7 Air

Air is the gaseous state of matter. It contains gases like nitrogen, oxygen, and carbon dioxide. It also contains water in the form of water vapour, dust particles, and germs. Plants and animals need air to live. Plants use carbon dioxide present in the air to make their food. Animals and plants take in oxygen from the air for breathing.

Learn about

- Matter
- Air
- Components of air
- Uses of air
- Air pollution

Before learning about air in detail, let us first revisit the concept of matter.

▶ Matter

Any substance that occupies space and has mass is called ***matter***. The three states of matter are solid, liquid, and gas. Matter is made up of small particles. However, the arrangement of these particles differs in the three states of matter.

Solids are the substances in which particles are tightly packed. Therefore, most solids are hard and have a fixed shape. Hat, wood, ice, and bicycle are a few examples of solids.


Hat


Wood


Bicycle


Ice

Examples of solids

Liquids are the substances in which particles are loosely packed. Thus, these particles get some space to move around. Hence, liquids do not have a fixed shape. Milk, tea, lassi, and water are a few examples of liquids.


Mango lassi


Tea


Water

Milk

Examples of liquids

Gases are the substances in which particles are very loosely packed. Thus, these particles get enough space to move around freely. Gases occupy the entire space available to them. Air and cooking gas are mixtures of gases.

Examples of gases

REMEMBERING UNDERSTANDING

Questions

Fill in the blanks with a suitable word.

1. A book occupies space and has mass; so it is a ..... .
2. The three states of matter are ....., ..., and ..... .
3. Solids are ..... and have a fixed ..... .
4. Particles of a liquid are ..... packed.
5. ..... is a mixture of gases.

▶ Air

Air is present all around us. We cannot see, smell, or touch it. However, we can feel air when it moves. *Moving air is called* ***wind****. A gentle wind is called a* ***breeze****.*

Properties of Air

Air can change the shape of things When air is filled into a flat tyre, the tyre changes its shape. A flat football becomes round when air is filled into it. A balloon becomes much larger and round in shape when air is blown into it. This shows that air can change the shape of things.


Air can change the shape of things.

Air fills up space Air is present everywhere. If you push an empty bottle into a bucket full of water, you will see bubbles coming out of the water. These are bubbles of air that were present inside the bottle.

Air fills up space.

Air has weight To find this out, you will need a weighing machine and a deflated[1] football. Put the deflated football on the weighing machine and note its weight. Now, fill air into this deflated football and compare their weights. The football filled with air will be heavier than the deflated football.

Air has weight.

Air has no colour We cannot see air around us. It is colourless. But we can feel it when it blows.

Air expands When air gets heated up, its particles move farther apart from each other and thus it expands. Let us perform an experiment to understand this easily.

Activity

(Adult supervision required)

Aim: To show that air expands on being heated

Materials required: A balloon, an empty glass water bottle, and a bowl containing hot water

Procedure:

1. Stretch the balloon over the mouth of the glass bottle.
2. Now, place the glass bottle in the bowl containing hot water for some time.

Observation: The balloon starts blowing up. As the air inside the bottle gets heated, it moves faster in all directions and also enters the balloon. In this way, we can observe that air expands. If we take out the bottle from the bowl, the balloon collapses again as air gradually cools down and, thus, contracts.

Conclusion: Air expands on being heated.

[1]**deflated:** not having air inside

▶ Components of Air

Air contains many gases, water vapour, smoke, dust particles, and germs.

Air contains gases

Air contains gases such as oxygen, nitrogen, and carbon dioxide. Nitrogen is the most abundant gas present in air. Oxygen is required for burning. Living things breathe in oxygen. Carbon dioxide is used by plants to make food. Air also contains water vapour.

Plants need carbon dioxide for photosynthesis.

