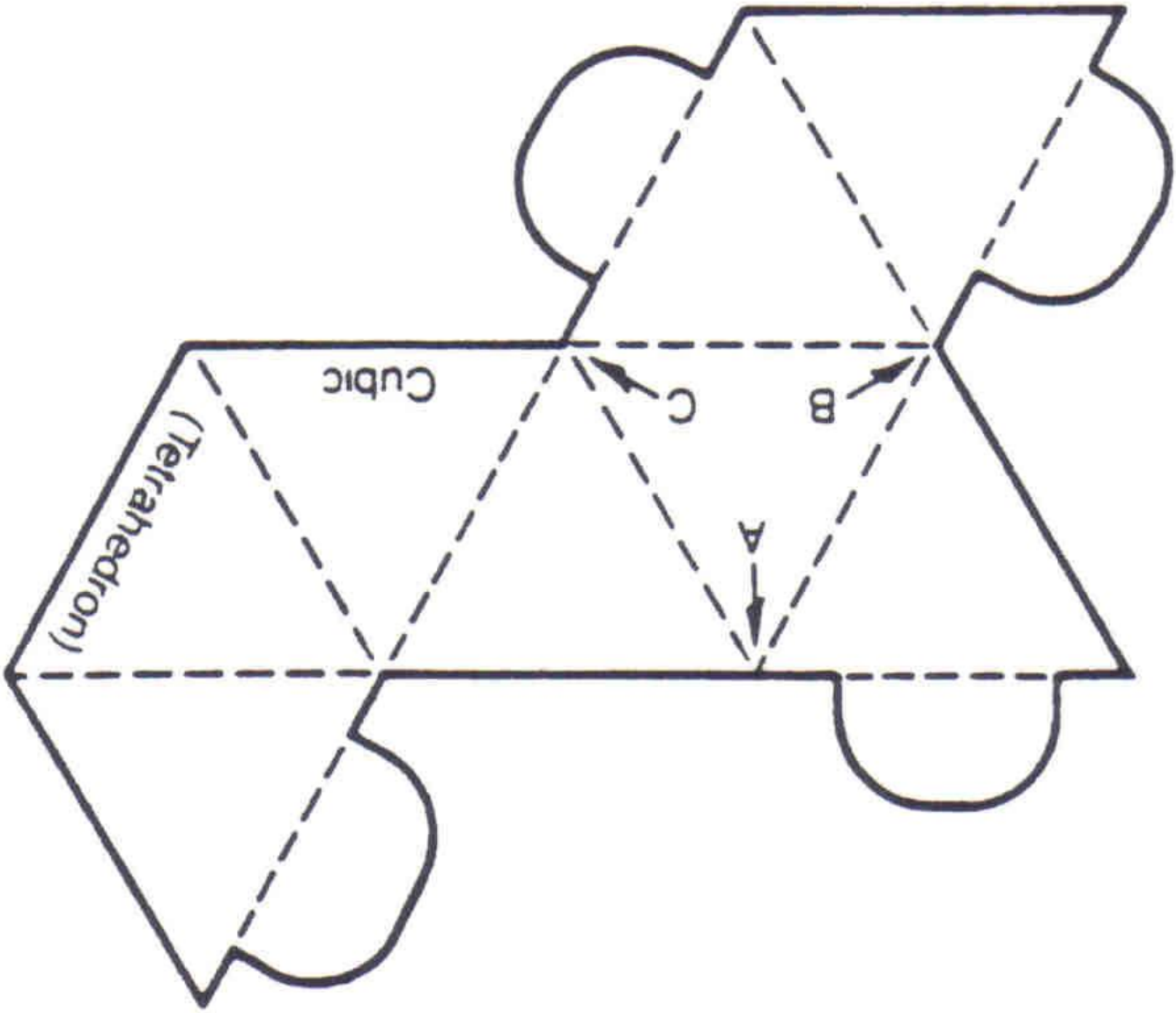
