True Shape (TS), Foreshortened (FS), and Edge Views (EV) of an Object

Unit: Media, Equipment, and Reproduction Methods

Problem Area: Free-Hand Sketching

Lesson: True Shape (TS), Foreshortened (FS), and Edge Views (EV) of an Object

Student Learning Objectives.

Instruction in this lesson should result in students achieving the following objectives:

1. **Identify the true length and foreshortened views of a line in space.**
2. **Identify the edge view, true length, true shape, and foreshortened views of a plane in space.**
3. **Identify the true shape, foreshortened shape, and edge view in an auxiliary view drawing.**

List of Resources.

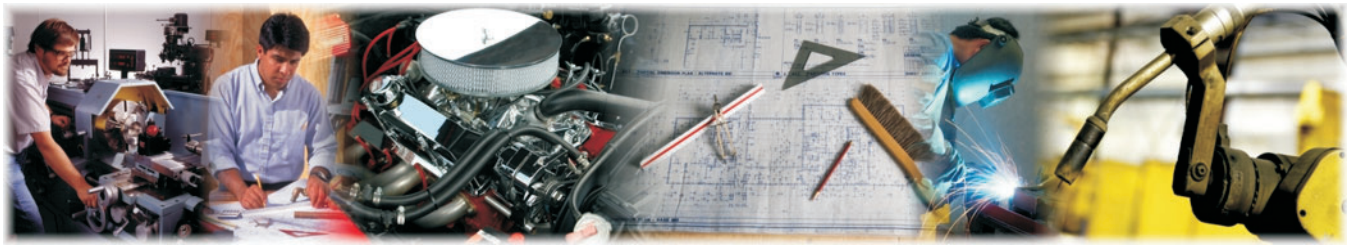
The following resources may be useful in teaching this lesson:

Giesecke, Frederick E., et al. *Technical Drawing*, 12th ed. Prentice Hall, 2003.

Illinois Drafting Educators Association. *I.D.E.A. Curriculum*. Accessed June 18, 2008. <http://www.idea-online.org/curriculum.html>.

Madsen, David A. *Engineering Drawing and Design*, 4th ed. Cengage Learning, 2007.

Spencer, Henry, et al. *Basic Technical Drawing*. Glencoe/McGraw-Hill, 2004.



List of Equipment, Tools, Supplies, and Facilities

- ✓ Overhead or PowerPoint projector
- ✓ Visual(s) from accompanying master(s)
- ✓ Copies of sample test, lab sheet(s), and/or other items designed for duplication
- ✓ Materials listed on duplicated items
- ✓ Computers with printers and Internet access
- ✓ Classroom resource and reference materials

Terms.

The following terms are presented in this lesson (shown in bold italics):

- auxiliary view
- edge view
- foreshortened line
- foreshortened plane
- inclined line
- inclined plane
- oblique line
- oblique plane
- point view
- projection lines
- projection planes
- true length
- true shape
- true size

Interest Approach.

Use an interest approach that will prepare the students for the lesson. Teachers often develop approaches for their unique class and student situation. A possible approach is included here.

> *Visualization is difficult for some students. Explain to them that seeing an object and understanding its relative position in space as well as its relationship to other objects encourages greater drawing and design experimentation. To demonstrate, hold a pencil in your hand and have the students do likewise. While concentrating on the pencil, ask the students to imagine that the pencil is a line segment in space. Each end of the pencil is an endpoint of the segment.*

> *If students look at the point of the pencil, all they see is the point or the end of the line segment. If they look at the eraser end, again they see the end of the line segment. As soon as the pencil is tipped, the students will start to see the pencil as a line segment. However, the line segment is foreshortened, not its true length. As the pencil is tipped more, they will see the pencil as a full line segment at its true length. As it is continuously tipped, the pencil will appear to get smaller again—a foreshortened view.*

Next, have the students take out a sheet of paper. With the paper on a desk, have the students stand above their sheets and look straight down. Their point of view is perpendicular to the sheet, so they are seeing the sheet full size—true size and true shape.

Instruct the students to hold the sheet of paper by a corner at an arm's length. When they turn their sheets, they begin to see an edge view, as though the sheet of paper "plane" was just a line. Each edge can be seen true length or foreshortened. The sheet of paper "plane" can be seen as true size and shape or as a foreshortened plane. You can use the pencil-line segment metaphor and the paper-plane metaphor throughout their visualization exercises to emphasize or reiterate a point that could be a point, true length or foreshortened line, or true size or foreshortened plane concerning visualization.

SUMMARY OF CONTENT AND TEACHING STRATEGIES

Objective 1: Identify the true length and foreshortened views of a line in space.

Anticipated Problem: How do you describe parallel and perpendicular in visualization?

I. Visible conditions of a line in space

A. A line "seen" as true length

1. A line is ***true length*** when the person viewing the line is at a right angle or is perpendicular to the line.
2. The line might be horizontal, vertical, or inclined.
   a. A horizontal frontal horizontal line is in the horizontal plane and is parallel to the frontal plane.
   b. A horizontal profile horizontal line is in the profile plane and is perpendicular to the frontal plane.
   c. A frontal profile vertical line is vertical in the frontal plane and is parallel to the profile plane.