Activity

EXPERIENTIAL LEARNING SCIENTIFIC SKILLS

Aim: To observe the presence of water vapour in air

Materials required: A glass, water, and ice cubes

Procedure:

1. Pour some water into the glass.
2. Add two or three ice cubes in it. Leave the glass for some time.

Observation: Drops of water are noticed on the outside of the glass. These droplets are formed when the water vapour present in air, touches the glass.

Conclusion: Air contains water vapour. The water vapour present in air comes in contact with the cold surface of the glass and condenses into droplets of water.

Air contains smoke, dust, and germs

You may have seen smoke coming out of vehicles and from chimneys in factories. Wind carries dust and smoke particles over great distances.

Air also contains germs. ***Germs*** *are tiny living organisms that can cause diseases.*

Air contains smoke, dust, and germs.

Smoke, dust, and germs make the air dirty. *Dirty air is called **polluted air**.* If we breathe in polluted air, we may fall sick.

Fact File

Lichens generally grow on hills and mountains, where there is less pollution. They cannot grow in regions where there is high pollution. Hence, they are considered as pollution indicators.

Questions

REMEMBERING UNDERSTANDING

Write *T* for True and *F* for False.

1. A gentle wind is called breeze. .....
2. Air cannot change the shape of things. .....
3. When air gets cooled, it expands. .....
4. Carbon dioxide is required for burning. .....
5. Smoke, dust, and germs make the air dirty. .....

▶ Uses of Air

Air is useful to us in many ways.

- All living things need air to breathe and stay alive.
- It helps birds to fly.
- It is used to inflate[2] balloons, footballs, and tyres.
- It is also needed for burning.

Air helps birds to fly.

Process of Breathing

*The process by which air is taken in and given out of the body is called **breathing**.*

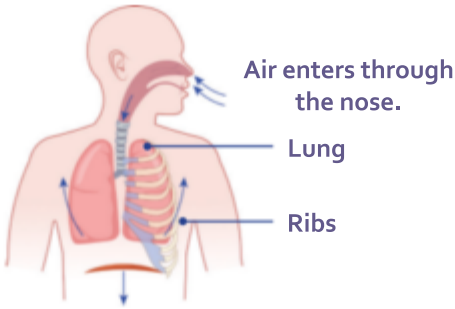
Animals need air for breathing. Different animals have different breathing organs. Insects breathe through tiny holes called **spiracles**. Fish breathe through **gills**. Frogs breathe through their **lungs** and **moist skin**. Birds and reptiles breathe through lungs.

*Human beings also breathe through lungs. They take in air through their nose. This is called **inhalation**. In the lungs, the exchange of gases takes place. Then the air goes out through the nose. This process is called **exhalation**.* Thus, the process of breathing comprises of inhalation and exhalation.

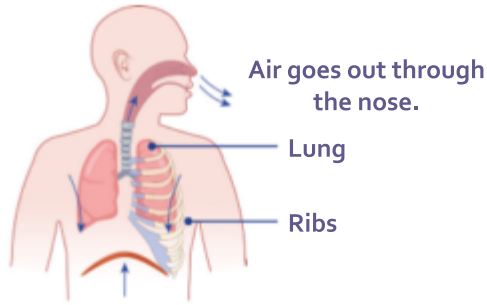
[2]**inflate:** to fill something or become filled with gas or air

Inhalation and exhalation of air During inhalation, the diaphragm moves down and flattens, and the rib muscles lift the ribs up and outwards. Therefore, the size of the chest cavity increases. As a result, air rushes into the lungs.

Reverse happens during exhalation. The diaphragm now moves up and the ribs move inwards. Thus the air that is inside, comes out through the nose.



Diaphragm moves down and flattens during inhalation.



Diaphragm moves up during exhalation.

Inhalation and exhalation of air

Activity

Aim: To demonstrate the process of inhalation and exhalation of air

Procedure:

1. Sit straight on a chair.
2. Slowly take a deep breath so that your lungs get completely filled with air. This is the process of inhalation.
3. Hold your breath for a moment.
4. Now, slowly breathe out air through the nose. This is the process of exhalation.

