Exploring Gravity on Inclined Surfaces with Paper Horses

Objective: Students will be able to explain how gravity affects the motion of objects on an inclined surface using paper horses.

Assessment:

Students will conduct an experiment using paper horses on inclined surfaces of varying angles. They will record their observations and explain how the angle of the incline affects the speed and distance traveled by the horses. Their explanations will be assessed using a rubric that evaluates understanding of gravity, incline, and motion.

Key Points:

- **Gravity:** A force that pulls objects towards the Earth.
- **Inclined Surface:** A sloped surface that can affect how fast an object moves.
- **Friction:** A force that opposes motion between two surfaces.
- **Angle of Incline:** The steepness of the slope, which affects how gravity influences motion.
- **Motion:** The change in position of an object over time.

Opening:

- Begin with a brief demonstration by rolling a paper horse down a flat surface and then down a sloped surface.
- Ask students: "What do you think happens to the horse when it goes down the slope compared to when it is flat?"
- Engage students in a discussion about their predictions and ideas about gravity and motion.

Introduction to New Material:

- Explain gravity and its role in pulling objects downwards.
- Introduce inclined surfaces and explain how they change the way gravity affects motion.
- Discuss friction and how it can slow down the horses.

- Anticipate the misconception that all objects will slide down an incline at the same speed regardless of the angle.

Guided Practice:

- Students will work in pairs to conduct a simple experiment with a paper horse on different angles of incline (using books or ramps).
- Set expectations for respectful collaboration and shared responsibilities.
- Begin with a gentle slope and ask guiding questions:
    - "What do you notice about how fast the horse travels?"
    - "What happens when you increase the angle of the incline?"
- Monitor groups by observing their discussions and checking their recorded observations for understanding.

Independent Practice:

- Each student will create a poster summarizing their experiment results, including:
    - The angles used,
    - The distance traveled by the horse,
    - An explanation of how gravity and incline affected the motion.
- Set expectations for neatness and clarity in their presentations.

Closing:

- Have a short class discussion where students share one interesting thing they learned about gravity and motion.
- Ask students to summarize in one sentence how incline affects the speed of the paper horses.

Extension Activity:

- Students who finish early can design their own inclined surface using various materials (like cardboard or foam) and predict how it will affect the motion of their paper horse.

Homework:

- Assign students to observe a real-world inclined surface (like a slide or ramp) and write a short paragraph describing how gravity affects motion on that surface.

Standards Addressed:

- Next Generation Science Standards (NGSS) 4-PS3-1: Use evidence to construct an explanation relating the speed of an object to the energy of that object.
- Common Core State Standards for Mathematics (CCSS.MATH.CONTENT.4.MD.A.3): Apply the area and perimeter formulas for rectangles in real-world and mathematical problems.