

# Higher Order Thinking and Reasoning (HOTR) Graphic Organizers to Support Essay Writing

---

Janis Bulgren, Ph.D., Research Professor Emerita  
University of Kansas Center for Research on Learning

## WHY focus on writing in content area classes?

1. Teachers have seen increasing demands to incorporate writing into general content area inclusive classes.
2. At the same time, more content area teachers face demands to incorporate higher order thinking and reasoning into general area education classes, in addition to foundational facts and definitions.
3. A research-based and evidence-based response\* is found in Higher Order Thinking and Reasoning graphic organizers such as the Question Exploration Guide.

## WHAT are Higher Order Thinking and Reasoning Routines (HOTR)?

HOTR Routines are a group of instructional procedures in the Content Enhancement series designed to promote reasoning that were developed at University of Kansas Center for Research on Learning. HOTRs focus on higher order reasoning in standards, use in inclusive content area classes, integrity of content, instructional supports for teacher use, and learning supports for students.

Higher Order Thinking and Reasoning Routines:

- Comparison – compare-and-contrast, differentiate, similar or different
- Cause and Effect – tracing the sequence of causes and effects of an event
- Question Exploration - answering critical or essential questions to explain main ideas and themes
- Decision Making – considering pros and cons between or among options
- Argumentation – evaluating and judging a claim with its evidence, reasoning counterarguments, rebuttals, and corroboration

## HOW can HOTR Content Enhancement Graphic Organizers be used to support writing essays across content areas?

All HOTR graphic organizers (i.e., visual devices) lend themselves to supporting essay writing; these include Question Exploration, Cause and Effect, Decision Making, Cross Curricular Argumentation, Scientific Argumentation and Concept Comparison.

### **BENEFITS of using HOTR graphic organizers to write essays:**

- **EFFECTIVE** - RESEARCH-AND-EVIDENCE BASED DATA\* supports teacher usage and positive learning on the part of students.
- **EFFICIENT** - COMMON INSTRUCTIONAL PROCEDURES across HOTRs mean increased student familiarity with instructional procedures and decreased introductory lessons on the use of future graphic organizers, embedded reasoning strategy steps, and the Cue-Do-Review Instructional procedures.
- **GENERALIZABLE** - Implementation of HIGHER ORDER REASONING routines across grade levels and content areas provides increased knowledge of the reasoning strategies and wider use of the strategies.

When HOTRs are used ACROSS grade levels AND content areas, it provides students with multiple exposures and helps students to master different types of reasoning and leads to generalization of use of the embedded reasoning strategies associated with higher order reasoning.

Essay writing instructional steps are used after the graphic organizer has been developed in a content area as support for writing a 5-paragraph essay:

- Collaboratively develop a graphic organizer that contains the information needed to develop a 5-paragraph essay
- Review the content of the graphic organizer
- Share Reasoning Steps (with an embedded Reasoning Strategy and acronym) of the selected HOTR and demonstrate how they guide the development of the essay as follows:
  - The critical question (becomes the basis of the topic sentence)
  - Background knowledge and definitions (provide the necessary prior knowledge)
  - A central section of the graphic in which the question is answered in depth (comprises the body of the essay using as many paragraphs as required)
  - The main idea answer (delivers the conclusion of the essay)
  - Extensions and generalization of the main idea answer (use the main idea in the same content area, other content areas or real-world issues)

A Question Exploration Guide (Fig. 1) developed to understand problems with the ozone layer will be used to demonstrate how essay writing from a graphic organizer works. However, this process can be used across all the HOTR routines.

**Figure 1: Question Exploration Guide (environment)**

Text Reference: Chapter 7, pages 101-116		Name: Marie David	
Course: _____		Title: Our Environment	
Unit: _____	Critical		
Lesson: _____	Question#: 3	Date: _____	

  

<b>1. What is the <u>critical question</u>?</b>	
How do problems with the ozone layer teach us about human effects on our environment?	
<b>2. What are the <u>key terms</u> and explanations?</b>	
environment	All the things surrounding us (air, land, living things)
ozone layer	Invisible layer of gas that shields us from UV radiation
UV	Ultraviolet radiation, or harmful rays from the sun
CFCs	Chlorofluorocarbons-chemicals with chlorine
<b>3. What are the <u>supporting questions</u> and answers?</b>	
What has happened in the past?	In the past, a protective ozone layer was formed when UV rays hit the oxygen in the air around the earth.
What has caused PROBLEMS?	The ozone layer around the earth is being destroyed by CFCs we may not even know about in cleaning products, foam containers, refrigerator coolants and spray cans.
What are the EFFECTS?	The effects include: 1) physical harm (skin cancer & cataracts) 2. environmental harm (crops and ocean plants) 3. change in weather patterns 4) greenhouse warming
What are SOLUTIONS?	Solutions include: 1. voluntary cutbacks of CFC products 2 use of alternatives to CFCs (HCFCs) 3. world conferences to cut CFCs
What are other concerns?	Some people still don't think it's a problem.
<b>4. What is the <u>main idea</u> answer?</b>	
People can harm the environment without intending it or even believing it.	
<b>5. <u>Explore</u> and use the main idea.</b>	
How can we explore the facts ourselves?	
Experiments with balloons show that oxygen can be changed to ozone.	
<b>6. <u>Extend</u> the main idea to your world.</b>	
What can an individual do?	
An individual can decide to do research on which products cause damage to ozone layer.	

