Chemistry

Unit 5: The Chemistry of Climate Change

Workbook 2

Name: _____ Period: _____

Guiding Question:

Do Now:

Important Definitions and Equations:

Notes:

_____: The process of taking in and not reflecting something, such as a light ray or radiation.

_____: the total amount of carbon gases produced directly and indirectly through human activities that use carbon-based fuels

_____: the prevailing, average weather conditions influenced by temperature, precipitation, humidity, and other meteorological factors in a given region over a long period of time.

_____: any process, activity, or reservoir that releases a greenhouse gas (GHG) into the atmosphere.

_____: A long-term significant change in the Earth's climatic patterns.

_____the gradual increase of average surface temperatures of Earth caused by high levels of atmospheric carbon dioxide.

_____: The combined effect of certain gases in the atmosphere absorbing radiation, affecting the overall temperature of Earth.

_____: any gas that absorbs infrared radiation in the atmosphere and contributes to the greenhouse effect.

_____Electromagnetic radiation not visible to the eye, measured as heat or thermal energy.

_____: study of past climate and its causes and effects

_____: process of scattering or bouncing back light or radiation.

_____: electromagnetic radiation emitted as heat

_____: conditions in the atmosphere at a given time and location.

Response:

9 Climate, A Changing Environment

Considering Climate Change

Purpose

Use graphical data to investigate how climate changes over long periods of time.

Part 1: *Climate Change in the Golden State*

Read pages 2-6 in the supplemental materials provided. Answer the questions that follow.

1. How is climate change different from global climate change?

2. Is climate change normal? Explain your answer.

3. What would happen if there were no greenhouse gases on Earth? Explain.

4. What is happening now with greenhouse gases and how does it compare to previous ages?

5. Describe the observable results of climate change in California in recent years.

6. List at least 3 effects of climate change in California.

7. **Reflecting Back** What are some changes you or society can make (give at least 2) to help reduce your greenhouse emissions.

Part 2: **Interpreting Data**

Using the graph provided and the reading you just did, complete the materials that follow.

READ:

Temperature is one of the components of climate. As temperatures change, climate changes. Climatologists record the global temperature as a way to describe and predict how climate is changing.

5.2 Resource 1 (separate) shows a collection of temperature changes that have been reconstructed by various scientific teams from around the world. Each team looked at a different time period and used a variety of evidence to determine how Earth's temperature had changed, not the actual temperature at the time.

WRITE: ***Using the graph provided and the reading you just completed, answer the questions that follow. Make sure to justify your answer with evidence from both the graph and the article.***

8. Consider how the climate has changed in the past and the fact that the climate is continuing to change. How could life be different in the future?

9. What are some of the issues people need to consider when examining climate change?

Guiding Question:

Do Now:

Important Definitions and Equations:

Notes:

As energy enters Earth's atmosphere, it does many different things:

- It can be _____ high in the atmosphere and returns to space
- It can _____ the atmosphere and
  -
  -
- It can be _____ and then _____
  -
  -

Earth's atmosphere acts like a _____.

