

Lab 2.1: Where a System Balances

Name: _____ Date: _____

Grading. Worth **50 points**: 25 for completion, 25 for effort. Effort means readable work, a labeled sketch where one belongs, and a real attempt on every part, not a correct final number. Point values are marked next to each part. Record every reading exactly as the panel gives it, units included, and describe what you actually saw rather than what you expected to see. Follow the assignment etiquette posted on the Assignment Center before you submit.

The simulations are on the lab page, physicstateds.com/ap-physics-1-2/lab-2-1/, and you can type your answers straight into it if you would rather not write on paper. Work down the page and use them as you go. Parts 2, 3 and 4 ask you to say what you expect before you touch the controls, so write that down first. Nothing here is calculated. Describe what you see.

1. Warm-up: move the boundary and watch

[5 pts]

Two blocks joined by a rope, with a pull on the right one. The three buttons choose what you are calling the system, and the dashed line is the boundary.

Simulation: "Which blocks are the system."

Move the slider. Press each of the three buttons. Watch which arrows are drawn and which are not. Then write **one sentence** about what you noticed.

2. Where three discs balance

[15 pts]

Three discs on a grid. Press **Reset** first.

Simulation: "Three discs on a grid."

- (a) Look at where the gold cross sits compared with the three discs. Is it nearer the heavy disc or the light ones? Describe how you can tell by eye, without using any of the numbers. [7 pts]
- (b) Before you click anything, write down which way you expect the cross to move if the 1 kg disc becomes a 3 kg disc. Then click that disc twice and describe what actually happened. Now drag one disc slowly across the grid and describe how the cross follows it. [8 pts]

3. Taking a piece out

[15 pts]

A 60 cm square steel plate. Press **Corner bite**, then **Reset**. The bite is then 24 cm by 24 cm, out of one corner.

Simulation: "A 60 cm steel plate with a piece taken out."

- (a) Two crosses are drawn: the red one is where the plate balanced before the cut, the green one is where it balances now. Describe where the green cross went and in which direction, and say why that direction makes sense. [7 pts]
- (b) Drag the corner handle to make the bite bigger, watching the line that says whether the balance point is on metal or in the empty part. Record the bite size at the moment it changes. Then say how an object can balance at a point where there is nothing, and name one everyday object where that is true. [8 pts]

4. What actually follows the parabola [15 pts]

A rod with a ball at each end, thrown across the room. Set the speed to **13.0 m/s**, the angle to **52 degrees** and the spin to **1.2 turns per second**. Leave those three alone and change only the two masses.

Simulation: "A rod with a ball at each end, thrown."

- (a) Leave the speed, angle and spin alone. Launch with both balls at 3 kg and watch the three traces: the two balls and the gold cross. Describe the shape of each one. Which is a smooth arc, and what do the other two do? [7 pts]
- (b) Now set the left ball to 1 kg and the right to 9 kg and launch again. Say where the cross sits along the rod now. Fill in the table, then say whether the throw went further, less far, or exactly as far as before, and what that tells you about which part of the rod the throw is really about. [8 pts]

Left ball (kg)	Right ball (kg)	Balance point from the left ball (m)	Time in the air (s)	Range (m)
3	3			
1	3			
1	9			
9	1			