

Practice Exercise Solutions

Chapter 2: The Invisible Living World: Beyond Our Naked Eye

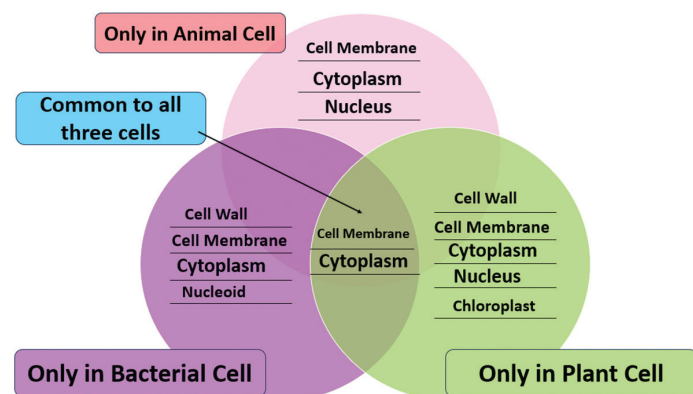
Time to Assess (A1)

1. Zacharias Janssen (with his father Hans Janssen) is credited with inventing the first compound microscope (around 1590). Antonie van Leeuwenhoek later improved it and first observed living microbes.
2. Robert Hooke coined the term 'cell' in 1665 while observing cork under a microscope.
3. The nerve cell (neuron) is the longest cell in the human body.
4. The red blood cell (RBC) / egg cell is round in shape.
5. A group of similar cells working together is called a tissue.

NCERT QUESTIONS

This section appears in the chapter under the heading 'Recent Questions'.

1.



2. (i) (c) Yeast produced a gas inside the test tube B, which inflated the balloon.

Explanation: The yeast fermented the sugar,

releasing carbon dioxide gas (CO_2), which inflated the balloon.

- (ii) She wants to test whether the gas produced is carbon dioxide (CO_2). If the lime water turns milky, it confirms the presence of CO_2 , because CO_2 reacts with lime water to form calcium carbonate.
3. Beans are leguminous crops that form a symbiotic relationship with Rhizobium bacteria present in their root nodules. These bacteria fix nitrogen from the atmosphere into the soil, providing a natural source of nitrogen.

Therefore, the second farmer does not need to add nitrogen-rich fertiliser.

4. She is trying to test the effectiveness of composting. Dry leaves provide the correct carbon-nitrogen balance required for decomposition.

So, in Pit A, the mixture of green waste (fruit/vegetable peels) and dry leaves will decompose faster as compared to the mixture in pit B without dry leaves.

5. (i) Bacteria
(ii) Yeast
(iii) Rhizobium

6. ACTIVITY

Take 3 bread slices. Tag them as A, B and C.

Keep slice A in warm and moist environment, slice B in dry environment in an air tight container and slice C in cold environment say in refrigerator.

Observe after 2-3 days. Share your findings.

Observation: Slice A will have maximum fungal growth and slice C will have least fungal growth.

Conclusion: Microorganisms grow best when temperature, moisture and air are optimal.

7. A bread slice near the sink will show fungal growth

(mold) while slices in the refrigerator will likely have no or slower growth.

Reason: Microbes grow faster in warm and moist condition.

8. 1. Lactobacillus bacteria are growing and multiplying rapidly, thus producing lactic acid that makes curd sour.

2. Warmer temperature increase the bacterial activity.

9. (i) The yeast ferments the sugar in the warm solution, producing carbon dioxide gas and a small amount of alcohol.

(ii) Lime water in test tube B turns milky. This happens because CO_2 produced in flask A travels through the delivery tube into flask B and reacts with lime water, confirming the presence of carbon dioxide.

Fermentation would not occur, so no carbon dioxide would be produced. As a result, lime water would remain clear in test tube B.

8. Penicillin

C. Match the following

1. c. Father of Microbiology (he coined the term 'cell') → c
2. a. Discovered living microbes → a
3. b. Discovered magnifying glass → b
4. d. Used in baking bread → d
5. e. Converts milk into curd → e
6. Provides rigidity to plant cells → f
7. g. Source of antibiotic (Penicillin) → g

D. Answer in one word (VSA)

1. Irregular (constantly changing) shape
2. Cell membrane
3. Amoeba (or Paramecium)
4. Cytoplasm
5. Rhizobium bacteria
6. Zacharias Janssen
7. Streptomycin (from Streptomyces bacteria)

E. Assertion and Reason

Options: a) Both A and R true, R correct explanation of A. b) Both true, R not correct explanation. c) A true, R false. d) A false, R true.

1. a — Both true and R correctly explains A.
2. a — Both true; R explains why viruses behave as living only inside a host.
3. d — A is false (cytoplasm is living), R is true.
4. d — A is false (microalgae are largely beneficial and produce oxygen), R is essentially true but does not make them harmful.
5. d — A is false (yeast is a fungus, not a bacterium), R is true.

HOTS

1. Lactobacillus bacteria present in milk multiply at room temperature and ferment the milk sugar (lactose) into lactic acid. The acid curdles the milk proteins, making it sour and thick. The responsible

PRACTICE FOCUS —

A. Choose the most appropriate answer

1. b. Cell
2. c. Hans and Zacharias Janssen
3. a. Robert Hooke
4. c. Mushroom
5. c. Nucleus
6. c. Curdling milk
7. b. Antonie van Leeuwenhoek

B. Fill in the blanks

1. Microscope
2. Cytoplasm
3. Antonie van Leeuwenhoek
4. Nucleus
5. Yeast
6. Algae (microalgae / phytoplankton)
7. Cell wall



microorganism is *Lactobacillus*.

2. Disease-causing microbes (viruses such as SARS-CoV-2) spread through tiny droplets released when an infected person coughs, sneezes or talks. A mask acts as a physical barrier that traps these droplets, reducing the number of microbes entering or leaving the respiratory tract, and so lowers the chance of infection spreading.
3. Microbes (bacteria and fungi, the decomposers) break down organic waste into simple nutrient-rich humus. This natural recycling enriches the soil, reduces dependence on chemical fertilisers and manages waste — supporting sustainable development by recycling resources and protecting the environment.

Picture Based Assessment

(1) The plant cell has a rigid cell wall outside the cell membrane, while the animal cell has only a cell membrane.

(2) The plant cells are shown box-shaped/regular and joined together, whereas the animal cells are rounded/irregular. (Plant cells also contain large vacuoles and chloroplasts, which animal cells lack.)

Value and Life Skill Based

- (a) Decomposers — bacteria and fungi.
- (b) It recycles waste into useful manure, reduces garbage and pollution, and enriches the soil naturally.
- (c) The family shows environmental responsibility, awareness and a sense of caring for nature.

Case Study Based Assessment (curd formation)

1. *Lactobacillus* bacteria.
2. *Lactobacillus* grows and ferments milk best in warmth. In summer the warm temperature lets it multiply quickly and set the curd; in cold winter it grows too slowly, so the milk does not set.
3. Keep the inoculated milk in a warm place — wrap the container in a thick cloth, keep it near a warm spot or inside a casserole/oven with the light on — to provide the warmth the bacteria need.

Learn Holistically — Report on Microbes (cross-curricular)

1. Science

- a. Norovirus, *Salmonella enterica* and *Listeria monocytogenes* (also *Campylobacter jejuni*, *E. coli*).
- b. Yeast (*Saccharomyces cerevisiae*) ferments dough and is used to make bread, and produces alcohol in brewing. *Lactobacillus* converts milk into yoghurt/curd and is used in cheese making.
- c. A quality mark (like the British Lion mark) shows the product was produced under hygienic, controlled conditions with reduced risk of harmful microbes such as *Salmonella*, making it safer to eat.