_____ absorb energy from the sun and traps it, warming the air and facilitating life within.

_____ in the atmosphere absorb energy from _____and _____, then _____ the energy, causing the planet to _____.

Without any atmosphere on Earth, there would be_____

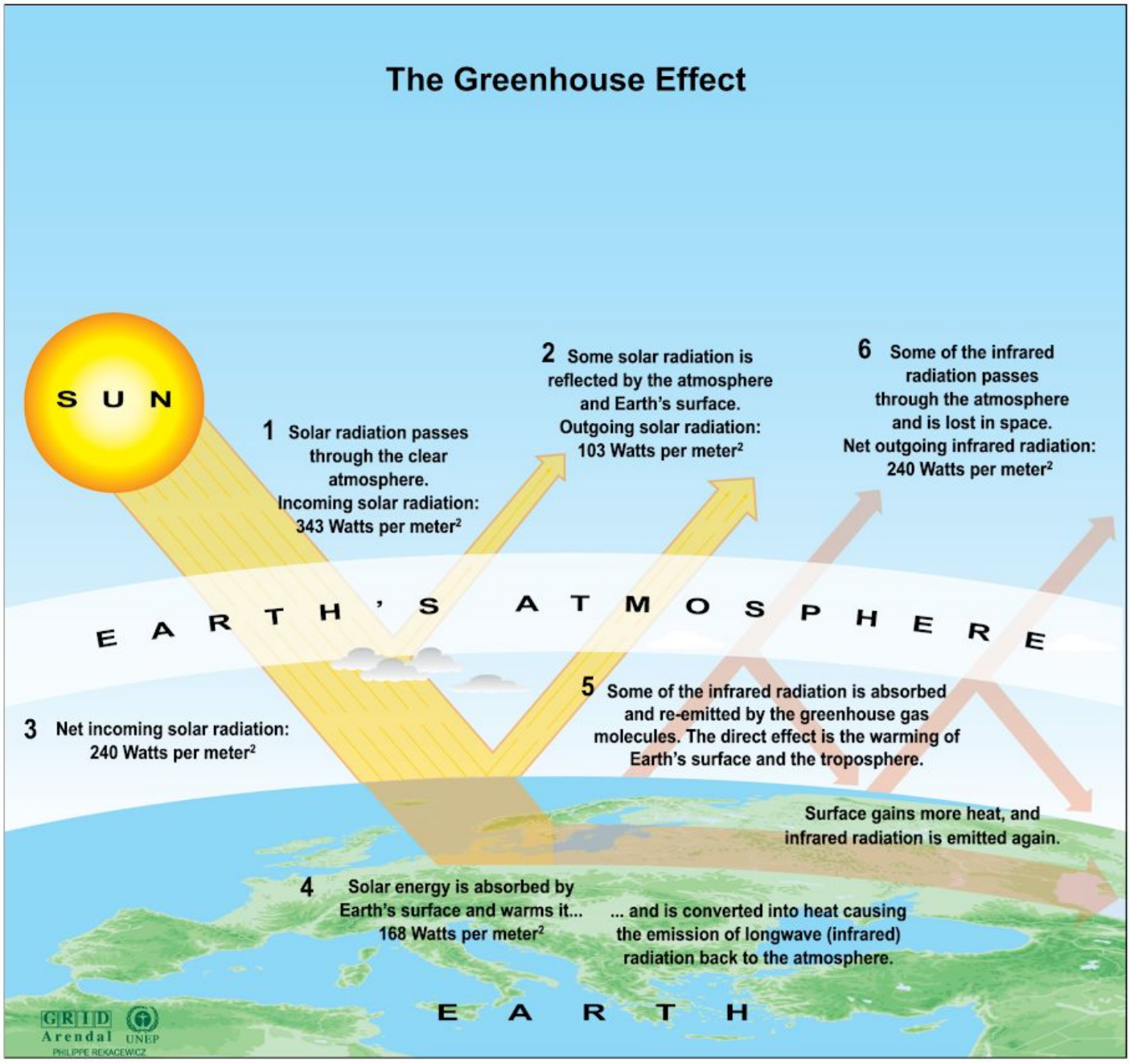
- This would make _____!
- Earth would be more like _____ – _____ _____!

Response:

10 Earth's Greenhouse

Describing Earth's Greenhouse Effect

Instructions: Use the illustration below to complete the following tasks.



Workbook 5.2 Date:

1. Summarize what happens to energy from the sun when it enters Earth's atmosphere.

2. What happens to the energy that is absorbed by Earth's surface?

3. Earth's atmosphere has greenhouse gases that naturally occur in it. If you increase the amounts of it, what would happen to the energy transmission pattern shown in the graphic on page 6?

