PART I

ORTHOGRAPHIC AND ISOMETRIC DRAWINGS

Everyone should have some basic understanding of descriptive drawing. Drawings, after all, are as important to the communication of ideas as words. In many cases a simple drawing can convey information much more clearly than any amount of verbal communication either spoken or written.

ORTHOGRAPHIC DRAWINGS

One of the most useful types of pictorial communication is called *orthographic drawing* or *orthographic projection.* The literal meaning of orthographic is perpendicular. In this case the literal meaning is quite descriptive, inasmuch as orthographic projections are drawings based on three perpendicular views of an object as shown in Figure 1. The illustration also shows what is meant by the term projection. As you can see, the three views can be thought of as projections onto planes perpendicular to three lines of sight. Here too is an example of a drawing communicating information much more clearly than words. Orthographic drawings are used extensively in the fields of engineering, design and architecture because they can clearly and accurately describe complex forms. They are also part of an international language. Technicians anywhere in the world can "read" orthographic drawings because they have become standardized forms of pictorial communication.

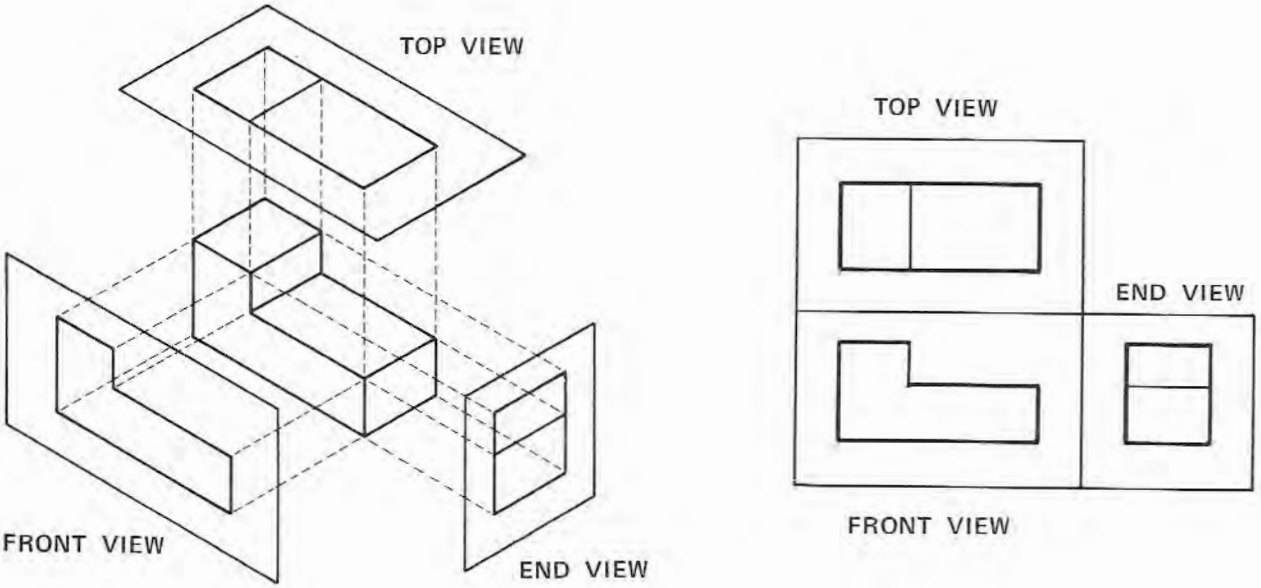
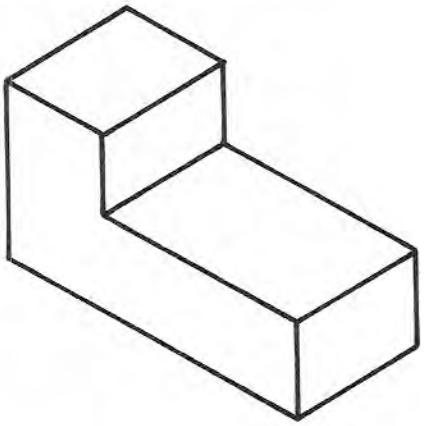


FIGURE 1 ORTHOGRAPHIC PROJECTION

ISOMETRIC DRAWINGS

Another standard form of pictorial communication is the *isometric* drawing. The isometric drawing is an attempt to portray three dimensional shapes on a two dimensional page. As can be seen in Figure 2 it is quite successful. The word isometric means equal measure and refers to the equal angles used in the drawing. An isometric drawing starts with one or two sets of three rays representing perpendicular edges of a three dimensional object. The isometric cube in Figure 3 indicates these sets of rays and gives the standard angles. Note that rays B,C,D and E represent horizontal edges and ray A represents a vertical edge. On the real cube of course, these edges would be at 90° to one another. Using the conventional 60° and 120° angles allows us to portray the cube in a way that resembles a perspective view with a minimum of distortion and without the complexities of the converging lines found in perspective drawings.

