EVALUATING
ACADEMIC READINESS
FOR APPRENTICESHIP TRAINING
Revised for
ACCESS TO APPRENTICESHIP

COMMUNICATIONS SKILLS
INTERPRETATION OF DIAGRAMS

AN ACADEMIC SKILLS MANUAL
for
The Horticulture Trades

This trade group includes the following trades:
Arborist, and
Horticulturist

Workplace Support Services Branch
Ontario Ministry of Training, Colleges and Universities

Revised 2011

In preparing these Academic Skills manuals we have used passages, diagrams and questions similar to those an apprentice might find in a text, guide or trade manual.

The information in them is not intended to instruct you in your trade. Trade related material is used only to demonstrate how understanding an academic skill will help you find and use the information you need.

COMMUNICATIONS SKILLS
INTERPRETATION OF DIAGRAMS

An academic skill required for the study of the Horticulture Trades.

INTRODUCTION

You've probably heard this expression: "A picture is worth a thousand words." It means that something you can see would take a thousand words to explain. The purpose of graphic material (diagrams, charts, pictures) is make information about your trade easy to see. The correct ***interpretation of diagrams*** is necessary in order for you to benefit from the information they contain. The information in a diagram might illustrate a new concept, show the correct order of the steps of a procedure or give you the requirements and measurements for a job. You need to be able to interpret scale drawings and identify angles to verify the placement of parts and tools. Clearly, *interpretation of diagrams* is an essential skill for your technical reading toolbox.

Diagrams can provide details about areas that you can't see or touch. When you don't have access to hidden structures, you rely on diagrams to provide the background information needed to work precisely and safely. Charts list details such as measurements in a way that makes it easy to find the correct component needed for a specific situation. Pictures can give you an idea of the result, or they can show differences in related items. Interpreting graphics correctly is an important skill to develop as you master the knowledge and techniques of your trade.

In this manual, we use the term ***graphics*** to refer to the various types of technical drawings and charts used in your trade. We will examine:

- Standard symbols and diagrams
- Symbols and diagrams as visual language
- Diagram and text that interpret information
- Information in text and diagrams that match

PART I
DIAGRAMS AND STANDARD SYMBOLS

Graphics
Graphics are a means of communicating information. They serve many purposes: they illustrate concepts, show relationships, compare information, illustrate how something works, how to do something, or where something is. They can clearly show you a complex idea in a small space.

Symbols
As you learn your trade, you will be introduced to many symbols. Symbols are a shortened form of language. An object, part, process, relationship or number can be converted into a symbol.

Many symbols are international. When you come across a symbol in your reading, or on the job, you need to learn what term the symbol stands for and you also need to know what that term means.

Example: These three international symbols demonstrate this:

×	multiplication symbol	Multiplication is indicated by the symbol **x**. The **x** symbol immediately identifies a process. It also tells you what to do.
CO_2	carbon dioxide symbol	The relationship between a carbon molecule and an oxygen molecule can be stated symbolically. The symbol **CO_2** stands for or represents carbon dioxide. The **C** stands for a carbon molecule; the **O** stands for an oxygen molecule; the **$_2$** tells you there are two oxygen molecules. Glance back over this explanation on **CO_2**. "A symbol is worth a thousand words".
M	number symbol for million	Many numerical amounts are represented by symbols. **M** is the first letter of the Greek word mega (great) and it is used to represent the number million.

While many symbols, such as the ones shown above, are international, some countries and some agencies have their own symbols. The International Standards Organization (ISO), the Canadian Standards Association (CSA) and the American National Standards Institute (ANSI) are different accredited groups that use their own symbols. The following extract from a table of hydraulic and pneumatic symbols tells you that *ISO* has published these symbols.

Example: Symbols convey specific information about an aspect of your trade.

Table 1: Basic Hydraulic and Pneumatic Symbols

ISO symbols	Definitions
▼	Hydraulic flow
▽	Pneumatic flow
➚	Indication of variability

Symbols in text

Symbols are routinely used in technical writing and in graphics.

