 pendulums are of equal length but have different masses.
    a) How does the period of the heavier pendulum compare to that of the lighter pendulum? (the periods will be equal, mass does not affect the period of a pendulum)
    b) How do their frequencies compare? (frequencies also equal)
    c) At what point is the KE of a pendulum greatest? (at the lowest point)
    d) At what point is the PE of a pendulum equal to the maximum KE? (at the top of the swing)
18. A spring is stretched a length of 10 cm when a 1.5 kg mass is hung from it.
    a) What is the spring constant of the spring? (147 N/m)
    b) What will the period be if it is stretched another 5 cm and released? (0.63s)
    c) What equation will describe the motion of the spring-mass system? ($x = A2\pi ft$)
    d) What will be the speed of the mass when it is 2cm beyond the equilibrium point? (0.45 m/s)
19. A 6500 Kg open railroad car coasts along with a constant speed of 9.3 m/s on a level track. Rain begins to fall vertically and fills the car at a rate of 3.50 kg/min. Ignoring friction on the track,
    a) What is the speed of the car after 1½ hours? (8.87 m/s)
    b) What caused the change in speed of the car? (momentum is always conserved)

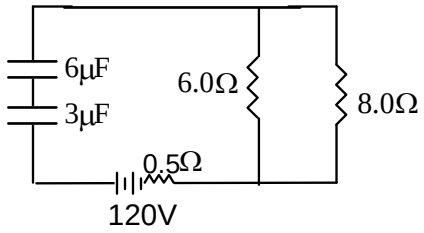
20. A 25 gram dart strikes and becomes embedded in a 0.75kg block of soft wood placed on a horizontal \ surface in front of the dart gun. When the gun is shot at point blank range into the block of wood, the wood slides a distance of 2.5 meters before the force of friction stops it. The coefficient of kinetic friction between the wood and the surface is 0.75
    a) What was the velocity of the wood just after it was struck by the dart? (6.06 m/s)
    b) What was the muzzle velocity of the dart? (188m/s)
    c) What is the kinetic energy of the wood/dart system? (14.23 J)

21 A 25g lead bullet is tested by firing it into a fixed block of wood with a mass of 0.75kg. If the block and the bullet absorb all the energy, and the temperature of each rises by 0.2^{o}C The specific heat of lead is 130 J/kg^{o}C and the specific heat of wood is 1700 J/kg^{o}C.
    a) What was the entering speed of the bullet? (143m/s)
    b) Had the block not been fixed, but had been on a rough surface where $\mu = 2.25$, how far would the block and bullet slide before coming to a stop? (0.83m)
    c) If the block had been resting on the edge of a table .75 meters high, how far from the base of the table would it have landed? (1.8m)

22. Two objects collide and bounce off each other. Kinetic energy
    a) is definitely conserved b) is definitely not conserved
    c) is conserved only of the collision is elasticd) is conserved only if there was no friction

23. What is the radial equivalent for force? (torque)
24. What is the radial equivalent for mass? (moment of inertia)
25. What thermodynamic process occurs when:
    a) A gas expands at 1 atmosphere, to twice its volume at constant temperature. (isothermal)
    b) A gas expands to twice its volume as it is heated from 20^{o}C to 50^{o}C at constant pressure. (isobaric)
    c) A gas is heated from 20^{o}C to 50^{o}C while the volume is held constant. (isochoric)
    d) A gas expands when the internal energy increases, but no heat is exchanged. (adiabatic)
26. What is the Kelvin equivalent of: 99^{o}F? 34^{o}C? (310 K, 307 K)
27. What is the Celsius equivalent of 68^{o}F? 156 K? (20^{o}C -117 K)
28. What is the specific heat of a substance if 3.2 kg absorbs 1500 J of heat to raise its temperature 25^{o}C? (18.75 J/kg^{o}C)
29. A lightening bolt transfers 12.0 C of charge to the earth through a potential difference of 23kV
    a) How much energy was dissipated in the flash? (276 kJ)
    b) How many liters of water could be brought to boiling from 15^{o}C if all the energy was dissipated as heat? (0.78 L)
30. A balloon is given a charge of 3.2x10^{-12} C. How many electrons has it lost? (20,000,000 e)
31. What is the potential between two 2500nF capacitor plates that each hold 6.2x10^{-6}C of charge? (2.48V)
32. What will be the resistance of the 150 Watt light bulb in a 120 V circuit? (96Ω)
33. A 0.25 kg hollow ball with a radius of 0.25 m and a moment of inertia of 2/3 MR^{2}, accelerates from 5 RPM to 10 RPM in 8 seconds.
    a) What is its initial angular speed? (0.42 rad/s)
    b) What is its average angular acceleration? (0.065 rad/s^{2})
    c) What is the final linear speed? (0.26 m/s)
34. How many kilowatts of power will a 5.0 Ω resistor draw from a 110 V line? (2.42kW)

