

# **Archery Leader Guide**

Basic and Advanced Levels

Ages 8-18 years

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# Table of Contents

Introduction.....	3
<b>Basic Lessons</b>	
1 Eye Dominance.....	5
2 Shooting Safety.....	8
3 Shooting Form.....	13
4 Archery Equipment.....	18
5 Instinctive Shooting.....	26
6 Basic Archery Disciplines.....	29
7 Building a Bow.....	41
Basic Assessment & Key.....	47
<b>Advanced Lessons</b>	
1 Types of Bows.....	57
2 Selecting Equipment.....	66
3 Trajectory of an Arrow.....	73
4 Physiology of Archery.....	78
5 Setting Up a Bow.....	83
6 Fletching an Arrow.....	88
7 Building and Using Sights.....	92
Advanced Assessment & Key.....	97
<b>Appendix-PowerPoint Slide Shows</b>	
Basic-Lesson 2: Shooting Safety.....	106
Basic-Lesson 5: Setting Up a Bow.....	108
Basic-Lesson 6: Basic Archery Disciplines.....	110
Advanced-Lesson 3: Trajectory of an Arrow.....	114
Advanced-Lesson 4: Physiology of Archery.....	119

## Introduction

The purpose of this guide is to provide a resource for archery leaders that include reflection, application and evaluation with the activities. The primary objectives are:

- To improve accuracy by performing proper shooting form
- Practice safety in all aspects of archery
- Develop life skills while learning archery

This guide was developed to address a need of archery leaders to plan activities that purposely incorporate life skills while teaching the youth all about archery. The concepts and principles originate in the National 4-H Shooting Sports Committee Instructor's Manual II. This guide is designed to be used only by Level I Certified Archery Instructors, the training required to be a 4-H archery leader, as the concepts included are covered in-depth in the training.

There are 14 lessons. Seven are in the Basic Section and seven in the Advanced Section. The sections are divided up by both skill level and age. All beginning archers, regardless of age should be learning the lessons from the Basic Section, especially 1-3. The Advanced Section is for more experienced archers (shot for at least a year) who have mastered the lessons in the Basic Section and are also age 11 or above.

In the Basic section, the evaluation in each lesson should be satisfactorily completed before moving to the next lesson. Some material takes more than one meeting to master so an understanding of the material may be sufficient for advancement. The Personal Safety life skill is featured in all seven lessons. This lowers the risk of injury when the safety protocols included in the lessons are followed. Safety is a consideration whenever archery equipment is being handled, whether the archer is shooting or not. Many of the lessons in this section can be taught by older Advanced Level archers.

The Advanced Section includes lessons that are critical for run recreational shooting. Instead, some concepts are more abstract including physics and physiology. The purpose of these lessons is not to teach the archer how to shoot. They are intended to develop the life skills of Marketable Skills and Personal Safety. Problem Solving and Decision Making are also focused on. Proficiency in a lesson is not a requirement to learn the following lesson. However, it is recommended that Lessons 1 and 2 be completed sequentially but it is not required.

Throughout the book, there are references to the 4-H Instructor Manual. It is recommended that you read the fact sheets included in the manual for in-depth information. The accompanying CD includes slide shows and a video which complement the lessons. Often in archery, seeing the action or concept instead of just hearing about it is more powerful than simply reading or hearing it. In the Appendix are fact sheets, diagrams and printed copies of the slide shows.

# **Basic Lesson 1**

## **Eye Dominance**

## **Lesson 1: Eye Dominance**

**Skill level:** Basic

**Time Needed:** 10 minutes

### **Learning Objectives:**

#### *Project Skills*

Youth will be able to identify their dominant eye.

#### *Skills for Life*

Teamwork

Critical Thinking

Personal Safety

### **Materials needed:**

Clipboard

List of archers

Pen/pencil

### **Setting:**

On the range

### **Lead in questions:**

How do you know what your dominant eye is?

How is your dominant eye related to your dominant hand?

Why is it important in archery to identify your dominant eye?

### **Introduction:**

Almost everyone has a dominant eye. The image one sees lines up with the dominant eye. Very few people have indeterminate eye dominance but a large minority is cross-dominant. That is to say, their dominant eye is opposite their dominant hand. Archers with eyedness and handedness on the same side have easier time learning archery than cross-dominant. However, if a cross-dominant person switches to the dominant hand side, they will have an even more difficult time mastering the sport. Even with the difficulties of being cross-dominant, in the long run, by following the eyedness, they will be better archers.

### **Background information:**

Most people have a dominant eye, just as they have a dominant hand or foot. When a person looks at an object with both eyes, the dominant eye aligns directly with the object unless an obstruction interferes with a clear line of sight. Under normal conditions, when a finger is pointed at an object, or two or more objects are aligned visually, the dominant eye determines the alignment. Just as some people are truly ambidextrous, a very small number of people

have indeterminate eye dominance. The majority, however, have a dominant eye. In most cases, eye dominance and hand dominance are on the same side, but many people are cross dominant. That is, their handedness and eyedness are on opposite sides (Howard & Peter, 2012). For more information, see the fact sheet, “Determining Eye Dominance” in the Florida 4-H Archery Discipline Instructor Manual.

**Activity:**

Pair archers and have them stand facing each other 6 feet apart. Start with one archer in each pair doing the following: have them place one thumb over the other and cross their fingers over the fingers of the other hand, leaving a small triangle. Raise both hands together, keeping both eyes open and their arms straight toward their partner. They will look at their partner’s nose through the opening. The partner should note which eye can be seen through the opening. Now keeping the nose in the opening, they will bring their hands slowly back to their face. The partner should watch for any “cheating” where the hands seem to wander from eye to eye. The eye that their hands return to is their dominant eye. Now switch roles and try it again. Do not be concerned if the handedness and eyedness are different. A significant minority of the people in the world are cross dominant. For this first shoot, give them a bow as indicated by their dominant eye. They can switch later.

## HAND AND EYE DOMINANCE



- **EXTEND ARMS FORWARD AND FORM OPENING BETWEEN THE HANDS**
- **LOOK AT DISTANT OBJECT THROUGH OPENING**
- **BRING HANDS TO FACE WHILE LOOKING AT OBJECT—OPENING WILL BE ALIGNED WITH THE DOMINANT EYE**

[www.pewpewtactical.com](http://www.pewpewtactical.com)

Chart the dominant eye.

Activity adapted from:

Howard, R. A. (2014) Basic archery lesson 1: Archery equipment, safety and range commands. *4-H Archery instructor manual-Level II*. National 4-H Shooting Sports Committee.

Howard Jr., R. A. & Peter Jr., J. (2012) Fact sheet 3: Eye dominance. *4-H Archery instructor manual-Level II*. National 4-H Shooting Sports Committee.

**Reflect:**

- What could an image, like the target, look like if you were looking at it with your non-dominant eye?
- What happens when you try to look out your non-dominant eye without closing your dominant eye?
- Why is it easier for an archer with eyedness and handedness on the same side to learn archery?

**Apply:**

- What is another activity where knowing your dominant eye would make it easier to do?
- Now that you know your dominant eye, is there any other activity you might do differently?

**Evaluation:**

The youth understands the concept if he or she selects a left-handed or right-handed bow according to his or her dominant eye and shoots using the bow. The youth does not select a bow based on handedness and instead begins shooting according to eyedness.

## **Basic Lesson 2**

### **Shooting Safety**



## **Lesson 2: Shooting Safety**

**Skill level:** Basic

**Time needed:** 30 minutes

### **Learning Objectives:**

#### *Project Skills*

Youth will respond correctly to range commands.

Youth will be able to distinguish between the different areas on the range.

Youth will be able to explain the safety reminders and range rules.

#### *Skills for Life*

Decision Making

Self-Responsibility

Personal Safety

### **Materials needed:**

Whistle

Range Rules Sheet

### **Setting:**

Archery range with lines and perimeter marked but not identified.

### **Introduction:**

*Before we begin shooting there are several safety practices that you need to know. Archery is a sport in which the tools can be dangerous if used incorrectly. Knowing the range layout and whistle commands will help to keep everyone on the range safe. The safety protocol must be strictly followed so that a fun and safe shoot takes place.*

### **Background information:**

In archery there are standard rules. It is important to make youth aware of the risks involved in archery and how to decrease the likelihood of an accident. A list of rules can be found with this lesson. Feel free to add to it, but don't subtract any. It is helpful to give this list to all participants at the first meeting and post a copy on the range.

However, there are two other safety protocols which apply to all archery ranges, inside and outside of 4-H. They are the range layout for outdoor FITA ranges and whistle commands. To follow risk management practices, the range should be laid out according to the Instructor Manual and whistle commands should be used every time the youth shoot. For the first several

shoots, the range officer should say the range commands after they blow the whistle. See the Appendix for a diagram of range layout.

**Lead in questions:**

Why is it important to have the same safety rules for all archery ranges?

Do you know where to stand when you are on the range?

Do you know what the three lines on the range are for?

**Activity:**

Have the group standing in the waiting area while you teach. Stand in between the waiting line and the shooting line. Before you begin shooting you need to know range rules, whistle commands, and the layout of the range. Let's start with the range layout. Pointing to the waiting line, ask if anyone knows what it is called. If no one answers, give them a hint, "Right now, you are waiting behind the line. What do you think it's called?" Once they identify the waiting line, move to behind the shooting line and point at it. "This is the line you stand on to shoot, what do you think it's called?" Once they answer that correctly, move to the target line or speed bump. Again, ask if they know what the line is. If no one answers, give them a hint, "This line is near the target and it is where people wait to pull their arrows out of the target." Once they answer correctly, move to the edge of the range. "This is the area reserved for safety. No one should be in this area when archers are shooting. What do you think it is called?" Move to the back of the range. "This area is also reserved for safety because no one should be in this area when archers are shooting. What is this area called?" Walk to the front of the range and stand outside the waiting area. "This area is where the spectators may stand or it may be left empty. What do you think it's called?" Once they have answered that correctly, gather everyone in waiting area.

"Now you are ready to learn whistle commands. Whistle commands are used to tell the archers what to do next. You should never take an action until you hear the whistle command that it is alright do move. The person in charge of the range is the range safety officer. She is the person who blows the whistle and gives commands. She determines when it is safe or unsafe to shoot. "The first whistle command I want you to know is the command for you to retrieve your bow and move from the waiting area to the shooting line. When I blow the whistle twice, move to the shooting line." Blow twice. Everyone should move to the shooting line. "Now that you're on the shooting line, should you begin shooting?" Wait for an answer. If no one answers, remind them they are to wait for a whistle command to tell them what to do. Tell that one whistle blow indicates it is alright to shoot. However until they hear the whistle, they should not take an arrow out of their quiver. Blow the whistle once. Tell them to raise their arm like they are going to shoot. Explain that once they are done shooting, they should put their bow back and go back to the waiting area. This way, the range safety officer knows when everyone

is done shooting and the range is cold or safe. Explain that when you blow the whistle three times, the archers move to the target line. Blow the whistle three times. Everyone moves to the target line. Tell them that one person at a time can pull their arrows and that everyone that has not pulled their arrows waits on the target line. After they pull an arrow, it should go into the quiver. Once an archer has pulled all their arrows, they should return to the waiting area.

When everyone is in the waiting area, it is safe to start the process over again. Go through the whistle commands again, having the archers move according to the whistle commands. Once they have done this correctly, move them back to the waiting area.

Explain what to do in an emergency or dangerous situation. Tell them they will hear the whistle blow four times it means “Cease fire” but don’t do it. Give some examples of dangerous situations: someone behind the targets, an arrow is dropped on the range, etc. Ask them to identify the whistle blows as you make them.

Review procedures for dropping an arrow, retrieving an arrow, pulling an arrow, lost arrow, carrying arrows. Remind them to always keep arrows pointed down range and only shoot the target in front of them.

Review the range rules. As you read a rule, discuss what the rule means to them and how it is applied to behavior on the range. Ask if there are any rules they should be added.

#### **Reflection:**

- How does having the rules written out help keep the range safe?
- Why are the range rules standard for all archery ranges?
- Why is it important to wait for a whistle command to move?
- What do you do when you hear four whistle blasts?
- Who is in charge of the range and blowing the whistle?
- Why aren’t spectators allowed on the range?

#### **Application:**

- What is an example of rules that keep you safe?
- Why is it important to know your surroundings?
- When does knowing your surroundings keep you safe?
- How do you know you are in an unsafe area?

#### **Evaluation:**

- Youth respond to whistle commands without verbal direction. This assesses their knowledge of whistle commands and the range layout.
- Youth describe at least three range rules.
- Youth follow range rules.

Howard, R. A. (2014) Basic archery lesson 1: Archery equipment, safety and range commands. *4-H Archery instructor manual-Level II*. National 4-H Shooting Sports Committee.

## Archery Range Rules

1. Always be absolutely sure that the path to the target and beyond is clear.
2. Never point a drawn arrow at anything you do not intend to shoot.
3. Always be absolutely certain that the target is clearly visible, safe to shoot and appropriate.
4. Always be aware of the danger areas at the ends of the arrow and the tips of the limbs.
5. Please an arrow only on the string when you are told it is safe to shoot.
6. Never fool around with your archery tackle. Respect it.
7. Never use archery equipment while your mental ability is impaired by fatigue, distractions or the influence of any drug.
8. Always exercise caution when retrieving arrows or removing them from a target.
9. Always be sure that all archery tackle is in perfect working condition and free from damage before it is used.
10. Always abide by the strictest codes of behavior and ethics applied to the archery sport in which you are participating. This includes specific range rules.

## **Basic Lesson 3**

### **Shooting Safety**

**Skill level:** Basic

**Time needed:** 45-60 minutes depending on size of group. Have no more than 10 youth per instructor.

**Learning Objectives:**

*Project Skills*

Youth will be able to perform the eleven steps to the 10-ring method.

Youth will demonstrate the eleven steps method to a partner.

*Skills for Life*

Critical thinking

Self-motivation

Personal Safety

**Materials needed:**

Bows and archery tackle for the participants and the instructor.

Eleven Steps to the 10-Ring sheet

Eleven Steps to the 10-Ring video

Projector

Laptop

Screen

**Setting:**

Classroom

On the range

**Introduction:**

No matter what kind of bow you are shooting, the basic form is the same. The method you are going to learn today can be used with compound or recurve bows. The reason a standard method was developed is because the key to consistent accuracy is consistently proper form. By learning and using this method every time you shoot, there will be a greater likelihood that your shooting will improve over time and your shooting will become more consistent. The Eleven Steps to the 10-ring method starts the minute you move to the shooting line and ends after the arrow hits the target.

**Background information:**

The eleven steps to the 10-ring is a proven method for teaching beginning archers proper form and correcting experienced archers' inconsistent shooting. While this lesson begins with direct instruction, most of this lesson is experiential. Identifying the person demonstrating the steps prior to the meeting is important as is learning the steps and their description prior to conducting this lesson. You and your demonstrator are encouraged to watch the Eleven Steps to the 10-Ring video to refresh your memory of the proper execution of the steps. After going through the steps with the demonstrator several times, you will be ready to conduct the direct instruction with the youth. For further information on the 11 steps, see the National Shooting Sports Committee's. *4-H Archery instructor manual-Level II*.

**Lead in questions:**

What are the four whistle commands?

Where is the waiting line, the shooting line and the target line?  
What do you do after you have finished shooting an end?  
What does it mean to shoot with consistently proper form?

**Activity:**

Hand out the Eleven Steps to the 10-Ring reference sheet. Watch the Eleven Steps to the 10-Ring video and discuss the form in each of the steps. Next go to the range.

Pair everyone up. Hand out the Eleven Steps to the 10-Ring sheet to each archer. Have a co-instructor or experienced archer work as your assistant. Point out the parts of the bow and arrow necessary for the first shot. With the assistant, demonstrate the 11 Steps method. Point out that steps 6-10 (draw-anchor-aim-release-follow through) happen very quickly so it can be difficult to see them. If you have a video of the eleven steps, you can more easily see all 11.

After the archers have selected their bows, they will shoot one end (series of shots fired before the arrows are scored or retrieved) of three arrows using the 11 steps method and pull arrows. The instructor will load their first arrow and watch their technique. The non-shooting partner offers feedback on the archer's form. The second end is when the process repeats for the other partner. After both have shot, bring the group together for a question and answer session. Using whistle commands get the partners back to the shooting line. This time, only the youth will give each other feedback. Repeat this as long you would like.

**Reflection:**

- Why would your arrows be all over the target?
- Which step is the most important?
- What happens if you shoot with consistently bad form?
- What could happen if you skip a step?
- As you become a better archer, is it still necessary to do the eleven steps?

**Application:**

- Why is it important to follow the directions to do something?
- What happens if you change the steps or ingredients in a recipe?
- Does it matter if you are learning how to fly a plane, should you be taught by an expert? How about riding a bicycle?
- What is the difference between expert and experienced?

**Evaluation:**

- Youth shoot using the Eleven Steps to the 10-Ring.
- Youth coach their partner using the Eleven Steps to the 10-Ring.
- Youth can recognize when they are missing steps as they shoot.

## The Eleven Steps to the 10-ring

### 1. Stance & Posture

- a. Place one foot on each side of the shooting line.
- b. Find a comfortable balance stance with feet shoulder width apart.
- c. Stand straight, keeping ribs and chest down, and bottom tucked under.
- d. Keep shoulders down and relaxed.

### 2. Nock Arrow

- a. Place arrow on arrow rest, holding arrow close to nock.
- b. Keep index fletching pointing away from the bow.
- c. Snap nock of arrow onto bowstring under nock locator.

### 3. Set Hook

- a. Set first groove of first three fingers around the bowstring with one finger above the nock and two below creating a hook.
- b. Keep back of drawing hand flat and relaxed.
- c. The thumb and pinky should be tucked away.

### 4. Set Bow-Hand Grip

- a. Position the bow-hand on the bow grip by making a Y with the fingers and thumb.
- b. The knuckles of the fingers should be positioned a 45-degree angle and the thumb point towards the target.

### 5. Raise & Extend Bow

- a. Raise the bow arm and string hand together towards the target, while keeping shoulder down and aligning chest perpendicular to target.
- b. Drawing arm should be near level of nose.
- c. Bow arm should be rotated so it is straight up and down.

### 6. Draw

- a. Draw the string back in a straight line from raising and extending the bow (step5) to the side of the face anchor point.



- b. Set drawing arm shoulder back and down until elbow is directly behind or a bit higher than arrow.

7. Anchor

- a. Draw string to side of face placing tip of first finger on corner of mouth.
- b. Keep hand snug against face folding thumb down and little finger towards palm.

8. Aim

- a. Look at target or through sight, keeping focus on form.
- b. Focus on the point of aim if not using a sight.
- c. If using a sight, then focuses on the point you want to hit.
- d. Keep string lined up with center of bow.

9. Release

- a. Release all tension in fingers and drawing hand, all at once, while continuing to draw bowstring back without stopping.
- b. Continue bow arm towards target.
- c. Continue focusing on target.

10. Follow Through

- a. The drawing hand should continue back beside neck with fingers relaxed and ending up behind the ear.
- b. Keep bow arm up.
- c. Maintain follow through until arrow hits the target.

11. Relax & Evaluate

- a. Relax after each shot.
- b. Evaluate the feeling of each shot to determine if you accomplished the goal you were trying to achieve.
- c. If not, you should refocus your efforts on the feeling of the proper shot and try again.

National 4-H Shooting Sports Committee (2014) The eleven steps to the 10-ring. *4-H Archery instructor manual-Level II*. National 4-H Shooting Sports Committee.

## **Basic Lesson 4**

### **Archery Equipment**

## **Lesson 4: Archery Equipment**

**Skill level:** Basic

**Time needed:** 40 minutes

### **Learning Objectives:**

#### *Project Skills*

Youth will be able to differentiate between compound and recurve bows.

Youth will identify the parts of a recurve bow and arrows.

Youth will be able to use safety equipment.

#### *Skills for Life*

Marketable Skills

Critical Thinking

Personal Safety

### **Materials needed:**

Compound bow with sights

Recurve Bow

Arrows with feathers\*

Arrow with vanes\*

Armguards for everyone

Finger tabs

Gloves

Quiver

Field point and Broadhead

Poster with parts of a bow & Poster with parts of an arrow OR

Slideshow of equipment

Diagram with parts of a bow for each learner

Diagram with parts of an arrow for each learner

Projector (if using the PowerPoint)

Laptop (if using the PowerPoint)

Screen (if using the projector)

\*Both arrows should have a crest.

### **Setting:**

Classroom with tables and chairs.

### **Introduction:**

The sport of archery requires specific equipment based on how and why you will be shooting. While all bows can be used for hunting and target shooting, some are better than others for different purposes. By knowing the parts of a bow and arrow, you can evaluate the equipment for safety. In another lesson, you will learn about the characteristics of equipment you should look for when selecting equipment for yourself. Today we are simply learning the parts and uses of equipment.

The definition of tool is an implement or machine used to do work or perform a task. Do you think that bow and safety equipment could also be called tools?

**Background information:**

While compound bows and recurve bows are both used in archery, they are very different tools. While both can be used for hunting and competition, compounds are more common for hunting. Recurves are used more often in competition than hunting, although some do hunt using traditional methods. Recurves are also the bows used for Olympic archery. Compound bows are used in target archery but are not used in Olympic archery. There are several types of recurve and compound bows, each designed with features suited to its purpose. However, within each style, the basic parts remain the same.

**Lead in questions:**

Can any type of full size (not toy) bow be used for hunting? Is one type better than another? Does it matter what an arrow is made of?

