Review Sheet for Final

(1) A hypothesis is a testable explanation for an observable problem.

example of a good hypothesis

example of a bad hypothesis

(2) Distance is the length of the entire path the object travels.
Displacement is how far the object is from its starting position in the shortest straight line path.

(3) Speed is how far the object travels in a certain amount of time.
Speed is a scalar quantity and is calculated based on distance.

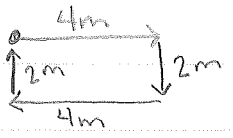
(4) Instantaneous Speed is the speed an object is moving at a specific point in time.

(5) Average speed is the total distance travelled by the object divided by the elapsed time to cover that distance.

(6) Speed is how fast the object moves.
Velocity is how fast the object moves in a specific direction

⑦ Acceleration is the change in velocity divided by time.
It is a vector quantity.

⑧ a) $\text{speed} = \frac{\text{distance}}{\text{time}} = \frac{440\text{ mi}}{8\text{ hr}} = \boxed{55\text{ mi/hr}}$

b) 

$\text{avg speed} = \frac{\text{distance}}{\text{time}} = \frac{(4+2+4+2)}{24\text{s}} = \frac{12\text{m}}{24\text{s}}$

$\text{avg speed} = \boxed{.5\text{m/s}}$

$\text{avg velocity} = \frac{\text{displacement}}{\text{time}} = \frac{0\text{m}}{24\text{s}} = 0\text{m/s}$

c) $V_i = 0\text{mi/hr} = 0\text{ mi/s}$

$V_f = 60\text{mi/h} = .017\text{ mi/s}$

$t = 4\text{s}$

$a = \frac{V_f - V_i}{t} = \frac{0.17 - 0}{4}$

$\boxed{a = .004\text{mi/s}^2}$

Note: You have to convert miles/hour to miles per second

⑨ Free falling is falling where the only thing acting on the object is gravity.

a) If 2 objects of different masses fall in a vacuum, they will fall at the same rate and will hit the ground at the same time.

b) In a tube with air resistance, the heavier mass will fall faster and hit first

⑩ At the top of its path, the speed of an object that is thrown straight up in the air is 0 m/s.

⑪ The acceleration due to gravity on Earth is $-9.81\ m/s^2$

⑫ A vector has both magnitude and direction

ex) 35 m/s North 5N to the right

⑬ A scalar quantity has magnitude only

ex) 35 m/s 5N

⑭ Projectile motion describes an object that is launched or pushed and has a horizontal and vertical component to its motion.

ex) a cannonball fired out of a cannon

a baseball thrown to 1st base

ex - Not Projectile motion - A box dropped from a crane when the cable breaks

⑮ We break projectile motion into horizontal & vertical components

	horizontal	vertical
a in m/s^2	a_x = acceleration in horizontal is 0	a_g = acceleration due to gravity
x = m	Δx_x = change in horizontal position aka how far from base	Δx_y = change in vertical position aka height
V = m/s	V_{ix} = initial velocity in horizontal	V_{iy} = initial velocity in vertical is 0

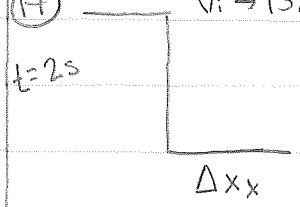
t = time (s)

(16) The 4 kinematic equations are

$V_f = at + V_i$ $\qquad \Delta x = \frac{1}{2}(V_i + V_f)t$

$\Delta x = V_i t + \frac{1}{2}at^2$ $\qquad V_f^2 = V_i^2 + 2a\Delta x$

(17)



$\Delta x_x = V_i t$

$\Delta x_x = (152)(2)$

$\boxed{\Delta x_x = 304 m}$

$\Delta x_y = \frac{1}{2}at^2$

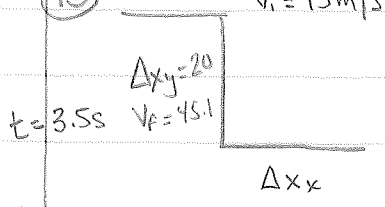
$\Delta x_y = \frac{1}{2}(9.81)(2)^2$

$\Delta x_y = (4.905)(4)$

$\boxed{\Delta x_y = 19.62 m}$

The cannonball will be 19.62 m lower and 304 m away from the tower

(18)



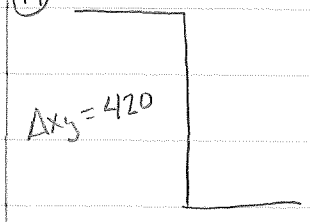
$\Delta x_x = V_i t$

$\Delta x_x = (15)(3.5)$

$\boxed{\Delta x_x = 52.5 m}$

The ball will fall 52.5 m from the building

(19)



