Appendix VII

Wood Knowledge Contest

Listed below are sample questions that can be used in a wood knowledge contest. Any 4-H leader can design a similar type of contest for his or her club. The same type of questions, with wood samples, can be used in other ways, such as a 4-H Wood Science Bowl.

Instructions: Circle one answer in the right hand column.

1. There are literally hundreds of specialty wood products and by-products. Which one of these is not a wood product? (no sample displayed)
   A. Rayon thread B. Turpentine C. Cooking oil ..... A B C

2. Which one of these groups of tree species is common to the Northwest Christmas tree industry? (no sample displayed)
   A. Austrian Pine, Blue Spruce, Hemlock B. Scotch Pine, Douglas-fir, Noble Fir
   C. Balsum Fir, White Pine, Giant Sequoia ..... A B C

3. This sample is from a group of different tree species with one common lumber trade name. It is
   A. Spruce B. Pine C. Hem Fir ..... A B C

4. I'm used for flooring, furniture, and wedges, and I'm not a common forest species in (your state or area). I'm
   A. Spruce B. Oak C. Maple (change samples for your area) ..... A B C

5. Of the three samples of plywood shown here, which one would be subject to the least warpage and surface checking? (display your own samples) ..... **A B C**

6. This wood product is known in the building trade as a
   A. Shake B. Shingle C. Miter ..... A B C

7. This wood product, made by cooking wood chips and then compressing and drying into sheets, is known as
   A. Fiberboard B. Particleboard C. Chipboard ..... A B C

8. This piece of plywood, generally sold with no grade stamp and often used in cabinet shops, is called
   A. C D plywood B. Shop or void plywood C. Marine plywood ..... A B C

9. My wood is quite soft and fine grained, and I'm from a five-needle Pine. My wood is used for interior finish, lumber, and woodworking. I'm
   A. Western White Pine B. Shore Pine C. Ponderosa Pine ..... A B C

10. The wood for this pencil is commonly made from
    A. Alaska Cedar B. Pacific Yew C. Incense Cedar ..... A B C

11. This is a chunk of one of the most common hardwood fireplace woods. I am
A. Maple B. Red Alder C. Douglas-fir ..... A B C

12. In the lumber business, this collection of samples would be called
A. Boards B. Dimension C. Timbers ..... A B C

13. Which sample, when used in home building resting on concrete or near the soil, is required by most building codes?
A. Cedar 2×4 B. P.T. 2×4 C. Douglas-fir 2×4 ..... A B C

14. This sample is from a western tree that produces most of the strongest (group 1) plywood. My common species name is
A. Engleman Spruce B. Douglas-fir C. Western Hemlock ..... A B C

15. Plywood that is made with a waterproof adhesive and can generally be used anywhere is called what grade plywood?
A. Interior B. Exterior C. Veneer ..... A B C

16. Examples of primary processing include
A. Cardboard boxes B. Particleboard C. Paper shopping bags ..... A B C

17. Which group of words (factors) are used in the Christmas tree grading standards?
A. Producer, wholesaler, retailer, marketer B. Balance, foliage, taper, density, deformities
C. Bevel, plane, miter, prune ..... A B C

18. This sample, whose actual measurement is ¾" × 3½", has a "normal size" classification of
A. 1×3 B. 1×4 C. 2×4 ..... A B C

19. Wood can be smoothed and leveled using which tool?
A. Bevel B. Miter C. Plane ..... A B C

20. This sample of dimension lumber is from what tree species?
A. Hem Fir B. Douglas-fir C. Pine ..... A B C

21. You are selecting plywood to make a natural finish, top quality display cabinet. These pieces represent four sheets of plywood. You are to compare and rate these sheets. How did you place the four pieces?

1st choice **2nd choice** **3rd choice** **4th choice**

22. This sample from a broadleaf hardwood, used in furniture and for making other items, is
A. Alder B. Big Leaf Maple C. Oak ..... A B C

23. This sample is called
A. Chipboard B. Particleboard C. Fiberboard ..... A B C

Appendix VIII

Exhibit Ideas

Division A: Wood Science (Display Samples)

- Labeled specimens of hardwoods common to your area
- Labeled specimens of softwoods common to your area
- Different products of dimension lumber
- Different plywood species
- Different hardwood plywoods
- Hardwood products
- Pulp products
- Stages in paper making
- Chemical process products of wood
- Seasoning woods for cooking

Division B: Woodworking: Articles Made from Wood (Display Samples)

- From Unit 1: tie rack, letter holder, note holder, picture frame, art design, bird nest shelf, puzzle, game, etc.
- From Unit II: key holder, cutting board, birdhouse, bookends, footstool, book rack, tool box, games, etc.
- From Unit III: toy, door knocker, sandbox, shoeshine box, step stool/chair, saw horse, garage door creeper, barn medicine cabinet, etc.

