Color the Kestrel

Complete the math problems to discover how to color the kestrel. Use a separate sheet of paper to show your work.

Leave all areas with this answer white.
21 X 10 =

Color all areas with this answer yellow-brown.
55 x 40 =

Color all areas with this answer orange-brown.
40 ÷ 8 =

Color all areas with this answer blue-gray.
50 x 20 =

Color all areas with this answer black.
60 ÷ 20 =

Color all areas with this answer brown.
30 x 5 =

Color all areas with this answer orange.
20 ÷ 5 =

Color all area with this answer yellow.
40 x 4 =

Color the Kestrel

Complete the math problems to discover how to color the kestrel. Use a separate sheet of paper to show your work.

Leave all areas with this answer white.
21 X 10 = 210

Color all areas with this answer yellow-brown.
55 x 40 = 2200

Color all areas with this answer orange-brown.
40 ÷ 8 = 5

Color all areas with this answer blue-gray.
50 x 20 = 1000

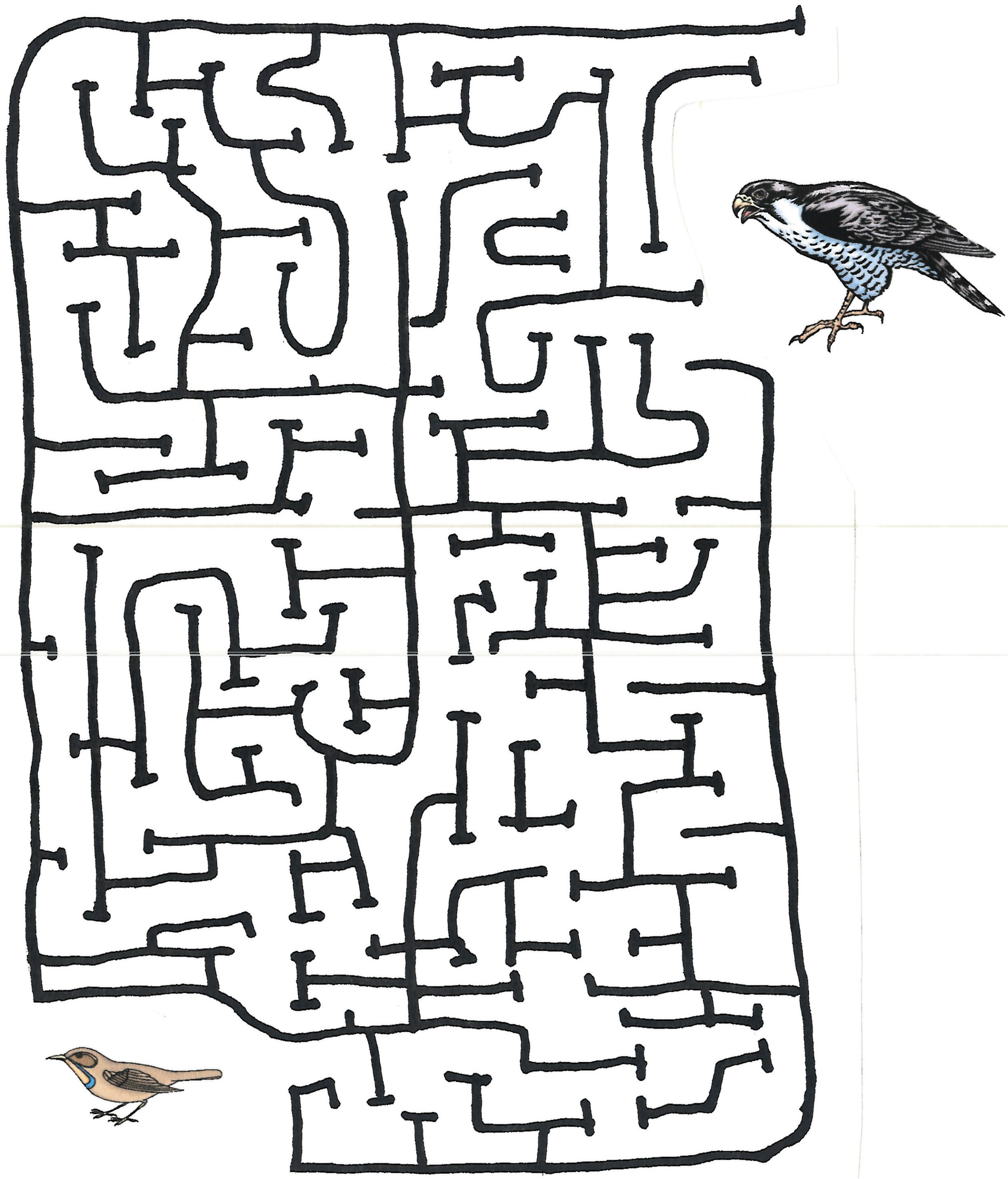
Color all areas with this answer black.
60 ÷ 20 = 3