**Activity:**

Have all the equipment spread out on tables in the front of the room. Hang posters with bow and arrow diagrams on the wall behind you or put the slides on the screen.

Start by describing the parts of a recurve bow because it has fewer parts. Use the piece of equipment to show the parts. The poster/slide is up to reinforce what you are saying. Explain a very brief history of the recurve, the fact that it can be shot instinctively (without sights) or with sights and that it is the type of bow used in the Olympics. Go through the same information about the compound bow. Explain how long it has been around and what it is best for (hunting) and why. Stress that it may be shot competitively but not in the Olympics.

Next describe the parts of the arrow using an arrow with a crest and the different types of quivers (hip, back, ground, and bow). Explain the difference between feathers and vanes and what type of bow each are designed to be used in. Describe the different materials used for arrow shafts. Talk briefly about the spine. In the lesson on making arrows, the spine and weight are discussed in-depth. The point of this lesson is to get them familiar with the equipment.

As you show the safety tackle, demonstrate how to use it. If you have enough for the group to each have a set (finger tab and arm guard), ask them to put it on or have pair share them and take turns trying them on.

**Reflection:**

- What are the three most common types of bows?
- What are the two most important pieces of safety equipment?
- What are the parts of a bow and arrow?
- If you get to be an accomplished archer, do you still need to wear an armguard and finger tab?
- Why do arrows with vanes work better in compound bows?
- What could you do to make your arrows identifiable?
- Why should you check your equipment every time you shoot?
- Is it safe to use someone else's equipment?

**Application:**

- What is the benefit of knowing the parts of a tool you are using?
- What can happen if you use a tool for something other than it was designed for?
- What is an example of a tool with multiple uses?

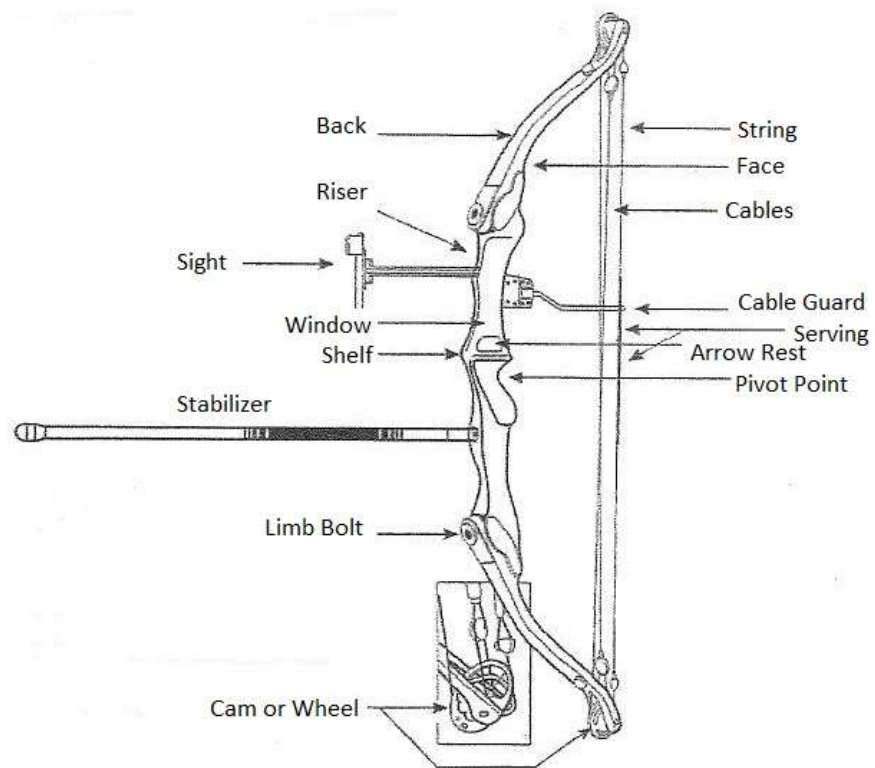
Tell them to keep reviewing the diagrams because they will need to know the parts of a bow and arrow for another activity later on.

**Evaluation:**

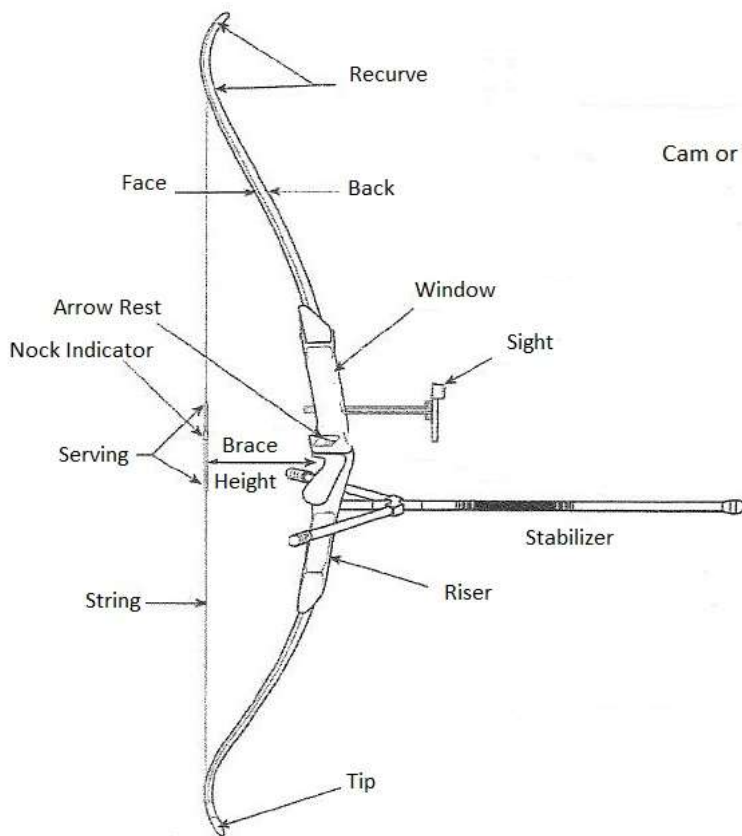
- Using the Archery Equipment Worksheet, youth will be able to identify at least 80% of the parts of a bow and arrow.

Archery Tackle Drawings: National 4-H Shooting Sports Committee (2014). Basic Archery Lesson 7: Bow Tuning. *4-H Archery instructor manual-Level II*. National 4-H Shooting Sports Committee.

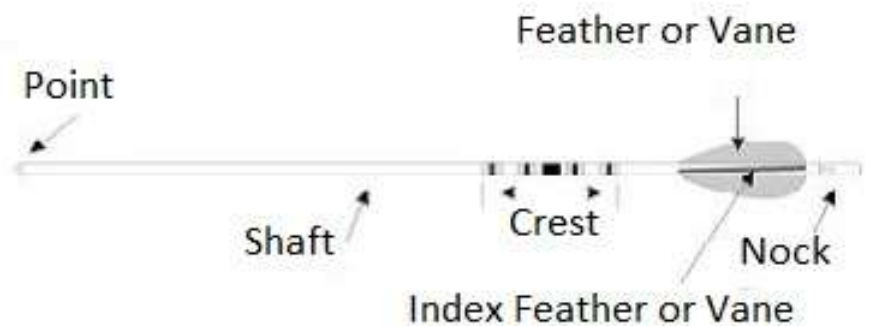
Bow and Arrow Drawings: Florida 4-H Archery Instructor Final Exam. (2015).



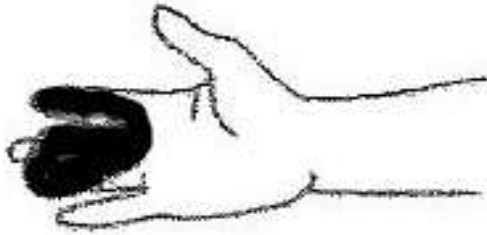
**Compound Bow**



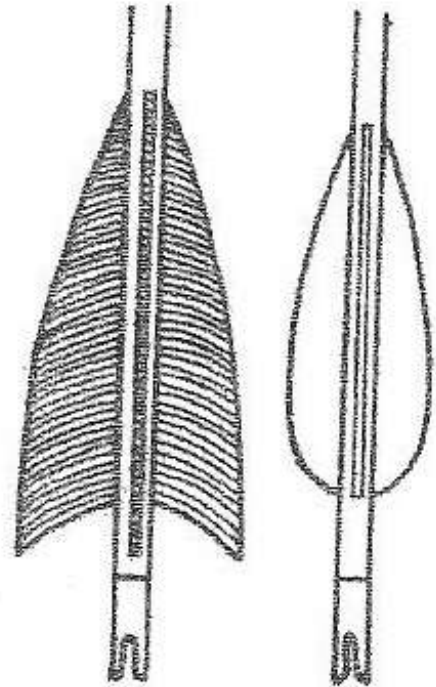
**Recurve Bow**



**Arrow**



**Finger Tab**

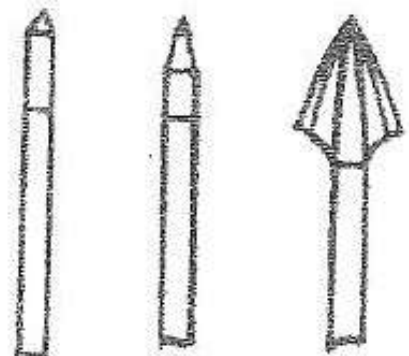


**Fletching (Feathers)      Vanes**

## **Fletching/Vanes**



**Glove**

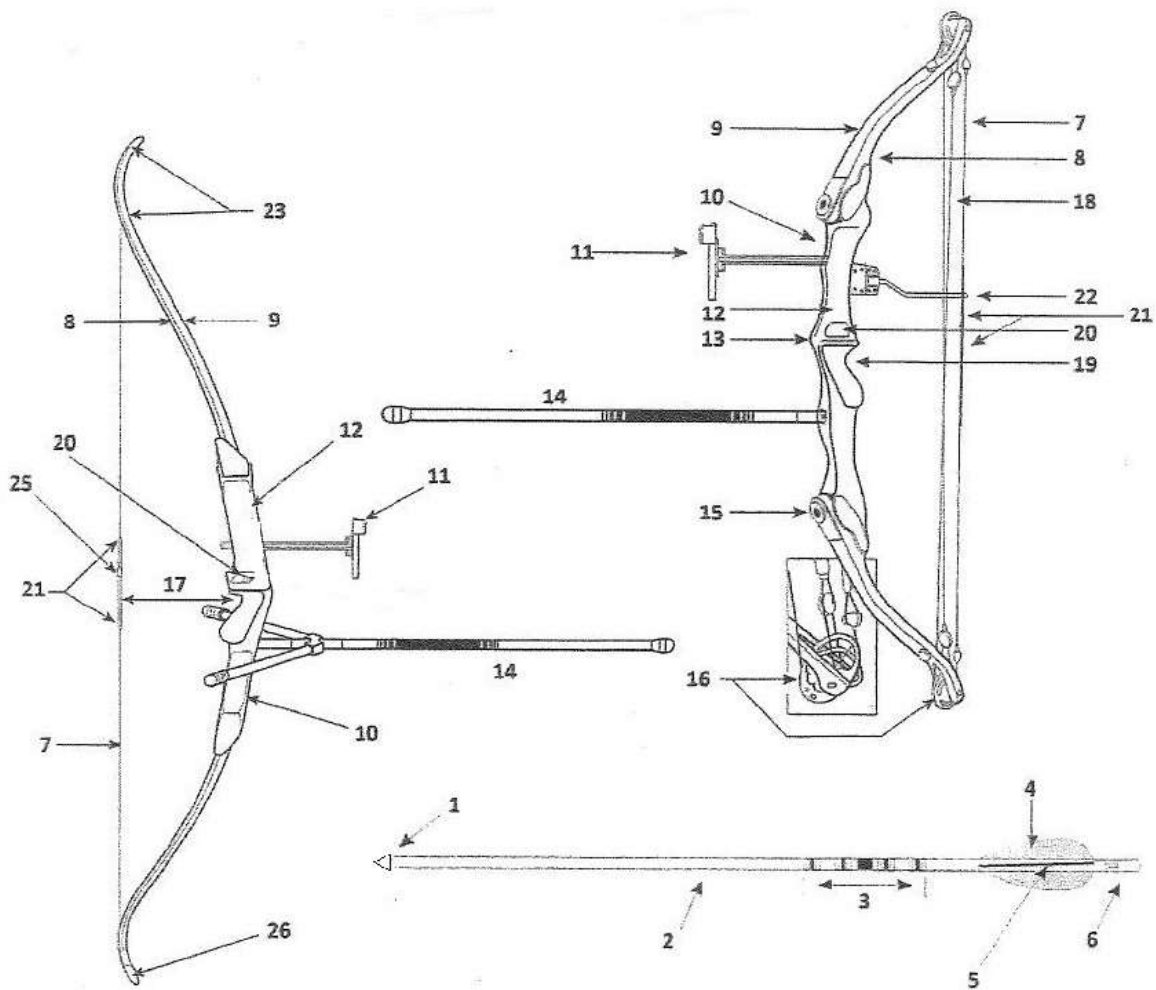


**Target      Field      Broadhead**

## **Points**

## Equipment Identification Worksheet

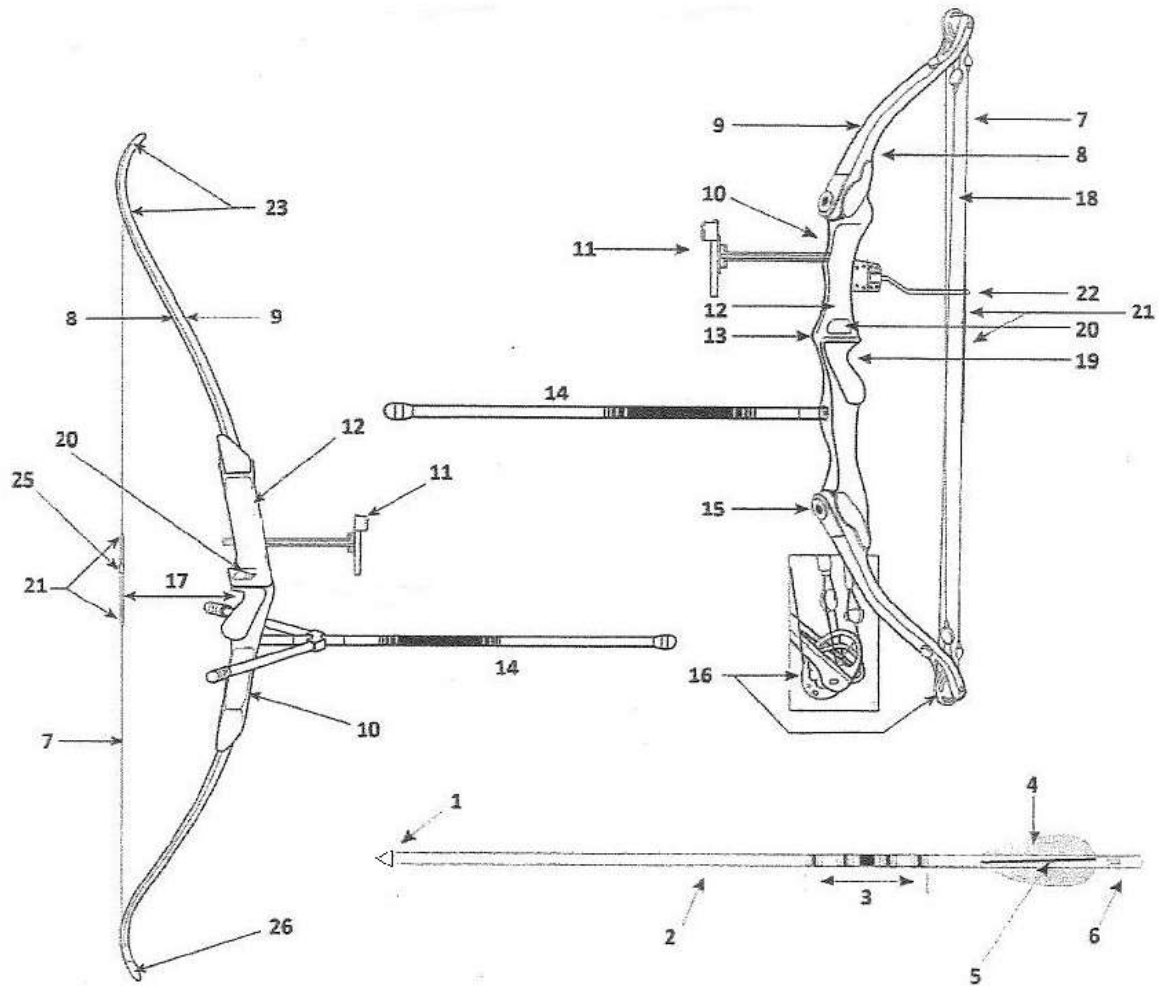
<input type="checkbox"/> Arrow Rest	<input type="checkbox"/> Riser	<input type="checkbox"/> Index Fletch or Vane
<input type="checkbox"/> Back	<input type="checkbox"/> Window	<input type="checkbox"/> Sight
<input type="checkbox"/> Crest	<input type="checkbox"/> String	<input type="checkbox"/> Serving
<input type="checkbox"/> Face	<input type="checkbox"/> Point	<input type="checkbox"/> Recurve
<input type="checkbox"/> Fletch or Vane	<input type="checkbox"/> Shelf	<input type="checkbox"/> Shaft
<input type="checkbox"/> Nock Locator	<input type="checkbox"/> Cables	<input type="checkbox"/> Limb bolt
<input type="checkbox"/> Brace Height	<input type="checkbox"/> Tip	<input type="checkbox"/> Stabilizer
<input type="checkbox"/> Cam or Wheel	<input type="checkbox"/> Nock	
<input type="checkbox"/> Pivot Point	<input type="checkbox"/> Cable Guard	





## Equipment Identification Worksheet-KEY

20	Arrow Rest	10	Riser	5	Index Fletch or Vane
9	Back	12	Window	11	Sight
3	Crest	7	String	21	Serving
8	Face	1	Point	23	Recurve
4	Fletch or Vane	13	Shelf	2	Shaft
25	Nock Locator	18	Cables	15	Limb bolt
17	Brace Height	26	Tip	14	Stabilizer
16	Cam or Wheel	6	Nock		
19	Pivot Point	22	Cable Guard		



## **Basic Lesson 5**

### **Instinctive Shooting**

## **Lesson 5: Instinctive Shooting**

**Skill level:** Basic

**Time Needed:** 30 minutes

### **Learning Objectives:**

#### *Project Skills*

Youth will be able to explain how to shoot instinctively.

Youth will be able to perform instinctive shooting.

#### *Skills for Life*

Teamwork

Critical Thinking

Personal Safety

### **Materials needed:**

Balls or bean bags for tossing

Archery equipment to shoot

### **Setting:**

On the range

### **Lead in questions:**

What does shooting instinctively mean?

When did people begin shooting instinctively?

Do you need special equipment to shoot instinctively?

### **Introduction:**

Instinctive shooting is using a bow without sights. This type of shooting is the oldest form of shooting. Shooting instinctively means focusing on the target instead of a sight. As you practice this way, you will learn how your form affects your shooting. As your shooting improves and you shoot at increasingly greater distances, take note of where your arrow hits the target. For example, if the arrow lands higher than you aimed for, lower your bow. After shooting at a particular distance, you should be able to adjust your aim to achieve accuracy.

Shooting instinctively is more difficult than shooting with sights, so it takes more practice to become consistently accurate. However, if you master instinctive shooting, you will be able to hit the target whether or not you have sights. Archers that learn with sights may find it more difficult, sometimes impossible, to be as accurate without sights.

### **Background information:**

Instinctive shooting simply means shooting without sights. Archers who learn to shoot instinctively before using sights become more confident archers than those relying solely on sights. Shooting instinctively is no different than tossing a ball. How do you know where to throw the ball? Do you line

up a finger or close one eye? If you answered no to both of those questions, then you understand instinctive shooting. In archery, you aim the bow down range using “instinct” to know how to aim it. You get an “instinct” about where to aim the bow through a great deal of practice. The more you practice, especially at different distances, the better able you will be able to adjust your aim to different situations. Learning to shoot instinctively is challenging so be patient. However, it is like riding a bike. As long as you are shooting a bow, you will be able to shoot instinctively.

**Activity:**

Pair up archers and have them stand six feet apart. Give one person in each pair a ball/bean bag. Instruct the partners to throw the projectile back and forth. Do this for less than 10 seconds. Have them move 12 feet apart and repeat. Have them move 10 more feet apart and repeat until the distance is too far to comfortably throw accurately.

**Reflect:**

- How did you know where to throw the ball/bean bag?
- What did you aim at?
- What did you change as you moved farther apart?
- Is there something you could use to make it easier to hit your target?

**Apply:**

- How is throwing a ball like shooting a bow?
- What is different about shooting a bow than throwing a ball?
- How do you know where to aim your bow?
- What can you learn from seeing where the arrow hit?

**Activity:**

Shoot 3 arrows instinctively at the bullseye on the target. Using the worksheet, after every shot, record where the arrow hit the target. Describe how you adjusted your aim after every shot.

**Reflect:**

- Where did the first arrow hit the target?
- What did you adjust to improve accuracy?
- How was the third shot different than the first shot?
- Why is evaluating your shot important?

**Apply:**

- How will evaluating each shot affect the next shot?
- Do you see evaluating each shot as necessary for accuracy?
- How can you improve your ability to shoot instinctively?

**Evaluation:**

- Youth will explain what instinctive shooting means.
- Youth will shoot instinctively with increasing accuracy.