B. A line "seen" as foreshortened

1. A ***foreshortened line*** appears shorter than it is in reality.
2. When the viewer is not at a right angle to the line, the line appears foreshortened.
3. A line appears foreshortened when it is in the horizontal, vertical, profile, or inclined plane.
   a. An ***inclined line*** can be inclined in the frontal, horizontal, or profile plane. It is seen as a foreshortened edge view in adjacent views.

b. An ***oblique line*** is an inclined line that is not parallel to any plane of projection.

C. The line is not seen as a line, and then the line is seen in point view.

1. The viewer is not seeing a line. Instead, he or she is seeing the end point of the line.
2. The point view can be in the horizontal, vertical, or profile plane.
3. A ***point view*** is an imaginary view of a line in which the line is seen as a point in space, not as a line.

Refer students to VM–A. Then demonstrate—with a CAD program and projection device or an overhead projector and transparencies—the models of point and line visualization. While drawing with a projection device, the students should do the same drawing at their work areas. Instruct them to label each model as it is completed. Give a specific line length, and then have students use graph paper to reproduce the line models in VM–A.

Remember, when viewing a line, the observer encounters three conditions: the line is true length; the line is foreshortened; or the line as a point, which is directly from an end. The use of previously defined terms is critical.

Objective 2: Identify the edge view, true length, true shape, and foreshortened views of a plane in space.

Anticipated Problem: How do you describe parallel and perpendicular with respect to a plane in space in visualization?

II. Visible conditions of a plane in space

A. A plane is "seen" in its true size and true shape.

1. A plane is ***true size*** when the person viewing the line is at a right angle or is perpendicular to the plane.
2. The size of a plane never changes. As the point of view changes, however, the shape of a plane can become distorted.
3. A plane in ***true shape*** is not distorted by the point of view.
4. The plane might be horizontal, vertical, or inclined.
   a. A horizontal frontal horizontal line exists if the plane is in the horizontal plane and if it is parallel to the frontal plane.
   b. A horizontal profile horizontal line exists if the plane is in the profile plane and if it is perpendicular to the frontal plane.
   c. A frontal profile vertical line exists if the plane is vertical in the frontal plane and if it is parallel to the profile plane.

B. A ***foreshortened plane*** appears shorter in one direction or another than it really is; the plane is "seen" as foreshortened.
   1. The viewer is not perpendicular to the plane.
   2. The plane might be in the horizontal, vertical, profile, or inclined plane.
      a. An ***inclined plane*** can be inclined in the frontal, horizontal, or profile plane. Consequently, it is seen as a foreshortened plane view in its adjacent views.
      b. An ***oblique plane*** is an inclined plane that is not parallel to any plane of projection. It requires an auxiliary view to determine the true size and true shape.

C. The plane is not seen as a shape, and the plane is seen in edge view.
   1. The viewer is not seeing a plane; he or she is seeing the edge of the plane.
   2. The edge view can be in the horizontal plane, the vertical plane, or the profile plane.
   3. ***Edge view*** is an imaginary view of a plane; the plane cannot be seen as a plane. Instead, it is seen as a line in space.

Refer students to VM–B. Demonstrate—with a CAD program and projection device or an overhead projector and transparencies—models of line and plane visualization. Identify projection lines and projection planes.

Explain that projection planes are the imaginary planes that separate each of the principal views of an object and are sometimes called fold lines to help identify the front, top, and side views. Tell the students that projection lines are construction lines that help align adjacent views. While drawing with a projection device, have the students do the same at their work areas. They should label each model as they complete it. Given a specific line length, have the students use graph paper to reproduce the line models in VM–B.

Remember, when viewing a plane, the observer encounters three conditions: true size, foreshortened, or an edge that is directly from an end. Use a pre- and post-quiz on these terms to assess student comprehension.

Objective 3: Identify the true shape, foreshortened shape, and edge view in an auxiliary view drawing.

Anticipated Problem: What is an auxiliary view drawing?

III. The creation of an auxiliary view aids in identifying the true shape as well as foreshortened and edge views of an object.

   A. It should be determined from which of the principal views of an object the auxiliary view will be taken.

1. An auxiliary view can be taken from any of the principal views of an object, but most often they are derived from the front, top, or right side views.
2. An ***auxiliary view*** is a perpendicular projection from a detailed principal view.

B. It is necessary to draw a projection plane line that is parallel to the edge view from which the auxiliary view will be derived. ***Projection planes*** are the imaginary planes that separate each of the principal views of an object. Sometimes they are called fold lines to help identify the front, top, side, or auxiliary views.

C. It is necessary to draw projection lines perpendicular to the projection plane from the edges of the principal view. ***Projection lines*** are construction lines that help align adjacent views.

D. It is necessary to take measurements from adjacent views to determine auxiliary view true size and foreshortened shapes.
   1. Only one shape in the auxiliary view is true size and shape.
   2. All of the other shapes that have coincidental edges with the true shape are foreshortened shapes.

E. If an auxiliary view is taken from the front view, then the width of the auxiliary view is the same as the width of the side view or top view.
   1. Sizes are always taken from the next adjacent view from which the auxiliary view is determined.
   2. In many auxiliary view drawings, foreshortened parts in the auxiliary view may be omitted.