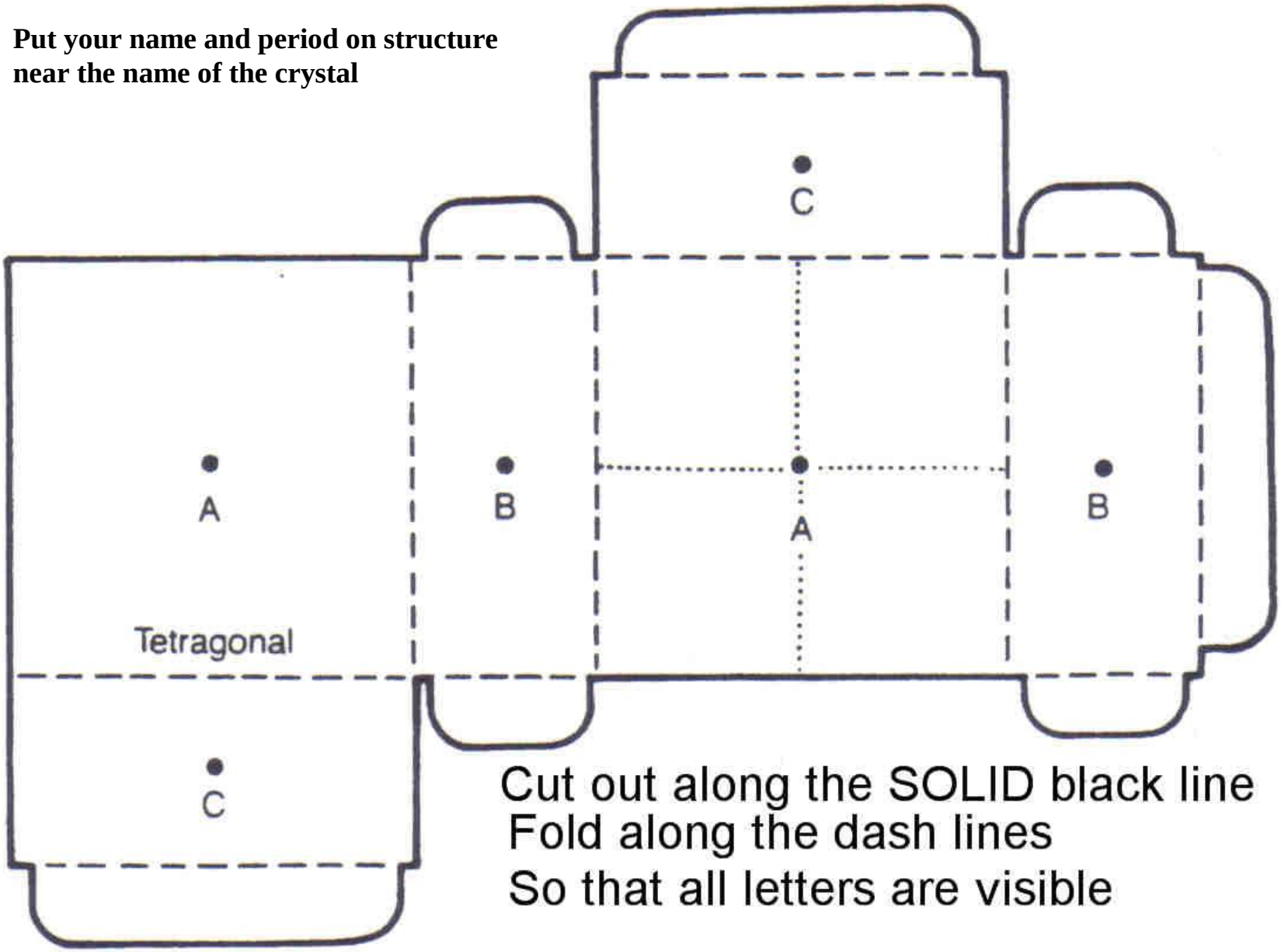
PAPER CRYSTAL STURCTURE

