IMPORTANT FACTS TO KNOW

Mechanics

1. Weight (force of gravity) decreases as you move away from the earth by distance squared.
2. Mass and inertia are the same thing.
3. Constant velocity and zero velocity means the net force is zero and acceleration is zero.
4. Weight (in newtons) is mass x acceleration (w = mg). **Mass is not weight!**
5. Velocity, displacement [s], momentum, force and acceleration are vectors.
6. Speed, distance [d], time, and energy (joules) are scalar quantities.
7. The slope of the velocity-time graph is acceleration.
8. At zero (0) degrees two vectors have a resultant equal to their sum. At 180 degrees two vectors have a resultant equal to their difference. From the difference to the sum is the total range of possible resultants.
9. Centripetal force and centripetal acceleration vectors are toward the center of the circle while the velocity vector is tangent to the circle.
10. An unbalanced force (object not in equilibrium) must produce acceleration.
11. The slope of the distance-time graph is velocity.
12. The equilibrant force is equal in magnitude but opposite in direction to the resultant vector.
13. Momentum is conserved in all collision systems.
14. Magnitude is a term use to state how large a vector quantity is.

Energy

15. Mechanical energy is the sum of the potential and kinetic energy.
16. Units: a = [m/sec^2], F = [kg•m/sec^2] (newton), work = pe= ke = [kg•m^2/sec^2] (joule)
17. An ev is an energy unit equal to 1.6 x 10^-19 joules
18. Gravitational potential energy increases as height increases.
19. Kinetic energy changes only if velocity changes.
20. Mechanical energy (pe + ke) does not change for a free falling mass or a swinging pendulum. *(when ignoring air friction)*
21. The units for power are [joules/sec] or the rate of change of energy.

**Electricity**

22. A coulomb is charge, an amp is current [coulomb/sec] and a volt is potential difference [joule/coulomb].

23. Short fat cold wires make the best conductors.

24. Electrons and protons have equal amounts of charge (\(1.6 \times 10^{-19}\) coulombs each).

25. Adding a resistor in parallel decreases the total resistance of a circuit.

26. Adding a resistor in series increases the total resistance of a circuit.

27. All resistors in series have equal current (I).

28. All resistors in parallel have equal voltage (V).

29. If two charged spheres touch each other add the charges and divide by two to find the final charge on each sphere.

30. Insulators contain no free electrons.

31. Ionized gases conduct electric current using positive ions, negative ions and electrons.

32. Electric fields all point in the direction of the force on a positive test charge.

33. Electric fields between two parallel plates are uniform in strength except at the edges.

34. Millikan determined the charge on a single electron using his famous oil-drop experiment.

35. All charge changes result from the movement of electrons not protons (an object becomes positive by losing electrons)

**Magnetism**

36. The direction of a magnetic field is defined by the direction a compass needle points.

37. Magnetic fields point from the north to the south outside the magnet and south to north inside the magnet.

38. Magnetic flux is measured in webers.

39. Left hands are for negative charges and right hands are for positive charges.

40. The first hand rule deals with the B-field around a current bearing wire, the third hand rule looks at the force on charges moving in a B-field, and the second hand rule is redundant.
41. Solenoids are stronger with more current or more wire turns or adding a soft iron core.

**Wave Phenomena**

42. Sound waves are longitudinal and mechanical.

43. Light slows down, bends toward the normal and has a shorter wavelength when it enters a higher \( n \) value medium.

44. All angles in wave theory problems are measured to the normal.

45. Blue light has more energy. A shorter wavelength and a higher frequency than red light (remember-ROYGBIV).

46. The electromagnetic spectrum (radio, infrared, visible. Ultraviolet x-ray and gamma) are listed lowest energy to highest.

47. A prism produces a rainbow from white light by dispersion (red bends the least because it slows the least).

48. Light wave are transverse (they can be polarized).

49. The speed of all types of electromagnetic waves is \( 3.0 \times 10^8 \) m/sec in a vacuum.

50. The amplitude of a sound wave determines its energy.

51. Constructive interference occurs when two waves are zero (0) degrees out of phase or a whole number of wavelengths (360 degrees.) out of phase.

52. At the critical angle a wave will be refracted to 90 degrees.

53. According to the Doppler effect a wave source moving toward you will generate waves with a shorter wavelength and higher frequency.

54. Double slit diffraction works because of diffraction and interference.

55. Single slit diffraction produces a much wider central maximum than double slit.

56. Diffuse reflection occurs from dull surfaces while regular reflection occurs from mirror type surfaces.

57. As the frequency of a wave increases its energy increases and its wavelength decreases.

58. Transverse wave particles vibrate back and forth perpendicular to the wave direction.

59. Wave behavior is proven by diffraction, interference and the polarization of light.

60. Shorter waves with higher frequencies have shorter periods.

61. Radiowaves are electromagnetic and travel at the speed of light (c).

62. Monochromatic light has one frequency.
63. Coherent light waves are all in phase.

**Geometric Optics**

64. Real images are always inverted.

65. Virtual images are always upright.

66. Mirrors produce images by reflecting light.

67. Light rays bend away from the normal as they gain speed and a longer wavelength by entering a slower (n) medium *(frequency remains constant)*.

68. You need a mirror that is one half your height located at a distance equal to your height in order to see your full image.

**Modern Physics**

69. The particle behavior of light is proven by the photoelectric effect.

70. A photon is a particle of light *(wave packet)*.

71. Large objects have very short wavelengths when moving and thus can not be observed behaving as a wave. *(DeBroglie Waves)*

72. All electromagnetic waves originate from accelerating charged particles.

73. The frequency of a light wave determines its energy *(E = hf)*.

74. The lowest energy state of a atom is called the ground state.

75. Increasing light frequency increases the kinetic energy of the emitted photo-electrons.

76. As the threshold frequency increase for a photo-cell (photo emissive material) the work function also increases.

77. Increasing light intensity increases the number of emitted photo-electrons but not their KE.

**Nuclear Physics**

78. Rutherford discovered the positive nucleus using his famous gold-foil experiment.

79. Fusion requires that hydrogen be combined to make helium.

80. Fission requires that a neutron causes uranium to be split into middle size atoms and produce extra neutrons.

81. Radioactive half-lives can not be changed by heat or pressure.
82. One AMU of mass is equal to 931 meV of energy \((E = mc^2)\).