Refer students to VM–C. Demonstrate—with a CAD program and projection device or an overhead projector and transparencies—the models for auxiliary view visualization. Identify projection lines and projection planes. While drawing with a projection device, have the students do the same at their work areas. They should label each view of the model as it is completed. Give them a specific line length, and have them use graph paper to reproduce the line models in VM–C.

Some students may have a difficult time associating a parallel line with an auxiliary view. Remind students that to determine an auxiliary view, projection lines must extend perpendicularly to the edge view of the object intended to be drawn in the auxiliary view. A new projection plane (auxiliary plane) is then established perpendicularly to these new projection lines. In an auxiliary view, only one plane is true size and true shape; all other planes are distorted and will be seen as foreshortened planes.

Review/Summary. Use the student learning objectives to summarize the lesson. Have students explain the content associated with each objective. Student responses can be used in determining which objectives need to be reviewed or taught from a different angle. Additional drawings that relate to the objectives can be found on the Illinois Drafting Educators Association curriculum web site: http://www.idea-online.org/curriculum.html.

Application. Use the included visual masters and lab sheets to apply the information presented in the lesson.

Evaluation. Evaluation should focus on student achievement of the objectives for the lesson. Various techniques can be used, such as student performance on the application activities. A sample written test is provided.

Answers to Sample Test:

Part One: Matching

1. d
2. b
3. e
4. c
5. a

Part Two: Short Answer

1. Auxiliary view is important because it shows true size and true shape details not shown in any other principal view of a drawing.
2. A true size plane has a perpendicular point of view, and a foreshortened plane does not have a perpendicular point of view.
3. An inclined line can be true length in a principal view, but an oblique line is only true length in an auxiliary view. An inclined line can be vertical or horizontal in a principal view, but an oblique line is never horizontal or vertical in a principal view.

Part Three: Completion

1. true size
2. foreshortened plane
3. true length, foreshortened, point view
4. true size, foreshortened, edge view

Sample Test

Name _____

True Shape (TS), Foreshortened (FS), and Edge Views (EV) of an Object

Part One: Matching

Instructions: **Match the term with the correct definition.**

a. edge view
b. projection planes
c. oblique plane
d. projection lines
e. auxiliary view

_____1. Construction lines that help align adjacent views

_____2. Imaginary planes that separate each of the principal views of an object

_____3. A perpendicular projection from a detailed principal view

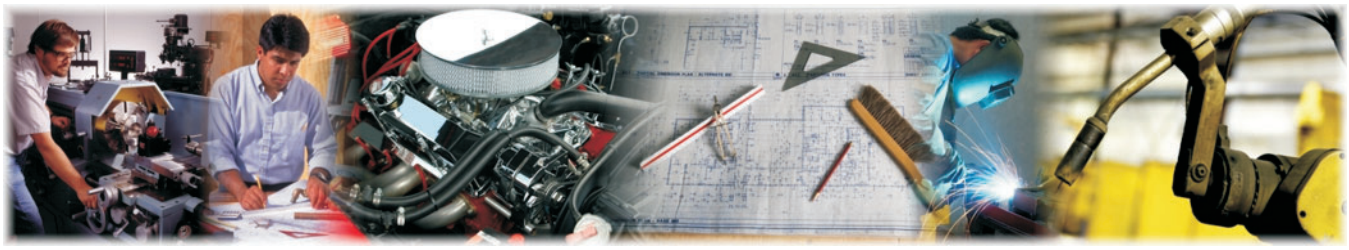
_____4. An inclined plane that is not parallel to any plane of projection