Put your name and period on structure near the name of the crystal. Cut along SOLID lines. Fold inward along DASH lines so that *your name and crystal's name is visible.*

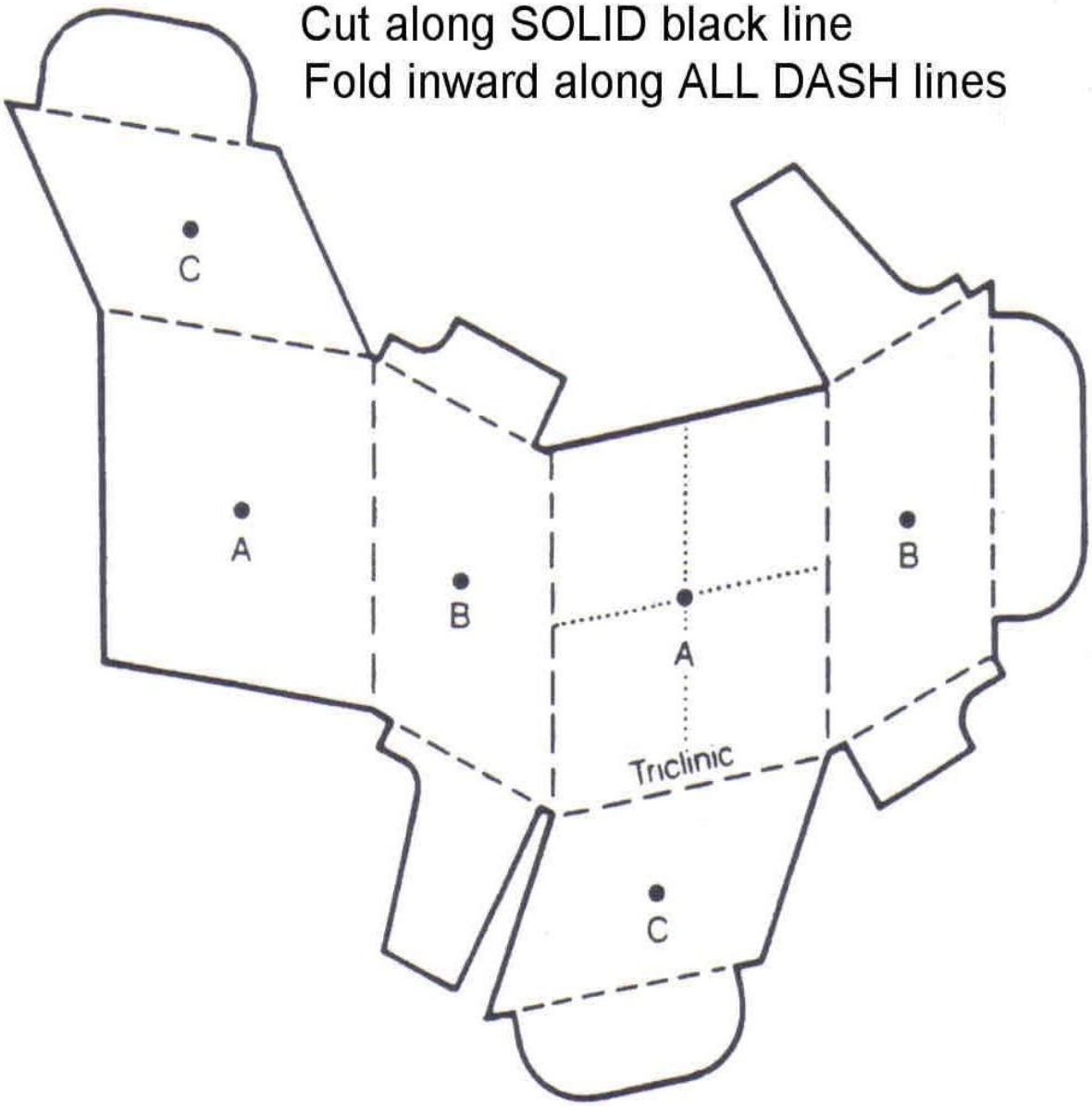
Cut along SOLID line
Fold inward along DASH lines