Color all areas with this answer brown.
30 x 5 = 150

Color all areas with this answer orange.
20 ÷ 5 = 4

Color all area with this answer yellow.
40 x 4 = 160

Help the falcon find its prey.



Hazardous Links, Possible Solutions

Objectives

Students will: 1) give examples of ways in which pesticides enter food chains; 2) describe possible consequences of pesticides entering food chains; and 3) describe how regulations attempt to control pesticide use.

Method

Students become hawks, shrews and grasshoppers in a physical activity.

Materials

White and colored drinking straws; pipe cleaners; poker chips or multi-colored, dry dog food—30 pieces per student, two-thirds white or plain and one-third colored; one bag per grasshopper (approximately 18-20)

Age: Grades 7-8

Subject Areas: Science, Expressive Arts, Environmental Education

Duration: two 30- to 45-minute sessions, with research time in between the two

Group Size: minimum of ten students

Setting: a large playing area

Conceptual Framework Topic Reference: HPIIB4

Key Terms: pesticide, insecticide, herbicide, food chain, accumulate, toxic, chemicals, trade-offs, organic, inorganic, biomagnification

Appendices: Local Resources, Agencies and Organizations, Outdoors, Simulations

Background

Pesticides are chemicals—often synthetic, inorganic compounds—developed to control organisms that have been identified as "pests" under some conditions. Herbicides are pesticides that control unwanted plants; insecticides are pesticides that control nuisance insects and so on. Although pesticides are useful to humans when used properly, they frequently end up going where they are not wanted. Many toxic chemicals have a way of persisting in the environment and often become concentrated in unexpected and undesirable places—from food and water supplies to wildlife and sometimes people, too. The process where chemicals accumulate in organisms in increasingly higher concentrations at successive trophic levels is called "biomagnification." Biomagnification results in the storage of these chemicals in organisms in higher concentrations than are normally found in the environment. The results can be far-reaching.

For example, the insecticide dichlorodiphenyltrichloroethane (DDT) was applied to control insects that were damaging crops. In the early 1970s, it was discovered that DDT entered the food chain with damaging results. Fish ate insects that were sprayed by the chemical; hawks, eagles and pelicans then ate the fish. The poison became concentrated in the birds systems, resulting in side effects such as thin egg shells. The weight on the adult bird would then crush the egg in the nesting process. The impact on species, including the bald eagle and the brown pelican, has been well documented.

continued

Law in the United States has now prohibited the use of DDT. However, DDT use is not prohibited worldwide. Resident and migrating animal populations in the countries that still allow the use of DDT are at particular risk. Even after the application of DDT is stopped, DDT and its by-products can affect the environment for decades.

Concerns over the growing use of pesticides led to the establishment of the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) in 1972. FIFRA gives federal government control over pesticide sale, use and distribution. Under FIFRA, the U.S. Environmental Protection Agency (EPA) gained authority to study pesticide use consequences and also to require pesticide registration by farmers, businesses and so on. FIFRA later was amended to require pesticide users to take certification exams. EPA must register pesticides used in the United States.

