

REDUCTION OF HEAT EFFECT - GAS EMISSIONS

The Chemistry of the "Blanket"

1. How Gases Trap Heat

To understand how to reduce emissions, we must understand the science. Our atmosphere is mostly nitrogen and oxygen, but these gases do not trap heat. Only **Greenhouse Gases (GHGs)** have the specific chemical structure to absorb infrared radiation (heat).

When sunlight hits the Earth, the surface warms up and radiates heat back toward space. Greenhouse gases catch this heat and send it back to the surface. This is why we call it the "Heat Effect."

2. Global Warming Potential (GWP)

Scientists use a measurement called **GWP** to compare gases.

- **CO₂** has a GWP of **1**. It stays in the air for hundreds of years.
- **Methane (CH₄)** has a GWP of about **28**. This means it is 28 times more powerful than CO₂ at trapping heat, even though it disappears faster.
- **Nitrous Oxide (N₂O)** has a GWP of **265**!

Decarbonizing the Energy Sector

1. The Problem with Combustion

For 200 years, humans have used "combustion" (burning) to get energy. Whether it is a car engine or a coal power plant, burning fuel releases carbon that was stored underground for millions of years. This "extra" carbon is what unbalances our climate.

2. The Solution: Electrification

The biggest strategy for reduction is **Electrification**. This means moving everything to run on electricity and then making that electricity "green."

- **Electric Vehicles (EVs):** By replacing gasoline engines with electric motors, we remove CO₂ from the streets.
- **Heat Pumps:** Replacing gas heaters in homes with electric heat pumps that use energy from the outside air.

3. Smart Grids

A "Smart Grid" is a digital electricity system. It helps manage wind and solar power (which change depending on the weather) to make sure no energy is wasted.

Agriculture and Methane Reduction

1. The Food-Climate Connection

Agriculture is responsible for about 25% of all global emissions. It is a difficult sector to change because we must still produce food for billions of people.

2. Reducing Methane

Methane is a "short-lived" gas. If we reduce it now, the Earth will cool down very quickly.

- **Better Feed:** Scientists are developing special seaweed snacks for cows that reduce the methane they produce during digestion.
- **Rice Farming:** Farmers are learning to grow rice with less water (Alternate Wetting and Drying), which stops methane-producing bacteria from growing in the mud.

3. Regenerative Farming

This is a style of farming that focuses on soil health. Healthy soil acts like a sponge for carbon. By not plowing the land too much, farmers can keep CO₂ trapped in the ground instead of letting it escape into the air.

SUSTAINABLE VS. TRADITIONAL

OUTCOMES OF REGENERATIVE AND CONVENTIONAL AGRICULTURE



Industrial

Innovation and Carbon Capture

1. "Hard to Abate" Industries

Some things are very hard to make without releasing CO₂, like **concrete** and **steel**. These industries require extremely high heat that electricity cannot always provide.

2. Green Hydrogen

Scientists are testing **Hydrogen** as a clean fuel. When you burn hydrogen, the only waste product is **water (H₂O)**. If we make hydrogen using renewable energy, it is a perfect "zero-emission" fuel for big ships and factories.

3. Carbon Capture and Storage (CCS)

This is a technology that "scrubs" CO₂ out of factory chimneys before it reaches the sky. The gas is then compressed into a liquid and pumped deep underground into old oil wells where it can stay safely forever.

The Circular Economy and Waste

1. From "Linear" to "Circular"

The traditional economy is **Linear**: We take resources → make a product → throw it away. This creates massive emissions during production and methane in landfills.

The **Circular Economy** aims to eliminate waste. Products are designed to be repaired, reused, or recycled perfectly.

2. Landfill Management

When organic waste (food, paper, wood) rots in a landfill without oxygen, it creates methane.

- **Composting**: Turning food waste into fertilizer prevents methane.
- **Landfill Gas Capture**: Some modern landfills have pipes that "catch" the methane and burn it to create green electricity.

3. Sustainable Consumption

Reducing emissions also means buying fewer things. Every product (a phone, a shirt, a toy) has "embodied carbon"—the total amount of CO₂ released during its creation and transport.

