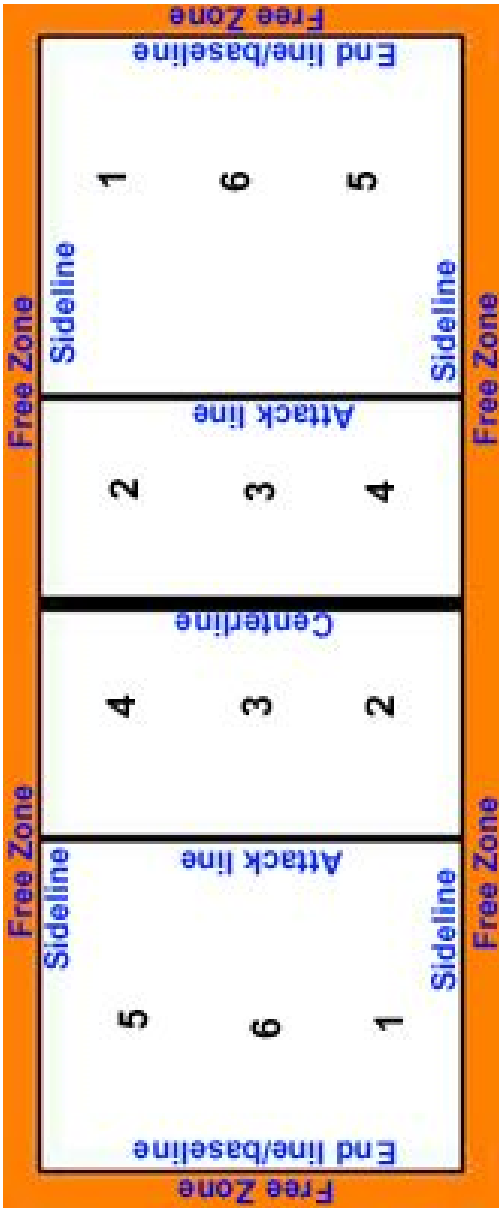
Module 1.1: THE VOLLEYBALL COURT

What is the perimeter of the volleyball court?

Answers vary based on court size.

Example: 180 feet (60 feet by 30 feet)



What is the perimeter of the endline to the attack line?

Answers may vary based on student results.

Example: 100 feet (20 feet by 30 feet)

What is the perimeter from attack line to attack line?

Answers may vary based on student results.

Example: 100 feet (20 feet by 30 feet)

What is the perimeter from the attack line to the centerline?

Answers may vary based on student results.

Example: 80 feet (10 feet by 30 feet)

What is the area of the volleyball court?

Answers may vary based on student results.

Example: 1800 ft^2 (60 feet by 30 feet)

What is the area of the polygon from the endline to the attack line?

Answers may vary based on student results.

Example: 600 ft^2 (20 feet by 30 feet)

What is the area from the attack line to the attack line?

Answers may vary based on student results.

Example: 600 ft^2 (20 feet by 30 feet)

What is the area of the polygon from the attack line to the centerline?

Answers may vary based on student results.

Example: 300 ft^2 (10 feet by 30 feet)

Module 3.1: VOLLEYBALL PROPERTIES

Bump Test: Results may vary among students. Example data below.

	Trial 1	Trial 2	Trial 3	Range
Light Touch Volleyball	20 feet	18 feet	23 feet	5 feet
First Touch Volleyball	22 feet	25 feet	19 feet	6 feet
Recreation Volleyball	17 feet	15 feet	20 feet	3 feet
Balloon	4 feet	5 feet	10 feet	6 feet

Answers may vary based on student results. Example data below.

Observations	Balloon	First Touch	Light Touch	Recreation
Differences	Thin Light weight Oval Orange Fragile	Blue	Red	Heaviest Green
Similarities	Bounces	Round Bonces Thick material Durable	Round Bonces, Thick material Durable	Round Bonces Thick material Durable
Durability (1-4)	1	2	3	4
Mass	4 g	230 g	140 g	280 g

Module 4.1: CALCULATING TOTAL FORCE

How does a Volleyball move? How does a Volleyball stop moving?
Review "Newton's Second Law" F = MA (force equals mass times acceleration). If the initial speed is zero, such as the case of hitting the volleyball, we can divide speed by time to understand no movement (no force) and movement (applied force).