## **Basic Lesson 6**

### **Archery Disciplines**

## **Lesson 6: Archery Disciplines**

**Skill level:** Basic

**Time needed:** 35-40 minutes

### **Learning Objectives:**

#### *Project Skills*

Youth will be able to distinguish between FITA, Field and 3-D archery.

Youth will be able to correctly score a shoot.

Youth will be able to describe the three range environments.

#### *Skills for Life*

Problem Solving

Teamwork

Personal Safety

### **Materials needed:**

Photos of target types with scoring

Discipline rules

Poster board or easel paper

Archery Disciplines Description handout for each participant

Target Scoring color worksheet, one for each group

Target Examples in color, 1 set

Quiz Bowl questions, cut

Archery Disciplines PowerPoint

Projector

Screen

Quiz buzzers

Something for prizes

### **Setting:**

Classroom with tables and chairs where group work can be done.

### **Introduction:**

There are several disciplines in archery. Some involve shooting outside while others are shot indoors. Some competitions involve multiple disciplines like the State Archery Match and others have only one discipline. The Olympics only shoots one discipline which you will hear about in a moment.

### **Background information:**

Florida 4-H Shooting Sports uses the National 4-H Shooting Sports standards for club and competitive shooting. The information here is from those standards. Scoring can be even more challenging than actually shooting. The youth can be in a hurry and there is a lot riding on their numbers being accurate.

Review the handout and practice scoring the worksheet yourself so that you can understand the challenges the youth might face trying to complete it.

**Lead in questions:**

*How many of you have shot competitively?*

*Which archery disciplines did you compete in?*

*What are the three archery disciplines 4-H uses in competition?*

**Activity:**

Evenly divide the participants into groups. Have youth of multiple ages in each group. Keep advanced archers in a group to be given roles in the later portion of the activity.

Give each participant an Archery Disciplines Descriptions handout.

Have advanced participants read portions of each of the descriptions. Use the descriptions to describe the picture of the target. Pass around the Target Examples so the group can examine them.

*Now that you have heard a description of the different archery disciplines and seen the targets, it's time to score an archery match. Collect the Target Examples. Pass out the Target Scoring worksheets, 1 per group. On the worksheets are the three types of targets. Each target has purple, pink and green dots on it that represent arrow hits by three archers. As a group, write down what type of target it is and calculate the score for each color (archer). Write the answers on the lines next to the targets. You will have 10 minutes to work as a group on this worksheet. Wait 10 minutes or until everyone is finished.*

*Now let's have some fun. We are going to play Quiz Bowl. There will be two types of questions to answer. For one I will show you a target from the worksheet and the group will have to identify it and tell the score. The second type of question is about the characteristics of each discipline. The first group to buzz in will get a chance to answer. Each question is worth five points. You can buzz in as soon as the target is shown. If the team that buzzes in gets it wrong, the question can still be answered for points. Let's begin. An advanced archer will read the questions, one will keep score, and another will operate the buzzer. Tally the scores and hand out the prizes to the winning team.*

**Reflection:**

- Which archery discipline would be the most challenging for you and why? There is no right answer.
- Why is it important to score the targets the same way, no matter where the range is located?
- How would the target's environment affect shooting?
- What might a 3-D range look like in our area? Think about terrain and vegetation.

**Application:**

- Where else could you use the skills you needed to score the targets?
- What are some other activities when having the right environment (terrain, weather, and space) is important?

**Evaluation:**

- Using the worksheet, youth will identify FITA, field and 3-D targets.
- Using the worksheet, youth will correctly score 80% of the targets.
- Youth draw the environment for one of the three disciplines.

Draw the shooting environment for \_\_\_\_\_ archery.



## 4-H Archery Disciplines

### FITA

Sometimes also called Target Archery. FITA stands for the French Federation Internationale de Tir a l'Arc, now known as World Archery Association. It is the governing body of the sport of archery.

- Target size: 40cm-122cm depending on the distance shot.
- Shot at an indoor or outdoor range.
- Scoring: 10X, 10, 9, 8, 7, 6, 5, 4, 3, 2, 1 point from center outward:  
Gold = 9-10-10X points (10x awarded for smaller X ring)  
Red = 7-8 point rings  
Blue = 5-6 point rings  
Black = 3-4 point rings  
White = 1-2 point rings

\*Pass through or bounce out: any shaft that fails to remain in the target may be scored by the mark on the target face.

- 3 shots per end (series of shots fired before the arrows scoring), 6 ends at each distance.
- Olympic archery shoots FITA.
- Ties are broken with the number of "X's" shot
- There are eleven rings including the x-ring.

### Field

This discipline is shot outside in a natural setting. There may be trees surrounding the range (but not in the shooting lane), the course may be set in a hilly area, or if there are no trees or hills, it may also be shot in an open field. The course is usually along a trail.

- Target size: 20cm & 65cm
- Scoring: Center ring with X= 5X points  
Two center black rings = 5 points  
Next 2 white rings = 4 points  
Last 2 black rings = 3 points
- Targets may be individual or in groups of up to four on a mat.
- Depending on the targets, archers may have to shoot from multiple spots. They may also have to select which target in a group they will shoot or shoot the targets in a specified order.
- Four arrows per lane
- Known distances between 10-60 yards depending on age division.

### **3-D**

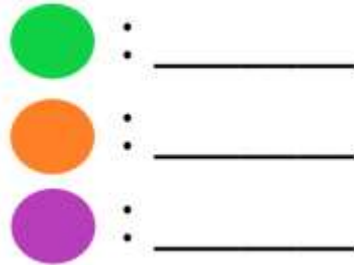
3-D stands for 3 dimensional targets.

- These are foam targets in the shape of game animals. Examples include deer, turkey, wild boar, bear and squirrel.
- Scoring:
  - Center vital zone ring = 11 points
  - Second vital zone ring = 10 points
  - Third vital zone ring = 8 points
  - Any other body shot except the foot= 5 points
- Distances may or may not be known depending on age division.
- Course is outdoors in a natural setting. It may be an open or wooded area.
- Archers only shoot one arrow per target.

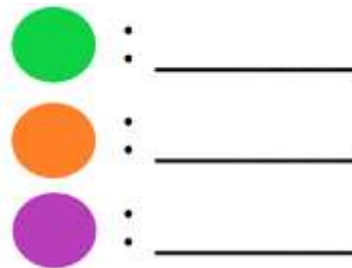
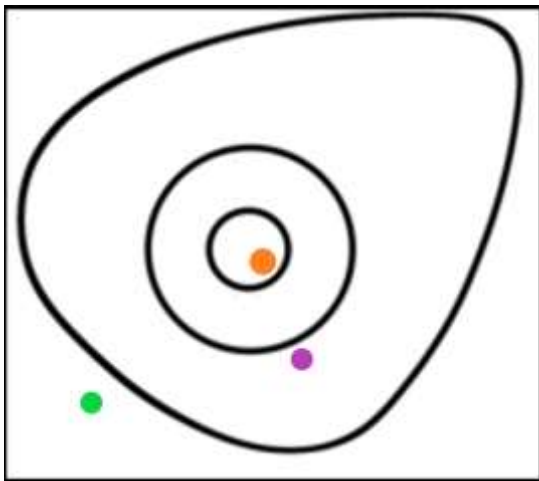
Other information:

- In scoring, a shot that lands between two areas on the line, the higher score is used.
- Arrows are not pulled until everyone has scored.
- Once arrows are pulled, the holes should be marked.

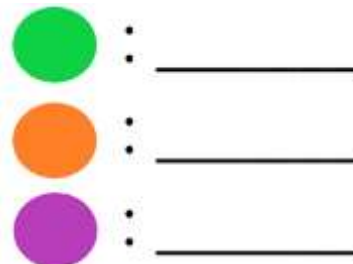
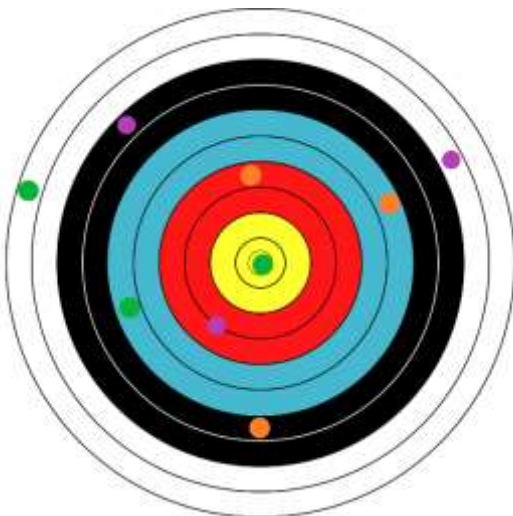
# Target Scoring



**Target:** \_\_\_\_\_

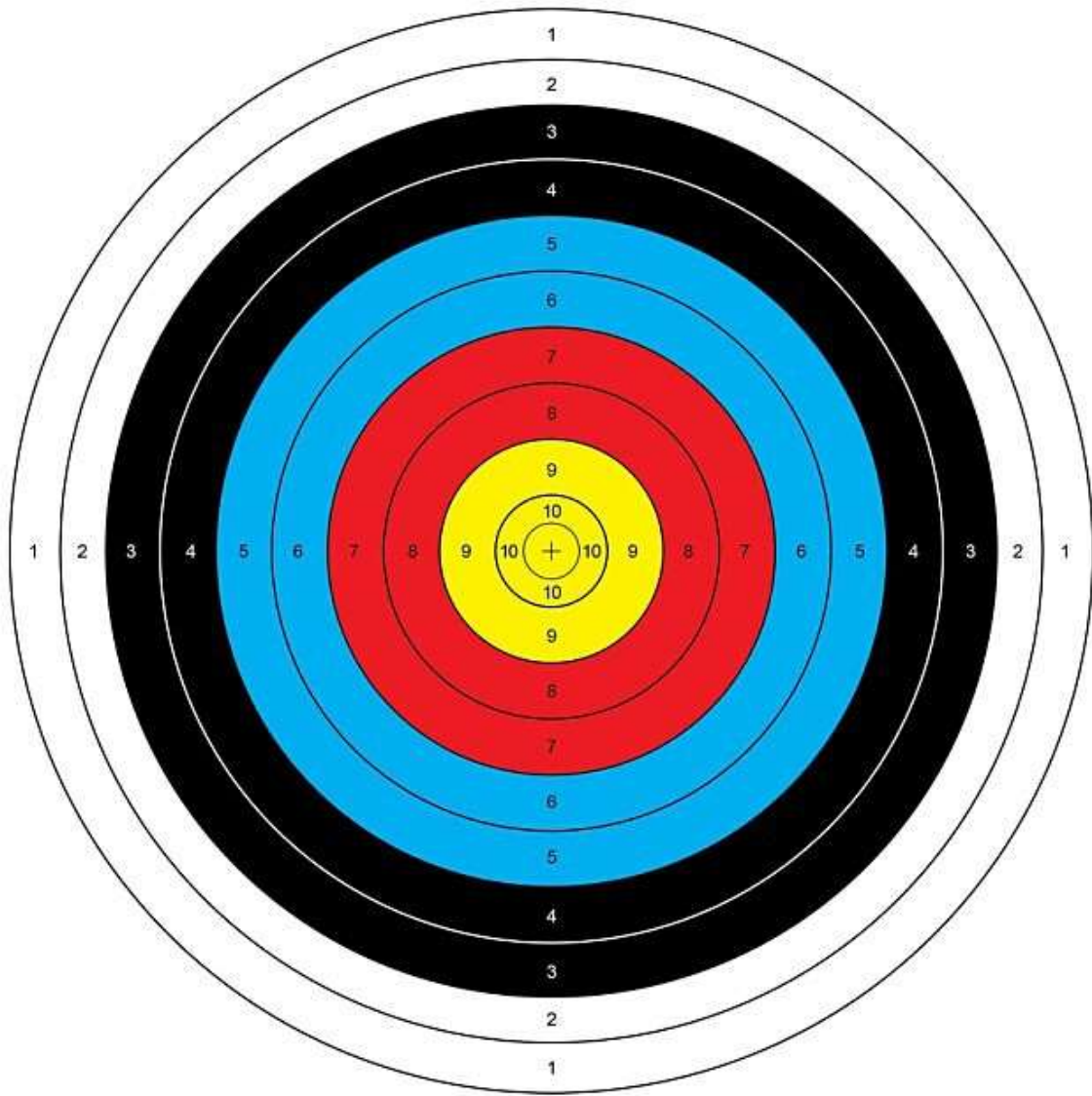


**Target:** \_\_\_\_\_

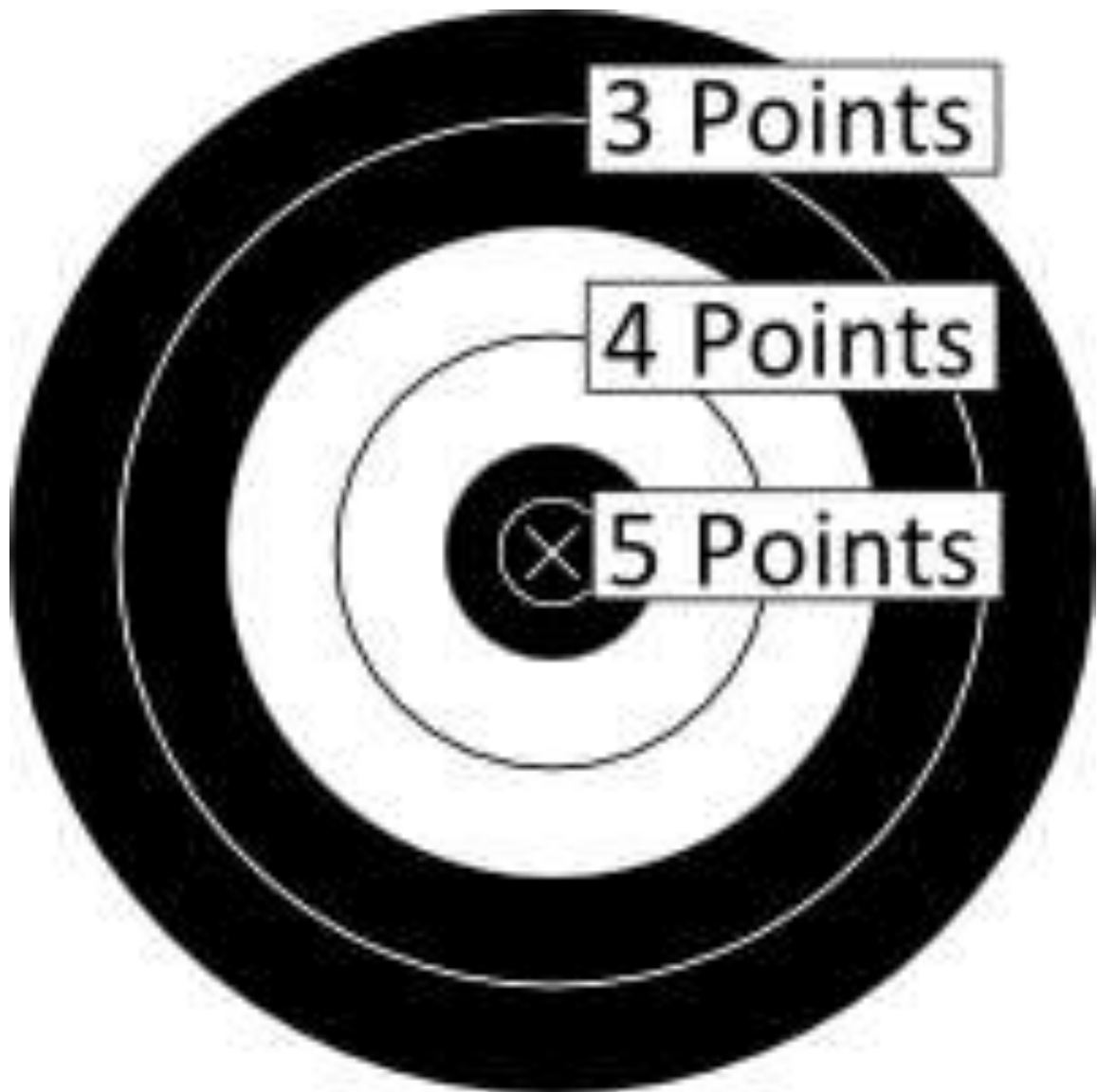


**Target:** \_\_\_\_\_

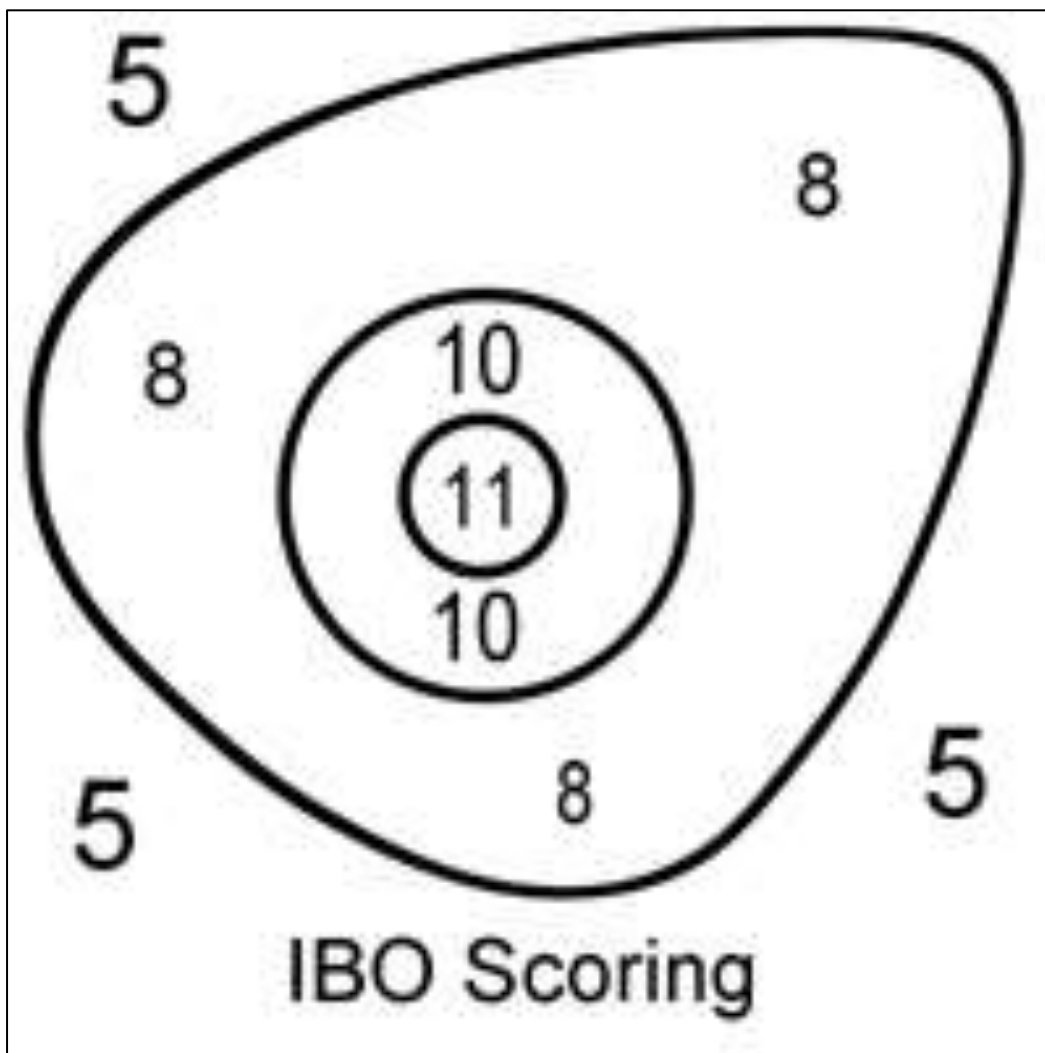
# FITA Target



# Field Target



# 3-D Target



## Quiz Bowl Questions

How many rings on a FITA target?	What type of archery is shot at the Olympics?	Name the three types of archery.
What are 3-D targets shaped like?	What does the environment on the field course look like?	What color or colors are on a FITA target?
What are the 5 numbers on a 3-D target?	How many arrows do you shoot at a field target or group of targets?	Name two game animals that could be 3-D targets?
What is the farthest distance on a FITA range?	How do you know how far away a target is on a 3-D range?	What is another name for FITA archery?

What is the score for the FITA target?	What is the score for the field target?	What is the score on the 3-D target?
On which target is the highest number ring 11?	Which type of archery can have you shooting from different positions at the same target?	How many 7 rings are on a field target?
How many points do you get if you hit outside the vitals on a 3-D target?	How is a tie score broken in FITA?	Which type of archery shoots the most ends?
Which type of archery can have multiple targets on one mat?	Besides zero, what is the lowest score area on a 3-D target?	How large can a FITA target be?



## **Basic Lesson 7**

### **Build a Bow**

## **Lesson 7: Building a Bow**

**Skill level:** Basic

**Time Needed:** 45 minutes

### **Learning Objectives:**

#### *Project Skills*

Youth will be able to construct a bow and describe why it did or didn't function.

Youth will be able to identify how changes in bow design affect functionality.

#### *Skills for Life*

Problem Solving

Planning/Organizing

Personal Safety

### **Materials needed:**

For each participant plus the instructor:

6 wooden dowels of varying lengths between 2' to 4'

10-12 feet of heavy fishing line

Scissors

1 roll of electrical tape for two participants

One recurve bow

### **Setting:**

Classroom with enough room to spread out on the floor or on large tables. Each participant needs a large area in which to work. Working on the floor where they can spread out works best.

### **Lead in questions:**

What can a bow be made of?

What do you need to know to make your own bow?

How does the size of the archer affect the bow design? How about the archer's strength?