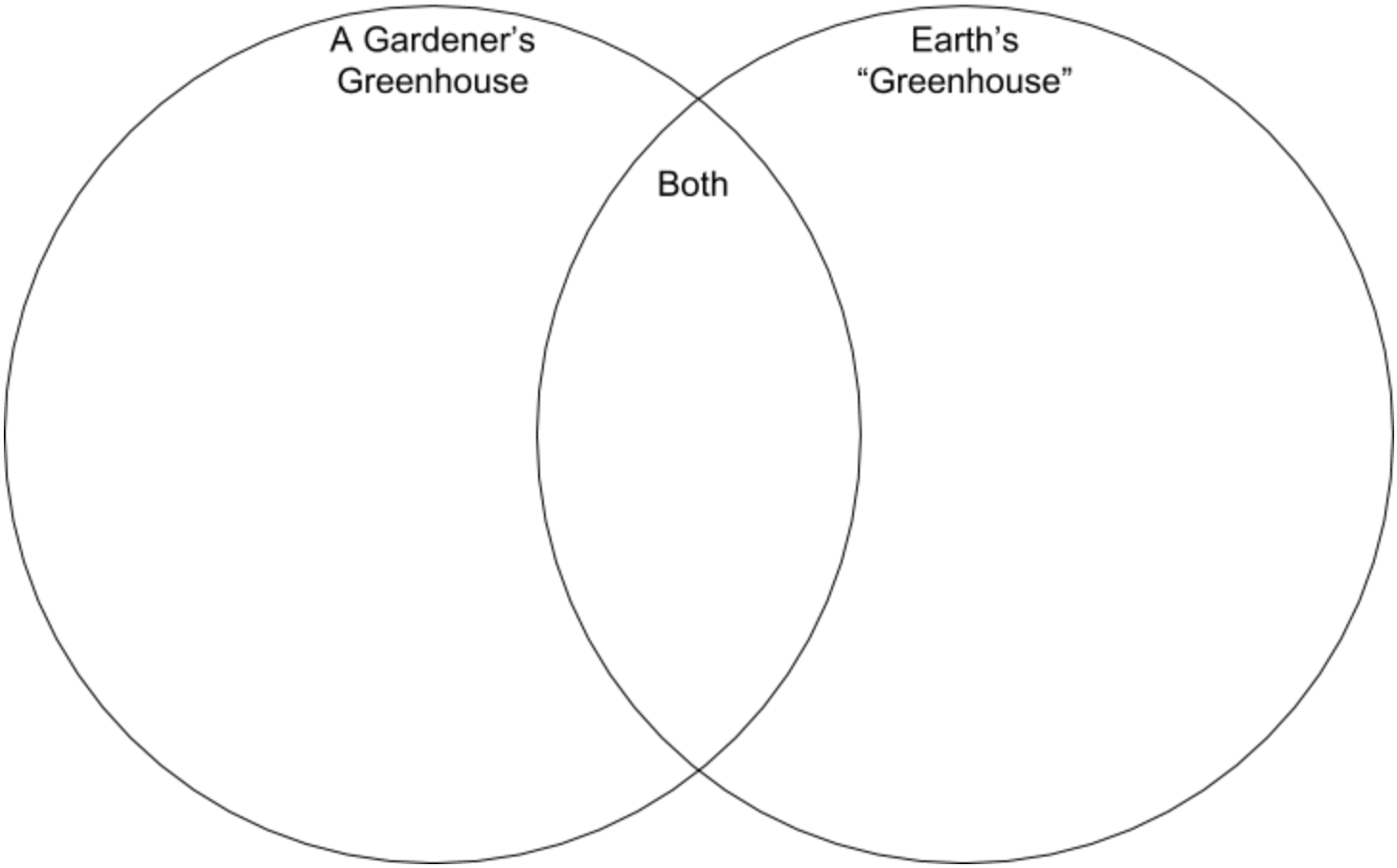
4. Describe how certain gases in the atmosphere (carbon dioxide, methane, water vapor, and nitrous oxide) influence Earth's thermal radiation, and how these gases affect Earth's atmosphere.

5. Explain what the "greenhouse effect" is and how it affects temperatures on Earth.

6. **Challenge Question:** Explain how keeping warm under a blanket mimics the Greenhouse effect. Draw a diagram to compare them:

Blanket	Greenhouse Effect

7. Complete the Venn diagram below by comparing a gardener's greenhouse to Earth's "greenhouse." How are they similar? How are they different?



Guiding Question:

Do Now:

Notes:

Water Vapor

- Sources:
- Sinks :
- Human Influence:

Carbon Dioxide

- Sources:
- Sinks :
- Human Influence:

Methane

- Sources:
- Sinks:
- Human Influence:

Nitrous Oxide

- Sources:
- Sinks:
- Human Influence:

Other:

- Sources:
- Sinks:
- Human Influence:

Response:

11 Getting Gassy
Sources and Sinks of Greenhouse Gases

Purpose
Investigate various greenhouse gases (GHG) and their sources and sinks.

Directions
Using the reading resource provided, determine the sources, sinks, and human influences. The discussion questions in the readings will help you fill out the organizer below.

GHG	Sources and Sinks
Water Vapor	Sources Sinks Human Influences
Carbon Dioxide	Sources Sinks Human Influences

GHG	Sources and Sinks
Methane	Sources Sinks Human Influences
Nitrous Oxide	Sources Sinks Human Influences

GHG	Sources and Sinks
Other	Sources Sinks Human Influences

Guiding Question:

Do Now:

Important Definitions and Equations:

Notes:

- Increases in GHGs can result in _____

  _____.
  - There is a _____ between changes in greenhouse gas concentrations and temperature changes.
- Concentrations of carbon dioxide and methane are at the _____ in our available historical records from

  _____
- There is a connection between _____ and _____
  - An increase in _____ does result in increased _____, which causes shifts in _____.

