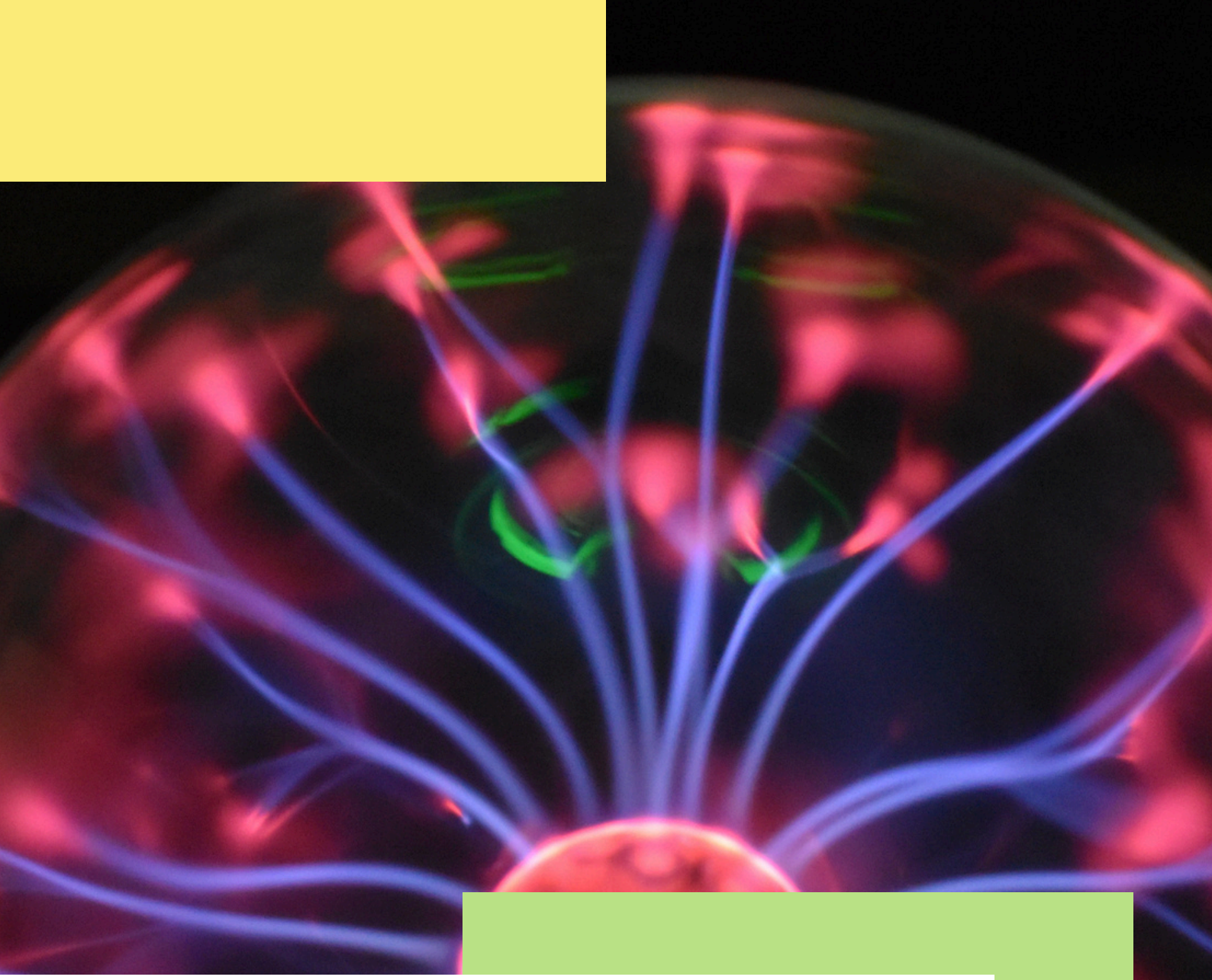

STEAM &Sports

Lesson 8 - Shoot for the Stars:
Physics of Motion in Sports

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Shoot for the Stars - Physics of Motion in Sports

Concept

Students will explore how velocity, angle, and gravity influence trajectories in sports, including ball sports and gymnastics. By analyzing ball trajectories and human motion (like jumps and flips), they will connect theoretical physics to real-world sports performance.

Learning objectives and Outcomes

By the end of this lesson, students will:

1. Understand the effects of velocity, angle, and gravity on sports movements.
2. Identify the differences between projectile motion in objects (e.g., balls) and human motion (e.g., jumps, flips).
3. Recognize key motion equations and their applications in sports performance analysis.
4. Explore how biomechanics and physics influence athletic efficiency and precision.