83. Nuclear forces are strong and short ranged.

**General**

84. The most important formulas in the physics regents are:

\[
\begin{align*}
\nu &= \frac{\Delta f}{\Delta t} \\
\nu &= \lambda f \\
\text{KE} &= \frac{1}{2}mv^2 \\
\text{PE} &= mgh \\
F &= ma \\
E &= hf \\
V &= IR \\
W &= F\Delta s
\end{align*}
\]


**Regents Review 1**

**Directions:** Answer all of the following questions. Chose the letter of the choice which best answers the question or statement and darken the appropriate space on the answer sheet corresponding to the question number. Each question is worth one point.

1. Which of the following is an equivalent unit for the fundamental units of \( \text{kg} \cdot \text{m/s}^2 \)?
   A) Joule  B) Newton  C) Watt  D) Coulomb

2. Which of the following is represents a parabolic relation?
   A) \( s = \frac{1}{2} (v_i + v_f) t \)  
   C) \( a = \frac{v^2}{r} \): \( v \) is constant.  
   B) \( v_f = v_i + at \): \( a \) is constant.  
   D) \( \Delta s = v_i t + \frac{1}{2} at^2 \): \( a \) and \( v \) are constant.

Use the following diagrams to answer questions 3 – 9. They represent basic graphical relations.

A) ![Diagram A]  
B) ![Diagram B]  
C) ![Diagram C]  
D) ![Diagram D]

3. Which of these represents a velocity vs. time graph when there is no acceleration?

4. Which of these represents a distance vs. time graph when the motion is accelerated?

5. Which of these represents a velocity vs. time graph when an object is in equilibrium?

6. Which of these represents a kinetic energy vs. velocity graph.

7. Which of these represents the relation between Potential Energy and height?

8. Which of these represents an acceleration vs. mass graph when there is a constant force?

9. Which of these represents the relation between force and acceleration with a constant mass?

10. What is the average velocity of a car that decelerates from +24 m/s to +10.0 m/s in 3.0 seconds?
    A) -5.7 m/s  
    B) +17 m/s  
    C) +7.0 m/s  
    D) +11 m/s

11. When a ball is thrown into the air vertically, the speed at which it returns to the thrower’s hand as compared to the speed it was thrown at is  
    A) half.  
    B) 3/4.  
    C) twice as much.  
    D) the same.

12. A ball is dropped from a 12.0 m tall bridge. How long does it take the ball to reach the river below the bridge?
    A) 1.57 sec  
    B) 2.45 sec  
    C) 4.00 sec.  
    D) 1.22 sec
Use the graph to the right to answer questions 13 – 16. It represents a person walking.

13. When does the person have the greatest velocity?
A) 0 to 2 sec.  
B) 5 to 7 sec.  
C) 7 to 8 sec.  
D) 9 to 12 sec.

14. What is the person’s velocity from 9 to 12 seconds?
A) -2 m/s  
B) +2 m/s  
C) +6 m/s  
D) -6 m/s

15. Where is the person located at 7.3 seconds?
A) At the origin.  
B) 7.3 meters from her starting position.  
C) at 6 meters.  
D) At -6 meters.

16. When is the person motionless?
A) 0 to 2 sec.  
B) 5 to 7 sec.  
C) 7 to 8 sec.  
D) 8 to 9 sec.

17. The greater an object’s mass, the larger its ? when it is not moving?
A) acceleration  
B) velocity  
C) momentum  
D) inertia

18. When an object is in equilibrium, how can it be moving?
A) At a constant velocity.  
B) No motion.  
C) Both A & B  
D) Neither A nor B

19. A person walks 64 m west, then 81 m north, then 64 m east. What is this person’s total displacement?
A) 210 m north  
B) 81 m north  
C) 47 m south  
D) 130 m south

20. What is the magnitude of the resulting force acting on the wagon?
A) 45.5 N  
B) 13.0 N  
C) 63.0 N  
D) 31.5 N

21. What is the direction of the equilibrant that would be needed to keep the wagon in equilibrium?
A) 33.3° S of W  
B) 56.7° S of W  
C) 33.3° N of E  
D) 56.7° N of E

22. How much does a 7.3 kg shotput weigh?  
A) 7.3 kg  
B) 71.5 N  
C) 7.3 N  
D) 71.5 kg.

23. How much force is needed to start a crate in motion if -25 N of static friction are acting on it?
A) +25 N  
B) more than +25 N  
C) less than +25 N  
D) It depends on the coefficient of friction.

24. A cart rolls off the edge of a table at the same time a ball is dropped from the exact same height. The time it takes the cart to fall as compared to the time it takes the ball is  
A) less.  
B) greater.  
C) the same.
25. A ball is rolled off a 0.75 m tall table at increasing velocities. What happens to the amount of time the ball is in flight during each of the trials? A) It increases. B) It decreases. C) It remains the same.

26. As a javelin is thrown at increasing angles with the horizontal, the distance it travels horizontally will A) increase. B) increase until the angle is 45° then decrease. C) decrease. D) be unaffected.

27. As a javelin is thrown at increasing angles with the horizontal, what happens to the acceleration it experiences at its highest point in its flight? A) The acceleration is zero at the top. B) The acceleration is the same throughout the flight. It is −9.8 m/s². C) The acceleration decreases as the angle of launch approaches 90°. D) The acceleration decreases until the launch angle is 45°, then increases to the amount it had at launch.

28. Using the diagram to the right, what is the direction of the centripetal force acting on the ball if it is rotating in a clockwise direction? A) 4 B) 1 C) 3 D) 2

29. The distance between two asteroids in space is increased to 9 times its original amount. What has happened to the magnitude of the force of gravity acting between them? A) It is 9 times less. B) It is 18 times less. C) It is 9 times greater. D) It is 81 times less.

30. The velocity of the planet is greatest A) from 1 to 2. B) from 2 to 3. C) from 3 to 4. D) from 4 to 1.

31. The area of A₁ as compared to the area of A₂ is A) larger. B) smaller. C) equal.

32. A 4.00 kg shotput and a 7.30 kg shotput are dropped from the same height at the same time. Neglecting air friction, which hits the ground first? A) They hit at the same time. B) The larger one. C) The smaller one. D) They never reach the ground.

33. As the velocity of an object is increased, its momentum will A) be unaffected. B) decrease. C) increase.

34. The impulse of a racket hitting a ball as compared to the ball’s change in momentum is A) greater. B) equal. C) less.