Congress also enacted the Toxic Substances Control Act (TSCA) in 1976 to regulate, test and screen all chemicals imported or produced in the United States. TSCA requires that any chemical in the market place be tested for toxic effects before commercial manufacture. TSCA also tracks and reports chemicals that pose health and environmental hazards. Authorization for toxic material cleanup also is placed under TSCA. TSCA supplements the Clean Air Act and the Toxic Release Inventory. Like FIFRA, TSCA is a balancing law, which says that the EPA is to make decisions on any chemical by comparing the risks it poses against the benefits it produces for firms and consumers.

Public pressure continues to force changes in the application and availability of pesticides. For example, there now is growing interest in integrated pest management. This agricultural approach considers the entire farm and garden ecosystem. Integrated pest management can include using a pest's predator as well as other biological controls to reduce crop damage.

Integrated pest management also can include the selective use of naturally occurring and synthetic pesticides, as well as habitat manipulations. One concern with this approach is the possible introduction of non-native species.

The major purpose of this activity is for students to recognize the possible consequences of accumulation of some pesticides in the environment and to evaluate measures to control pesticide use.

Procedure

1. Discuss the term "food chain" with the students. (Food chain: a sequence or "chain" of living things in a community, based on one member of the community eating another and so forth [e.g., grasshopper eats plants like corn, shrews eat grasshoppers, hawks eat shrews.])
2. Divide the group into three teams. In a class of 26 students, there would be two "hawks," six "shrews" and 18 "grasshoppers." (This activity works best with approximately three times as many shrews as hawks and three times as many grasshoppers as shrews.) OPTIONAL: Have grasshoppers, hawks and shrews labeled so they can be identified easily. For example, a green cloth flag (tied around the arm) for grasshoppers, red bandannas for "red-tail hawks" and brown cloth flag (tied around the arm) or caps for shrews.
3. Distribute a small paper bag or other small container to each "grasshopper." The container is to represent the "stomach" of the animal.
4. With the students' eyes closed, or otherwise not watching where the food is placed, distribute the white and colored straws (or whatever material used) around in a large open space. Outside on a playing field if it is not windy or on a gymnasium floor will work; a classroom also will work if chairs and tables or desks can be moved.

5. Give the students the following instructions: the grasshoppers are the first to go looking for food. The hawks and shrews are to sit quietly on the sidelines watching the grasshoppers; after all, the hawks and shrews are predators and are watching their prey. At a given signal, the grasshoppers are allowed to enter the area to collect as many food tokens as they can, placing the food tokens in their stomachs (the bags or other container). The grasshoppers have to move quickly to gather food. At the end of 30 seconds, the grasshoppers are to stop collecting food tokens.

6. Next, allow the shrews to hunt the grasshoppers. The hawks are still on the sidelines quietly watching the activity. The amount of time available to the shrews to hunt grasshoppers should take into account the size area in which you are working. In a classroom, 15 seconds may be enough time; on a large playing field, 60 seconds may be better. Each shrew should have time to catch one or more grasshoppers. Any grasshopper tagged or caught by the shrew must give its bag or container of food to the shrew and then sit on the sidelines.

7. Next, allow from 15 to 60 seconds or whatever set time, for the hawks to hunt the shrews. The same rules follow. Any shrews still alive may hunt for grasshoppers. If a hawk catches a shrew, the hawk gets the food bag and the shrew goes to the sidelines. At the end of the designated time period, ask all the students to come together in a circle, bringing whatever food bags they have with them.

8. Ask the students who have been consumed to identify what animal they are and what animal ate them. If they are wearing labels this will be obvious. Next, ask any animals still alive to empty their food bags out onto the floor or on a piece of paper where they can count the number of food pieces they have. They should count the total number of white food pieces and total number of multi-colored food pieces they have in their food sacks. List any grasshoppers and the total number of white and multi-colored food pieces each has; list the number of shrews left and the number of white and multi-colored pieces each has; and finally list the hawks and the number of white and multi-colored food pieces each has.