2. English

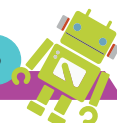
- a. Microbes are both friends and foes in our food. As friends, yeast helps bread rise and *Lactobacillus* turns milk into curd and cheese, giving us tasty, nutritious food. As foes, microbes like *Salmonella* and Norovirus spoil food and cause foodborne illness with symptoms such as vomiting and diarrhoea. By storing food properly, cooking it well and keeping clean, we enjoy the friendly microbes while keeping the harmful ones away.
- b. Cause — eating food contaminated with harmful microbes; Effect — foodborne illness. Sentence: Because the leftover food was contaminated with harmful microbes (cause), the whole family suffered from food poisoning (effect).

3. Maths

- a. $100\% - 70\% = 30\%$ is caused by other microbes.
- b. Fraction = $140/200 = 7/10$. Percentage = $(140/200) \times 100 = 70\%$.
- c. Probability = $8/50 = 4/25 = 0.16$ (16%).

4. Art Integration

- a. Activity: Make a two-column poster. Left column 'Good Microbes' — draw bread, curd, cheese and label yeast and *Lactobacillus*. Right



column 'Bad Microbes' — draw spoiled food and a sick person, label Salmonella and Norovirus. Add the slogan 'Some microbes feed us, some make us ill — choose clean food!'

- b. Activity: A chart with five icons — (1) Wash hands before eating, (2) Cook food thoroughly, (3) Store food in the fridge, (4) Keep raw and cooked food separate, (5) Check quality marks/ expiry dates. Title it 'Stay Safe — Eat Clean'.

Chapter 3: Health: The Ultimate Treasure

Time to Assess (A1)

1. Tuberculosis and Cholera (also Influenza, Malaria, Chickenpox).
2. Diabetes (a long-lasting non-communicable disease).
3. Vector — female Anopheles mosquito; Pathogen — Plasmodium (the malaria-causing protozoan).
4. Hepatitis (Hepatitis A/B).

NCERT QUESTIONS

1. **Communicable disease:** Cold and flu, Typhoid, Chicken pox

Non-Communicable disease: Diabetes, Asthma

2. b. Asthma and diabetes are non-communicable diseases.

3. **(i) Immediate actions the school should take to prevent further spread:**

- • Advise students with flu symptoms to stay at home until they recover.
- • Inform parents about the outbreak and take necessary precautions.
- • Ensure classrooms and common areas are well-ventilated and cleaned regularly.
- • Provide hand sanitizers or soap for regular handwashing.
- • Encourage students and staff to wear masks, especially if coughing or sneezing.

- (ii) Responding to a classmate with flu symptoms considerably:**

- Politely suggest they visit the school nurse or

inform a teacher about how they are feeling.

- Offer them tissues or hand sanitizer if they need it.
- Maintain a friendly attitude while keeping a safe distance.

(iii) Protecting yourself and others:

- Wash your hands often with soap and water or use sanitizer.
- Wear a mask in crowded or enclosed areas.
- Avoid touching your eyes, nose and mouth unnecessarily.
- Keep a safe distance from people showing symptoms.
- Maintain good hygiene—cover your own mouth and nose when coughing or sneezing.
- Eat healthy food, get enough sleep and drink plenty of water to keep your immune system strong.

4. **(i) Precautions before, during and after the trip:**

Before the trip:

- Check health advisories for the area and consult a doctor about preventive malaria medication.
- Pack mosquito repellents, insecticide-treated nets and full-sleeved clothes.

During the trip:

- Sleep under a mosquito net, especially at night.
- Apply mosquito repellent on exposed skin.
- Wear light-coloured, long-sleeved clothing to reduce bites.
- Avoid stagnant water near your stay, as it attracts mosquitoes.

After the trip:

- Watch for symptoms like fever, chills and body aches.
- Seek medical help immediately if symptoms appear.

- (ii) Nets and repellents act like a shield. They stop mosquitoes from reaching us while we sleep or play, keeping us safe from getting sick. It's like wearing a raincoat in a storm only this time, the**

'storm' is mosquitoes.

- (iii) If travellers ignore health advisories they may be at a higher risk of catching malaria or other mosquito-borne diseases. Illness can disrupt travel plans and lead to serious health problems. If untreated, malaria can become life-threatening.

Returning home while sick could spread the disease to others if local mosquitoes pick up the infection.

5. (i) I would say to my uncle that I know you want to spend time with your friends, but smoking can really harm your lungs, heart and overall health. You're important to our family and we would like you to be around for many more years.

There are better ways to connect with friends that don't put your life at risk.

- (ii) If a friend offers me a cigarette at a party:

- Politely refuse by saying, "No thanks, I don't smoke it's not good for my health."
- Change the subject or suggest doing another activity together.
- Avoid situations where there is pressure to try harmful substances.

- (iii) Schools can help prevent students from picking up harmful habits in following ways:

- Conduct awareness programs about the dangers of smoking, alcohol and drugs.
- Invite doctors or health experts to speak about the harmful effects.
- Encourage healthy hobbies like sports, arts and music to keep students engaged.
- Create a supportive environment where students feel confident saying "No" to peer pressure.
- Display posters and materials promoting healthy living around the school.

6. Vinita could ask Saniya questions like:

- Do you know that antibiotics only work against bacterial infections, not viral ones like the flu or common cold?

- Have you heard about antibiotic resistance and how overusing antibiotics can make them stop working?
- If antibiotics cured every infection, why do doctors sometimes give other medicines or vaccines instead?
- Can you think of diseases, like dengue or COVID-19, where antibiotics don't help at all?

7. (i) In the months of July, August and September the cases of dengue were highest.

(ii) In January the dengue cases were lowest.

(iii) During the peak months of July, August and September, dengue cases rise mainly due to natural and environmental factors. Heavy rains and waterlogging in the monsoon season create stagnant water, which becomes breeding sites for mosquitoes. High humidity and warm temperatures during these months help mosquitoes survive longer and multiply faster.

(iv) The community and government can take preventive steps like cleaning and covering water storage containers, spraying insecticides to kill mosquito larvae and organizing awareness campaigns to encourage people to keep their surroundings clean before the peak dengue season.

8. For Reducing Communicable Diseases:

- "Clean Hands, Healthy You!": Wash hands regularly with soap and water.
- "Cover to Care": Always cover your mouth and nose when coughing or sneezing.
- "Say No to Sharing Germs": Avoid sharing personal items like towels, bottles and utensils.
- "Stay Home, Get Well": Rest at home when you are sick to prevent spreading illness.
- "Protect Yourself, Protect Others": Keep vaccinations up to date.

For Reducing Non-Communicable Diseases:

- "Move More, Sit Less": Exercise at least 30 minutes every day.
- "Eat Smart, Live Long": Choose healthy, balanced meals instead of junk food.