35. A rifle’s mass is 5.00 kg. It fires a 0.0400kg bullet with a velocity of +425 m/s. What is the rifle’s recoil velocity? A) -425 m/s B) -85.0 m/s C) -17.0 m/s D) -3.40 m/s
36. How much work do you do holding a 1.25 kg board 0.25 m over your head so some one can nail it into place?  A) 3.06 J  B) 27.6 J  C) 0.00 J  D) 0.313 J

37. A rope is pulled at a 27.0° angle with the horizontal to move a box 13.0 m. The force acting on the rope is 50.0 N. How much work is done moving the box?  A) 6.50×10^2 J  B) 295 J  C) 3.43 J  D) 579 J

38. As you decrease the power you use to do a certain amount of work, the time it takes to do that work will  A) decrease.  B) increase.  C) be unaffected.

Use the diagram of the pendulum to the right to answer questions 39 and 40. It represent the pendulum making *ONE* swing from the left to the right.

39. At which point does the pendulum have its greatest kinetic energy?  A) 1 and 5  B) 2 and 4  C) 3  D) 1, 3, and 5

40. How could you increase the period of this pendulum?  A) Start it farther to the left.  B) Increase its length.  C) Decrease its mass.  D) Push it.

41. A simple machine makes work easier by  A) having a mechanical advantage multiply the work you do on the machine.  B) decreasing the friction acting on the machine.  C) decreasing the effort needed to move the machine.  D) changing the amount and/or direction of the applied force acting on the machine.

42. Which of the following is NOT an example of a machine that has had its mechanical advantage increased?  A) When the handle of a lever has been lengthened.  B) When you increase the height of a ramp.  C) When you add more pulley wheels to a pulley system.  D) When you use a thinner wedge.

43. A spring can be stretched 0.0400 meters by a force of 520.0 N. How much force is needed to stretch the spring a distance of 0.12 meters?  A) 520. N  B) 1560 N  C) 1.30×10^4 N  D) 1.08×10^5 N

44. A spring is stretched 5.00×10^{-2} m by a force of 4.00 N. What is the potential energy of the spring when it is stretched that far?  A) 0.200 J  B) 0.100 J  C) 0.500 J  D) 80.0 J

45. The area under a Force vs. distance graph indicates  A) how far the object traveled.  B) the power of the force.  C) the work done on the object.  D) the effort used to move the object.
46. 4900 J of work was done raising a box 5.0 m off the ground. What is the box’s potential energy?  
A) 4900 J  B) 980 J  C) 25,000 J  D) 0.0 J

47. If a car’s velocity is increased from 5 m/s to 20 m/s, how much did the car’s kinetic energy change?  
A) It increased by 4 times.  C) It decreased by 16 times.  
B) It increased by 16 times.  D) It decreased by 4 times.

48. A box with a mass of 4.50 kg is held 2.80 meters off the ground. Neglecting air friction, how fast will the box be moving as it hits the ground?  
A) 5.60 m/s  B) 2.37 m/s  C) 54.9 m/s  D) 7.41 m/s

49. A spring with an elastic constant of $2.50 \times 10^3$ N/m is compressed 0.035 meters to shoot a 0.125 kg ball into the air. How high will the ball rise if there is no air resistance?  
A) 71.4 meters  B) 35.7 meters.  C) 1.25 meters.  D) 14.6 meters

50. A ball has a mass of 2.75 kg and is held 5.00 meters off the ground. It is released and hits the ground with a speed of 6.00 m/s. How much energy was lost to air friction?  
A) none.  B) 85.3 J  C) 135 J  D) 49.5 J

**Regents Review 2**

**Directions:** Answer all of the following questions. Chose the letter of the choice which best answers the question or statement and darken the appropriate space on the answer sheet corresponding to the question number. Each question is worth one point.

1. The elementary charge is equal in magnitude to the charge on a (an)  
A) neutron.  B) proton  C) Both A and B  D) Neither A nor B

2. The diagram to the right represents the electric field between two charged objects. Which of them has a negative charge?  
A) X  B) Y  C) They are both negative.  D) They are both positive.

3. Two charged spheres are separated by a distance of 0.125 m. Sphere A has a charge of $+3.0 \times 10^{-6}$ C, while sphere B’s charge is $-2.8 \times 10^{-7}$ C. What is the action and magnitude of the electrostatic force acting between the spheres?  
A) A repulsive force of $-6.1 \times 10^{-2}$ N.  C) An attractive force of $-0.48$ N  
B) A repulsive force of $-0.48$ N  D) An attractive force of $-6.1 \times 10^{-2}$ N

4. If the distance between the spheres in question #3 were increased to 4 times the original amount, what happens to the magnitude of the force between them?  
A) It is 1/4 of its original amount.  C) It is 2 times its original amount.  
B) It is 16 times its original amount.  D) It is 1/16 of its original amount.

5. When a thunder cloud causes a charge to form in the ground below it, the cloud does this by a process called  
6. In the Millikan Oil Drop experiment: the magnitude of the charge on the oil drop was always
A) equal to the magnitude of the electrostatic force.
B) less than the electric field intensity.
C) equal to the magnitude of the drop’s weight.
D) equal to a whole number multiple of the elementary charge.

7. The amount of energy per unit of charge is equivalent to the
A) voltage. B) current. C) conductivity. D) resistance.

8. In a simple circuit, the source voltage is 6.00 V. It is connected to a lamp that has a resistance of 480 Ω.
How much energy does the lamp use in 20.0 seconds?
A) 1.50 J  B) 75 mW  C) 2.88 kW  D) 57.6 kJ

9. The resistance of a material will decrease when its
A) length is increased. B) temperature is increased. C) cross sectional area is increased. D) All of these.

10. According to Ohm’s law: if the resistance of a component in a circuit is increased, while the voltage stays
the same, the current will
A) stay the same. B) increase. C) decrease.

11. A parallel circuit has resistor values of 6.00 Ω, 60.0 Ω, and 15.0 Ω, that are connected in parallel branches
to each other. What is their effective resistance?
A) 4.00 Ω  B) 81.0 Ω  C) 40.5 Ω  D) 0.25 Ω

12. A 15 Ω resistor and a 60 Ω resistor are connected in series to a 12.0 volt source. The amount of current
flowing through the larger resistor as compared to the smaller one is
A) 1/4 as large. B) equal. C) 4 times as large.

13. As loads (bulbs or resistors) are added in parallel to a circuit the total current in the circuit will
A) increase. B) decrease. C) stay the same.