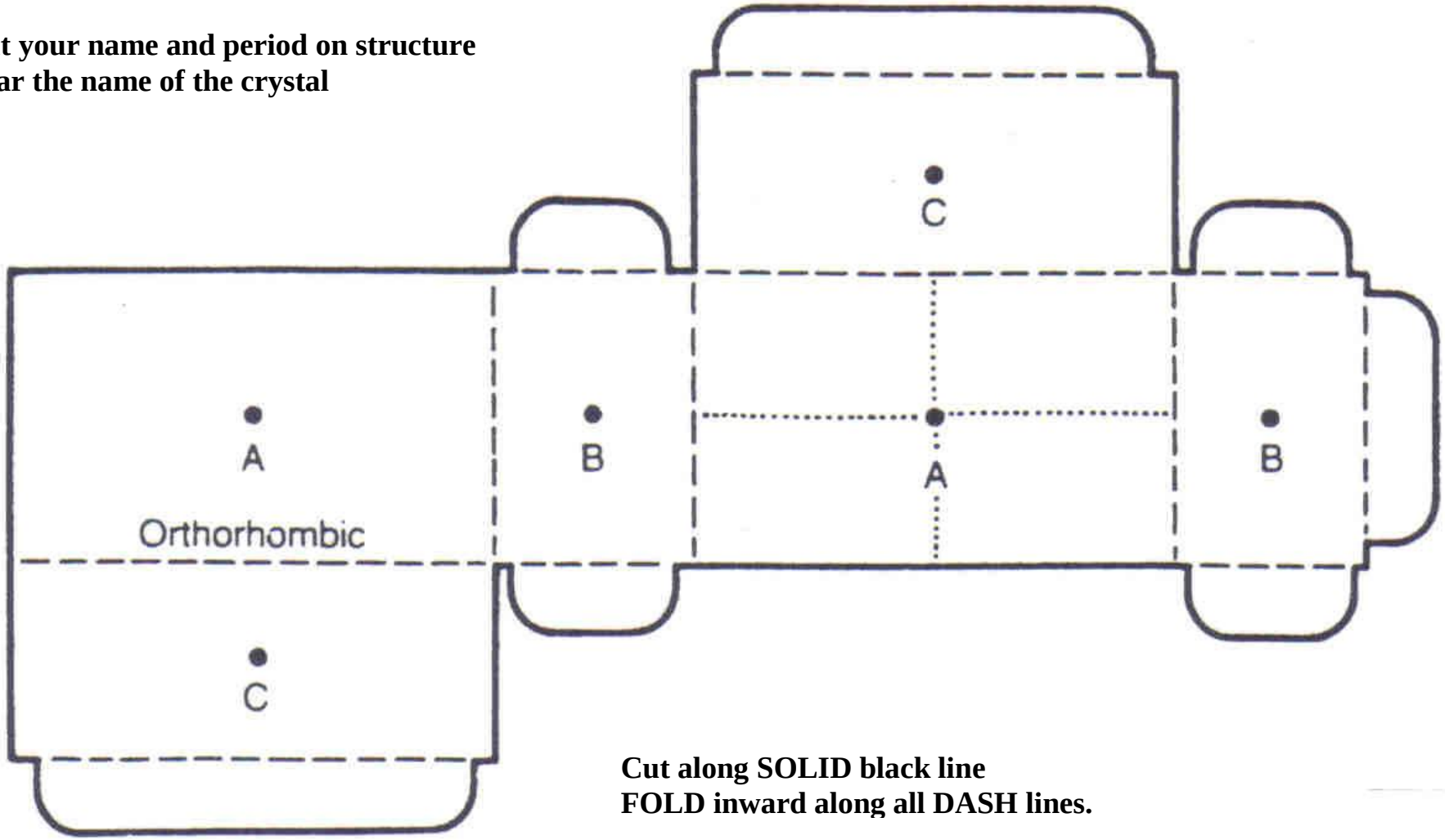
Put your name and period on structure near the name of the crystal