- “Sleep Well, Stay Well”: Get 7–9 hours of good sleep each night.
 - “Think Positive, Stay Strong”: Manage stress through hobbies, meditation or talking to friends.
 - “Your Health, Your Choice”: Avoid smoking, alcohol and other harmful habits.
9. Antibiotics work only against bacterial infections, not viral infections like the common cold, cough or flu. Taking antibiotics for viral illnesses will not help you recover faster. In fact, unnecessary use can lead to antibiotic resistance, where bacteria change and become harder to kill. This makes future bacterial infections more difficult and expensive to treat and some may even become untreatable. Additionally, antibiotics can cause side effects like stomach upset or allergies without providing any benefit for viral infections.
10. The diseases that may spread if drinking water is contaminated by the excreta of an infected person are:
- Hepatitis A
 - Poliomyelitis (Polio)
 - Cholera
11. When our body encounters a pathogen for the first time, the immune system takes time to recognize it and produce specific antibodies, so the response is slower and weaker. During this first exposure, the body also creates memory cells that “remember” the pathogen. When the same pathogen enters again, these memory cells quickly recognize it and trigger a faster, stronger and more effective immune response, often preventing illness or reducing its severity. This is also the principle behind how vaccines work.

PRACTICE FOCUS —

A. Choose the most appropriate answer

1. b. Complete physical, mental and social well-being
2. b. Tuberculosis
3. b. Virus

4. c. Malaria
5. b. Diabetes
6. b. Drinking unboiled water
7. b. Bacterial infections

B. Fill in the blanks

1. Communicable (infectious)
2. Disease
3. Non-communicable
4. Malaria
5. Vaccination (vaccine)
6. Air Quality Index (AQI)
7. Lifestyle
8. Bacteria

C. State True / False (and correct the false ones)

1. False — Many diseases (diabetes, asthma) are non-communicable.
2. True
3. False — They cause non-communicable diseases such as cancer and heart disease.
4. False — Malaria spreads through the bite of the female Anopheles mosquito (a vector).
5. False — Vaccines strengthen immunity by preparing the body to fight specific germs.
6. True
7. False — Diabetes is non-communicable; it does not spread.
8. False — Health is complete physical, mental and social well-being, not merely the absence of illness.

D. Answer in one word (VSA)

1. Pathogen
2. Immunity
3. Female Anopheles mosquito
4. Liver
5. Deficiency disease (e.g., kwashiorkor / marasmus / anaemia)

6. Antibiotic
7. Vaccination (immunisation)
8. Hypertension

E. Assertion and Reason

1. a — Both true and R explains A.
2. b — Both true, but R is not the direct explanation of how it spreads.
3. a — Both true and R explains A.
4. d — A is false (they do not work on viruses), R is true.
5. a — Both true and R explains A.
6. d — A is false (mental health is closely linked to social well-being), R is true.

HOTS

1. Burning garbage releases harmful smoke and toxic gases that pollute the air, causing breathing problems, asthma, eye irritation and other illnesses for the whole community. It worsens air quality and can trigger respiratory diseases.
2. (Physical) A sports/yoga day and a healthy-tiffin contest; (Social) a community clean-up and team games; (Mental) a meditation session and a 'gratitude / no-screen' challenge with counselling talks.
3. She may develop physical problems (obesity, weak eyesight, poor posture, low fitness) and mental/social problems (stress, poor sleep, less social interaction) — an overall lifestyle imbalance.

Picture Based Assessment

Picture 1 shows Tuberculosis (a communicable bacterial lung disease) — prevention: BCG vaccination, cover the mouth while coughing, good ventilation, complete the medicine course, avoid crowding. Picture 2 shows droplet/airborne spread of infection — prevention: wear masks, maintain distance, wash hands, cover sneezes and isolate infected people.

Value and Life Skill Based

Gargi is responsible, caring, socially aware and helpful. Such acts spread awareness, help others protect themselves, reduce the spread of disease and build a healthier, safer community — supporting collective well-being.

Case Study Based Assessment (cholera outbreak)

1. A water tank that had not been cleaned for months supplied contaminated water containing cholera bacteria.
2. Disease — Cholera; Pathogen — the bacterium *Vibrio cholerae*.
3. They boiled their drinking water, cleaned the tank regularly, ran awareness campaigns and followed proper hygiene.
4. Clean and disinfect water tanks regularly, drink only boiled/filtered water, maintain sanitation and hygiene, and spread awareness about safe water.

Learn Holistically — Swachh Bharat Abhiyan article (cross-curricular)

1. Science
 - a. Decomposer microbes (bacteria and fungi) break down organic waste into simple humus/manure, recycling nutrients back into the soil.
 - b. Hands carry germs that cause communicable diseases like diarrhoea, cholera and typhoid. Washing removes these pathogens and prevents them from entering the body through food.
2. Maths
 - a. 80% have toilets → 20% still need them. 20% of 1,250 = 250 households.
 - b. Increase = 1,50,000 – 75,000 = 75,000. Ratio of increase = 75,000 : 75,000 = 1 : 1 (i.e., it doubled / 100% increase).
3. Social Science
 - a. To make India clean and open-defecation free by building toilets, promoting hygiene and



changing sanitation behaviour.

- b. The TSC (1999) was a rural, supply/demand-driven sanitation programme focused on building facilities through education. The SBA (2014) was a nationwide flagship mission with a wider goal of a clean, open-defecation-free India, combining toilet building, waste management and large-scale public awareness.

4. G.K.

- a. Hygiene → cleanliness/sanitation; Initiative → campaign/mission; Participation → involvement; Awareness → consciousness/knowledge.
- b. Activity (sample): 'Good morning everyone. Our city is our home, and keeping it clean is my duty too. I promise never to litter and to always use a dustbin. I will separate wet and dry waste, avoid plastic, and join clean-up drives in my locality. I will plant trees and remind my friends and family to keep public places tidy. A clean city means healthy people and fewer diseases. If each of us does our small part, together we can make our city the cleanest and the happiest place to live. Thank you.'

Chapter 4: Electricity: Magnetic and Heating Effects

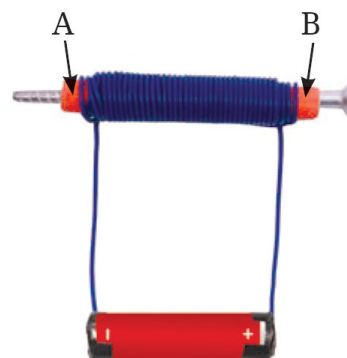
Time to Assess (A1)

1. Resistance (its opposition to the flow of electric current).
2. Nichrome (an alloy with high resistance and high melting point).
3. Electric Fuse
4. Thermostat.
5. Electromagnet.

NCERT QUESTIONS

1. (i) Electrolyte Solution, (ii) Magnet

2. (i) False. Dry cells are easy to carry and light in weight
(ii) True. When current passes through to the coil it becomes an electromagnet due to magnetic effect of current.
(iii) False. Electromagnet with two cells attracts more clips due to stronger magnetic field
3. (c) both will happen due to heating and magnetic effect of current
4. i-d, ii-c, iii-a, iv-b
5. generates more heat for a given current.
6. Electric heating devices are cleaner and do not produce smoke, reducing indoor air pollution and health issues. They save time and effort as there is no need to collect or burn fuel like firewood or charcoal. Such devices are safer and easier to control, especially in urban households. They also help reduce deforestation and environmental damage, benefiting society at large.
7. i. Current will flow in the direction of arrow, from positive to negative terminal.



- ii. The compass needle moves because the electric current creates a magnetic field around the coil.
- iii. Reversing the battery terminals reverses the current direction, changing the direction of the magnetic field. As a result, the compass needle deflects in the opposite direction.
8. The battery may have become weak or drained because it was left connected for too long. As the current

decreased, the magnetic field weakened, so the

electromagnet could no longer lift clips. The wire remains warm due to the heating effect of residual current. This shows that electromagnets need a strong current to work effectively.