Appendix IX

Wood Science and Wood Scientists

You as a leader may be asked for a definition of wood science or an explanation of what wood scientists do. We hope that you will encourage youth in the 4-H Wood Science Project to learn more about wood and wood science.

Wood Science is a relatively new profession. It is a materials engineering science. Graduates of university wood science programs have a comprehensive knowledge and understanding of wood as a raw material. This knowledge includes the anatomy, physical, chemical, mechanical, and biological properties of wood. In addition, they receive extensive training in the major wood processing operations such as drying, machining (including sawmilling and veneering), gluing, finishing, and treating wood. Additional areas of study often selected are industrial engineering, business administration, marketing, personnel relations, economics, civil engineering, and chemistry.

A wood scientist must know chemistry, physics, mathematics, and other sciences. However, he or she is distinguished from the chemist, physicist, mathematician, engineer, and forester in that the wood scientist knows wood. He or she knows wood as a biological product of the forest, as a raw material, as a material for construction, and as a part of our civilization. He or she knows why it acts the way it does and what to look for when it doesn't.

Wood scientists are expanding the broad scientific base for wood science through educational and research efforts. The behavior of wood is often explained by its peculiar structure and organization. Very few materials in the field of construction are as complex as wood, yet wood has been, and still is, being used by those who know nothing of its complex properties.

Because wood is such a common and easily used material, many users do not even know that wood has unique properties. Much of the difficulty encountered when working with wood is due to misinformation or the lack of information regarding its properties and behavior. A wood scientist can help you and your 4-H'ers better understand the properties of wood and how they affect the use of wood.

Wood scientists have organized as professionals into a Society of Wood Science and Technology (SWST). The Society publishes a quarterly journal called *Wood and Fiber Science* which began in 1983. Prior to that were two publications, *Wood and Fiber* and *Wood Science,* which merged. Libraries may have copies of each up through 1982. The new publication (*Wood and Fiber Science*) contains technical information about wood. In addition, there are numerous trade publications which deal specifically with harvesting, processing, furniture manufacturing, and pulp and paper.

Information about the Society and careers in wood science is available from SWST, P.O. Box 5062, Madison, Wisconsin 53705.

Another publication, *The Forest Products Journal,* is published monthly by the Forest Products Research Society, 2801 Marshall Court, Madison, Wisconsin 53705.

Appendix X

Suggested Wood Science Experiments

The youth who are enrolled in this project will learn a great deal about wood and woodworking tools as they progress through each Unit. You can help them even more by conducting some simple experiments. These experiments will help 4-H'ers learn to better use wood. And you, as a leader, may even discover something you didn't know about wood.

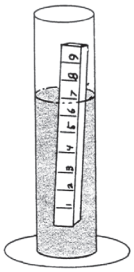
Here are a few suggestions. There are many other possibilities. Feel free to pick and choose those which best suit the needs of your 4-H members. Your reward will be to see your members build better products from wood because of what they have learned through their experiments and experiences with you as a leader.

Specific Gravity and Strength of Wood

Specific gravity tells how heavy wood is compared to water. Most wood is lighter than water, so it has a specific gravity of less than one.

You can do a reasonably good job of finding the specific gravity of wood by floating a piece on end and measuring the proportion of it that gets wet. Do it quickly before the wood gets so wet that it sinks further than it did when dry. If half gets wet, its specific gravity is 0.5, which means that it is half as heavy as water.

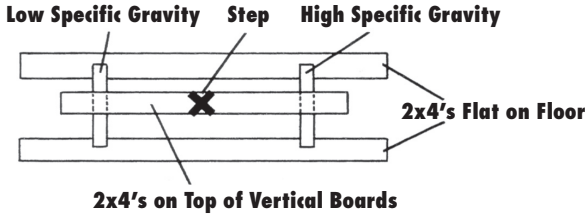
Better yet, dip it in hot paraffin or paint it first. Cut a 10-inch piece of uniform cross section (¾"×¾" or 1½"×1½") from a board or a 2×4. Draw a line at each inch. Float it on end. Count the number of spaces that get wet. Divide by 10. That gives the specific gravity. (You can estimate in between the spaces to be more accurate).