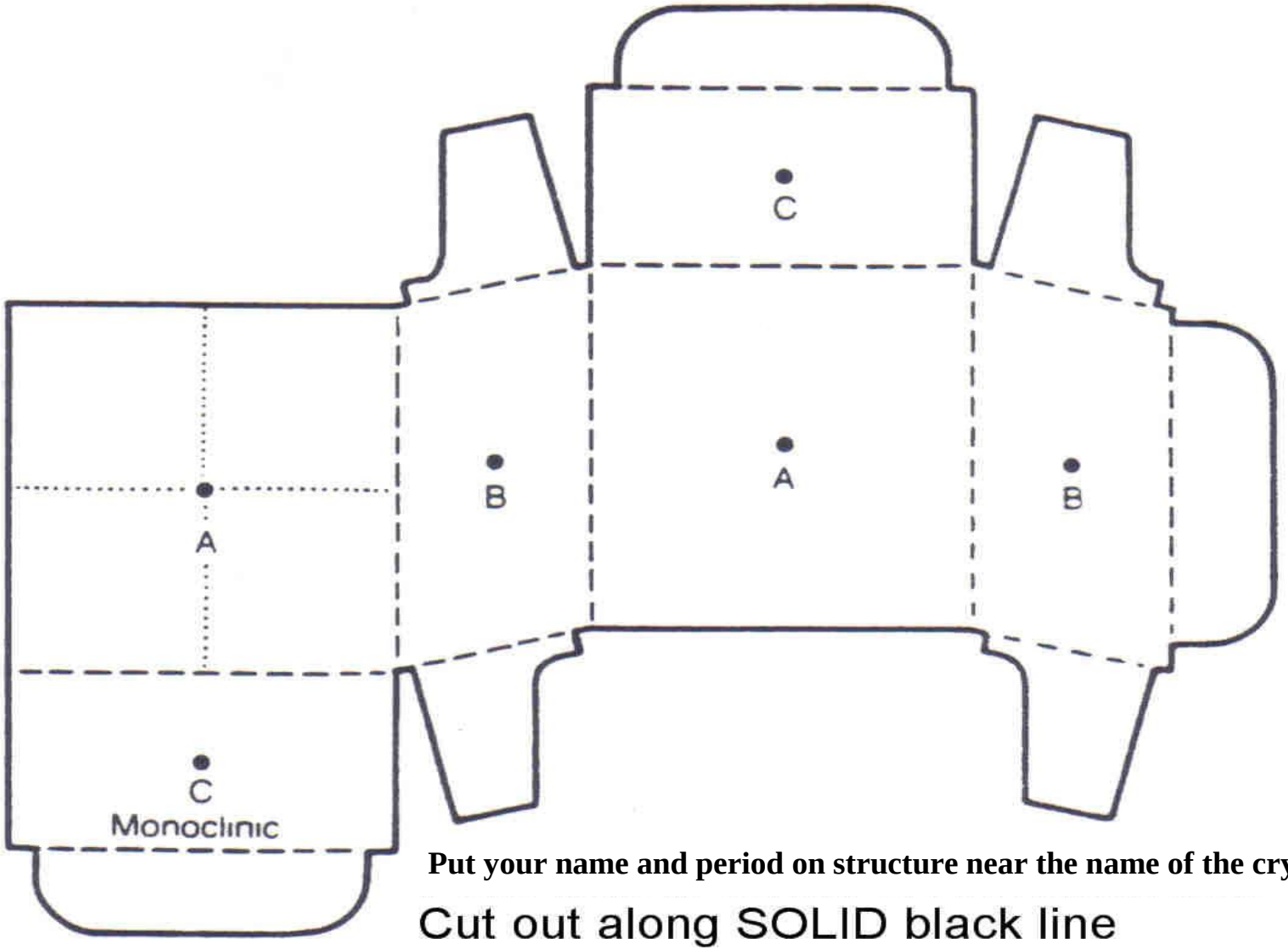
Put your name and period on structure near the name of the crystal



Put your name and period on structure near the name of the crystal



Cut along SOLID black line
FOLD inward along all DASH lines.