9. In fig (a) the LED will glow. Lemon juice is acidic and acts as an electrolyte, enabling chemical reactions between the electrodes to generate a small current.

In pure water no or very little current will flow hence LED will not glow. Pure water is a poor conductor and lacks enough ions to allow current to pass between the electrodes.

10. Yes, the coil will still deflect the compass because electric current produces a magnetic field. However, the deflection will be less than before. This is because the iron nail, when present, acts as a core and increases the magnetic strength. Without the iron core, the magnetic field is weaker, so the compass deflects less.
11. Option (iv), in all four circuits the compass will deflect because all are good conductor of electricity.

PRACTICE FOCUS —

A. Choose the most appropriate answer

1. d. Nichrome
2. c. Resistance produces heat energy
3. b. Low melting point
4. c. It melts and breaks the circuit
5. b. Electric current flows through the coil
6. b. Mobile phones and laptops
7. b. A chemical solution that conducts electricity

B. Fill in the blanks

1. Resistance
2. Conductor (coil/wire)
3. Electric current
4. Anode
5. Carbon (graphite)
6. Ammonium chloride and manganese dioxide (with

zinc chloride)

7. Waste (and cost)
8. Electric

C. Match the following

1. c. High resistivity
2. d. Used in wiring
3. b. Used in cranes
4. e. Melts on overheating
5. f. Positive terminal
6. g. Positive electrode in dry cell
7. a. Negative terminal of dry cell

D. Answer in one word (VSA)

1. Resistance
2. Fuse
3. Magnetic field
4. Electromagnet
5. Anode
6. Ammonium chloride paste
7. Lithium-ion battery
8. Electrolyte

E. Assertion and Reason

1. a — Both true and R explains A.
2. a — Both true and R explains A.
3. b — Both true, but R explains how to vary strength, not directly why they are used in bells/cranes.
4. a — Both true and R explains A.
5. a — Both true and R explains A.

HOTS

1. The old iron's heating element (nichrome coil) has aged — it may be partly worn, oxidised or have a changed resistance/loose contacts, so it converts electrical energy to heat less efficiently and heats up slowly.
2. With repeated charge–discharge cycles, chemical reactions inside the battery cause its electrodes



and electrolyte to degrade. This reduces the charge it can store, so the battery drains faster and its efficiency falls.

3. The electromagnet with ten coils is stronger. The strength of an electromagnet increases with the number of turns of the coil (for the same current), so more turns give a stronger magnetic field.

Picture Based Assessment

(a) The heating effect of electric current. (b) A thermostat switches the current on and off to keep the iron at the set temperature; the indicator glows when current flows (heating) and turns off when the set temperature is reached — preventing overheating and saving energy.

Value and Life Skill Based

Risks: wasted electricity, higher bills, overheating and fire hazards, and shorter appliance life. Social impact: it wastes a shared resource and increases pollution from power generation. Switching off devices reflects responsibility, discipline and care for resources and the environment.

Case Study Based Assessment (copper wire warms up)

1. Even copper has a small resistance; as current flows, some electrical energy is converted into heat (the heating effect of current), so the wire becomes slightly warm.
2. Aluminium (like copper) has low resistance, so it conducts well and warms only slightly. Nichrome has high resistance, so it conducts less easily and heats up much more for the same current.
3. The greater the resistance of a wire, the more electrical energy it converts to heat, so high-resistance wires (nichrome) get hotter than low-resistance wires (copper, aluminium).
4. Because they have low resistance, conduct electricity efficiently with little heat loss, and are relatively cheap and easily available.
5. Use low-voltage cells, switch off when not in use, avoid touching bare wires or wet hands, do

not short-circuit cells, and work under teacher supervision.

Learn Holistically — 'The Electric World Around Us' (cross-curricular)

1. Science

- a. Moving electrons collide with the metal atoms; this resistance converts electrical energy into heat, warming the wire. Appliances such as heaters, irons, geysers and toasters use this heating effect, controlled safely with thermostats and fuses.
- b. Knowing that current makes an electromagnet, we could design devices like an automatic door lock, a magnetic crane to lift scrap, a doorbell, or a sorting machine that separates magnetic from non-magnetic waste — solving everyday problems.

2. English

- a. Activity (sample): 'Gargi, Atri and Agastya built a simple circuit with a battery, wires and a bulb. As the bulb lit up, they observed the heating effect — the wire grew warm because electrical energy changed into heat through the interaction of moving electrons with metal atoms. A compass placed near the wire moved, showing the magnetic effect. They concluded that an electric current can produce both heating and magnetic effects. This simple interaction of electricity, energy and matter explains how everyday machines like heaters, fans and bells work safely and usefully in our homes every day.'
- b. Activity (sample): 'Our school should switch to rechargeable batteries for all science projects. They can be used hundreds of times, so they save money in the long run and reduce the waste of throwing away dead cells. This protects our environment from harmful battery chemicals and teaches us to use resources wisely. Rechargeable batteries are reliable,

eco-friendly and economical — a small, smart change that makes our science learning greener and more responsible.'

3. Social Science

Electricity transforms communities. It lights homes and schools, enabling children to study at night and improving education. It powers hospitals and clinics, improving healthcare; runs machines, pumps and small industries, creating jobs and income; and connects people through phones and the internet. Overall, these changes raise the standard of living and show how basic infrastructure like electricity drives social progress and economic growth.

Chapter 5: Exploring Forces

Time to Assess (A1)

Fill in the blanks

1. Muscular force
2. Friction (frictional force)
3. Newton (N)
4. Gravitational force (gravity)
5. Electrostatic force

NCERT QUESTIONS

The textbook numbers these questions Q1–Q7 and then Q9–Q10 (there is no Question 8 printed in the book).

1. i - b, ii - e, iii - a, iv - c, v - d
2. (i) True.
(ii) False
(iii) False
3. When two balloons are rubbed with a woollen cloth and brought near each other, they move away from each other. Rubbing the balloons with a woollen cloth transfers similar to both balloons. Since similar charges repel, the balloons experience a repulsive electrostatic force and push away from each other.
4. When a coin sinks in water and a larger wooden block float, it is because of buoyant force and the

density of the materials.

The coin is made of metal, which is denser than water. The buoyant force acting on it is less than its weight, so it sinks.

The wooden block, though bigger, is less dense than water. The buoyant force on it is greater than or equal to its weight, so it floats. Thus, whether an object floats or sinks depends on its density and the upward force (buoyancy) acting on it.

5. (i) During its upward motion: Gravitational force acts downward (towards the Earth). There is no upward force after the ball leaves the hand; only gravity acts.
(ii) During its downward motion: Gravitational force continues to act downward, pulling the ball back to Earth.
(iii) At its topmost position: Gravitational force still acts downward. The ball has zero velocity at this point, but gravity immediately causes it to fall back down.

So, gravity acts downward in all three cases.

6. (i) To stop the ball before point A we need more rough surface like sandpaper and wood so that friction can be increased and due to friction (which acts in opposite direction to the motion) the ball can be stopped before point A.
(ii) To stop the ball crossing point A we need more smooth surface like glass and tile so that the friction with the surface reduces and ball can travel further.
7. We sometimes slip on smooth surfaces like ice or polished floors because these surfaces offer very little friction.
Friction is the force that resists motion between two surfaces in contact. On smooth or slippery surfaces, the friction is too low to provide the grip needed for our feet to push against the ground. As a result, we lose balance and slip easily.
8. Yes, a force is being applied to an object in non-uniform motion. Non-uniform motion means the object's speed or direction is changing. A change in speed (acceleration or deceleration) or direction



indicates that a net force is acting on the object, according to Newton's laws of motion.