Example: The purpose of the paragraph below is to provide specific information about an aspect of your trade – *granular pesticides:*

If the label says to use 60kg/ hectare and the area you wish to treat is 2.6ha, adjust and calibrate the spreader so that its output is 60kg/ha.

Your ability to follow the directions above, to meet the requirements stated above depends on your ability to understand the meaning of kg, ha, and /. If symbols such as these are not clear to you, then you need to stop and look them up. We have listed the meanings below:

kg = abbreviation for kilograms

ha = abbreviation for hectares
/ = symbol for "per" or divide

As you learn your trade, you will encounter many symbols – some will be familiar and others will be new. It is your job to learn what they mean to add to your understanding of the concepts, principles, and "language" of your trade.

Which way is up?
Symbols help explain information.

Example: Objects shown at right angles can be viewed from different positions. The symbols in Figure 1 indicate the angle at which you view an object. They show whether you are viewing from left to right (**first-angle**) or from right to left (**third-angle**).

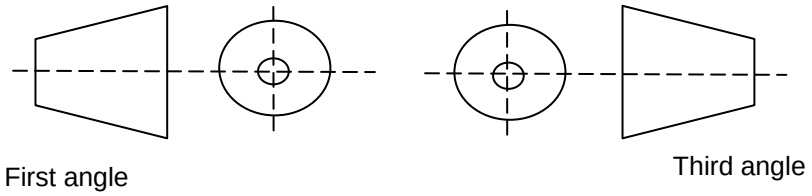


Figure 1: ISO Symbols for First and Third-Angle Projections

Symbols are shorthand for something. You need to know how to unlock the meaning presented by a symbol in a text or drawing. Each symbol transfers information to you efficiently, but you need to know precisely what it stands for. The difference between 30^{o} and 30" is significant.

Purpose
Your purpose in learning symbols is to learn to read and speak the language of your trade.
You need to interpret both written material *and* any graphic material found in the text to understand and use the information presented.

PART II
SYMBOLS AND DIAGRAMS AS VISUAL LANGUAGE

When you understand the meanings of trade symbols, you can correctly interpret what you read. The passage about granular pesticides did not explain terms such as *calibrate,* or *output*. You can, though, correctly interpret the symbols used.

Example: This is the next sentence in the paragraph about granular pesticides on page 2.

If the calibrated output is 60kg/ha, divide the hopper capacity by the calibrated output:

$$\frac{30\text{kg}}{60\text{ kg/ha}} = 0.5\text{ha}$$

.

You already know the meaning of hg, ha and/, so you can figure out what the sentence is saying.

Lines mean something
Lines used in technical drawings provide you with information. Lines can be *thick* or *thin*; broken, with equal spacing; broken with long/short spacing and so on. As with symbols, *standards apply to these lines and define their meaning* in the trades.

Different lines mean different things and the information they convey must be exact.

> **Example:** Canadian Standards define line thicknesses as *thick* or *thin*: *thick* is at least twice the thickness of *thin*. It is essential that you recognize what each line stands for in a chart or diagram. Figure 2 contains some samples to illustrate this:

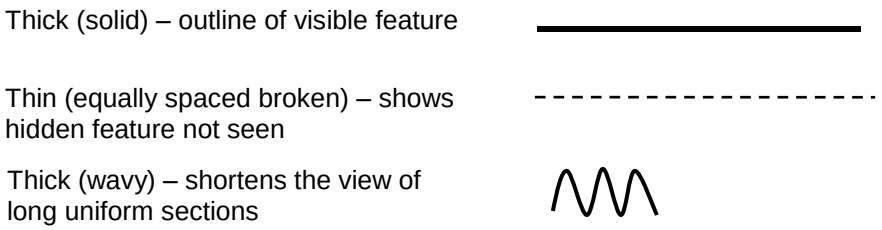


Figure 2: Examples of Lines in Technical Drawings

What does this mean?
A diagram that contains lines and shapes is abstract in that it represents something real but it doesn't look like the real thing.

> **Example:** A diagram of an automatic bleed-down circuit.