_____5. An imaginary view of a plane in which the plane is seen as a line in space

Part Two: Short Answer

Instructions: **Complete the following.**

1. Explain why an auxiliary view is important.



2. Explain the difference between a true size plane and a foreshortened plane.

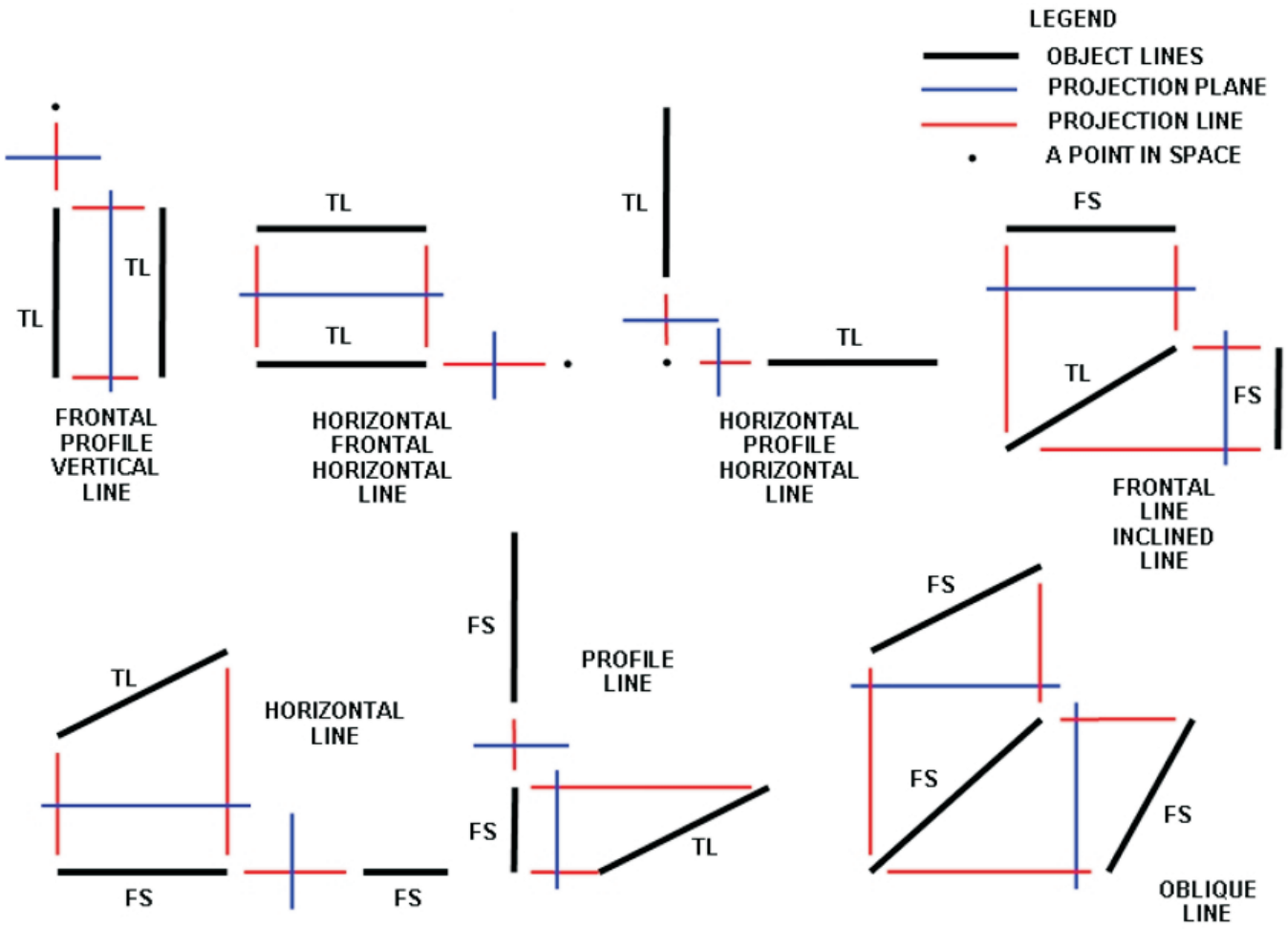
3. Explain the conditions that make an oblique line different from an inclined line.

Part Three: Completion

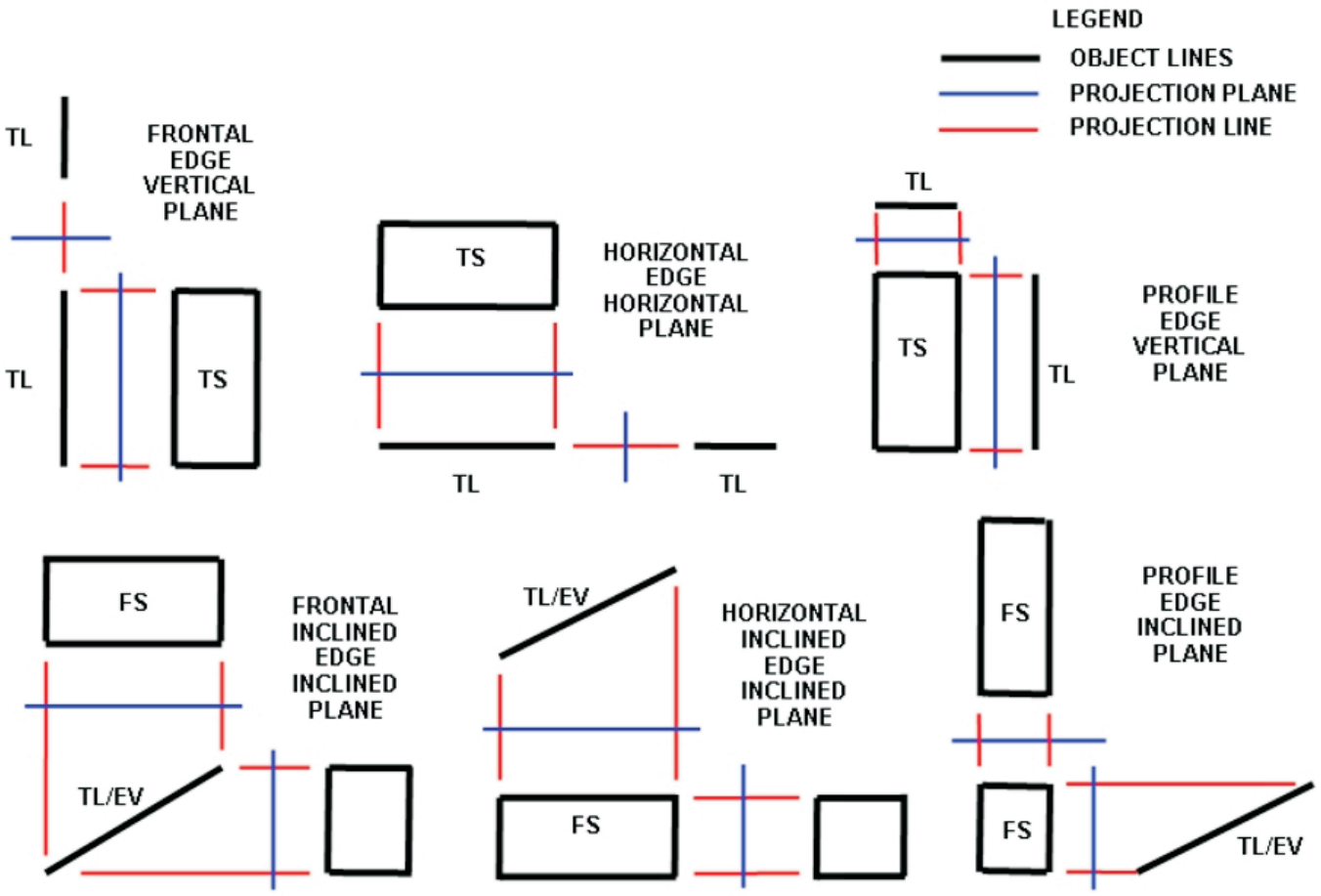
Instructions: **Provide the word or words to complete the following statements.**