### **Introduction:**

Archers come in all shapes and sizes and so do bows. Bows can be made of many kinds of materials depending on the purpose of the bow. Commercially produced recurves and long bows can be made of wood, fiberglass, carbon fiber or aluminum. Compound bows may be made of several types of man-made materials. The recurve shown here is made of wood and laminate (if you have this type of bow to show). The bow you will be making today will be constructed from wooden dowels and electrical tape with fishing line as the bow string.

We will be using wood that flexes. When the bowstring is drawn back, the archer applies force on the string bending the limbs backward. The amount of force applied to the string when it is pulled (drawn) back as far as possible is called the "draw weight." The energy in the bent limbs is now "potential energy" which will be converted firing arrow when the string is released. In physics, Hooke's Law states that draw weight is proportional to the draw length. The more the

limbs are deformed when they are pulled back further in the draw length, the greater the force because of the increased stored potential energy.

<http://www.untamedscience.com/archery-physics/>

When the bows are finished, we will take them to the range to try them out.

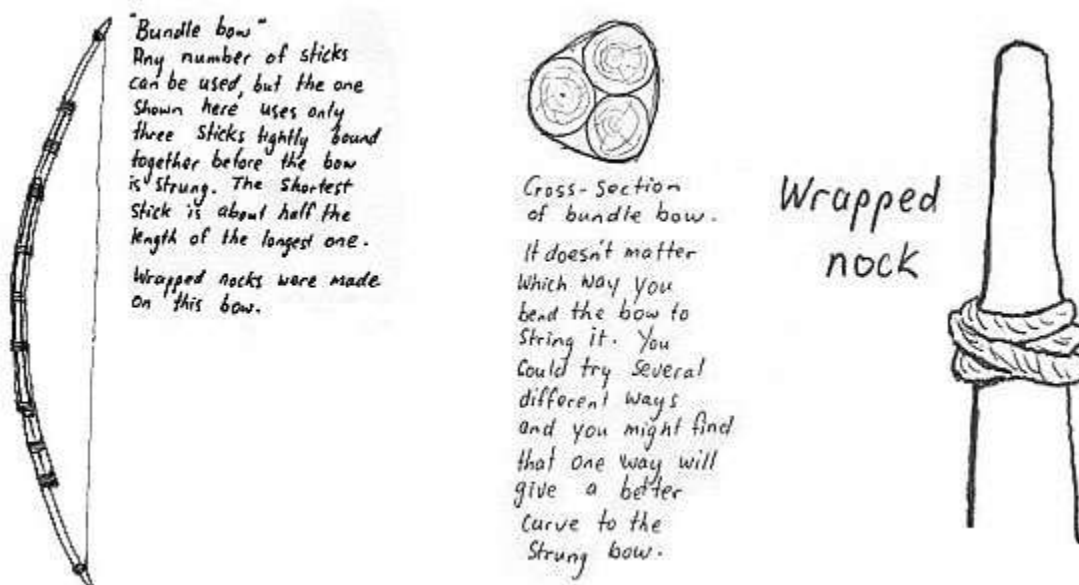
### Background information:

Bundle bows are primitive bows that, if made properly, can be shot. In this exercise, youth will be able to design and build their own bow with the option to shoot it after it is constructed. Make them aware that the wood they are using isn't very strong, so the bow may crack if shot. If the youth can draw the string, even without releasing it, then he/she has made a functional bow. During this exercise, offer as little help as possible. The aim of this lesson is to facilitate the construction of the bow by youth. Even if the bow fails, if they can problem solve to identify a reason it failed, they have gained important life skills through this lesson.

Make a bow before the meeting to use as an example of what the bundle bow will look like. This will also allow you to anticipate construction challenges the youth may have.

### Activity:

This bow is made from several, reasonably straight sticks (or similar objects) of uniform thickness that are bound together into a bundle. A single, plain stick with a string tied to it will make a bow of sorts, but it may be likely to bend too much in the middle and be inefficient. An efficient bow carved from a single piece of wood will generally be quite tapered towards both ends to balance the leverage applied by the string so that the bow bends evenly throughout both limbs. A bundle bow is generally made up of sticks that are tied together in such a way to achieve a similar taper.



Three sticks of a similar diameter (and a fairly uniform thickness for their whole length) can make a good bow. The shortest stick should be around half the length of the longest one. The middle-sized stick should be about three-quarters the length of the longest one. One quarter inch dowels of varying lengths work well.

When choosing bow-making materials, or thinking about a good design for a bow, it is good to try to keep the outer ends of the limbs as light as is practically possible. This does not mean that you should choose the lightest possible wood to make a bow... some of the most "recommended" bow woods are relatively dense and heavy, and light woods are generally not recommended for bow making. If you only have light wood available, then perhaps you should experiment with it. You may be surprised at what is possible.

It is often recommended that a bow should be longer than twice your draw length (the greatest distance between the back of the bow and the bow string when the bow is fully drawn). Twice your draw length plus 20% might be a good guide to start with. A shorter bow may shoot a little faster and be more convenient to carry than a longer bow, but it may be more likely to fail. A longer bow may help you shoot more accurately and will probably be a bit more durable. It is good to experiment. For a start, you might like to make your bow nearly as tall as yourself - up to your forehead perhaps.

The diagrams accompanying this article show examples of what the construction should look like. Plenty of strong, tight bindings should be applied to stop the sticks slipping. Strong adhesive tape may be a suitable alternative in some cases. Electrical tape works best because it stretches a bit. The sticks will be more securely held together if the smallest stick is tied (at least at each end) to the longest stick first. Then the next longest stick should be tied in place and so on. If all the sticks are simply picked up as a bundle and the only binding to be applied goes around the outside of the bundle, some of the smaller sticks may move when the bow is flexed.

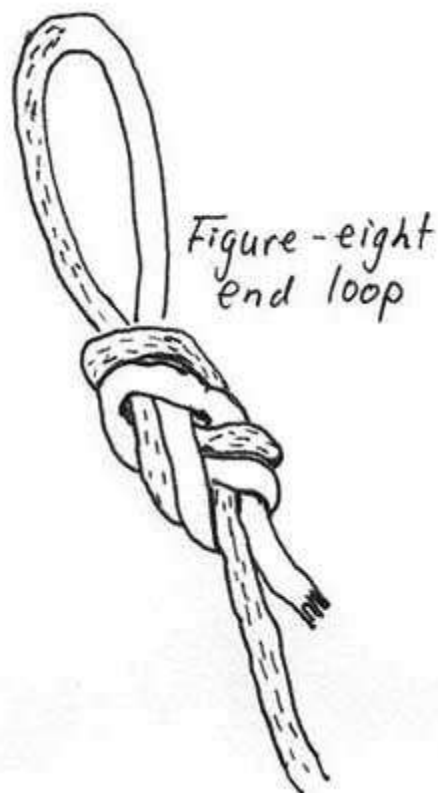
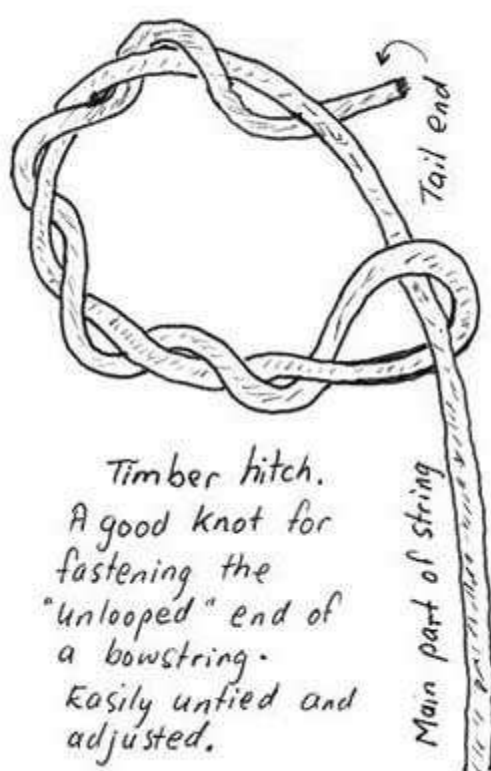
On many traditional bows carved from one stick, nocks are cut near the tips of each limb to hold the bow string. Instead of using cut nocks, the bow string can be stopped from slipping down the bow by applying a tight wrapping of cord or leather strapping around the end of the limb. This "lump" of cord may be more secure if it is glued into place (see diagram).

## **THE BOW STRING**

It is said that a bow string should have a breaking strain of four or five times the draw weight of your bow, and that it shouldn't stretch too much (this reduces the efficiency of the bow). All sorts of fiber can be used to make a bow string. You can just use a single piece of cord as a bow string.

Many of my own strings are made up of three lengths of polyester butcher's twine. I plait an eye into one end and twist the strands loosely to form the main part of the string.

It is not essential to have a special plaited or braided loop (or eye) to fasten the string to the bow. One end can be tied with a timber hitch knot, and the other end can have a loop formed by a knot. To form the loop a bowline is not recommended - it may weaken the string too much for a powerful bow. A figure-eight loop is preferred.



The string should be just long enough to create the right gap between the string and the bow when the bow is strung. Some people use a gap of one "fistmele". A fistmele is the distance between the top of your thumb and the bottom of your fist when you give a "thumbs up" sign.

Activity adapted from Simple, Cheap and Effective Bows and Arrows by Stephen Coote. Retrieved from the website Primitive Ways: [http://www.primitiveways.com/bow\\_and\\_arrow.html](http://www.primitiveways.com/bow_and_arrow.html)

#### Reflect:

- How did you decide what size dowels to use?
- Why did you choose the dowels for your bow?
- What surprised you about constructing the bow?
- Did where you taped the dowels affect the flexibility of the bow?
- What could you have done different to make your bow function better?
- Why is the riser thicker than the limbs?
- Why do the limbs need to flex?
- What is the purpose of an arrow rest or shelf?
- How does the size of the string affect the curve of the bow?
- What material would not be good for constructing a bow?

#### Apply:

- What else could you build using these same techniques?
- How will building your bow help you shoot more accurately?
- What did building this bow teach you about your bow?

**Evaluation:**

- Youth independently construct a bow.
- Youth identify the reasons the bow failed.
- Youth name two ways the bundle bow is like their modern bow.

# Basic Archery Assessment

Name: \_\_\_\_\_ Date: \_\_\_\_\_

1. On the range, what should you do when you hear the whistle blow once:

- ☐ Move to the shooting line.
- ☐ Nock an arrow.
- ☐ It is safe to go down range and retrieve arrows.
- ☐ Cease fire! Stop shooting and put your bow down.

2. What line does the archer shoot from?

- ☐ Target line
- ☐ Waiting line
- ☐ Shooting line

3. If you draw but don't pause before you release, what steps are you missing?

- ☐ Anchor, Aim
- ☐ Nock an arrow, Aim
- ☐ Anchor, Follow Through
- ☐ Follow Through, Relax & Evaluate

4. Why is knowing your dominant eye important in archery?

5. What should an archer do with their feet when they are on the shooting line?

- ☐ Keep both feet behind the line.
- ☐ Straddle the line.
- ☐ Stand with both feet in front of the line.

6. Describe something you could do to let other archers know which arrows belong to you.

7. On the range, what should you do when you hear the whistle blow twice:

- ☐ Move to the shooting line.
- ☐ Nock an arrow.
- ☐ It is safe to go down range and retrieve arrows.
- ☐ Cease fire! Stop shooting and put your bow down.

8. Where should spectators stand on the range?

- ☐ In the waiting area.
- ☐ Behind the shooting line.
- ☐ Behind the waiting area.

9. Check the three types of bows.

- ☐ Compound bow
- ☐ Recurve bow
- ☐ Long bow
- ☐ Square bow

10. Why should you check your equipment every time you shoot?

11. On the range, what should you do when you hear the whistle blow three times:

- ☐ Move to the shooting line.
- ☐ Nock an arrow.
- ☐ It is safe to go down range and retrieve arrows.
- ☐ Cease fire! Stop shooting and put your bow down.

12. An archer who has been shooting a bow for 15 years doesn't need to wear an armguard and finger protection.

- ☐ True
- ☐ False

13. Which type of fletchings are better to use with a compound bow?

- ☐ Feathers
- ☐ Vanes
- ☐ Bristles

14. What is the eleventh and last step in a shot?



- ☐ Release
- ☐ Follow Through
- ☐ Relax & Evaluate
- ☐ Aim

15. What is the most important thing to do when you are learning to shoot instinctively?

- ☐ Close one eye.
- ☐ Lean forward.
- ☐ Practice shooting at different distances.

16. Mark all the following things to consider when shooting outdoors.

- ☐ Wind
- ☐ Temperature
- ☐ Obstacles
- ☐ Rain or snow

17. Why is it important to score a FITA target the same way every time?

18. If you increase the distance to the target, how should you adjust your aim?

- ☐ Lower the bow.
- ☐ Keep the bow at the same level.
- ☐ Raise the bow.

19. What type of archery uses foam animal targets?

- ☐ FITA
- ☐ Field
- ☐ 3-D

20. Why do the limbs need to flex on a recurve bow?

- ☐ To distribute energy.
- ☐ Because it looks cool.
- ☐ To keep the string in place.

21. Name three (3) range rules.

22. On the range, what should you do when you hear the whistle blow four times:

- ☐ Move to the shooting line.
- ☐ Nock an arrow.
- ☐ It is safe to go down range and retrieve arrows.
- ☐ Cease fire! Stop shooting and put your bow down.

23. Which is NOT a reason to have an arrow rest on a bow?

- ☐ Limit friction on the arrow.
- ☐ Protect the riser.
- ☐ Keep the arrow straight.
- ☐ Helps the archer see where to aim.

24. What is the step called when the archer clicks the arrow on the string?

- ☐ Load the bow.
- ☐ Put the arrow on the shelf.
- ☐ Nock the arrow.

25. What is the step after release?

- ☐ Relax & evaluate
- ☐ Follow Through
- ☐ Raise and extend the bow
- ☐ Draw

26. Check all the following items that are archery safety equipment.

- ☐ Armguard
- ☐ Elbow shield
- ☐ Finger tab
- ☐ Glove

27. Which type of archery is the most difficult for you, FITA, Field or 3-D, and why?

28. How do you tell if a bow is meant to be shot instinctively?

- ☐ It is made of wood.
- ☐ It has sights.
- ☐ It doesn't have sights.
- ☐ It doesn't have an arrow rest.

29. When the string is too short on a recurve bow, it puts too much pressure on the limbs.

- ☐ True
- ☐ False

30. How many colors, including white, are on a field target?

- ☐ Two
- ☐ Four
- ☐ Five

## Basic Archery Assessment-KEY

Name: \_\_\_\_\_ Date: \_\_\_\_\_

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- ☐ Move to the shooting line.
- ☒ Nock an arrow.
- ☐ It is safe to go down range and retrieve arrows.
- ☐ Cease fire! Stop shooting and put your bow down.

2. What line does the archer shoot from?

- ☐ Target line
- ☐ Waiting line
- ☒ Shooting line

3. If you draw but don't pause before you release, what steps are you missing?

- ☒ Anchor, Aim
- ☐ Nock an arrow, Aim
- ☐ Anchor, Follow Through
- ☐ Follow Through, Relax & Evaluate

4. Why is knowing your dominant eye important in archery?

*When a person looks at an object with both eyes, the dominant eye aligns with the object.*

5. What should an archer do with their feet when they are on the shooting line?

- ☐ Keep both feet behind the line.
- ☒ Straddle the line.
- ☐ Stand with both feet in front of the line.

6. Describe something you could do to let other archers know which arrows belong to you.

*Write your initials on the shaft with a marker or nail polish.*

7. On the range, what should you do when you hear the whistle blow twice:

- ☒ Move to the shooting line.
- ☐ Nock an arrow.
- ☐ It is safe to go down range and retrieve arrows.
- ☐ Cease fire! Stop shooting and put your bow down.

8. Where should spectators stand on the range?

- ☐ In the waiting area.
- ☐ Behind the shooting line.
- ☒ Behind the waiting area.

9. Check the three types of bows.

- ☒ Compound bow
- ☒ Recurve bow
- ☒ Long bow
- ☐ Square bow

10. Why should you check your equipment every time you shoot?

*Any reasonable answer.*

11. On the range, what should you do when you hear the whistle blow three times:

- ☐ Move to the shooting line.
- ☐ Nock an arrow.
- ☒ It is safe to go down range and retrieve arrows.
- ☐ Cease fire! Stop shooting and put your bow down.

12. An archer who has been shooting a bow for 15 years doesn't need to wear an armguard and finger protection.

- ☐ True
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13. Which type of fletchings are better to use with a compound bow?

- ☐ Feathers
- ☒ Vanes
- ☐ Bristles

14. What is the eleventh and last step in a shot?

- ☐ Release
- ☐ Follow Through
- ☒ Relax & Evaluate
- ☐ Aim

15. What is the most important thing to do when you are learning to shoot instinctively?

- ☐ Close one eye.
- ☐ Lean forward.
- ☒ Practice shooting at different distances.

16. Mark all the following things to consider when shooting outdoors.

- ☒ Wind
- ☒ Temperature
- ☒ Obstacles
- ☒ Rain or snow

17. Why is it important to score a FITA target the same way every time?

*They should be scored the same so that competitions are the same no matter where the match is being held.*

18. If you increase the distance to the target, how should you adjust your aim?

- ☐ Lower the bow.
- ☐ Keep the bow at the same level.
- ☒ Raise the bow.

19. What type of archery uses foam animal targets?

- ☐ FITA
- ☐ Field
- ☒ 3-D

20. Why do the limbs need to flex on a recurve bow?

- ☒ To distribute energy.
- ☐ Because it looks cool.
- ☐ To keep the string in place.

21. Name three (3) range rules.

22. On the range, what should you do when you hear the whistle blow four times:

- ☐ Move to the shooting line.
- ☐ Nock an arrow.
- ☐ It is safe to go down range and retrieve arrows.
- ☐ Cease fire! Stop shooting and put your bow down.

23. Which is NOT a reason to have an arrow rest on a bow?

- ☐ Limit friction on the arrow.
- ☐ Protect the riser.
- ☐ Keep the arrow straight.
- ☒ Helps the archer see where to aim.

24. What is the step called when the archer clicks the arrow on the string?

- ☐ Load the bow.
- ☐ Put the arrow on the shelf.
- ☒ Nock the arrow.

25. What is the step after release?

- ☐ Relax & evaluate
- ☒ Follow Through
- ☐ Raise and extend the bow
- ☐ Draw

26. Check all the following items that are archery safety equipment.

- ☒ Armguard
- ☐ Elbow shield
- ☒ Finger tab
- ☒ Glove

27. Which type of archery is the most difficult for you, FITA, Field or 3-D, and why?

*Any answer is acceptable.*

28. How do you tell if a bow is meant to be shot instinctively?

- ☐ It is made of wood.
- ☐ It has sights.
- ☒ It doesn't have sights.
- ☐ It doesn't have an arrow rest.

29. When the string is too short on a recurve bow, it puts too much pressure on the limbs.

- ☒ True
- ☐ False

30. How many colors, including white, are on a field target?

- ☐ Two
- ☐ Four
- ☒ Five



## **Advanced Lesson 1**

### **Types of Bows**

## **Lesson 1: Types of Bows**

**Skill level:** Advanced

**Time Needed:** 60 minutes

### **Learning Objectives:**

#### *Project Skills*

Youth will be able to recognize the parts of compound and recurve bows.

Youth will be able to compare the advantages and disadvantages of compound and recurve bows.

Youth will be able to select which bow is best for the archery activities they wish to engage in.

#### *Skills for Life*

Marketable Skills

Decision Making

Personal Safety

### **Materials needed:**

Compound bow

Recurve bow

Longbow

Arrows for each type of bow

Archery tackle

Types of Bows worksheet for each participant

Poster of compound and recurve bows with stick on labels.

### **Setting:**

In a classroom with tables

### **Lead in questions:**

What are three most common types of bows used in archery?

Does each type have a different purpose? What are they?

What are the parts of the bow?

### **Introduction:**

The parts of recurve and compound bows are very similar. Both have limbs, riser, handle or grip, arrow shelf/rest, arrow plate, sight window and a string. The compound bow also has cable and eccentric wheels of some type to give a mechanical advantage. There are advantages and disadvantages to using both types of bows.

### **Background information:**

All three types of bows will be introduced but recurve and compound bows will be the focus. The worksheet with all types of bows is included in this lesson along with a key. Put the Poster of Parts of a Bow poster on board in front of room.

**Activity:**

Give each a participant a worksheet. Describe each part of the bow and ask them to tell the volunteer where the label should be placed on the poster. Go through all parts. Now go through the parts again, placing the correct labels on the parts. Ask them to use the poster to label the bows correctly on the worksheets.

As you can see, the parts on each bow are different. These differences contribute to the discipline they are best for. There are some advantages and disadvantages to each type of bow. As you go through the list, point to the parts of the bow which affect the characteristic.