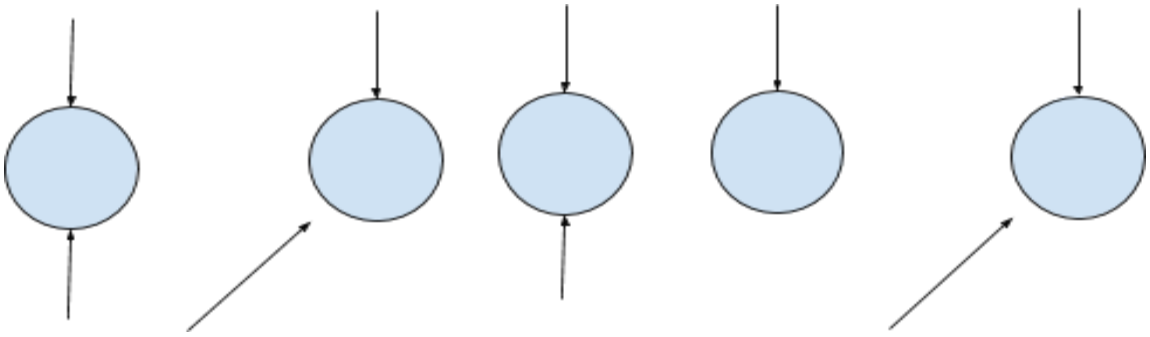
Hypothesis (What do you think will make a ball move and why?)
Answers may vary among students.
Example response: If I hit the ball harder, it will go faster.

Scaffolding Experiment
Example data below.

	Is it moving? (Y or N)	How long does it take before it stops moving?	What speed is it traveling at?
Ball on the ground	N	N/A	0 mph
Ball after a serve	Y	3 seconds	32 mph
Holding the ball	N	N/A	0 mph
Dropping the ball	Y	< 1 second	12 mph
Ball after a bump	Y	6 seconds	13 mph

Force diagrams: Answers may vary based on student results.

Example diagrams below.



On the ground Serving Holding Dropping Bumping

How does force create motion (Answer using evidence from your experiment)? Answers may vary based on student results.
Example response: When a ball is hit, the energy that it is hit with is transferred to the ball. If no energy is being transferred, no motion will occur. But sometimes you don't need to hit the ball, like when you drop it. And sometimes energy is being used to hold the ball up, but no movement occurs. The force or energy needs to be uneven, like in the force diagrams.

Module 5.1: IMPROVING SERVING

Part 1

Question: How do you improve your serve?

Answers may vary among students.

Example response: I can improve my serve by using a underhand serve instead a torque serve

Hypothesis: Which of the following will improve your serve: position, person serving, serve type or volleyball?

Answers may vary among students.

Example hypothesis: If I change the serve type from torque to underhand, more serves will make it over the net.

Data Collection: Record the distance and location of each serve.

Results may vary among students. Example data below.

	Partner 1	Partner 2	Position 1 (1 foot behind line)	Position 2 (on the line)
Underhand Serve	30 feet, net serve	40 feet, near attack line	25 feet, before the net	45 feet, near the attack line
Torque Serve	42 feet, left near the attack line	20 feet, before the net	30 feet, net serve	30 feet, net serve
First Touch Ball	53 feet, center near the end line	43 feet, right near the attack line	30 feet, net serve	42 feet, just over the net, near attack line
Light Touch Ball	55 feet, near the end line	30 feet, net serve	53 feet, near the end line	63 feet, past the end line

Conclusion: What variable improved your serve? How do you know?

Answers may vary based on student results.

Example response: My serve got better when I used the Torque serve and the First Touch volleyball and stood closer to the line.
Each of the data for that hit was higher for me and my partners.