9. The change in weight of an object on the Moon is caused by the Moon's weaker gravitational pull, which is about one-sixth of Earth's gravity. That's why an object weighs much less on the Moon. However, the mass of the object remains the same because mass is the amount of matter in an object and does not change with location. Only weight, which depends on gravity, changes.
10. Option (ii), w_1 is highest because the object is submerged most in the water, similarly w_2 is greater than w_3 because it is more submerged than w_3 in water.

PRACTICE FOCUS —

A. Choose the most appropriate answer

1. c. Friction
2. b. Atri (the larger force; net force 200 N in Atri's direction).
3. c. Electrostatic force
4. c. Gravel road
5. b. Upward
6. c. Gravity
7. a. Adding them

B. Fill in the blanks

1. Newton (N)
2. Opposite
3. Attractive (pulling) force
4. Buoyant (upthrust)
5. Non-contact
6. Subtract
7. Floating and sinking (buoyancy and displacement)

C. State True / False (and correct the false ones)

1. False — Gravity always pulls objects downward (it is an attractive force).
2. False — Friction usually opposes motion (though it also helps us grip and walk).

3. True
4. False — Weight changes with gravity, but mass remains constant everywhere.
5. False — It is a non-contact force; it acts even without touching.
6. False — Buoyant force acts upward.
7. False — More friction makes movement harder (it opposes motion).

D. Answer in one word (VSA)

1. Friction
2. Gravity (gravitational force)
3. Electrostatic force
4. Magnetic force
5. Newton
6. Buoyant force
7. Spring balance

E. Assertion and Reason

1. a — Both true and R explains A.
2. d — A is false (weight varies), R is true.
3. a — Both true and R explains A.
4. a — Both true and R explains A.
5. a — Both true and R explains A.
6. a — Both true and R explains A.

HOTS

1. (1) Apply more force (push harder or take help). (2) Reduce friction — put rollers/wheels under the box or move it on a smoother surface.
2. Friction acted between the tyres and the road (and air resistance). These opposing forces gradually slow the bicycle until it stops.
3. Find the net force. The table moves in the direction of the larger force; if both forces are equal, the table stays still.

Picture Based Assessment

The box may be too heavy and the friction/its weight too large for the boy's force, so his applied force is not

enough to overcome it. The force needed to move it is greater than the force he can apply, hence no motion (balanced forces).

Value and Life Skill Based

Floatation devices trap air and have low density, so they displace a large volume of water; the buoyant force keeps the person afloat instead of sinking. Understanding buoyancy helps design life jackets and boats, saving lives — showing how science serves society and the value of responsibility and care for others.

Case Study Based Assessment (vegetable vendor's cart)

1. Low friction on the smooth cement road made it easy to push.
2. The rough, soft mud greatly increased the friction (and the wheels sank), so a much larger force was needed and the cart slowed and got stuck.
3. Both forces act in the same direction, so they add up to give a larger net force, making it easier to move the cart.
4. Net force = $150\text{ N} + 120\text{ N} = 270\text{ N}$.
5. The cart's weight presses down on the soft mud, which cannot push back enough, so the wheels sink. The downward weight (gravitational force) opposes the upward reaction of the ground.

Performance Metrics (Competency Based)

1. b. Fly it against the wind to create lift
2. c. The air inside makes the body lighter by exerting an upward force (buoyancy).
3. c. $450\text{ Newton (approx)} - \text{weight} = \text{mass} \times g = 45 \times 10 = 450\text{ N}$.
4. c. Gravel on road (roughest, so most friction).
5. b. Because buoyant force is equal or greater than the gravitational force.

Learn Holistically (cross-curricular)

Activity prompts (sample guidance).

Science: explain push/pull and friction using everyday

examples. English: write a short paragraph using the words 'force', 'friction' and 'gravity'. Maths: calculate net force and weight (force = mass $\times$ g). Art: draw labelled diagrams of contact and non-contact forces acting on a moving object.

Chapter 6: Pressure, Winds, Storms and Cyclones

Time to Assess (A1) — Fill in the blanks

1. Pascal (Pa)
2. Pressure
3. Atmospheric pressure
4. Pressure (air pressure)
5. Decrease

NCERT QUESTIONS

- 1 (i) (d) equal in all three vessels
(ii) (b) Both M and N will not stick to their surfaces.
(iii) (a) increase the height 'H' at which the tank is placed.
(iv) (a) $P_A = P_B$, $F_A = F_B$
2. (i) True (ii) False (iii) False (iv) True
3. The boy standing vertically will sink more in the sand because the surface area of the body is more in (a) hence pressure will be less, where as area while standing will be less hence pressure exerted will be higher.
4. Weight of Elephant = 20000 N
Area of 1 foot of elephant = 0.25 m^2
Area of 4 foot of elephant = $4 \times 0.25 = 1\text{ m}^2$
Pressure = Force / Area = $20000/1 = 20000\text{ Pascal}$
5. Force on Boat A = $5\text{ person} \times 700$ (weight of each person) = 3500 N

Area of base of Boat A = 7 m^2

$$\text{Pressure} = \frac{\text{Force}}{\text{Area}}$$

$$= \frac{3500}{7} = 500\text{ Pa} = \text{Pressure on Boat A}$$



Force on Boat B = 3 person $\times$ 700 (weight of each person) = 2100 N

Area of base of Boat B = 3.5 m²

Area of base of Boat A = 7 m²

$$\text{Pressure} = \frac{\text{Force}}{\text{Area}}$$

$$= \frac{2100}{3.5} = 600 = \text{Pa} = \text{Pressure on Boat B}$$

Pressure on Boat B will be more by 100 Pa

6. No, lightning would not occur if air and clouds were good conductors of electricity.

Lightning happens because air and clouds are poor conductors (insulators). This allows electric charges to build up in the clouds until the difference in charge becomes very large. When the air can no longer resist, the charges suddenly discharge as lightning. If air and clouds were good conductors, charges would flow away smoothly without accumulating and the sudden discharge (lightning) would not take place.

7. When water is filled into the bottle up to a certain height, both balloons A and B will bulge. They will bulge equally, even if the bottle arms have different diameters. This is because the bulging of the balloons depends on the pressure exerted by the water column (height of water), not on the amount (weight) of water in each arm. Thus, equal heights of water columns exert equal pressure, leading to equal bulging of both balloons.

8. A storm becomes a cyclone when certain conditions intensify it:

- Warm, moist air rises rapidly from the sea surface, creating a low-pressure region.
- Surrounding cooler air rushes in to replace the rising warm air.
- The continuous rise of warm air and inflow of cooler air sets up a cycle, releasing large amounts of heat (latent heat of condensation) from condensing water vapour.
- This heat makes the system stronger, with faster winds and lower pressure at the center.

- Due to the Earth's rotation (Coriolis effect), the winds start spiraling around the low-pressure center.
- When this process strengthens enough, the storm grows into a cyclone.

9. As per the direction of the trees the land is on side A, because the breeze is flowing from B to A means during daytime in summer wind blows from sea to land due to low pressure zone above land.

