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Kinematics — Unit 1 ↓

- Vector vs. Scalar
- Displacement vs. Distance
- Velocity vs. Speed
- Acceleration
- Linearization
- Big Four Equations
  - $Vf = Vo + at$
  - $\Delta x = Vot + 1/2\,at^2$
  - $Vf^2 = Vo^2 + 2a\Delta x$
  - $\Delta x = 1/2\,t(Vo + Vf)$
- Projectile Motion
- Position-Time Graphs
- Velocity-Time Graphs
- Acceleration-Time Graphs
- Acceleration due to Gravity (g = 9.8 m/s/s)

Dynamics — Unit 2 ↓

- Equilibrium: net force is equal to 0
- Newton's 1st Law
  - Law of Inertia
- Newton's 2nd Law
  - Force = mass x acceleration
- Newton's 3 ← Especially ΣF=ma
  - Third Law Force Pairs (equal and opposite)
- Friction $Ff = Fn\,\mu$
- Ramps/Inclined Planes
- Force Body Diagrams
- Force and Net Force

Uniform Circular Motion & Gravitation — Unit 3 ↓

- Centripetal Force: **not** a new force, just an expression for the net force pointing inwards of the circular path
  - Fc = mv^2/r
- Centripetal Acceleration
  - Ac = v^2/r
- Universal Gravitation
- Uniform Circular Motion: constant speed (magnitude of velocity is constant)
- Combos with Forces, Energy, SHM, Rotation
- Inertial mass vs. Gravitational mass
  - How do you find each one experimentally?

Energy — Unit 4 ↓

- Work (W = Fd)
  - Parallel: (+) Work
  - Antiparallel: (-) Work
- Work = Change in Energy
- PEg, PEs, 2 kinds of KE
  - PEg = mgh
  - PEs = $1/2\,kx^2$
  - KE = $1/2\,mv^2$
  - KEr = $1/2\,I\omega^2$
- Mechanical Energy: the sum of a system's kinetic and potential energy
- Power (P = W/t) or (P = Fv)
- Conservation of Energy
- Bar Charts, Graphs & Diagrams

Momentum — Unit 5 ↓

- Momentum (p=mv)
- The direction of momentum is the same as the direction of motion
- Impulse (J = Ft)
- F vs t graphs (Impulse = Area)
- Conservation of Momentum
- Center of Mass
- Combo with Energy, Rotational, Forces
- Collisions (Inelastic vs. Elastic)
  - Elastic -> Kinetic Energy and Momentum are conserved
  - Inelastic -> Momentum is conserved
  - The velocity of the center of mass in a closed system is constant

Simple Harmonic Motion — Unit 6 ↓

- Spring & Pendulum
- Energy relationships
- F, a, v, x ← Diagrams & Graphs
- Combo with Forces, UCM, Energy, Rotational
- Hooke's Law (F = kx)
- Period Equations
- What affects the period of a pendulum?
  - $T = 2\pi \frac{\sqrt{L}}{\sqrt{g}}$
  - L is the length of a pendulum
  - g is the gravitational field
- What affects the period of a mass on a spring?
  - $T = 2\pi \frac{\sqrt{m}}{\sqrt{k}}$
  - m is the mass attached to the spring
  - k is the spring constant

Torque & Rotational Motion — Unit 7 ↓

- Rotational Kinematics (θ,ω,α)
  - Same as Unit 1 Big 4, but with new symbols
  - Remember x = θR, v = ωR, a = αR
- Torque & Moment of Inertia ($\Sigma\tau$ = Iα)
- Torque: a force applied to a point on an object about the axis of rotation (**not** the center of mass)
- Net Torque causes angular acceleration
- Rotational KE and Conservation of Energy
- Angular Momentum & Conservation of Momentum
- Angular "Impulse"

Other Key Concepts

- Does this equation model the correct observations?
  - Are the variables showing a direct or indirect relationship?
  - Did the math lead to an answer with the correct units?
- Writing Prompt TIps
  - Cite info from the problem
  - Bring in Basic Physics/Basic Equations
  - Describe how the info works with the Physics
  - Answer the question with a claim

FRQ TIPS: Qualitative/Quantitative Translation (25 minutes, 60%), Paragraph Argument Short Answer (15 minutes, 40%)