Process of Burning

Let us understand the process of burning with the help of an activity.

Activity

Aim: To show that air is required for burning

Materials required: A candle, a matchbox, and a glass jar

Procedure:

1. Light a candle.
2. Cover the candle with a glass jar.
3. Observe what happens to the candle after sometime.

Observation: The candle goes out after sometime. This is because the glass jar does not contain enough air to keep the candle burning.

Conclusion: Air supports burning.

Questions

REMEMBERING UNDERSTANDING

Fill in the blanks with a suitable word.

1. Animals need air for ..... .
2. Air is used to fill ....., ..., and ..... .
3. Fish breathe through ..... .
4. Birds and reptiles breathe through ..... .
5. Human beings inhale air through ..... .

▶ Air Pollution

The addition of harmful and undesirable substances to the air as a result of human activities is called ***air pollution****.*

The smoke that comes out from exhausts of vehicles and factory chimneys, and when we burn garbage or leaves, or burst crackers, leads to **air pollution.** It may cause difficulty in breathing and other health problems in living beings. Air pollution is also caused by harmful dust particles and the presence of germs such as bacteria and viruses in the air.

Chimneys in factories

Burning garbage

Exhaust of vehicles

Causes of air pollution

Think and Discuss

21st CENTURY SKILLS SDG KNOWLEDGE OF INDIA

Note down the air quality index of atleast 7 states of India for a week. Does air pollution impact the air quality index of these states? Make conclusions based on your findings and discuss.

Know Your SDGs

21st CENTURY SKILLS

SDG 13: **Climate Change**

(*Take urgent action to combat climate change and its impacts*)

Air pollution and climate change are both caused by burning of fossil fuels—coal, petroleum, and natural gas. So, the solution of both these environmental issues are similar. Suggest two ways by which we can keep our air clean.

The table below lists the causes, effects, and preventive measures of air pollution.

Causes
• Smoke and harmful gases (containing particles of dust and heavy metals) released from industries and factories • Harmful gases and chemicals released from vehicles • Smoke released from burning of solid wastes • Harmful particles like dust and spit that release germs into the air
Effects
• Causes diseases such as asthma and lung cancer • Causes breathing problems, coughing, sneezing, headaches, etc. • May even destroy the ozone layer in the atmosphere
Preventive measures
• Industries should filter out harmful pollutants before the smoke is released. Energy-efficient boilers should be preferred. Industries should be located far away from residential areas. • Less-polluting fuels, such as CNG, should be preferred over petrol or diesel, for vehicles. • Burning of garbage, leaves, and wood should be avoided.

Wrap Up

- Solids are substances in which particles are tightly packed. Therefore, most solids are hard and have a fixed shape.
- Liquids are substances in which particles are loosely packed. Hence, liquids do not have a fixed shape.
- Gases are substances in which particles are very loosely packed. These particles have enough space to move around freely. Gases do not have a fixed shape.
- Air contains gases (such as oxygen and carbon dioxide), water vapour, smoke, dust particles, and germs.
- Living things breathe in oxygen.
- Oxygen is required for burning.
- Air pollution is caused by smoke and harmful gases released by vehicles and factories, burning of leaves and garbage.
- Air pollution leads to breathing problems, coughing, sneezing, headaches, and diseases such as asthma and lung cancer.

Exercises

REMEMBERING UNDERSTANDING APPLYING

SECTION I

A Choose the correct option.

1. The particles are very loosely packed in ..... .
   a. solids b. liquids c. gases d. both solids and liquids
2. Which of the following is a less polluting fuel?
   a. Petrol b. Coal c. Diesel d. CNG
3. Which of the following is/are the properties of air?
   a. It takes space. b. It has weight. c. It expands. d. All of these
4. Which of the following gases is required for burning?
   a. Oxygen b. Carbon dioxide
   c. Nitrogen d. Water vapour
5. Which of the following things can be inflated using air?
   a. Table b. Pen c. Balloon d. Plant

B Assertion and Reasoning questions.