10. **Activity:** Air Movement from High Pressure to Low Pressure

Procedure:

- i. Insert one end of the straw into the neck of an empty balloon and tie it tightly with a rubber band.
- ii. Inflate another balloon and hold its mouth tightly so that air does not escape.
- iii. Insert the free end of the straw into the neck of the inflated balloon and secure it with a rubber band.
- iv. Now the straw connects the inflated balloon to the empty balloon.
- v. Observe what happens to the size of the two balloons.

Observation: Air moves from the inflated balloon (high pressure) into the empty balloon (low pressure). The inflated balloon becomes smaller while the empty balloon becomes bigger.

Conclusion: This shows that air always flows from a region of high pressure to a region of low pressure.

11. A thunderstorm is a violent weather condition that involves strong winds, heavy rain, thunder and lightning. It develops due to the rapid upward movement of warm and moist air.

Formation of a Thunderstorm

- i. Warm, moist air near the Earth's surface rises quickly into the atmosphere.
- ii. Strong winds carry this warm, moist air upwards. At the same time, cooler air from higher altitudes moves downwards.

- iii. As the moist air rises, it cools and condenses to form large cumulonimbus clouds (thunderclouds).
- iv. Inside the cloud, ice particles and water droplets rub against each other due to up-and-down winds. The upper part of the cloud becomes positively charged and the lower part negatively charged.
- v. When the charge difference becomes very large, a sudden discharge occurs: within the cloud, between clouds or between a cloud and the ground. This produces lightning (a flash of light) and thunder (the sound due to rapid expansion of heated air).
- vi. A thunderstorm is formed when warm, moist air rises rapidly, creating large clouds, strong winds, lightning and thunder.

12. Process of Lightning Formation

- i. Cloud formation: During a thunderstorm, warm moist air rises rapidly and forms tall thunderclouds.
 - ii. Upward and downward winds: Strong winds inside the clouds move water droplets and ice particles up and down.
 - iii. Charge separation: Due to constant collisions and rubbing, electric charges get separated:
 - The upper part of the cloud becomes positively charged.
 - The lower part of the cloud becomes negatively charged.
 - iv. Discharge of charges: When the difference in charge between the cloud regions (or between cloud and ground) becomes very large, the insulating air can no longer hold them apart. A sudden discharge of electricity occurs, producing a bright flash of light called lightning.
13. Holes are made in banners and hoardings to reduce the air pressure acting on them. When strong winds blow, air exerts pressure on the surface of banners and hoardings. If there are no holes, the large surface area resists the wind and the banner may tear or get blown away. By making holes, the air can pass through them, reducing the pressure difference on the two sides. This prevents damage and keeps the banner or hoarding stable.

PRACTICE FOCUS —

A. Choose the most appropriate answer

1. b. Force ÷ Area
2. d. High pressure to low pressure
3. d. Pointed heels (smallest area).
4. a. Difference in air pressure
5. d. Thunderstorms
6. b. Increase in depth
7. b. Electric charge separation in clouds

B. Fill in the blanks

1. High; low
2. Rises; sinks (descends)
3. Eye
4. Strong winds and heavy rain (with lightning and thunder)
5. High (more)
6. Weight (column)
7. Warm

C. State True / False (and correct the false ones)

1. False — Pressure decreases when area increases (pressure = force ÷ area).
2. True
3. False — Standing under a tall tree during lightning is dangerous; one should take proper shelter.
4. True
5. False — Warm air is lighter and rises; cold air sinks.
6. False — Storms can occur in any season, especially in warm, humid conditions.
7. False — Blunt knives have a larger edge area, so they exert less pressure; sharp knives exert high pressure.

D. Answer in one word (VSA)

1. Air (the atmosphere)
2. Wind (storm)
3. It creates a low-pressure area (and cool air rushes



in)

4. Lightning conductor (lightning rod)
5. Land breeze
6. Lightning
7. Pressure difference (pressure-gradient force)

E. Assertion and Reason

1. c — A is true, but R is false (small area means pressure increases, which is why they cut better).
2. a — Both true and R explains A.
3. a — Both true and R explains A.
4. d — A is false (fast winds lower pressure), R is true.
5. d — A is false (the eye is calm) and R is false (pressure is lowest at the centre). [Best fit: A false, hence option d as R points to a false-to-A relation.]
6. b — Both true, but R is not the direct explanation of A (liquids exert pressure on the bottom and sides regardless).
7. a — Both true and R explains A.

HOTS

1. The pointed heels have a very small area, so her body weight produces very high pressure on a small spot of her feet/ground, causing pain.
2. Cyclones bring very strong winds, high waves and heavy rain over the sea, which can capsize boats and endanger lives, so fishermen are warned to stay away.
3. Pressing the pump pushes air out, creating low pressure (partial vacuum) inside. The higher outside pressure then pushes the blockage; repeated pressing and pulling moves the clog back and forth until it loosens and clears.

Picture Based Assessment

The phenomenon is a cyclone. The calm region at the centre is the eye of the cyclone. The swirling clouds around it are the cyclone's spiral bands. Two safety rules:

- (1) Move to a safe pucca shelter and stay indoors away from windows.

- (2) Keep emergency supplies ready, follow official warnings/evacuation orders and avoid the coast.

Value and Life Skill Based

Yes. Real survivor stories make the science of cyclones relatable and memorable, teach practical safety, and inspire courage, empathy and resilience. Combining values with science helps students stay calm in emergencies, help others and build emotional strength and a sense of community responsibility.

Case Study Based Assessment (village storm warning)

1. Uneven heating warms the air near the ground; it rises and forms a low-pressure region. Cooler, higher-pressure air rushes in to fill it, creating strong winds. Rising warm moist air condenses into clouds, releasing energy that develops into storms.
2. By valuing traditional weather signs alongside modern systems — inviting elders to share knowledge, explaining how science improves accuracy and early warning, and combining both so the community trusts and adopts the new system without feeling disrespected.
3. Keep emergency kits ready, secure roofs and loose objects, identify safe shelters, heed warnings, and help neighbours — especially the elderly and children. These actions show responsibility, care and community solidarity.

Learn Holistically (cross-curricular)

Activity prompts (sample guidance).

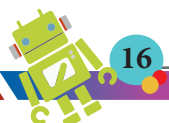
Science: explain pressure (force $\div$ area) and wind formation with diagrams. **Maths:** calculate pressure from given force and area. **Social Science:** map cyclone-prone coastal regions of India (e.g., Odisha) and discuss disaster preparedness. **English:** write a short report or poster on cyclone safety measures.

Chapter 7: Particulate Nature of Matter

Time to Assess (A1)

Answer the following

1. Matter is anything that has mass and occupies



space (has volume).

- The three states of matter are solid, liquid and gas.
- Light and heat (also sound, electricity) — they have no mass or volume.
- The interparticle space and the interparticle force of attraction decide the state of matter.
- Yes, matter can change its state on heating or cooling (e.g., ice $\rightarrow$ water $\rightarrow$ steam).

NCERT QUESTIONS

- (iv) closely packed in solids and move past each other in liquids.
- (i) True, (ii) False, (iii) True, (iv) True, (v) True, (vi) False
- (iii) Nothing of the chair will remain.