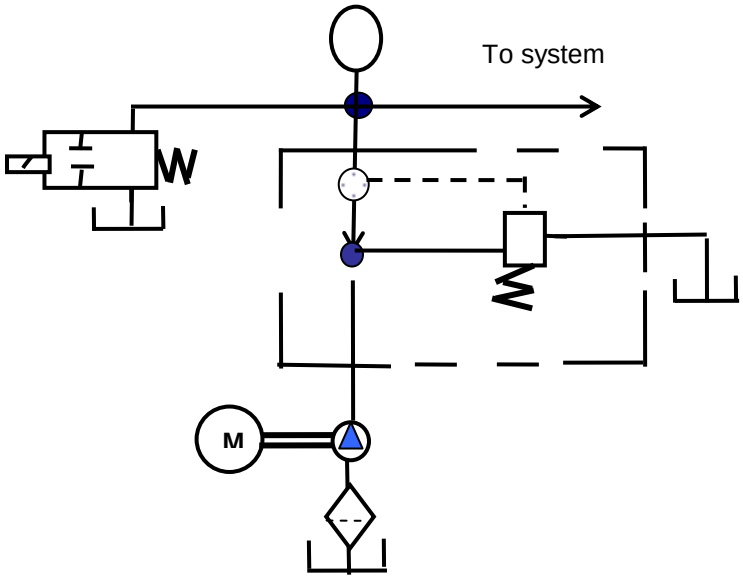


Figure 3: Automatic Bleed-Down Circuit

You can see that working diagrams usually don't look like what they represent. **Figure 3**, has a circle with **M** in the middle. It stands for motor. It doesn't look like a motor but, when you know **M** represents a motor and you see it in the diagram, you know the diagram includes a motor.

Each symbol and line in a diagram provides exact information about an object or a process. **Figure 3** uses lines and symbols to show a series of relationships. Each part of this diagram conveys information about the placement of the following in an automatic bleed-down circuit:

- flow lines
- springs
- motor

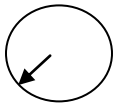
Road maps

Compare **Figure 3** to a road map. A road map shows you a whole system: compass directions, routes, distances, names of places. From it, you can calculate distance and travelling time, determine stopping points, plan routes. A figure with each of its symbols is like a map to use as a guide to essential trade information.

PART III
DIAGRAMS AND TEXT INTERPRET INFORMATION

Diagrams

Diagrams relate to something real. They show you how to do something, what something looks like, or the things that you can't see such as the flow of liquids or electrons. In some cases, the diagram looks like the real thing (such as the drawing of a tool); in other cases, it represents but does not look like the real thing such as this symbol for a pressure gauge.



Pressure Gauge

Figures

When you are reading, you might be directed to a graphic, which is usually labelled as a Figure with a number. The reference to the graphic may be in parentheses like this (Figure 2-10). Or, the text may tell what the graphic will show you.

> **Example:**
> The two chloroplasts shown in Figure 2-10, have been magnified 36 800 times their actual size and are separated by the walls of adjacent cells.

Read everything

Knowing the purpose of a graphic helps you interpret what is being conveyed to you. It's important to get all the information available from a graphic. The information is there to help you develop a clear understanding of the principles and concepts required by your trade.

Labels

To interpret a diagram, start by reading the label. A label offers important information. It may:

- ♦ identify the diagram,
- ♦ describe how to follow the information on the diagram,
- ♦ refer you to the text for clarification, and
- ♦ highlight important points.

Diagram labels provide a focus for the information presented. Each one gives accurate information and directs you to the related graphic and text. Here are some samples of labels attached to diagrams.

Figure 1 A conductivity metre
Figure 2 Taking readings from a conductivity metre.
Figure 3 A conductivity metre being used to measure the soluble salt content in greenhouse soils.

Notice that each of these labels has a different amount of information about what is in the figure..

Using Text and Diagram Together

Passage 1 and Figure 4 explain a process. The text explains **why** and provides details (**how**). Figure 4 lets you see **where** and **how** the action should occur. The diagram and text are important and useful on their own but together they give you a more complete picture.