9. Inform the students that there is something called a "pesticide" in the environment. This pesticide was sprayed onto the crop the grasshoppers were eating in order to prevent a lot of damage by the grasshoppers. If there were substantial crop damage by the grasshoppers, the farmers would have less of their crop to sell and some people and domestic livestock might have less of that kind of food to eat—or it might cost more to buy it because a smaller quantity was available. This pesticide accumulates in food chains and can stay in the environment a long time. In this activity, all of the multi-colored food pieces represent the pesticide. All of the grasshoppers that were not eaten by shrews may now be considered dead, if they have any multi-colored food pieces in their food supply. Any shrews for which half or more of their food supply was multi-colored pieces also would be considered dead from chemical side effects. The one hawk with the highest number of multi-colored food pieces will not die; however, it has accumulated so much of the pesticide in its body that the egg shells produced by it and its mate during the next nesting season will be so thin that the eggs will not hatch successfully. The other hawks are not visibly affected at this time.

10. Talk with the students about what they just experienced in the activity. Ask them for their observations about how the food chain seems to work and how toxic substances can enter the food chain with a variety of results. Introduce the term biomagnification and discuss how it can result in the accumulation of chemicals in species higher in the food chain. The students may be able to give examples beyond those of the grasshopper—shrew—hawk food chain affected by the pesticide in this activity.

continued

11. Divide the class into two, four or more groups. Ask one or two groups of students to research other chemicals—such as tributyltin (TBT), polychlorinated biphenyls (PCBs) or dieldrin—that have demonstrated the ability to persist and accumulate through food chains. What are the effects of these chemicals on organisms? What limitations have been set on the use of these substances? Have the other groups research legislation such as FIFRA and TSCA to determine how these laws work to control toxic chemicals. Allow all groups to present their findings in class, and then have the students hypothesize the effectiveness of the laws in controlling the various chemicals that were researched.

Extensions

1. Consider and discuss possible reasons for use of such chemicals. What are some of the benefits? What are some of the consequences?
2. Offer and discuss possible alternatives to uses of such chemicals in instances where it seems the negative consequences outweigh the benefits. For example, some farmers are successfully using organic techniques (e.g., sprays of organic, nontoxic substances; crop rotation; companion planting); biological controls (e.g., predatory insects); and genetic approaches (e.g., releasing sterile male insects of the pest species) in efforts to minimize damages to their crops.
3. What research is being developed and tested on the effects of pest control efforts—from effects of possibly toxic chemicals to nontoxic alternatives? What are the benefits? Consequences? Potential?
4. Review news media for relevant local, national or international examples of such issues.

Aquatic Extensions

1. See the Project WILD activity "What's in the Water?"
2. Have the students describe how pesticides can enter an aquatic food chain. Also, describe how pesticides can enter aquatic environments and end up in the food chains of terrestrial environments (mosquito larvae—fish—birds). Show how pesticides can enter the food chains in terrestrial environments and end up in aquatic environments (grasshoppers—small fish—large fish).

Evaluation

1. Identify examples of how pesticides could enter a food chain.
2. Discuss two possible consequences of pesticides entering the food chain for each of the examples given above.
3. A group of ecologists studied the presence of a toxic chemical in a lake. They found the water had one molecule of the chemical for every one billion molecules of water. This concentration is called one part per billion (ppb). The algae had one part per million (ppm) of the toxic chemical. Small animals, called zooplankton, had 10 ppm. Small fish had 100 ppm. Large fish had 1,000 ppm. How do you explain this increase in this toxic chemical to 1,000 ppm for the large fish? Use a drawing to help support your answer. The ecologists found the chemical was a pesticide that had been sprayed on cropland 100 miles away from the lake. How did so much of the chemical get into the lake?
4. Evaluate the effectiveness of at least one law that regulates hazardous chemical usage.

Share your backyard with a Kestrel!

