Name Key Hour _____

Summary of Physics for Q1 and Q2:

Introductory Information:

1. **Conversion factors:**

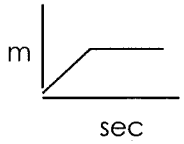
1 m = 100 cm	1 km = 1000 m	1 in = 2.54 cm
1 mile = 1609 m	1 kg = 1000 g	1 kg = 2.2 lbs

2. **Graphing relationships:**
   Direct: As 1 variable goes up, the other goes up
   Indirect or inverse: As 1 variable goes up, the other goes down

1-D Motion:

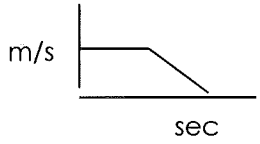
1. $V = \Delta x / \Delta t$ can only be used when the velocity is constant
2. When something is dropped near earth's surface, v_i = 0 and a = $-9.8\ m/s^2$
3. The gravity near the earth's surface is $-9.8\ m/s^2$. This means that for every second an object falls, its speed increases by 9.8 m/s.
   If $\Delta t = 0$, v = 0 If $\Delta t = 1$ sec, v = 9.8 If $\Delta t = 2$ sec, v = 19.6
4. Graphs:

Distance vs. Time



Slope = speed (m/s)
Horizontal line means: not moving

Velocity vs. Time



Slope = acceleration (m/s^2)
Horizontal line means: moving at constant speed
Area under graph = $\frac{m}{s} \cdot s = m$ (distance)

Vectors:

1. **Scalar**- quantity with just magnitude. Ex: mass, time
2. **Vector**- quantity with magnitude **AND** direction. Ex: velocity, F, a, p
3. **Resultant**- The sum of 2 or more vectors
4. Adding Vectors- 2 Methods
   a. **Graphically**: Draw head to tail path, measure R and angle using protractor.
   b. **Resolution into components**: Break each vector into a right triangle and solve for x and y components. Find $Rx = Ax + Bx$ (sometimes you have to subtract), $Ry = Ay + By$, then use $R^2 = Rx^2 + Ry^2$ to find R.

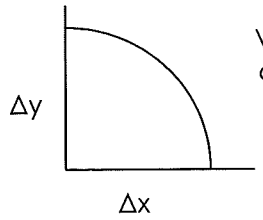
Always put answer like this: R = 100 m at 25 ° N of E (or whatever direction)

Name _____ Hour _____

Projectile Motion:

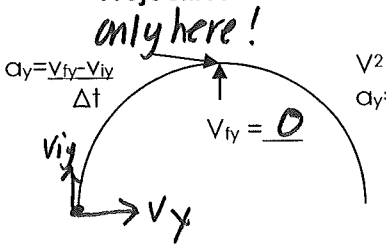
1. A projectile is anything that once it's in the air cannot control its own motion.

Projectiles Shot Horizontally:



V_{iy} = 0
a_y = $-9.8\ m/s^2$

Projectiles shot at an angle



$V^2 = V_{iy}^2 + V_x^2$
$a_y = -9.8\ m/s^2$

CANNOT interchange variables because no acceleration in x-direction
→x: $V_x = \Delta x/\Delta t$ (Can use constant V equation because: neglect air resistance
→y: $\Delta y = V_{iy}\Delta t + 1/2 a_y \Delta t^2$ and $a_y = \frac{V_{fy} - V_{iy}}{\Delta t}$ **(only works at ½ way pt of angled proj)**

The velocity in the **x-direction** remains constant
The velocity in the **y-direction** decreases (slows down) going up and increases (speeds up) going down.

Newton's Laws and Forces:

1. Newton's 1st law: inertia
2. Newton's 2nd law: F = ma
3. Newton's 3rd law: every action has equal and opposite reaction
4. **Mass** is the amount of matter (kg), **Weight** is the force of gravity pulling on that matter (N)
   Terminal velocity: maximum speed of a falling object, weight = air resistance
5. **g force:** How many times your weight you are experiencing. 1 g = m x g
   3 g's = 3 x weight, 0.33 g's = 1/3 weight

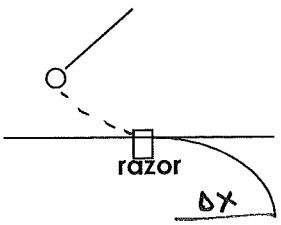
Work and Energy:

1.	**Work**: Force times the distance	W = F x d	Unit: N x m = J
2.	**Power**: rate at which work is done	P = W/Δt	Unit: J/sec = Watt
3.	**Kinetic energy**: energy of motion	KE = ½ mv^2	Unit: J
4.	**Potential energy**: energy of position	PE = mgh	Unit: J

5. **Conservation of energy**: total energy remains constant (not created or lost)

$$mgh_i + \frac{1}{2}mv_i^2 = mgh_f + \frac{1}{2}mv_f^2$$

6. **Conservation of energy + Projectiles:** Marble on a string lab



1. CE to find V_f.
2. V_f = V_x
3. Horizontal projectile equations to find Δy or Δx

Momentum (p):

1. p = m x v
2. Change in momentum (mΔv) = **IMPULSE** (I) Caused by force acting over a time period

$$I = m\Delta v = F\Delta t$$

3. **Conservation of momentum**: Total momentum remains constant during a collision
   a. **Explosion**: objects start at rest and explode apart
   b. **Elastic**: objects collide and bounce off each other
   c. **Inelastic**: objects collide and stick together