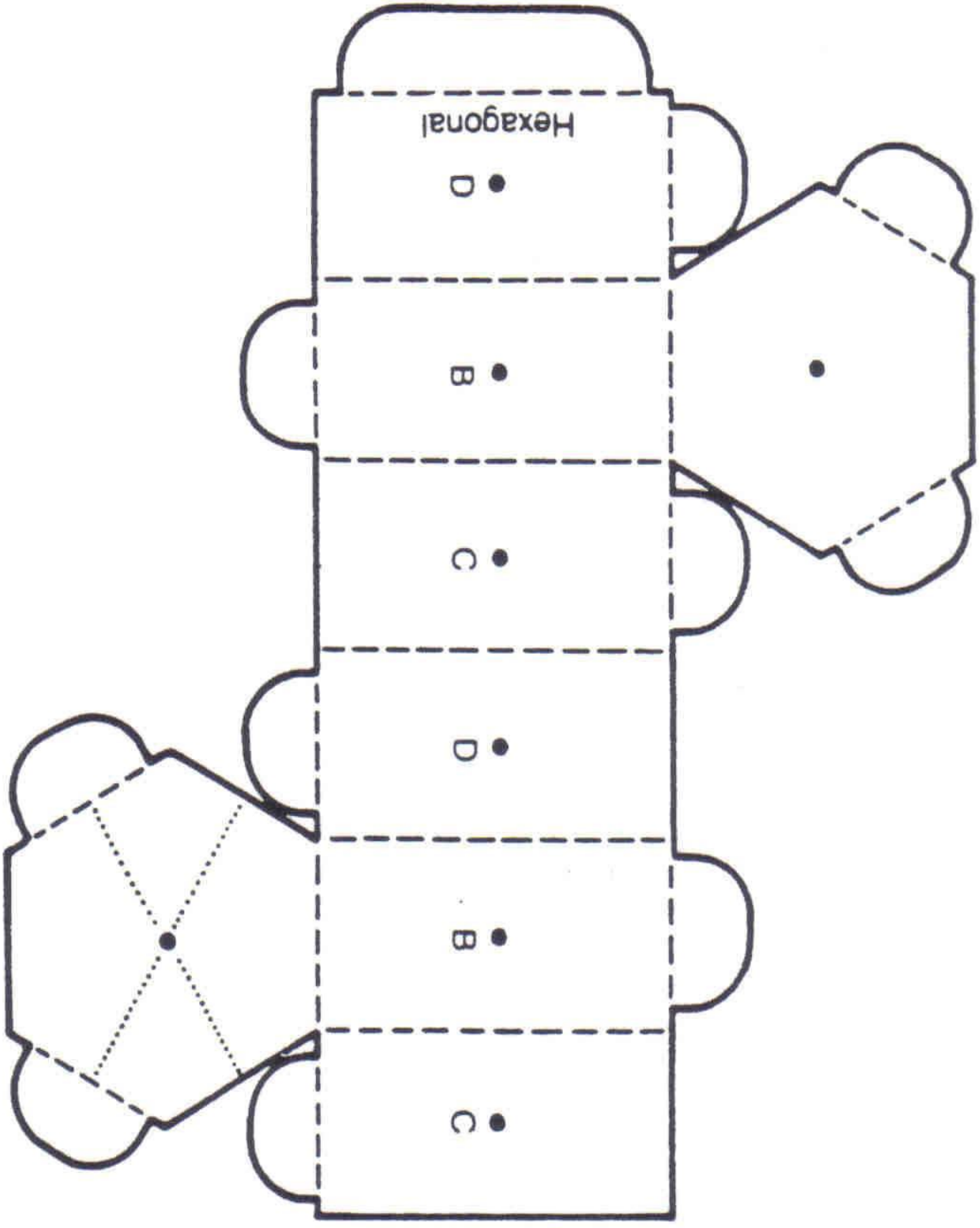


Put your name and period on structure near the name of the crystal

Cut out along SOLID black line
Fold inward along all DASH lines

Put your name and period on structure near the name of the crystal

Cut along SOLID line; Fold inward along DASH lines



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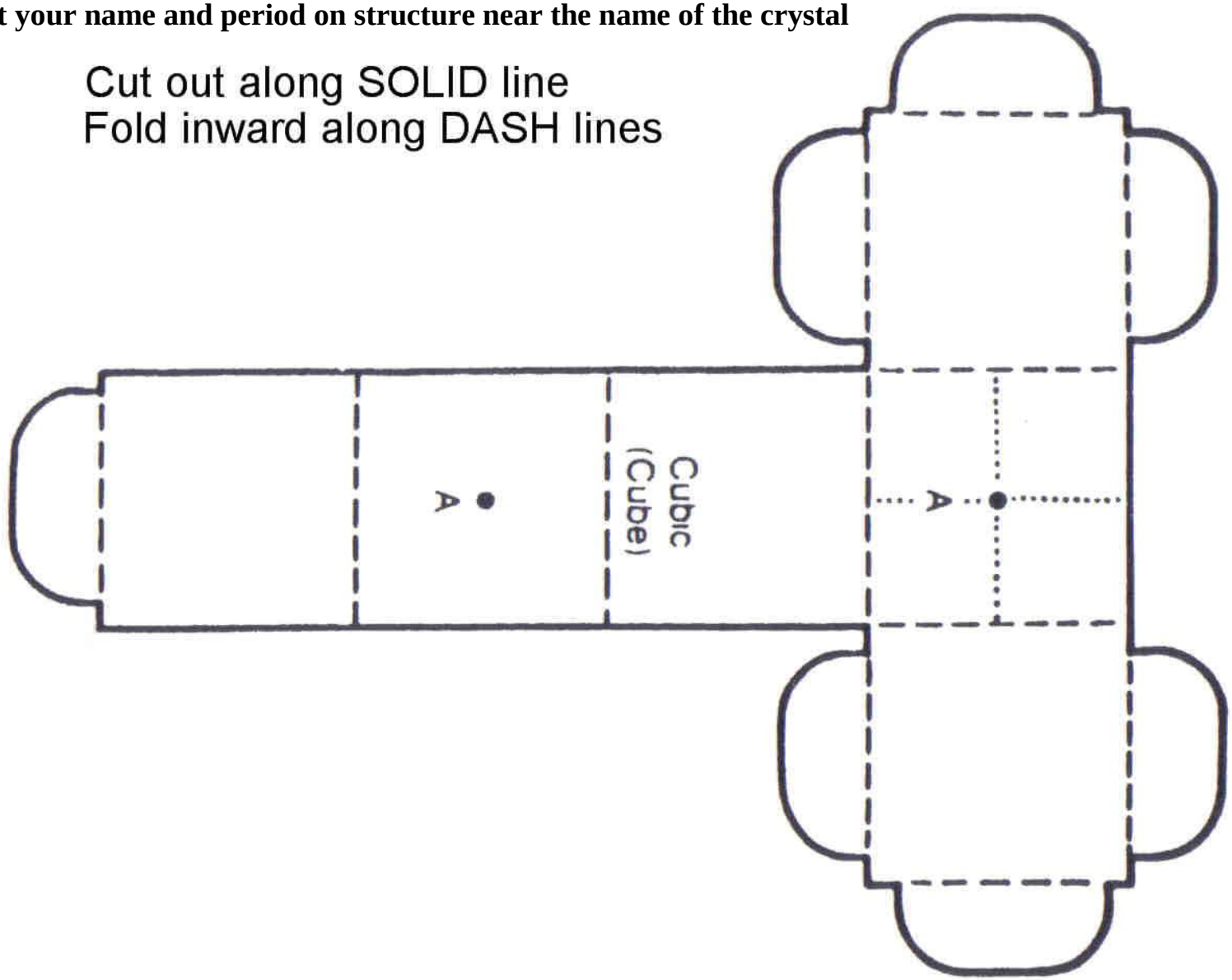

PAPER CRYSTAL STURCTURE

BACKGROUND: Minerals form crystals, or solids that have a definite geometric shape. Crystals have flat sides, or faces, that come together at certain angles to form edges and corners. The shape of a mineral's crystal reflects the way the atoms, or building blocks of matter, are arranged inside the mineral.

