BitWith Bite

PYGAME MASTERY WORKSHEET

Physics

Module 12 of 20 · Level ★★☆ · Time: 40 min

SCORE ___ / 20

Name _____ Class _____ Date _____

AFTER THIS WORKSHEET YOU CAN

- ✓ Apply Euler integration each frame
- ✓ Simulate gravity and bouncing
- ✓ Explain elastic collisions and momentum
- ✓ Compute projectile launch velocity

QUICK RECAP

Physics in Pygame is built from Euler integration (acceleration updates velocity, velocity updates position), gravity as a constant downward acceleration, bouncing via a restitution coefficient, and projectile motion decomposed into x/y velocity components with trigonometry.

Section A · Concept Check • INTERMEDIATE 4 × 1 = 4

1 What is the correct order in Euler integration each frame?

- ◯ A. Position first, then velocity
- ◯ B. Velocity from acceleration, then position from velocity
- ◯ C. Any order works identically
- ◯ D. Only position ever updates

2 What does a restitution of 0.7 mean for a bounce?

- ◯ A. Retains 70% of velocity, losing energy each bounce
- ◯ B. Bounces exactly 70 times
- ◯ C. Moves 70% slower horizontally
- ◯ D. No effect

3 Why is vy negative for an upward launch angle in Pygame?

- ◯ A. It's a bug
- ◯ B. Up the screen means decreasing y
- ◯ C. Negative means stopped
- ◯ D. It reverses gravity

4 What is momentum?

- ◯ A. Mass times velocity
- ◯ B. Speed divided by gravity
- ◯ C. A bounding rectangle
- ◯ D. Same as friction

Section B · Problem Solving • INTERMEDIATE 2 + 3×3 = 11

5 Gravity is applied as a constant _____ acceleration each frame.

6 For equal masses, an elastic collision simply _____ the velocity components along the collision axis.

7 Write the two lines that update velocity then position given acceleration and dt.

8 Why does a bouncing ball get progressively shorter with each bounce when restitution < 1?

9 What two trigonometric functions split a launch speed into x and y velocity components?

Section C · Challenge • CHALLENGE 5

10 A bouncing ball demo has 15 balls that should bounce off screen edges AND off each other. Explain what two physics techniques from this module are needed, and in what order you'd apply them each frame.

Reflection — the most useful thing I learned:

A ___/4 B ___/11 C ___/5 **Total ___/20**

Teacher's Signature

Parent's Signature

✂ ANSWER KEY — FOLD OR CUT BEFORE HANDING OUT

1-B 2-A 3-B 4-A | 5 downward 6 swaps 7 = vel += acc * dt; pos += vel * dt 8 = restitution < 1 removes a fraction of velocity (energy) on every bounce, so each successive bounce reaches a lower peak height than the one before 9 = cos() for the x-component (vx = speed*cos(angle)), sin() for the y-component (vy = speed*sin(angle)) | 10 = apply gravity + bounce-off-screen-edges (restitution) to each ball every frame for the world collision, then separately check each pair of balls for overlap and apply the elastic collision (velocity swap along the collision axis) formula — gravity/bounce handles the world, the pairwise elastic collision check handles ball-to-ball impacts