14. As loads (bulbs or resistors) are added in parallel to a circuit, what happens to the individual branch
currents in the circuit?
A) Each branch current remains the same because each branch has a separate connection to the source.
B) Each branch current decreases because they have to share the same total current.
C) Each branch current increases because the total current increased.
D) Each branch current is unaffected because the voltage in each branch decreased.

15. As loads (bulbs or resistors) are added in series to a circuit, what happens to the voltage across each
individual load in the circuit?
A) Each voltage remains the same, the current goes down.
B) Each voltage decreases because they have to share the source with more resistances now.
C) Each voltage increases because there are more resistances using the same current.
D) Each voltage remains the same because they all experience the same current.

16. The diagram to the right represents a junction of four wires. The currents are as
\[ I_1, I_2, I_3, I_4 \]
indicated with the directions of each as shown. $I_1=3.4\,\text{A}$, $I_2=2.5\,\text{A}$, and $I_3=4.0\,\text{A}$. What is the magnitude and direction of current $I_4$?

A) 9.9 A out of the junction. C) 1.9 A into the junction.
B) 2.5 A out of the junction. D) 1.9 A out of the junction.

17. Which of the following devices must be connected in series with the components of an electric circuit in order for them and the circuit to function properly?

18. The amount of resistance a voltmeter has compared to the resistance of the component it is measure is
A) very large. B) about the same. C) very small. D) does not matter.

19. Magnetic fields are created by
A) the presence of electric charge. C) Both A and B
B) the movement of electric charge. D) Neither A nor B

20. Which of the following diagrams best represent the magnetic field around a straight current carrying wire with the current flowing as shown?

A) Use the diagram to the right to answer question 21. It represents a wire that has a current flowing through it as it is in a magnetic field. The magnitude of the current is 35 amps and is flowing toward the top of the page. The magnetic field strength is 1.5 Tesla and the length of the wire in the field is 0.90 m.

21. In which direction will the wire move?
A) Toward the top of the page. (This $\uparrow$ way.) C) Down into the page. (This way $\otimes$.)
B) Up out of the page. (This way $\bigcirc$.) D) To the right (toward the S pole).

22. When a wire moves through a magnetic field, in which direction should the wire be moved as compared to the field’s direction in order to induce the greatest amount of current in the wire?
A) Move the wire parallel to the field but in the opposite direction to the field’s direction.
B) Move the wire parallel to the field but in the same direction as the field’s direction.
C) Move the wire perpendicularly to the field’s direction.
D) None of these, the wire must be held stationary in the magnetic field for a current to be induced in it.

23. As a wave moves through a medium, what is the wave transferring?
A) energy B) mass C) momentum D) force

24. Waves that cause the particles of a medium to move along (parallel) to the path of the wave’s travel are called
A) transverse. B) pulsating. C) longitudinal. D) axial.

25. The quantity that represents the time it takes a wave to make one full vibration is its

26. Which of the following occurs as a wave spreads out to fill an empty region of a medium?  
A) reflection.  B) refraction  C) interference  D) diffraction

27. What determines how much of a wave’s energy is reflected and refracted when a wave encounters a boundary between mediums?  
A) The difference in the “densities” (permittivities) of the mediums.  
B) The difference in the “transparencies” of the two mediums.  
C) The extent to which the second medium can “hold” the wave’s energy.  
D) The amount that is reflected does not depend on how much gets refracted.

28. When a wave is refracted as it enters a less “dense” (higher permittivity) medium, its frequency will  
A) increase.  B) decrease.  C) stay the same.

29. When two sound waves interfere destructively, we notice  
A) an increase in volume.  C) a decrease in volume.  
B) an increase in the pitch.  D) a decrease in the pitch.

30. According to the Doppler Effect, if a train is blowing its whistle as it is traveling toward you, what do you hear?  
A) An increase in the pitch of the sound.  C) A decrease in the pitch of the sound.  
B) An increase in the volume of the sound.  D) A decrease in the volume of the sound.

31. SKIP

32. The angle between an incident ray of light and the reflected ray is 60°. What is the angle of incidence?  
A) 30°  B) 60°  C) 120°  D) 15°

33. In order for a sound to cause a glass to shatter by destructive resonance, the sound must  
A) have a pitch equal to the glass’s natural frequency and have a very high volume.  
B) have a very high pitch compared to the glass’s natural frequency.  
C) have a very high volume, yet the pitch can be any pitch.  
D) Sound is not capable of breaking glass, only a crushing blow.

34. Which of the following parts of the electromagnetic spectrum moves fastest in a vacuum?  
A) Visible light  B) Radio waves  C) Gamma rays  D) All parts of the electromagnetic spectrum move at the same speed.

35. A ray of light is passing from crown glass into air at an angle less than the critical angle. What is the relation between the ray’s angle of incidence and its angle of refraction?  
A) \( \theta_i = \theta_r \)  B) \( \theta_r = 90^\circ \)  C) \( \theta_i < \theta_r \)  D) \( \theta_i > \theta_r \)
36. The type of reflection that occurs off a mirror is a __ reflection.
   A) diffuse   B) composite   C) symmetrical   D) regular

37. When must you be concerned about an incident angle being greater than the critical angle?
   A) When light passes from a high index of refraction to a low index of refraction medium.
   B) When light passes from a low index of refraction to a high index of refraction medium.
   C) Both A and B
   D) Neither A nor B

38. What will the speed of yellow light be as it passes from air into diamond?
   A) \(3.00 \times 10^8\) m/s  B) \(8.07 \times 10^{-9}\) m/s  C) 340 m/s  D) \(1.24 \times 10^8\) m/s

39. Which of the following colors of light has the lowest frequency?
   A) blue   B) red   C) yellow   D) green

40. An example of an opaque material would be
   A) a pane of regular window glass.
   B) a window that has been frosted over in the winter.
   C) a blue painted wall.
   D) Only A and B.

41. In a diffraction pattern, the points of bright areas are caused by

42. What determines how much a certain color of light will be refracted by a prism as white light passes through it?
   A) frequency.   B) amplitude.   C) speed.   D) All of these.

**NEWTON’S 2nd LAW PROBLEMS**

1. A crate is to be pulled across the floor. The crate will experience a force of friction of - 34 N. You pull on the crate with a force of 75 N. The mass of the crate is 8.5 kg.
   A) What is the net force acting on the crate?
   B) What is the crates rate of acceleration?