<b>Compound Bow</b>	<b>Recurve Bow</b>
Relaxation at full draw. Once the arrow is drawn to the anchor point, the draw weight diminishes.	No let off at draw. The archer is holding the entire weight until release.
Ease of holding anchor	Anchor must be held steady while holding full draw weight.
Because the string is pulled back farther due to being run through the wheels, it transfers a greater proportion of stored energy to the arrow.	The distance the string is drawn back is only the amount the string moves when drawn.
Reduced stress on the arrow permits the use of a lighter arrow with less spine	There is a great deal of stress on the arrow because all the potential energy rests on the arrow and is not distributed to cams or wheels.
Compact size makes it more efficient for hunting	Length of limbs can make hunting in the woods more difficult.
Minor errors in form may produce major changes in arrow flight.	While form is important, errors have less dramatic results.
Bow's mechanics cause more complicated tuning and it is difficult to reduce noise.	Without mechanics of a compound bow, most adjustments can be made by the archer.
Extra moving parts and added stress on the limbs, cables, strings, other bow parts increase the possibility of breakage during shooting.	The only stress on the limbs is the force of the string.
Increased weight of bow can lead to fatigue.	The weight of materials, limbs and riser, make bow easy to carry.
Additional parts require extra care and make the bow less durable.	The only parts to maintain are the riser, the limbs and the string.
Because of the complex mechanics, compound bows are more expensive than recurve bows.	Materials, not mechanics are the reason for expense in recurve bows.

The advantages of the compound bow make it a better bow for hunting. Its compact size and ability to hold the draw for an extended time make it easier to set up a shot. However, its weight and complex parts make it difficult to carry long distances and prone to breakdown due to the elements.

Overall, the compound bow is easier to shoot. This fact puts the recurve archer at a disadvantage in competition with the compound. For this reason, compound bows and recurve bows are not scored together or ranked together. More people shoot compound than recurve.

You must consider the characteristics of each type of bow and decide which is right for you. In many cases, it comes down to personal preference.

**Reflect:**

- What are the extra parts on the compound and what do they do?
- Why can a compound archer hold an anchor longer than a recurve archer?
- How are compound bows able to shoot lighter arrows with less spine than recurve bows?
- Why are recurve bows easier to repair?

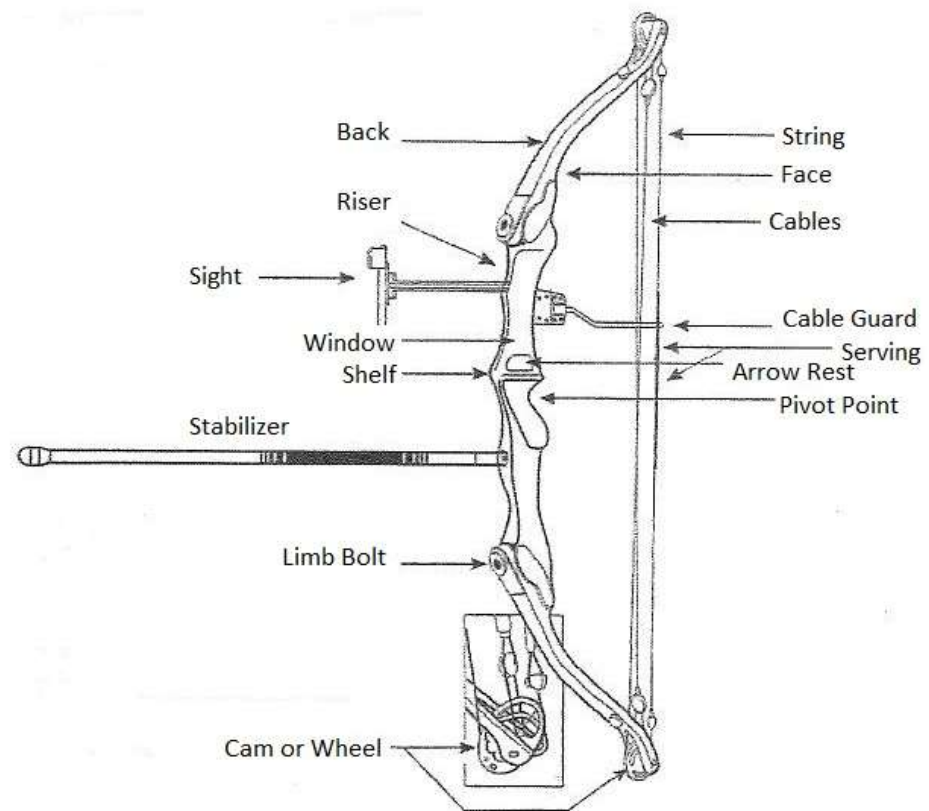
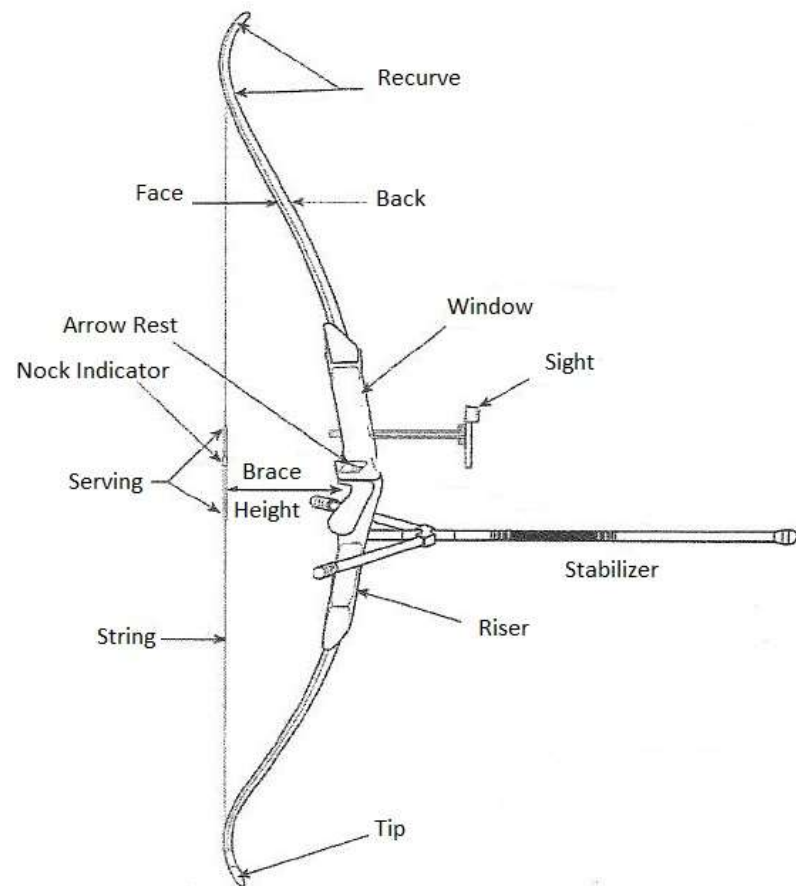
**Apply:**

- What factors should you consider when choosing between a compound and recurve bow?
- If both bows have the same draw weight, which bow can shoot a farther distance and why?
- Why are compound bows more popular for hunting than recurve bows?
- How can learning archery using a recurve bow before a compound bow make a more skilled archer?

**Evaluate:**

- Using diagrams of bows without labels, youth will be able to identify the parts of compound and recurve bows.
- Youth will be given scenarios of situations where an archer must select what type of bow they should choose. The youth will select the best bow for the scenario 80% of the time.
- After the youth lists the archery activities in which they participate, they select a bow that is best for them.

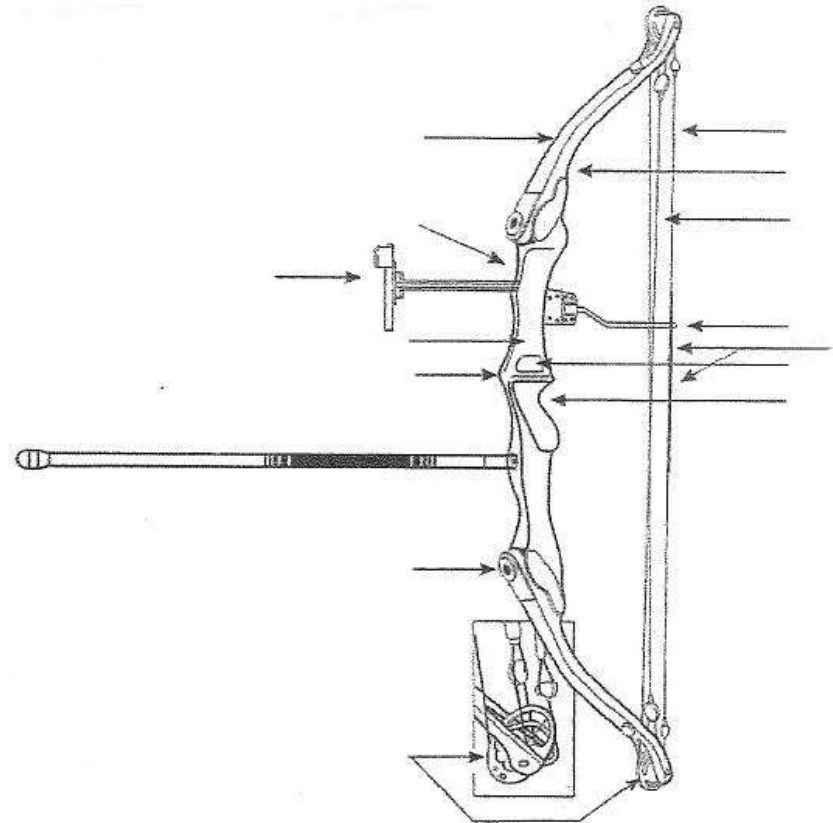
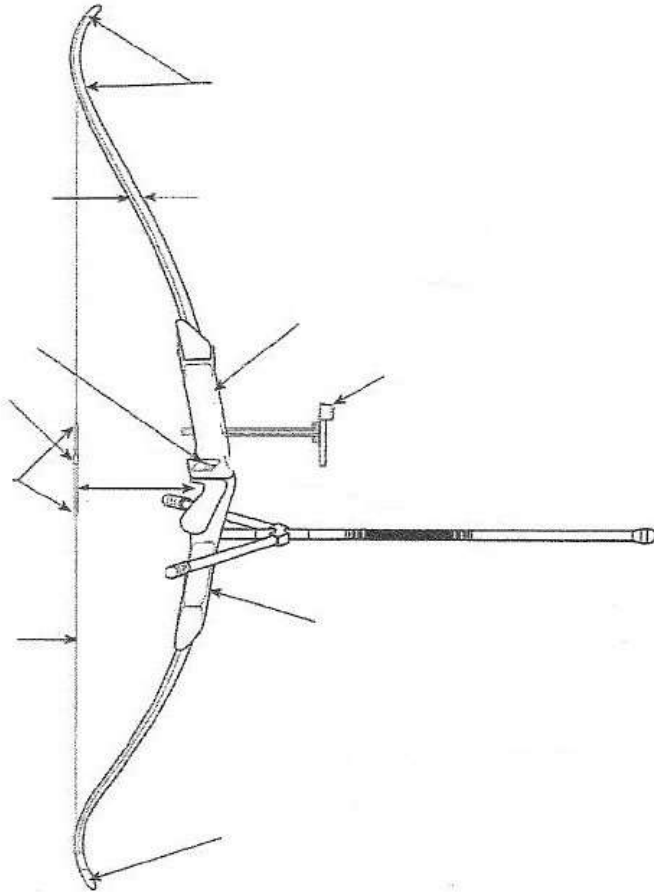
# Bows



Graphics adapted from Florida 4-H Archery Level 1 Instructor Exam.

# Bows

(Poster)



## Bow Parts for Poster

Arrow Rest	Sight	Shelf	String
Arrow Rest	Stabilizer	Cables	Pivot Point
Back	Stabilizer	Cam or Wheel	Window
Face	Limb Bolt	Sight	Window
Face	Recurve	Cable Guard	Riser
Back	Tip	Nock Locator	Riser
Serving	Serving	String/Brace Height	String

Name: \_\_\_\_\_

## Bow Selection Scenarios

Often, a compound bow and a recurve bow can be used for the same purpose. However, sometimes one bow is better for the task than the other. Select the bow which is best for the described scenario.

- |   |                 |                |
|---|-----------------|----------------|
| 1. Christian will be hunting deer from a ground blind.  | <b>Compound</b> | <b>Recurve</b> |
| 2. Anna will be training for Olympic archery.   | <b>Compound</b> | <b>Recurve</b> |
| 3. Juan lives 60 miles from the closest bow repair shop.  | <b>Compound</b> | <b>Recurve</b> |
| 4. Leesha wants to visit her brother across the country and shoot her bow with him.   | <b>Compound</b> | <b>Recurve</b> |
| 5. Devon wants to accurately hit a target at 60 yards, but he isn't very strong.  | <b>Compound</b> | <b>Recurve</b> |
| 6. Josiah wants to hunt, but the draw weight on his bow must be 40 pounds, which is very difficult for him to hold his anchor point on. | <b>Compound</b> | <b>Recurve</b> |
| 7. Maliqua is learning archery and tends to make a lot of mistakes.   | <b>Compound</b> | <b>Recurve</b> |
| 8. Jackson is a junior who wants to shoot at a lot of competitions, so he must carry his bow a lot.                                     | <b>Compound</b> | <b>Recurve</b> |
| 9. Brooklyn can spend up to \$130 on a new bow.   | <b>Compound</b> | <b>Recurve</b> |
| 10. Maria lives 10 miles from a bow repair shop.  | <b>Compound</b> | <b>Recurve</b> |



## Bow Selection Scenarios-KEY

Often, a compound bow and a recurve bow can be used for the same purpose. However, sometimes one bow is better for the task than the other. Select the bow which is best for the described scenario.

- |   |                 |                 |                |
|---|-----------------|-----------------|----------------|
| 1. Christian will be hunting deer from a ground blind.  | <b>Compound</b> | <b>Recurve</b>  |                |
| 2. Anna will be training for Olympic archery.   | <b>Compound</b> | <b>Recurve</b>  |                |
| 3. Juan lives 60 miles from the closest bow repair shop.  | <b>Compound</b> | <b>Recurve</b>  |                |
| 4. Leesha wants to visit her brother across the country and shoot her bow with him.   | <b>Compound</b> | <b>Recurve</b>  |                |
| 5. Devon wants to accurately hit a target at 60 yards, but he isn't very strong.  | <b>Compound</b> | <b>Recurve</b>  |                |
| 6. Josiah wants to hunt, but the draw weight on his bow must be 40 pounds, which is very difficult for him to hold his anchor point on. | <b>Compound</b> | <b>Recurve</b>  |                |
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| 8. Jackson is a junior who wants to shoot at a lot of competitions, so he must carry his bow a lot.                                     |                 | <b>Compound</b> | <b>Recurve</b> |
| 9. Brooklyn can spend up to \$130 on a new bow.   | <b>Compound</b> | <b>Recurve</b>  |                |
| 10. Maria lives 10 miles from a bow repair shop.  | <b>Compound</b> | <b>Recurve</b>  |                |

## **Advanced Lesson 2**

### **Selecting Equipment**

## **Lesson 2: Selecting Equipment**

**Skill Level:** Advanced

**Time Needed:** 60 minutes

### **Learning Objectives:**

#### *Project Skills*

Youth will be able to select equipment based on use, price, fit, availability and personal preference.

#### *Skills for Life*

Marketable Skills

Decision Making

Personal Safety

### **Materials needed:**

Score sheets

Scenario descriptions

Pencils

Clip boards

Equipment:

- Recurve bows
- Fiberglass bows
- Compound bows
- Finger tabs
- Gloves
- Arm Guards (3 styles)
- Hip quivers
- Back quivers
- Bow quivers
- Arrows
- Need price and specifications for each. You can use catalog photos or real items.

### **Setting:**

In a classroom with tables.

### **Lead in questions:**

How did you choose your equipment?

How do you know what the right equipment is for you?

Does a higher price indicate a more useful product?

### **Introduction:**

Selecting the right equipment can be overwhelming, especially if you are a beginning archer. In this exercise, we are going to use what you already know, along with facts to make informed decisions about the right equipment for a situation.

**Background information:**

Families struggle with deciding on the archery equipment they need for their young archer. Usually it is the leader or maybe a salesperson who guides the decision. The youth and their parents often don't even know what to ask for to begin a fruitful search.

By teaching the youth about the right equipment for the right reason, they can help their family select archery equipment that meets their needs and their family's requirements.

Read pages 72-73 in National Shooting Instructor's Manual.

**Activity:**

It is time to purchase your own equipment but what do you select? There are several factors to take into consideration. The first piece of equipment you should select is your bow. The bow should fit you, your skill level, your strength, and your budget. The most expensive bow is not necessarily the best bow. There are lots of good bows for sale which are suitable for beginning archers or hobbyists. Let's start with how a bow should fit. We will look at a recurve bow.

Bow selection. Bow size is determined by draw length. To identify draw length, stand with your arms stretched out to the sides as far as you can. Ask someone to measure the distance from fingertip to fingertip. Take that number and divide it by 2.5. That is your draw length.

To convert draw length to bow length, use this chart. Don't worry if it doesn't list your exact draw length. Round up to the next closest draw length. It is better to have a bow that is a little big, than a little small.

DRAW LENGTH (INCHES)	BOW LENGTH (INCHES)
14-16	48
17-20	54
20-22	58
22-24	62
24-26	64-66
26-28	66-68
28-30	68-70
31 +	70-72

\*Lancaster Archery Bow Fitting Chart

A common misconception is a person's height determines the bow length. That is not exactly true. The only way that height affects draw length is that a taller person probably has longer arms therefore they will have a longer draw length.

These numbers are for target shooting. There are different measurements for choosing a bow to hunt with.

Draw weight is determined by the archer's strength. The archer should be able to shoot for 45 -60 minutes before feeling fatigue. A heavier draw weight is required for longer distances. It is best to try bows of different draw weights to find out what is comfortable for the archer.

Take down recurve bows are recurve bows in which the limbs can be removed from the riser. This can be done to store the bow or transport it. It also allows the archer to change limbs to higher or lower poundage. Limbs must be made for the specific model bow. Generally, take down bow risers have a draw weight limit. Some risers fit bows with a draw weight from 10-25lb. limbs and others are made for 30lbs. and above. The draw weight on compound bows can be adjusted using the limb bolts.

Arrow selection. Next, you'll need to select your arrows, and there are several factors to consider. You'll need to consider length, weight and spine. The spine is the stiffness of the arrow and it is the most important factor in arrow performance. The spine determines the archer's paradox. The archer's paradox means that an arrow must flex to fly straight. (If you have a video of an arrow in flight exhibiting the archer's paradox, this is the time to show it to the group. Point out the flex of the arrow as it leaves the bow.) A longer arrow is "softer" than shorter arrows so arrow length affects stiffness. (Pass around arrows with different spines and encourage the participants to slightly bend the arrow to compare the stiffness.) For target archery, the arrows should be the same length as the draw length. (Show the group a spine chart to highlight the relationship between length and stiffness.)

Arrow weight, therefore speed and momentum, are influenced by shaft length too. The longer arrow has greater mass and inertia. Although it may have greater momentum, it is more difficult to propel at the speed or velocity as a lighter shaft. It is also important to consider the weight of the point as part of the weight of the arrow. Thinner arrows are primarily for outdoors because they cut the wind better while thicker arrows are made for indoors.

There are a lot of choices for fletchings. Look for fletching (either vanes or feathers) which fit the type of arrow rest on the bow and the bow itself. Vanes can be used on compound bows or recurve bows with arrow rests. Feathers should be used on recurve bows with hair rests or arrow rests. If the points are heavy, then a larger fletching is required. Target archers can use 2-3" fletchings while hunting and field archers may choose arrows with 5" fletchings to balance the heavier point. Fletchings with a helical (feathers are twisted to the left or right) help the arrow fly straighter.

Archery Tackle. Safety equipment is required for shooting a bow. The styles of equipment are often a matter of preference. There are three pieces of archery tackle every archer should use: quiver, armguard and finger protection.

- Quiver. For competitive archers and beginning archers, a hip quiver is the best. It is easy to slip the arrows into and stays in place. Back quivers are usually not allowed in competition. It is difficult to slip the arrow into the quiver leading to possibly poking the person behind the archer and wasting time trying to find the quiver without looking. Bow quivers are also not normally used in competition and are made for hunting.
- Armguard. The armguard should be long enough to cover the bow arm from wrist to elbow crease. Some armguards also cover the top of the arm which is also acceptable. There are many armguard styles and materials. In addition to size, think about the temperature outside and how much arm you want covered from side to side. Beginning archers may consider a wider armguard.

- Finger protection. This is usually a matter of preference. A finger tab is more flexible and allows the archer to feel the string. Some archers find it easier to hold the string without curling their fingers around the string and pinching the nock. It can be challenging to put on and does not stay in place when the archer isn't shooting. A finger tab can be made from leather or soft plastic. A finger tab can be made at home. A shooting glove provides finger protection with leather or fabric. It should fit snugly, reaching from the fingertip to the wrist. Some archers find it difficult to hold the string without wrapping their fingers around it and pinching the string. It is difficult to feel the string. It stays in place when the archer is waiting to shoot. These must be purchased and cannot be made at home.

#### **Reflection:**

- If a bow has a 30 lb. draw weight and the other bow has a 40 lb. draw weight, which bow shoots the heavier arrow?
- Mariah can shoot tight groups at the 30m target. She wants to shoot at the 40m and 50m targets but the arrows are falling short before they reach the target. What can she do?
- Zach grew taller over the summer and the distance between his fingertips has increased from 55 inches to 63 inches. What length bow does he need?
- Jake sweats under his armguard in the summer. What kind of armguard does he need?
- Keisha is wrapping her fingers around the string because she says she can't keep it on her fingers otherwise. What type of finger protection should she try?
- Kim loves the movie, "The Hunger Games," and wants a quiver like Kat. She plans to shoot in the state archery match. Which quiver should she get?

#### **Apply:**

Copy and enlarge photos from archery catalog. Get photos of as many different weights, sizes, materials of each as possible. Get opening price, mid-range price and high-end price. Have at least three of each piece of equipment.