Passage 1

Exhaust stroke
Once the piston has completed the power stroke in a four-cycle engine, the burned gases must be removed from the cylinder before beginning a fresh charge. This removal occurs during the **exhaust stroke**. The exhaust valve opens and the piston rises, pushing the exhaust gases from the cylinder.

Cooling the valve
The heat that the exhaust valve absorbs during this stroke needs to be controlled or it can suffer rapid deterioration. Some of this cooling occurs through conduction through the valve stem to the guide. The hottest part of the valve (the valve head), transfers heat through the valve seat to the cylinder block.

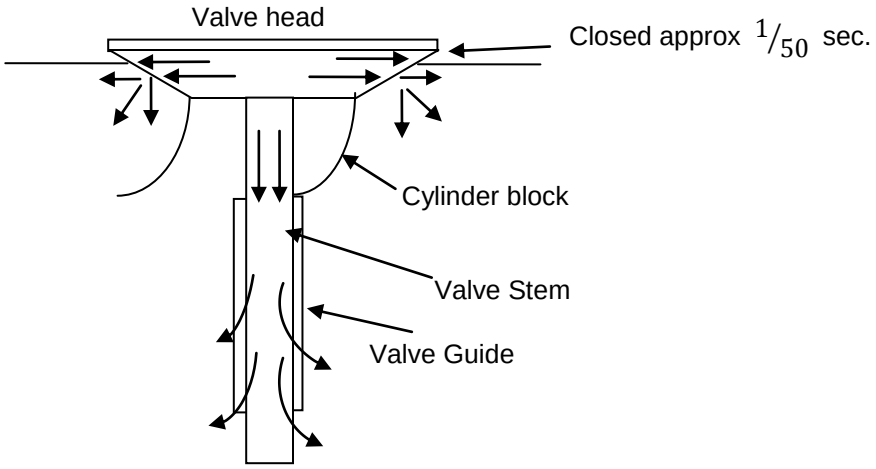


FIGURE 4: Cooling the Valve
Heat is conducted from the valve through the seat to the cylinder block. Some heat conducts down the stem and to the valve guide. This cooling must occur very quickly ($^{1}/_{50}$ sec, at 3600 rpm).

The diagram above gives you a good idea of how heat is controlled in a valve. It has a clear purpose: it is labelled so that you can identify various parts. It is simplified: you get enough information to see an operation, but not so much that it distracts you from understanding the key

details. Also, note the information added with symbols - the direction of movement of heat (arrows).

The diagram aids your understanding of one aspect of the exhaust stroke. You can "see" the following:

- valve stem,
- valve guide,
- cylinder block,
- heat transferring from the valve head to the cylinder block,
- heat flowing down the valve stem,
- heat leaving through the valve guide, and
- the rate at which cooling must occur (1/50 sec).

The text provides explanations and directions not found in the diagram. ***The diagram*** shows concepts which are difficult to put into words. ***They work together*** to describe an important process, to give reasons for it and to provide a mental and visual understanding of it.

When you have read and understood both the graphic and the text, you should be able to:

1. Explain the *exhaust stroke* and the function of the piston and exhaust valve during this stroke.
2. Explain when heat needs to be transferred and how quickly.
3. List two ways heat is transferred from the exhaust valve. Show this in a diagram.

Headings
Notice how headings give you an idea of what is in a diagram and what you show be looking for. Be sure to read all titles and headings. The label or description below a diagram identifies what you are looking at; they may contain directions or point you to an important aspect of the diagram.

Headings, titles and labels add to the information available in diagrams and help you interpret what the information is telling you. ***Use all the information provided in the labels and written descriptions within the diagram along with the graphics to get the complete picture.***

How not to . . .
Technical drawings often show you how to do something. The text describes the actions to be done and explains the reasons for doing them, while the drawings show how to perform those actions. Examining both text and drawings helps you accurately follow directions and avoid problems. In the next sample, the text describes how pressure affects spray patterns. The diagrams show what it looks like.