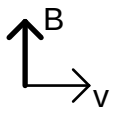
35. Evaluate the circuit shown below:



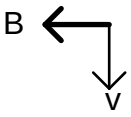
a) Find the net resistance of the circuit immediately after the switch is closed? (3.93Ω)
b) Find the net capacitance of the circuit. (2μF)
c) What maximum current flows through the circuit? (30.5 A)
d) What maximum current flows over the 8.0Ω resistor? (13.1 A)

36. What is the strength of the magnetic field 15 cm from a wire carrying a 15 A current? ($2x10^{-5}$T)

37. Using the right-hand rule, find the direction of force on a positive charge moving with velocity v in magnetic field, B as shown below:



(Out of the paper (O))



(into the paper (X))

(Right)

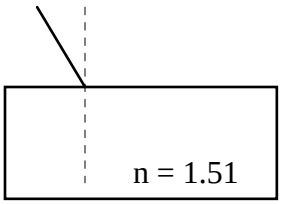
(Up)

38. A transformer has 2500 turns in the primary coil and 150 turns in the secondary. If the input voltage is 120V and the output current is 5 A, what is the secondary voltage and the primary current? (7.2 V, 0.3 A)

39. A + 3.8nC charge moving perpendicular to a 3.32T magnetic field experiences a force of 0.058N.
a) What is the path of the charge? (a circle)
b) How fast is it moving? ($4.6x10^{6}$)
c) What is the energy of the charge in eV, if it weighs 13pg? (0.137J or $8.6x10^{7}$ eV)
d) What is the radius of the circular path of the charge? (4.74m)

40. Put these in the proper order from longest to shortest wavelength:
Ultraviolet light, infrared light, gamma rays, radio waves, microwaves, x-rays, visible light light rays of red, green, orange, yellow, blue, violet
(radio, micro, infrared, ROYGBIV, ultraviolet, x-ray, gamma ray)

41. Trace the path of a beam of light as it reflects off and refracts through and emerges from the plastic block shown. The incident angle is 32^{o}:



a) What is the speed of light in the block? ($1.99x10^{8}$m/s)
b) What is the reflected angle? (32^{o})
c) What is the refracted angle? (20.5^{o})

42. What is the critical angle of light for a lucite-to-air interface? (n_{lucite} = 1.51, n_{air} = 1.00)

43. Where are each of the following commonly found?
a)Diverging lenses (glasses for near-sighted people)
b) Diverging mirrors (security mirrors)
c) Converging lenses (magnifying glasses or glasses for far-sighted people)
d) Converging mirrors (makeup mirrors)

