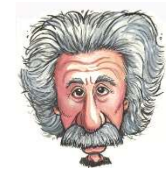
Mr. Mellon's Need to Know Physics Review Sheet



Kinematics (Units 2 – 3)

- **Scalar quantities only have a magnitude (size)** – e.g., speed, power, energy, time, charge…
- **Vector quantities have a magnitude (size) and __direction__** – e.g., momentum, velocity, acceleration, fields…
- Distance (scalar) = total length traveled vs. Displacement (vector) = change in position
- __Average Speed__ = __distance__/time vs. __Average Velocity__ = __displacement__/time
- Resultant: sum of vectors (use Head-to-Tail Method to find). Equilibrant: same size, but opposite direction
- **Projectile Motion** – horizontal acceleration is ZERO and the vertical acceleration is 9.81 m/s^2 down
- **Horizontal Projectiles important note:** initial VERTICAL velocity is ZERO
- **Projectiles at an Angle important notes:**
  - break initial velocity into x and y components ($A_x = A\cos\theta$, $A_y = A\sin\theta$)
  - at its maximum height, vertical velocity equals ZERO
  - the time to reach its maximum height is HALF of its total flight time (if fired on flat surface)
  - d = vt is the ONLY equation you can use for HORIZONTAL motion (since $a_x = 0$)
  - Greatest range (horizontal distance) at 45° and greatest time in air at 90° (if fired on flat surface)

X	Y
$a_x = 0$	$a_y = -9.81\ m/s^2$
$v_{ix} = v_i\cos\theta$	$v_{iy} = v_i\sin\theta$
$d_x = v_{ix}t$	

- **Distance vs. Time Graphs**
  - slope of the line equals velocity
  - curved line indicates accelerated motion
  - straight angled line indicates constant velocity (a = 0, net force = 0, object is in equilibrium)
- **Velocity vs. Time Graphs**
  - slope of the line equals acceleration
  - area underneath the line equals the displacement

Forces and Friction (Unit 4)

- Inertia ≈ mass of an object (Which object has the most inertia? The one with the greatest mass.)
- $F_{net} = ma$ and $F_{net} = F_1 + F_2 + F_2$…(consider direction (+ and -) when adding forces)
- If an object is in equilibrium (balanced forces) , Fnet = 0 and object is either at rest or in constant velocity (a = 0)
- For every force, there is an equal and opposite direction force (when a bus hits a bug, F on bus = **-** F on bug)
- **WEIGHT = Force due to Gravity = Gravitational Force = F_g = mg ("Fg mg")**
- Normal force (F_N) is the force from surface pushing perpendicular to the surface ($F_N = F_g = mg$ **__IF__** those are the only two vertical forces and the object is on a flat horizontal surface that is NOT accelerating vertically)
- **Elevator problems: Normal force (F_N) = scale reading**
  - if accelerating up: you appear heavier on a scale (increase in F_N and $F_N > F_g$)
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- Static friction opposes the start of motion while kinetic friction opposes an object already in motion
- Find ***__minimum force__*** needed to **__START motion__** by calculating **__STATIC friction__**; in order to keep it moving at a **__constant velocity__**, calculate **__KINETIC friction__** (for both cases assume $F_{applied} = F_f$ since a = 0)
- If an object is on an **__INCLINE plane/ramp__**: $F_{gx(\text{parallel})} = F_g\sin\Theta$ and $F_{gy(\text{perpendicular})} = F_g\cos\Theta$ and if at rest or moving down at a constant velocity $F_f = F_{gx}$ and $F_N = F_{gy}$

Circular Motion and Universal Law of Gravity (Unit 5)

- **IMPORTANT EQ. NOT ON REF. TABS.: Circular speed =** $v = 2\pi r/T$ and $F_c = mv^2/r$
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- **↑distance, ↓Fg (inverse *__squared__* – *e.g. - if distance is doubled, Fg is quartered*)**

Momentum and Impulse (Unit 6)