1. A plane is _____ when the person viewing the line is at a right angle or is perpendicular to the plane.
2. A(n) _____ appears shorter in one direction or another than it is in reality.
3. The three conditions of a line are _____, _____, and _____.
4. The three conditions of a plane are _____, _____, and _____.

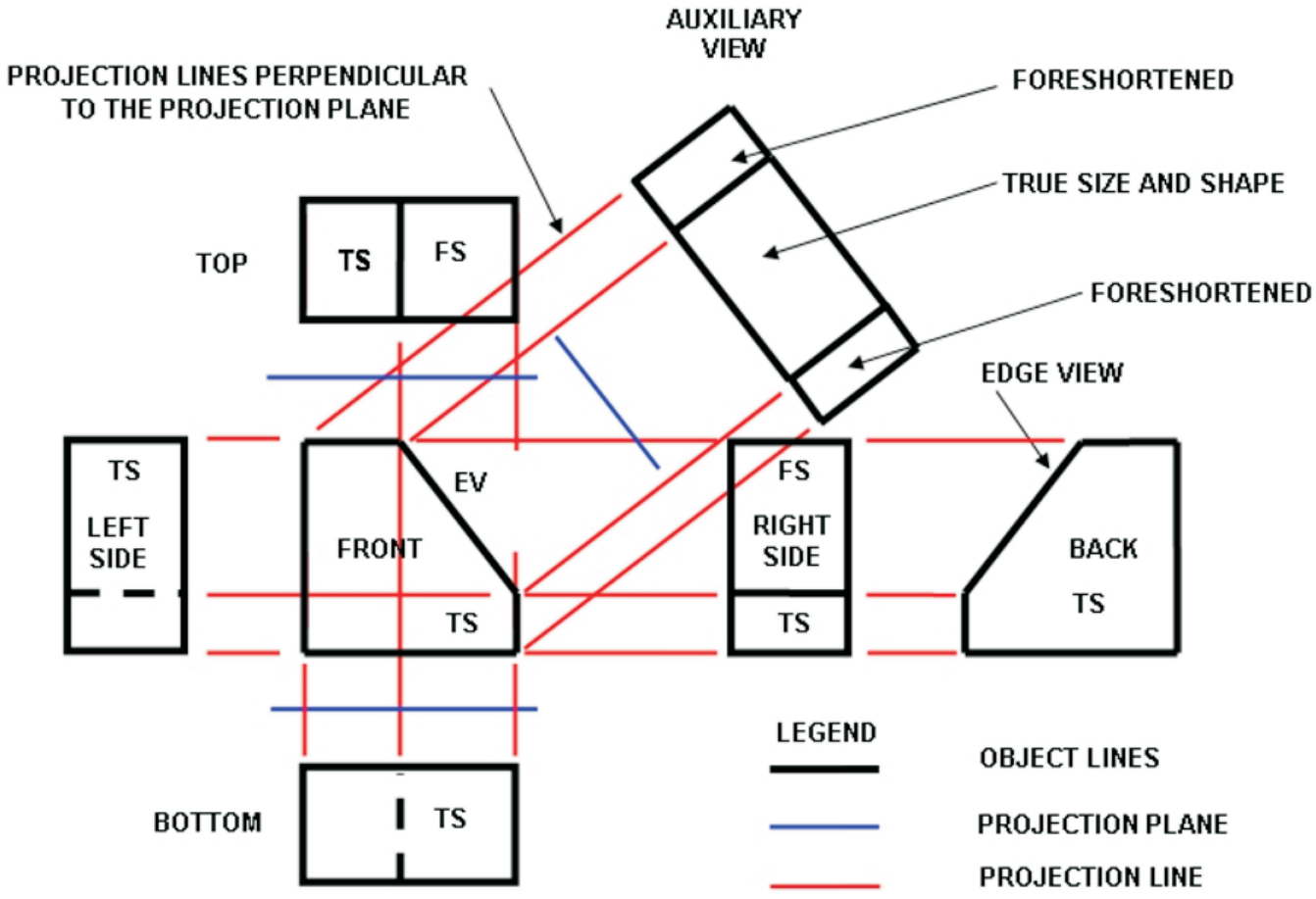
IDENTIFY TRUE LENGTH (TL) AND FORESHORTENED (FS) VIEWS OF A LINE SEGMENT



IDENTIFY TRUE LENGTH (TL), TRUE SHAPE (TS), EDGE VIEW (EV), AND FORESHORTENED (FS) VIEWS OF A PLANE IN SPACE



IDENTIFY TRUE SHAPE (TS), FORESHORTENED (FS), AND EDGE VIEWS (EV) OF AN OBJECT



LS–A

Name _____

Matching the Names of the Views of a Line with 2D Drawings that Represent Those Conditions (TL and FS)

Purpose

The purpose of this activity is to match the names of the various conditions of a line in space with two-dimensional drawings that represent those conditions.

Objectives

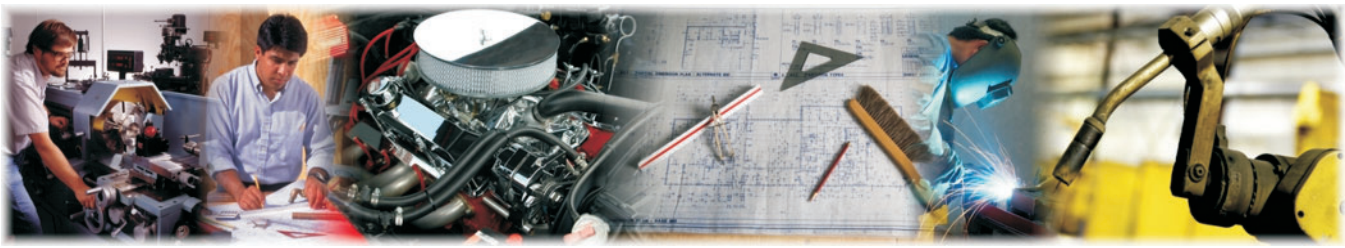
1. Identify the true length and foreshortened views of a line in space.
