

MR. HARDEN

4TH and 5TH GRADE SCIENCE

Introduction to Science

NAME

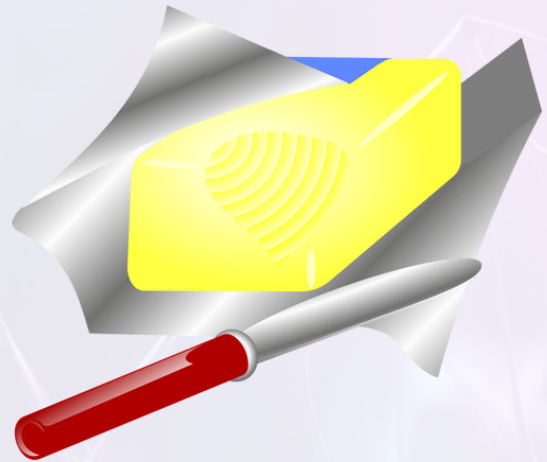


Introduction to Science:

The Carbon-Based Butter Crisis and Beyond

1. The carbon-based butter crisis

We often hear that our planet is getting warmer because of gases like carbon dioxide (CO_2) trapping heat from the Sun. A lot of these gases come from raising cows and other animals. The United Nations reports that livestock farming (meat and dairy) produces about 14.5 % of all global greenhouse-gas emissions. Cows also eat plants grown on huge farms, drink lots of water and make methane – another warming gas. Scientists and inventors are looking for ways to reduce these emissions. One new idea is to make butter from carbon instead of cows. A company called Savor found a way to combine



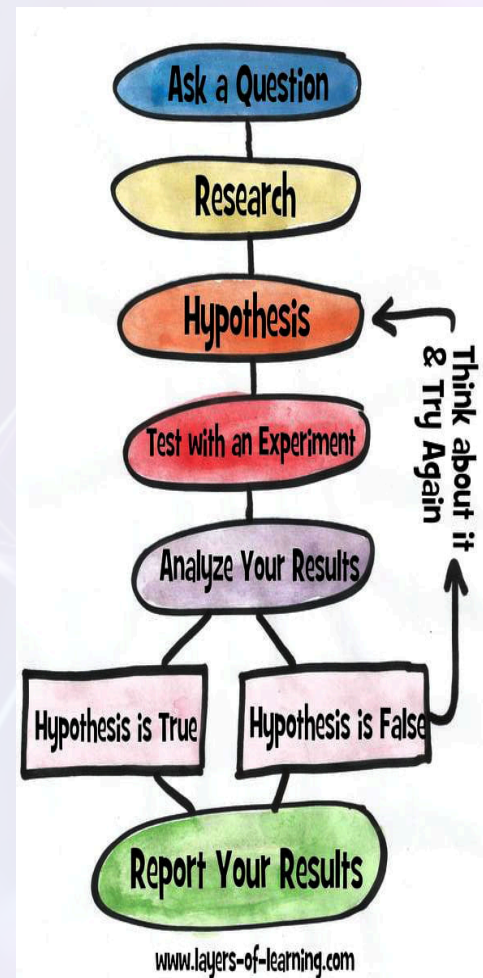
carbon dioxide from the air with hydrogen from water to build fat molecules similar to those found in dairy butter. Their process produces no greenhouse-gas emissions and uses almost no farmland. According to early estimates, this “carbon-based butter”

could have a climate footprint of less than 0.8 g of CO_2 equivalent per calorie,

much lower than the 2.4 g CO₂ per calorie for regular butter. Savor's butter isn't sold in stores yet, but the company hopes it will be available around 2027.

2. How scientists use science to create change

This story about butter shows how science can solve big problems. First, scientists ask questions like “How can we make foods without using cows?” Then they gather information and create hypotheses (ideas) about how to do it. In Savor's case, the team knew that fats are chains of carbon and hydrogen, so they wondered if they could build these chains from gases. They set up experiments in a lab, combining CO₂ and hydrogen under special conditions to form a waxy fat. When the experiments worked, they analysed the results, tasted the product and compared its climate footprint with regular butter. Finally, they communicated their discovery so others could learn from it and support further research. This method – ask, test, observe and share – is used in all areas of science, from studying stars to making medicine. Scientists are also careful to repeat experiments and have others check their work to make sure the results are true.



