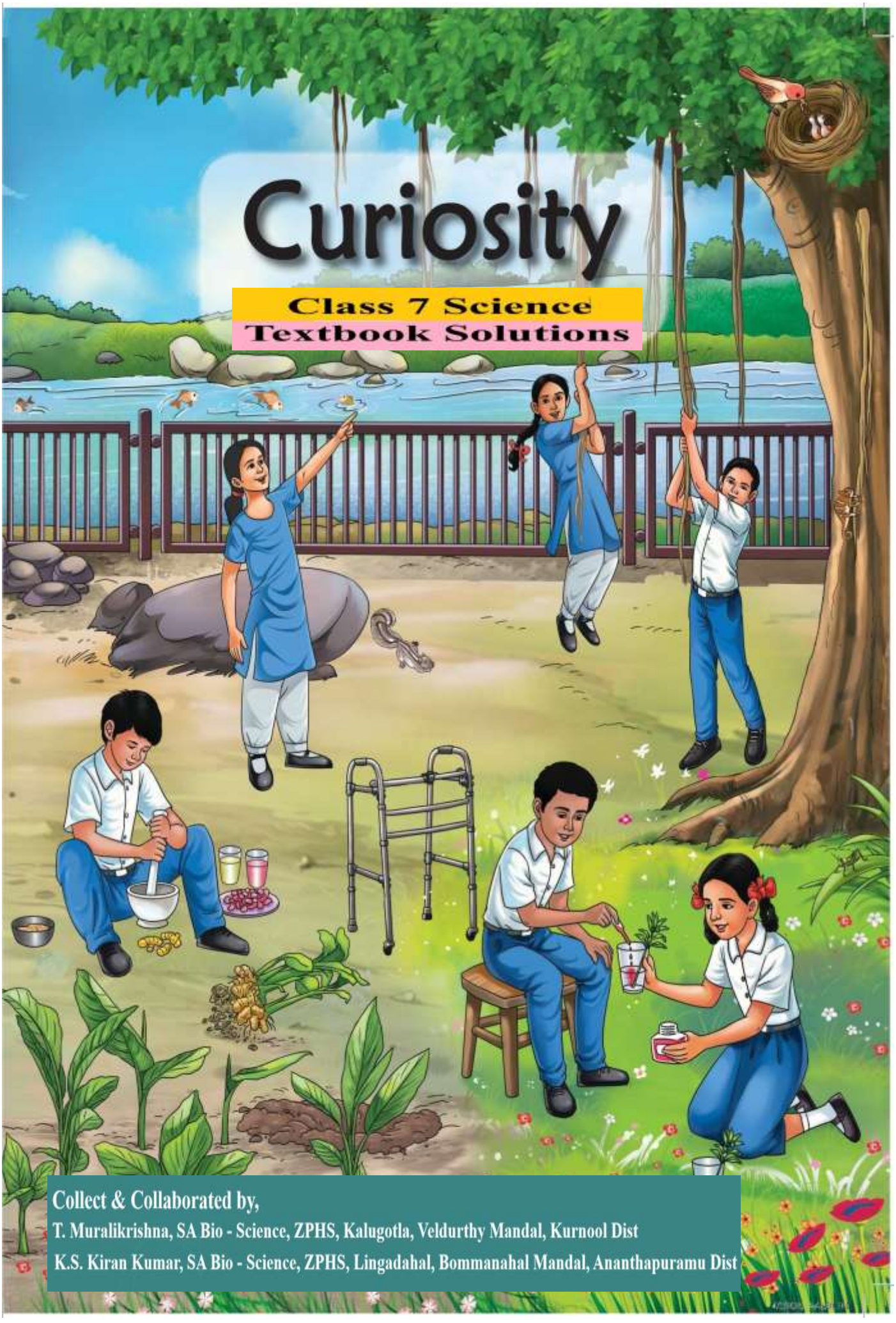

Collect & Collaborated by,
T. Muralikrishna, SA Bio - Science, ZPHS, Kalugotla, Veldurthy Mandal, Kurnool Dist
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Curiosity

Textbook of Science for Grade 7

CONTENTS

Note: We enrich the learning experience by adding additional information.

Our sincere thanks to,

NCERT Solutions, NCERT Guru, Chat GPT, Google Gemini AI, Perplexity AI and Google images and reputed Image apps..,

Class 7 Science Curiosity
Chapter 1. The Ever - Evolving World of Science

Activity 1.1: Question the Answer

Look at the answers below. Your task is to come up with a curious, creative, and fun question or situations that could lead to these answers.

1. What should I do to prepare oatmeal?

A. Just add some milk.

2. Why did you take your cat to the veterinary doctor?

A. Because the cat's teeth were crooked.

3. What should we do if we get stranded on a deserted island?

A. Don't panic; I have my towel.

4. How many days of summer vacation are you getting this year?

A. 42

Chapter 2. Exploring Substances: Acidic, Basic, and Neutral

Let us enhance our learning

1. A solution turns the red litmus paper to blue. Excess addition of which of the following solution would reverse the change?

(i) Lime water

(ii) Baking soda

(iii) Vinegar

(iv) Common salt solution

A. **(iii) Vinegar**

Red litmus turning blue indicates that the solution is basic. To reverse this, an acidic solution like vinegar is needed.

2. You are provided with three unknown solutions labelled A, B, and C, but you do not know which of these are acidic, basic, or neutral. Upon adding a few drops of red litmus solution to solution A, it turns blue. When a few drops of turmeric solution are added to solution B, it turns red. Finally, after adding a few drops of red rose extract to solution C, it turns green.

Based on the observations, which of the following is the correct sequence for the nature of solutions A, B, and C?

(i) Acidic, acidic, and acidic

(ii) Neutral, basic, and basic

(iii) Basic, basic, and acidic

(iv) Basic, basic, and basic

Kiran & Murali

A. **(iv) Basic, basic, and basic**

Solution A is basic because it turns red litmus paper blue. Solution B is basic because turmeric turns red in a basic solution. Solution C is basic because red rose extract turns green in a basic solution.

3. Observe and analyse Figs. 2.13, 2.14, and 2.15, in which red rose extract paper strips are used. Label the nature of solutions present in each of the containers.

Fig. 2.13 Fig. 2.14 Fig. 2.15

A. Fig. 2.13: Basic solution, as it turns the color of the paper strip to green.

Fig. 2.14: Neutral solution, since there is no change in the color of the paper strip.

Fig. 2.15: Acidic solution, as it turns the color of the paper strip to red.

4. A liquid sample from the laboratory was tested using various indicators:

Indicator	Red litmus	Blue litmus	Turmeric
Change	No change	Turned red	No change in colour

Based on the tests, identify the acidic or basic nature of the liquid and justify your answer.

A. The liquid sample is acidic because it turned blue litmus red and showed no color change with turmeric - both of which are characteristic properties of acids.

5. Manya is blindfolded. She is given two unknown solutions to test and determine whether they are acidic or basic. Which indicator should Manya use to test the solutions and why?

A. Manya can use olfactory indicators to test whether the solutions are acidic or basic, as these are substances whose odour changes in acidic or basic conditions.

6. Could you suggest various materials which can be used for writing the message on the white sheet of paper (given at the beginning of the chapter) and what could be in the spray bottle? Make a table of various possible combinations and the colour of the writing obtained.

A.

Writing material (on paper)	Spray bottle content	Color of writing after spray
Lime water (Basic)	Red rose extract	Green
Soap water (Basic)	Red rose extract	Green
Baking Soda Solution (Basic)	Red rose extract	Green
Vinegar (Acidic)	Red rose extracts	Red
Orange juice (Acidic)	Red rose extracts	Red
Vinegar (Acidic)	Turmeric solution	Red
Orange juice (Acidic)	Turmeric solution	Red
Amla juice (Acidic)	Turmeric solution	Red

7. Grape juice was mixed with red rose extract; the mixture got a tint of red colour. What will happen if baking soda is added to this mixture? Justify your answer.

A. When baking soda is added to the mixture of grape juice and red rose extract, the red colour will gradually fade. This happens because baking soda is basic in nature and neutralizes the acidity of the grape juice. As the mixture becomes neutral or slightly basic, the red tint disappears.

8. Keerthi wrote a secret message to her grandmother on her birthday using orange juice. Can you assist her grandmother in revealing the message? Which indicator would you use to make it visible?

A. Yes, I can assist her grandmother in revealing the message. Since orange juice is acidic, I would apply red rose extract to the written message, which would make it appear red. This happens because red rose extract turns red in acidic solutions.

9. How can natural indicators be prepared? Explain by giving an example.

A. Natural indicators can be prepared from parts of plants such as flowers, leaves, and vegetables.

Example: Red rose extract preparation

Collect and wash red rose petals, then crush them gently in a glass. Pour hot water over the crushed petals and let the solution sit for 5–10 minutes. Filter out the petals - the coloured liquid is your natural red rose indicator.

10. Three liquids are given to you. One is vinegar, another is a baking soda solution, and the third is a sugar solution. Can you identify them only using turmeric paper? Explain.

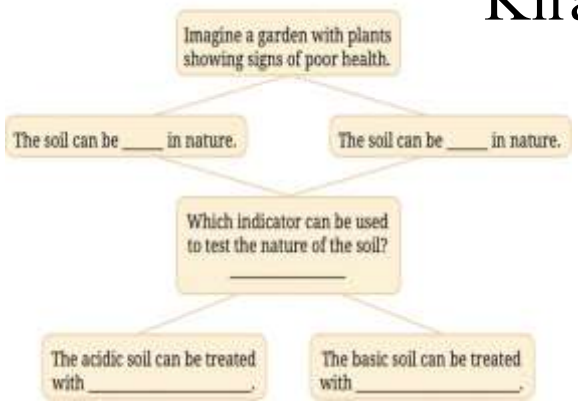
A. The liquid that turns turmeric paper red is baking soda, as turmeric turns red in a basic solution. The other two liquids don't change the color of the turmeric paper, so they are either vinegar or a sugar solution. This is because turmeric stays yellow in acidic or neutral solutions and can't be used to distinguish them.

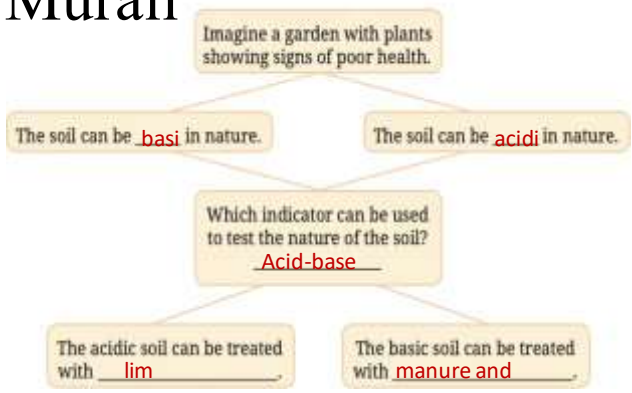
11. The extract of red rose turns the liquid X to green. What will the nature of liquid X be? What will happen when excess of amla juice is added to liquid X?

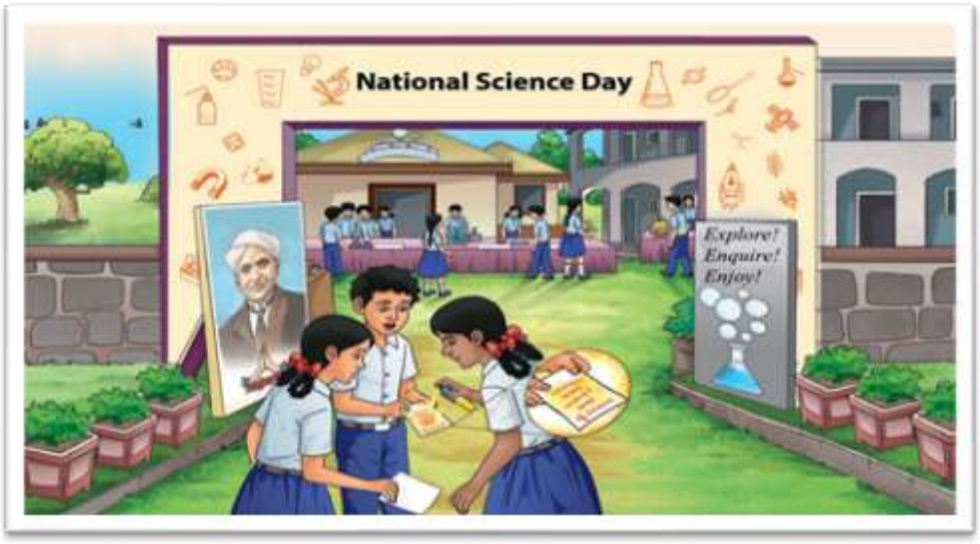
A. Liquid X is basic because it turns red rose extract green. Amla juice is acidic, and when added in excess, it neutralizes the basicity of liquid X, making the solution acidic. The red rose extract will turn this solution red.

12. Observe and analyse the information given in the following flowchart. Complete the missing information.

Kiran & Murali







Stinging effect of an ant bite

Chapter 3. Electricity: Circuits and their Components

Let us enhance our learning

1. Choose the incorrect statement.

An electric cell

(i) A switch is the source of electric current in a circuit.

(ii) A switch helps to complete or break the circuit.

(iii) A switch helps us to use electricity as per our requirement.

(iv) When the switch is in 'OFF' position, there is an air gap between its terminals.

A. **(i) A switch is the source of electric current in a circuit.**

A switch is a device that completes or breaks a circuit.

2. Observe Fig. 3.16. With which material connected between the ends A and B, the lamp will not glow?

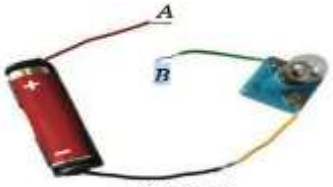
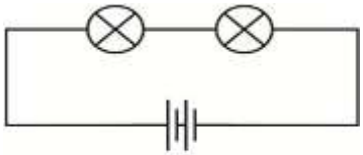


Fig. 3.16

A. The lamp will not glow when insulating materials like rubber, plastic, and ceramics are connected between ends A and B.

3. In Fig. 3.17, if the filament of one of the lamps is broken, will the other glow? Justify your answer.



Kiran & Murali

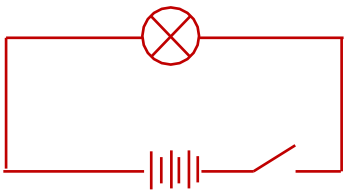
A. The current in the circuit flows through a single path, as both bulbs are connected in series. If the filament of one lamp is broken, the circuit becomes open, and the other bulb will not glow.

4. A student forgot to remove the insulator covering from the connecting wires while making a circuit. If the lamp and the cell are working properly, will the lamp glow?

A. No, the lamp will not glow because the insulating cover on the wires prevents current from flowing. The insulation needs to be removed from the connecting wires to establish proper contact between the wires.

5. Draw a circuit diagram for a simple torch using symbols for electric components.

A.



6. In Fig. 3.18:

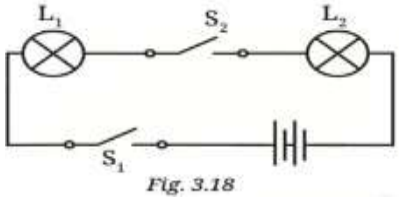


Fig. 3.18

(i) If S2 is in 'ON' position, S1 is in 'OFF' position, which lamp(s) will glow?

A. No lamp will glow because the circuit is broken at S1.

(ii) If S2 is in 'OFF' position, S1 is in 'ON' position, which lamp(s) will glow?

A. No lamp will glow because the circuit is broken at S2.

(iii) If S1 and S2 both are in 'ON' position, which lamp(s) will glow?

A. Both L1 and L2 will glow because the circuit is complete.

(iv) If both S1 and S2 are in 'OFF' position, which lamp(s) will glow?

A. No lamp will glow because the circuit is open at both switches.

7. Vidyut has made the circuit as shown in Fig. 3.19. Even after closing the circuit, the lamp does not glow. What can be the possible reasons? List as many possible reasons as you can for this faulty operation. What will you do to find out why the lamp did not glow?

A. Possible reasons why the lamp doesn't glow:

Fig. 3.19

(i) The cell is weak or dead.

(ii) The bulb is fused or faulty.

(iii) Loose or faulty connections.

(iv) The safety pin is an insulator or a poor conductor.

(v) Corroded battery terminals.

Things to do to find the problem:

(i) Check the battery.

(ii) Test the bulb.

(iii) Inspect all connections.

(iv) Examine the safety pin and replace it with a good conductor material.

8. In Fig. 3.20, in which case(s) the lamp will not glow when the switch is closed?

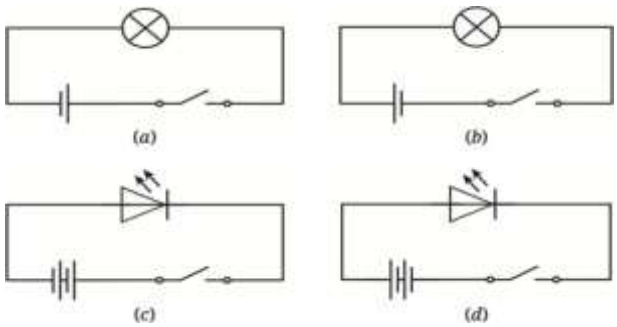


Fig:3.20

A. (a) The switch is closed, current flows, and the lamp glows.

(b) This is the same circuit as (a), but the cell is reversed. The lamp will still glow regardless of the polarity.

(c) LEDs allow current to flow in only one direction. Due to the wrong polarity, the current will not flow and the LED will not glow.

(d) The LED is connected with the correct polarity,

So current flows and the LED will glow. Hence, (a), (b) and (c) are the cases in which the lamps will not glow.

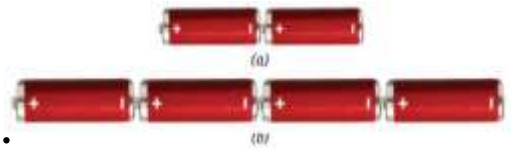
9. Suppose the '+' and '–' symbols cannot be read on a battery. Suggest a method to identify the two terminals of this battery.

A. The two terminals of a battery can be identified using an LED. Connect the battery terminals to the LED in any order. If the LED glows, the battery terminal connected to the positive terminal (longer wire) of the LED is the positive (+) terminal, and the other is the negative (–) terminal.

10. You are given six cells marked A, B, C, D, E, and F. Some of these are working and some are not. Design an activity to identify which of them are working.

(i) List the items that you require.

A. Items Required: A torch bulb, bulb holder, connecting wires and the six cells (A, B, C, D, E, F)



A battery made up of (a) two cells (b) four cells

(ii) Write the procedure that you will follow.

A. Procedure:

1. Connect the bulb to a cell using the wires.

2. Observe if the bulb lights up.

3. Repeat the process for each cell (A to F), testing one at a time.

4. Record which cells cause the bulb to glow.

(iii) With the items, carry out the activity to identify the cells that are working.

A. Activity:

If the bulb lights up: The cell is working.

If the bulb does not light up: The cell is not working.

Test all six cells and note which are functional based on the bulb's response.

11. An LED requires two cells in series to glow. Tanya made the circuit as shown in Fig. 3.21. Will the lamp glow? If not, draw the wires for correct connections.

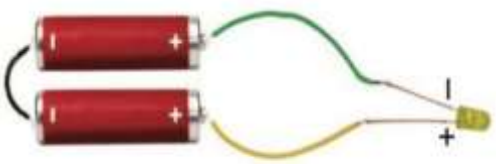


Fig. 3.21

Caution

A. No, the LED will not glow due to incorrect connections.

An LED glows only when its positive terminal (longer wire) is connected to the battery's positive terminal and its negative terminal (shorter wire) to the negative terminal of the battery.