Students will be able to:

1. Design and conduct experiments to analyze trajectories of balls or gymnastic jumps.
2. Record and interpret data using slow-motion video, measurement tools, and graphs.
3. Apply motion equations to explain and predict movement in different sports.
4. Suggest improvements in sports techniques based on biomechanical insights.

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Educational Standards in Connection with Sports

1. This lesson integrates science, mathematics, and physical education, aligning with national and international curricula. It promotes:
2. Understanding the role of velocity, gravity, and motion in sports performance.
3. Using physics and data analysis to optimize movement and technique.
4. Applying scientific principles to improve athletic performance in various sports.

Subjects covered in this lesson

1. Physics & Mathematics – Motion equations, velocity, gravity, and trajectory calculations.
2. Physical Education & Biology – Application of physics in athletic performance.
3. Critical Thinking & Analysis – Data

Timeframe

Duration: 90 minutes

Age Group

Age Group: 12–15 years old

Material needed

1. Various sports balls (soccer, basketball, volleyball, etc.)
2. Gymnastics mat or safe jumping area
3. Protractor, tape measure/meter stick
4. Smartphones/tablets with slow-motion video capability
5. Graph paper
6. Stopwatch
7. Calculators

Short description of the content

In this lesson, students will investigate the physics behind motion in sports, focusing on how velocity, angle, and gravity impact movement. By experimenting with ball trajectories and human jumps, they will analyze real-world applications of motion equations. Using slow-motion video, data collection, and calculations, students will connect physics concepts to athletic performance and explore ways to optimize movement efficiency.

Methodology

- Group Work: Students collaborate in mixed-ability groups (3–5 members), ensuring teamwork and shared learning.
- Hands-on Experiments: Groups choose to focus on either ball sports or gymnastics to analyse motion.
- Data Analysis: Students utilize slow-motion video, physics equations, and graphing tools to bridge theory and practice.

Inclusion & Adaptations

1. **Visual Aids** such as diagrams and real-world examples to reinforce concepts.
2. **Clear step-by-step instructions** for experiments, ensuring accessibility for all learners.
3. **Alternative participation methods** for students who may need modifications in physical tasks (e.g., analysing pre-recorded videos instead of performing jumps).
4. **Differentiated instruction** to support students at varying levels of math and physics understanding.

Sequence of the lesson

1. Engage (10 minutes)
Demonstration: Drop or throw a ball at different angles and discuss its trajectory.
Video or live demo: Show a gymnast performing a leap and discuss height/distance.

Discussion Questions:

- How do the ball's path and the gymnast's motion compare?
- How do angle, force, and gravity affect these motions?

2. Explore (25 minutes)
Group Choice:

- Ball Sports Experiment: Test different angles (e.g., 30°, 45°, and 60°) and measure distance, height, and time of flight.
- Gymnastics Experiment: Perform safe jumps (e.g., straight or tuck jumps) and record height and distance using slow-motion video.
- Data Collection: Record observations in tables, noting angle, velocity, and surface type for example:

Angle	Distance travelled (m)	Time
30°	4.2 m	1.8 s
45°	5.7 m	2.1 s
60°	4.9 m	2.3 s

3. Elaborate (20 minutes)
Analysis:

- Ball sports groups calculate velocity, distance, and trajectory graphs.
- Gymnastics groups analyze video footage to calculate jump height, flight time, and angle of takeoff.

Discussion:

- What are the differences in human motion versus ball trajectories?
- How can motion equations explain the results?
- How can understanding these principles improve sports performance?

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4. Evaluate (15 minutes)
Group Presentations: Findings presented using graphs, charts, or video analysis.

Class Discussion:

- What similarities did students notice across different sports?
- How can understanding these principles improve athletic performance?

5. Extend (20 minutes)
Brainstorm:

- How do these concepts apply to other sports (e.g., swimming dives, pole vaulting)?
- How could technology (motion capture, wearable trackers) enhance analysis in sports?

Optional Challenge: Groups predict and test new scenarios (e.g., changing surfaces for jumps, varying ball weight).

Tips for age group differentation (for older/younger kids than indicated in the lesson)

For younger students (10–12 years): Focus more on visual demonstrations and estimating angles with paper templates or body movement rather than using protractors or formulas.

For older students (15–16 years): Dive deeper into projectile motion equations and add discussions on energy conservation or air resistance.

To which SDG(s) does the lesson relate most

SDG 3: Good Health and Well-being
Highlights body movement and sports engagement.

SDG 4: Quality Education
Makes physics concepts relevant and fun through sports.

What Inclusivity and Accessibility measures can or should the teacher take for this lesson

Allow students with limited mobility to observe, analyse, and present data instead of performing physical activities.

Use diagrams and video demonstrations to reinforce concepts.

Allow students to use physical or digital graphing tools, depending on ability.

Pair students strategically to ensure peer support during tasks.

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