Recurve bows  
Fiberglass bows  
Compound bows  
Finger tabs  
Gloves  
Arm Guards (3 styles)  
Hip quivers  
Back quivers  
Bow quivers  
Arrows

Explain how to use the score sheets to determine which piece of equipment is the best for the scenario. Equipment will be selected on use, price, fit, availability and personal preference

#### **Evaluate:**

This lesson is evaluated by the results of the equipment choice exercise.

Example Scenarios. You can create your own scenarios which best fit the members of your club.

1. Antonio is 8 years old and a beginning archer. He has been using club equipment and his parents are ready to buy him his own. He has been using a 10 lb. fiberglass bow with feathered arrows, a finger tab, an arm guard and a hip quiver. The bow is very easy for him to shoot. His parents don't want to keep buying bows as he gets stronger. He needs a bow, 8 arrows, quiver, finger protection, and armguard. His budget is \$300.00. Which bow should he purchase?
2. Isabella is 11 years old and has been in her 4-H archery club for 2 years. She has been shooting a 25-pound recurve with her club. Her father bow-hunts and she wants to hunt with him. She has a 25 lb. recurve, feathered arrows, an armguard, hip quiver and glove of her own. Which bow package (all the equipment) should she purchase?
3. Jonathan is a senior who has been shooting a bow for eight years. He plans to compete at the state match with the intention of qualifying for nationals. After he graduates from high school, he will attend college on an archery scholarship. He has saved \$1,000 to purchase a new bow and arrows before the state match. Which bow should he purchase?
4. Gina has been using club equipment and finally got her own bow, arrows and quiver for her birthday. She needs a new armguard and finger protection. She shoots with her 4-H club and at matches. She has been using finger gloves and prefers them over a finger tab. It is hot in Florida. Her budget is \$40. Which glove should she purchase?
5. Shante has broken or lost several arrows and needs to purchase 12 new ones. She shoots outdoors most the time; her draw length is 28lbs., shoots a recurve bow with a hair rest. Her budget is \$100. Which arrows should she purchase?

## Archery Equipment Score Sheet

Name: \_\_\_\_\_

Scenario 1	1
	2
	3
Scenario 2	1
	2
	3
Scenario 3	1
	2
	3
Scenario 4	1
	2
	3
Scenario 5	1
	2
	3
Scenario 6	1
	2
	3
Scenario 7	1
	2
	3
Scenario 8	1
	2
	3
Scenario 9	1
	2
	3
Scenario 10	1
	2
	3



## **Advanced Lesson 3**

### **Trajectory of an Arrow**

### **Lesson 3: Trajectory of an Arrow**

**Skill level:** Advanced

**Time Needed:** 30 minutes

#### **Learning Objectives:**

##### *Project Skills*

Youth will be able to explain trajectory of an arrow.

Youth will understand why knowing an arrow's trajectory is important.

##### *Skills for Life*

Problem Solving

Marketable Skills

Personal Safety

#### **Materials needed:**

Cotton swabs (one for each participant)

Straws (one for each participant)

Tape or string

Trajectory worksheets

Two different colored crayons for everyone

Trajectory PowerPoint Presentation

Screen

Projector

#### **Setting:**

Classroom with space for whole group to line up at a "starting line" and another line at 15 feet.

#### **Lead in questions:**

What is the trajectory of an arrow?

How does knowing the trajectory affect your shooting?

#### **Introduction:**

Trajectory is the path followed by a projectile flying or an object moving under the action of given forces. If you understand the trajectory of an arrow, you will know how to adjust your aim at varying distances. With enough practice at varying distances, you will come to know the trajectory for each distance and be able to adjust accordingly.

#### **Background information:**

Read the Fact Sheet 5 in the 4-H Archery Instructor Manual- Level 1.

Prepare the room by placing one piece of string long enough for all the participants to stand behind it. Place another piece of string the same length at 15 feet from the first. Queue up the PowerPoint presentation.

**Activity:**

When everyone is seated, pass out the worksheet and two different colored crayons. On this sheet you will see an archer and target. Draw a line from the archer to where the arrow will hit the target. (Give them time to think about this and complete the exercise.)

Now that you've got your arrow path, let's see if that arrow path is correct. Have everyone gather at the starting line and give them a straw and a cotton swab. In a moment, but not yet, you will place the cotton swab into the end of the straw with the cotton sticking out the end. Then you will wrap your lips around the other end and blow as hard as you can to propel that straw to the finish line. The one that shoots the farthest is the straw-blowing champion. Archers, load your straw. I'm going to countdown and when I say blow, blow! Ready? 5-4-3-2-1 BLOW! When everyone has blown, announce the winner and have everyone note where their cotton swab landed. Have everyone return to their seat.

Based on what you saw with your cotton swab, using a different colored crayon, draw where you think the arrow will hit. If you think it was right the first time, you don't have to draw anything. Give them some time to think it over. Queue the PowerPoint while they are drawing. When they appear to be finished, go on. Let's see where the path of the arrow is. Play the PowerPoint. The arrow is pointing up so the arrow starts out going up but what happens? (Look for the answer that gravity pulls it down.) That is trajectory. The arrow never travels in a straight line. Think about how many of your cotton swabs ended up on the ground before they hit the end.

**Reflection:**

- Why did some swabs make it to the end and others came up short?
- What did those archers do differently?
- Would blowing harder help?
- How could the straw be held to extend the trajectory?

**Apply:**

- How will you know what the trajectory of your arrow is?
- How will you adjust your aim to compensate for trajectory?
- When is another time to adjust for trajectory?
- What is a way to diminish the effect of gravity on flight path?
- Why does a heavy arrow have a shorter trajectory than a light arrow?

**Evaluate:**

- Youth will complete the following exercise: Youth will adjust aim by knowing the trajectory of arrow at 10-yard intervals. If the arrow hits the same spot at each distance, they are adjusting their aim for trajectory. If the arrow hits in different spots at each distance, they are not considering trajectory when aiming.

## Arrow Path



**Line of Sight:** \_\_\_\_\_

**Trajectory:** \_\_\_\_\_

# Arrow Path



**Line of Sight:**

**Trajectory:**



## **Advanced Lesson 4**

### **Physiology of Archery**

## **Lesson 4: Physiology of Archery**

**Skill level:** Advanced

**Time Needed:** 45 minutes

### **Learning Objectives:**

#### *Project Skills*

Youth will be able to recognize the parts of the body used in shooting.

Youth will be able to demonstrate how form affects how the parts of the body used.

Youth will be able to explain how healthy bones, muscles and heart positively affect shooting.

#### *Skills for Life*

Problem Solving

Healthy Lifestyle Choices

Marketable Skills

### **Materials needed:**

Bow that is easy to draw and hold

Crayons

Body diagram worksheet

Body diagram PowerPoint or Poster

Screen

Projector

### **Setting:**

In a classroom with tables

### **Lead in questions:**

What parts of the body are used in archery?

What is an instance when adjustments to equipment need to be made?

How can you get injured from shooting a bow?

### **Introduction:**

In the sport of archery, there are more parts of the body than just the draw arm which are being used.

It is important to know what they are so that the archer can be sure they are healthy enough to shoot.

Injuries can happen if an archer shoots too long or with improper form or unsafe equipment. If you know what parts of the body are involved in shooting, you can take steps to get your body ready for shooting a bow safely and for an extended period such as a competition.

### **Background information:**

It is easy to see that the arms and the shoulders are used in archery but there is more to it than that.

Archers should know what parts of the arm and shoulder and the other parts of the body. This will allow the archer to stretch properly and engage in strength training to improve their skill and stamina.

**Activity:**

Pair the archers up and give them one bow to share. They should each have a pencil and a worksheet.

Start by getting into the correct stance and going through the eleven steps up through anchor without an arrow. Pay attention to what muscles in your body are used as you go through the steps. Using the worksheet, color in the muscles you feel being used through the first seven steps (stance, nock arrow, set bow hand grip, raise and extend, draw, anchor). DO NOT release! Color in the muscles on the diagram you felt being used. Repeat with the next person.

When everyone has completed the exercise, bring the group back together. Put the body diagram PowerPoint up. Describe the parts of the body that are used in archery.

**Reflect:**

- Which parts of the body did you miss?
- What part of the body that was used surprised you?
- How does form affect which muscles you use?
- Were more or fewer muscles used than you thought?
- Which joints moved the most?
- Which muscles worked hardest?

**Apply:**

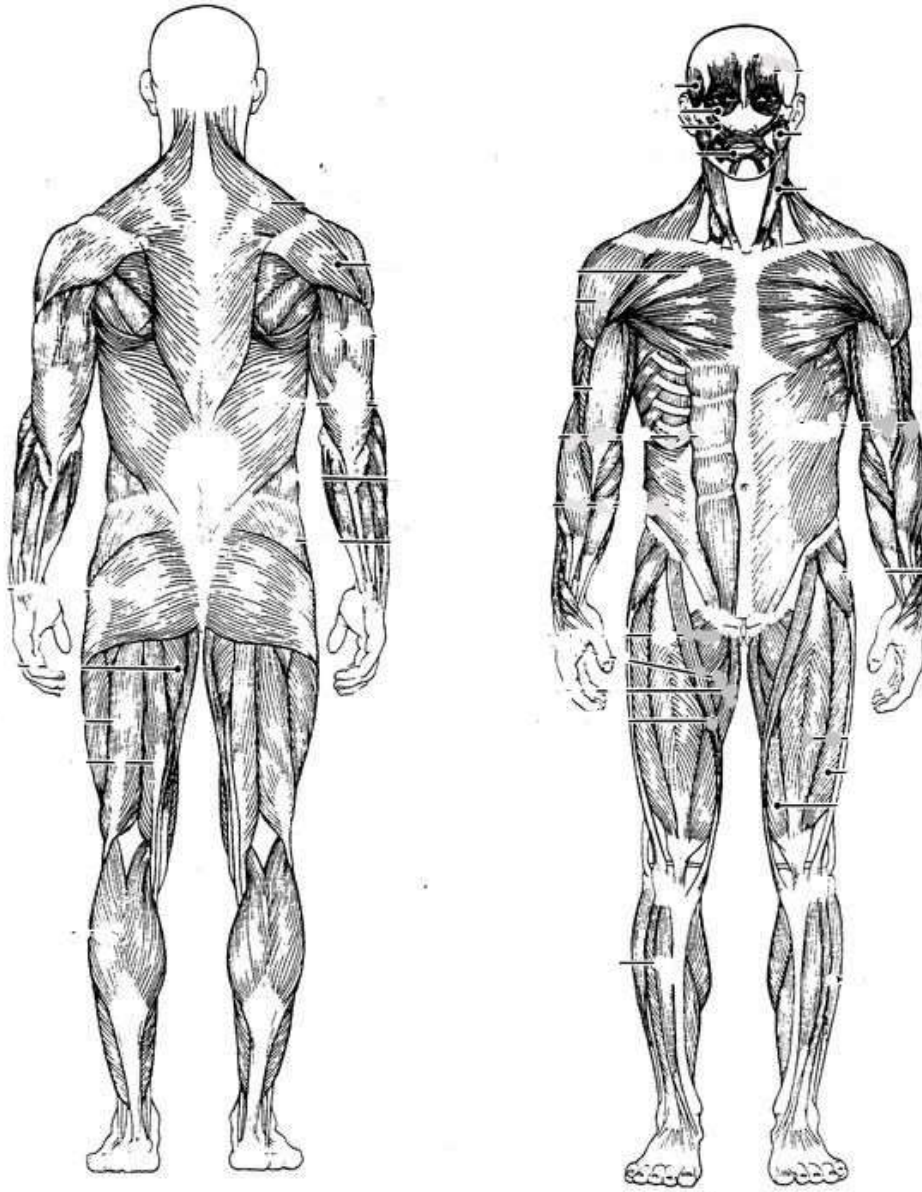
- What can you do to strengthen your body for archery?
- Where in your body do you need to strengthen?
- How is your form affecting how you are using your body?
- How long can you shoot before your body gets tired?
- What role does the heart play in shooting?

**Evaluation:**

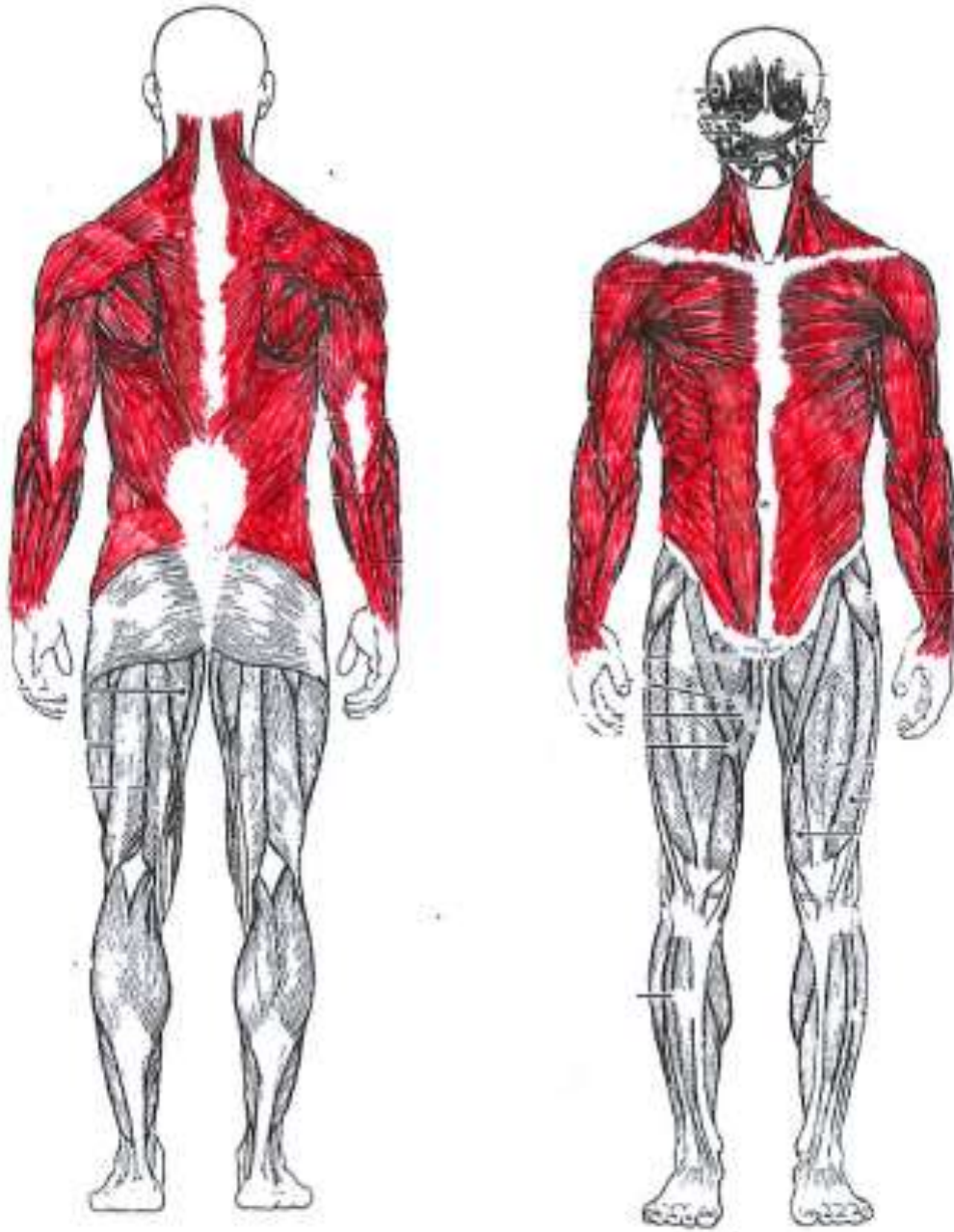
- Youth research online and find two warm up activities which prepare parts of the body identified in this lesson. They can use any reputable fitness site that has stretches which target the areas identified in this exercise. Youth will lead the group in one the researched activities before they shoot.



## Muscle Groups Worksheet



## Muscle Groups Worksheet-KEY



Graphic created using information from: Cole, D. (2017) Archery muscles and exercises from Bowfit™. Retrieved from Bowhunting.net website:

<https://www.bowhunting.net/2017/02/archery-muscles-by-bowfit/>

## **Advanced Lesson 5**

### **Setting Up a Bow**

## **Lesson 5: Setting Up a Bow**

**Skill Level:** Advanced

**Time Needed:** 60 minutes

### **Learning Objectives:**

#### *Project Skills*

Youth will be able to recognize the parts of a recurve bow.

Youth will be able to convert a bare bow to a safe, usable bow.

You will be able to recognize a safely set up bow.

#### *Skills for Life*

Personal Safety

Marketable Skills

Problem Solving

### **Materials needed:**

Completed recurve bow

Recurve riser

Limbs

Served string

Bow stringer

Nock indicator

Arrow rest or hair rest (can be the soft side of Velcro or a purchased hair rest)

Arrow plate

Bow tip protector (optional)

Bow square

Crimping tool

String wax

Steps to Setting Up a Recurve Bow reference sheet for each participant

### **Setting:**

In a classroom with tables. Get the participants close to the demonstration area as some of the parts are small. Set all the bow parts and tools on the table where the participants can easily see them.

### **Lead in questions:**

What parts is a new recurve bow missing?

When can a trained archer repair a bow and when does a bow shop need to make the repair?

What tools and supplies should be carried in an archery tool box?

### **Introduction:**

Normally, new recurve bows come with a riser, served string, two limbs and sometimes a stick-on arrow rest and arrow plate. To fully understand how a bow works, it is important to know how each part affects shooting. Knowing this will help you determine if inaccurate shooting is improper form or a malfunctioning bow. Being able to repair your own bow will get you back to shooting faster and save money on having a shop make the repair for you. However, these procedures you will learn don't

include the steps to repairing a damaged limb or riser. Those malfunctions must be handled by a professional as they made lead to replacing the limb or riser.

**Background information:**

Normally, new recurve bows come with a riser, served string, two limbs and sometimes a stick-on arrow rest and arrow plate. A hair rest or another arrow rest can be substituted for the one that is included. In addition to learning how to set up a bow from the beginning, another skill this lesson will teach is how to make simple repairs. This is especially helpful at archery matches. Situations such as a loose nock locator or a string at the incorrect brace height will need to be corrected before a bow passes inspection. Having all the parts on a bow assembled properly will aid the archer in making consistently accurate shots by allowing them to focus on their form.

**Activity:**

We will be going over the steps to properly setting up a bow. First we will watch a YouTube video on what assembly looks like. Next you will get the chance to do it yourself. YouTube video:

[https://youtu.be/0bOcsWGf\\_HE](https://youtu.be/0bOcsWGf_HE)

You will also get a reference sheet with the steps and illustrations of each step. (Found in the Appendix) As I list the steps, read the description over. Watch what I am doing and take any notes which will help you remember the techniques. Relate the live demonstration to the illustration to help you recall what you saw today.

**Step 1: Assemble the bow.**

The limbs do not come attached to the riser. Identify the top and bottom limbs. The bottom limb has the draw weight on the face. Start by unscrewing the bolt on the bottom of the riser. Fit the limb into the space and screw the bolt back in. Screw it in tightly but don't over tighten it or you may not be able to remove it at another time. The limb should be snugly in place without wiggling. Repeat with the top limb.

**Step 2: Add the string.**

The top of the string has a larger loop. Slip this end of the string over the tip and slide it down as far as it will go. Slip the bottom string on the other end. String the bow.

**Step 3: Attach rest and arrow plate.**

- Stick-on Rest
  - Can be used with feathered arrows or vanes.
  - If a stick-on rest is being used, remove adhesive and attach on the side and in the center of the sight window. Take care that it is on straight and that the rest isn't sitting on the shelf.
- Hair Rest
  - Can only be used with feathered arrows. The vanes will be torn off.
  - If a hair rest is being used, cut the fabric to fit on the shelf. Take care not to have any material going up the side of the sight window or hanging off. Remove adhesive and attach to shelf.
  - Attach the arrow plate on the center side of the sight window. It should touch the hair rest but not go below it.

**Step 4: Install the nock locator.**

Attach the two-prong end of the bow square to the string so that the perpendicular pieces sits on the arrow rest. It should be able to swing free with a little resistance. Measure approximately  $\frac{1}{4}$ " up from where the bow square is attached to the string using the ruler on the square. This is where you will attach the locator. Use the larger hole on the crimping tool to crimp the nock locator on the string. Once it will stay in place, use the small hole on the crimper to tighten the nock locator on the string. When the arrow is nocked, it should be touching the arrow rest but lightly.

**Step 5 (optional)**

Install a tip protector on the bottom tip of your bow. Pull it over the end and make sure it fits snugly.

Your bow is ready to shoot.

Review the tools to be included in an archery tool kit:

Bow equipment & supplies:

Bow square  
Nock indicators  
String wax  
Served string  
Crimping tool  
Extra arrow rest or extra hair rest

Arrow equipment & supplies:

Feathers or vanes  
Glue  
Jig  
Nocks  
Points  
Inserts  
Permanent marker or bright nail polish (to identify arrows)

**Reflect:**

- Why is the brace height important?
- How do you know where to put the nock indicator?
- What is the difference between a stick-on rest and a hair rest?
- How do you remove a nock indicator?
- What should you do if the laminate comes off a limb?
- What should you do if the riser cracks?
- How long would it take you to set up a bow?
- Where can you make a bow repair?
- How does a missing nock indicator affect safety?
- What happens if an arrow rest falls off?
- When should you replace a hair rest?

**Apply:**

- What is the importance of having all the tools needed a job whenever the job is being done?