To correct it:

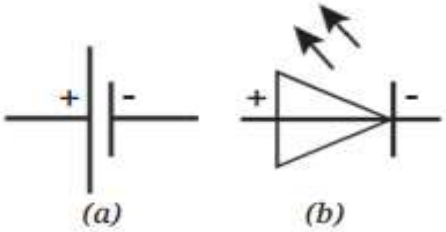
(i) Connect the positive terminal of the first cell to the negative terminal of the second cell (series connection).

(ii) Connect the free negative and positive terminals to the LED accordingly.

Electrical components and their symbols

S.No.	Electrical component	Symbol
1.	Electric cell	
2.	Battery	
3.	Electric lamp	
4.	Light Emitting Diode (LED)	
5.	Switch in 'ON' position	
6.	Switch in 'OFF' position	
7.	Wire	

A small incandescent lamp used in a torch



Positive and negative terminals in the symbols of (a) a cell (b) an LED

LEDs of different colours

Chapter 4. The World of Metals and Non-metals

Let us enhance our learning

1. Which metal is commonly used to make food packaging materials as it is cheaper, and its thin sheets can be folded easily into any shape?

Burning of magnesium ribbon

(i) Aluminium (ii) Copper (iii) Iron (iv) Gold

A. **(i) Aluminium**

2. Which of the following metal catches fire when it comes in contact with water?

(i) Copper (ii) Aluminium (iii) Zinc (iv) Sodium

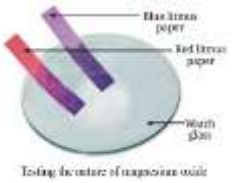
A. **(iv) Sodium**

3. State with reason(s) whether the following statements are True [T] or False [F].

(i) Aluminium and copper are examples of non-metals used for making utensils and statues.

False. Aluminium and copper are metals used to make utensils and statues.

(ii) Metals form oxides when combined with oxygen, the solution of which turns blue litmus paper to red.



Testing the nature of magnesium oxide

False. Metal oxides are basic in nature and turn red litmus paper blue.

(iii) Oxygen is a non-metal essential for respiration.

True.

(iv) Copper vessels are used for boiling water because they are good conductors of electricity.

False. Copper vessels are used for boiling water because copper is a good conductor of heat.

4. Why are only a few metals suitable for making jewellery?

A. Some essential properties for making jewellery include lustre, malleability, ductility, and resistance to corrosion (i.e., they don't tarnish easily). Only a few metals, such as gold and silver, possess all of these properties, which is why they are commonly used in jewellery making.

5. Match the uses of metals and non-metals given in Column I with the jumbled names of metals and non-metals given in Column II.

Column I	Column II
(i) Used in electrical wiring	(a) E N X Y G O
(ii) Most malleable and ductile	(b) N E C O H I R L
(iii) Living organisms cannot survive without it.	(c) P E P O R C
(iv)Plants grow healthy when fertilisers containing it are added to the soil.	(d) T E N G O I N R
(v) Used in water purification	(e) O G D L

The Iron Pillar (Delhi)

A.

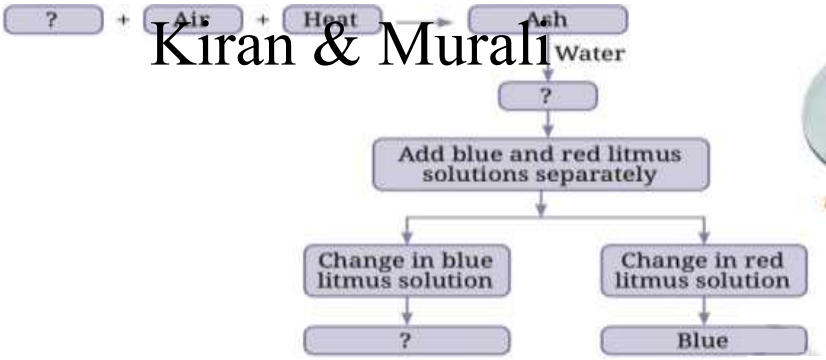
Column I	Column II
(i) Used in electrical wiring	(c) COPPER
(ii) Most malleable and ductile	(e) GOLD
(iii) Living organisms cannot survive without it.	(a) OXYGEN
(iv)Plants grow healthy when fertilisers containing it are added to the soil.	(d) NITROGEN
(v) Used in water purification	(b) CHLORINE

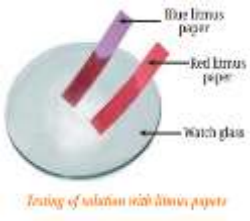
6. What happens when oxygen reacts with magnesium and sulfur. What are the main differences in the nature of products formed?

A. Magnesium reacts with oxygen to form magnesium oxide. When magnesium oxide is dissolved in water, it forms a basic solution that turns red litmus paper blue.

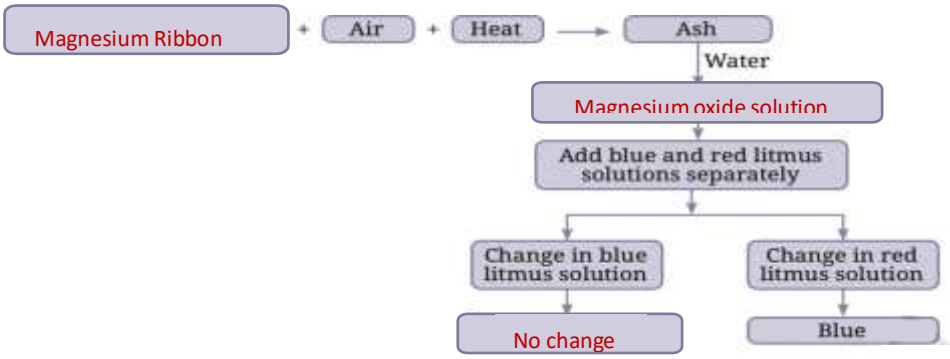
Sulfur, when burned in air, reacts with the oxygen present to form sulfur dioxide. When sulfur dioxide is dissolved in water, it forms sulfurous acid, which is acidic in nature and turns blue litmus paper red.

7. Complete the following flow chart:





A.



8. You are provided with the following materials. Discuss which material would be your choice to make a pan that is most suitable for boiling water and why?

Iron, copper, sulfur, coal, plastic, wood, cardboard

A. To make a pan suitable for heating, iron and copper would be the best choices. Both are metals with high melting points, so they can withstand high temperatures without melting or deforming. They are also good conductors of heat, allowing heat to spread evenly across the surface of the pan.

9. You are provided with three iron nails, each dipped in oil, water and vinegar. Which iron nail will not rust, and why?

A. The iron nail dipped in oil will not rust because rusting requires the presence of both water and air (oxygen). The layer of oil prevents air and moisture from reaching the surface of the iron, thereby stopping the rusting process.

10. How do the different properties of metals and non-metals determine their uses in everyday life?

A. Metals are used in making wires and cables (due to electrical conductivity); kitchenware and utensils (due to heat conductivity); structures, tools, and weapons (for their strength and hardness); bells (because of sonority); and jewellery (due to lustre, malleability, and ductility).

Non-metals are usually brittle, poor conductors, and lack metallic lustre, but they are useful in other ways-for example, oxygen for breathing, graphite in pencils, chlorine for water purification, nitrogen in fertilizers, and plastic and rubber as insulators.

11. One of the methods of protecting iron from getting rusted is to put a thin coating of zinc metal over it. Since sulfur does not react with water, can it be used for this purpose? Justify your answer.

A. No, sulfur cannot be used to coat iron like zinc because it is a brittle non-metal that does not form a strong, durable, or protective layer. It can easily crack or flake off, leaving the iron exposed to air and moisture, which would allow rusting to occur.

12. An ironsmith heats iron before making tools. Why is heating necessary in this process?

A. Heating is necessary in this process because it softens the iron and increases its malleability, making it easier to bend, shape, and form into the desired tool.

Additional Information

🔍 Comparison Table: Metals vs Nonmetals

Property	Metals	Nonmetals
Appearance	Shiny (lustrous)	Dull (not shiny)
Hardness	Generally hard (except sodium, potassium)	Usually soft (except diamond)
State at Room Temp.	Mostly solids	Solids, liquids (bromine), or gases
Malleability	Can be beaten into thin sheets	Brittle, break when hammered
Ductility	Can be drawn into wires	Not ductile
Conductivity	Good conductors of heat and electricity	Poor conductors (except graphite)
Sonority	Produce ringing sound when hit	Do not produce ringing sound
Examples	Iron, Copper, Gold, Aluminium	Sulphur, Carbon, Oxygen, Chlorine

🧪 Metals, Non-metals & Rare Earth Metals — Examples & Uses

🔹 Type	📌 Element	✅ Use / Application
Metals	**Iron (Fe)**	Used to make buildings, bridges, tools
	Copper (Cu)	Used in electric wires, motors, and coins
	Gold (Au)	Used in jewelry and high-end electronics due to non-rusting
	Aluminium (Al)	Used in cooking foil, airplane bodies, and soft drink cans
	Zinc (Zn)	Used to coat iron (galvanization) to prevent rust
Nonmetals	**Oxygen (O_2)**	Essential for breathing and burning (combustion)
	Carbon (C)	Found in all living things; graphite used in pencils
	Chlorine (Cl_2)	Used to purify water and in disinfectants
	Sulphur (S)	Used in making fertilizers and fireworks
	Nitrogen (N_2)	Used in food packaging and fertilizers; makes up most of our air
Rare Earth Metals	**Neodymium (Nd)**	Used in strong magnets (headphones, wind turbines)
	Lanthanum (La)	Used in camera lenses and hybrid car batteries
	Cerium (Ce)	Used for polishing glass and as a catalyst
	Yttrium (Y)	Used in LEDs, lasers, and TV screens
	Samarium (Sm)	Used in powerful magnets and nuclear reactors

🧠 Fun Facts

- 💡 **Gold** is the most ductile metal - just 1 gram can be drawn into a 2 km long wire!
- 🔥 **Graphite** (a form of carbon) is a nonmetal but conducts electricity!
- 💧 **Bromine** is the only nonmetal that is liquid at room temperature.

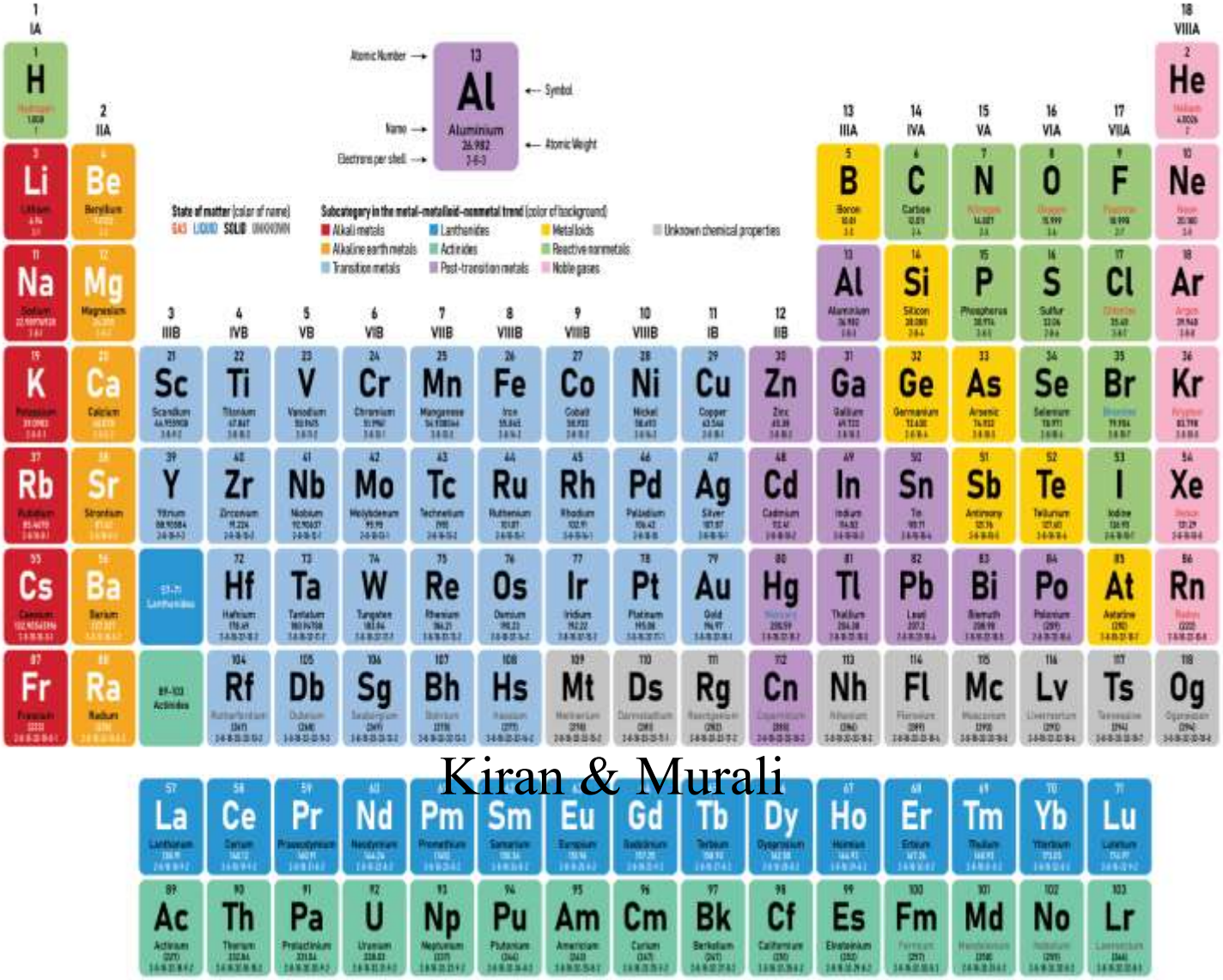
🌈 Did You Know?

- 🧲 **Rare Earth Metals** are not really "rare" in Earth — they are just hard to separate from each other.
- ✨ **Gold** is so soft you can scratch it with a coin!
- 🌬️ **Oxygen** is the second most abundant element in the air.

🌟 Fun Curiosity Corner

- 🎧 **Neodymium** magnets are so strong they can hold 1,000 times their weight!
- 🛩️ **Aluminium** is so light and strong it's perfect for airplanes.
- 💎 **Diamond**, the hardest known substance, is made of **carbon**, a nonmetal!

Periodic Table of the Elements



Chapter 5. Changes Around Us: Physical and Chemical

Let us enhance our learning

1. Which of the following statements are the characteristics of a physical change?

(i) The state of the substance may or may not change.

(ii) A substance with different properties is formed.

(iii) No new substance is formed.

(iv) The substance undergoes a chemical reaction.

Michael Faraday

a) (i) and (ii)

b) (ii) and (iii)

c) (i) and (iii)

d) (iii) and (iv)

A. **(i) and (iii) are correct**

The statement (ii)is not correct because in physical change a substance with different properties is not formed.

The statement (iv) is not correct because in physical change the substance does not go through a chemical reaction.

2. Predict which of the following changes can be reversed and which cannot be reversed. If you are not sure, you may write that down. Why are you not sure about these?

i) Stitching cloth to a shirt

A. It is not reversible because it is not possible to join threads of a cloth like before once it is cut.

ii) Twisting of a straight string

A. It is a reversible change.

iii) Making idles from a batter

A. This is an irreversible change as we cannot make batter from the idles again.

iv) Dissolving sugar in water

A. This is a reversible change. The sugar can be recovered by evaporating the water.

v) Drawing water from a well

A. This is a reversible change because the water can be dropped into the well again after drawing.

vi) Ripening of fruits

A. This is an irreversible process. It is impossible to return a ripened fruit to its previous raw state.

vii) Boiling water in an open pan

A. This is a reversible process. The vapour can be easily returned to its liquid state as water.

viii) Rolling up a mat

Blowing air in (a) tap water; (b) lime water

A. This is a reversible process.

ix) Grinding wheat grains into flour

A. This is an irreversible process. It is impossible to turn flour into grains again.

x) Formation of soil from rocks

A. This is an irreversible process. Soil cannot turn back into the rocks it was made from.

3. State whether the following statements are True or False. In case a statement is False, write the correct statement.

i) Melting of wax is necessary for burning a candle.

☑ True

(Melting of wax is necessary because the liquid wax is drawn up the wick and vaporized to sustain the flame.)

ii) Collecting water vapour by condensation involves a chemical change.

❌ False

☑ Correct statement: Collecting water vapour by condensation involves a physical change.

(Because the change is only in the state of matter—gas to liquid—and no new substance is formed.)

iii) The process of converting leaves into compost is a chemical change.

☑ True

(The decomposition of leaves into compost involves microbial activity that changes the chemical composition.)

iv) Mixing baking soda with lemon juice is a chemical change.

Fire triangle

☑ True

(A chemical reaction occurs, producing carbon dioxide gas, a new substance.)

4. Fill in the blanks in the following statements:

i) Nalini observed that the handle of her cycle has got brown deposits. The brown deposits are due to rusting, and this is a chemical change.

ii) Folding a handkerchief is a physical change and can be reversed.

iii) A chemical process in which a substance reacts with oxygen with the evolution of heat is called oxidation, and this is a chemical change.

iv) Magnesium, when burnt in air, produces a substance called magnesium oxide. The substance formed is basic in nature. Burning of magnesium is a chemical change.

5. Are the changes of water to ice and water to steam, physical or chemical? Explain.

A. When water turns into ice and steam only the physical state of the water changes from liquid to solid and gaseous. These changes are reversible in nature. From these we can conclude that the change of water to ice and steam is a physical change.

6. Is curdling of milk a physical or chemical change? Justify your statement.

A.Curding of milk is a chemical change.

When milk turns into curd the chemical composition of the milk is changed that happens in a chemical change. Once milk is turned into curd it cannot be turned into milk again so it is an irreversible process. This proves that curding of milk is a chemical change.

7. Natural factors, such as wind, rain, etc., help in the formation of soil from rocks. Is this change physical or chemical, and why?

A. The formation of soil is a result of both physical and chemical changes.

Physical factors like flowing water and wind break large stones into small pieces. This is a physical change.

On the other hand, water and the chemicals present in the water react with the stone and change its chemical composition.

From these, we can see that the formation of soil from rocks is a combination of both physical and chemical changes.

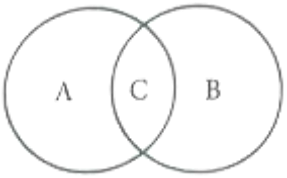
8. Read the following story titled 'Eco-friendly Prithvi' and tick the most appropriate option(s) given in the brackets. Provide a suitable title of your choice for the story.

Prithvi is preparing a meal in the kitchen. He chops vegetables, peels potatoes, and cuts fruits (physical changes✓/chemical changes). He collects the seeds, fruits, and vegetable peels into a clay pot (physical change✓/chemical change). The fruits, vegetable peels, and other materials begin to decompose due to the action of bacteria and fungi, forming compost (physical change/chemical change✓). He decides to plant seeds in the compost and water them regularly. After a few days, he notices that the seeds begin to germinate and small plants start to grow, eventually blooming into colourful flowers (physical change/chemical change✓). His efforts are appreciated by all his family members.

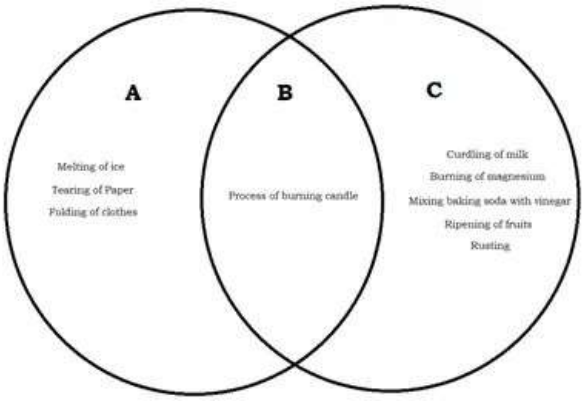
A suitable title for the story would be **"Green Mission for Prithvi".**

9. Some changes are given here. Write physical changes in the area marked 'A' and chemical changes in the area marked 'B'. Enter the changes, which are both physical and chemical, in the area marked 'C'.