Questions after sections 1-2

1. Why do scientists want to reduce greenhouse-gas emissions from cows?
 - A. Cows taste bad
 - B. Raising cows produces gases that warm Earth
 - C. Cows make butter cheaper
 - D. Cows drink water
2. What two gases does Savor combine to make carbon-based butter?
 - A. Oxygen and nitrogen
 - B. Carbon dioxide and hydrogen
 - C. Helium and hydrogen
 - D. Methane and oxygen
3. Which statement about carbon-based butter is true?
 - A. It is already sold in every grocery store
 - B. It produces more CO₂ than regular butter
 - C. It uses almost no farmland
 - D. It cannot be eaten
4. What step comes first in the scientific method?
 - A. Share results
 - B. Make butter
 - C. Ask a question
 - D. Taste the product
5. Why do scientists repeat experiments and let others check their work?
 - A. To make their work secret
 - B. To make sure the results are true
 - C. To sell the product faster
 - D. To use more cows

3. Lab safety rules

Working safely is essential in any laboratory, whether you are making butter

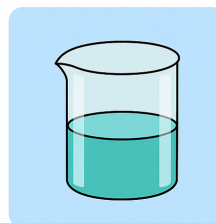


or examining rocks. Never touch chemicals or lab equipment unless your teacher tells you to. Always follow written and verbal instructions, and ask questions if you do not understand. Do not work in the lab without a teacher present. Eating, drinking, playing or using mobile phones is strictly forbidden in the lab because food and devices can become contaminated. Before using any chemicals, read the label and keep the container away from your face. Wear safety goggles, a lab coat and closed shoes to

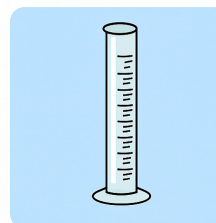
protect your eyes and skin. Check glassware for cracks and let hot equipment cool before touching it. Most importantly, if an accident happens, stay calm and inform your teacher right away.

4. Science equipment and measurements

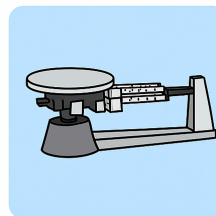
Scientists use many tools to investigate and measure the world. A beaker is a cylindrical container with a small pouring spout. It is great for holding, mixing and heating liquids; some beakers have marks to give a rough idea of volume, but they are not very precise. For accurate measurements, we use a graduated cylinder – a tall, narrow tube with markings like a ruler. To read it correctly, look at the meniscus, the curve at the surface of the liquid, and make sure your eyes are level. The cylinder helps us measure volume in



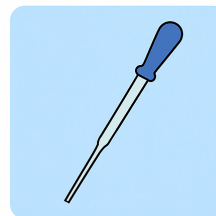
Beaker



Graduated cylinder



Triple beam balance



Pipette



millilitres (mL). A triple beam balance measures mass. It has a pan on one side and three sliding weights on parallel beams on the other. You move the weights until the pointer lines up with zero, then add the values to find the mass. Mass is recorded in grams (g). A pipette is like a super-accurate dropper. Scientists use pipettes to transfer small amounts of liquid very precisely. Simple transfer pipettes have a squeeze bulb, while micropipettes can measure tiny volumes, even fractions of a millilitre. An Erlenmeyer

flask looks like a cone with a narrow neck. The conical shape reduces spills

and evaporation when mixing or heating liquids. Finally, a thermometer measures temperature—how hot or cold something is. Laboratory thermometers often have a long stem and a bulb filled with a liquid (such as alcohol or mercury) that expands when heated and contracts when cooled.

Questions after sections 3–4

1. Why should you never eat or drink in a science lab?
 - A. It wastes food
 - B. Food could be contaminated by chemicals
 - C. There are no tables
 - D. Teachers don't allow water
2. What should you do if something breaks or an accident happens in the lab?
 - A. Hide it from the teacher
 - B. Panic and run
 - C. Inform your teacher immediately
 - D. Continue the experiment
3. Which tool gives you the most accurate liquid volume measurement?
 - A. Beaker
 - B. Graduated cylinder
 - C. Pipette
 - D. Thermometer
4. What does a triple beam balance measure?
 - A. Temperature
 - B. Length
 - C. Mass
 - D. Volume
5. Why is the neck of an Erlenmeyer flask narrow?
 - A. To make it look pretty
 - B. To reduce evaporation and prevent spills
 - C. So you can drink from it
 - D. To measure length

Summary cloze notes

Summary Cloze Notes

Fill in the blanks using words from the word bank. Each blank represents one word.