$\Delta x_y = \frac{1}{2}at^2$

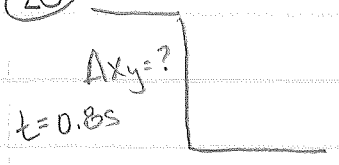
$-420 = \frac{1}{2}(-9.81)(t)^2$

$420 = 4.905\,t^2$

$t^2 = 85.63$

$\boxed{t = 9.25 s}$

(20)



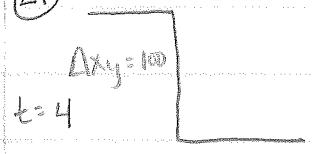
$\Delta x_y = \frac{1}{2} a t^2$

$\Delta x_y = \frac{1}{2}(9.81)(0.8)^2$

$\Delta x_y = (4.905)(.64)$

$\boxed{\Delta x_y = 3.13\,m}$

(21)



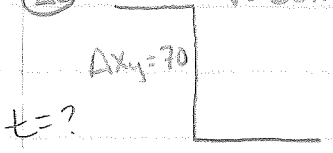
$a_{mars} = -3.37\,m/s^2$

$a = \frac{V_f - V_i}{t}$ $\quad -3.37 = \frac{V_f - 0}{4}$

$(4)(-3.37) = V_f$

$\boxed{V_f = -13.48\,m/s}$

(22)



$\Delta x_y = \frac{1}{2} a t^2$

$70 = \frac{1}{2}(9.81)(t^2)$

$70 = 4.905\,t^2$

$\frac{70}{4.905} = t^2$

$14.27 = t^2$

$\boxed{t = 3.8\,s}$

$a = \frac{V_f - V_i}{t}$

$9.81 = \frac{V_f - 0}{3.8}$

$(3.8)(9.81) = V_f$

$\boxed{V_f = 37.1\,m/s}$

(23) You solve the resultant of vectors

a) going in the same direction by adding them

b) going in the opposite direction by subtracting them

c) If they are @ 90° to each other add tip to tail then use Pythagorean theorem to find the resultant.

(24) Acceleration is caused by unbalanced forces

(25) Newton's 1st Law - Objects in motion stay in motion and objects at rest stay at rest unless acted on by an unbalanced force.

(26) Newton's 1st Law is also known as the Law of Inertia

(27) Newton's 2nd Law $F = ma$ an objects acceleration is dependent on the force divided by the mass.

(28) Newton's 3rd Law For every action there is an equal and opposite reaction.

(29) Weight = mass x acceleration due to gravity
The units for weight are Newtons (N)

(30) $\text{mass} = \frac{\text{Force}}{\text{acceleration}}$

(31) If you push gently on something, it will push gently on you.

(32) Friction is a force that acts in a direction opposite the objects motion and acts to prevent or slow motion.

(33) Action reaction pairs → Newton's 3rd Law

ex) ball on glove ; glove on ball

foot on pedal ; pedal on foot

(34) The acceleration of an object when thrown up in the air at its highest point is $-9.8 m/s^2$

(35) PE is potential energy $PE = mgh$ KE is kinetic energy $KE = \frac{1}{2}mv^2$

(36) Energy is measured in Joules

(37) $m = .25kg$ $KE = \frac{1}{2}mv^2$

$KE = 65J$ $65 = \frac{1}{2}(.25)(v^2)$

$v = ?$ $65 = .125\ v^2$

$520 = v^2$

$\boxed{v = 22.8 m/s}$

(38) $KE = 350000J$ $KE = 1/2mv^2$

$v = 32 m/s$ $350000 = \frac{1}{2}(m)(32)^2$

$m = ?$ $350000 = \frac{1}{2}(m)(1024)$

$350000 = 512(m)$

$\boxed{683.6kg = m}$

(39) $F = 37N$ $PE = mgh$

$d = 3m$ $PE = (37)(3)$

$\boxed{PE = 111J}$

(40) Law of conservation of energy states that energy can't be created or destroyed. It can only change forms.

(41) Speed variable = s unit = m/s

(42) Velocity variable = v unit = m/s

(43) Time variable = t unit = s

(44) Force variable = $\vec{F}$ unit = N

(45) mass variable = m unit = kg

(46) Acceleration variable = a unit = m/s^2

(47) Energy variable = E unit = J
= KE
= PE
= ME

(48) Friction variable = F_f unit = N

(49) distance variable = x unit = m
= d

(50) displacement variable = Δx unit = m

(51) gravity constant = $-9.81\ m/s^2$