Process of burning a candle; Tearing of paper; Rusting; Curdling of milk; Ripening of fruits; Melting of ice; Folding of clothes; Burning of magnesium and Mixing baking soda with vinegar.



A.



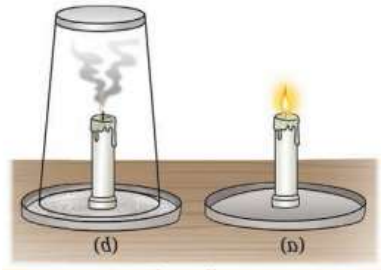


Fig. 5.6:Candle (a) burning (b) covered with a glass tumbler

10. The experiments shown in Figures a, b, c, and d were performed. Find out in which case(s) did lime water turn milky and why?

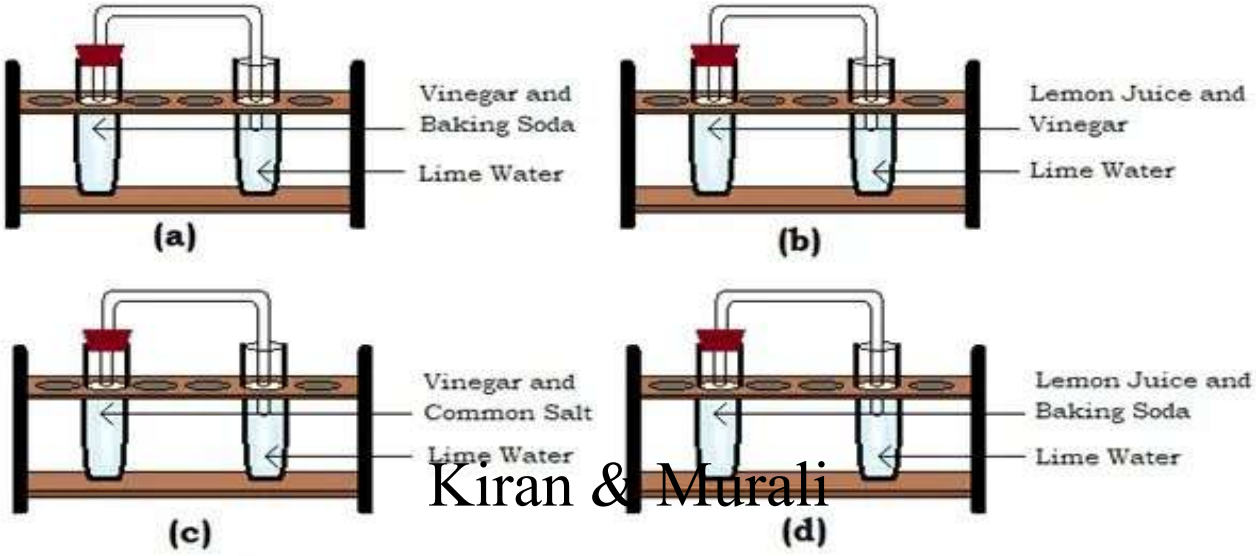


Fig. 5.11

A. In the experiment (a) the carbon dioxide formed by the mixture of vinegar and baking soda will react with Lime water and turn lime water milky.

In the experiment (b) the lime water does not turn milky.In the experiment (c) the lime water does not turn milky.In the experiment (d) the carbon dioxide formed by the mixture of lemon

juice and baking soda will react with Lime water and turn the lime water milky.

A chameleon

(a) Sediments at the base of a cliff (b) red sediment layer

Chapter 6. Adolescence: A Stage of Growth and Change

Let us enhance our learning

1. Ramesh, an 11-year-old boy, developed a few pimples on his face. His mother told him that this is because of ongoing biological changes in his body.

(i) What could be the possible reasons for the development of these pimples on his face?

A. Ramesh is 11 years old, and he is entering adolescence, a stage marked by various physical and hormonal changes in the body. A common occurrence during the adolescent years is a skin condition called acne, in which small, reddish pimples appear. These are commonly visible on the face. Acne occurs due to an increase in oily secretions from the skin during adolescence that can clog the skin pores and lead to infections.

(ii) What can he do to get some relief from these pimples?

A. To get relief from the pimples, Ramesh can follow a few simple steps. Regularly washing his face with a mild soap or acne cleanser will help remove excess oil and prevent clogged pores. It's important for him not to touch, scratch, or pop the pimples, as this can lead to further irritation or scarring. Using non-comedogenic skincare products, which won't clog pores, is another helpful step.

2. Which of the following food groups would be a better option for adolescents and why?

A. Image (ii) would be a better food option for adolescents because The plate in image (ii) represents a balanced and nutritious Indian meal, including:Vegetables, Lentils/dal, Chapati and rice,Curd/yogurt, Salad.

In contrast, image (i) shows junk food like burgers, fries, donuts, and pizza, which are:High in unhealthy fats, sugar, and salt and Low in essential nutrients.Can lead to obesity, poor concentration, and long-term health issues

3. Unscramble the underlined word in the following sentences:

(i) The discharge of blood in adolescent girls which generally occurs every 28–30 days is nstmnoiaretu.

A. The discharge of blood in adolescent girls which generally occurs every 28–30 days is Menstruation.

(ii) The hoarseness in the voice of adolescent boys is due to enlarged iceov xob.

A. The hoarseness in the voice of adolescent boys is due to enlarged Voice box.

(iii) Secondary sexual characteristics are natural signs that the body is preparing for adulthood and mark the onset of urtypeb.

A. Secondary sexual characteristics are natural signs that the body is preparing for adulthood and mark the onset of Puberty.

(iv) We should say NO to lahoclo and srugd as they are addictive.

A. We should say NO to Alcoholand drugs as they are addictive.

4. Shalu told her friend, "Adolescence brings only physical changes, like growing taller or developing body hair." Is she correct? What would you change in this description of adolescence?

A. Shalu's description of adolescence is partly correct, but it misses out on important aspects. While it's true that physical changes like growing taller or developing body hair happen during this time, adolescence is much more than just physical transformation. It's also a period of emotional and psychological changes."Adolescence brings physical changes like growing taller or developing body hair, but it also includes emotional, psychological, and social changes. During this time, individuals develop a sense of identity, experience changes in their feelings and relationships, and become more independent."

5. During a discussion in the class, some of the students raised the following points. What questions would you ask them to check the correctness of these points?

(i) Adolescents do not need to worry about behavioural changes.

A. Questions to ask:

(a) Why do you think adolescents don't need to worry about behavioural changes?

(b) What are some common behavioural changes that adolescents might experience?

(c) How can adolescents manage or understand these changes in a healthy way?

(ii) If someone tries a harmful substance once, they can stop anytime they want.

A. Questions to ask:

(a) What makes harmful substances addictive?

(b) Why do some people find it hard to stop using harmful substances even if they want to?

(c) What are the risks of developing an addiction or dependence on harmful substances?

6. Adolescents sometimes experience mood swings. On some days, they feel very energetic and happy, while on other days, they may feel low. What other behavioural changes are associated with this age?

A. Behavioural changes associated with the age are as follows:

1) Feeling very happy and energetic on some days and low on others, they may also start seeking more independence and want to make their own decisions.

2) This is also a time when they become more self-conscious and may worry a lot about how they look or what others think of them. 3) They might start valuing their friends' opinions more than their parents', which can lead to peer pressure. Some adolescents may also become more private and less open about their thoughts and feelings.

All of these changes are normal during adolescence and are part of the journey from childhood to adulthood.

7. While using a toilet, Mohini noticed that used sanitary pads were scattered near the bin. She got upset and shared her feelings with her friends. They discussed the importance of menstrual hygiene and healthy sanitary habits. What menstrual hygiene and sanitary habits would you suggest to your friends?

A. Menstrual hygiene and healthy sanitary habits I suggest to my friends:

1) First, it's important to change sanitary pads every 4 to 6 hours to avoid infections and maintain hygiene.

2) Used pads should be wrapped properly in paper before disposing of them in a covered dustbin.

3) Second, one should always wash hands thoroughly with soap and water after changing pads to prevent the spread of germs.

4) It's also good to carry extra pads and tissues in a pouch, especially during school or travel, so that you're always prepared.

5) Wash the external vaginal area with plain water during your regular bath or shower. Avoid using harsh soaps or vaginal washes, as these can disrupt the natural pH balance and lead to irritation or infections.

8. Mary and Manoj were classmates and good friends. On turning 11, Mary developed a little bulge on the front of her neck. She visited the doctor who gave her medication and asked to take iodine-rich diet. Similarly, a bump was developed on the front of Manoj's neck when he turned 12. However, the doctor told him that it was a part of growing up. According to you, what could be the possible reason for advising Mary and Manoj differently?

A. 1) The reason Mary and Manoj were advised differently by the doctor is because the conditions they were experiencing, although they looked similar, had different causes.

2) In Mary's case, the bulge on her neck was likely due to a condition called goitre, which is caused by the deficiency of iodine.

3) On the other hand, Manoj's neck bump was most likely the enlargement of the voice box or larynx, which is a normal part of adolescence in boys.

4) As boys grow, their voice box becomes bigger and more prominent, often seen as a bump in the throat called the Adam's apple.

5) This is a sign of puberty and does not require any treatment.9. During adolescence, the boys and girls undergo certain physical changes, a few of which are given below.

(i) Change in voice.

(ii) Development of breasts.

(iii) Growth of moustache.

(iv) Growth of facial hair.

(v) Pimples on the face.

(vi) Growth of hair in the pubic region.

(vii) Growth of hair in armpits.

Categorise these changes in the table given below:

Physical changes during adolescence		
Observed only in boys	**Observed only in girls**	**Common in boys and girls**

A.

Observed only in boys	Observed only in girls	Common in boys and girls
Change in voice	Development of breasts	Pimples on the face
Growth of moustache		Growth of hair in the pubic region
Growth of facial hair		Growth of hair in armpits

10. Prepare a poster mentioning the tips for adolescents to live a healthy lifestyle.

A. Tips for adolescents to live a healthy lifestyle are:

(i) Eat Nutritious Food: Include fruits, vegetables, whole grains, milk, and protein-rich foods.

(ii) Exercise Daily: Engage in physical activities like walking, running, cycling, or playing sports. It keeps your body fit and mind fresh.

(iii) Drink Plenty of Water: Stay hydrated to help your body function well.

(iv) Maintain Personal Hygiene: Bathe daily, brush your teeth, and keep nails clean. Follow proper menstrual hygiene.

(v) Avoid Harmful Substances: Say NO to drugs, alcohol, and tobacco.

Chapter 7. Heat Transfer in Nature

Let us enhance our learning

1. Choose the correct option in each case.

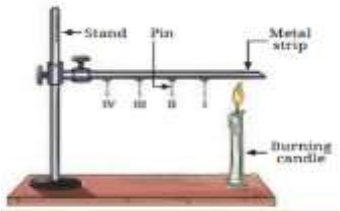
(i) Your father bought a saucepan made of two different materials, A and B, as shown in Fig. 7.14. The materials A and B have the following properties -

(a) Both A and B are good conductors of heat
(b) Both A and B are poor conductors of heat
(c) A is a good conductor and B is a poor conductor of heat
(d) A is a poor conductor and B is a good conductor of Heat

Saucepan

A. ☑ Correct option: (c) A is a good conductor and B is a poor conductor of heat

(ii) Pins are stuck to a metal strip with wax and a burning candle is kept below the rod, as shown in Fig. 7.15. Which of the following will happen?



Heat transfer set-up

(a) All the pins will fall almost at the same time
(b) Pins I and II will fall earlier than pins III and IV
(c) Pins I and II will fall later than pins III and IV
(d) Pins II and III will fall almost at the same time

A. ☑ Correct option: (b) Pins I and II will fall earlier than pins III and IV

(iii) A smoke detector is a device that detects smoke and sounds an alarm. Suppose you are fi tting a smoke detector in your room. The most suitable place for this device will be:

(a) Near the floor
(b) In the middle of a wall
(c) On the ceiling
(d) Anywhere in the room

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A. ☑ Correct option: (c) On the ceiling

Reason: Smoke rises upward due to convection currents, so placing the detector on the ceiling helps it detect smoke early.

2. A shopkeeper serves you cold lassi in a tumbler. By chance, the tumbler had a small leak. You were given another tumbler by the shopkeeper to put the leaky tumbler in it. Will this arrangement help to keep the lassi cold for a longer time? Explain.

A. Yes, the arrangement will help to keep the lassi cold for a longer time.

Explanation:

When the leaky tumbler is placed inside another tumbler, the air trapped between the two acts as an insulator, reducing heat transfer from the surroundings. This slows down the warming of the lassi, keeping it colder for longer.

3. State with reason(s) whether the following statements are True [T] or False [F].

(i) Heat transfer takes place in solids through convection.

❌ False

Reason: In solids, heat is transferred mainly through conduction, not convection. Convection requires particle movement, which solids can't allow.

(ii) Heat transfer through convection takes place by the actual movement of particles.

☑ True

Reason: In convection, warmer particles move and carry heat with them (common in liquids and gases).

(iii) Areas with clay materials allow more seepage of water than those with sandy materials.

✗ False

Reason: Sandy materials allow more seepage because they have larger particles and spaces between them. Clay has fine particles that hold water.

(iv) The movement of cooler air from land to sea is called land breeze.

☑ True

Reason: At night, land cools faster than the sea. Cool air from the land moves toward the warmer sea — this is a land breeze.

4. Some ice cubes placed in a dish melt into water after sometime. Where do the ice cubes get heat for this transformation?

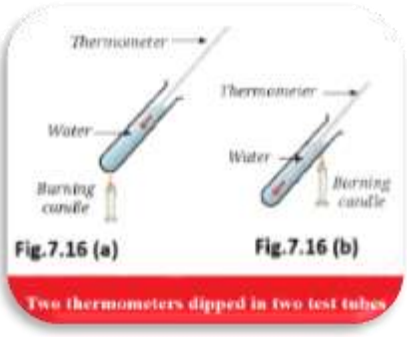
A. The ice cubes get heat from the surrounding air and the dish through conduction and convection.

This heat is absorbed by the ice, raising its temperature to the melting point, and then melts the ice into water.

5. A burning incense stick is fixed, pointing downwards. In which direction would the smoke from the incense stick move? Show the movement of smoke with a diagram.

A. The smoke will rise upward due to the heat, which causes the air and smoke to become lighter and rise (convection).

6. Two test tubes with water are heated by a candle flame as shown in Fig. 7.16. Which thermometers (Fig. 7.16a or Fig. 7.16b) will record a higher temperature? Explain.



A. The thermometer in Fig. 7.16 (b) will record a higher temperature.

Explanation:

In Fig. 7.16 (b), the thermometer is placed near the top, where hot water rises due to convection.

In Fig. 7.16 (a), the thermometer is at the bottom and may not detect much temperature change initially since hot water rises.

7. Why are hollow bricks used to construct the outer walls of houses in hot regions?

A. Hollow bricks contain air gaps, and air is a poor conductor of heat. These bricks reduce the amount of heat that passes through the walls, keeping the inside of the house cooler in hot regions. This helps in maintaining a comfortable indoor temperature and reduces the need for cooling systems like fans or air conditioners.

8. Explain how large water bodies prevent extreme temperature in areas around them.

A. Large water bodies like lakes, seas, or oceans absorb and store heat during the day and release it slowly at night. Water heats up and cools down more slowly than land, so places near large water bodies experience moderate temperatures — cooler during the day and warmer at night. This helps in preventing extreme temperatures in coastal or nearby regions.

9. Explain how water seeps through the surface of the Earth and gets stored as groundwater.

A. When it rains or water is poured onto the ground:

• Some of it **runs off** over the surface.

• The rest **seeps through the soil** and moves downward due to gravity.

• It passes through **pores and spaces** in soil and rock layers.

• Finally, it collects in **underground layers of rock** called **aquifers**, where it is stored as **groundwater**.

10. The water cycle helps in the redistribution and replenishment of water on the Earth. Justify the statement.

Ice stupa

A. The water cycle includes processes like:

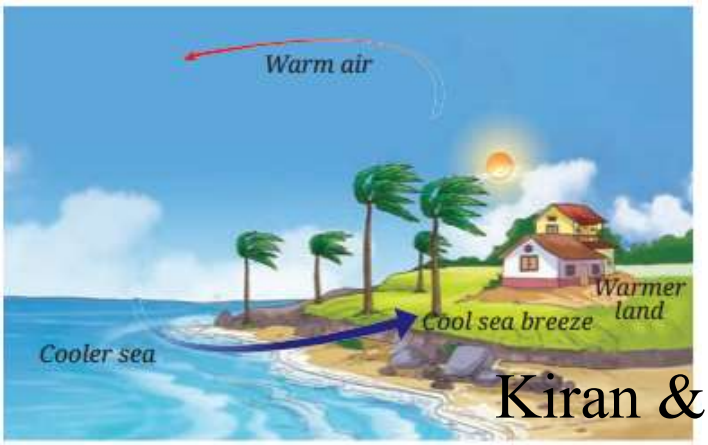
• **Evaporation:** Water turns into vapor and rises into the air.

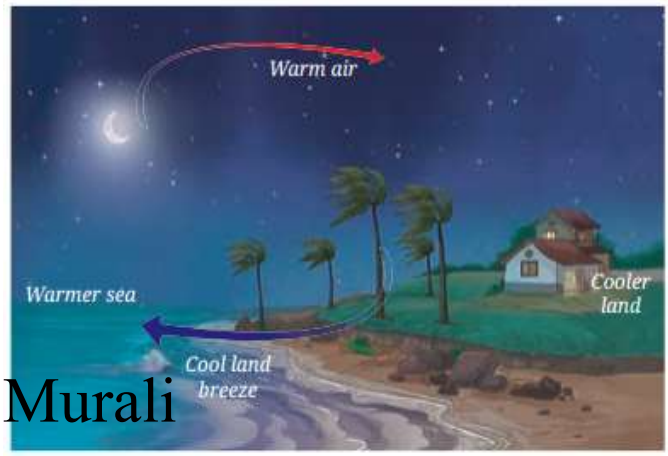
• **Condensation:** Water vapor cools and forms clouds.

• **Precipitation:** Water falls back to Earth as rain, snow, etc.

• **Collection and seepage:** Water collects in rivers, lakes, and underground.

This cycle redistributes water from oceans to land and replenishes groundwater, rivers, and lakes. It ensures that water keeps moving and is **available in different parts of the Earth**, supporting life and the environment.





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Sea breeze **Land breeze**

Good & Poor Conductors of Heat

Good Conductors of Heat	Poor Conductors of Heat (Insulators)
1. Copper	1. Wood
2. Aluminium	2. Plastic
3. Iron	3. Glass
4. Silver	4. Rubber
5. Gold	5. Air
6. Steel	6. Water
7. Brass	7. Paper
8. Mercury (metallic liquid)	8. Cloth
9. Graphite (form of carbon)	9. Thermocol
10. Bronze	10. Wool

Curiosity Corner:

- **Why metals are good conductors?**
  Because they have **free electrons** that easily transfer heat.
- **Why are materials like wood or plastic poor conductors?**
  They **lack free electrons** and their particles are not good at passing heat.

Conduction:

Definition: Transfer of heat through a solid from one particle to another without the movement of the object.

Example: A metal spoon getting hot when placed in a cup of hot tea.

Curiosity Tip:

Metals conduct heat because their tiny particles called free electrons move fast and carry heat!

Convection:

Definition: Transfer of heat in liquids and gases through the movement of the fluid itself.

Example: Water boiling in a pot — hot water rises and cold water sinks.

Curiosity Tip:

It's like a heat dance in water and air — hot parts go up, cold parts come down!