Word bank: beaker – carbon – CO₂ – fat – hydrogen – mass – meniscus – mercury – microscope – pipette – safety – scientist – spout – temperature – thermometer – triple beam balance – volume

1. Livestock farming produces a lot of ____ (greenhouse gas) that causes our planet to warm.
2. Savor makes butter by combining carbon dioxide and ____.
3. A ____ is a cylindrical container with a small ____ for pouring.
4. A graduated cylinder has markings so you can read the liquid's ____ by looking at the bottom of the ____.
5. To measure an object's ____, use a ____.
6. A ____ allows scientists to move a very exact amount of liquid from one place to another.
7. An Erlenmeyer flask's narrow neck helps prevent spills and reduce evaporation, making it good for mixing liquids and measuring ____.
8. A laboratory ____ has a long stem and a bulb that often contains ____, which expands when heated.
9. Always follow the lab ____ rules: listen to your teacher, wear goggles and never eat or drink in the lab.
10. A ____ is a measure of how much matter is in an object, while ____ measures how hot or cold something is.
11. Scientists use the scientific method to ask, test, observe and share when solving problems such as making butter from ____.
12. In a graduated cylinder, you read the meniscus at eye level to get an accurate measurement of ____.

13. The triple beam balance has sliding weights on parallel beams that you move to find an object's ____.
14. To reduce greenhouse-gas emissions from food, scientists are creating a new carbon-based butter using captured ____.
15. A pipette is like a super-accurate dropper used to transfer small amounts of liquid; it often works alongside a beaker or flask to measure ____.

Answer key

Multiple-choice answers

1. B 2. B 3. C 4. C 5. B 6. B 7. C 8. B 9. B 10. B

Cloze notes answers

1. CO₂ 2. hydrogen 3. beaker, spout 4. volume, meniscus 5. mass, triple beam balance 6. pipette 7. volume 8. thermometer, mercury 9. safety 10. mass, temperature 11. carbon 12. volume 13. mass 14. carbon dioxide 15. volume

Vocabulary List

- **Planet** – a large body in space that goes around a star, like Earth.
- **Water** – the clear liquid all plants and animals need to live.
- **Animal** – a living creature that can move and eats food.
- **Emissions** – gases or particles that are released into the air.
- **Livestock** – farm animals such as cows, pigs and chickens that people raise for food.
- **Inventor** – someone who creates or designs a new product or process.
- **Experiment** – a test done to see how something works or to answer a question.
- **Environment** – everything around us (air, water, land) where people, animals and plants live.

- **Contamination** – when something is made dirty or unsafe by harmful substances.
- **Parallel** – two lines or objects that stay the same distance apart and never meet.
- **Carbon dioxide** – a gas that people and animals breathe out; plants use it to grow, and it can trap heat in the atmosphere.
- **Methane** – a gas made by cows and other sources that also holds heat in the air.
- **Hydrogen** – a very light gas; when combined with carbon dioxide it can form fats.
- **Greenhouse gas** – a gas that keeps heat in Earth's atmosphere and makes the planet warmer.
- **Climate footprint** – a measure of how much a product or activity adds to global warming.
- **Hypothesis** – a possible answer or explanation that a scientist tests through experiments.
- **Scientific method** – a step-by-step way scientists answer questions by asking, testing, observing and sharing results.
- **Mass** – the amount of matter in something; how heavy it is.
- **Volume** – the amount of space something takes up (like how much liquid fits in a container).
- **Evaporation** – the process where a liquid slowly changes into a gas.