Response:

12 Reading the Ice
GHGs and Climate Change

Purpose

Use graphical data to investigate how ice can be used to study historical climate.

Directions

Studying data from natural recorders, like tree rings (called *proxy data*) shows us that throughout much of Earth's geologic past, changes in climate occurred over long periods. The scale of these changes was generally large whether the transition was from periods of cold to warm, or the opposite. Respond the the questions using the information from the ice core graph in 5.2 Reference 2 and what you learned in *What can ice tell us about past climate?* (page 15 in Student Edition).

1. Describe what happens to carbon dioxide and methane over time.

2. How does the temperature data compare to changes in carbon dioxide and methane gases? Explain your answer.

3. What is the overall pattern we can draw from this data in 5.2 Resource 2? How would you describe this pattern?

4. How does the concentration of methane and carbon dioxide from 320,000 years ago compare with current concentrations?

5. Were the concentrations of methane and carbon dioxide ever higher than they are today?

6. Based on this data, would you conclude that temperatures are warming or cooling? Use evidence from the reading and resource to support your answer.

7. Given ancient ice core data and your understanding of the greenhouse effect, what conclusions can you draw about global climate change?

Guiding Question:	
Do Now:	
Important Definitions and Equations:	**Notes:**
Response:	

13 Too Much of a Good Thing?

Predicting a Warming Trend

Purpose

Use data and current trend patterns to predict potential outcomes of current global warming trend.

Directions

In this activity, you will be using graphic materials and other previous resources to predict future potential outcomes. Read the short description regarding different emission scenarios **below**, and compare to *5.2 Resource 3*. Use this material and material presented in lessons 9-12 to answer the questions that follow. Remember to use evidence in your answer and cite by indicating lesson number and page number in parenthesis.

Ex: Chemistry is awesome (Lesson 1, pages 1-2).

Read:

Lower Emissions Scenario
This scenario predicts that global population growth will slow, and people will switch from using fossil fuels to technologies that are cleaner and greener. In this scenario, greenhouse gas emissions will peak by 2050 and then decline, with carbon dioxide emissions doubling from pre-industrial levels by 2100.

Medium-High Emissions Scenario
This scenario projects continuous population growth and the introduction of some new technologies to replace fossil fuels. In this scenario, greenhouse gas emissions increase throughout the century, and CO_2 emissions triple by 2100 from pre-industrial levels.

High Emission Scenario
This scenario predicts a world in which fossil fuels are a main source of energy. In this scenario, new fossil-fuel-free technologies are not introduced until the end of the century. By 2100, greenhouse gas emissions will more than triple from pre-industrial levels.

Questions: *Use the descriptions above and 5.2 Resource 3 to answer these. Make sure to use evidence and cite as shown above.*

1. What is global climate change?

2. What do scientists think is the likely cause of it?

3. How could global climate change affect our human communities?

4. What actions could be taken to avoid the projected results that would arise with the “High Emissions Scenario”?

Guiding Question:

Do Now:

Important Definitions and Equations:

Notes:

Response:

14 Deciding About the Atmosphere
Reconsidering Climate Change

Purpose

Investigate scientific discoveries about GHGs and policies implemented by government.

Part 1: Reading *California's Global Warming Solutions Act of 2006*

1. What were the goals of the act?

2. Based off of the timeline provided on page 16 in the reading, what things do you see in your daily life that address these goals?

3. Pick 4 *Discoveries* and their *Policy or Decision* on pages and record them in the space below. Then explain why you think lawmakers made the decision that they did based on the *Discovery*.

Discovery	**Policy or Decision**	**Explanation**

Part 2: Applying It to Us

In the space below, outline a proposal to present to our school board on how our school (1) contributes currently to greenhouse gas emissions (*problem)* and (2) how we can reduce those emissions (*solution*). Be sure to list real, applicable things that you are willing to take part of and help do on our campus to reduce GHGs produced by our school.

Workbook 5.2 Date:

Part 3: Putting it all together

CER - Claim Evidence Reasoning
Select one of the prompts below and circle it. Then use the CER template below to answer the question. You must cite at least 3 specific pieces of evidence for the CER

1. How has climate changed in the past and how is it continuing to change?
2. How could life be different in the future?
3. What are some of the issues people need to consider when examining climate change?

Claim	*Statement about the results of an investigation. Answers the Question.*
Evidence	*Scientific data used to support the claim. Use numbered evidence and numbered reasoning to tie them together.*
Reasoning	*Ties together the claim and the evidence. Use numbered evidence and numbered reasoning to tie them together.*