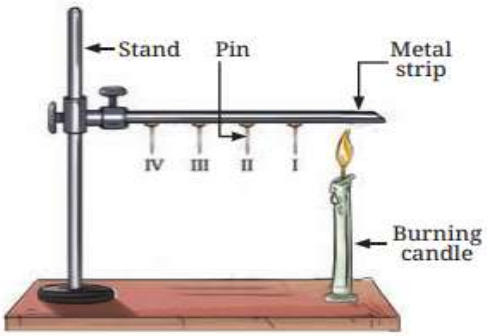
Radiation:

Definition: Transfer of heat through empty space (vacuum) without touching or moving particles.

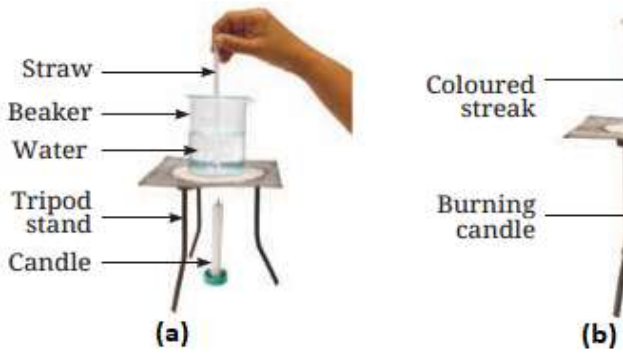
Example: Feeling warm in sunlight even though space between you and the Sun has no air!

Curiosity Tip:

This is how Earth gets heat from the Sun — by invisible heat rays called infrared radiation!



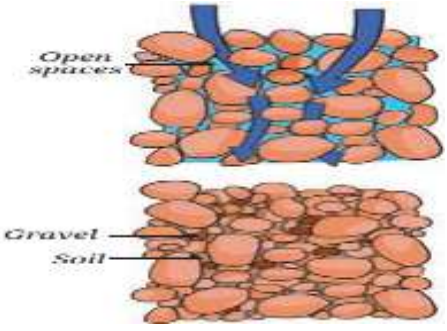
Heat transfer in a metal strip (Conduction)



Convection in heated water

Heating water in a pan (Radiation)

Bukhari



Water readily moves, and is stored where spaces are wide, open and connected

Differences between Conduction, Convection and Radiation

Feature	Conduction	Convection	Radiation
What is it?	Heat transfer in solids	Heat transfer in liquids and gases	Heat transfer through empty space
Medium needed?	Yes (solid)	Yes (liquid or gas)	No (can happen in vacuum)
How heat moves?	From particle to particle	By movement of fluid	By invisible heat rays (infrared)
Speed of transfer	Slow	Medium	Fast
Example	Hot spoon in tea	Boiling water in a pot	Feeling sunlight on your skin
Main action	No movement of object	Movement of particles in the fluid	No need for particles
Takes place in?	Solids	Liquids and gases	Solids, liquids, gases, and vacuum
Real-life example	Iron rod heated at one end	Warm air rising in a room	Solar heater using sun's heat
Needs contact?	Yes, direct contact	Yes, fluid movement	No contact needed
Curiosity fact	Metals are best conductors	Wind and ocean currents are convection!	This is how the Sun heats Earth!

Water Cycle

Aquifer

Himalayas

Desert

Chapter 8. Measurement of Time and Motion

Let us enhance our learning

1. Calculate the speed of a car that travels 150 metres in 10 seconds. Express your answer in km/h.

Sundial

A. Given:

Distance = 150 m

Time = 10 s

Speed = Distance / Time

150 m / 10 s = 15 m/s

Now, convert m/s to km/h:

1 m/s = 3.6 km/h

So,

15 m/s × 3.6 = 54 km/h

15 m/s or 54 km/h

2. A runner completes 400 metres in 50 seconds. Another runner completes the same distance in 45 seconds. Who hasa greater speed and by how much?

Some common clocks and watches

A. Runner 1 speed = 400 ÷ 50 = 8 m/s

Runner 2 speed = 400 ÷ 45 ≈ 8.89 m/s

Difference = 8.89 – 8 = 0.89 m/s

Runner 2 is faster by 0.89 m/s

3. A train travels at a speed of 25 m/s and covers a distance of 360 km. How much time does it take?

Sundial - Janta Mantar in Jaipur, Rajasthan

A. Convert distance to metres:

360 km = 360,000 m

Time = Distance / Speed

360,000 ÷ 25 = 14,400 seconds

Convert seconds to hours:

14,400 ÷ 3600 = 4 hours

4. A train travels 180 km in 3 h. Find its speed in:

(i) km/h

(ii) m/s

(iii) What distance will it travel in 4 h if it maintains the same speed throughout the journey?

A. Given:

Distance = 180 km

Time = 3 hours

Step 1: Speed in km/h

Speed = Distance ÷ Time

= 180 km ÷ 3 h

= 60 km/h

A train on a straight track

Step 2: Speed in m/s

To convert km/h to m/s, we use the formula:

1 km/h = 5/18 m/s

So,

Speed = 60 × (5/18) = (300 / 18) = 16.67 m/s (approx)

So, the speed is 16.67 m/s

Step 3: Distance travelled in 4 hours

Speed = 60 km/h (from Step 1)

Time = 4 hours

Distance = Speed × Time

= 60 × 4 = 240 km

An Hourglass

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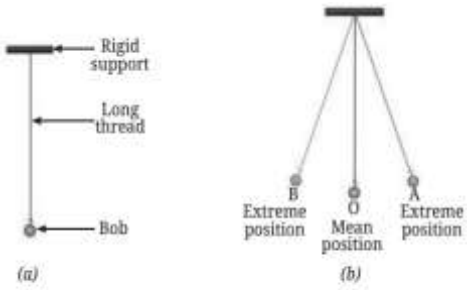
🎯 Final Answers:

Part	Answer
(i)	60 km/h
(ii)	16.67 m/s (approx)
(iii)	240 km



A Simple Pendulum

5. The fastest galloping horse can reach the speed ofapproximately 18 m/s. How does this compare to the speed of a train moving at 72 km/h?

A. Convert train speed to m/s:

72 km/h = 72 × 1000 ÷ 3600 = 20 m/s

Comparison:

Train = 20 m/s

Horse = 18 m/s

A Wall Clock

Difference = 20 – 18 = 2 m/s

The train is faster by 2 m/s

6. Distinguish between uniform and non-uniform motion usingthe example of a car moving on a straight highway with no traffi c and a car moving in city traffic.

A.

Type of Motion	Definition	Example
Uniform Motion	Motion in which an object covers **equal distances in equal intervals of time**	A car moving at constant speed on a straight highway with no traffic
Non-Uniform Motion	Motion in which an object covers **unequal distances in equal time intervals**	A car moving in city traffic where it slows down, stops, and speeds up again

- **Uniform motion:** Car on a straight highway (no traffic).
- **Non-uniform motion:** Car moving in city traffic.

7. Data for an object covering distances in different intervals of time are given in the following table. If the object is in uniform motion, fi ll in the gaps in the table.

Time (s)	0	10	20	30		50		70
Distance (m)	0	8		24	32	40		56

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A. Let's find the distance covered in each known 10-second interval:

- 0 to 10 s → 8 m
- 10 to 30 s → 24 m – 8 m = 16 m (over 20 s, or 8 m per 10 s)
- 30 to 40 s → 32 – 24 = 8 m
- 40 to 50 s → 40 – 32 = 8 m
- 50 to 70 s → 56 – 40 = 16 m (over 20 s, or 8 m per 10 s)

This suggests a uniform motion at 8 m per 10 seconds, or 0.8 m/s


A Candle Clock

✅ Final Answer (Assuming Uniform Motion):

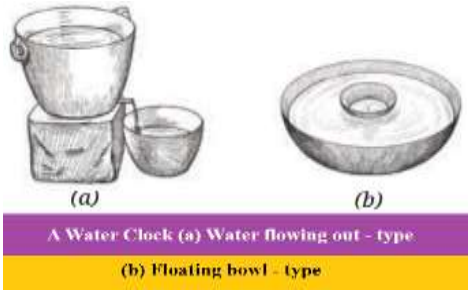
Time (s)	**0**	**10**	**20**	**30**	**40**	**50**	**60**	**70**
Distance (m)	0	8	**16**	24	32	40	**48**	56

8. A car covers 60 km in the fi rst hour, 70 km in the second hour, and 50 km in the third hour. Is the motion uniform? Justify your answer. Find the average speed of the car.

A. Let's solve this step by step:

🚙 **Given:**

- Distance in 1st hour = 60 km
- Distance in 2nd hour = 70 km


(a) (b)

A Water Clock (a) Water flowing out - type

(b) Floating bowl - type

- Distance in 3rd hour = 50 km
- Total time = 3 hours

Speedometer

❓ **Is the motion uniform?**

Uniform motion means:

An object travels equal distances in equal intervals of time.

Here, the car covers **different distances** in each hour:

- 60 km → 70 km → 50 km
  So, **the motion is NOT uniform**.

✅ **Answer:**

No, the motion is **not uniform** because the car covers **unequal distances in equal time intervals**.

📊 **Now, Find the Average Speed**

Formula:

Average Speed = Total Distance ÷ Total Time

- Total Distance = 60 + 70 + 50 = **180 km**
- Total Time = 3 hours

So,

Average Speed = 180 ÷ 3 = 60 km/h

🎯 **Final Answer:**

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Part	Answer
Is the motion uniform?	❌ No, because the car covers unequal distances in equal time intervals.
Average Speed	✅ **60 km/h**

9. Which type of motion is more common in daily life-uniform or non-uniform? Provide three examples from your experience to support your answer.

A. More common type of motion: Non-uniform motion is far more common in daily life.

Examples of Non-uniform motion:

1. A person walking or running: When you walk or run, you constantly change your speed (speeding up, slowing down, stopping, starting) and often change direction.

2. A car driving in city traffic: Cars in city traffic frequently accelerate, decelerate, stop at traffic lights, and navigate around other vehicles, making their motion non-uniform.

3. A bus or train journey: While a train on a long stretch might maintain a relatively constant speed, it still undergoes non-uniform motion when starting, stopping, accelerating out of stations, or slowing down for curves. Similarly, a bus constantly stops and starts for passengers, making its motion non-uniform.

10. Data for the motion of an object are given in the following table. State whether the speed of the object is uniform or non-uniform. Find the average speed.

Time (s)	0	10	20	30	40	50	60	70	80	90	100
Distance (m)	0	6	10	16	21	29	35	42	45	55	60

A. **Step 1: Check if the speed is uniform or non-uniform**
Uniform speed means **equal distances in equal time intervals**.
Let's examine how the distance changes every 10 seconds:

Time (s)	Distance (m)	Time Interval (Δt) (s)	Distance Covered (Δd) (m)	Speed (Δd/Δt) (m/s)
0	0	-	-	-
10	6	10 - 0 = 10	6 - 0 = 6	6 / 10 = 0.6
20	10	20 - 10 = 10	10 - 6 = 4	4 / 10 = 0.4
30	16	30 - 20 = 10	16 - 10 = 6	6 / 10 = 0.6
40	21	40 - 30 = 10	21 - 16 = 5	5 / 10 = 0.5
50	29	50 - 40 = 10	29 - 21 = 8	8 / 10 = 0.8
60	35	60 - 50 = 10	35 - 29 = 6	6 / 10 = 0.6
70	42	70 - 60 = 10	42 - 35 = 7	7 / 10 = 0.7
80	45	80 - 70 = 10	45 - 42 = 3	3 / 10 = 0.3
90	55	90 - 80 = 10	55 - 45 = 10	10 / 10 = 1.0
100	60	100 - 90 = 10	60 - 55 = 5	5 / 10 = 0.5

As you can see, **speed varies**, so the motion is **non-uniform**.
Step 2: Calculate Average Speed
Average speed is calculated as the total distance covered divided by the total time taken.

- **Total Distance** = 60 m (from the last entry in the distance column)
- **Total Time** = 100 s (from the last entry in the time column)

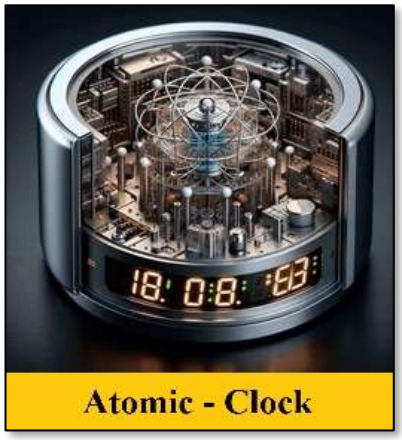
Average Speed = Total Distance / Total Time = 60 m / 100 s = **0.6 m/s**

✅ **Final Answer:**

- **The motion is non-uniform** (since speed varies with time).
- **Average speed = 0.6 m/s**.

11. A vehicle moves along a straight line and covers a distance of 2 km. In the first 500 m, it moves with a speed of 10 m/s and in the next 500 m, it moves with a speed of 5 m/s. With what speed should it move the remaining distance so that the journey is complete in 200 s? What is the average speed of the vehicle for the entire journey?

A. 1. Calculate time taken for the first two segments:



- **First 500 m:**
  - Distance (d1) = 500 m
  - Speed (v1) = 10 m/s
  - Time (t1) = d1/v1 = 500 m / 10 m/s = 50 s
- **Next 500 m:**
  - Distance (d2) = 500 m
  - Speed (v2) = 5 m/s
  - Time (t2) = d2/v2 = 500 m / 5 m/s = 100 s

2. Calculate the remaining distance and time:

- **Total distance** = 2 km = 2000 m
- **Distance covered so far** = d1+d2 = 500 m + 500 m = 1000 m
- **Remaining distance (d3)** = Total distance - Distance covered = 2000 m - 1000 m = 1000 m
- **Total journey time** = 200 s

- **Time taken so far** = t1+t2 = 50 s + 100 s = 150 s
- **Remaining time (t3)** = Total journey time - Time taken so far = 200 s - 150 s = 50 s

3. Calculate the speed for the remaining distance:

- Speed for remaining distance (v3) = d3/t3 = 1000 m / 50 s = 20 m/s

4. Calculate the average speed for the entire journey:

- **Average speed** = Total distance / Total time
- Average speed = 2000 m / 200 s = 10 m/s

Answer:

- The vehicle should move the remaining distance with a speed of **20 m/s**.
- The average speed of the vehicle for the entire journey is **10 m/s**.

🌈✨ Measurement of Time and Distance

🔢 Quantity	📘 Formula	🧠 How to Remember	🎯 Unit
🚗 **Speed**	**Speed = Distance ÷ Time**	"Speed is how fast you go!"	km/h or m/s
🛣️ **Distance**	**Distance = Speed × Time**	"Distance is how far you go!"	km or m
⏱️ **Time**	**Time = Distance ÷ Speed**	"Time tells how long you take!"	hours (h) or seconds (s)

🌍📏 Units of Time and Distance

🔢 Quantity	🍼 Unit	🔤 Symbol	🌟 Interesting Fact
⏱️ Time	Second	**s**	Basic unit of time in SI
⏱️ Time	Minute	**min**	1 min = 60 seconds
⏱️ Time	Hour	**h**	1 hour = 60 minutes
⏱️ Time	Day	—	1 day = 24 hours
🛣️ Distance	Metre	**m**	Basic unit of distance in SI
🛣️ Distance	Kilometre	**km**	1 km = 1000 metres
🛣️ Distance	Centimetre	**cm**	1 m = 100 cm
🛣️ Distance	Millimetre	**mm**	1 cm = 10 mm
🌌 Space Distance	Astronomical Unit	**AU**	Distance between Earth and Sun ≈ **150 million km**
🌌 Space Distance	Light Year	**ly**	Distance light travels in 1 year ≈ **9.46 trillion km**
🌌 Space Distance	Parsec	**pc**	Used to measure huge space distances

🌟 **Curiosity Boost!**

- 🌞 **1 AU** = Distance from **Earth to Sun**
- 🌠 **1 Light Year** = Distance light travels in **1 year**
- 🌌 **1 Parsec ≈ 3.26 light years**

🧠 **Curiosity Tip:**

- 🕰️ **Sundials** don't work at night!
- 🔬 **Atomic clocks** are so accurate they lose **1 second in millions of years**!

🌈 **Color Key:**

- 🔵 **Short time** (Day to Month)
- 🟢 **Medium time** (Year to Decade)
- 🟡 **Special celebrations** (Silver, Golden, Platinum)
- 🔴 **Long time** (Century and Millennium

⏳ 🌞 Time Sequence Table

🔢 Time Period	🗓️ Length	🎯 Unit	💡 Fun Fact
🌞 **Day**	24 hours	—	One full rotation of Earth
🗓️ **Week**	7 days	—	7 days = 1 week
🌗 **Fortnight**	14 days	—	"Fort" = 14 → Half a month
🗓️ **Month**	28–31 days	—	Varies with the month (e.g., Feb has 28 or 29 days)
🗓️ **Year**	12 months / 365 days	1 year	Leap year has 366 days
🔟 **Decade**	10 years	10 years	"Deca" means ten
🧂 **Silver Jubilee**	25 years	25 years	Celebrates 25 years of achievement
🏅 **Golden Jubilee**	50 years	50 years	Gold for 50 years celebration
💎 **Platinum Jubilee**	75 years	75 years	Royal and grand celebration
💯 **Century**	100 years	100 years	A full century — 100 years
🕰️ **Millennium**	1000 years	1000 years	"Milli" = 1000 — a thousand-year period

⏰ 🕰️ Types of Clocks – A Journey Through Time!

🧭 Type of Clock	📘 Description	💡 Curiosity Fact
🌞 **Sundial**	Uses the shadow of the sun to tell time	Oldest known type of clock!
🕳️ **Water Clock** (Clepsydra)	Measures time by the flow of water	Used in ancient Egypt and India
🔥 **Candle Clock**	A marked candle burns slowly to show time	Each section burns in equal time
⚖️ **Hourglass**	Sand flows from one glass bulb to another	Often used in games and cooking
🧱 **Mechanical Clock**	Uses gears and springs to move hands on a dial	First made in the 14th century
🔋 **Pendulum Clock**	A swinging pendulum keeps the clock ticking	Very accurate in the 1600s
🔋 **Quartz Clock**	Uses a tiny vibrating quartz crystal powered by battery	Found in most modern wall clocks and wristwatches
📱 **Digital Clock**	Shows time in numbers (like 07:30 AM) using electronics	Easy to read and common in homes and phones
📶 **Atomic Clock**	Measures time using vibrations of atoms (usually cesium)	Most accurate clock in the world!
🌍 **Smart Clocks**	Connected to internet or phone, auto-adjusts time & gives weather	Found in smartwatches and smart homes

Chapter 9. Life Processes in Animals

Let us enhance our learning

1. Complete the journey of food through the alimentary canal by filling up the boxes with appropriate parts-

Food → Mouth → ____ → Stomach → ____ → ____ → Anus

A. Food ➔ Mouth ➔ Oesophagus ➔ Stomach ➔ Small Intestine ➔ Large Intestine ➔ Anus

2. Sahil placed some pieces of chapati in test tube A. Neha placed chewed chapati in test tube B, and Santushti took boiled and mashed potato in test tube C. All of them added a few drops of iodine solution to their test tubes - A, B, and C, respectively. What would be their observations? Give reasons.

A. **Iodine solution** is used to test the presence of **starch**.

- If starch is **present**, iodine turns **blue-black**.
- If starch is **absent**, the iodine remains **brown or yellowish**.

Test Tube	Material	Observation	Reason
A	Pieces of chapati	**Blue-black color appears**	Chapati contains **starch**, and iodine reacts with it.
B	Chewed chapati (with saliva)	**Little or no blue-black color**	Saliva contains **salivary amylase**, which starts **breaking down starch** into sugar. So, less starch is left.
C	Boiled and mashed potato	**Blue-black color appears**	Potatoes are rich in **starch**, and iodine reacts with the starch present.