Vocabulary Practice Test

Multiple Choice (choose the best answer):

1. Which of the following best describes a **planet**?
 - A. A large body in space that orbits a star
 - B. A tiny drop of water
 - C. A type of gas
 - D. A lab tool
2. Which animals are called **livestock**?
 - A. Tigers and lions
 - B. Frogs and fish
 - C. Cows and chickens
 - D. Dogs and cats
3. The amount of matter in something is called its:
 - A. volume
 - B. mass
 - C. environment
 - D. experiment
4. When a liquid slowly turns into a gas, this process is called:
 - A. evaporation
 - B. contamination
 - C. invention
 - D. parallel

5. **Carbon dioxide** is:

- A. a sweet liquid
- B. a gas that people breathe out and plants use to grow
- C. a type of solid metal
- D. a tiny animal

6. Which gas is combined with CO₂ to make carbon-based butter?

- A. methane
- B. hydrogen
- C. water
- D. oxygen

7. What do we call the natural surroundings—air, water and land—where people, animals and plants live?

- A. emissions
- B. environment
- C. mass
- D. hypothesis

8. Which word names a person who creates or designs a new thing?

- A. inventor
- B. livestock
- C. experiment
- D. emission

9. A gas that traps heat in the atmosphere and warms Earth is called a:

- A. planet
- B. contamination

- C. greenhouse gas
- D. volume

10. When scientists test an idea to find out what happens, they perform a(n):

- A. environment
- B. experiment
- C. hypothesis
- D. scientific method

True or False:

- 11. A **hypothesis** is an idea or guess that scientists can test.
- 12. **Emissions** are gases or particles that get released into the air.
- 13. **Hydrogen** is a heavy gas used to build houses.
- 14. **Methane** is a gas made by cows and other sources that holds heat in the air.
- 15. **Parallel** lines cross each other at one point.
- 16. **Volume** measures how much space something takes up, and **mass** measures how much matter is in it.

Fill in the Blank:

- 17. The clear liquid that all living things need to survive is called _____.
- 18. Scientists follow a series of steps called the _____ to ask questions, test ideas and share results.
- 19. Making something dirty or unsafe with harmful substances is called _____.
- 20. Two lines that run side by side and never meet are _____.
- 21. A measure of how much a product or activity adds to global warming is its climate _____.
- 22. Dogs, cats and cows are examples of an _____.

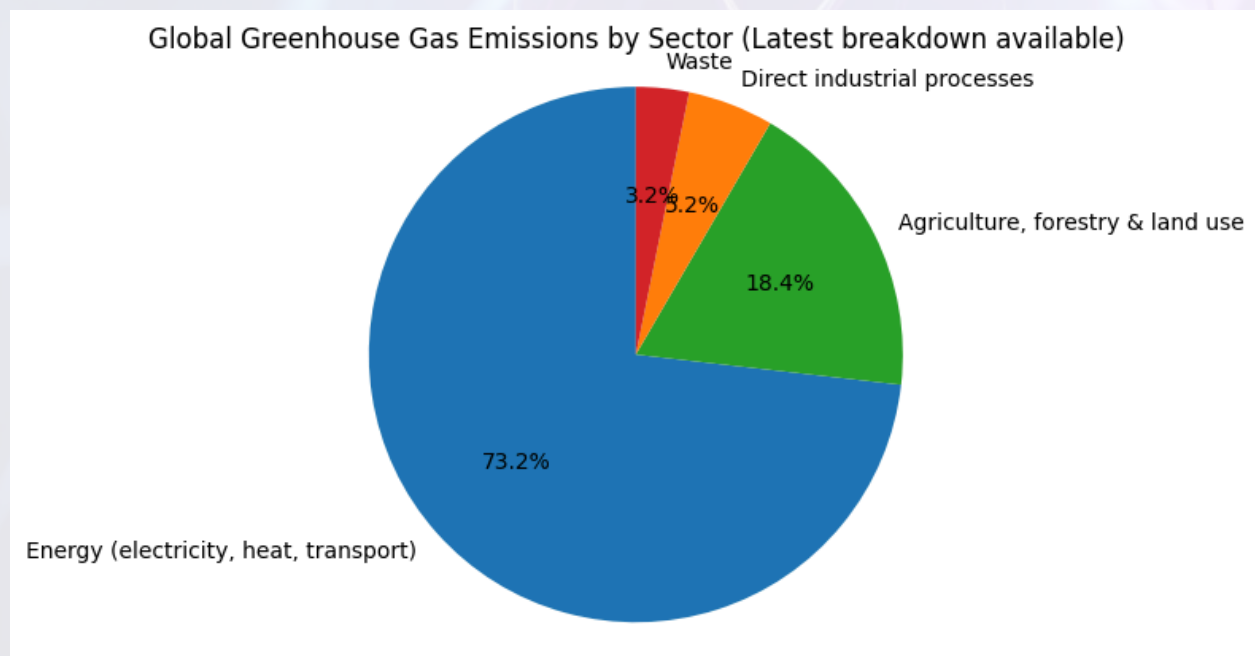
Answer Key

1. A 2. C 3. B 4. A 5. B 6. B 7. B 8. A 9. C 10. B
11. True 12. True 13. False 14. True 15. False 16. True
17. Water 18. Scientific method 19. Contamination 20. Parallel 21. Footprint 22. Animal