FIGURE 2 ISOMETRIC DRAWING



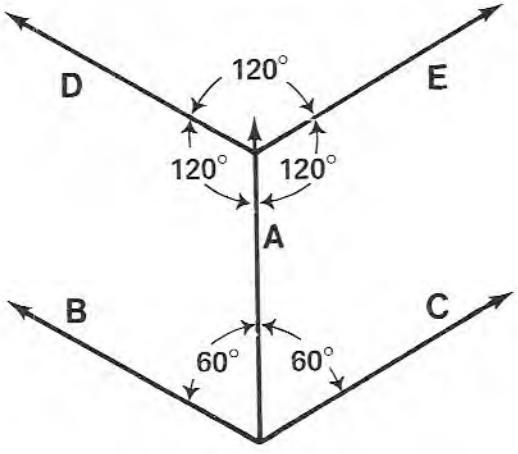
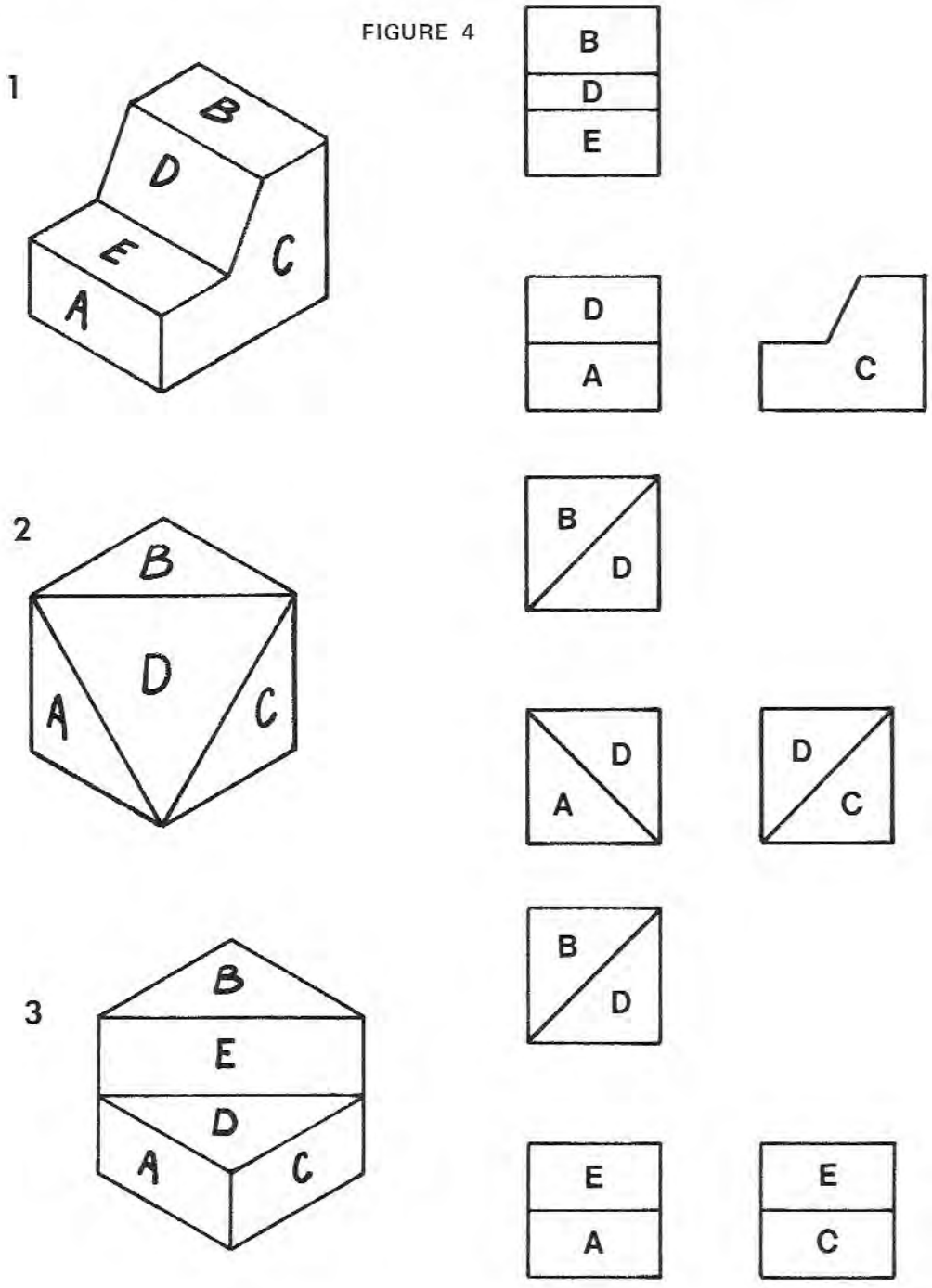


FIGURE 3 ANGLES OF ISOMETRIC DRAWING

COMPARING ORTHOGRAPHIC AND ISOMETRIC DRAWINGS

In Figure 1 we saw how orthographic projections were developed from a three dimensional object. In that diagram an isometric drawing of the object was used to represent the three dimensional object. It helped to show that the orthographic drawing is a projection of three views of the object onto planes. In fact the isometric drawing shows the same three views as the orthographic drawing ; we should, therefore, be able to look at an orthographic drawing and construct the isometric drawing and vice versa. Figure 4 illustrated three examples of sets of isometric and orthographic drawings of the same object. The faces have been given letter designations to help identify them in the various views.

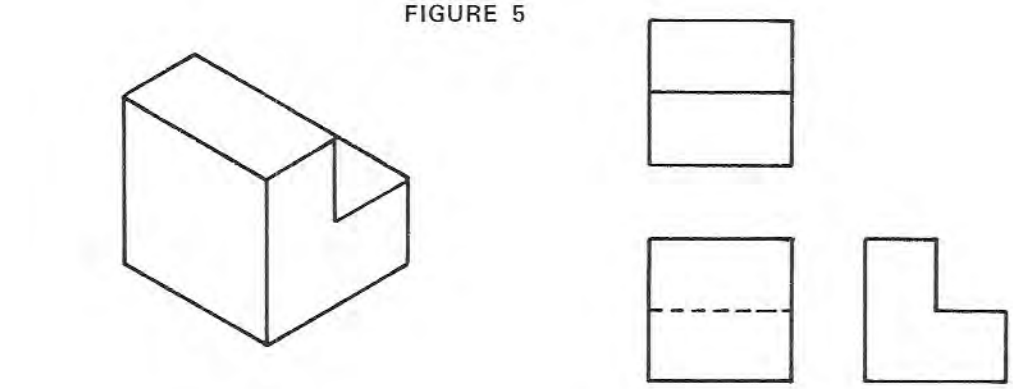
FIGURE 4



HIDDEN LINES

When viewed from a certain direction,an edge or part of an edge of an object may be hidden from view. When this is the case in an orthographic projection the hidden edge is shown as a dotted line as shown in Figure 5. If a hidden line and a visible line coincide,the line is shown as solid as seen in Figure 6.