2. Use proper terminology to identify the conditions of a line in space.

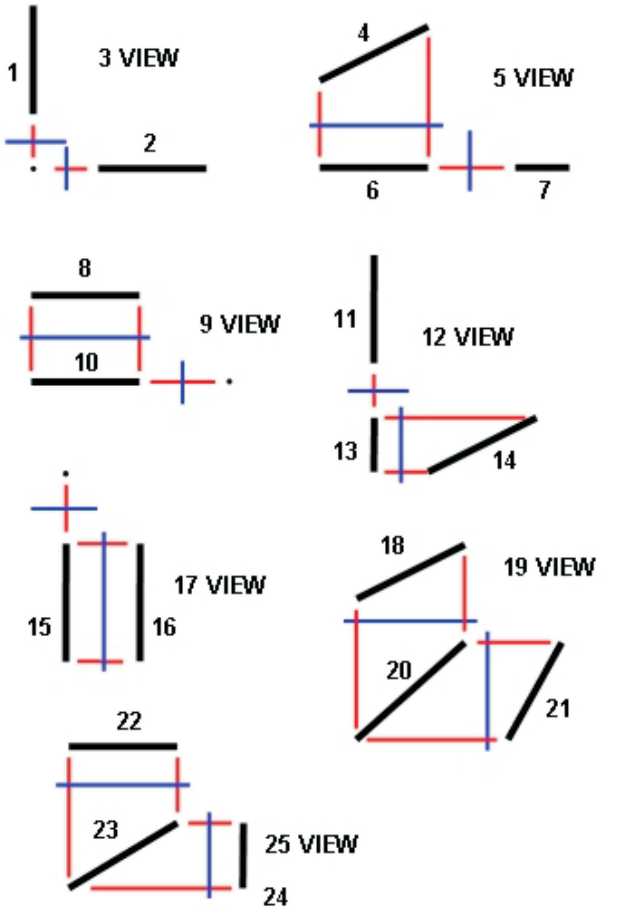
Materials

- lab sheet
- paper
- writing utensil

Procedure

1. Match the word choices with the various numbered two-dimensional lines.
2. The choices “foreshortened” and “true size” are used more than once.
3. Write the answers on a numbered answer sheet.
4. Turn in your answer sheet to your instructor.





LEGEND

OBJECT LINES

PROJECTION PLANE

PROJECTION LINE

A POINT IN SPACE

A. FORESHORTENED

B. FRONTAL LINE INCLINED

C. FRONTAL PROFILE VERTICAL

D. HORIZONTAL FRONTAL HORIZONTAL LINE

E. HORIZONTAL

F. HORIZONTAL PROFILE HORIZONTAL LINE

G. OBLIQUE

H. PROFILE

I. TRUE

LS–B

Name _____

Matching the Names of the Views of a Line with 2D Drawings that Represent Those Conditions (TL, TS, EV, and FS)

Purpose

The purpose of this activity is to match the names of the various conditions of a plane in space with two-dimensional drawings that represent those conditions.