- What is an example of a situation where having the right tools or equipment could help someone that is injured?
- How will considering all the possible outcomes of an activity help you prepare for it?

**Evaluate:**

- Youth will set up a bow by completing Steps 1-5.
- (If no bow available to set up) Youth will list and describe Steps 1-5.

## **Advanced Lesson 6**

### **Fletching an Arrow**



## **Lesson 6: Fletching an Arrow**

**Skill level:** Advanced

**Time Needed:** 60 minutes depending on how many jigs are available.

### **Learning Objectives:**

#### *Project Skills*

Youth will be able to select materials to fletch an arrow.

Youth will be able to fletch an arrow.

Youth will describe difference between their personal arrows and the arrow they fletched.

#### *Skills for Life*

Critical thinking

### **Materials needed:**

Carbon fiber arrow shafts with inserts, points and nocks already installed (One for each participant)

Fletching jig (One single for every two participants or multiple arrow jigs.)

Fletching glue

Different colored feathers or vanes (3 for each participant)

Fletching tape

Permanent markers (fine point)

Rubbing alcohol

Cotton balls

Assembled arrow from materials to be used

### **Setting:**

Ventilated classroom with tables. Cover tables with newspaper to protect them from glue.

### **Lead in questions:**

What are the parts of an arrow?

What is the difference between fletchings and vanes?

Which type of bows use fletchings? Which type of bows use vanes?

### **Introduction:**

Arrows can be purchased in several stages of readiness. Shafts come alone without fletching, inserts or points. Shafts with inserts and points are also available or arrows come completely assembled. The price varies based on how much it has been assembled. Today you will be fletching your own arrow using feathers or vanes. Once the fletching has dried you will have an arrow that you can shoot from your bow.

Arrows with feathers offer more control than arrows with vanes. Feathers flex and fold as the arrow passes over the shelf. They also fold as the arrow passes the back of the bow and arcs because of archer's paradox. The flexing of the feathers keeps the arrow flying in the direction it is being shot without interference shifting its direction. However, feathers may hiss in flight, slow the arrow's speed and be affected by wet weather. Feathers are the time-honored fletching substance. Arrows with vanes, the plastic fletchings, are best for high speed arrow flight and work well on lighter shafts. However,

because they don't flex like feathers, they provide less room for error. Vanes work best on compound bows or recurves with an arrow rest instead of a shelf rest. Vanes cannot be used on bows with shelf rests because the friction will tear the vane.

**Background information:**

Fletchings can come loose or come off while being shot. If an archer learns how to fletch an arrow and has the right equipment, they can repair their arrows without the expense or inconvenience of taking them to a shop. As the archer progresses in skill, they may come to find that changing the fletching makes a difference in how their arrow flies. This could lead them to shooting arrows custom made for their shooting style.

Make an arrow before the lesson to familiarize yourself with how the equipment and supplies will work. Be ready to demonstrate making another arrow for the group. You will be demonstrating making another arrow as they do as a guide. Some of the steps they will be doing may be difficult to understand without a demonstration.

Because of the time it takes for the fletching glue to dry, you can finish the lesson at a subsequent meeting where they shoot and evaluate their arrows against the arrows they normally use.

Set up the jig using the directions it came with.

**Activity:**

Describe the supplies and equipment to be used to fletch the arrows. Holding up a completed arrow, review the parts of an arrow.

Instruct the participants to select three feathers or vanes of at least two colors. Once they have chosen their feathers or vanes, begin the explanation of the fletching.

Demonstrate the instructions as they are given. Before the fletching the arrow, the shaft must be cleaned so that the adhesive will stick to it. Wet a cotton ball with alcohol and rub the cotton ball at the end of the shaft where the feathers will be attached. Let it dry and don't touch the area with fingers. This will leave grease on the shaft.

Place the cleaned shaft in the assembled jig. Place a feather or vane in the clamp. Next, run a thin glue bead down the length of the fletching. Place the clamp on the jig, applying slight pressure to seat the fletching against the shaft. Let the glue dry 3-4 minutes and repeat the process with the remaining feathers or vanes. Remove the clamp. Rotate the nock receiver to bring a new area of the shaft into position. Repeat the process until all the fletchings have been applied.

Adapted from Einsmann, Scott. (2018) Step by step: How to fletch arrows. Retrieved from <https://www.archery360.com/2018/01/31/step-step-fletch-arrows/>

**Reflection after fletching:**

- What is the advantage of using feathered arrows in a recurve bow?
- What is a reason being able to fletch your own arrows important?
- Why did you choose the feathers you did?
- What surprised you most about fletching the arrow?

**Applying after fletching:**

- How will knowing how to fletch an arrow help your shooting?
- Who else could benefit from knowing how to fletch an arrow?
- What parts of the arrow that you made different from the arrows you normally use?

**Evaluation after fletching:**

- Youth will fletch one functional arrow with materials provided.
- 

If time is an issue, conduct this activity at a subsequent meeting.

**Activity**

- The archer shoots one their personal arrows and note where it hit.
- Next, the archer shoots the arrow that was just fletched.

**Reflection after shooting:**

- If the arrow you made flew differently than the one you normally use, why might that be?

**Applying after shooting:**

- How could you improve on the arrow you fletched?
- Would you choose the same fletching materials used in the arrow you fletched for your next arrows?
- How will this exercise impact your next arrows?

**Evaluation after shooting:**

- Youth will explain why their arrow shoots the same or differently than the arrow they fletched. This can be done by asking each person in the group or having each youth write their answers out.

## **Lesson 7**

### **Building and Using Sights**

## **Lesson 7: Building and Using Sights**

**Skill Level:** Advanced

**Time Needed:** 45 minutes

### **Learning Objectives:**

#### *Project Skills*

Youth will be able to shoot using a homemade sight.

Youth will be able to adjust the sight for their personal use.

#### *Skills for Life*

Marketable Skills

Problem Solving

Personal Safety

### **Materials needed:**

Weather-stripping foam

Dressmaker's pins with enamel heads

Scissors

Bows without sights

### **Setting:**

On the range with tables to set materials to make the sights on.

### **Lead in questions:**

What is the purpose of a sight on a bow?

On what types of bows can sights be used?

How is a sight adjusted for shooting?

### **Introduction:**

Sights can be used on bows direct the archer where to hold the bow to hit the target. There are several types of sights: fixed-pin sights, multi-pin sights and recurve sights. Fixed-pin and multi-pin sights are designed for compound bows and recurve sights are designed for recurve bows. Pin sights can be mounted on recurve bows, but it is not recommended.

### **Background information:**

When teaching archery, it is important to teach beginning archers the instinctive method of shooting. If an archer can shoot instinctively then the transition to a sighted bow will be relatively easy. They will also have a reference point for how well or how poorly their performance changes when they switch to a sighted bow. Not all instinctive shooters want to add a sight to their bow. Some prefer the challenge of instinctive shooting although it will take significantly more practice to make them competitive with sighted bows.

It is rare that a compound bow is shot instinctively. The biggest challenge archers, especially recurve archers have shooting with sights from the beginning is that they are often unable to function without a sight, making them dependent on this equipment. Compound bows are the most common bows for

hunting. Sights are important in hunting because accuracy is crucial for humanely killing an animal. If a shot is just a little bit off, the animal may be wounded and suffer a painful death.

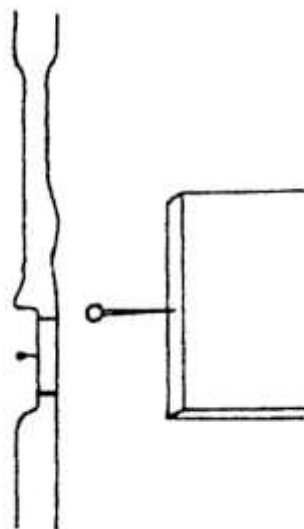
If you have a pin sight, a pendulum sight and a recurve sight, show them and explain their use. If not, use the identification sheet with this lesson.

Make a sight ahead of time so that you can show the group an example of what they will be making.

**Activity:**

We are going to make a simple pin sight for your bow. It will even be adjustable. Stick a strip of foam on the back of the bow at the sight window. Stick the pin into the foam, leaving the enamel head in the sight window. A good starting point places the pin about the same distance above the arrow rest as the eye is above the anchor point. The head of the pin should stick out into the sight window about as far as the edge of the arrow is from the dominant eye, about 1.5cm (3/4"). This arrangement should place the arrows close to the point of aim at close range (15 to 25 yards). The sights can be adjusted by trial and error to place the group center on the point of aim.

The sights will need to be adjusted. To do so, the archer must know where the arrows are hitting relative to the point of aim. That means that the ability to shoot tight groups is essential. A minimum of three arrows should be shot to establish the point of impact. Use the same sight setting, anchor point and point of aim. If the sight setting places the first arrow completely off the butt or target and your form was good, adjust the sight after that arrow to get on the target. Using the "chase the arrows with the pin" approach, move the sight to the left if the hits are to the left, upward if they are high and so on. With this type of sight, adjustments may need to be made by trial and error. Once the sights are set to your satisfaction, mark the pin and foam with the distance. Shoot using the sight at multiple distances to discover how distance affects sight adjustment.



Howard Jr., R. A. (2014). Shooting with Sights. *4-H Archery instructor manual: Level 1*. National 4-H Shooting Sports Committee.

**Reflect:**

- How did using a sight improve your accuracy?
- What did you do to adjust your sight after evaluating your shot?
- Why was evaluating your shot each time important when sighting in your bow?
- How did your shooting form change because of using a sight?

**Apply:**

- Why was it important to learn to shoot instinctively before learning to use a sight?
- After learning to use a sight, what will change about how you shoot instinctively?
- What is an example of shooting archery when accuracy is more important than shooting competitively and sight would be useful? Why?

**Evaluate:**

- Youth will shoot one end correctly using the sight they have made.
- Youth will adjust sight to improve accuracy on one end.

# Sights



**Pin Sight**



**Pendulum Sight**



**Recurve Bow Sight**



## Advanced Assessment

## Advanced Archery Assessment

Name: \_\_\_\_\_

Date: \_\_\_\_\_

1. Why can a compound shooter hold an anchor longer than a recurve archer?
  - ☐ A compound bow has let off.
  - ☐ Compound bows aren't made of wood.
  - ☐ Compound bows use arrows with vanes.
2. Compound bows are able to shoot lighter arrows with less spine than recurve bows because the cams absorb more energy than the limbs on a recurve bow.
  - ☐ True
  - ☐ False
3. A bow with a 30 lb. draw weight shoots a \_\_\_\_\_ arrow than a bow with a 40 lb. draw weight.
  - ☐ heavier
  - ☐ lighter
  - ☐ same weight
4. Keisha saw an archer in a movie that used a back quiver and she liked the way it looked. She is shooting in the state match next month. What type of quiver should she purchase?
  - ☐ Back quiver
  - ☐ Bow quiver
  - ☐ Hip quiver
5. A 120-grain arrow has a shorter trajectory than a 110-grain arrow because the heavier the object, the greater the effect of gravity.
  - ☐ True
  - ☐ False

6. Caden can shoot tight groups at the 40 meter target. He wants to shoot at the 50 meter target but the arrows are falling to the ground before they reach the target. What should he do?

- ☐ Hold the anchor for a shorter time.
- ☐ Use lighter arrows.
- ☐ Use a bow with a higher draw weight.

7. How do you adjust your aim to compensate for the trajectory of the arrow?

- ☐ Point the arrow directly at the bullseye.
- ☐ Point the arrow slightly below the bullseye.
- ☐ Point the arrow slightly above the bullseye.

8. Which of the following muscle groups are used when shooting a bow? Select all that apply.

- ☐ Shoulder muscles
- ☐ Facial muscles
- ☐ Abdominal muscles

9. Why should an archer have good cardiovascular function? Select the best answer.

- ☐ Because they have to walk back and forth to the target.
- ☐ They have to carry their equipment.
- ☐ They need stamina to shoot for long periods at a time.

10. Describe an effective warm-up stretch for archery.

11. Select all the reasons that brace height is important.

- ☐ The nock indicator will line up with the arrow.
- ☐ The string is putting the right amount of pressure on the limbs.
- ☐ The string will stay untangled.

12. What should you do if the laminate splits on a recurve limb.

- ☐ Glue the laminate back on and continue shooting.
- ☐ Nothing, the laminate is only for appearance.
- ☐ Stop using the bow and buy new limbs.

13. Which of the following can happen if the nock indicator is missing?

- ☐ The arrow won't click on the string.
- ☐ The arrow won't line up with the rest.
- ☐ The arrow won't come off the bow.

14. Mark all of the following which may happen if the arrow rest falls off.

- ☐ The arrow won't stay on the bow.
- ☐ The arrow won't line up with the nock indicator.
- ☐ The brace height will be wrong.

15. What is NOT a reason to learn to fletch your own arrows?

- ☐ You can save money by making the repairs yourself.
- ☐ You can customize the vanes or feathers you want.
- ☐ You can change the spine of the arrow.
- ☐ You can repair an arrow immediately.

16. Why is it important to learn to shoot instinctively before learning to use a sight?

17. A bow with a 30 lb. draw weight shoots a \_\_\_\_\_ arrow than a bow with a 40 lb. draw weight.

- ☐ Heavier
- ☐ Lighter
- ☐ Same weight

## Advanced Archery Assessment-Key

Name: \_\_\_\_\_

1. Why can a compound shooter hold an anchor longer than a recurve archer?

- ☒ A compound bow has let off.
- ☐ Compound bows aren't made of wood.
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2. Compound bows are able to shoot lighter arrows with less spine than recurve bows because the cams absorb more energy than the limbs on a recurve bow.

- ☒ True
- ☐ False

3. A bow with a 30 lb. draw weight shoots a \_\_\_\_\_ arrow than a bow with a 40 lb. draw weight.

- ☐ heavier
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4. Keisha saw an archer in a movie that used a back quiver and she liked the way it looked. She is shooting in the state match next month. What type of quiver should she purchase?

- ☐ Back quiver
- ☐ Bow quiver
- ☒ Hip quiver

5. A 120-grain arrow has a shorter trajectory than a 110-grain arrow because the heavier the object, the greater the effect of gravity.

- ☒ True
- ☐ False

6. Caden can shoot tight groups at the 40 meter target. He wants to shoot at the 50 meter target but the arrows are falling to the ground before they reach the target. What should he do?

- ☐ Hold the anchor for a shorter time.
- ☐ Use lighter arrows.
- ☒ Use a bow with a higher draw weight.

7. How do you adjust your aim to compensate for the trajectory of the arrow?

- ☐ Point the arrow directly at the bullseye.
- ☐ Point the arrow slightly below the bullseye.
- ☒ Point the arrow slightly above the bullseye.

8. Which of the following muscle groups are used when shooting a bow? Select all that apply.

- ☒ Shoulder muscles
- ☐ Facial muscles
- ☒ Abdominal muscles

9. Why should an archer have good cardiovascular function? Select the best answer.

- ☐ Because they have to walk back and forth to the target.
- ☐ They have to carry their equipment.
- ☒ They need stamina to shoot for long periods at a time.

10. Describe an effective warm-up stretch for archery.

*Anything reasonable. Best if they can tell the source.*



11. Select all the reasons that brace height is important.

- ☒ The nock indicator will line up with the arrow.
- ☒ The string is putting the right amount of pressure on the limbs.
- ☐ The string will stay untangled.

12. What should you do if the laminate splits on a recurve limb.

- ☐ Glue the laminate back on and continue shooting.
- ☐ Nothing, the laminate is only for appearance.
- ☒ Stop using the bow and buy new limbs.

13. Which of the following can happen if the nock indicator is missing?

- ☐ The arrow won't click on the string.
- ☒ The arrow won't line up with the rest.
- ☐ The arrow won't come off the bow.

14. Mark all of the following which may happen if the arrow rest falls off.

- ☒ The arrow won't stay on the bow.
- ☒ The arrow won't line up with the nock indicator.
- ☐ The brace height will be wrong.

15. What is NOT a reason to learn to fletch your own arrows?

- ☐ You can save money by making the repairs yourself.
- ☐ You can customize the vanes or feathers you want.
- ☒ You can change the spine of the arrow.
- ☐ You can repair an arrow immediately.

16. Why is it important to learn to shoot instinctively before learning to use a sight?

*Because it is more difficult to shoot instinctively and if an archer can shoot instinctively, they can learn relatively easily to shoot with sights. However, if an archer learns with a sight first, it will be difficult for them to learn to shoot instinctively.*

17. A bow with a 30 lb. draw weight shoots a \_\_\_\_\_ arrow than a bow with a 40 lb. draw weight.

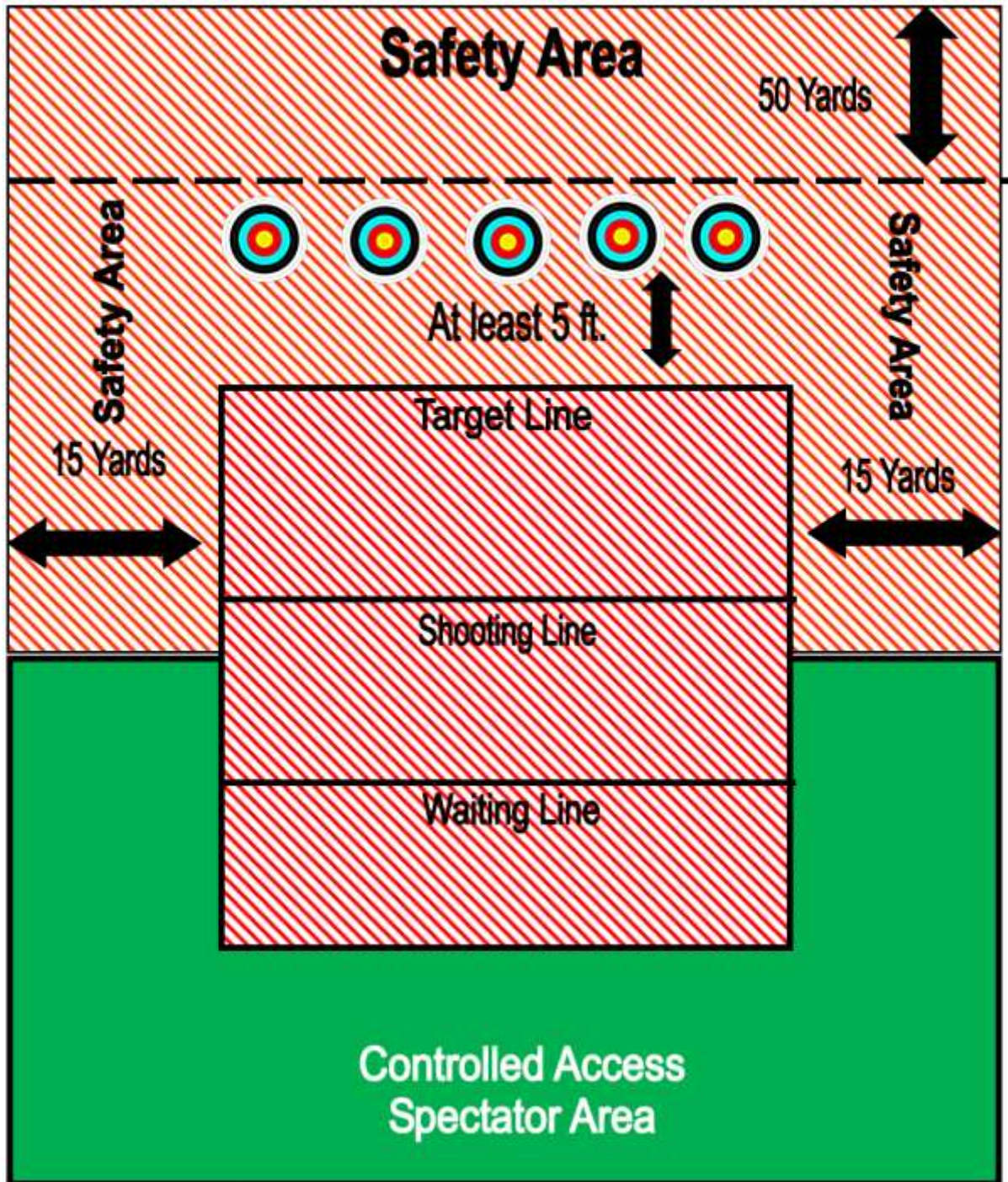
- ☒ Heavier
- ☐ Lighter
- ☐ Same weight



# Appendix

# Basic Lesson 2: Shooting Safety

# Outdoor Archery Range Layout



# Basic Lesson 5:

## Setting Up a Bow

## Steps to Setting Up a Recurve Bow

### Step 1: Assemble the bow.

The limbs do not come attached to the riser. Identify the top and bottom limbs. The bottom limb has the draw weight on the face. Start by unscrewing the bolt on the bottom of the riser. Fit the limb into the space and screw the bolt back in. Screw it in tightly but don't over tighten it or you may not be able to remove it at another time. The limb should be snugly in place without wiggling. Repeat with the top limb.

### Step 2: Add the string.

The top of the string has a larger loop. Slip this end of the string over the tip and slide it down as far as it will go. Slip the bottom string on the other end. String the bow.

### Step 3: Attach rest and arrow plate.

- Stick-on Rest
  - Can be used with feathered arrows or vanes.
  - If a stick-on rest is being used, remove adhesive and attach on the side and in the center of the sight window. Take care that it is on straight and that the rest isn't sitting on the shelf.
- Hair Rest
  - Can only be used with feathered arrows. The vanes will be torn off.
  - If a hair rest is being used, cut the fabric to fit on the shelf. Take care not to have any material going up the side of the sight window or hanging off. Remove adhesive and attach to shelf.
  - Attach the arrow plate on the center side of the sight window. It should touch the hair rest but not go below it.