PIE CHART STUDY

The most recent widely available breakdown of global greenhouse-gas emissions by sector comes from a data set collected in 2016. According to this breakdown, energy use for electricity, heating and transport produces about 73.2 % of total emissions. Activities linked to agriculture, forestry and land use — such as livestock farming, rice cultivation and deforestation — contribute roughly 18.4 %. Direct industrial processes like cement and chemical production add around 5.2 %, and waste management (landfills and wastewater treatment) releases about 3.2 %. Even though these figures are several years old, they remain the clearest picture of how human activities contribute to global greenhouse-gas emissions as of 2025.

Below is a pie chart showing these sectors and their approximate shares of global emissions:



Key percentages used in the chart

Sector	Percentage	Notes
Energy (electricity, heat & transport)	73.2 %	Burning fossil fuels for power, heat and transport dominates global emissions.
Agriculture, forestry & land use	18.4 %	Emissions from livestock, soils, rice cultivation, deforestation and other land uses.
Direct industrial processes	5.2 %	Cement, chemicals and petrochemicals produce CO ₂ during manufacturing.
Waste	3.2 %	Methane and nitrous oxide from landfills and wastewater treatment.

Interpretation: The chart highlights that cutting energy-sector emissions is key to mitigating climate change. Transitioning to renewable power, using energy more efficiently and electrifying transport would address the largest share of emissions. Agriculture and land use are the next major sources, so sustainable farming, forest conservation and diet changes can also have a significant impact. Improving industrial processes and waste management further contributes to reducing the smaller sectors' emissions.

Chart-Interpretation Questions

1. Which sector is responsible for about three-quarters of global greenhouse-gas emissions?
 - A. Agriculture, forestry & land use
 - B. Energy use (electricity, heat & transport)
 - C. Direct industrial processes
 - D. Waste
2. Which sector is the second-largest source of emissions?
 - A. Waste
 - B. Direct industrial processes
 - C. Agriculture, forestry & land use
 - D. Energy use
3. Waste management accounts for roughly:
 - A. Less than 1 %
 - B. About 3 %
 - C. About 10 %
 - D. About 20 %
4. If agriculture, forestry and land use emissions were cut in half, they would represent approximately:
 - A. 9.2 %
 - B. 18.4 %
 - C. 36.8 %
 - D. 5.2 %
5. True or False: Direct industrial processes emit more greenhouse-gas emissions than agriculture, forestry and land use.

6. Based on the chart, which action would probably have the greatest impact on cutting total emissions?
- A. Increasing recycling programs
 - B. Expanding renewable energy and electrifying transport
 - C. Planting small gardens
 - D. Using less office paper
7. Together, the two smallest sectors (direct industrial processes and waste) contribute approximately:
- A. 3 %
 - B. 8 %
 - C. 14 %
 - D. 21 %
8. True or False: Changing farming practices and diets could influence nearly one-fifth of global emissions.
9. The difference between the largest sector (energy) and the smallest sector (waste) is closest to:
- A. 70 percentage points
 - B. 50 percentage points
 - C. 30 percentage points
 - D. 20 percentage points

Answer Key

1. **B** — Energy use (electricity, heat & transport)
2. **C** — Agriculture, forestry & land use
3. **B** — About 3 %
4. **A** — 9.2 %
5. **False** — Direct industrial processes (5.2 %) emit far less than agriculture and land use (18.4 %).
6. **B** — Expanding renewable energy and electrifying transport would address the largest sector.
7. **B** — About 8 % (5.2 % + 3.2 %).
8. **True** — Agriculture and land use contribute about one-fifth of the total.
9. **A** — Approximately 70 percentage points (73.2 % – 3.2 %).