Passage 2

Irrigation Patterns
Proper operating pressure is essential for achieving distribution patterns that can be overlapped for uniform coverage. Refer to figure 5. Inadequate pressure (figure 5B) results in streams of water that won’t break up sufficiently for wedge-shaped distribution. In extreme cases, a donut shaped pattern

occurs in which most of the water is confined to a ring surrounding the sprinkler. A series of green rings appears with brown or dormant ringgrass occurring inside and outside each ring. Excessive pressure (figure 5C) causes fine atomization of the spray, so that the small water droplets are highly susceptible to wind drift. The result is an irregular and unpredictable pattern. The correct pressure will allow for even coverage and avoid these problems (figure 5A).

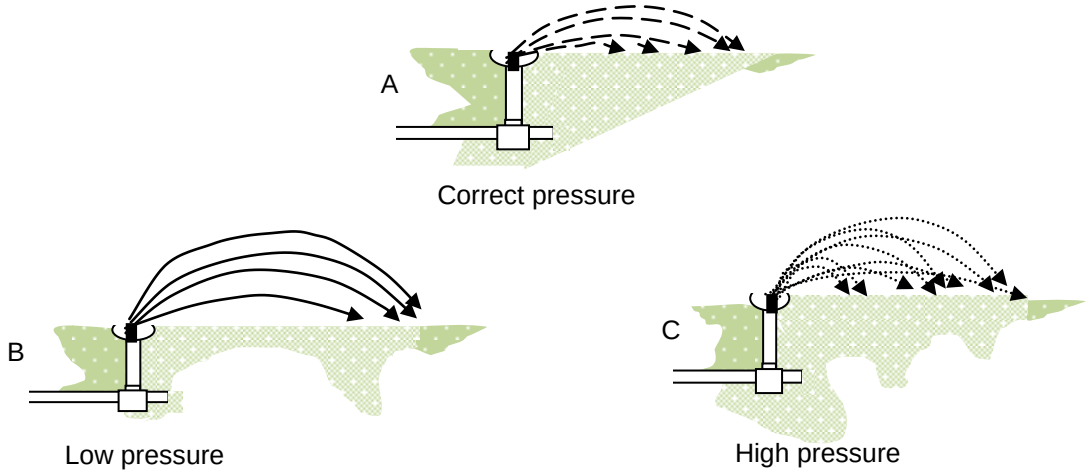


FIGURE 5 Comparison of irrigation patterns as influenced by operating pressure

Read it all

When we look at diagrams, charts or tables, we need to refer back to *the guidance of the text*. The text tells us when to refer to the diagram and directs us to specific aspects of a drawing; it may repeat or emphasize important points.

The text in **Passage 2** directs you to the figures then directs your attention to a point on the diagram and the result of incorrect pressure:

> Inadequate pressure (figure 5B) results in streams of water that won't break up sufficiently for wedge-shaped distribution.... a donut shaped pattern occurs in which most of the water is confined to a ring surrounding the sprinkler.

Figure 5C shows you another incorrect pressure (excessive pressure) and the text provides a short description of the problem and the result:

> … causes fine atomization of the spray so that the small droplets of water are susceptible to wind drift … an irregular and unpredictable pattern.

Figure 5A shows you incorrect installation. After comparing correct and incorrect methods, you should be able to apply these directions. Further, the visual information should help you remember how to do this and why it is important to do it right.

> … correct pressure will allow for even coverage and avoid these problems (figure 5A).

Make sure you find the corresponding spots on the diagram so that you can see and understand the concept. You need to be sure that you are seeing exactly what you are supposed to see.

Test yourself

Assess how well you are interpreting diagrams. If we removed the references to the figures in the text above (e.g. Figure 5 A, B and C), could you do the following?

1. Match the text and diagrams correctly.
2. Demonstrate the correct method of installation and which is incorrect.
3. Explain why. If it is not clear, read and then reread. Match diagram to text and text to diagram as you go. Find spots on the diagram the way you would pick out points on a map.
4. Compare the diagrams and refer to the text.
5. Suggest possible consequences of incorrect water pressure.