🧠 **Curiosity Corner:**

- 🥣 **Chewing** mixes food with **saliva**, which has **enzymes** like **amylase** that break down starch into sugar.
- 🧪 This shows how **digestion starts in the mouth** even before food reaches the stomach!

3. What is the role of the diaphragm in breathing?

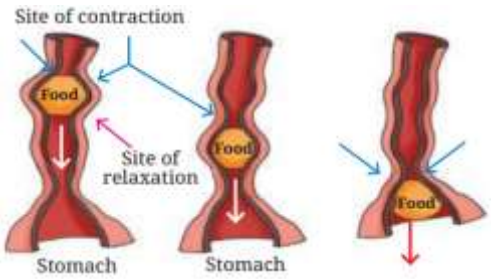
(i) To filter the air

(ii) To produce sound

(iii) To help in inhalation and exhalation

(iv) To absorb oxygen

A. **(iii) To help in inhalation and exhalation**



Movement of food in the food pipe

4. Match the following

Name of the part	Functions
(i) Nostrils	(a) fresh air from outside enters
(ii) Nasal passages	(b) exchange of gases occurs
(iii) Windpipe	(c) protects lungs
(iv) Alveoli	(d) tiny hair and mucus help totrap dust and dirt from the air we breathe
(v) Ribcage	(e) air reaches our lungs through this part

A.

Name of the part	Function
(i) Nostrils	(a) Fresh air from outside enters
(ii) Nasal passages	(d) Tiny hair and mucus help trap dust and dirt from the air we breathe
(iii) Windpipe	(e) Air reaches our lungs through this part
(iv) Alveoli	(b) Exchange of gases occurs
(v) Ribcage	(c) Protects lungs

5. Anil claims to his friend Sanvi that respiration and breathing are the same process. What question(s) can Sanvi ask him to make him understand that he is not correct?

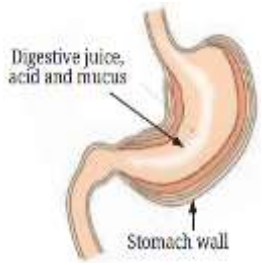
A. Sanvi can ask:

• Does breathing produce energy for the body?

• Is oxygen used to break down food in breathing?

• Can you breathe without releasing energy?

• Where does glucose get broken down—in breathing or respiration?



Stomach

6. Which of the following statements is correct and why?

Anu: We inhale air.

Shanu: We inhale oxygen.

Tanu: We inhale air rich in oxygen.

A. Tanu: We inhale air rich in oxygen. ✅ (Correct)

👉 Explanation:

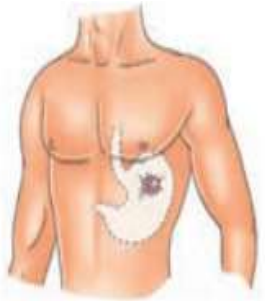
Tanu is correct because the air we inhale is a mixture of gases, mostly:

• Nitrogen (78%)

• Oxygen (21%)

• Carbon dioxide and others (1%)

We inhale air that is rich in oxygen, not oxygen alone.



Martin's shotgun wound

7. We often sneeze when we inhale a lot of dust-laden air. What can be possible explanations for this?

A. 👉 **Possible explanations for Sneezing:**

• The tiny hair and mucus in our nasal passages trap dust and irritants.

• When too many dust particles enter, the nose triggers a sneeze reflex to expel the irritants quickly and protect the lungs.

Sneezing helps clean the nasal cavity and prevent harmful particles from reaching deeper into the respiratory system.

8. Paridhi and Anusha of Grade 7 started running for their morning workout. After they completed their running, they counted their breaths per minute. Anusha was breathing faster than Paridhi. Provide at least two possible explanations for why Anusha was breathing faster than Paridhi.

A. 👉 **Possible explanations for faster breathing:**

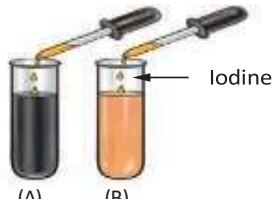
1. Higher energy use: Anusha may have run faster or longer, so her body needed more oxygen and produced more carbon dioxide.

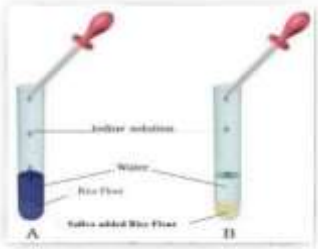
2. Fitness level: Paridhi might have better stamina or lung efficiency, so her breathing returned to normal faster.

3. Body condition: Anusha might be tired, dehydrated, or have a higher metabolic rate.

Faster breathing helps remove carbon dioxide and bring in more oxygen for the muscles.

9. Yadu conducted an experiment to test his idea. He took two test tubes, A and B, and added a pinch of rice flour to the test tubes, half-filled with water and stirred them properly. To test tube B, he added a few drops of saliva. He left the two test tubes for 35–45 min. After that, he added iodine solution into both the test tubes. Experimental results are as shown in Fig. 9.15. What do you think he wants to test?





Effect of saliva on starch

A. **Experiment:** To study the effect of saliva on starch.

Aim: To demonstrate how saliva breaks down starch into simpler sugars, making it unreactive to iodine.

Apparatus: Two test tubes, Starch solution, Dropper, Water.

Chemicals: Amylase (an enzyme found in saliva), Iodine solution.

Procedure:

1. Add rice flour to both test tubes A and B with water and stir well.
2. Add a few drops of saliva to test tube B only.
3. Let both test tubes sit for 35–45 minutes.
4. Add iodine solution to both test tubes.

Observations:

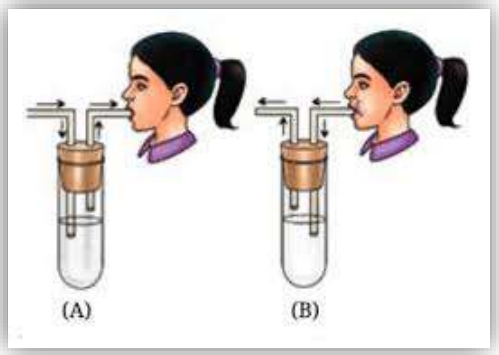
1. Test Tube A (No saliva): Turns blue-black on adding iodine → Starch is present.
2. Test Tube B (With saliva): No colour change (remains brownish) → Starch is broken down.

Conclusion:

Saliva breaks down starch into simpler sugars. Iodine reacts with starch but **not with sugar**, so the lack of blue-black colour in test tube B shows that starch has been digested.

10. Rakshita designed an experiment taking two clean test tubes, A and B and fi lled them with lime water as shown in the fi gure. In test tube A, the surrounding air that we inhale was passed on by sucking air from the pipe, and in test tube B, the exhaled air was blown through the pipe (Fig. 9.16). What do you think she is trying to investigate? How can she confirm her findings?

A. Rakshita is conducting an experiment to compare the amount of carbon dioxide (CO_2) in inhaled air versus exhaled air using lime water as an indicator.



Objective:

To demonstrate that exhaled air contains more carbon dioxide than inhaled air.

Experiment Setup:

• Test Tube A: Air inhaled from surroundings is passed through lime water.

• Test Tube B: Air exhaled (breathed out) is passed through lime water.

Expected Observations:

• Test Tube A (inhaled air): Little or no change in lime water - stays clear or very slightly cloudy (low CO_2).

• Test Tube B (exhaled air): Lime water turns milky quickly (high CO_2).

Conclusion:

Kiran & Murali

• Exhaled air has more carbon dioxide than inhaled air.

• This proves that our body produces CO_2 during respiration and removes it via exhalation.

Basic Nutritional Facts

Nutrient	Function in the Body	Examples of Foods
Carbohydrates	Provide energy for daily activities	Rice, bread, potatoes, bananas
Proteins	Help build and repair muscles and tissues	Eggs, milk, pulses, meat, fish
Fats	Give energy and help absorb vitamins	Nuts, butter, oil, cheese
Vitamins	Protect the body from diseases and keep it healthy	Fruits, vegetables, milk, eggs
Minerals	Help in bone strength, blood health, and other body functions	Salt, spinach, nuts, dairy products
Water	Keeps the body hydrated and supports all bodily functions	Water, fruits like watermelon and oranges
Fiber	Helps in digestion and keeps the stomach clean	Whole grains, fruits, vegetables, beans

Fun Facts:

- **Proteins** are like body-building blocks.
- **Vitamin C** in oranges helps fight colds.
- **Iron** in spinach makes your blood strong.
- **Bananas** give quick energy – that's why athletes love them!
- **Milk** has protein **and** calcium – a double bonus for growing kids!
- **Too much fat or sugar** can cause health problems – balance is the key!

Inner lining of the small intestine

🍽️ Types of Nutrition

Animal / Organism	Type of Nutrition	Mode of Feeding	Example Description
Amoeba	Holozoic (Ingestive)	Engulfs food with pseudopodia	Single-celled, surrounds food and digests inside.
Paramecium	Holozoic	Cilia help in feeding	Uses tiny hair-like structures to push food inside.
Earthworm	Holozoic	Swallows soil and digests nutrients	Eats soil, extracts nutrients.
Mosquito (female)	Parasitic	Sucks blood	Feeds on blood of other animals.
Cow, Goat	Holozoic (Herbivore)	Grazing on grass	Eats plant material only.
Lion, Tiger	Holozoic (Carnivore)	Hunts and eats animals	Feeds on flesh of other animals.
Crow, Human	Holozoic (Omnivore)	Eats both plants & animals	Eats a variety of food sources.
Tapeworm	Parasitic	Absorbs nutrients from host	Lives inside other animals and steals nutrients.
Butterfly	Siphoning	Sucks nectar	Uses a long tube-like tongue to drink flower nectar.
Fungus (e.g. bread mold)	Saprotrophic	Absorbs nutrients from dead matter	Grows on decaying things and absorbs nutrients.

🌟 Fun Facts:

- **Humans are omnivores** – we enjoy fruits *and* fries!
- **Parasites** like tapeworms can live inside other animals.
- **Amoeba** "eats" by wrapping around its food!

🍽️ Digestive Enzymes in Humans

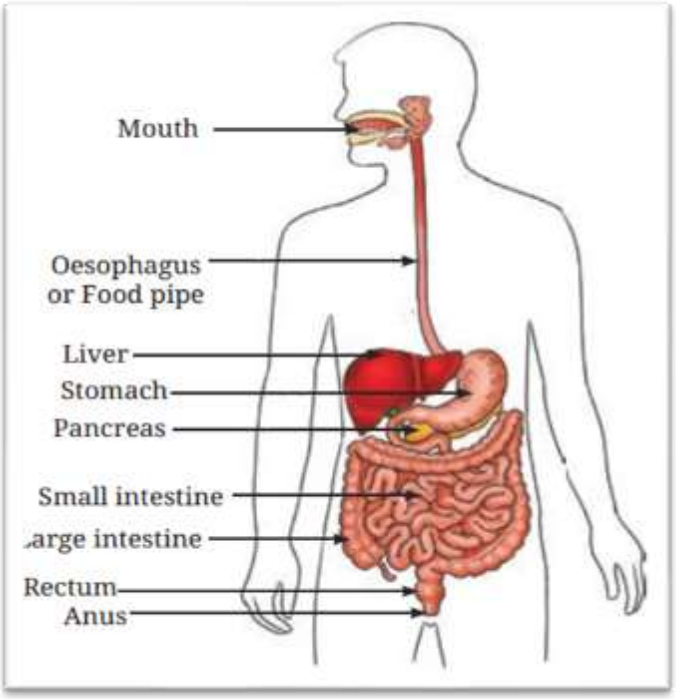
Organ	Secretion / Enzyme	Acts On (Nutrient)	End Product	Special Notes
Mouth	Salivary Amylase	Starch (carbohydrates)	Maltose (simple sugar)	Begins digestion in the mouth
Stomach	Pepsin (with HCl help)	Proteins	Peptides	Pepsin works only in acidic environment
	Hydrochloric Acid (HCl)	—	—	Kills germs, activates pepsin
Liver	**Bile (not an enzyme)**	Fats (large droplets)	Small fat droplets (emulsified)	Helps lipase work better by breaking down fats
Pancreas	Pancreatic Amylase	Starch	Maltose	Continues carbohydrate digestion in small intestine
	Trypsin	Proteins	Peptides	Works in alkaline medium
	Lipase	Fats	Fatty acids + Glycerol	Digests emulsified fats
Small Intestine	Maltase, Sucrase, Lactase	Simple sugars	Glucose, Fructose, etc.	Final sugar digestion
	Peptidase	Peptides	Amino acids	Final protein digestion

🧪 Fun Science Facts:

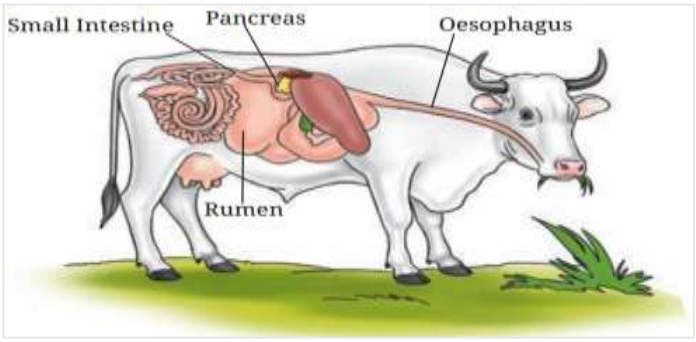
- **Amylase** starts working right in your mouth!
- **Pepsin** works best in acidic (sour) conditions, like in your stomach.
- **Bile** (from the liver) is not an enzyme, but **breaks down fat** into tiny droplets so enzymes can digest it faster!

- **Liver** makes **bile**, stored in the **gallbladder**, and helps digest fats.
- **Pancreas** produces enzymes that break down **all three** major nutrients: carbs, proteins, and fats.
- **Small intestine** is the main site where **complete digestion and absorption** happens!

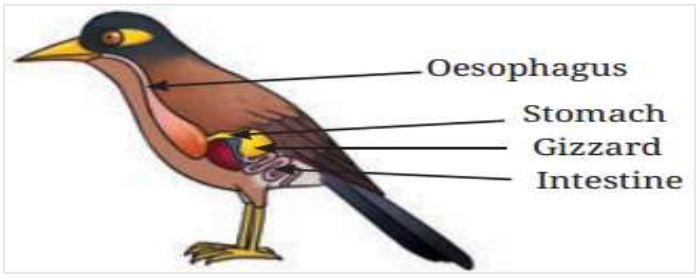
Human Digestive System



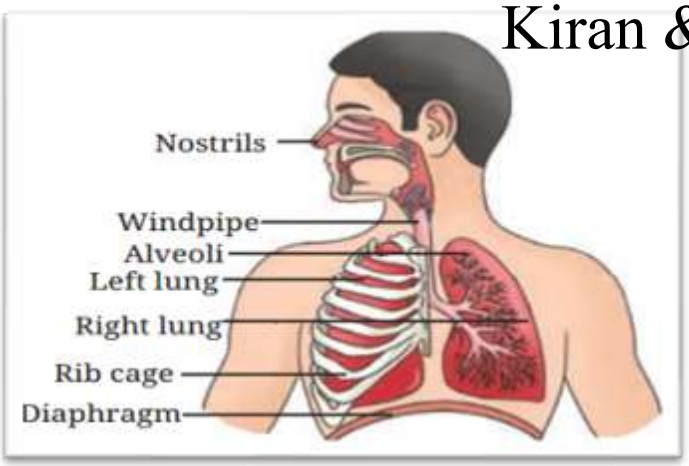
Digestive system of a ruminant



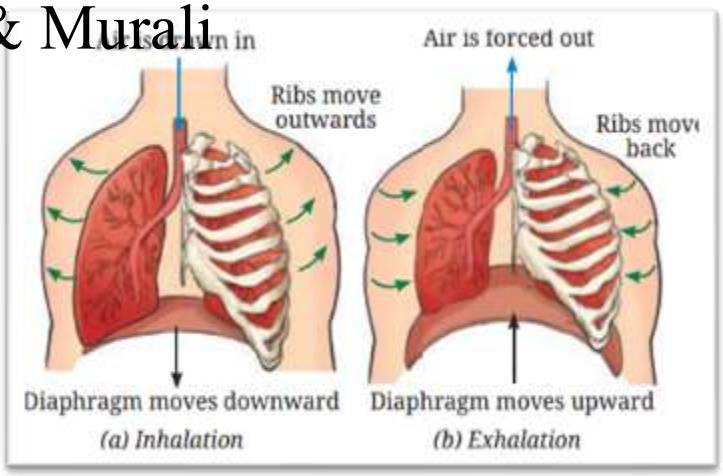
Digestive system in birds

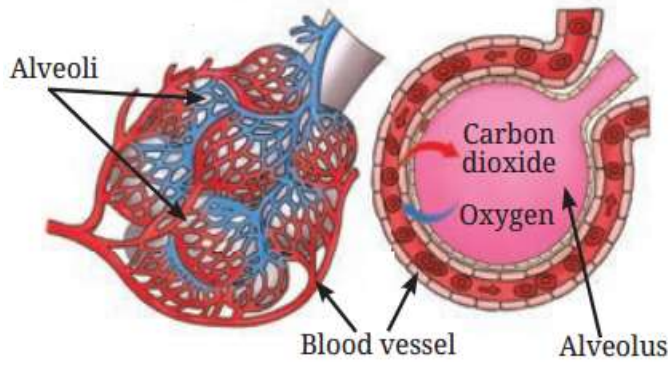


Human Respiratory System

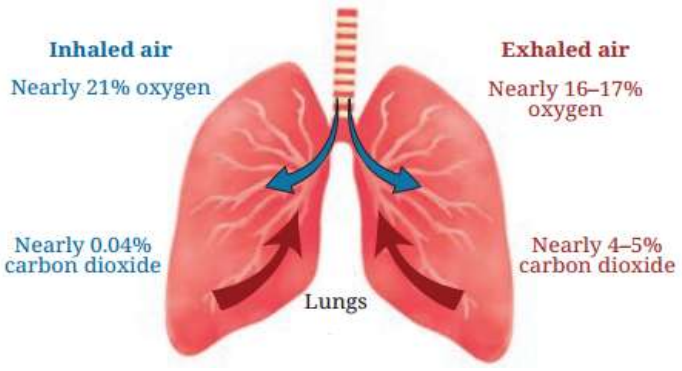


Mechanism of breathing





Gas exchange through alveoli



The percentage of Oxygen and Carbon dioxide in inhaled and exhaled air

🫁 Respiratory Systems in Animals

Organism	Type of Respiration	Respiratory Organ/Method	Example Description
Amoeba	Cellular respiration	Diffusion through cell membrane	Oxygen enters and carbon dioxide leaves directly through the surface.
Earthworm	Skin respiration	Moist skin	Breathes through moist skin; gases exchange directly with environment.
Fish	Aquatic respiration	Gills	Gills take in dissolved oxygen from water.
Frog	Dual respiration (aquatic & land)	Skin (in water), Lungs (on land)	Skin works in water, lungs on land.
Insects (e.g., grasshopper)	Air-tube system	Spiracles and tracheae	Air enters through spiracles into tracheae for gas exchange.
Birds	Pulmonary respiration	Lungs with air sacs	Efficient system with continuous airflow.
Humans	Pulmonary respiration	Nose → windpipe → lungs	Inhale oxygen-rich air, exhale carbon dioxide.

🔍 Fun Science Facts:

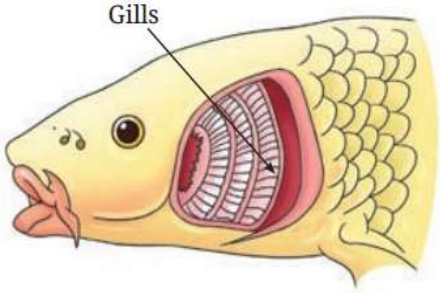
- **Earthworms** need moist skin to breathe - that's why they come out when it rains!
- **Fish** cannot survive long out of water because their **gills collapse** in air.
- **Insects** don't have lungs at all!