Part 2

Question: How do you improve your serve?
Answers may vary among students.
Example response: I can improve my serve by changing my foot position with my forward foot.

Hypothesis: Will a change in foot position increase the distance of a serve?
Answers may vary among students.
Example response: If I point my front foot forward and my back foot at 45 degrees, my serves will go further.

Data Collection: Collect distance in feet.
Results may vary among students. Example data below.

	Trial 1	Trial 2	Trial 3	Average
Both feet forward	35 feet	37 feet	30 feet	34 feet
Back foot at 45 degrees & front foot forward	33 feet	38 feet	43 feet	38 feet
Both feet at 45 degrees	29 feet	36 feet	31 feet	32 feet

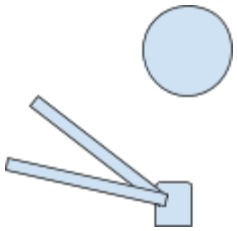
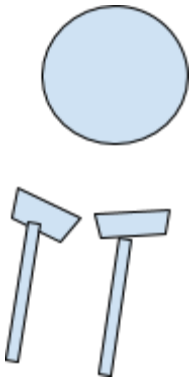
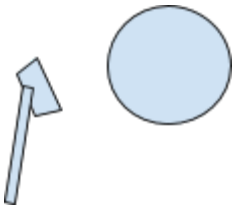
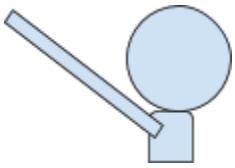
Conclusion: Which foot position improved the distance of the serve? How do you know?
Answers may vary based on student results.
Example response: My hypothesis was supported because the average for my back foot at 45 degrees and front foot forward was the highest.

What are the similarities and differences between the two experiments?
Answers may vary based on student results.
Example response: In both experiments, we were testing how to improve the serve. In the second experiment, it was easy to tell if I was doing better. In the first experiment, I was confused as I was trying more ways to improve my serve at the same time.

What would a coach more likely use to change/improve their players serve? Explain.
Answers may vary among students.
Example response: The second experiment because it is more clear the change made a difference on the player's serve.

Module 6.1: SPEED OF THE VOLLEYBALL

Results may vary among students. Example data below.

Hit type	Bump	Set	Serve (Torque)	Serve (Underhand)
Labeled drawing of the hit and motion				
Distance	21 feet	16 feet	38 feet	33 feet

Results may vary among students. Example data below.

Hit Type	Trial 1	Trial 2	Trial 3
Bump	15 mph	13 mph	12 mph
Set	12 mph	19 mph	21 mph
Serve (Torque)	38 mph	42 mph	55 mph
Serve (Underhand)	31 mph	58 mph	27 mph

Write a mathematical expression putting each hit in order from fastest to slowest. Support your expression with a written justification.

Answers may vary based on student results.

Example response: A Torque serve > Underhand serve > Set > Bump

Overall, the Torque serve had the highest average so it was the fastest

volleyball at 45 mph; a underhand serve was next fastest at an average of 39 mph; a set was at 17 mph; the bump was the slowest hit at 13 mph.

Module 7.1: SUCCESSFUL SERVING

Place an X when the serve is completed (hits the wall): Examples data below.

Serve	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	Fraction
Underhand Serve	o	x	x	x	x	o	x	o	x	x	7/10
Torque Serve	x	x	x	x	x	o	x	x	o	x	8/10

Write a mathematical expression using the greater than or less than symbols. Put the serve in order of most successful to least successful.

Underhand Serve: 7/10 < 8/10 :Torque Serve

1) Torque Serve: 8/10 = .80
2) Underhand Serve: 7/10 = .70

Module 8.1: ADAPTIVE TECHNOLOGY

Create a device that will help adaptive players retrieve the ball after a play.
Brainstorm ways to help Adaptive Players:
Results may vary among students.

Select a Design (draw in detail, label materials and provide measurements): Results may vary among students.