FIGURE 5



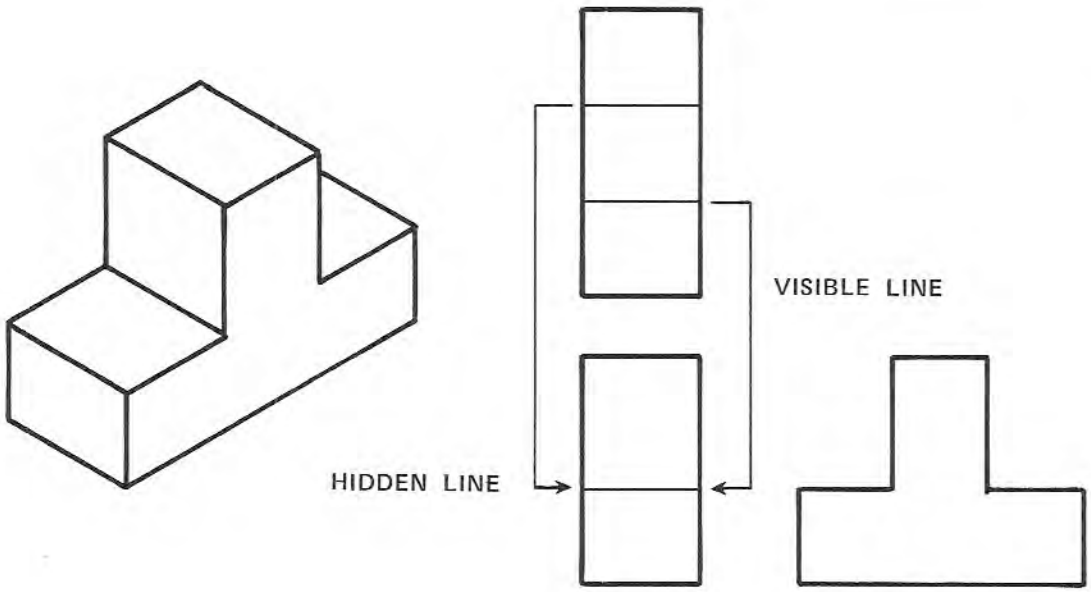


FIGURE 6 HIDDEN AND VISIBLE LINES

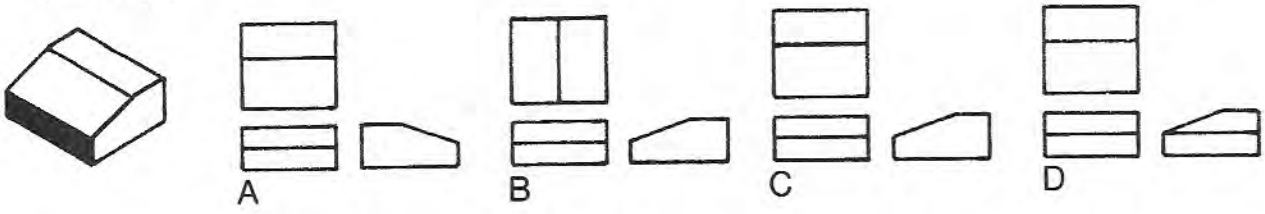
EXERCISES

The exercises in this chapter require an understanding of orthographic and isometric projections and their relationship. They give excellent practice in "reading" both kinds of drawings and visualizing three dimensional objects as described by two dimensional representations. Both activities strengthen the general ability of the student to visualize.

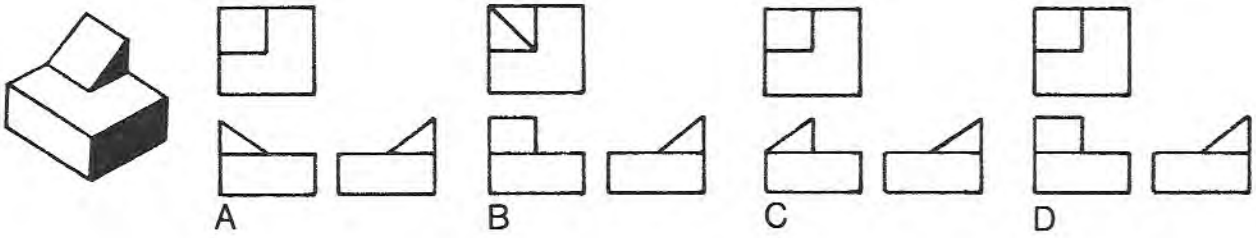
EXERCISE 1-A

The object of the exercises in this section is to select the one set of orthographic projections from the four in each row that describes the same object as the isometric drawing on the left.