1. **Assertion (A):** The weight of inflated balloon is more than the weight of deflated balloon.
   Reason (R): Air has weight.
   a. Both A and R are True b. Both A and R are False
   c. A is True and R is False d. A is False and R is True
2. **Assertion (A):** Less polluting fuels, such as CNG, should be preferred over petrol or diesel, for vehicles.
   Reason (R): Smoke that comes out of petrol or diesel vehicles causes air pollution.
   a. Both A and R are True b. Both A and R are False
   c. A is True and R is False d. A is False and R is True

C Write *T* for True and *F* for False. Correct the false statements.

1. We can see air around us.
2. Gases do not have a fixed shape.
3. Air does not contain smoke and dust particles.
4. Dirty air is also called polluted air.
5. Air pollution destroys the ozone layer in the atmosphere.
6. Burning of garbage is necessary.

D Name the following.

1. The gas used by plants in photosynthesis .....
2. The state in which the particles are tightly packed .....
3. Tiny living organisms present in air that often cause diseases .....
4. Insects breathe through them .....
5. Moving air is known as .....
6. The addition of harmful substances to air because of human activities .....

SECTION II

APPLYING ANALYSING

E Short answer questions.

1. Name one gas present in the air.
2. What is a germ?
3. List two uses of air.
4. What are the components of air?
5. Define air pollution.

F Long answer questions.

1. Air occupies space. Elaborate with an example.
2. Differentiate between inhalation and exhalation.
3. Explain the process of breathing in human beings.
4. Give any two causes, effects, and preventive measures of air pollution.

ANALYSING EVALUATING TP

Picture Study

1 Look at the picture and answer the questions.

a. What do you observe in the picture?

.....

.....

b. What does it prove?

.....

.....

2 **Observe the given activity, and write the aim for performing this activity.**

.....

.....

My Learning Corner

21st CENTURY SKILLS · SUBJECT INTEGRATION · SDG · STEM

A Think about

1. Suman asked her mother, "Mother, if there is no air around us, what will happen to the living organisms?" Think and answer what her mother would have said.

2. In villages, the old, conventional method of cooking with coal and wood as fuel is still used. Justify whether it is good or bad in terms of pollution.
3. In our country, the Petroleum Conservation Research Association (PCRA) advises people to save petrol and diesel while driving. Can you suggest why?

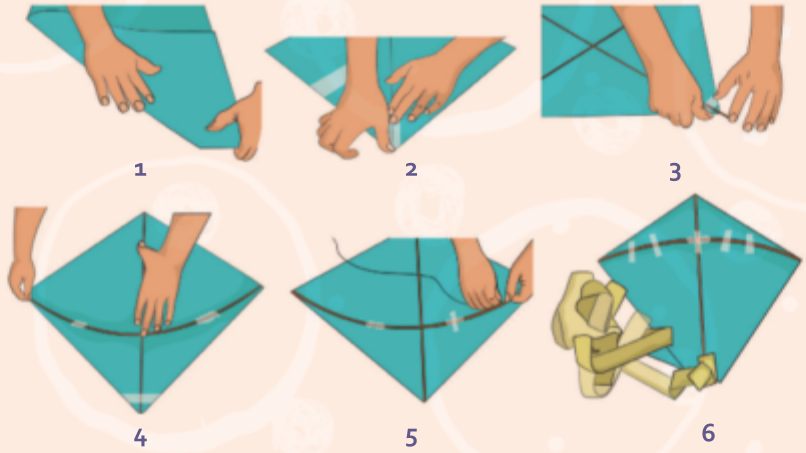
PCRA

B Try out

1. On the political map of India, mark two states where large-scale burning of crop residue after harvest results in excessive air pollution in Delhi. Take the help of Internet. Also, suggest measures to deal with it.
2. Recently the government has decided to ban burning of crop residue or stubble in the fields after crop harvesting. Is it justifiable or not? Make a report on it.
3. Make your paper kite as shown through the steps given below.