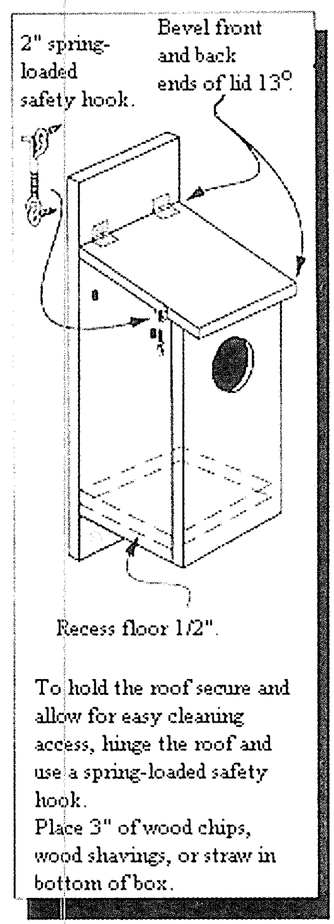
Materials:

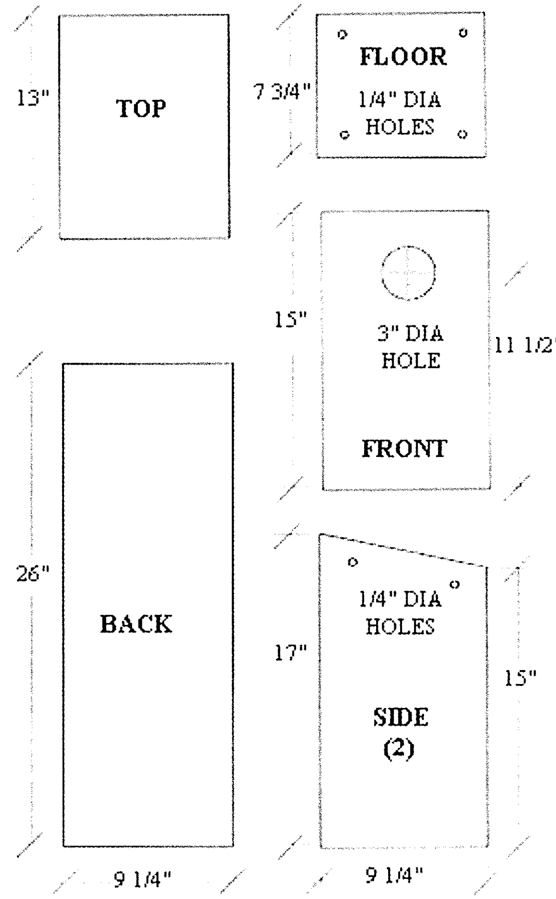
(1) 1" x 10" x 8' board
(2) 2" hinges
(1) 2" spring-loaded safety hook or wire
(22) 2" wood screws
(2) 1 ½" galvanized nails

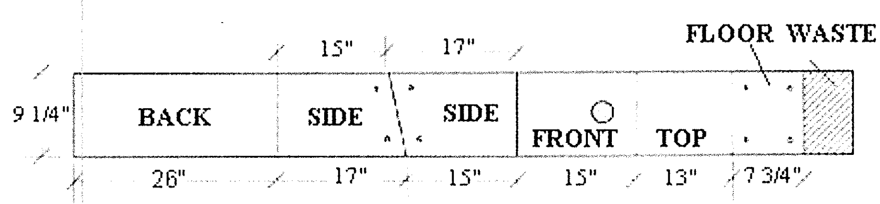
Construction:

1. Mark and cut out the pieces as shown.
2. Cut a 3" diameter entrance hole in the front piece, 11 ½" from the bottom edge.
3. Drill two ¼" holes near the top edge of both side pieces.
4. Drill four ¼" holes in the floor piece, as shown, to allow for drainage.
5. Assemble the box as shown in the diagram.
6. Attach the roof on top of the box using two hinges, for easy cleaning access.
7. Place one nail in the side of the roof and one nail in the face of the adjoining side piece, as shown in the diagram, so that they line up vertically. Use a spring-loaded safety hook or wire tied around the two nails to keep the roof closed to predators.
8. Place 2-3" of sawdust on the bottom of the box.