2. A 12 kg box is being lifted by a force of +90.0N.
   A) What does the box weigh?
   B) What is the net force acting on the box?
   C) What is the box’s acceleration? What is the box’s motion?

3. A sled is being pulled across a barn floor by a force of +320 N. The coefficient of sliding friction between sled and the floor is 0.45. The mass of the sled is 65 kg.
   A) What does the sled weigh?
   B) What is the force of friction acting on the sled?
   C) What is the net force acting on the sled?
   D) What is the sled’s acceleration?
4. A crate is being pulled by a rope which is horizontal to the floor. The crate’s mass is 45.0 kg and it is currently accelerating at +3.50 m/s². The coefficient between the floor and the crate is 0.300.
   A) What is the amount of the net force acting on the crate?
   B) What is the tension on the rope? (Hint: What is the applied force, and what is pulling the crate?)
   C) If the crate started from rest, how fast will the crate be going once it is moved 6.00 m?
   D) How much force is needed on the rope to keep the crate moving at the velocity found in part C?

5. A large model rocket has a mass of 30.0 kg. It’s engine can generate a thrust of 750.0 N.
   A) What is the net force acting on the rocket when its engine is fired?
   B) What is the acceleration of the rocket when its engine is burning?
   C) If the engine burns for 20.0 seconds, how far will the rocket travel under that acceleration?

6. A sled is being pulled across a floor. The sled’s mass is 75.0 kg and the coefficient of sliding friction is 0.250. If the sled is pulled by a force of 250.0 N, what is the acceleration of the sled?

7. An industrial engineer is designing a “box slider” to move heavy boxes across a shipping warehouse floor. The coefficient of friction between the floor and the boxes is 0.333. The boxes have a mass of 28.0 kg and can not be given an acceleration greater than 2.75 m/s². How much force must the box slider push on the boxes with in order to achieve this?

8. If a 5.00 kg pail is currently in motion and being lifted up by a force of 49 N, what kind of motion does it have?

9. A person weighs 1500 N and is standing in an elevator on a scale that is currently reading 1200 N as they are descending. What is happening to this person?

10. How much force is required to hold a 12 kg box off the ground?

11. How much force is required to move the 12 kg box up at a constant velocity?

12. How much force is required to move the 12 kg box down at a constant velocity?

13. How much force is required to start moving the 12 kg box up?

14. How much force is required to stop the 12 kg box as it is moving down?

   **Kinematics Review**

1. What kind of oil drop pattern would a car make if it were moving from left to right with the following motions?
   - constant acceleration?
   - constant velocity
   - constant deceleration?

2. A car moves 5 m N and 10m East. What is the displacement of the car? Draw the picture of this movement.
3. **Part I)** Draw a **distance vs. time** plot for each of the following motions:

a) Constant + velocity  
   b) rest  
   c) constant + speed  
   d) constant non-zero acceleration

**Part II)** Now show how these motions would look if they were plotted on a **V vs t plot**.

a) Constant velocity  
   b) rest  
   c) constant speed  
   d) constant non-zero acceleration

4. Plot this data on the grid on the right.

<table>
<thead>
<tr>
<th>time (second)</th>
<th>Velocity (m/s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
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<tr>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>4</td>
<td>6</td>
</tr>
</tbody>
</table>

Find the distance traveled from t = 0 to t = 3 (by finding the area underneath a speed (or velocity) vs. time plot).

5. A car moving at a speed of 8.0 m/s enters a highway and accelerates at 3.0 m/s². How fast will the car be moving after it has accelerated for 56 meters?

6. Measure this line and correctly report this measurement with the appropriate significant digits.____

7. Know the definition of vector and scalar. Know several example of each.

   scalar -  
   vector -  

   ex)  
   ex)

8. Sketch a plot of increasing, decreasing and constant slope.

9. How do you find the acceleration of an object from a **v vs. t plot**?

10. If an object is moving south and slowing down, what is the direction of the acceleration?

11. A baseball pitcher throws a fastball at 21 meters per second. If the batter is 18 meters from the pitcher, approximately how much time does it take for the ball to reach the batter?
12. Acceleration is the time-rate change in ______________________

13. Name 3 ways an object can accelerate.

14. 1 meter =

**Gravity/Friction/Momentum Review 1**

1. What two factors determine the amount of friction between two objects?

2. Explain why a female pro golfer can hit a golf ball further than the average NFL linebacker. (show equation)

3. If an object is moving with a velocity of 5 m/s south, what is the direction of the object's momentum? __________________

   a) How does the direction of an object's motion compare to the direction of the friction force? ______

4. What happens to each of the following quantities when we move away from the earth?

   Mass _____ Weight _____ Force from the earth _____

5. What are the units for each of the following quantities?

   Mass _____ Weight _____ Force from the earth _____

6. Write the gravity equation ________________________________

7. How would the force of gravity between the earth and moon change if you:

   a) tripled the mass of the earth (moon unchanged) _______ b) doubled the mass of the moon only _______

   c) tripled the mass of the earth and doubled the mass of the moon _______

   d) Quadrupled the distance between the moon and earth _______

   e) Doubled the mass of the earth and moon and doubled their separation distance. ______

8. Compare the earth's force on you with your force on the earth.
9. At constant speed the applied force on an object = ______________

![Diagram of force applied to an object]

10. Scalar (S) or Vector (V)?? - momentum ____impulse ____ Force of Gravity ____ mass ____
    Friction____

11. Be able to create the big momentum equation (from your notes) \( J = Ft = _____ = _____ \)

12. A constant braking force of 5 N is applied for 5 seconds is used to stop a 10 kg cart traveling at 2.5 m/s. The magnitude of the impulse applied to stop the cart is …

13. All things being equal, which 2 materials on the reference table would produce the greatest amount of friction? ____________________ least? __________________

**Gravity/Friction/Momentum Review 2**

1. State the Law of Conservation of Momentum. “When two or more objects interact …

   ___________________________________________________________________

   a) Write the mathematical formula ________________________________

   b) If the objects are going in opposite directions, what do you have to remember to do?
       __________________

2. When a hunter fires her gun, the total momentum of the gun, bullet and her body = ______ Why?

3. A 200 N block is at rest on a horizontal table. A force of 40 N is required to start the block moving. What is the maximum coefficient of static friction between the box and the surface?

4. Sketch the shape of the plot of a **mass vs. distance** and **Gravitational force vs. distance** for a rocket ship moving away from the earth.