- When an object experiences a net force for a period of time, its momentum changes ($J = Ft = \Delta p = mv_f - mv_i$). Remember how airbags work (cushion the blow (increase time), therefore decreasing the force)
- **IMPORTANT EQ. NOT ON REF. TABS.:** Conservation of Momentum: $m_a v_{ai} + m_b v_{bi} = m_a v_{af} + m_b v_{bf}$ if they stick together: $m_a v_{ai} + m_b v_{bi} = (m_a + m_b)v_f$
- In the case of an explosion: total momentum before and after = 0 (therefore, the momentum of each object after are EQUAL and OPPOSITE DIRECTION; $m_a v_f = -m_b v_f$)

Energy, Work, and Power (Unit 7)

- Work = Fd = ΔE (if no displacement, no work, no change in energy)
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- **IMPORTANT EQ. NOT ON REF. TABS.:** Conservation of Energy: $\mathbf{KE_i + PE_i \pm W = KE_f + PE_f}$
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- Internal Energy can be HEAT GENERATED BY FRICTION and can take away ME

2nd Semester

Waves and Sound (Unit 8)

- **Transverse** waves (e.g., light/EM waves, guitar string) = motion **perpendicular** to energy
- **Longitudinal** waves (e.g., sound) = motion **parallel** to energy ($v_{light(EM\ waves)}$ (3×10^8 m/s)>>> v_{sound} (331 m/s))
- Mechanical waves require a medium to travel in and their energy depends on the amplitude of the wave.
- **Speed of a wave depends on the medium only; so increasing f, decreases λ <u>in a given medium</u>**
- Period is the time for one cycle (T = t/# of cycles in t); λ is length for one cycle (λ = length/# of cycles in length)
- **Max. Constructive Interference:** increase in amplitude (size of wave) (colliding waves 0° in phase)
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- **Standing wave:** created by two waves with same amplitude, same wavelength, same frequency, traveling the same medium, but in OPPOSITE DIRECTION.
- **<u>No</u>des** - destructive interference (**<u>no</u>** amplitude) & **<u>A</u>ntinodes** - constructive interference (max. **<u>A</u>**mplitude)
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Light (Unit 9)

- ALL electromagnetic waves (gamma, x-ray, radio…) in a vacuum move at the speed of light (3×10^8 m/s)
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- **<u>ALWAYS MEASURE FROM THE NORMAL IN A RAY DIAGRAM!!!</u>**
- Dispersion: Separating white light into individual colors (frequencies) (think rainbows)
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Electrostatics, Electricity, and Magnetism (Units 10, 11, and 12)

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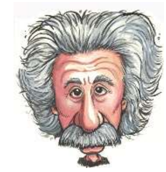

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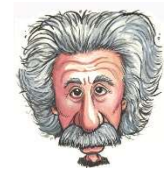

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  - When light (EM) wave enters a SMALLER index of refraction: speed and wavelength increase, it bends AWAY from normal, **frequency remains constant**

Electrostatics, Electricity, and Magnetism (Units 10, 11, and 12)

- ONLY NEGATIVE CHARGES MOVE (objects become positively charged by losing electrons (negative charge) and become negatively charged by gaining electrons (negative charge))
- Elementary charge = charge of an electron or proton = 1.6×10^{-19} C
- Opposites attract, likes repel, **neutral objects are attracted to either a + or - charged objects**
- You CAN NOT HAVE FRACTIONS OF ELEMENTARY CHARGES (e.g. – 1.65 e does not exist)
- Conservation of charge: Total charge is divided evenly between objects that come in contact with each other
- Electric Field: Field lines go **AWAY** from **positive** charges and **TOWARD negative** charges.
- Electric field between oppositely charged plates is uniform (constant) anywhere between the plates.
- **<u>MAKE VIRP TABLES FOR SERIES/PARALLEL CIRCUIT PROBLEMS</u>**
- **Series – One path for I (I is the same through each device, if ↑ # of resistors then total I ↓ & P↓)**
- **Parallel – MULTIPLE paths for I (V is the same across each device, if ↑ # of resistors then total I↑ & P↑)**
- Magnetic Field: Field lines go AWAY from North Pole and TOWARD South Pole.
- ***Moving charged*** particles create magnetic **<u>and</u>** electric fields
- All field lines (Magnetic, Electric, or Gravitational) never overlap/cross and the field is strongest where the lines are closest together.

<u>Modern Physics (Unit 13)</u> I am out of space and we just covered this unit so…um…uh…just use your Ref. Tabs.!!!