Objectives

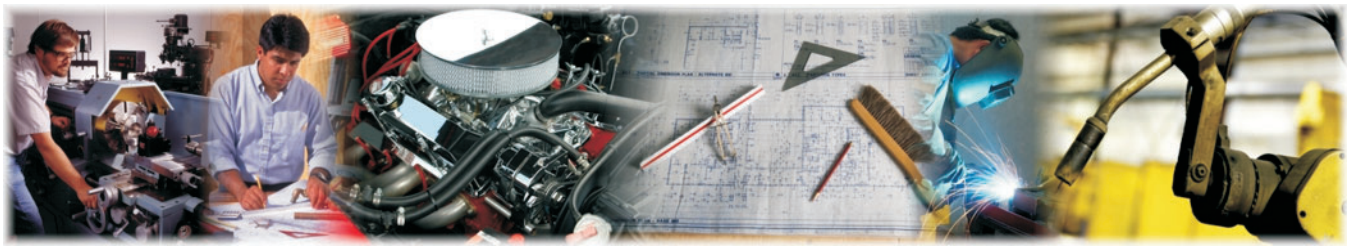
1. Identify the true length and foreshortened views of a plane in space.
2. Use proper terminology to identify the conditions of a plane in space.

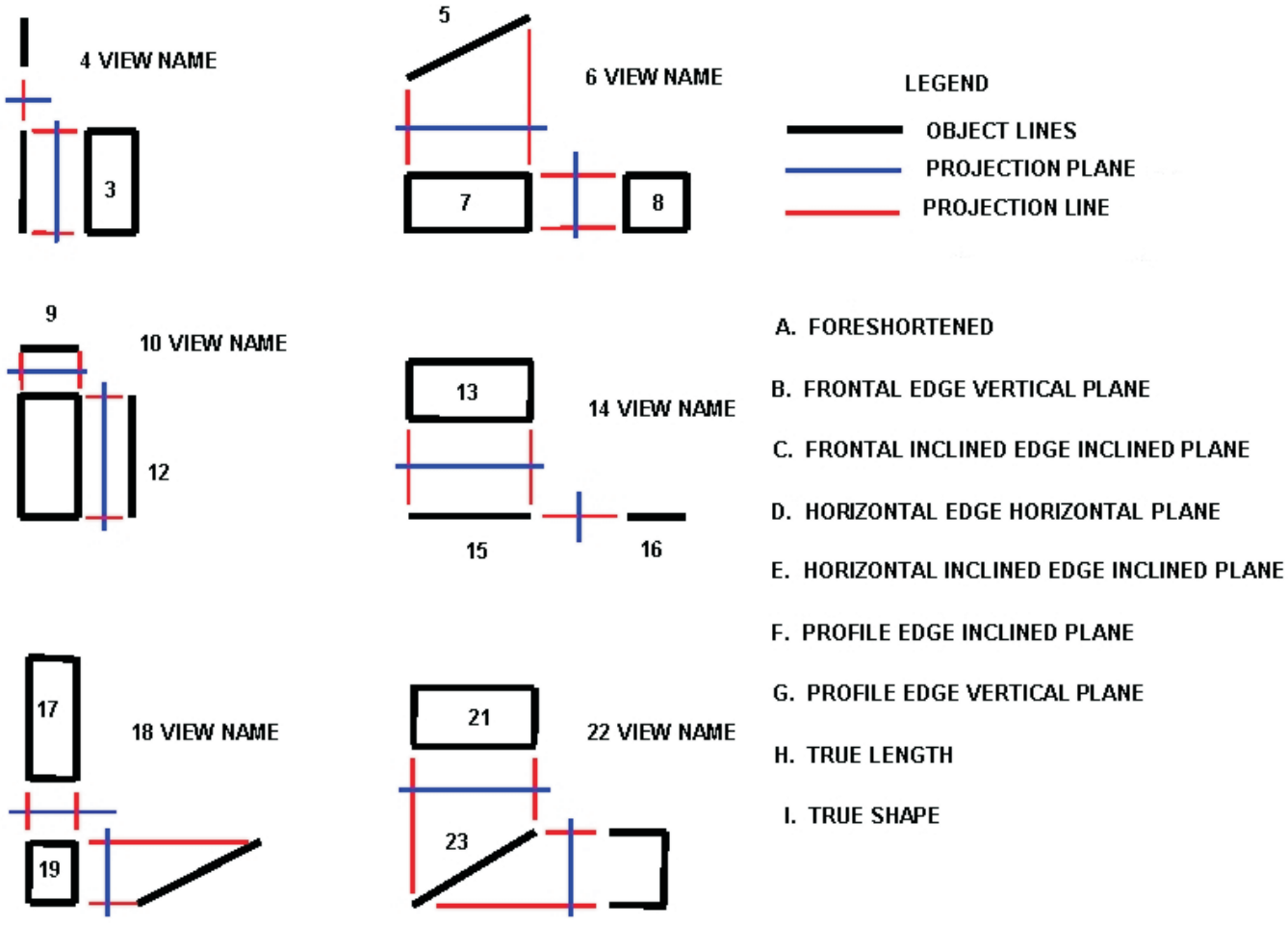
Materials

- lab sheet
- paper
- writing utensil

Procedure

1. Match the word choices with the various numbered two-dimensional lines or shapes.
2. The choices “foreshortened,” “true length,” and “true shape” are used more than once.
3. Write the letter answer on a numbered answer sheet.