<table>
<thead>
<tr>
<th>Mass</th>
<th>Fg</th>
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<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Distance</td>
<td>Distance</td>
</tr>
</tbody>
</table>
5. Compare the force of friction that you must overcome to start a block moving with the force of friction you need to overcome to keep a block moving at constant speed.

6. Compare the impulse a golf club applies to a golf ball with the impulse the ball applies to the club.

7. Convert the Houston Rockets center Yao Ming's weight (300 pounds) to kilograms _____________ and newtons _____________

\[
1 \text{ kg} = \text{_______ lbs} \quad 1 \text{ kg} = \text{____ N}
\]

8. Be able to create the big momentum equation \( J = Ft = \underline{____} = \underline{____} \)

9. When do you use \( M_1V_1 = M_2V_2 \) ? (Practice these problems)

10. 2 cars are at rest with a coiled spring between them. One car is 100 kg and the other car is 75 kg. When the coiled spring between the carts is released the cars are pushed apart. If the 75 kg cart attains a speed of 4 m/s, what speed does the 100 kg attain?

11. If a box is being pulled up a ramp, what would the direction of the friction be?

12. A 300 kg car skids on a horizontal wet concrete road. What is the force of friction on the car?

13. A 300 N car skids on a horizontal wet concrete road. What is the force of friction on the car?

14. What can you do to a car to increase the amount of friction between the car’s tire and the road?

15. A 2 kg object traveling 3 m/s east has a perfectly elastic collision with a 12 kg object traveling 4 m/s west. a) Find the total momentum after the collision
16. A hunter fires a bullet from a rifle. What is the total momentum of the rifle, hunter and bullet after the rifle is fired? If the momentum of the bullet is 1200 kg m/s, what is the momentum of the hunter and rifle?

**Magnetism Review Homework**

1. Magnetism is always present when electrical charges _____________

2. The _____________ pole of a compass is used to determine the direction of a magnetic field.

3. Label the left side of this bar magnet north and the right side south. Draw the magnetic field around the bar magnet. Be sure to show the direction of the flux lines.

4. Where is the magnetic field strongest? ___________ What do the flux lines look like there?

5. Draw the flux line pattern between opposite (N and S) and like poles (N and N, S and S).  
   North poles  2 South Poles  North Pole and a South Pole

5.a) Which setup above creates the greatest magnetic field? __________

6. SKIP

7. SKIP

8. SKIP

9. SKIP

10. SKIP

11. SKIP
Energy Review

<table>
<thead>
<tr>
<th>Relationships/Plots</th>
<th>KE and m</th>
<th>KE and v</th>
</tr>
</thead>
<tbody>
<tr>
<td>KE = 1/2 mv²</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PE = mgh</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PE = 1/2 kx²</td>
<td>PE and m</td>
<td>PE and h</td>
</tr>
</tbody>
</table>

PE and x - Relationship? __________________________

3. Know your units Power _________ Work _________ Energy _________ Spring Constant ______

Energy changes when an object falls: Practice Problems: Conservation of Energy - Free Fall
4. The Law of Conservation of Energy states that energy cannot be ______________

As an object falls the sum of the KE and PE ________________________________

5. Everything in the energy unit is a scalar or vector?
Vector (V) or Scalar (S)?

a) Power _______ Work ________ KE___________ PE _____

b) If the velocity of an object is tripled, its kinetic energy will ____________

6. Know the PE and KE changes in a pendulum

a. The potential energy is maximum at

b. The KE is at its maximum at:

c. The PE at 1 is equal to the PE at:

d. The PE at 1 is equal to the KE at:

Work Fill-ins
7a. Work is being done when a force causes an object to move in the direction of the force.

7b. There are two ways to increase your power: Do more work in the same time or do the same work in less time.

7c. The applied force on an ideal spring is directly proportional to the stretch it produces.

7d. Power is the amount of work done per unit time.

8. How much work is done when a ball weighing 20 N is lifted a vertical distance of 2 meter?
   a) What kind of energy does the ball acquire? Kinetic Energy. How much? 40 J

9. An object moving at a constant speed of 4 m/s possesses 160 J of K.E.. What is the objects mass?

10. As an object falls its KE decreases and its PE increases. As the object falls the amount of PE that is lost is equal to the amount of kinetic energy gained.

11. Sketch the shape of a F vs. x stretch plot for an ideal spring.

12. A one meter spring is stretched to 1.2 m by a force of 6 N. Find the spring constant of this spring. (include units)

13. Power is the time rate of doing work.

---

**Static Electricity Review**

1. What are the three principles of static electricity you learned?
   a) Opposite charges attract b) Like charges repel
   c) Only electrons move when charge is transferred.

2. When an object is electrically neutral the number of electrons = the number of protons.

3. Name the three parts of the atom and their charge. a) Protons +1 b) Neutrons 0 c) Electrons neutral

4. Neutral objects become positive by losing electrons.

5. Neutral objects become negative by gaining electrons.

6. Two spheres of \(-1 \times 10^{-3} \text{ C}\) and \(+7 \times 10^{-3} \text{ C}\) come into contact and are separated.
   a) Total charge before contact \(-6 \times 10^{-3} \text{ C}\) b) Total charge after contact \(+6 \times 10^{-3} \text{ C}\)
c) Charge of each sphere after contact ______

d) Which way do the electrons flow when the two charges touch (left to right, or right to left) circle

7. Two spheres are side by side (not touching). One is positive and one is neutral. Draw each sphere and show how the positive sphere effects the charge distribution of the neutral body.

8. What is the purpose of the white plastic collar on an electroscope?

9. Where would the electrons in this neutral electroscope go if a positive rod came near? _____

10. Where would the electrons in this neutral electroscope go if a negative rod came near? _____

11. If a negatively charged rod touched this neutral electroscope and then was removed, what would the charge be at

   A ____ B ____ C _____?

12. If a positively charge rod touched this neutral electroscope and then was removed, what would the charge be at

   A ____ B ____ C _____?

13. Why do the leaves of a charged electroscope diverge?______________________________

14. Where does the charge move when you touch the top of a negatively charged electroscope with your finger. (positive electroscope?)

15. Show the electron arrangement of the neutral pith ball near a negative rod shown on the below.

a) What would happen if a negative rod touched a neutral pith ball? ________________

16. What would the charge be on a neutral coke can placed on a table if a negatively charged rod came near?
a) What would the Coke can in the picture above do when a negatively charged rod came near?