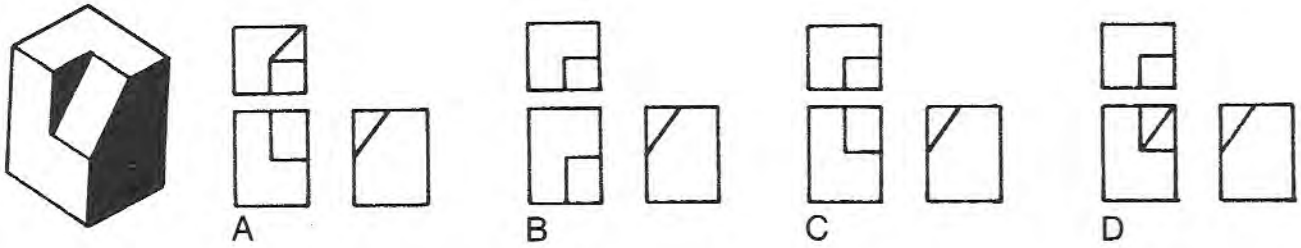
1



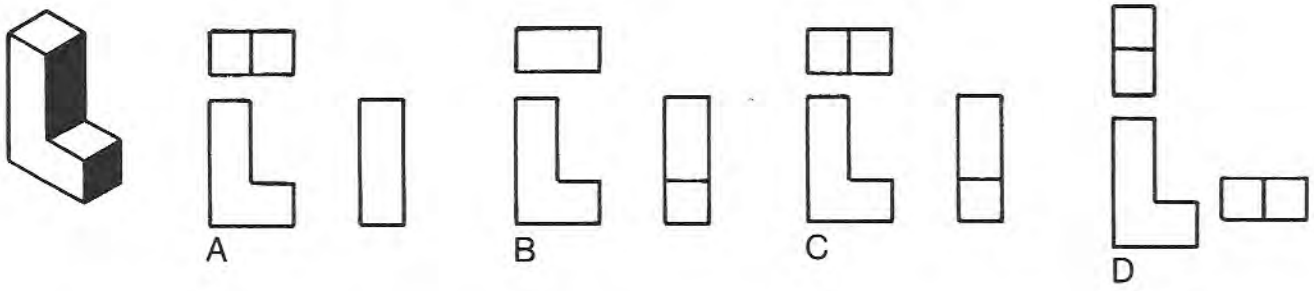
2



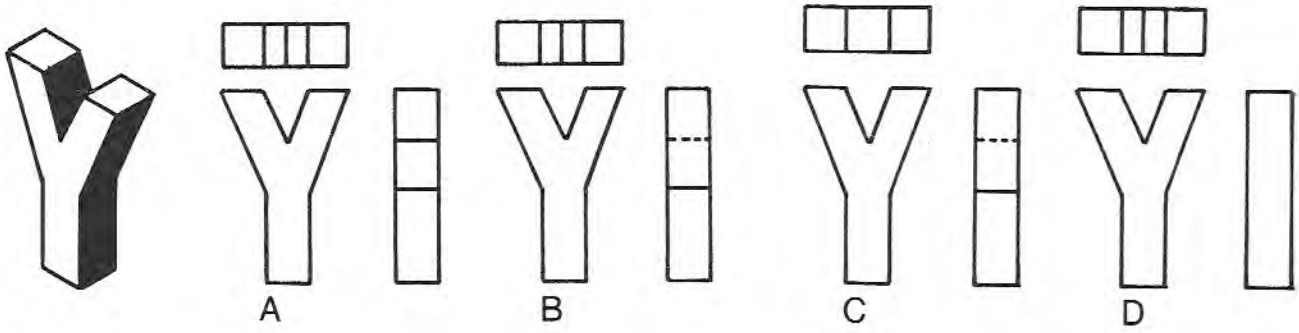
3



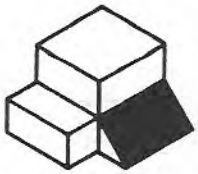
4

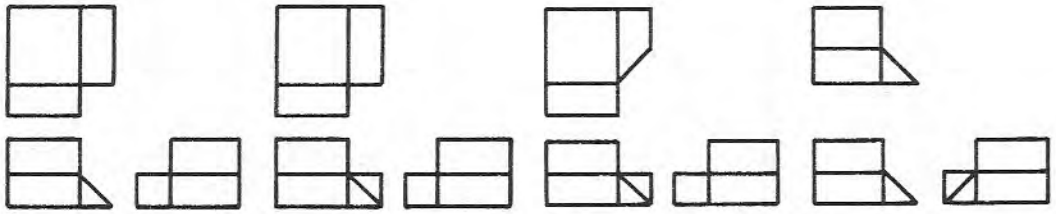


5



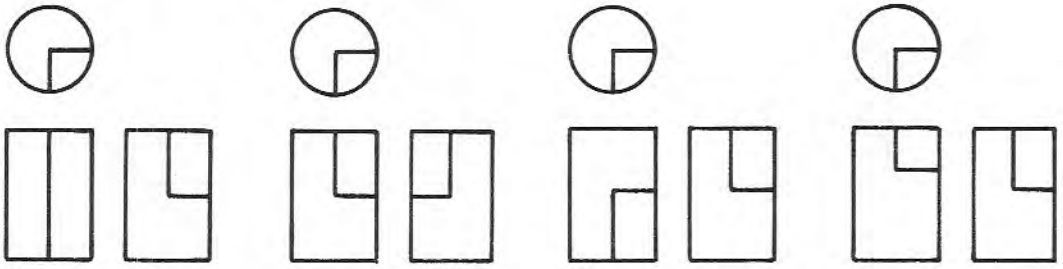
6





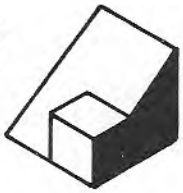
A B C D

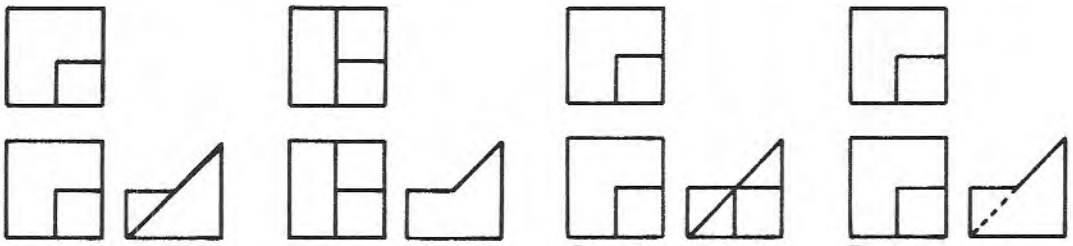
7



A B C D

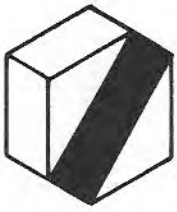
8

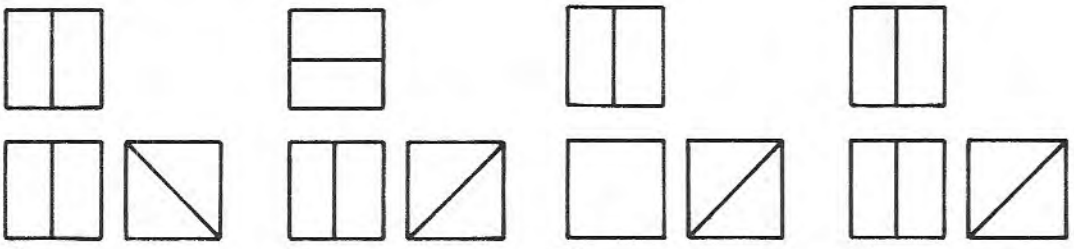




A B C D

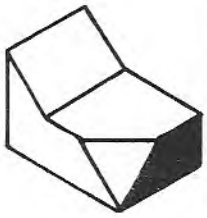
9

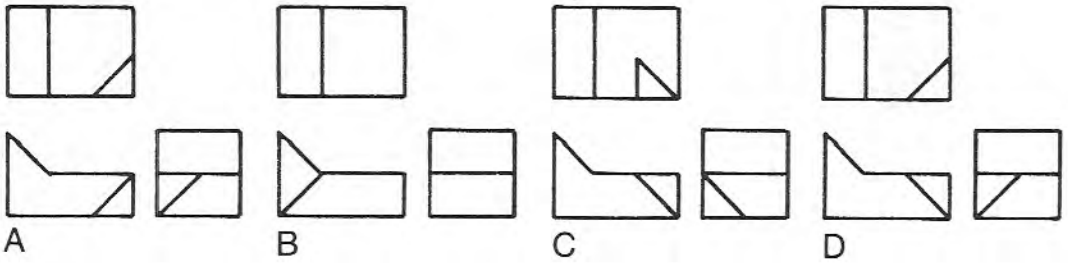