$\frac{6.5}{10}$ = 0.65 SPECIFIC GRAVITY (because 0.65 of sample is under water)

Note: You will need to support the wood gently in order to get it to float on end rather than float on its side. If in supporting it you accidentally push down or pull up, that will change the level at which the wood floats and, therefore, give an inaccurate reading of its actual specific gravity. A tall glass tube just large enough for the sample works best, but if you do not have one, a paper milk carton will work quite well.

You can demonstrate that a heavyweight wood is stronger than a lightweight wood by using two pieces the same size. Use the two that have the greatest difference in specific gravity. Set them across supports (2×4's laid flat on the floor) and support a third 2×4 on top of them as shown below. Ask progressively heavier members to stand near the center of the third 2×4 until one piece breaks.



Thermal Properties of Wood

You'll need a plastic bag filled with ice cubes, any long metal rod or bolt, and a piece of wood the same length. Stick the rod and wood in the bag of ice cubes at the same time and have the group feel them both from time to time. Note that the rod feels cold while the wood does not. Wood is a good insulator; poor conductor. (You could demonstrate the same property using hot water instead of ice.)

Strength of Nails, Screws, Bolts, Glue

You will need short pieces of 2×3's or 2×4's, all about the same length, each with one end cut at a 45-degree angle. (Making these might be a group exercise.) You will need a variety of fasteners, such as short nails, long nails, modified shank nails, wood screws, bolts, and glue. Fasten two pieces together to form a V at the top.

Hold an old baseball bat, table leg, or pipe in the V notch and have the lightest to the heaviest member pound on or jump on the bat, or hit it with different weights of hammers. Write the pounds force or some qualitative measure on the broken piece (such as, it took Bob to break it; it took James and Lynn). List the fasteners tested, from the weakest to the strongest.

BB Driving Contest

You'll need a hammer, some BB's or ballbearings, one softwood board, and one hardwood board. Have members drive the BB's first into the softwood board and then try to drive them into the hardwood board. Try to drive them in both the sides and the ends of the boards, and then find out which was the easiest and which was the most difficult.

The Tug of War

All you need is one long, smooth board (a furring strip, about ¾×1 would be good). Choose two members approximately the same weight or divide the group into two teams, if the board is long enough. Have the two pull and tug on the board. No matter how hard they pull, as long as they pull straight, they will probably not be able to pull the board apart. (Caution: be sure it is a smooth board and wear gloves for protection from slivers.) This demonstrates the strength of wood in tension.

If the piece of wood is expendable, demonstrate how easily it can be broken by the two smallest students bending it against a post. (Be careful of sharp ends when it breaks.) Cut off any sharp ends. Fasten the two pieces together with a nail or screw. Pull again. This demonstrates that it is hard to fasten wood and have strength equal to the original wood.

Distortion of Wood Upon Swelling

Paint one side of a flat, dry board and both sides of another. Mark the center on each. Measure the board lengthwise from center to end. Soak both boards in water. Again, measure the boards from center to end. Note that the board painted on one side curves because it swells first on the unpainted side, but it flattens out later when both sides have swollen.

Repeat, but first dry the boards in an oven just before painting. Then allow them to pick up moisture from the air, rather than soaking them. You will see that coatings delay swelling but do not prevent it, yet coating both sides is a good practice to prevent uneven swelling.

Measuring the Moisture Content of Wood

Weigh a small wood sample taken at least 20 inches from the end of a board (the ends dry more rapidly, so a sample from the end may not indicate the true moisture content). Weigh the sample accurately right after it is cut. Dry it in an oven set at 225 to 250 °F until the sample reaches a constant weight (this might take 12 hours). This is the **oven-dry weight**. Subtract the oven-dry weight from the weight of the sample when cut. The difference is the weight of water removed in drying. Divide the weight of water removed by the oven dry weight and multiply by 100. This gives percent moisture content. Note that it is traditional among wood scientists to use the oven-dry weight as the denominator when expressing moisture content. (Engineers often use the wet weight as the denominator. This results in a slightly lower value for moisture content in dry wood, and a much lower value in wetter wood.)

Here is an example: If a small sample of wood weighs 220 grams when cut, and 200 grams after drying, it has lost 20 grams of moisture. The percent moisture content equals:

$$\frac{\text{weight when cut minus oven-dry weight}}{\text{oven-dry weight}} \times 100 =$$

$$\frac{220 - 200}{200} \times 100 = \frac{20}{200} \times 100 = 10\%$$

(Note: If *weight when cut* was used as the *denominator*:

$$\frac{220 - 200}{220} \times 100 = \frac{20}{220} \times 100 = 9\%)$$