17. A large charge called A is next to a small charge called B. Compare the electrical force of A on B with the force of B on A. (Hint - Remember what Newton would say)

18. What is the mathematical relationship between force and distance for two spherical charges? (see Coulombs Law Equation)

a) What would the shape of the plot of F vs. d look like for two spherical charges.

**Static Electricity Review 2**

1. Draw the electric field line arrows for the following spherical charges
   a) Positive Charge   b) Negative Charge   c) Where is the electric field strongest?

2. What is the smallest possible charge in nature? _______________ Coulombs OR ______ elementary charges
   a) Which two particles have this charge? ___________ ___________
   b) Is this charge possible in nature? - 8 x 10^{-19} C _______
   c) What is the charge in coulombs of +3 elementary charges? _______________
      Explain _______________________________________

3. Draw the electric field pattern between two parallel, oppositely charged plates.

4. Practice V = W/q and E = V/d problems E = F/q

5. Describe Millikan's famous oil drop experiment. What did he discover?
6. How would you move two like charges to increase their PE? closer together OR further apart

7. How would you move two opposite charges to increase their PE? closer together OR further apart

**Motion in a Plane Review**

1. What angle of projection produces the greatest height? _____ greatest range?_____

2. In what direction do the force of gravity AND the acceleration due to gravity always act on a projectile? Draw this.

3. What is the name for the shape of a projectile path? Draw the shape.

4. A projectile is fired at an angle. The vertical velocity of the object is 10 m/s and the horizontal velocity is 20 m/s. How far will the object travel in 3 seconds?

5. Draw in the velocity, centripetal acceleration and centripetal force vectors for this object moving in a circle.

6. What are horizontal and vertical components of a projectile projected at an angle of 60 degrees and a velocity of 20 m/s?
   - **Horizontal Component:**
   - **Vertical Component:**

7. a) An object with a speed of 2 m/s has an acceleration of 4 m/s². What is the radius of the circle in which the object travels?
b) If an object with a mass of 2 kg and a velocity of 5 m/s travels in a circle with a radius of 2 m, how much force must be applied to this object to keep it its circular path?

8. Know your mathematical relationships. \( F = \frac{mv^2}{r} \)

Which 2 variables show inverse? ________direct? ________direct square?____

b) What will happen to the centripetal force if you double m? ________ v? ________ r? ________

9. What is a geosynchronous satellite?

10. What is the orbital period of a geosynchronous satellite? (i.e. time for one revolution)

11. All things being equal, is the centripetal force and centripetal acceleration greatest in a small circle or large circle? What is this relationship called?

12. How do each of the following change when an object is dropped?
Vertical velocity _____ Horizontal velocity _____ Vertical Acceleration _____ Horizontal Accel. _____

13. How do each of the following change when an object is projected horizontally?
Vertical velocity _____ Horizontal velocity _____ Vertical Acceleration _____ Horizontal Accel. _____

14. How do each of the following change for a projectile heading toward the peak?
Vertical velocity _____ Horizontal velocity _____ Vertical Acceleration _____ Horizontal Accel. _____

15. How do each of the following change for a projectile moving past it's peak?
Vertical velocity _____ Horizontal velocity _____ Vertical Acceleration _____ Horizontal Accel. _____

16. A projectile has a vertical speed of 30 m/s and a horizontal speed of 10 m/s. Fill out this chart below.
17. Is the acceleration due to gravity constant on the moon?

18. What does the plot of free fall look like on a d vs. t plot and a V vs. t plot?

19. A bullet is fired straight upward. If the bullet leaves the gun at a speed of +1200 m/s, approximately what speed does it have when it returns to the ground?

20. An astronaut dropped a feather and a sledge hammer on the moon. What happened?

22. Why is the horizontal velocity of a projectile constant, while the vertical velocity constantly changes?

**Circuit Electricity**

1. What is the mathematical relationship between V and I. (Hint: Look up equation and cross multiply to separate variables)

2. All resistors connected in series have the same ____________ (see equations)

3. All resistors connected in parallel have the same ____________ (see equations)

4. \( V_T = 30 \text{ V} R_1 = 60 \text{ ohms} R_2 = 15 \text{ ohms} \)

   a) **Draw this circuit connected in Series**

   Find \( R_T, I_T, I_1, I_2, V_1, V_2 \)

   b) **Draw this circuit connected in Parallel**

   Find \( R_T, I_T, I_1, I_2, V_1, V_2 \)
5. Connect an **ammeter** to each circuit above in a position where it will measure the total current.

6. Connect an **voltmeter** to each circuit above in a position where it will measure the voltage of the first resistor.

7. Adding resistors "in series" to an existing circuit will **INCREASE** or **DECREASE** the total resistance. (see equations)

8. Adding resistors "in parallel" to an existing circuit will **INCREASE** or **DECREASE** the total resistance. (see equations)

9. An electric heater rated at 600 watts is operated on 120 volts. How much energy is used in 5 seconds?

10. a) Power is the ________ of doing work. b) The current in a resistor is 3.0 A, and its resistance is 10 ohms. What is the power developed in the resistor?

11. Some Christmas lights are designed so that when one light bulb goes out, the rest of them stay on. What kind of circuit is this?

12. What is the total resistance of a parallel circuit with a 2 ohms, 3 ohms and 4 ohms?
Wave Review #1

1. Draw two wave cycles "in phase" (crest/crest and trough/trough). Give one wave an amplitude of 2 boxes and a wavelength 4 boxes. Draw another wave with the same wavelength and an amplitude of 4 boxes.

2. a) How many wave cycles are there between the arrows in the picture shown on the right? _____
   b) If the distance between the arrows is 1.80 cm, what is the wavelength of this wave? _______
   c) Use a dotted line to show where the troughs are in the picture on the right.

3. Draw a transverse wave (side view) with a wavelength of 6 boxes and an amplitude of 3 boxes.
   a) Label two points on your wave that are in phase and 2 points that are "out of phase".

4. Draw a standing wave that is 2 wavelengths long. a) Label the nodes with black dots. Label the antinodes with an X.

5. Show diffraction through a slit.
6. What is the one thing that a wave transfers? 

7. What is a pulse 

8. What is a periodic wave? 

9. Longitudinal wave - vibration is ____________ to the direction that the wave travels.
   ex: ____________________

10. Transverse Wave - vibration is ____________ to the direction that the wave travels.
    ex: ____________________

11. Frequency - ____________ units ______ equation ________
    f and T have an ____________ relationship.

12. Draw a wave with a very high frequency and a very low frequency.
    high frequency        low frequency

13. What kinds of overlapping waves create constructive interference? - When a crest overlaps a ____________ destructive interference? When a crest overlaps a ____________


15. A radar gun is used to measure the speed of a pro pitcher's fastball. Explain how this technology uses waves to accomplish this task? (hint: it's just like the radar that cops use to catch speeders.)