A B C D

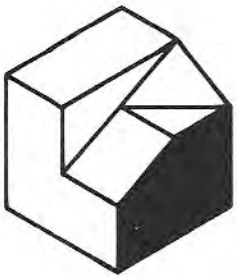
10

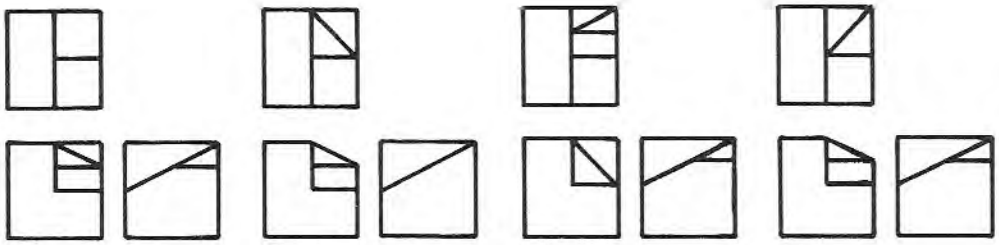




A B C D

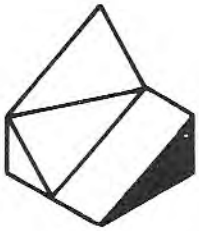
11

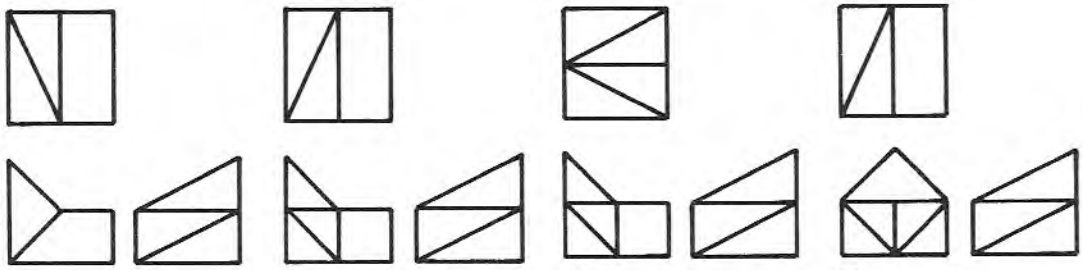




A B C D

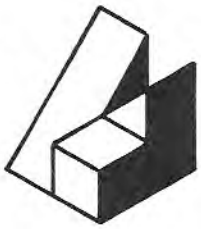
12

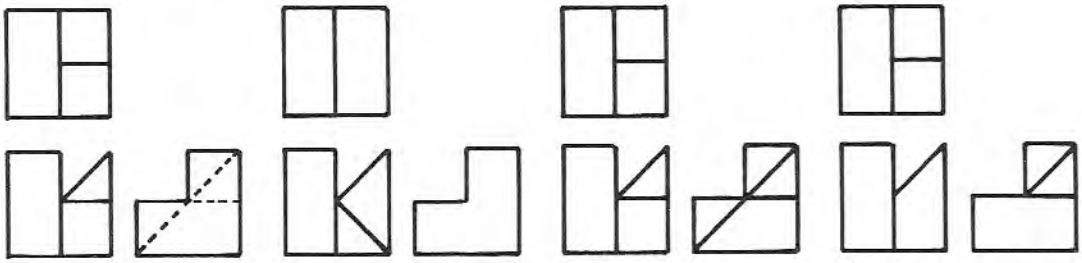




A B C D

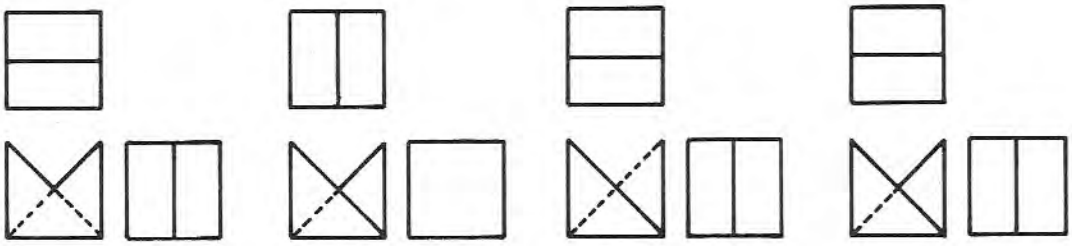
13





A B C D

14

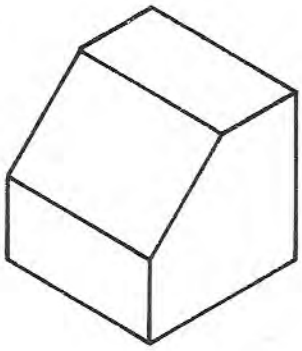


A B C D

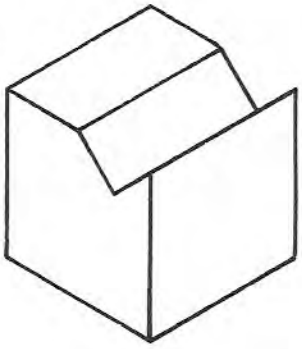
EXERCISE 1-B

Draw the orthographic projections of the objects shown in the following isometric drawings.

