Physics

Mr Rall

Week 1: Introduction to Physics & Motion

Topics:

1. **What is Physics?**
    - The scientific method and physics as a discipline.
    - SI units and measurements.
2. **Kinematics: Motion in One Dimension**
    - Concepts: displacement, velocity, acceleration, and time.
    - Graphical representation of motion (position vs. time, velocity vs. time).
    - Equations of motion.
3. **Free Fall and Gravity**
    - Understanding gravity, acceleration due to gravity (g).
    - Free-fall motion and velocity-time graphs.

Activities:

- Demonstration of motion using timers and measuring distance.
- Analyze simple motion graphs and practice using kinematic equations.

Assessment:

- Homework problems on one-dimensional motion.
- Quiz on basic concepts of motion and gravity.

Week 2: Forces and Newton’s Laws

Topics:

1. **Force and Types of Forces**
    - Newton's definitions of force.
    - Gravitational force, normal force, friction, tension, etc.
2. **Newton’s First Law (Law of Inertia)**
    - Concept of inertia and equilibrium.
    - Examples of objects at rest or constant velocity.
3. **Newton’s Second Law (F = ma)**
    - Relationship between force, mass, and acceleration.
    - Solving problems involving forces and accelerations.
4. **Newton’s Third Law (Action and Reaction)**
    - Action-reaction pairs.
    - Applications like walking, swimming, and rocket propulsion.

Activities:

- Lab: Measure forces using spring scales and observe the effects of various forces on objects.
- Group discussions on real-life applications of Newton's Laws.

Assessment:

- Homework problems on forces, Newton’s Laws, and applying F = ma.
- Group activity report on real-life action-reaction examples.

Week 3: Work, Energy, and Power

Topics:

1. **Work and Energy**
    - Definition of work (W = F × d), conditions for work to be done.
    - Kinetic energy and potential energy.
    - Conservation of mechanical energy.
2. **Power**
    - Definition of power (P = W/t).
    - Calculating power in various contexts.
3. **Work-Energy Theorem**
    - Relationship between work done and change in kinetic energy.
    - Applications like cars braking, lifting objects, etc.

Activities:

- Lab: Use different objects to demonstrate work (e.g., lifting objects, rolling a ball).
- Calculate work done in various situations (e.g., lifting, pushing, or pulling).

Assessment:

- Homework on work, energy, and power problems.
- Short quiz on work-energy principles.

Week 4: Momentum and Circular Motion

Topics:

1. **Momentum and Impulse**
    - Definition of momentum (p = mv).
    - Impulse and the Impulse-Momentum Theorem.
    - Conservation of momentum in collisions (elastic and inelastic).
2. **Circular Motion**
    - Definitions of centripetal force and acceleration.
    - Calculations for objects moving in circular paths (uniform circular motion).
3. **Applications of Circular Motion**
    - Examples like satellites, cars on curves, and roller coasters.

Activities:

- Lab: Investigate collisions with toy cars or basketballs to understand conservation of momentum.
- Demonstration of circular motion using a string and object to analyze centripetal force.

Assessment:

- Homework on momentum and circular motion problems.
- A test or quiz covering topics from Week 1 through Week 4 (motion, forces, work/energy, momentum).

End of Unit Project:

- Students will apply the concepts they've learned to a real-world situation (e.g., designing a roller coaster, calculating energy required to move an object, or analyzing the forces involved in a car crash).

Additional Notes:

- Include time for reviewing and reinforcing concepts.
- Encourage group collaboration for problem-solving during activities and labs.
- Assess both understanding of concepts and ability to apply them to real-world situations.