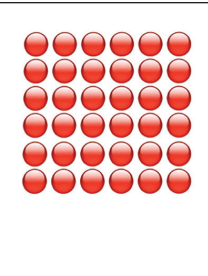
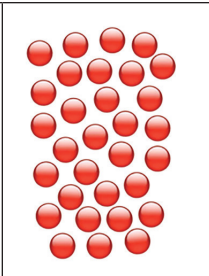
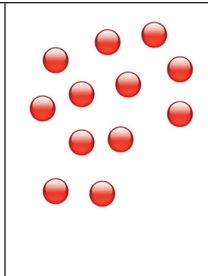
A chair is matter made entirely of constituent particles (atoms/molecules). If all those particles are removed, there is no mass and no space occupied. So, nothing is left.

- Gases mix easily because their particles are far apart, have very weak interparticle forces and move freely in all directions. This random motion allows gas particles to spread and mix quickly with other gases. Solids do not mix easily because their particles are tightly packed with very strong interparticle forces, leaving almost no space for movement.

Hence, solids retain their shape and cannot diffuse like gases.

- Milk is a liquid and liquids do not have a fixed shape. Their particles can move freely and flow, so milk spreads when spilled. The glass tumbler is a solid, whose particles are tightly packed with strong interparticle forces, giving it a definite shape. Hence, milk flows and spreads, but the tumbler retains its shape.

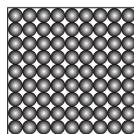
6.

		
Ice (Solid): Particles are closely packed in an ordered arrangement with very little freedom of movement.	Water (Liquid): Particles are still close, but the order is lost. They have more freedom to move around.	Water Vapour (Gas): Particles are very far apart and move freely in all directions.

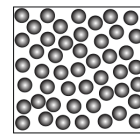
Ice $\rightarrow$ Water: Heat energy weakens the strong interparticle forces, allowing particles to move more freely.

Water $\rightarrow$ Vapour: With further heating, particles overcome almost all attractions and spread far apart, moving randomly.

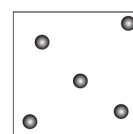
7.



i. Aluminium Foil

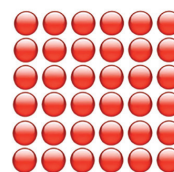


ii. Glycerin



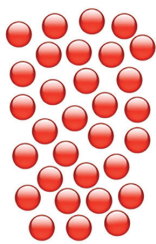
iii. Methane gas

- When a candle is blown out after burning for some time, we can see:
 - Solid Wax: The unburnt part of the candle remains in the solid state, where particles are closely packed and have a fixed shape.

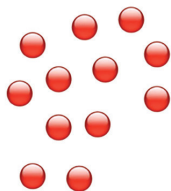


- Liquid Wax: Near the wick, solid wax melts into liquid form, where particles are still close but can move past each other.





- iii. Wax Vapour: Just above the wick, wax is converted into vapour (gas), where particles are far apart and move freely.



9. The water in the ocean tastes salty because it contains dissolved salts, mainly sodium chloride. When salt dissolves in water, it breaks down into tiny constituent particles (ions) that mix with the water particles. These particles are too small to be seen with the naked eye, but their presence can be sensed by the salty taste.
10. Both grains of rice and rice flour are solids, not liquids. Even though they seem to take the shape of the container, each grain or particle has a fixed shape and volume of its own. In a container, the spaces between grains make them behave like a fluid, but they do not lose their individual solid nature.

PRACTICE FOCUS —

A. Choose the most appropriate answer

- d. Intermolecular space
- a. Solid
- c. Maximum intermolecular space
- c. Diffusion
- b. 0°C
- b. They have intermolecular space
- b. Boiling point

B. Fill in the blanks

- Mass and volume (occupies space)
- Molecule (particle)
- Least (minimum)
- Maximum (largest)
- Fluids
- 100°C
- Increases

C. Match the following

- g. Strong particle attraction
- c. Indefinite shape
- a. High compressibility
- d. 0°C melting point
- e. Movement of particles
- f. Contains trapped air
- b. Very high diffusion

(NOTE: rigidity best matches 'strong attraction'; per the textbook ordering, final key below.)

D. Answer in one word (VSA)

- Interparticle (intermolecular) force of attraction
- Fluidity
- Gas
- Melting point
- Liquid
- Intermolecular space
- Diffusion

E. Assertion and Reason

- a — Both true and R explains A.
- a — Both true and R explains A.
- c — A is true, R is false (solids have minimum space).
- a — Both true and R explains A.
- a — Both true and R explains A.
- a — Both true and R explains A.
- a — Both true and R explains A.



HOTS

1. The burning agarbatti releases vapour/smoke particles that move and spread by diffusion, mixing with air particles and travelling all the way to the balcony, so the smell reaches Gargi.
2. In warm water the particles have more kinetic energy and move faster, so they collide with and separate the sugar particles more quickly, speeding up dissolving.
3. A sponge has lots of trapped air (large spaces) that can be squeezed out, so it compresses easily. A cricket ball is a tightly packed solid with very little space between particles, so it cannot be compressed.
4. Heating gives particles more energy. In ice (solid) particles only vibrate; on melting they gain energy, spaces increase and they slide as liquid water; on further heating they move very fast, spread far apart and escape as steam (gas).

Picture Based Assessment (interconversion of states)

Solid → Liquid = Melting; Liquid → Solid = Freezing; Liquid → Gas = Evaporation/Boiling (Vaporisation); Gas → Liquid = Condensation. Particle drawings: Solid — tightly packed regular; Liquid — close but loose/random; Gas — far apart and free-moving. (Solid ↔ Gas directly = Sublimation/Deposition.)

Value and Life Skill Based

Resources like water and food are limited and precious; using them carefully avoids waste and saves them for others and the future. At home and school we can show this value by closing taps, not wasting food, switching off lights and reusing materials — acting responsibly toward nature.

Case Study Based Assessment (boiling water)

1. The bubbles are water vapour (gas) forming throughout the liquid — they show the water has reached its boiling point and is turning into vapour.
2. Evaporation is slow, happens only at the surface and at any temperature below boiling; boiling is rapid, happens throughout the liquid and only at

the boiling point.

3. Temperature, surface area, humidity and wind/air movement (higher temperature, larger surface, lower humidity and more wind increase evaporation).

Learn Holistically (cross-curricular)

Science

1. Shape, volume and compressibility — solids have fixed shape and volume and are least compressible; liquids have fixed volume but no fixed shape; gases have neither fixed shape nor volume and are most compressible. These arise from particle spacing and movement.
2. Heat gives the ice particles more energy; the interparticle attraction weakens and the spaces increase, so the fixed particles begin to move and slide — changing the solid into liquid water.
3. It demonstrates that a liquid has no fixed shape — it takes the shape of its container (fluidity).

Maths

1. Ratio = 0.1 : 1.0 = 1 : 10.

English

1. Solid, liquid, gas (also water, table, air).
2. Sample: 'A solid keeps its own shape and volume, and a gas spreads out to fill space.' — conjunction: and.

Performance Metrics (Competency Based)

Identify everyday examples of solids, liquids and gases and justify by particle arrangement; predict what happens to particle spacing on heating/cooling; explain why gases are compressible but solids are not — in each case answer using interparticle space and force of attraction.

Chapter 8: Elements, Compounds and Mixtures

Time to Assess (A1)

Fill in the blanks

1. Heterogeneous



2. A compound
3. Solution (homogeneous mixture)
4. Metalloids
5. Semiconductors (e.g., silicon)

NCERT QUESTIONS

The textbook numbers these questions Q1–Q8 and then Q10–Q12 (there is no Question 9 printed in the book).

1. (iv) A and B are elements since they cannot be broken down further by chemical reactions. When they combine in a fixed ratio, they form C, which is a compound with a definite composition.