### Step 4: Install the nock locator.

Attach the two-prong end of the bow square to the string so that the perpendicular pieces sits on the arrow rest. It should be able to swing free with a little resistance. Measure approximately ¼" up from where the bow square is attached to the string using the ruler on the square. This is where you will attach the locator. Use the larger hole on the crimping tool to crimp the nock locator on the string. Once it will stay in place, use the small hole on the crimper to tighten the nock locator on the string. When the arrow is nocked, it should be touching the arrow rest but lightly.

### Step 5: Tip Protector (optional)

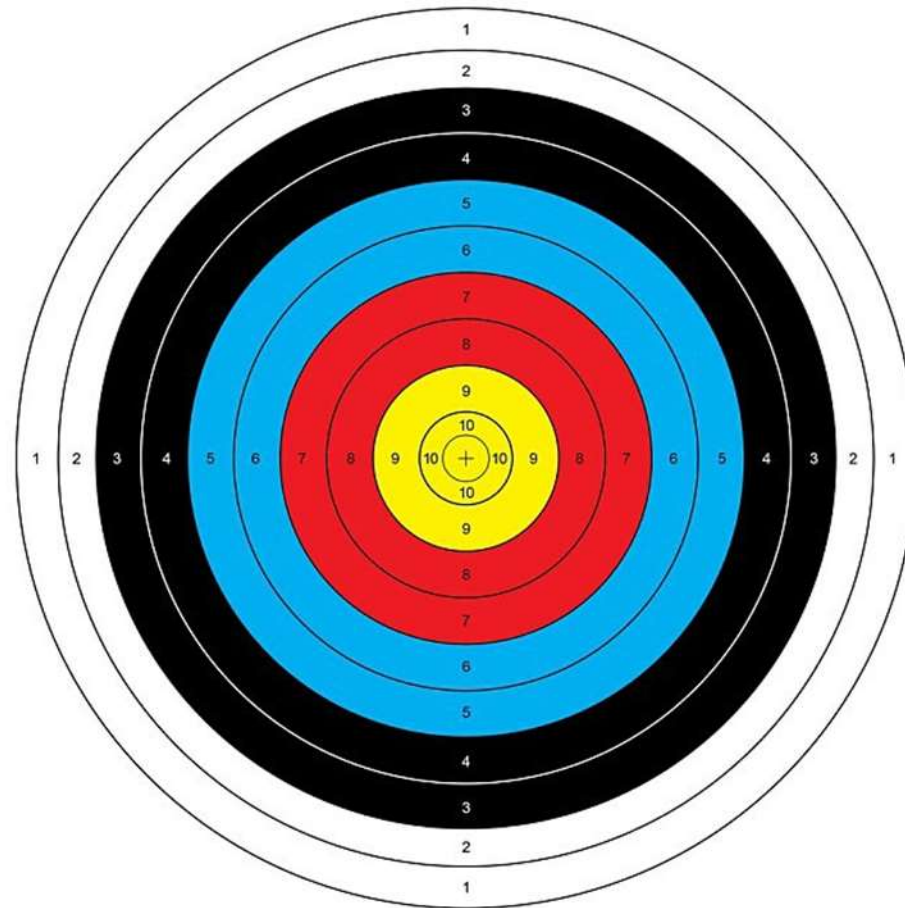
Install a tip protector on the bottom tip of your bow. Pull it over the end and make sure it fits snugly.

Your bow is ready to shoot.

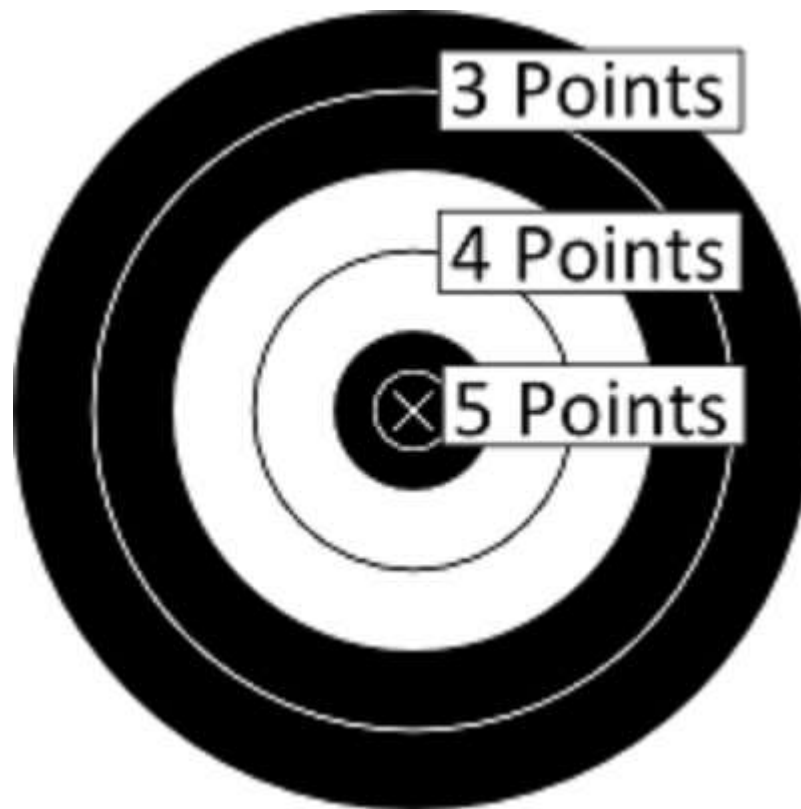
You can find a video of set up at: [https://youtu.be/0bOcsWGf\\_HE](https://youtu.be/0bOcsWGf_HE)

# Basic Lesson 6: Archery Disciplines

# FITA Target

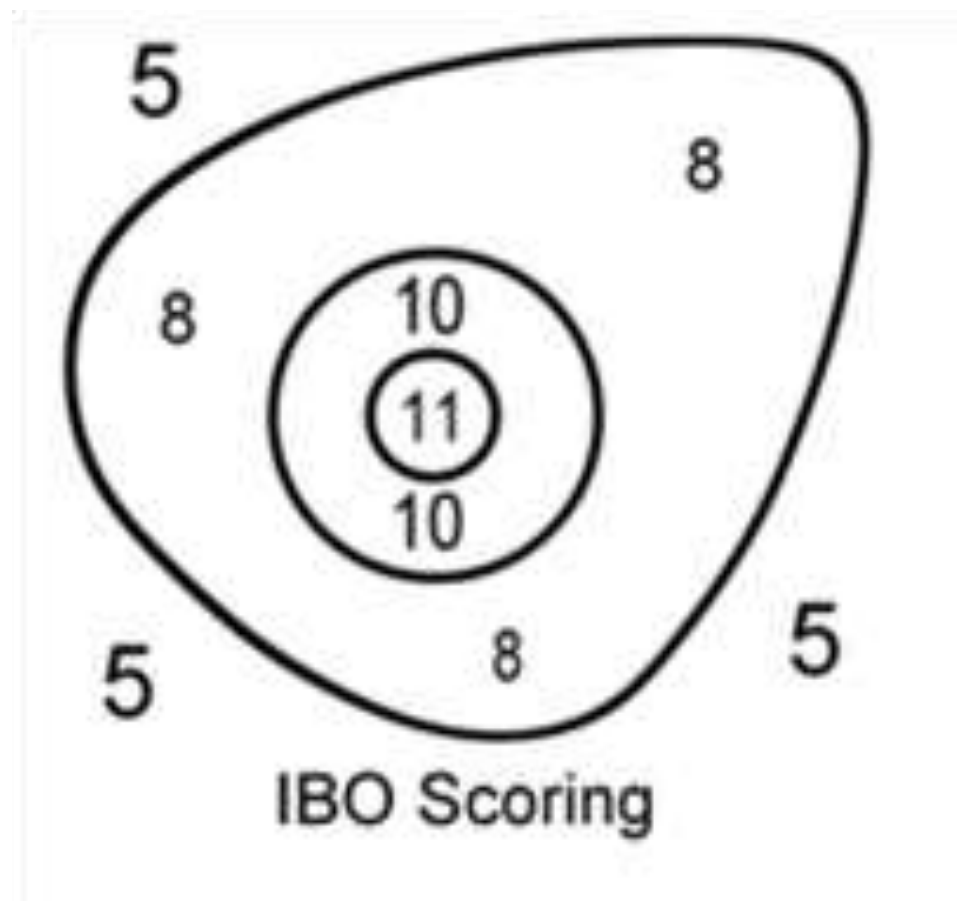


# Field Target





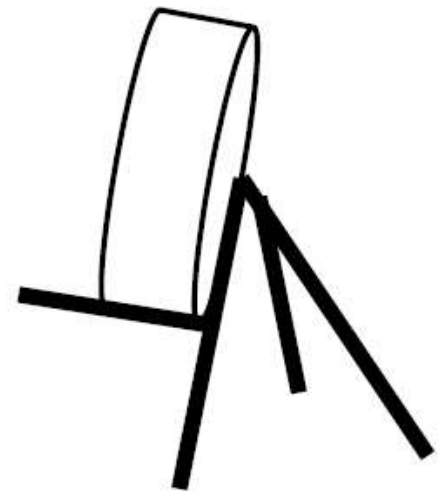
# 3-D Target



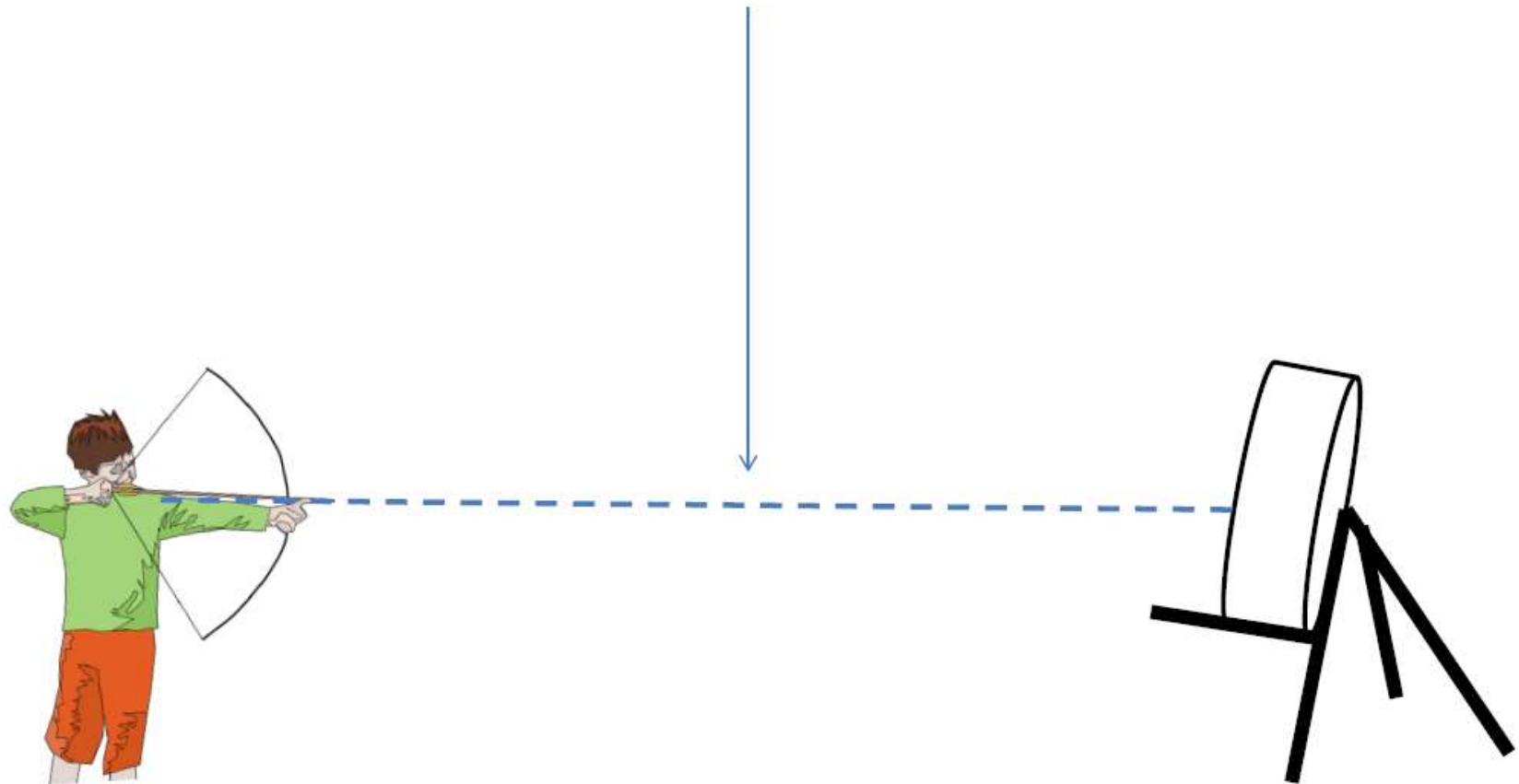
# Advanced Lesson 3:

## Trajectory of an Arrow

# Arrow Path

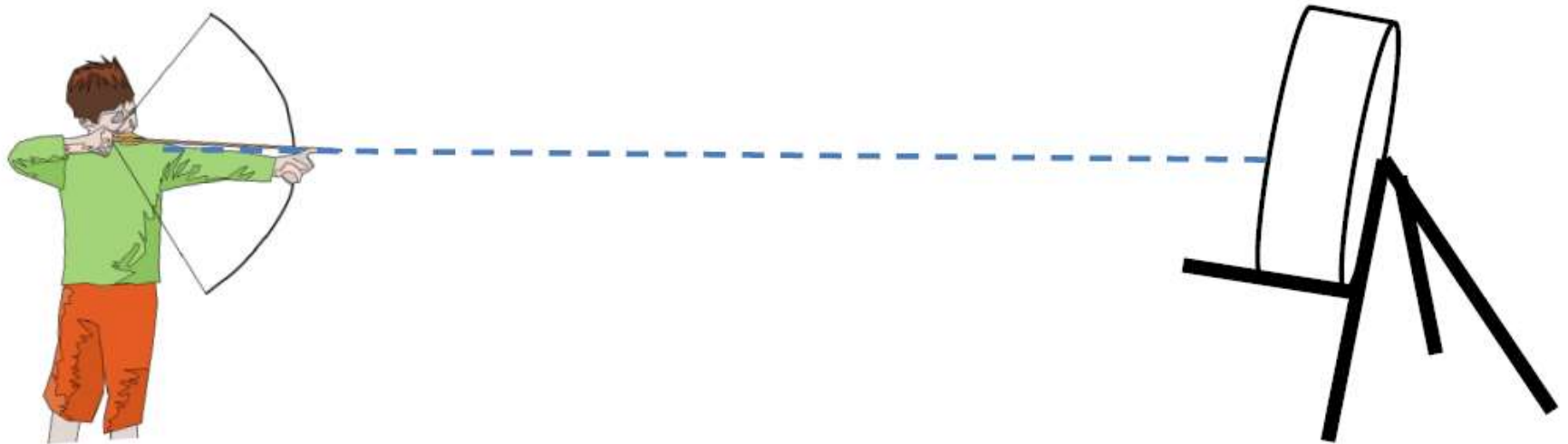


# Line-of-Sight

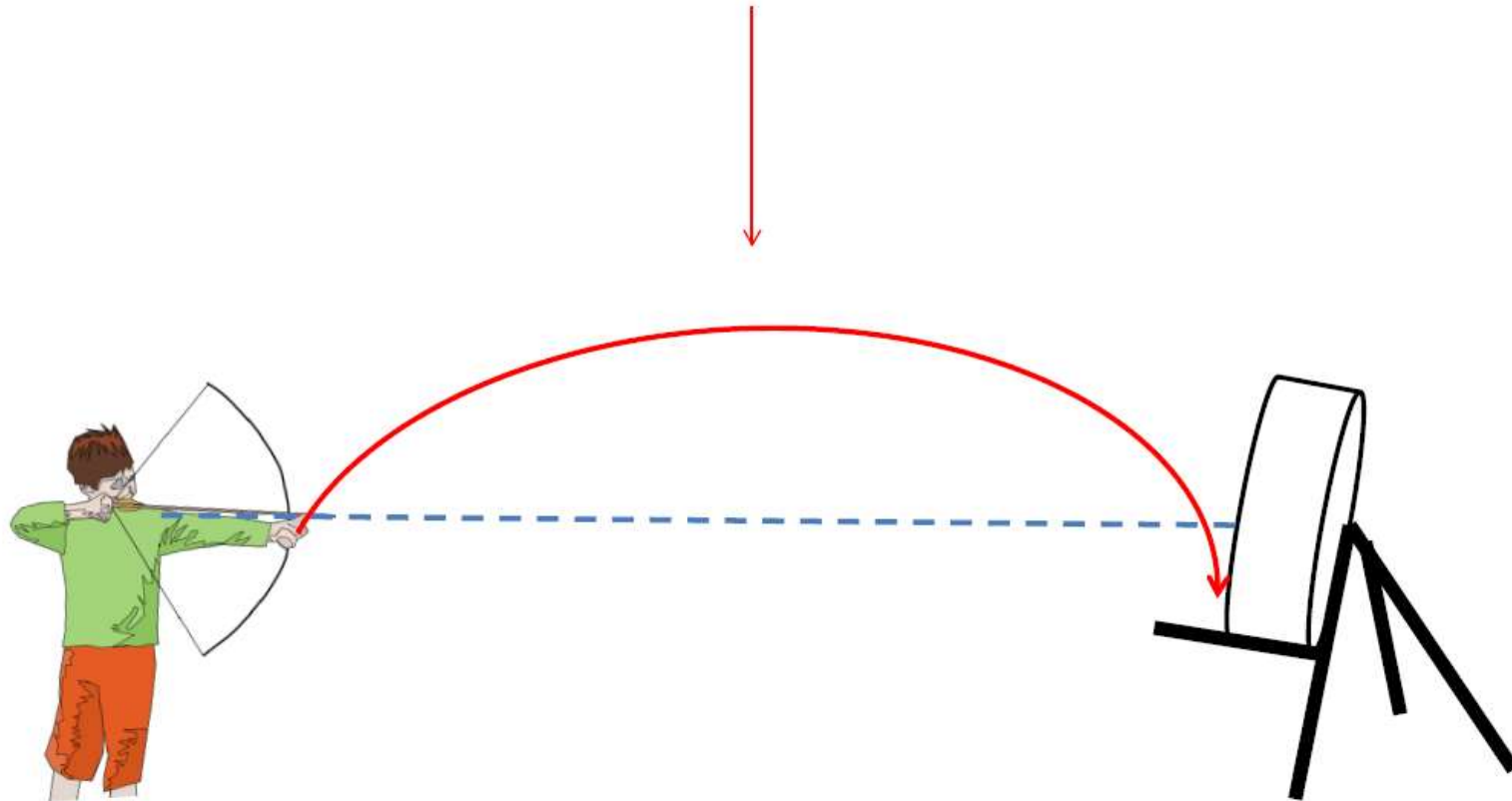


**Line of sight: straight line between the shooter and the target.**

# Trajectory



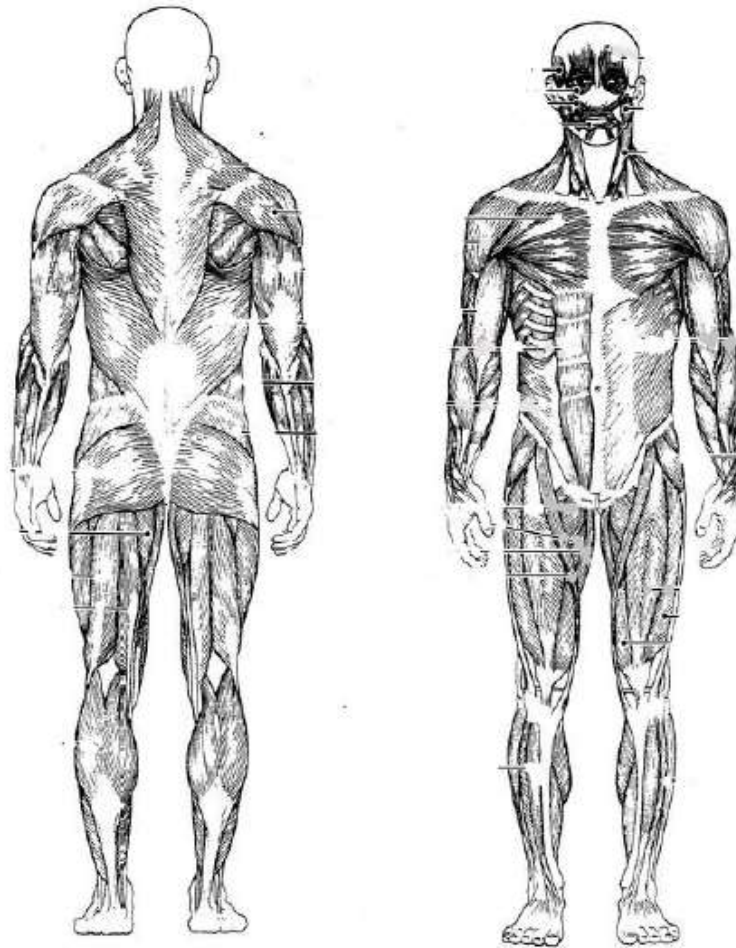
# Trajectory



**Trajectory:** Path followed by a projectile flying or an object moving under the action of given forces.

# Advanced Lesson 4: Physiology of Archery

# Archery Muscles





# Archery Muscles