16. Label the wave characteristic below with the letter M if it is determined by the medium of the wave or S if it is determined by the source of the wave.

   Speed _____ Frequency _____ Period _____ Amplitude _____ Wavelength ______
1. Measure the angle of incidence (\(\theta_i\)).
Measure the angle of refraction of light IN the medium (\(\theta_r\))

2a) Label the reflected ray and the refracted ray
2b) What is wrong with this picture below? (hint: measure angles)

Outside Medium - Air
Inside medium - Lucite

3. The tallest person that can see her whole body in a .4 meter mirror is ____________
   Draw a picture

4. Light starts in **medium x** (top) and enters **water** (bottom) at an angle of 20 degrees. The angle of refraction is 40°.
   What is the index of refraction of medium x. Draw a picture showing how light would bend as goes from medium x to water.

5. What kind of reflection produces an image? __________

6. What kind of reflection doesn’t produce an image? ________________ Why?

7. Measure the angle of incidence _____ and the angle of reflection. ______ (hint: draw normal first)
8. In refraction, if the angle of refraction is smaller than the angle of incidence, what does that tell you about the speed and index of refraction of the second medium? faster? slower? same?
   a. if the angle of refraction is greater than angle of incidence? - second medium is faster? slower? same?
   b. if the angle of refraction = angle of incidence? - second medium is faster? slower? same?

9. What is the speed of light in Lucite? (see reference table for equation) ___________

10. Which medium on your reference table is the slowest? ___________ How do you know?
      fastest? ___________ How do you know?

11. What if light in a slow medium, bordering on air, comes in at an angle greater than its critical? Draw a picture.
      Equal to its critical angle? Draw a picture.


Wave Review 3

1. List 4 reasons why we believe light has a wave behavior (DDIP)

2. How far can light travel in a vacuum for 20 seconds?

3. Name the 6 colors of the spectrum in order.

4. Which color has the largest frequency______________, smallest frequency ____________, (see reference table)
   largest wavelength ____________, and smallest wavelength __________?

5. a) Which color is the fastest in glass? __________ b) Slowest? _______

6. a) If light comes from air and enters glass, which color is bent the most? __________
   b) The least?____________________

7. What kind of reflection produces an image? ________

8. What color of light has a frequency of $6 \times 10^{14}$ Hz? ______________

9. SKIP

10. Because light can be polarized it proves that light is a ____________ wave.
11. How does the color of a fast moving star change when it turns and comes toward the earth?
______________ Away from the earth? ________________

12. a) Do the dangerous electromagnetic waves tend to have a high or low frequency? b) Name two dangerous electromagnetic radiations. ___________ ___________

c) All electromagnetic radiations have the same __________ in a vacuum.

d) Electromagnetic radiation is created by accelerating __________

13. Where will a ray of light go when it passes from air to glass?
( see picture below) A B C D

13 a) Which wave characteristics change when light is refracted?
direction?__wavelength?__frequency? ___ period? ___ speed? ___

14. A ray of light (A) in Lucite intersects a boundary with air.
a) Which ray shows the path of reflection? ____
b) Which ray(s) are not possible? ____
15. Which incident ray, if any, is correct?  A  B  C  D

16. Name the wave behavior.

Wave Behavior

a) 

b) 

Wave Behavior
17. What do each of the following pictures show?

a)

b)

n1

n2

53°

c)

d)
**Projectile Review**

1. Make a chart showing the vertical and horizontal velocity of the projectile from \( t = 0 \) to \( t = 6 \) sec.

<table>
<thead>
<tr>
<th>( V_x ) (m/s)</th>
<th>( V_y ) (m/s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>30</td>
</tr>
</tbody>
</table>

\( V_x = 10 \text{ m/s} \quad V_y = 30 \text{ m/s} \)

1a) How does gravity change a projectile's vertical motion on the way up to the peak.

1b) A projectile's vertical velocity at the peak is always \( \text{________} \).

1c) How does gravity effect the vertical velocity of a projectile after an object passes the peak?

1d) What is the vertical acceleration of this ball?

1e) What is the horizontal acceleration?

2. A projectile takes 2 seconds to reach the peak of its parabolic path, what is the total time it spends in the air?

3. How should you aim at a target when you know it's going to fall when you shoot?

4. If an object is **projected horizontally** at 1000 m/s, what is \( V_y \) and \( V_x \)? (no trig is needed for this one)

   \[ V_y = \_\_\_\_ \quad V_x = \_\_\_\_ \]

5. What is the vertical component of a soccer ball's velocity if it is kicked at a speed of 10 m/s and an angle of 60 degrees?

6. What is the horizontal component?

7. An object is dropped off a cliff and at the same time a second ball is **projected horizontally at 10 m/s**.
Compare the following for each object:

a) time spent in air before hitting the ground

b) vertical height of both objects (show this in your drawing)

c) horizontal displacement (dx)

d) vertical acceleration

8. In the previous question, what is the horizontal velocity of the second ball when it hits the ground.

9. A 10 kg object an a 100 kg object are dropped simultaneously from the same height. Compare each object's:
   a) height at any point in time _________________
   b) time each spends in the air ________________
   c) vertical velocity at any point in time _________________
   d) vertical acceleration at any point in time _________________

**Force Vectors, Resultants and Components Quiz Tips**

1. Range of Possible resultants  ex) 3 N and 10 N

2. Could these forces be in equilibrium? 7 N, 10 N, 2 N  Explain.

3. Two forces of 4 N East and 2 N North act on an object concurrently. Draw the forces **Head to Tail**.

   a) Draw the resultant and equilibrant for each picture. b) Find the magnitude and direction for the resultant and equilibrant.

40
4. Draw the force 15 N 25 degrees S of W.

5. Resultant = 5 N 20 degrees S of W  Equilibrant = _________________

6. Draw 50 N 25 degrees S of W  Scale 1 cm = 10 N

7. a) Draw the horizontal and vertical components for the force above.

b) Use trig to find the magnitude of the horizontal and vertical components.

8. How would you change the angle of a force to increase the horizontal component? (increase or decrease the angle?)

a) How would you change the angle of a force to increase the vertical component?