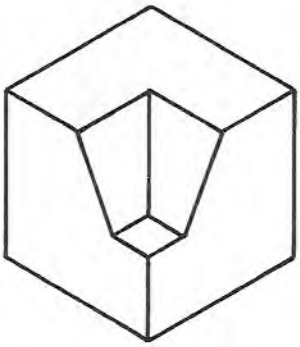
1



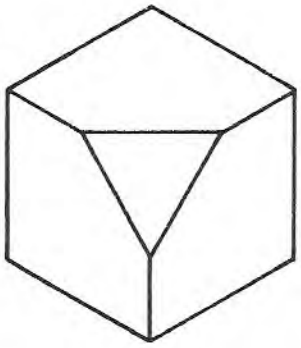
2



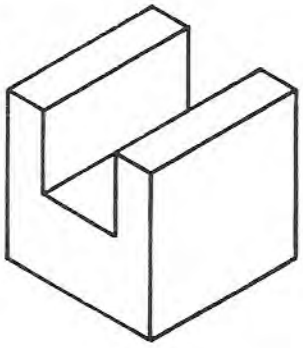
3



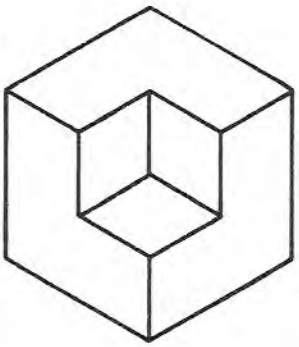
4



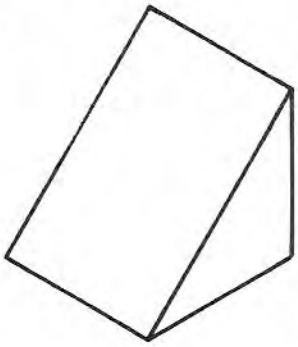
5



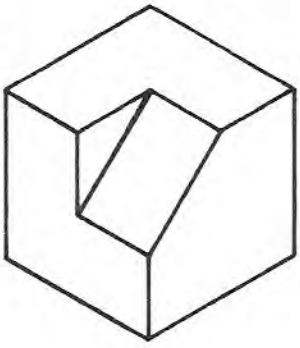
6



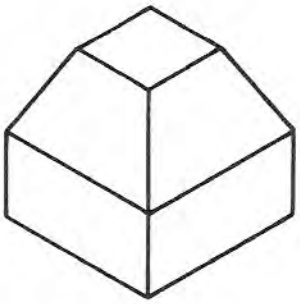
7



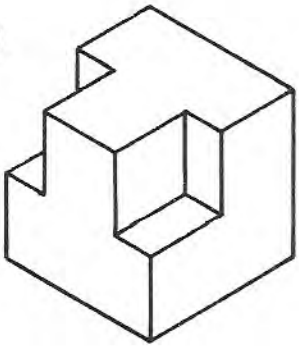
8



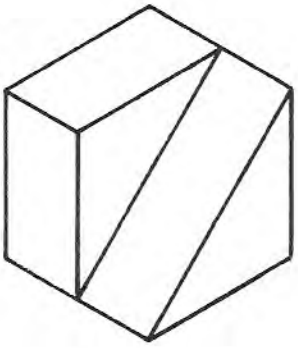
9



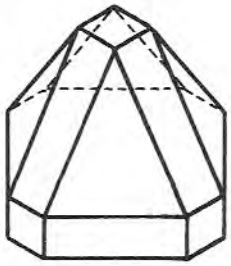
10



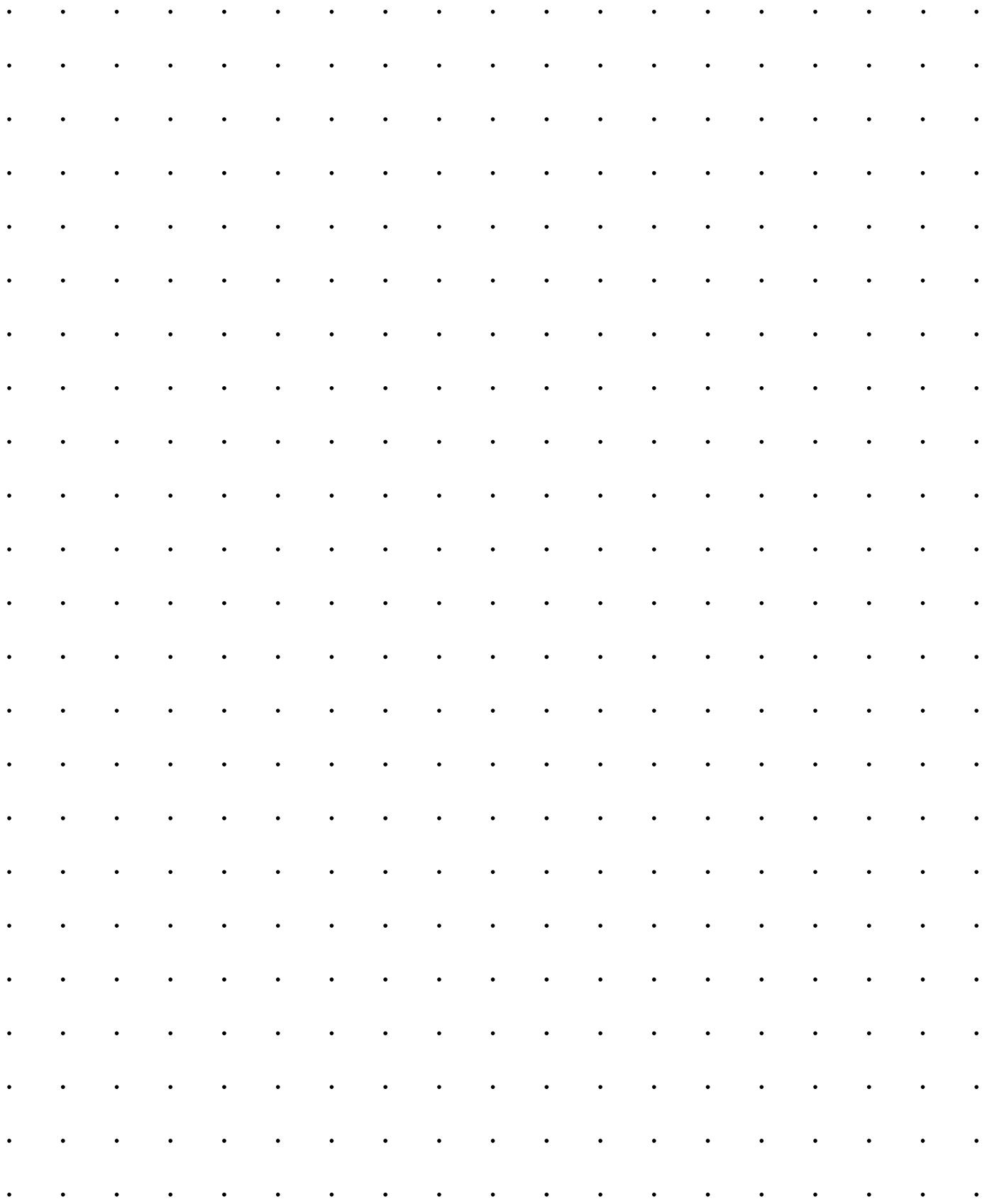
11



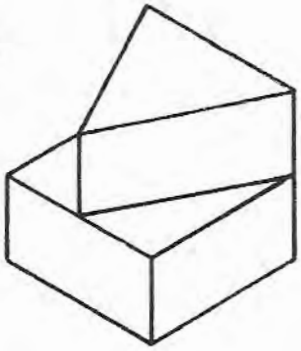
12



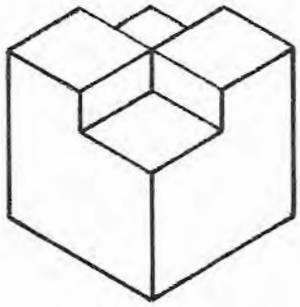
Square Dot Paper (1 cm)