Crystals are assigned to six crystal systems according to their shape: cubic, hexagonal, orthorhombic, monoclinic, tetragonal, and triclinic. These systems are based on the length and position of special lines known as axes (AK-seez; singular: axis). An axis is an imaginary line that runs through the center of the crystal. An axis ends at the corner, edge, faces. If a crystal is cut in half along one of its axes, the two resulting pieces are the same shape

In this activity, you will make models of some common crystal shapes

MATERIALS:

Paper crystals	Scissors	Strands of uncooked spaghetti (box)
Glue stick	Metric ruler	

PROCEDUES:

A. Carefully poke a hole in each of the DOTS marked on the crystal figures.

B. Carefully cut out each pattern along the **SOLID** (—) lines.

C. Assemble each crystal
   1. By folding along the **DASHED** lines (---) to form faces
   2. Then gluing the flaps together to form edges and corners.

D. The dotted lines (▪▪▪▪) on one of the faces show the relative position of two of the axe.

   1. Explain why these are not the crystal's real axes?

CRYSTAL SYSTEMS	# OF FACES	# of AXES (length)	POSITION
Cubic (isometric)			
Tetragonal			$a \neq c$
Orthorhombic			$a \neq b \neq c \neq a$
Monoclinic			$a \neq b \neq c \neq a$ $\beta \neq 90°$
Triclinic			$a \neq b \neq c \neq a$ $\alpha \neq \beta \neq \gamma \neq 90°$
Hexagonal		3 equal, 1 unequal	$a \neq c$ $\alpha \neq 90°$ 3 equal axes @ 120° in 1 plane (flat surface)

2 In some crystal systems, two of the axes are at right angles to each other. (You can think of a right angle as being the corner of a square or as the angle formed by a line that goes up-an-dow n and a line that goes straight across.) Examine the dotted lines of the crystals. In which crystals are these lines at right angles? Circle your answers.

Cubic Tetragonal Orthorhombic Monoclinic Triclinic Hexagonal

E. Gently run a strand of uncooked spaghetti through the holes on the cubic crystal structure (cube). Note that the spaghetti is at right angles to the two dotted lines.

F. REPEAT the step on the corners of the tetrahedron marked B.

1. Do you think these axes are at right angles? YES NO

2. How might you confirm your answer? _____

3. From your observations of the cube and tetrahedron, what can you conclude about the axes of crystals in the cubic system?

4. Using the ruler and the strand of spaghetti, determine the length of the axis on the cubic structure that runs between the two dots marked "A"? _____

5. How does the length of this axis compare with the length of the other two axes? _____

6. What might you conclude about the length of the axes of crystals in the cubic system'.' _____

CRITICAL THINKING:

7. How many faces do the various shapes have?

Cubic: Tetragonal: Orthorhombic: Monoclinic: Triclinic: Hexagonal

8. Which of the crystal systems have 3 axes? Circle your answers

Cubic: Tetragonal: Orthorhombic: Monoclinic: Triclinic: Hexagonal

9. Which have more than 3 axes? Circle your answers

Cubic: Tetragonal: Orthorhombic: Monoclinic: Triclinic: Hexagonal

10. Which crystal systems show ALL axes at right angles? Circle your answer

Cubic: Tetragonal: Orthorhombic: Monoclinic: Triclinic: Hexagonal

11. Which system has at LEAST ONE axis not at a right angle to the plane of the others? Circle your answers

Cubic: Tetragonal: Orthorhombic: Monoclinic: Triclinic: Hexagonal

12. How are the cubic and tetragonal systems alike? How are they different?

13. How are the tetragonal and orthorhombic systems alike? How are they different?

14. How are the monoclinic and triclinic systems alike? How are they different?

15. List all the shapes belonging to the isometric system that you have?