## Steps in the Essay Creation Process:

- 1. Develop Paragraph 1:** Using the Question Exploration Guide developed on the topic of the ozone layer, start with sections 1 and 2 of the Guide to write Paragraph 1. In this paragraph, the critical question (Section 1) becomes the basis for the topic sentence and Section 2 provides the necessary background information in the essay. This paragraph contains key terms, definitions and explanations that provide the background information needed to follow the reasoning process of answering the question and developing the main idea answer.

Text Reference: _____		Name: _____	
Course _____	Title: _____		
Unit _____	Critical Question #: _____		
Lesson _____	Date: _____		

  

<b>1 What is the critical question?</b> How do problems with the ozone layer teach us about human effects on our environment?	<p>Develop the question as a topic sentence in Paragraph 1.</p> <p>Use background information and definitions to develop Paragraph 1.</p>
<b>2 What are the key terms and explanations?</b> What is our environment? What is the ozone layer? What is UV? What are CFCs?	

- All the things surrounding us (air, land, living things)
- Invisible layer of gas that shields us from UV radiation
- Ultraviolet radiation, or harmful rays from the sun
- Chlorofluorocarbons-chemicals with chlorine

© Janis Bulgren, 2025

### PARAGRAPH 1 (created using the graphic organizer)

Problems with ozone can teach us about human effects on our environment. The ozone layer is an invisible layer of gas that shields us from UV radiation. UV radiation is ultraviolet radiation, or rays of the sun that can harm living things. One problem today is that the protective ozone layer around the earth is being destroyed.

- 2. Develop the body of the essay in Paragraphs 2, 3 and 4:** Use Section 3 of the QEG graphic organizer to write Paragraphs 2, 3, and 4 of the essay. This section of the graphic focuses on breaking apart a complex critical question into smaller supporting questions and answering them. The answers to the smaller supporting questions are used to develop different paragraphs, representing the body of the essay.

<b>3 What are the supporting questions and answers?</b> What has happened in the past?  What has caused PROBLEMS?  What are the EFFECTS?  What are SOLUTIONS?  What are other concerns?	<ul style="list-style-type: none"><li>• In the past, a protective ozone layer was formed when UV rays hit the oxygen in the air around the earth.</li><li>• The ozone layer around the earth is being destroyed by CFCs we may not even know about in cleaning products, foam containers, refrigerator coolants and spray cans.</li><li>• The effects include: 1) physical harm (skin cancer &amp; cataracts) 2. environmental harm (crops and ocean plants) 3. change in weather patterns 4) greenhouse warming</li><li>• Solutions include: 1. voluntary cutbacks of CFC products 2 use of alternatives to CFCs (HCFCs) 3. world conferences to cut CFCs</li><li>• Some people still don't think it's a problem.</li></ul>	<p>Use answers to smaller questions to develop the body of the essay e.g., Paragraphs 2, 3, &amp; 4.</p>
--	--	--

© Janis Bulgren, 2025

## PARAGRAPHS 2, 3, and 4 (created using the graphic organizer)

In the past the ozone layer protected the earth from UV rays. Now the ozone layer is being destroyed by CFC's or chlorofluorocarbons which are chemicals we may not even know about in products we use. For example, CFCs are used to manufacture common cleaning products, foam plastic containers, refrigerator coolants, and spray cans we use every day.

There are several effects of this destructive destruction. First, physical harm such as skin cancer and cataracts can happen. Second, there can be environmental damage to crops and also to plants in the ocean food chain. Third, weather patterns can be disrupted. In addition, the earth can be heating up; this is also called the greenhouse effect.

Several solutions have been tried. First, there have been voluntary cutbacks of the use of products containing CFCs. For example, McDonald's stopped using foam containers. Second, alternatives are being explored such as HCFCs. And third, world conferences are being held, and agreements are being made to find solutions and limit the use of CSCs. However, some people still don't think it's a problem.