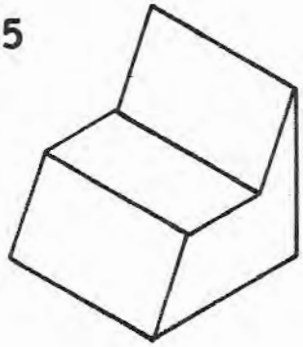
13



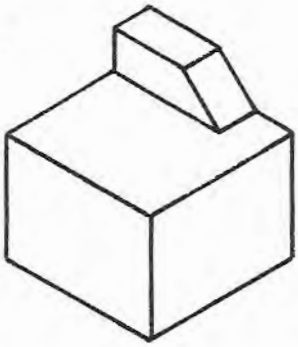
14



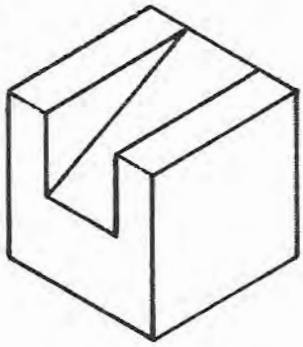
15



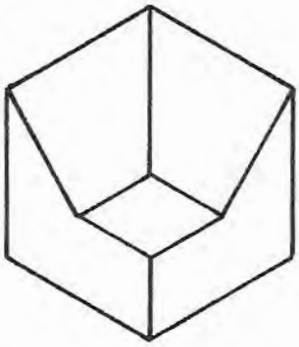
16



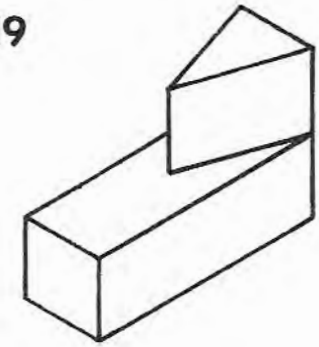
17



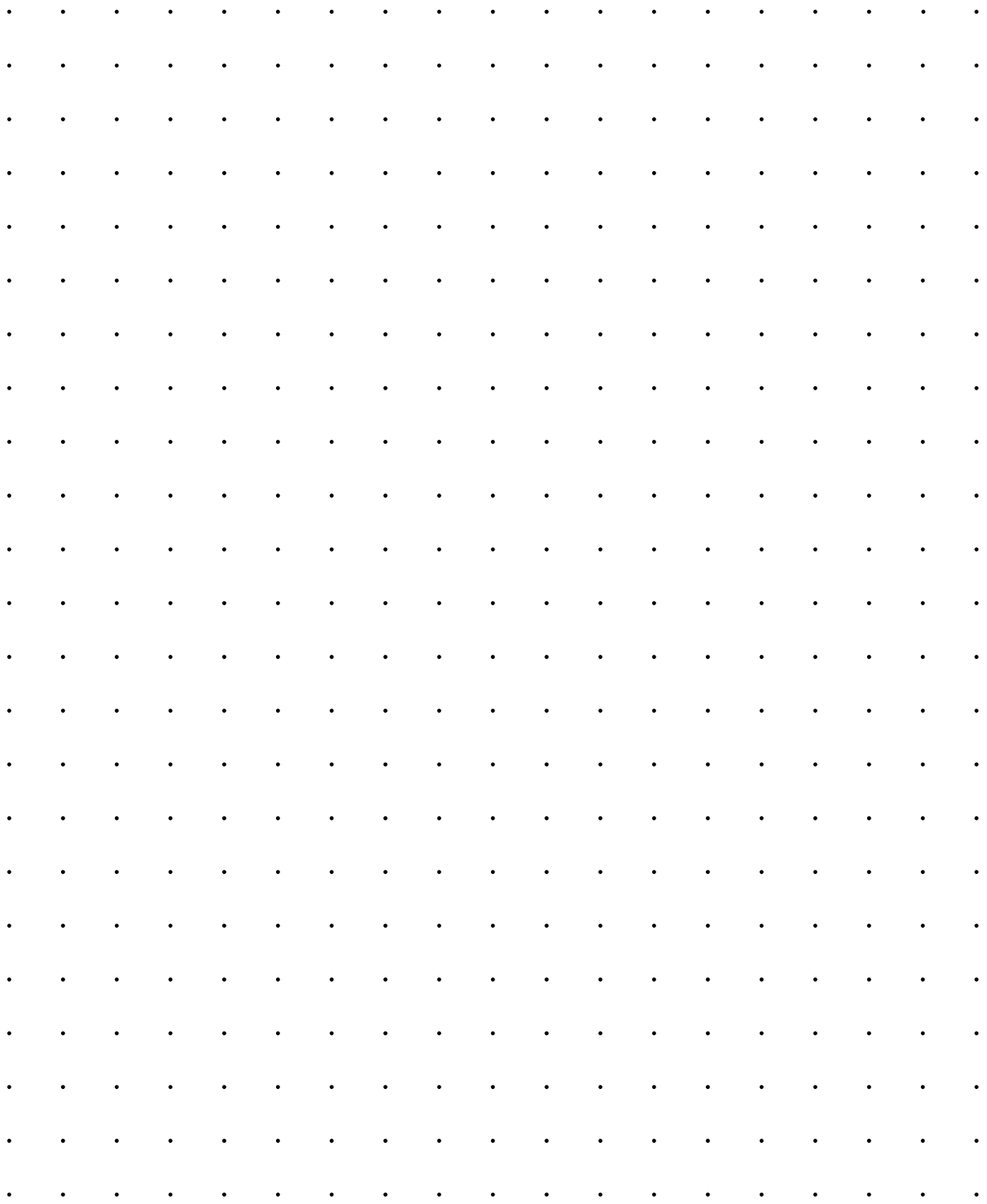
18



19

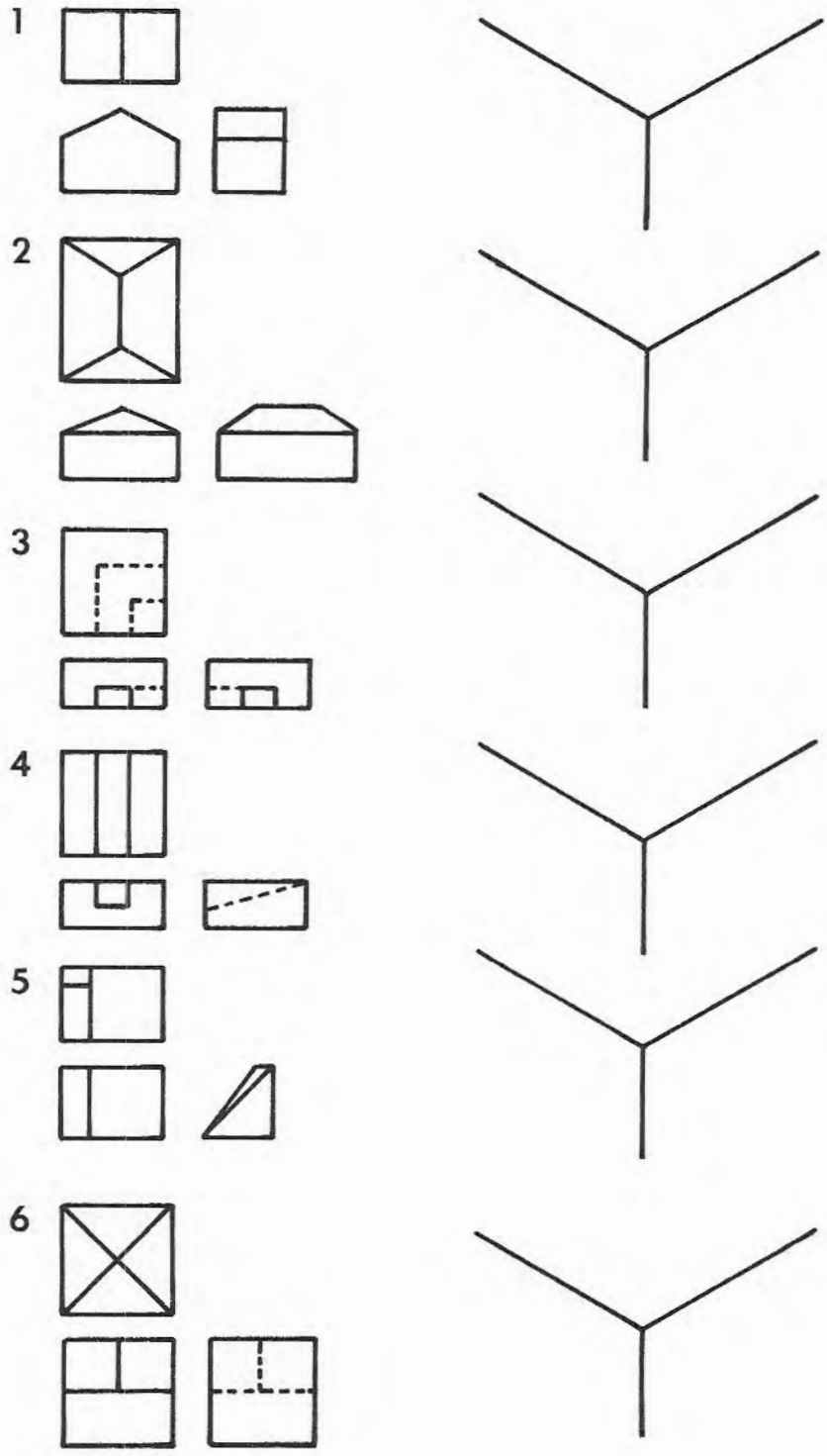


Square Dot Paper (1 cm)