🧬 Respiratory Pigments in Animals

Organism Type	Respiratory Pigment	Color	Function
Amoeba (unicellular)	❌ *None*	—	Oxygen diffuses directly into the cell - no pigment used.
Earthworm	**Hemoglobin** (in plasma)	Red	Carries oxygen from skin to body cells.
Insects	❌ *None*	—	Oxygen reaches cells through air tubes (tracheae); no need for pigment.
Snails & some Mollusks	**Hemocyanin**	Blue	Uses copper instead of iron to carry oxygen.
Octopus	**Hemocyanin**	Blue	Very efficient in cold, low-oxygen water.
Leech	**Hemoglobin** (in plasma)	Red	Carries oxygen even without red blood cells.
Fish & Amphibians	**Hemoglobin**	Red	Found in red blood cells - helps in aquatic & land breathing.
Humans & Mammals	**Hemoglobin**	Bright red (when oxygenated)	Carries oxygen in red blood cells throughout the body.

🔬 Fun Facts for Students:

- **Hemoglobin** contains **iron** — that's why blood is red!
- **Hemocyanin** contains **copper**, which makes it **blue**!
- Insects don't need pigments — they breathe through tiny holes called **spiracles**!



Breathing body parts of a fish

Chapter 10. Life Processes in Plants
Let us enhance our learning

1. Complete the following table

S.No	Feature	Photosynthesis	Respiration
1.	Raw materials		
2.	Products		
3.	Word equation		
4.	Importance		

A.

S.No	Feature	Photosynthesis	Respiration
1.	Raw materials	Carbon dioxide, Water, Sunlight (energy)	Glucose (sugar), Oxygen
2.	Products	Glucose (sugar), Oxygen	Carbon dioxide, Water, ATP (energy)
3.	Word equation	Carbon dioxide + Water + Light energy → Glucose + Oxygen	Glucose + Oxygen → Carbon dioxide + Water + Energy
4.	Importance	Produces food (glucose) for plants and ultimately for all life; releases oxygen into the atmosphere	Releases energy from food for cellular activities; produces carbon dioxide for photosynthesis

2. Imagine a situation where all the organisms that carry out photosynthesis on the earth have disappeared. What would be the impact of this on living organisms?

A. Impact on living organisms:

- There would be no oxygen production, leading to a lack of breathable air.
- Food chains would collapse as plants form the base of most ecosystems.
- Carbon dioxide levels would rise, worsening global warming.
- All animals, including humans, would eventually die due to lack of food and oxygen

3. A potato slice shows the presence of starch with iodine solution. Where does the starch in potatoes come from? Where is the food synthesised in the plant, and how does it reach the potato?

A. The starch in potato comes from,

The starch in potatoes comes from glucose made during photosynthesis in the leaves.

Leaves use sunlight, carbon dioxide, and water to produce food.

This food (glucose) is converted into starch for storage.

It is transported through the phloem to storage organs like the potato.

4. Does the broad and flat structure of leaves make plants more efficient for photosynthesis? Justify your answer.

A. Yes, the broad and flat structure of leaves makes plants more efficient for photosynthesis.

A larger surface area allows leaves to capture more sunlight.

The thin shape helps gases like carbon dioxide to diffuse easily.

Together, these features increase the rate of photosynthesis.

5. X is broken down using Y to release carbon dioxide, Z, and energy.

X + Y Carbon dioxide + Z + Energy

X, Y, and Z are three different components of the process. What do X, Y, and Z stand for?

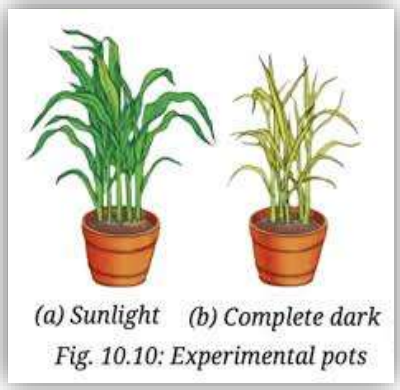
A.

- X = Glucose
- Y = Oxygen
- Z = Water

So, glucose (X) is broken down using oxygen (Y) to release carbon dioxide, water (Z), and energy.

This is the process of cellular respiration.

6. Krishna set-up an experiment with two potted plants of same size and placed one of them in sunlight and the other in a dark room, as shown in Fig. 10.10.



(a) Sunlight (b) Complete dark

Fig. 10.10: Experimental pots

Answer the following questions -

(i) What idea might she be testing through this experiment?

A. Krishna is likely testing whether sunlight is necessary for photosynthesis in plants.

(ii) What are the visible diff erences in plants in both the conditions?

A. The plant placed in sunlight will look healthy, green, and upright because it can perform photosynthesis and produce food.

• The plant kept in the dark room will appear pale or yellowish, weak, and possibly drooping due to a lack of photosynthesis and food production.

(iii) According to you, leaves of which plants confirm the iodine test for the presence of starch?

A. The leaves of the plant placed in sunlight will confirm the iodine test for starch. This is because photosynthesis, which produces starch, only occurs in the presence of sunlight. The leaves of the plant in the dark room will not show a positive result, as no starch is produced without light.

7. Vani believes that 'carbon dioxide is essential for photosynthesis'. She puts an experimental set-up, as shown in Fig. 10.11, to collect evidence to support or reject her idea.

Fig. 10.11: A potted plant with sufficient water is placed under the prescribed conditions

Answer the following questions –

Photosynthesis requires sunlight, carbon dioxide, and water to produce glucose (which is stored as starch) and oxygen.

(i) In which plant(s) in the above set-up(s) will starch be formed?

A. Starch will be formed in plant (a) because it has both sunlight and carbon dioxide, which are essential for photosynthesis.

(ii) In which plant(s) in the above set-up(s) will starch not be formed?

A. Starch will not be formed in plants (b), (c), and (d).

• Plant (b) lacks carbon dioxide.

• Plants (c) and (d) lack sunlight.

(iii) In which plant(s) in the above set-up(s) will oxygen be generated?

A. Oxygen will be generated in plant (a) because it is undergoing photosynthesis, which produces oxygen as a byproduct.

(iv) In which plant(s) in the above set-up(s) will oxygen not be generated?

A. Oxygen will not be generated in plants (b), (c), and (d) as they are not performing photosynthesis due to the lack of either carbon dioxide or sunlight.

8. Ananya took four test tubes and fi lled three-fourth of each test tube with water. She labelled them A, B, C, and D (Fig. 10.12). In test tube A, she kept a snail; in test tube B, she kept a water plant; in test tube C, she kept both a snail and a plant. In test tube D, she kept only water. Ananya added a carbon dioxide indicator to all the test tubes. She recorded the initial colour of water and observed if there are any colour changes in the test tubes after 2–3 hours. What do you think she wants to find out? How will she know if she is correct?

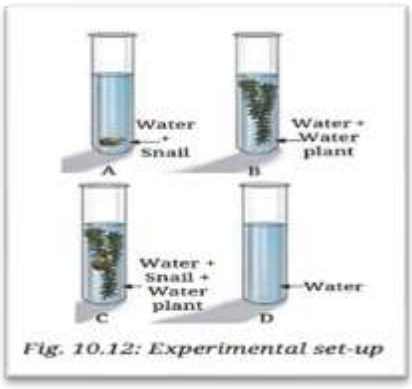


Fig. 10.12: Experimental set-up

A. **(i) What Ananya wants to find out:**

Ananya wants to find out how aquatic plants and animals affect the carbon dioxide (CO_2) levels in water. Specifically, she is investigating:

- Whether animals (like snails) release CO_2 through respiration
- Whether aquatic plants absorb CO_2 during photosynthesis
- Whether a combination of plants and animals maintains a balance of CO_2 in water

(ii) How will she know if she is correct?

She uses a carbon dioxide indicator (e.g., bromothymol blue) which changes colour based on CO_2 concentration:

- Yellow: High CO_2 (acidic)
- Green: Normal/neutral CO_2 level
- Blue: Low CO_2 (alkaline)

After 2–3 hours, the colour changes in each test tube will indicate the level of CO_2 and allow her to draw conclusions:

Test Tube	Contents	Expected Colour Change	Reason
A	Snail only	Turns yellow	Snail respires and releases CO_2; no plant to absorb it
B	Plant only	Turns blue	Plant performs photosynthesis, absorbs CO_2 from water
C	Snail + Plant	Stays green or slightly blue	CO_2 released by snail is used by the plant → balance
D	Water only	Stays green	No respiration or photosynthesis → no change in CO_2

Conclusion:

By comparing the colour changes, Ananya can confirm that:

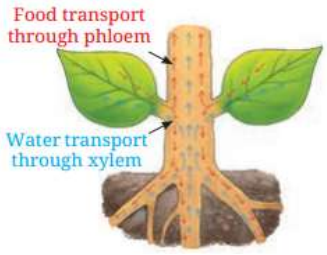
- Animals produce CO_2 during respiration.
- Plants use CO_2 during photosynthesis (in presence of light).
- A balance of plants and animals can stabilize CO_2 levels in an aquatic environment.

9. Design an experiment to observe if water transportation in plants is quicker in warm or cold conditions.

Kiran & Murali

A. **Aim:** To observe whether water transportation in plants is quicker in warm or cold conditions.

Materials Needed: Two identical leafy plant stems (e.g., balsam or celery), two beakers, coloured water (add a few drops of food colouring to water), thermometer, warm location (e.g., under a lamp or in sunlight), Cold location (e.g., near a fan, or place in a refrigerator for mild cooling), stopwatch or timer.



Transport of water and minerals in a plant

Procedure:

1. Fill both beakers with colored water.
2. Place one plant stem in each beaker.
3. Keep one setup in a warm area and the other in a cool area.
4. Note the time when both stems are placed in water.
5. After 30–60 minutes, observe how far the colored water has risen in each stem.
6. Measure and compare the distance the colored water has travelled in both stems.

Observation:

Record how much distance the coloured water moved up the stem in each condition.

Conclusion:

If water moves faster in the warm condition, it shows that higher temperatures increase the rate of water transportation in plants, likely due to faster evaporation and transpiration.

10. Photosynthesis and respiration are essential to maintain balance in nature. Discuss.

A. Photosynthesis and respiration are complementary processes that help maintain a balance of oxygen and carbon dioxide in nature.

Photosynthesis:

- Occurs in plants.
- Plants take in carbon dioxide (CO_2) and release oxygen (O_2).
- They use sunlight to convert CO_2 and water into glucose (food) and O_2.
- This provides oxygen for animals and humans to breathe.


Venus Flytrap

Respiration:

- Occurs in all living organisms.
- Organisms take in oxygen and release carbon dioxide.
- They break down glucose to release energy for life processes.

Balance Maintained:

- The oxygen released by plants during photosynthesis is used by animals and humans during respiration.
- The carbon dioxide released during respiration is used by plants during photosynthesis.
- This cycle maintains a stable level of gases in the atmosphere and supports life.

Conclusion:

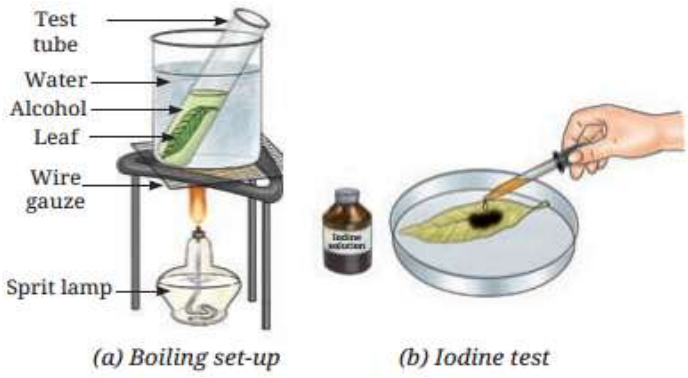
Photosynthesis and respiration are interdependent and together maintain the oxygen–carbon dioxide balance in the environment, which is essential for the survival of all living beings.

🌱 Types of Nutrition in Plants

Type of Nutrition	Description	Example Plants	Fun Fact
Autotrophic	Plants **make their own food** using sunlight (photosynthesis)	Mango, Neem, Tulsi, Grass	They are **producers** of the food chain!
Parasitic	Plants take food from a **host plant**	Cuscuta (Amarbel), Mistletoe	Cuscuta is called a "**plant thief**" 🌿🔗
Insectivorous	Plants trap and digest **insects** for nutrients (usually nitrogen)	Venus Flytrap, Pitcher Plant, Sundew	Pitcher Plant has a **leaf shaped like a jar**! 🦟🌱
Saprophytic	Plants get food from **dead and decaying** matter	Fungi (Mushroom, Bread mold)	These are the **cleaners of nature**! 🍄🧽
Symbiotic	Two plants (or plant and fungus) **help each other** and share food/resources	Lichen (algae + fungus), Mycorrhiza	Lichens can even grow on **rocks**! 🪨🦠

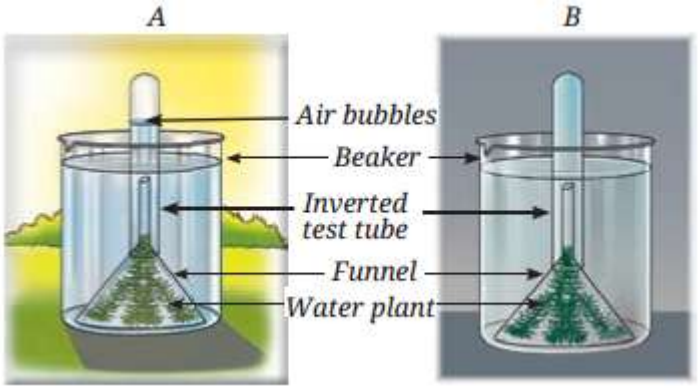
🧠 Fun Recap:

- **Autotrophs** = Self-feeders 🌞
- **Heterotrophs** = Depend on others for food 🌿
- Not all plants are green or make their own food!

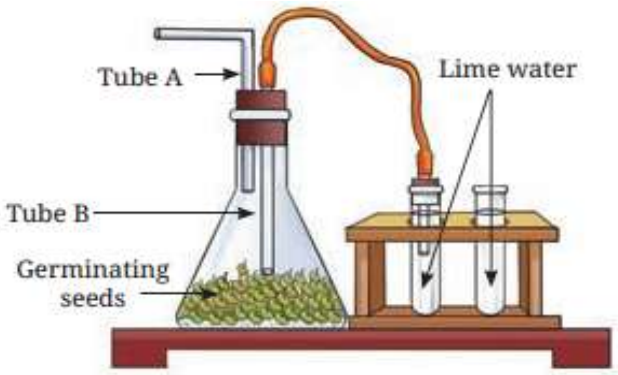


Starch test in a leaf

Testing the role of chlorophyll and air



Activity showing the release of oxygen during photosynthesis



Respiration in plants

Kiran & Murali

🧑‍🔬 Scientists and Their Work on Plant Nutrition

Scientist Name	Contribution / Discovery	Fun Fact or Year
Jan Baptista van Helmont	Proved that plants **gain mass from water**, not just soil	🌱 Famous willow tree experiment (1648)
Joseph Priestley	Discovered that **plants release oxygen**	🧪 Used a candle and mint plant (1771)
Jan Ingenhousz	Showed that **light is needed** for oxygen release in plants	🌞 Light + green plants = oxygen (1779)
Julius von Sachs	Proved that **chlorophyll is essential** for photosynthesis	🎨 Showed starch is made in green parts
Jean Senebier	Found that **plants absorb carbon dioxide** during photosynthesis	🫧 CO_2 is food for green leaves!
Theodor de Saussure	Explained that **both CO_2 and water** are needed for plant growth	🧬 Combined earlier discoveries (1804)
Melvin Calvin	Discovered the **Calvin Cycle** (how plants make glucose)	🏅 Won Nobel Prize in 1961

🌈 Pigments in Plants

Pigment Name	Color	Function	Examples
Chlorophyll	Green	Helps in **photosynthesis** – captures sunlight	Found in most green leaves (spinach, mint)
Carotenoids	Yellow, orange	Absorb sunlight; protect chlorophyll	Carrots, marigold flowers
Xanthophyll	Yellow	Helps absorb light; gives yellow color	Bananas, autumn leaves
Anthocyanins	Red, purple, blue	Attract pollinators; protect from UV rays	Beetroot, red cabbage, rose petals
Phycobilins	Red or blue	Absorb light in **algae**, especially underwater	Found in red and blue-green algae

🔬 Fun Facts:

- **Chlorophyll** is the most important pigment – it helps plants **make food**!
- In **autumn**, chlorophyll fades, and other pigments like **carotenoids** and **xanthophylls** become visible – that's why leaves turn yellow or red!
- **Anthocyanins** make flowers look pretty and **attract bees** for pollination.

🌿 Types of Stomata in Plants

Type of Stomata	Shape & Structure	Example Plants	Where Found on Leaf
Anomocytic (Irregular)	Surrounded by cells similar to other epidermal cells (no special pattern)	Sunflower, Bean, Cotton	Lower surface
Anisocytic (Unequal)	Surrounded by **3 cells**, one smaller than the others	Tobacco, Potato	Lower surface
Paracytic (Parallel)	Has **2 subsidiary cells** parallel to the guard cells	Pea, Grass, Mango	Both surfaces (more on lower side)
Diacytic (Crosswise)	**2 subsidiary cells** placed at right angles to guard cells	Clove, Tomato	Both surfaces
Graminaceous (Dumb-bell shaped)	Guard cells are **dumb-bell shaped** (special type in grasses)	Wheat, Rice, Sugarcane (grasses)	Upper and lower surface (in grasses)

🔬 What are Stomata?

- **Tiny pores** on leaves.
- Help in **gas exchange** (CO_2 in, O_2 out).
- Allow **transpiration** (water loss from leaves).

🌱 Fun Facts:

- Stomata are like the **"mouths"** of plants!
- They **open and close** depending on sunlight, water, and temperature.
- In dry areas, some plants have **fewer stomata** to save water.

🎨 Bonus: Acronym to Remember Plant Nutrition Types

A P I S S 🧠

- **A** – Autotrophic (Green plants)
- **P** – Parasitic (Cuscuta)
- **I** – Insectivorous (Pitcher plant)
- **S** – Saprophytic (Mushrooms)
- **S** – Symbiotic (Lichen)

Chapter 11. Light: Shadows and Reflections

Let us enhance our learning

1. Which of the following are luminous objects?

Mars, Moon, Pole Star, Sun, Venus, Mirror

A. Pole Star, Sun are the luminous objects.

Explanation: Luminous objects are those that emit their own light. Mars, Moon, and Venus reflect light from the Sun, making them non-luminous. A mirror reflects light, but does not produce its own.

2. Match the items in Column A with those in Column B.

Column A	Column B
Pinhole camera	Blocks light completely
Opaque object	The dark region formed behind the object
Transparent object	Forms an inverted image
Shadow	Light passes almost completely through it

A.

Column A	Column B
Pinhole camera	Forms an inverted image
Opaque object	Blocks light completely
Transparent object	Light passes almost completely through it
Shadow	The dark region formed behind the object

3. Sahil, Rekha, Patrick, and Qasima are trying to observe the candle flame through the pipe as shown in Fig. 11.16. Who can see the flame?

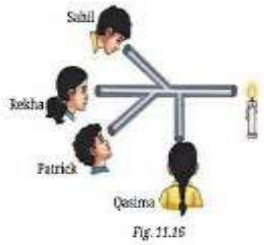


Fig. 11.16

A. Only Rekha (the child directly in line with the straight path of the pipe facing the candle) can see the flame.

Reason: Light travels in a straight line. The pipes connected in a straight line from the flame to Rekha's eye allow light to reach her. The other children (Sahil, Patrick, and Qasima) are connected to bent or blocked paths, so they cannot see the flame.

