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Kinematics

1. **Scalars and Vectors:**
   - **Explanation:**
     - Scalars are quantities that have only magnitude, such as mass or temperature. Vectors have both magnitude and direction, like displacement, velocity, and acceleration.
   - **Applications:**
     - Scalars: Mass in physics, time in kinematics.
     - Vectors: Displacement of an object, velocity of a car.
   - **Formulas:**
     - Vector addition: $\vec{A} + \vec{B} = \vec{C}$
     - Scalar multiplication: $c\vec{A}$
2. **Motion in One Dimension:**
   - **Explanation:**
     - Motion in one dimension refers to the movement of an object along a straight line.
   - **Applications:**
     - Falling objects under gravity, cars moving along a straight road.
   - **Formulas:**
     - $v = u + at$
     - $s = ut + \frac{1}{2}at^2$
3. **Projectile Motion:**
   - **Explanation:**
     - Projectile motion describes the motion of an object thrown into the air, considering the influence of gravity.
   - **Applications:**
     - Throwing a ball, trajectory of a missile.
   - **Formulas:**
     - Range (R): $R = \frac{u^2 \sin(2\theta)}{g}$
     - Time of flight (T): $T = \frac{2u \sin(\theta)}{g}$

4. **Relative Motion:**
   - **Explanation:**
     - Relative motion deals with the motion of one object with respect to another.
   - **Applications:**
     - Calculating the speed of one car relative to another.
   - **Formulas:**
     - Relative velocity (v_{rel}): $v_{\text{rel}} = v_1 - v_2$
5. **Motion in Two Dimensions:**
   - **Explanation:**
     - Describes the motion of an object in a plane.
   - **Applications:**
     - Particle moving on an inclined plane, a ball thrown at an angle.
   - **Formulas:**
     - $\vec{r} = \vec{r_0} + \vec{v_0}t + \frac{1}{2}\vec{a}t^2$
6. **Uniform Circular Motion:**
   - **Explanation:**
     - Uniform circular motion involves an object moving in a circle at a constant speed.
   - **Applications:**
     - Revolution of planets around the sun, motion in a roundabout.
   - **Formulas:**
     - Centripetal acceleration (a_c): $a_c = \frac{v^2}{r}$
7. **Relative Motion in Two Dimensions:**
   - **Explanation:**
     - Describes motion in two dimensions involving different frames of reference.
   - **Applications:**
     - Boats moving in a river with currents.
   - **Formulas:**
     - Relative velocity ($\vec{v}_{\text{rel}}$): $\vec{v}_{\text{rel}} = \vec{v}_1 - \vec{v}_2$

8. **Kinematics of Rigid Bodies:**
    - **Explanation:**
        - Describes the motion of extended objects, considering both translational and rotational motion.
    - **Applications:**
        - Rolling motion of a wheel, a spinning top.
    - **Formulas:**
        - Instantaneous center of rotation: $v_A = \omega r$
9. **Non-Uniform Circular Motion:**
    - **Explanation:**
        - Describes circular motion with varying speed.
    - **Applications:**
        - Cars negotiating curved paths, roller coasters.
    - **Formulas:**
        - Tangential acceleration (a_t): $a_t = \frac{dv}{dt}$
10. **Simple Harmonic Motion (SHM):**
    - **Explanation:**
        - Simple harmonic motion is a periodic back-and-forth motion.
    - **Applications:**
        - Motion of a pendulum, oscillation of a spring.
    - **Formulas:**
        - Displacement (x): $x = A\cos(\omega t)$
        - Velocity (v): $v = -A\omega\sin(\omega t)$
11. **Differential Calculus in Kinematics:**
    - **Explanation:**
        - Involves using derivatives to analyze motion, finding instantaneous velocity and acceleration.
    - **Applications:**
        - Calculating the rate of change of position with respect to time.
    - **Formulas:**
        - Velocity (v): $v = \frac{ds}{dt}$

12. **Integration in Kinematics:**
    - **Explanation:**
        - Involves using integrals to find displacement and velocity.
    - **Applications:**
        - Determining the total distance traveled by an object.
    - **Formulas:**
        - Displacement (s): $s = \int v \, dt$

EACH TOPIC IS DESIGNED BY 3 EXPERTS & 2 AIbots

WE TRY TO GIVE
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