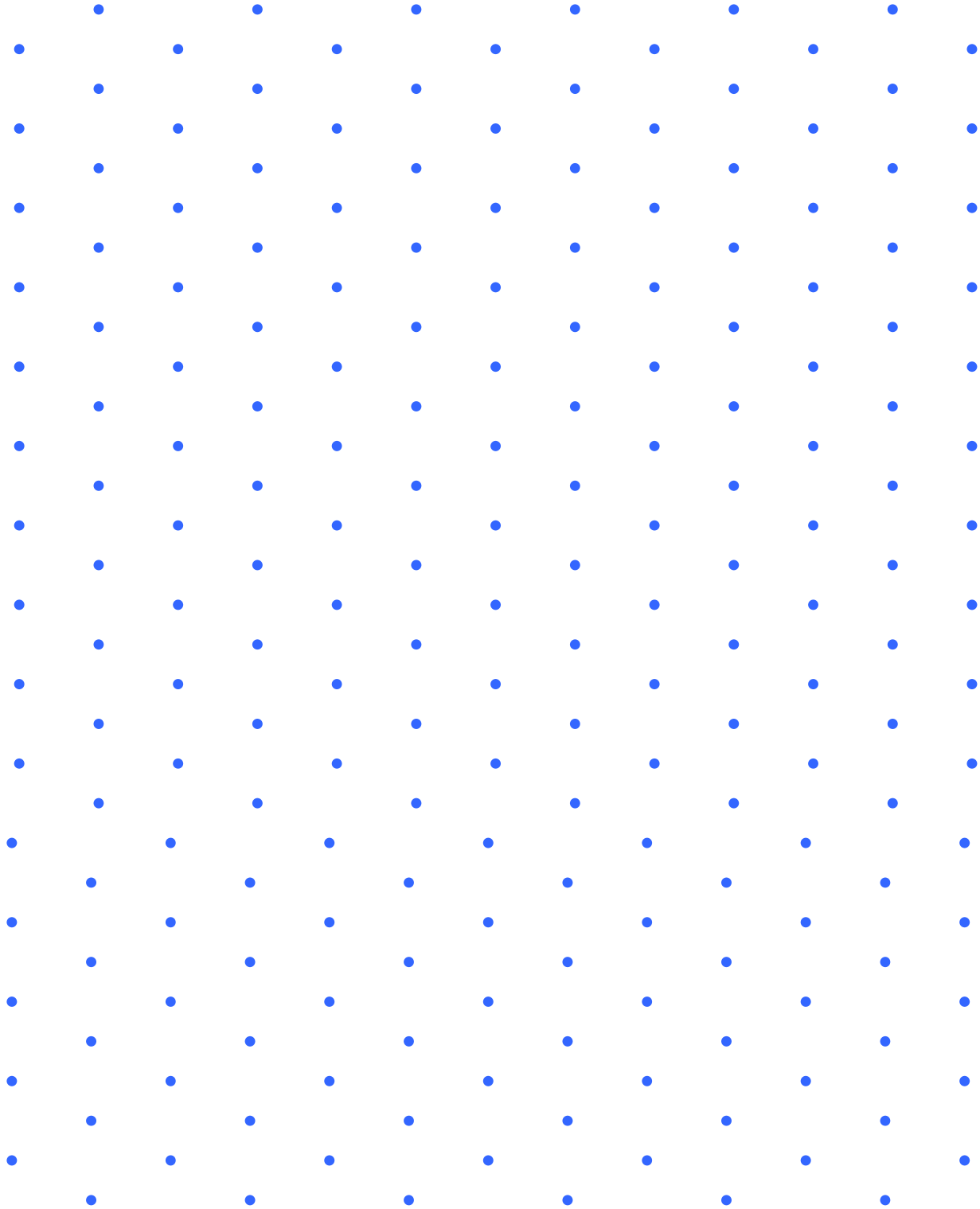


EXERCISE 1-C

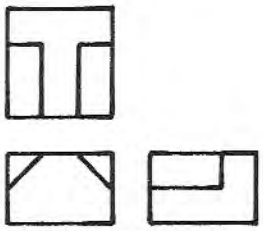
Draw the isometric drawings of the objects shown in the following orthographic projections.

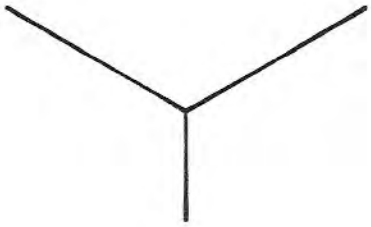


Isometric Dot Paper

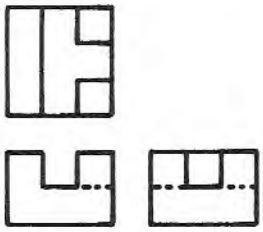


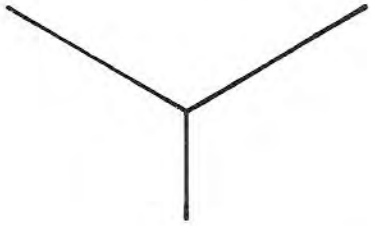
7



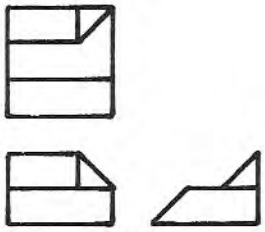


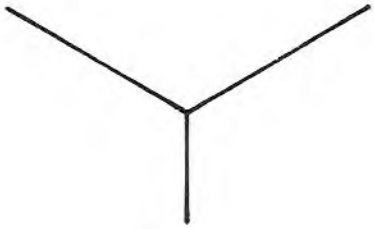
8



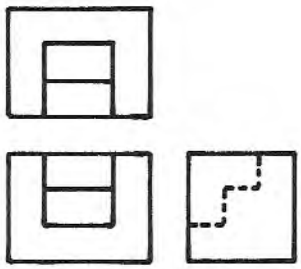


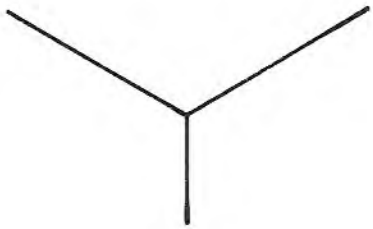
9



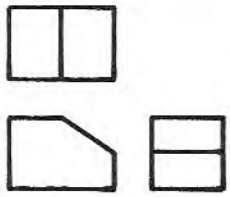


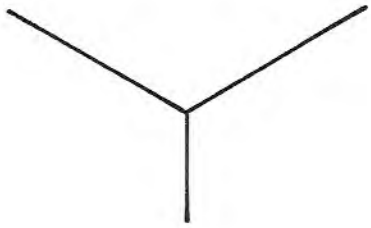
10



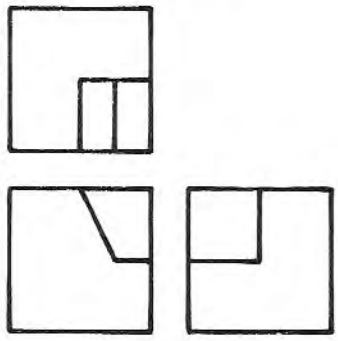


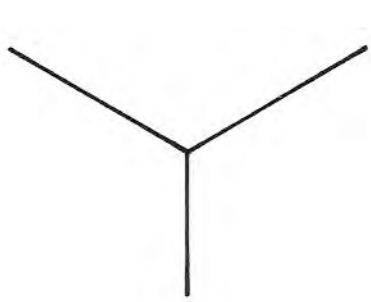
11





12





Isometric Dot Paper