4. Look at the images shown in Fig. 11.17 and select the correct image showing the shadow formation of the boy.

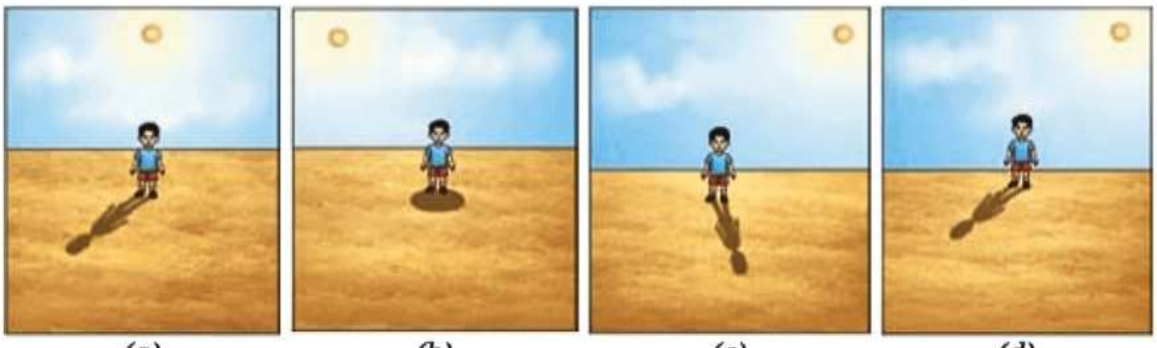


Fig. 11.17

A. Shadows are always formed on the opposite side of the light source. If the light is coming from above, the shadow will fall below. If the light comes from the side, the shadow will be cast in the opposite direction. Thus, option (d) is the correct image showing the shadow formation of the boy.

Some Natural Sources of Light

Analysis of Each Image (Fig. 11.17):

(a): The shadow is in front, and the Sun is high overhead - ❌ Incorrect

(b): The shadow is directly under the boy, and the Sun is right side the boy- ❌ Incorrect

(c): The shadow is in front of the boy, and the Sun is left side the boy - ❌ Incorrect

(d): The shadow is right side the boy, and sun is left side the boy - ✅ Correct

✅ Correct Image: (d)

Thus, option (d) is the correct image showing the shadow formation of the boy.
If only one must be chosen and it's asking for the most realistic general case, choose:

👉 Answer: (d)

5. The shadow of a ball is formed on a wall by placing the ball in front of a fi xed torch as shown in Fig. 11.18. In scenario (i) the ball is closer to the torch, while in scenario (ii) the ball is closer to the wall. Choose the most accurate representation of the shadows formed in both scenarios from the options provided (a and b).

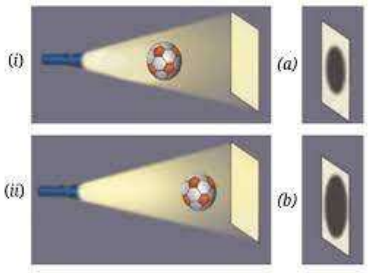


Fig. 11.18

A. In Fig. 11.18, two shadow-forming scenarios are shown with a ball, a torch, and a wall:

Scenario (i):

- The ball is close to the torch
- This creates a larger and blurrier shadow because the ball blocks more diverging light rays.

Scenario (ii):

- The ball is close to the wall
- This creates a smaller and sharper shadow because less light is blocked and the shadow edges are more defined.

Now match with shadow images:

- Image (a): Smaller and sharper shadow → matches scenario (ii)
- Image (b): Larger and blurrier shadow → matches scenario (i)

✅ Correct matching:

- Scenario (i) → Shadow (b)
- Scenario (ii) → Shadow (a)

A. (i) → (b), (ii) → (a)

6. Based on Fig. 11.18, match the position of the torch in Column A with the characteristics of the ball's shadow in Column B

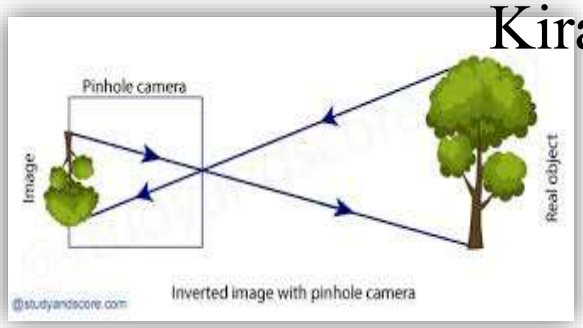
Column A	Column B
If the torch is close to the ball	The shadow would be smaller
If the torch is far away	The shadow would be larger
If the ball is removed from the set-up	Two shadows would appear on the screen
If two torches are present in the set-up on the left side of the ball	A bright spot would appear on the screen

A.

Column A	Column B
If the torch is close to the ball	The shadow would be larger
If the torch is far away	The shadow would be smaller
If the ball is removed from the set-up	A bright spot would appear on the screen
If two torches are present in the set-up on the left side of the ball	Two shadows would appear on the screen

7. Suppose you view the tree shown in Fig. 11.19 through a pinhole camera. Sketch the outline of the image of the tree formed in the pinhole camera.

A. Key Characteristics of a Pinhole Camera Image:



- Inverted (upside down)
- Real
- Diminished or same size depending on distance between object, hole, and screen
- Laterally correct (not flipped left-right.

✏️ Outline Sketch Description:

You should draw:

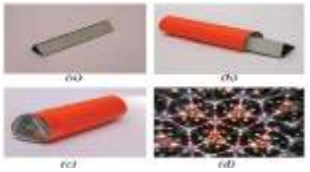
1. A rectangle representing the screen inside the pinhole camera.

2. An upside-down version of the tree on that screen:

   - The top leaves of the real tree appear at the bottom of the image.
   - The trunk appears at the top.

3. Ensure the image fits within the camera box and aligns with the rays shown in the figure.

8. Write your name on a piece of paper and hold it in front of a plane mirror such that the paper is parallel to the mirror. Sketch the image. What difference do you notice? Explain the reason for the difference. (Here we take **RAMU** as example)



A Kaleidoscope

A. "**RAMU** in the Mirror"

Step 1: Write the name **RAMU** on a piece of paper in **capital letters**.

RAMU

Step 2: Hold this paper **parallel to a plane mirror**, with the written side **facing the mirror**.

Sketch of Mirror Image:

If this is what you wrote: **RAMU** ← (your real writing)

The mirror image will look like: **UMAR** ← (as seen in the mirror)

A Periscope

😳 What Difference Do You Notice?

- The word appears **flipped horizontally** (left-right reversal).
- The letter shapes are the same, but their **order and direction are reversed**.
- The mirror does **not reverse top and bottom**, only left and right.

🧠 Why Does This Happen?

- A **plane mirror** creates a **lateral inversion**.
- That means it **flips the image sideways**, just like how your **right hand looks like your left hand** in a mirror.
- It's because each point of the object reflects directly back from the mirror at the **same distance** but in the **opposite direction**.

📚 Key Concept: **Lateral Inversion**

Real Word	Mirror Image
RAMU	UMAR

9. Measure the length of your shadow at 9 AM, 12 PM, and 4 PM with the help of your friend. Write down your observations:

(i) At which of the given times is your shadow the shortest?

(ii) Why do you think this happens?

Activity: Measure your shadow at:

- 9 AM
- 2 PM
- 4 PM


Fire as a source of Artificial light

Typical Observations:

- 9 AM: Long shadow (Sun is low in the sky)
- 12 PM: Shortest shadow (Sun is nearly overhead)
- 4 PM: Long shadow again (Sun is lower in the opposite direction)

(i) At which time is your shadow the shortest?

A. 12 PM

(ii) Why does this happen?

A. At 12 PM, the Sun is almost directly overhead, so its rays fall almost vertically. This causes the shadow to be shortest. When the Sun is at an angle (like in the morning or evening), shadows become longer.

10. On the basis of following statements, choose the correct option.

Statement A: Image formed by a plane mirror is laterally inverted.

Statement B: Images of alphabets T and O appear identical to themselves in a plane mirror.

(i) Both statements are true

(ii) Both statements are false

(iii) Statement A is true, but statement B is false

(iv) Statement A is false, but statement B is true

A. Statement A: Image formed by a plane mirror is laterally inverted

True

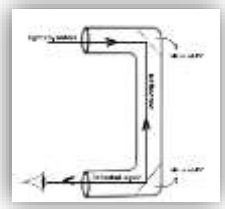
Statement B: Images of alphabets T and O appear identical to themselves in a plane mirror

True

(These letters look the same even after lateral inversion)

Correct Option: **(i) Both statements are true**

11. Suppose you are given a tube of the shape shown in the Fig. 11.20 and two plane mirrors smaller than the diameter of the tube. Can this tube be used to make a periscope? If yes, mark where you will fix the plane mirrors.



A. Yes, the tube can be used as a periscope.

- 🪞 Fix mirrors at both bends at 45° angles.
- 👁 Light enters, reflects twice, and reaches your eyes.

12. We do not see the shadow on the ground of a bird flying high in the sky. However, the shadow is seen on the ground when the bird swoops near the ground. Think and explain why it is so.

A. **When a bird is flying very high:**

- It is far from the ground, so its shadow becomes very faint or dispersed.
- The Sun's light is spread over a large area, and the bird blocks only a tiny portion of it.
- As a result, the shadow is too light and too diffused to be visible to our eyes on the ground.

When the bird flies close to the ground:

- Bird blocks more light in a concentrated area, forming a darker and sharper shadow.
- The distance between the bird and the ground is small, so the shadow is clearly visible.

Conclusion:

We don't see the shadow of a bird flying high because it is too far and the shadow becomes too faint to notice. When the bird is near the ground, its shadow becomes sharp and dark, making it easily visible.

🌓 Types of Objects and Their Shadows

Type of Object	What It Means	Shadow Formed?	Examples
Opaque	**Does not allow light** to pass through	✅ **Yes – dark shadow**	Wood, Book, Wall, Stone
Translucent	**Allows some light** to pass through	☁️ **Yes – faint shadow**	Butter paper, Tinted glass, Wax paper
Transparent	**Allows all light** to pass through clearly	❌ **No shadow** or very faint	Glass window, Clear water, Plastic sheet

🌞 Bonus: Fun Shadow Facts!

- **Shadow direction** changes with the position of the **sun/light** source.
- **Size of shadow** increases when the object is **closer to the light**.
- Shadows are always **formed on the opposite side** of the light source.
- **No shadow** is formed when light falls **exactly from above** at noon!

🌟 Facts vs. Myths about Light's Journey Through the Universe

Statement	✅ Fact / ❌ Myth	Explanation
Light always travels in a straight line.	✅ **Fact**	Light moves in straight lines unless it is reflected, refracted, or bent by gravity.
Light can travel through space (vacuum).	✅ **Fact**	Light doesn't need a medium – that's why sunlight reaches Earth through space! 🌞🌍
Light is the fastest thing in the universe.	✅ **Fact**	Light travels at ~300,000 km/s – nothing is faster in a vacuum! ⚡
The Sun's light reaches Earth instantly.	❌ **Myth**	It takes about **8 minutes and 20 seconds** for sunlight to reach us.
We can see stars as they are right now.	❌ **Myth**	We see them **as they were in the past**, because their light took years to reach us. 🌌
Light can bend around corners.	❌ **Myth**	Light cannot bend around corners — it needs reflection or refraction to change direction.
Shadows form only during the day.	❌ **Myth**	Shadows can form **anytime** there's a light source — even at night (like streetlights).
Light has energy but no mass.	✅ **Fact**	Light is made of **photons** which have **no mass** but do carry **energy**. ⚛️

🌠 Fun Science Insight:

Looking at the stars is like **looking into the past** - you're seeing light that may be **millions of years old**!

🔦 Reflection of Light and Its Uses

Type of Reflection	Description	Where It Is Used	Fun Fact
Regular Reflection	Light rays reflect **neatly in one direction** from a smooth surface	Mirrors, Periscopes, Car headlights	Gives a **clear image**!
Diffuse (Irregular) Reflection	Light reflects in **many directions** from a rough surface	Wall paint, Clothes, Paper	No clear image, but helps **spread light**!
Plane Mirror Reflection	Flat mirrors that form a **same-size, virtual image**	Bathroom mirrors, Dressing mirrors	Your **left looks like right**!
Concave Mirror Reflection	Curved mirror that **converges light rays**	Shaving mirrors, Solar cookers, Dentist tools	Can focus sunlight to **burn paper!** 🌞🔥
Convex Mirror Reflection	Curved mirror that **spreads light rays out**	Vehicle side mirrors, ATM corners	Shows a **wider view**, but smaller image

🧠 Quick Recap:

- Reflection helps us **see objects**.
- Without reflection, **we'd see nothing** - light has to bounce to reach our eyes!

🌗✨ Types of Shadows and Reflections & Their Uses

Type	What It Is	Example / Use	Fun Fact
Umbra (Dark Shadow)	The **darkest part** of a shadow where **all light is blocked**	Solar eclipses, hand shadows	It's where **no light reaches**! 🌑
Penumbra (Light Shadow)	The **lighter outer part** of a shadow where **some light reaches**	Partial solar eclipse, torchlight shadows	You see this during **partial eclipses**!
No Shadow	When the object is **transparent or light is directly above**	Glass objects, sunlight at noon	Happens when **light passes through**
Regular Reflection	Light reflects in **one direction** from a smooth surface	Mirrors, Periscopes, Telescopes	Gives **clear images**
Diffuse Reflection	Light reflects in **many directions** from a rough surface	Wall paint, clothing, paper	Helps in **lighting a room evenly**!
Plane Mirror	Flat mirror that forms **virtual, same-size image**	Household mirrors, optical instruments	Shows **left-right reversal**!
Concave Mirror	Curved inward, **focuses light to a point**	Solar cookers, shaving mirrors	Can **burn paper** using sunlight! 🌞🔥
Convex Mirror	Curved outward, **spreads light rays out**	Vehicle side mirrors, security mirrors	Shows a **wide-angle view** but smaller image

🌟 Summary:

- **Shadows** form when **light is blocked**.
- **Reflections** help us **see objects, images, and light direction**.
- Both are part of how **light behaves** in our world!

🔮 Types of Mirrors and Their Images in Optical Devices

Type of Mirror	Shape / Design	Image Formed	Used In	Importance in Optics
Plane Mirror	Flat surface	**Virtual, Upright, Same Size**	Bathroom mirror, Periscope	Helps in **seeing reflections** clearly and accurately
Concave Mirror	Curved inward like a cave	**Real/Inverted** (far) or **Virtual/Upright** (near)	Reflecting Telescope, Makeup mirror, Solar cooker	Can **focus light** — useful for magnification and heating
Convex Mirror	Curved outward like a dome	**Virtual, Upright, Smaller**	Vehicle side mirrors, Security mirrors	Gives a **wide-angle view**, good for **safety and surveillance**
Combination Mirrors	Mix of convex and concave in one device	Varies depending on the combination	**Microscopes, Telescopes, Periscopes**	Used for **focusing, magnifying, and direction change**

🔧 Optical Devices & Mirrors Used

Device	Mirror Type Used	What It Does
Microscope	Plane + Curved (Concave Lens)	**Magnifies tiny objects** using lenses and mirrors
Telescope	Concave + Plane	**Gathers light from far stars** and forms visible images
Periscope	Plane Mirrors at 45° angles	Allows to **see over walls or corners** (used in submarines)

Fun Facts:

- **Plane mirrors** always show a **left-right reversed image**.
- **Concave mirrors** can **start a fire** using sunlight!
- **Convex mirrors** are used at **blind turns on roads**.

Shadow puppetry:

Shadow puppetry is an ancient art form where flat puppets are held between a light source and a screen to create moving shadows. The puppets are usually made of leather or paper and have beautiful cut-out designs. When light shines on them, their shadows appear on the screen and tell stories through movement. This art uses the science of shadows - how light travels in straight lines and gets blocked by objects. It is a fun way to learn how opaque objects form shadows and how their size and shape change with the distance from the light. Shadow puppetry is popular in countries like India, Indonesia, and China, mixing science with storytelling!

Fireflies:

Fireflies, also known as **lightning bugs**, are small insects that produce light from their bodies. This glowing light is called **bioluminescence** and is made in a special part of their abdomen. Fireflies use this light to **attract mates** and sometimes to **scare away predators**. The light they produce is **cold light**, meaning it gives off **no heat**! The glow is made by a chemical reaction involving **luciferin** (a chemical), **oxygen**, and an enzyme called **luciferase**. Fireflies are a natural example of how **living organisms can create light**, making them both magical and scientific wonders in nature!

Chapter 12. Earth, Moon and the Sun

Let us enhance our learning

1. In Fig. 12.17, how many hours of sunlight do the North Pole and the South Pole receive during one rotation of the Earth?

Fig. 12.17

A. Based on the image "Fig. 12.17":The image shows the Earth illuminated by the Sun, with the line separating day and night (the terminator) passing directly through both the North Pole (NP) and the South Pole (SP). This configuration represents an equinox (either vernal/spring or autumnal).During an equinox, the Sun's rays are perpendicular to the Earth's axis of rotation, and the circle of illumination passes through both poles.

This results in: 🌞🌎🌙

- The North Pole receives approximately 12 hours of sunlight.
- The South Pole receives approximately 12 hours of sunlight.

2. Fill in the blanks

(i) Stars rise in the **east** and set in the **west**.

(ii) Day and night are caused by the Earth's **rotation**.

(iii) When the Moon fully covers the Sun from our view, it is called a **total** solar eclipse.

3. State whether True or False

I. Lunar eclipse occurs when the Sun comes between the Earth and the Moon.

A. **False**

(A lunar eclipse occurs when the Earth comes between the Sun and the Moon).

II. Sunrise happens earlier in Gujarat than in Jharkhand.

A. **False**

(Jharkhand is to the east of Gujarat, and the Earth rotates from west to east. Therefore, sunrise occurs earlier in eastern regions like Jharkhand than in western regions like Gujarat.)

III. In Chennai, the longest day occurs on the summer solstice.

A. **True**

(The summer solstice, around June 21st, marks the longest day in the Northern Hemisphere, which includes Chennai).

IV. We should watch the solar eclipse directly with our naked eye.

A. **False**

(Looking directly at a solar eclipse can cause permanent eye damage).

V. Seasons occur due to the tilt of Earth's axis of rotation and its spherical shape.

A. **False**

(Seasons occur due to the tilt of Earth's axis of rotation and its revolution around the Sun, not its spherical shape directly influencing seasons).

VI. The Earth's revolution around the Sun causes day and night. 🌞🌎🌙

A. **False**

(The Earth's rotation on its axis causes day and night; its revolution around the Sun causes seasons).

4. Padmashree saw the Orion constellation nearly overhead at 8 pm yesterday. When will she see Orion overhead today?

A. Stars appear to rise about 4 minutes earlier each day due to the Earth's revolution around the Sun. So, if she saw it at 8 pm yesterday, she will see Orion overhead approximately 7:56 pm today

5. Nandhini saw a group of stars rising at midnight on 21 June. When will she see the same group of stars rising at midnight next year?

A. Due to the Earth's revolution, a star or constellation will appear in the same position in the sky at the same time approximately one year later. So, she will see the same group of stars rising at midnight again on June 21st next year.

6. Abhay noticed that when it was daytime in India, his uncle who was in the USA was generally sleeping as it was night-time there. What is the reason behind this difference?

A. This difference is due to the Earth's rotation on its axis and the resulting time zones. As the Earth rotates, different parts of the planet are illuminated by the Sun (daytime) while others are in darkness (night-time). India and the USA are in significantly different time zones, meaning that when one side of the Earth (like India) is facing the Sun, the opposite side (like the USA) is facing away from the Sun.