LS–C

Name _____

Matching the Names of the Views of a Line with 2D Drawings that Represent Those Conditions (TS, FS, and EV)

Purpose

The purpose of this activity is to match the names of the various conditions of a line in space with two-dimensional drawings that represent those conditions.

Objectives

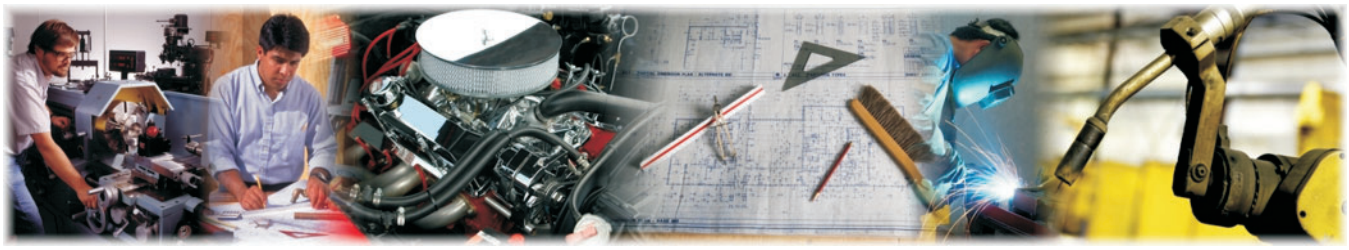
1. Identify the true shape, foreshortened, and edge views of an object.
2. Use proper terminology to identify the conditions of shapes and surfaces of an object.

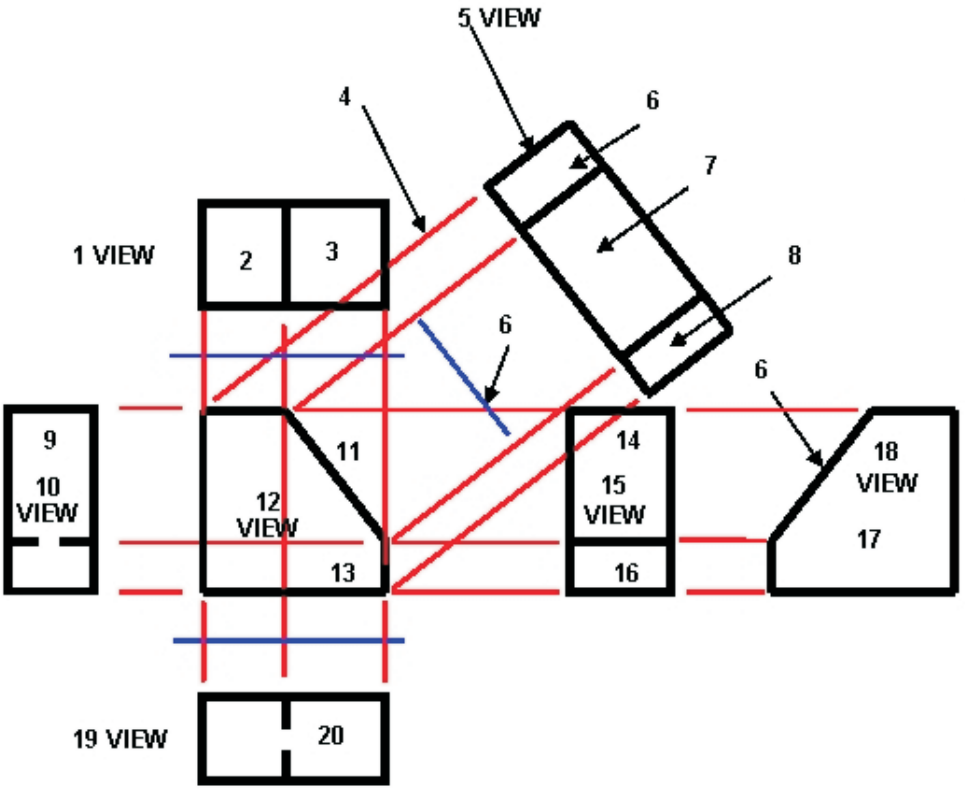
Materials

- lab sheet
- paper
- writing utensil

Procedure

1. Match the word choices with the various numbered two-dimensional lines or shapes.
2. The choices “foreshortened” and “true size” are used more than once.
3. Note that some numbers have the word “view.” For those, choose the name of the view.
4. Write the letter answer on a numbered answer sheet.





A. AUXILIARY VIEW
B. BACK
C. BOTTOM
D. EDGE
E. FORESHORTENED
F. FRONT
G. LEFT SIDE
H. PROJECTION LINE
I. PROJECTION PLANE
J. RIGHT SIDE
K. TOP
L. TRUE SIZE AND SHAPE