44. An object 12.0 cm tall is placed 8.0 cm in front of a 15.0 cm focal length converging lens.
    a) Find the image distance (di = -17 cm)
    b) Calculate the magnification (M = 2.14)
    c) State the following about the image formed:
        i. Is it real or virtual? (virtual)
        ii. Is it magnified or reduced? (magnified)
        iii. Is it upside down or right side up (RSU)
45. White light is viewed through multiple diffraction gratings spaced 6.8×10^{-6}m apart. A rainbow is seen on a screen to the right of the light, 1.5 meters from the viewer, and the violet fringe is measured at exactly 9.3 cm from the light.
    a) What is the velocity of the white light? (3×10^{8} m/s)
    b) What is the velocity of the violet light? (3×10^{8} m/s)
    c) What is the wavelength of the violet light? (421.6 nm)
    d) What is the frequency of the violet light? (7.110^{14} m/s)
    e) If the light were viewed through diffraction gratings spaced 7.5×10^{-6}m apart, what color of light would be observed at the 20cm mark? (you wouldn't see light, these are microwaves)
46. What kind of image can be created from:
        a) a plane mirror (RSU same size)
        b) a converging mirror or lens (RSU and larger, USD and larger, smaller or same size)
        c) a diverging mirror or lens (RSU and smaller)
47. Light of wavelength 575 nm falls on a double-slit and the third order bright fringe is seen at an angle of 68.7^{o}. What is the separation between the double slits? (1.85×10^{6} m)
48. What happens to the speed of a planet as it gets closer to the sun? (it speeds up)
49. What happens to the angular momentum of a planet as it gets closer to the sun? (momentum is always conserved)
50. At speeds that approach the speed of light:
    a) what happens to time? (Time slows by the factor ($t' = \frac{t}{\sqrt{1 - \frac{v^2}{c^2}}}$))
    b) What happens to length? (length increases by ($l' = l\sqrt{1 - \frac{v^2}{c^2}}$)
    c) What happens to mass? (momentum increases)
51. Define the following: frictional force, normal force, resultant force, gravitational force, torque, Moment of inertia, frequency, period, capacitor, diode, electron volt, diffraction, refraction, polarization, total internal reflection, critical angle,
52. Know units for: displacement, velocity, acceleration, amplitude, frequency, period, time, angular velocity, current, electric charge, heat energy, momentum, force, kinetic energy, loudness, intensity, power, magnetism, electromotive force, resistance, magnetic flux, work, wavelength, index of refraction, coefficient of friction, capacitance, electric potential, torque, moment of inertia
53. Know the contributions or experiments of the following people:
    Aristarchos, Ptolemy, Galileo, Kepler, Brahe, Maxwell, Michaelson-Morely, Young, Einstein, Compton, Davisson and Germer

54. **Know the names of these equations:**

$\frac{1}{2}mv^2$ $B = \frac{\mu_O I}{2\pi R}$ v = v$_o$ + at $\Delta x = v_o t + \frac{1}{2}at^2$ $t = \sqrt{\frac{2\Delta y}{g}}$

$R = \frac{v_o^2 \sin 2\Theta}{g}$ $v^2 = v_o^2 + 2a\Delta x$ $(m_1 + m_2)v_i = m_1 v_1 + m_2 v_2$ $Fg = G\frac{m_1 m_2}{r^2}$

Q = mcΔT $T = 2\pi\sqrt{\frac{l}{g}}$ $m_1 v_1 + m_2 v_2 = (m_1 + m_2)v_f$) F = ma

V = IR $\frac{mv^2}{r}$ Energy = qV $Emf = \frac{-NBA}{t}$ $t' = \frac{t}{\sqrt{1 - \frac{v^2}{c^2}}}$

$Fe = k\frac{q_1 q_2}{r^2}$ F = Δp/Δt Δp = m Δv W$_{fr}$ = mgμd (on a flat surface)

PE = mgh U$_{sp}$ = 1/2 kx^2 FΔt = m(v-v$_o$) F$_{sp}$ = kx

C = Kε_oA/d V = Ed W = qEd $V = k\frac{Q}{r}$ Q = CV

mλ = dsinΘ mλ = dΔy/L mgcos$\Theta\mu$ PV = nRT