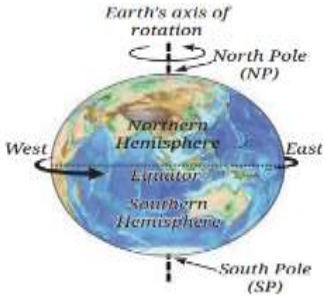
7. Four friends used the following ways to see the solar eclipse. Who among them was being careless?

(i) Ravikiran used a solar eclipse goggle.

(ii) Jyothi used a mirror to project the Sun's image.

(iii) Adithya saw the Sun directly with his eyes.

(iv) Aruna attended a programme arranged by a planetarium



Rotation of the Earth

A. (i) Ravikiran used a solar eclipse goggle. (Careful)

(ii) Jyothi used a mirror to project the Sun's image. (Careful - this is a safe indirect method)

(iii) Adithya saw the Sun directly with his eyes. **(Careless)**

(iv) Aruna attended a programme arranged by a planetarium (Careful - planetariums use safe viewing methods).

Adithya was being careless. Directly viewing a solar eclipse with unprotected eyes can cause severe and permanent eye damage.

8. Fill in the circles in Fig. 12.18 appropriately with one of the following: Sun, Moon, Earth.

A. Based on the image provided (Fig. 12.18) and the standard understanding of solar and lunar eclipses, here's how to fill in the circles:

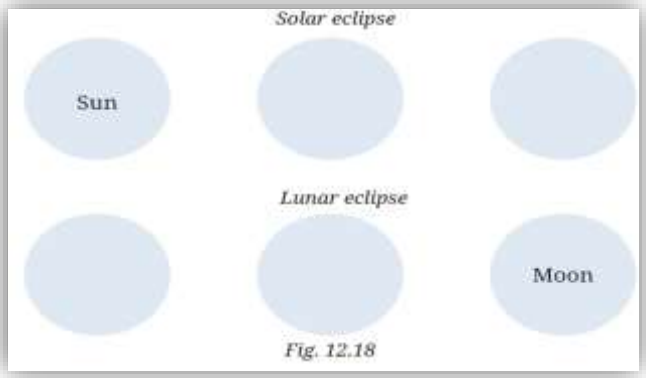


Fig. 12.18

Solar Eclipse

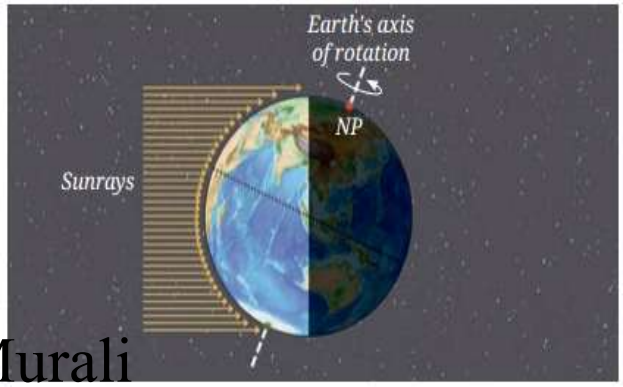
- Occurs when the Moon comes between the Sun and the Earth, casting a shadow on the Earth.
- Correct order (left to right):

Sun – Moon – Earth

Lunar Eclipse

- Occurs when the Earth comes between the Sun and the Moon, casting a shadow on the Moon.
- Correct order (left to right):

Sun – Earth – Moon



Sunlight falls on half of the Earth's surface

Therefore, the circles should be filled as follows:

Top row (Solar eclipse):

- Sun
- Moon
- Earth

Bottom row (Lunar eclipse):

- Sun
- Earth
- Moon

9. The Moon is much smaller than the Sun, yet it can block the Sun completely from our view during a total solar eclipse. Why is it possible?

A. The Moon can block the Sun completely because it is much closer to the Earth than the Sun.

Although the Sun is about 400 times larger in diameter than the Moon, it is also about 400 times farther away from Earth.

This makes the Sun and Moon appear almost the same size in the sky, allowing the Moon to cover the Sun perfectly during a total solar eclipse.

10. The Indian cricket team matches in Australia are often held in December. Should they pack winter or summer clothes for their trip?

A. They should pack summer clothes. December is summer in Australia because it is located in the Southern Hemisphere, where seasons are opposite to those in the Northern Hemisphere (like India).

11. Why do you think lunar eclipses can be seen from a large part of the Earth when they happen, but total solar eclipse can be seen by only a small part of the Earth?

A.

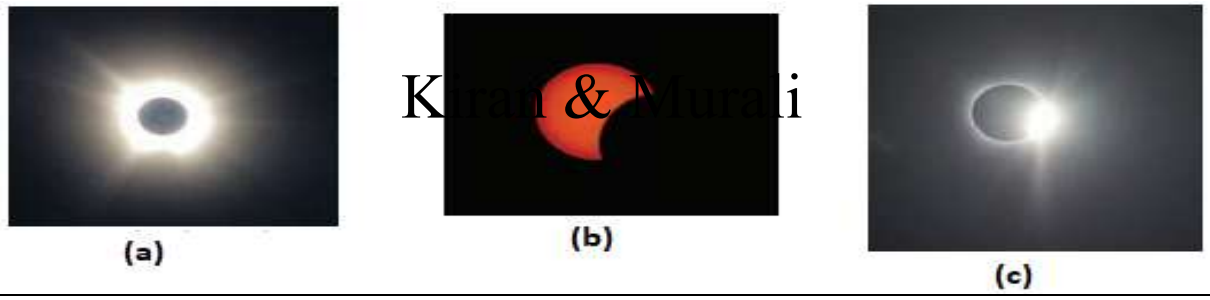
- A lunar eclipse occurs when the Earth casts its shadow on the Moon, and this can be seen by anyone on the night side of the Earth, covering a large area.
- In contrast, during a total solar eclipse, the Moon's shadow falls on a very narrow path on the Earth's surface, so only people in that small area can see the eclipse.
- This makes lunar eclipses visible to more people.

12. If the Earth's axis were not tilted with respect to the axis of revolution, explain what would be the effect on seasons?

A.

- If the Earth's axis were not tilted, there would be no seasons.
- Every place on Earth would receive the same amount of sunlight throughout the year, meaning there would be no variation in temperature or daylight hours between months.
- The weather would stay fairly constant year-round. 🌞🌎🌙

Solar Eclipse



(a) Total Solar Eclipse

(b) Partial Solar Eclipse

© A **'diamond ring'** seen after a total solar eclipse. Just when the Moon starts to move away.

🌎🌞🌙 Sun, Moon, and Earth – Amazing Universal Facts

1. **The Sun is a star** at the center of our solar system and gives us **light and heat**. 🌞
2. **The Earth revolves around the Sun** once every **365 days**, giving us **seasons**. 🌎
3. **The Moon is Earth's only natural satellite** and takes about **27 days** to orbit Earth. 🌙
4. **The Moon reflects sunlight**, which is why it **shines at night** — it doesn't produce its own light! ✨
5. **The Earth rotates on its axis**, causing **day and night** in 24 hours. 🕛🌗
6. **We see only one side of the Moon** from Earth because the Moon spins at the same rate it orbits. 🌗
7. **Eclipses happen** when the Sun, Moon, and Earth line up — **solar** (Sun blocked) or **lunar** (Moon blocked). 🌚🌑
8. The Sun's **gravity holds Earth and other planets** in orbit, making the solar system stable. 🌌

🌟 Famous Observatories of the World

Observatory Name	Location	Famous For	Interesting Fact
Mount Wilson Observatory	California, USA	Solar and stellar observations	Helped discover that the universe is expanding!
Mauna Kea Observatory	Hawaii, USA	Optical, infrared, and radio astronomy	Located on a **volcano** 4,200 m above sea level!
Greenwich Observatory	London, UK	Timekeeping and navigation	The **Prime Meridian** (0° longitude) passes here!
Arecibo Observatory	Puerto Rico (Closed)	Radio astronomy and detecting space signals	Once had the **world's largest radio dish** 🌌
Very Large Telescope (VLT)	Chile, South America	Deep space imaging in visible and infrared	Located in the **Atacama Desert** for clear skies
Indian Astronomical Observatory	Ladakh, India	Optical and infrared astronomy	One of the **highest observatories** in the world! 🇮🇳
Jantar Mantar	Jaipur & Delhi, India	Ancient astronomy instruments	Built in the **1700s** without telescopes! 🕉️

🔭 Bonus Fact:

Astronomers use observatories to **study stars, planets, and galaxies**. Some even help in finding **new exoplanets**!

🌎 Seasons of the Earth

Season	Months (Northern Hemisphere)	Reason for the Season	What Happens in Nature	Fun Fact
Spring	March to May	Earth's tilt makes sunlight increase after winter	Flowers bloom, animals become active	Spring Equinox happens around **March 21** 🌸
Summer	June to August	Northern Hemisphere is tilted **towards** the Sun	Days are long, weather is hot	**Longest day** of the year in **June** 🌞
Autumn (Fall)	September to November	Sunlight starts decreasing as Earth tilts away	Leaves change color and fall	Fall Equinox is around **Sept 23** 🍁
Winter	December to February	Northern Hemisphere is tilted **away** from the Sun	Cold weather, snow in many places	**Shortest day** of the year in **December** ❄️

🔁 Why Seasons Happen:

- **Earth's axis is tilted** at 23.5°.
- As it **revolves around the Sun**, different parts get more or less sunlight.

🌗✨ Equinox – Key Points

1. **Equinox** means "**equal night**" — when **day and night are nearly the same length** everywhere on Earth.
2. It happens **twice a year**: around **March 21** (Spring Equinox) and **September 23** (Autumn Equinox).
3. On these days, the **Sun is directly above the equator**, giving **equal sunlight** to both hemispheres.
4. Equinox marks the **beginning of spring** in March and **autumn** in September.
5. It helps in balancing **daylight and darkness** and affects **plant growth, animal behavior, and farming**.
6. Equinox shows how Earth's **tilt and orbit** create **changing seasons** across the year.

🌟 Famous Scientists in Astronomy & Space Science

Scientist Name	Time Period	Main Contribution / Discovery	Fun Fact
Aryabhata (India)	5th century CE	Said Earth rotates on its axis; explained eclipses	Wrote **Aryabhatiya** at just 23 years old!
Nicolaus Copernicus (Poland)	1473–1543	Proposed that the **Sun is at the center** of the solar system (Heliocentric model)	His model changed how people saw the universe! 🌞
Galileo Galilei	1564–1642	Used the telescope to observe the Moon, Jupiter's moons	Supported Copernicus' heliocentric theory
Johannes Kepler	1571–1630	Gave **laws of planetary motion** (elliptical orbits)	His laws helped future space calculations 🚀
Isaac Newton	1643–1727	Discovered **gravity** and made laws of motion	Explained how planets stay in orbit 🌌
Albert Einstein	1879–1955	Theory of Relativity — explained time, space & gravity	Helped us understand **black holes** and the universe
Edwin Hubble	1889–1953	Discovered the **universe is expanding**	The **Hubble Telescope** is named after him!
Kalpana Chawla	1962–2003	First Indian-born woman to go to space	A symbol of courage and curiosity 👩‍🚀
Stephen Hawking	1942–2018	Studied black holes, Big Bang, and cosmology	Used a wheelchair and computer to speak & teach 🌠

🌟 Greatest Astronauts of the World

Kiran & Murali

Astronaut Name	Country	Famous For	Fun Fact
Yuri Gagarin	Russia (USSR)	**First man in space** (1961)	Orbited Earth in **Vostok 1** 🌍
Valentina Tereshkova	Russia (USSR)	**First woman in space** (1963)	Went to space at just **26 years old** 👩‍🚀
Neil Armstrong	USA	**First person to walk on the Moon** (1969)	Said the famous line: *"That's one small step..."* 🌕
Buzz Aldrin	USA	Second man on the Moon	Helped place the **US flag on the Moon** US
Kalpana Chawla	India/USA	**First Indian-born woman in space**	Flew on **Space Shuttle Columbia** 🛰️
Rakesh Sharma	India	**First Indian in space** (1984)	Said: *"Saare Jahan Se Achha"* from space IN
Sunita Williams	USA (Indian origin)	Held record for **longest spacewalk time** by a woman	Ran a marathon in space! 🏃‍♀️🚀
Peggy Whitson	USA	**Longest time spent in space** by any American (665 days)	Called the "**space record queen**" 👑✨
Chris Hadfield	Canada	Known for his space guitar and science videos	Sang *"Space Oddity"* in orbit 🎸🌌

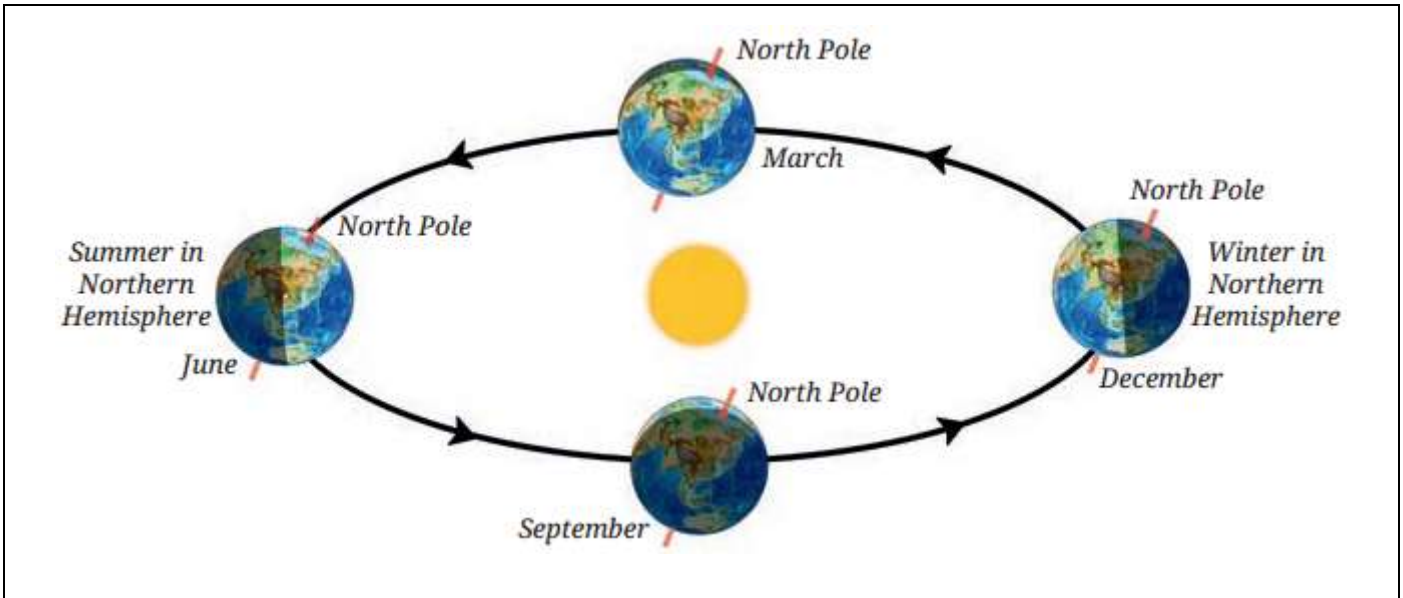
🚀 **Bonus Tip:**
These astronauts are not only brave, but they also help scientists learn more about **space, Earth, health, and life in zero gravity**!

Famous Space Agencies and Their Contributions

Agency Name	Country	Full Form	Major Contributions	Fun Fact
NASA	United States	National Aeronautics and Space Administration	First Moon landing, Mars rovers, Hubble Telescope	Sent the first humans to the **Moon** in 1969
ISRO	India	Indian Space Research Organisation	Chandrayaan (Moon), Mangalyaan (Mars), Gaganyaan (crew mission)	**Mangalyaan** reached Mars in 1st attempt! IN
ESA	Europe (22 countries)	European Space Agency	Earth observation, Mars missions, space telescopes	Works with NASA and ISRO on many missions
Roscosmos	Russia	Russian Federal Space Agency	First man in space (Yuri Gagarin), space stations	Built the **first space station – Mir**
JAXA	Japan	Japan Aerospace Exploration Agency	Moon probes, asteroid missions (Hayabusa)	Collected samples from an asteroid!
CNSA	China	China National Space Administration	Chang'e Moon missions, Tiangong space station	Built their **own space station – Tiangong**
SpaceX	USA (Private)	—	Reusable rockets, Starship, commercial crew missions	First private company to send humans to space
Blue Origin	USA (Private)	—	Suborbital space tourism (New Shepard)	Founded by Amazon's Jeff Bezos

Did You Know?

These agencies help launch satellites, explore planets, observe Earth, and even dream of building homes on **Mars and the Moon**!



Different positions of the Earth while revolving around the Sun (The Earth's orbit appears elongated because this is a side view and not the top view. The sizes and distance is not to scale)

Famous Satellite Launches and Their Contributions

Satellite Name	Launch Year	Country / Agency	Purpose / Achievement	Fun Fact
Sputnik 1	1957	USSR (Russia)	**First artificial satellite** in space	Sent **radio beeps** from space; started the Space Age!
Explorer 1	1958	USA (NASA)	Discovered **radiation belts** around Earth	America's **first satellite** into orbit
Ariel 1	1962	UK (with NASA)	Studied **Earth's upper atmosphere**	**First British satellite**
INSAT-1A	1982	India (ISRO)	For **weather and communication** in India	Started **India's satellite communication** age
Hubble Space Telescope	1990	USA (NASA & ESA)	Took deep space pictures; helped study galaxies, stars, and more	Helped discover **age of the universe**
Chandrayaan-1	2008	India (ISRO)	Mapped the Moon and found **water molecules**	India's **first mission to the Moon**
Kepler Space Telescope	2009	USA (NASA)	Found **thousands of new exoplanets**	Helped search for **Earth-like planets**
Mangalyaan (Mars Orbiter Mission)	2013	India (ISRO)	Studied Mars' surface and atmosphere	Reached Mars in **first attempt**, low cost! IN
James Webb Space Telescope	2021	NASA, ESA, CSA	Sees farthest galaxies; studies birth of stars	Can look back **13 billion years** in time!

Bonus Fact:

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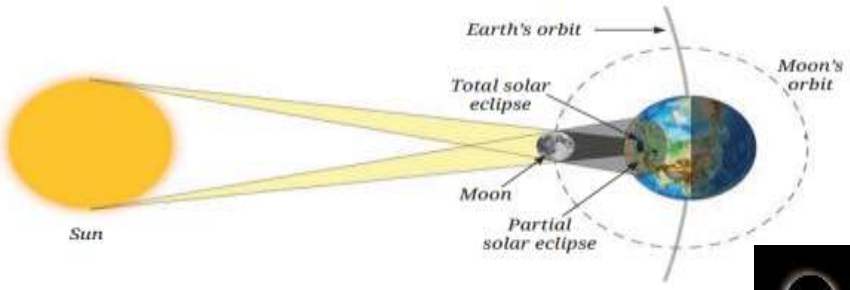
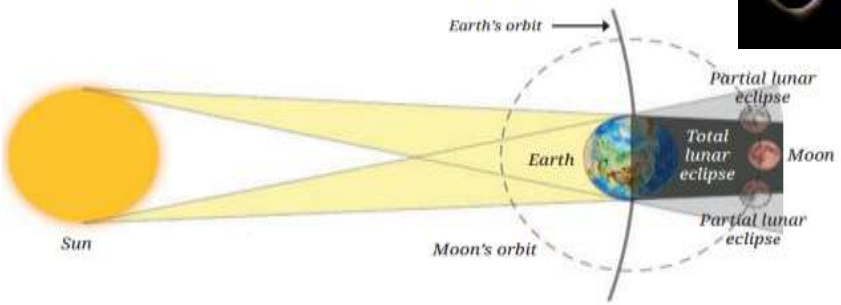
Satellites help us **understand space**, predict weather, support GPS, and explore planets, stars, and galaxies far, far away!

Solar Eclipse{



Lunar Eclipse



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