Global Policy – The "Rules" of Reduction

1. Net Zero

Many countries have a goal called "**Net Zero**" by 2050. This means they will reduce emissions as much as possible, and any tiny amount left over will be absorbed by planting new forests.

2. Carbon Pricing

To encourage companies to change, governments use **Carbon Taxes**. If a company pollutes a lot, they must pay a high tax. This makes green technology cheaper and more attractive for businesses.

3. International Cooperation

The **Paris Agreement** is the most important treaty. It requires every country to report their emissions every year and show a plan for how they will reduce them. This creates "transparency" and encourages everyone to do their part.

Task 1: Emission Awareness (True/False)

Read the statements and decide if they are True (T) or False (F).

1. Greenhouse gases trap heat in the atmosphere like a blanket. ()
2. Oxygen is the gas most responsible for global warming. ()
3. Burning coal and oil releases carbon dioxide (CO₂). ()
4. Methane is a weak gas that does not affect the temperature. ()
5. Renewable energy sources, like wind, produce zero emissions. ()
6. Energy efficiency means using more electricity to finish a task. ()
7. Forests help reduce emissions by absorbing carbon dioxide. ()
8. Electric cars help reduce the "heat effect" from transportation. ()
9. Agriculture (farming) does not produce any greenhouse gases. ()
10. The goal of emission reduction is to keep the planet's temperature stable. ()

Task 2: Multiple Choice

Circle the correct answer (A, B, or C).

1. **Which gas is produced in large amounts by cows?**
A. Oxygen B. Methane C. Nitrogen
2. **What is a "Fossil Fuel"?**
A. Solar power B. Coal C. Wind energy
3. **What does a "Carbon Sink" do?**
A. Produces CO₂ B. Absorbs CO₂ C. Heats the ocean
4. **Energy efficiency is best described as:**
A. Using energy wisely B. Wasting energy C. Not using any tools
5. **Which of these is a renewable energy source?**
A. Natural Gas B. Oil C. Solar Power

Task 3: Vocabulary Gap Fill

Fill in the gaps using the words from the box.

WORD LIST: *emissions, renewable, transition, methane, efficiency, fossil, atmosphere, sustainable, carbon, reduction*

1. We must move away from _____ fuels to protect the air.
2. Solar energy is a _____ source that never runs out.
3. The _____ of greenhouse gases is our main goal.
4. Greenhouse gases stay in the _____ and trap heat.
5. High energy _____ means your house stays warm with less heating.
6. Cows and landfills are the main sources of _____ gas.
7. The _____ to green energy will take many years.
8. Every car has a _____ footprint based on its fuel use.
9. Schools can adopt _____ policies to reduce waste.
10. Factory _____ are often regulated by the government.

Task 4: Definitions Matching

Match the term to the correct definition.

Mitigation (___)	A. Power from the sun or wind.
Renewable Energy (___)	B. Actions to reduce the severity of climate change.
Carbon Footprint (___)	C. A gas that traps heat in the air.
Greenhouse Gas (___)	D. The total amount of GHGs produced by a person.
Reforestation (___)	E. Planting trees to absorb CO ₂ .

Task 5: Sentence Completion

Complete the sentences using your own words.

- To reduce CO₂ emissions in my city, we should _____.
- If we use renewable energy, the atmosphere will _____.
- Methane is a dangerous gas because it _____.
- We can improve energy efficiency at home by _____.
- Protecting the forests is important because _____.

TEACHER'S ANSWER KEYS

Task 1 (T/F): 1.T, 2.F, 3.T, 4.F, 5.T, 6.F, 7.T, 8.T, 9.F, 10.T

Task 2 (MC): 1.B, 2.B, 3.B, 4.A, 5.C

Task 3 (Gap Fill): 1.fossil, 2.renewable, 3.reduction, 4.atmosphere, 5.efficiency, 6.methane, 7.transition, 8.carbon, 9.sustainable, 10.emissions.

Task 4 (Match): 1-B, 2-A, 3-D, 4-C, 5-E.

Task 5 (Sentences): (Suggested) 1.Use public transport, 2.Become cleaner/cooler, 3.Traps a lot of heat, 4.Turning off lights/using LEDs, 5.They are carbon sinks.

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