3. **Develop the Concluding Paragraph of the Essay:** Using the Question Exploration Guide developed on the topic of the ozone layer, begin with Section 4 of the organizer to write Paragraph 5. This paragraph focuses on answering the Critical Question with a clear, concise Main Idea answer. Then, add insights from Sections 5 and Section 6 to expand the answer, show deep understanding and explore generalization of the main idea answer (use a sixth paragraph if needed to expand and generalize the answer).

4 What is the <u>main idea</u> answer?	Use Main Idea Answer to develop a conclusion in Paragraph 5.
People can harm the environment without intending it or even believing it.	
5 <u>Explore</u> and use the main idea.	Add insights to conclusion in Paragraph 5 with generalization.
How can we explore the facts ourselves? Experiments with balloons show that oxygen can be changed to ozone.	
6 <u>Extend</u> the main idea to your world.	
What can an individual do? An individual can decide to do research on which products cause damage to ozone layer.	

Figure 1: Question Exploration Guide for the question, "How do problems with the ozone layer teach us about human effects on our environment?"

© Janis Bulgren, 2025

## PARAGRAPH 5 (created using the graphic organizer)

Therefore, people can harm the environment without intending to harm it or even believing it is happening. However, they can learn about the situation by conducting experiments such as with balloons to show that oxygen can be changed to ozone or doing research on products that cause damage to the ozone layer.

## Completed Essay

### Human Effects on the Ozone Layer

Problems with ozone can teach us about human effects on our environment. The ozone layer is an invisible layer of gas that shields us from UV radiation. UV radiation is ultraviolet radiation, or rays of the sun that can harm living things. One problem today is that the protective ozone layer around the earth is being destroyed.

In the past the ozone layer protected the earth from UV rays. Now the ozone layer is being destroyed by CFC's or chlorofluorocarbons which are chemicals we may not even know about in products we use. For example, CFCs are used to manufacture common cleaning products, foam plastic containers, refrigerator coolants, and spray cans we use every day.

There are several effects of this destructive destruction. First, physical harm such as skin cancer and cataracts can happen. Second, there can be environmental damage to crops and also to plants in the ocean food chain. Third, weather patterns can be disrupted. In addition, the earth can be heating up; this is also called the greenhouse effect.

Several solutions have been tried. First, there have been voluntary cutbacks of the use of products containing CFCs. For example, McDonald's stopped using foam containers. Second, alternatives are being explored such as HCFCs. And third, world conferences are being held, and agreements are being made to find solutions and limit the use of CSCs. However, some people still don't think it's a problem.

Therefore, people can harm the environment without intending to harm it or even believing it is happening. However, they can learn about the situation by conducting experiments such as with balloons to show that oxygen can be changed to ozone or doing research on products that cause damage to the ozone layer.

---

As shown in the completed essay, students used the skills learned in the process of developing the graphic organizer (note-taking, acquiring content knowledge, applying the reasoning strategy, etc.) to craft a well thought out essay.

Based on increasing demands to incorporate essay writing instruction into content area classes, as well as to teach higher order thinking and reasoning skills, SIM Higher Order Thinking and Reasoning Routines provide multiple benefits: a wide representation of supports for helping students answer challenging questions, make comparisons, engage in decision making, explain the causes and effects of an event and engage in argumentation (Question Exploration, Cause and Effect, Decision Making, Cross Curricular Argumentation, Scientific Argumentation and Comparison).

In addition, repeated use across grade levels and content areas can increase the possibility of more efficient, effective and generalized use of reasoning skills. The HOTR routines have research- and evidence-based support, as provided in the following study that indicated improved student performance in writing essays, content knowledge, generalization of use of reasoning, notetaking skills, and mastery of associated reasoning strategies.

**Study reference:**

Bulgren, J. A., Marquis, J. G., Lenz, B. K., Schumaker, J. B., & Deshler, D. D. (2009). Effectiveness of question exploration to enhance students' written expression of content knowledge and comprehension. *Reading & Writing Quarterly: Overcoming Learning Difficulties*, 25(4), 271–289. <https://doi.org/10.1080/10573560903120813>

- The Purpose of this study was to examine the effectiveness of the Question Exploration Routine and associated graphic organizer, the Question Exploration Guide, to enhance the quality of students' written responses, content knowledge, and comprehension on a topic similar to those taught in inclusive core content course.
- \*Data illustrated how students can effectively use a Question Exploration Guide to write 5 (or 6) paragraph essay when evaluated according to the 6-Trait Writing analysis guidelines in this study.
- The Results of the study showed significant differences and moderately large to large effect sizes for students in the experimental condition compared to students in the control condition with regard to knowledge and comprehension of content, written response to a question when a 5-paragraph essay was scored using the 6-Trait Writing analysis, to take better notes and to learn the reasoning strategy.