Credit: http://www.dnr.state.md.us/

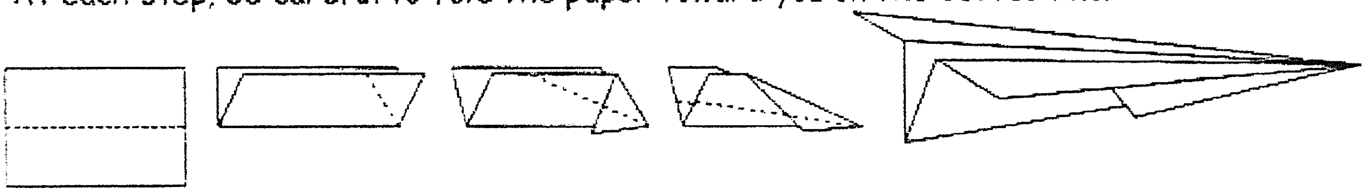






FALCON GLIDER

At each step, be careful to fold the paper toward you on the dotted line.



1) Fold in half lenthwise

2) Fold front edges diagonally to bottom

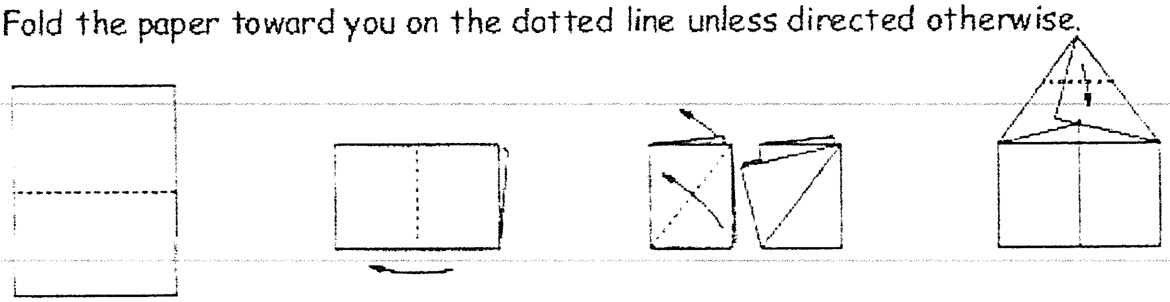
3) Fold front edges to bottom again

4) Fold front edges to bottom once more

5) Adjust wing angle. Attach a paper clip to the bottom; move it forward and back to see how it affects balance. Then let it FLY!

EAGLE GLIDER

Fold the paper toward you on the dotted line unless directed otherwise.

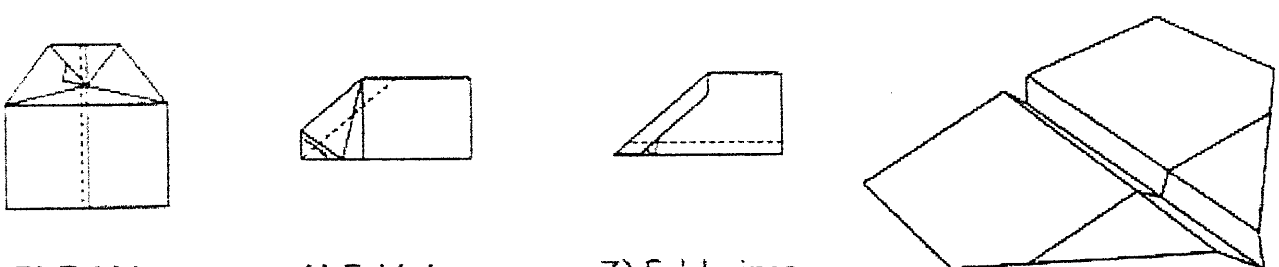


1) Fold in half crosswise

2) Fold in half again

3) Fold corners back diagonally, then unfold steps 1 and 2

4) Fold point down to point where layers cross, as shown



5) Fold in half away from you

6) Fold down front edge, as shown

7) Fold wings down parallel with bottom of plane

8) Adjust the wing angle. Then let it FLY!