PART IV
INFORMATION IN TEXT AND DIAGRAMS

Passage 2 and Figure 6 below are directly related to it and vice versa: they are partners. Be sure to read all titles and headings. In a diagram, the label or description below it identifies what you are looking at; it may contain directions or it may direct you to an important aspect of the diagram. Use all the information provided in both text and diagram. When you read the text, identify places or points on the diagram that correspond to the it.

The text explains what is happening; the diagram converts the explanation into something visual. Also, when you use the text with the diagram, you will probably remember the process, the order and the reasons better than you would if you used one alone.

Use Figure 6 and Passage 2 to answer the questions which follow.

PASSAGE 2

Photosynthesis

Photosynthesis is the single most important process on earth. It takes place in two phases, the light reaction stage and the CO_2 fixation stage.

In the **light reaction phase**, energy from light boosts the electrons of **chlorophyll *a*** to a higher energy potential. These energized electrons are diverted to a system that stores this energy for later use in producing sugars and other products for the cell. The chlorophyll quickly replaces the lost electrons with new ones it obtains from water molecules in the cell. The water molecules that have lost electrons through this process split into its component hydrogen (H) and oxygen (O) atoms. The oxygen (O_2) escapes through openings in the cell (stomata) into the atmosphere.

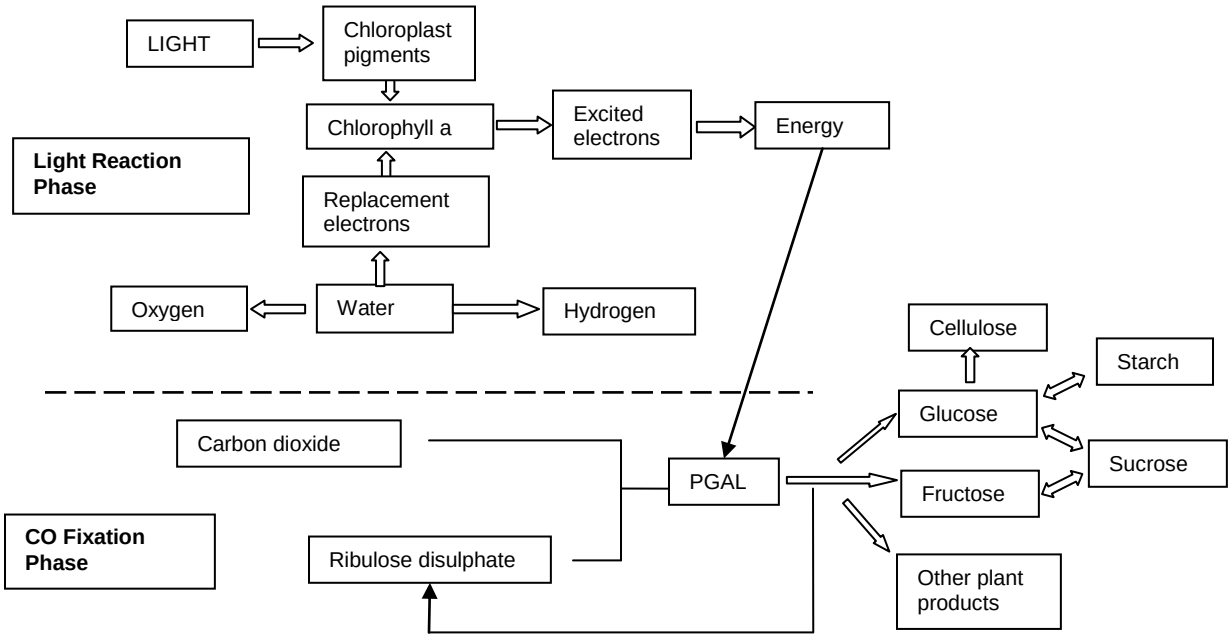


FIGURE 6: An Outline of Photosynthesis

During the **CO_2 - fixation phase**, carbon dioxide (CO_2) from the atmosphere unites with the sugar, ribulose diphosphate. The resulting molecule splits into two equal, smaller molecules. These smaller molecules join with the hydrogen that was released when the water molecules split in the light reaction phase. This results in molecules of phosphoglyceraldehyde (PGAL) which are used for the construction of more elaborate sucrose molecules and other plant products. Several products result, including more ribulose diphosphate (which the system regenerates, ready to repeat CO_2 - fixation). Although CO_2 - fixation is slower than the light reaction, millions of PGAL molecules are synthesized within minutes after light enters a leaf's mesophyll tissues.