   Aim: To make a paper kite

   Materials required: An 8 inches by 11 inches sheet of paper, a wooden skewer, kite string, a pair of scissors, a ribbon, and tape



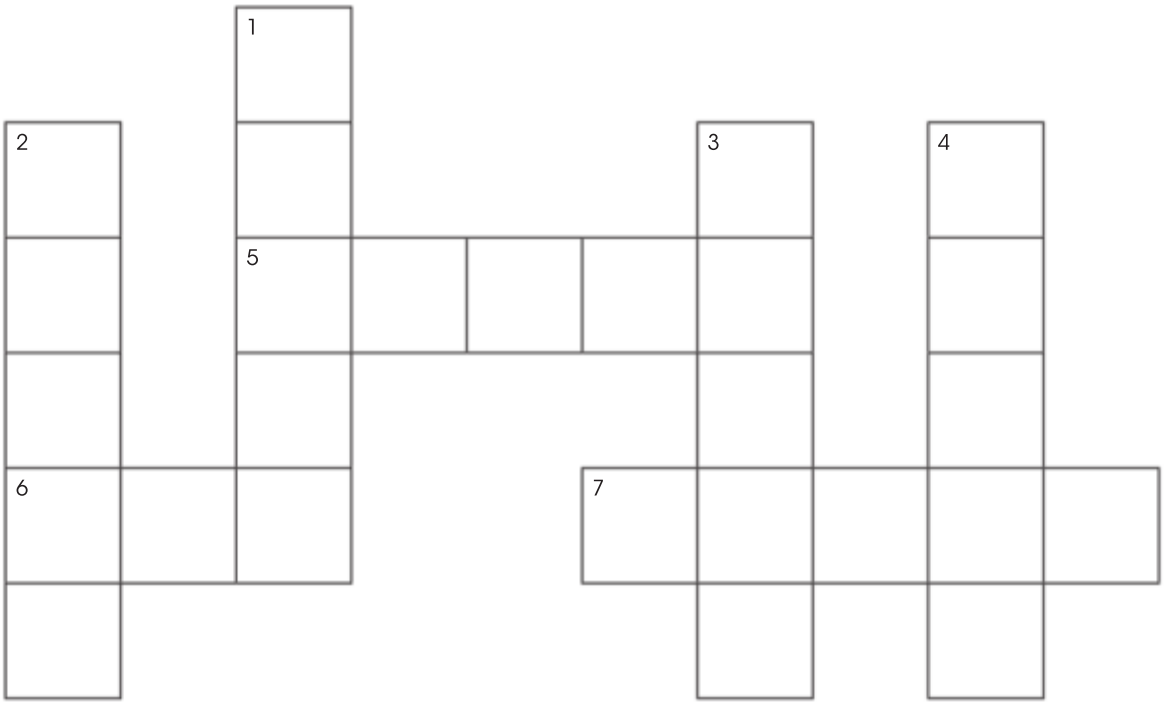
Self-Assessment

Now that you have completed the chapter, score each of the following tasks from 1 to 5 to indicate how well you can do them.
Score 5 = I can definitely do this.
Score 1 = I cannot do this yet.

I can...	My score
• define matter.	
• define air and explain its properties.	
• explain the components of air.	
• list the uses of air.	
• explain air pollution, its various causes, effects, and preventive measures.	

Worksheet

Complete the Word Puzzle given below based on the clues provided.



Across

5. A solid on which we keep our books and study
6. A gas which is colourless and present all around us
7. A gas emitted by vehicles which causes pollution

Down

1. A liquid which we occasionally drink to quench our thirst
2. Another name for water vapour
3. The air around us contains these tiny organisms that cause diseases
4. A solid which has pages that we read