Questions:

1. Which of the following accurately describes the role of energy created by light channelled through the chlorophyll?

   a) Energy is used to split the water molecules.
   b) Energy is is stockpiled for future use.
   c) Energy is is used create PGAL.

2. Which sequence of information is correct, **A** or **B**?

   A a) Light enters chlorophyll.
   b) Chlorophyll's energy is stored.
   c) Electrons become excited.
   d) Water replenishes lost electrons.

   B a) CO_2 combines with ribulose diphosphate.
   b) This product combines with PGAL.
   c) Energy from the light reaction is added.
   d) Various products, including sugar, are formed.

3. Ribulose diphosphate is both a component and product of photosynthesis.

   T F

4. What are the products of photosynthesis mentioned by the passage and diagram?

CONCLUSION

The text that accompanies a diagram is directly related to it. They are partners. Usually the main text explains in words the information you see in a diagram. It also directs you at the appropriate time to study the diagram. It tells you what you should look for in the diagram. When you use the information from both text and graphics, you develop a clearer understanding of a principle, a procedure or a type of equipment. Use text and diagrams together to enrich your learning.

When the text describes steps in a process and the diagram illustrates it, you can follow the information flow,. Your eyes can move in all directions. You can *see* the information from different points in the process. You can interpret what is happening at different stages.

Technical diagrams and symbols transfer information. Provided you read carefully and interpret correctly, graphics can do any of the following in little space and at a glance:

- show relationships,
- make abstract ideas easier to understand,
- show you something invisible or hidden, and
- focus on and emphasize important aspects on information.

Summary

1. **Symbols are a form of shorthand.** Understand what these symbols represent to understand the language of your trade. Note any differences between countries.

2. **Lines convey information**. Lines and symbols can show relationships, objects and processes.

3. **Diagrams (graphics) use a visual approach to make technical information meaningful.**

4. **Diagrams are labeled clearly** to identify parts and their relationships.

5. **The text and diagram are directly related to each other and work as partners**. Always use them together.

6. **Always read the description that accompanies each diagram**. They tell you what you are looking at and what to look for.

7. **Diagrams and symbols relate to something you need to know**. Interpret and connect them to achieve understanding.

ANSWER PAGE

PART IV Photosynthesis

1. Which of the following accurately describes the role of energy created by light channelled through the chlorophyll?
   b) Energy is stockpiled for future use.

   Both the passage and diagram provide you with this answer. The passage clearly states that the system "*stores their energy for later use in producing sugars and other products...*" If we look to the diagram, the long arrow indicates that the energy eventually combines with the PGAL toward the end of the CO_2 - fixation process.

2. Which sequence of information is correct, **A** or **B**?
   B a) CO_2 combines with ribulose diphosphate
   b) this product combines with PGAL
   c) energy from the light reaction is added
   d) various products, including sugar, are formed

   Again, use both the passage and the diagram to confirm the sequence. The problem with **A** is that two of the steps, a) and b), are in the wrong order. **B**, however, is clearly laid out by the labels and arrows in the diagram, and the information in paragraph 2.

3. Ribulose diphosphate is both a component and product of photosynthesis.
   T This is true. The last sentence of the passage tells you that ribulose diphosphate is a product that results from CO_2 - fixation, and it also tells you that *the system regenerates* it *ready to repeat CO_2 - fixation*. The diagram also conveys the same information: you see that the ribulose diphosphate appears after the PGAL and energy combine, but the arrow takes it from the product section, circles around, and places it back at the beginning of the process.

4. What are the products of photosynthesis mentioned in both the passage and diagram?

   The only product mentioned by the passage is the sugar ribulose diphosphate. The diagram, however, provides you with more: fructose, glucose, cellulose, starch, sucrose and other plant products.