2. (i) Both Assertion and Reason are true and Reason is the correct explanation for Assertion.

Explanation: Air is a mixture of various gases such as nitrogen, oxygen, carbon dioxide etc, which are present in the atmosphere without any reaction between them.

3. Water (H_2O) is a compound formed when hydrogen and oxygen combine chemically in a fixed ratio. Its properties are entirely different from those of its constituent elements:

- Hydrogen is a colourless, highly flammable gas.
- Oxygen is a colourless gas that supports combustion.
- Water, however, is a liquid at room temperature, is not flammable and is used to extinguish fire.

Thus, when elements chemically combine to form a compound, the resulting substance acquires new properties different from the properties of the elements that formed it.

4. (iii) Pure substances – Carbon dioxide, iron, oxygen and sugar are all pure substances. (Correctly matched). A pure substance is composed of only one type of particle. Carbon dioxide, iron and oxygen are all elements, meaning they are made up of only one type of atom. Sugar is a compound, but it is still considered a pure substance because it consists of only one type of molecule.

5. Iron reacts with moist air to form iron oxide

- Iron (Fe) + Oxygen (O_2) + Water (H_2O) → Iron Oxide (Fe_2O_3)
- Magnesium burns in oxygen to form magnesium oxide
- Magnesium (Mg) + Oxygen (O_2) → Magnesium Oxide (MgO)

Substance	Type	Justification
Iron (Fe)	Element	A pure substance made of one kind of atom; it cannot be broken down chemically.
Magnesium (Mg)	Element	Pure metal element; basic building block of matter
Oxygen (O_2)	Element	Diatomic gas: a pure substance made of oxygen atoms
Water (H_2O)	Compound	Chemically combined hydrogen and oxygen in a fixed ratio.
Iron Oxide (Fe_2O_3)	Compound	Formed by a chemical reaction between iron and oxygen, has new properties
Magnesium Oxide (MgO)	Compound	Formed by a chemical reaction between magnesium and oxygen.
Moist Air	Mixture	Contains gases like oxygen, nitrogen, water vapour, not chemically combined

6.

Elements	Compounds	Mixtures
Aluminium	Carbon Dioxide (CO_2)	Sand
Gold	Magnesium Oxide (MgO)	Seawater
Oxygen	Rust (Fe_2O_3)	Muddy Water
Nitrogen	Iron Sulphide (FeS) Air	Air



Sulphur	Glucose (C ₆ H ₁₂ O ₆)	Fruit Juice
Hydrogen	Water (H ₂ O)	
	Sodium Chloride (NaCl)	
	Baking Soda (NaHCO ₃)	

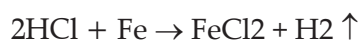
7. When a mixture of iron filings and sulphur powder is heated, they react to form a new substance called iron sulphide (FeS).

Difference from the mixture: In the original mixture, iron and sulphur retain their individual properties (iron is magnetic, sulphur is yellow and non-magnetic).

After heating, a chemical reaction occurs and iron sulphide is formed. This compound has completely new properties and cannot be separated by physical means.

Word equation: The word equation for the reaction is Iron + sulphur → Ferrous Sulphide

8. No, a substance cannot be classified as both an element and a compound. Elements are pure substances that cannot be broken down into simpler substances by chemical means, while compounds are formed when two or more different elements are chemically bonded together. The defining characteristic of a compound is that it is composed of multiple elements, whereas an element is a single type of atom. Therefore, a substance cannot be both a single type of atom and a combination of different types of atoms simultaneously.
9. If water were just a mixture of hydrogen and oxygen, it would not have the life-supporting properties we depend on. The gases would remain separate, with hydrogen being explosive and oxygen supporting combustion. We could not drink it, use it to grow crops or use it to put out fires. Life on Earth would not be possible without water as a compound.
10. By analyzing the figure, it is found that there will be a chemical reaction inside the test tube between dilute HCl and Fe.



So the reaction forms Iron Chloride (FeCl₂) and the gas above will be Hydrogen (H₂).

Hydrochloric Acid + Iron filing → Iron Chloride + Hydrogen (g)

Thus, Gas A = Hydrogen

11. Two compounds are:

1. Carbon dioxide (CO₂)

- Used in fire extinguishers.
- Used by plants in photosynthesis.

2. Ammonia (NH₃)

- Used in making fertilizers.
- Used as a refrigerant gas.

12. Gold can be classified as both a mineral and a metal:

- As a mineral: Gold occurs naturally in the Earth's crust in a pure form, so it is considered a mineral.
- As a metal: Gold is a metallic element with properties like malleability, ductility, lusture and conductivity, so it is also classified as a metal.

Thus, gold fits into both categories a naturally occurring mineral and a useful metal.

PRACTICE FOCUS —

A. Choose the most appropriate answer

1. c. Pure substance
2. d. Sodium chloride (a compound).
3. c. Electrolysis
4. c. Carbon dioxide
5. c. O₂
6. c. Silicon
7. c. Has fixed composition

B. Fill in the blanks

1. Homogeneous mixture (solution)
2. Chemical
3. Atom
4. Water vapour (and other gases like argon)
5. S₈ (eight sulphur atoms)



- Pure substance
- Semiconductors (electronic chips)

C. State True / False (and correct the false ones)

- False — Only some can; many need filtration, evaporation, etc.
- True
- False — Elements cannot be broken down into simpler substances by chemical reactions.
- False — Air is a homogeneous mixture.
- False — Most metals occur chemically combined in minerals/ores.
- True
- False — A molecule of an element (e.g., O_2) is not a compound; all compounds are molecules but not all molecules are compounds.

D. Answer in one word (VSA)

- Silicon and germanium
- Molecule
- Element (a metal)
- Adulterants
- Common salt (table salt)
- As a molecule, N_2 (a gas)
- Carbon (charcoal/black residue)

E. Assertion and Reason

- a — Both true and R explains A.
- b — Both true, but R is not the correct explanation of A.
- d — A is false (fruit salad is heterogeneous), R is essentially false/not applicable, but best fit: A is false. (Choose d if R is read as a true general statement.)
- a — Both true and R explains A.
- d — A is false (brass is a mixture/alloy), R is false too — best fit: A false; brass is a mixture, not chemically bonded.
- c — A is true, but R is false (some elements exist as

single atoms, e.g., noble gases).

- a — Both true and R explains A.

HOTS

- An alloy like the ring is gold mixed with other metals (e.g., copper) without any chemical bonding; the metals keep their own properties and can be separated by physical/metallurgical means, and the proportion is not fixed — so it is a mixture, not a compound.
- Air is a mixture — its gases (nitrogen, oxygen, etc.) are not chemically combined, have no fixed ratio, keep their own properties and can be separated physically. So air is a mixture, not a compound.
- Brass is a mixture (alloy) of copper and zinc. Students can reason that the metals are not chemically combined in a fixed ratio, retain their properties, and can be separated physically — so it is a mixture, not a compound.

Picture Based Assessment

Water (H_2O) — molecule of a compound (different atoms bonded). Oxygen (O_2) — molecule of an element (same atoms bonded). A single oxygen sphere — an element/atom. Difference: an element is one kind of atom; a molecule of an element joins same atoms; a molecule of a compound joins different atoms chemically.

Value and Life Skill Based

The dilemma is saving money versus protecting health, soil and safety. I would recommend not using adulterated fertilizers, because cheap adulterants can harm crops, soil and people's health. Honesty, responsibility and care for community health and the environment matter more than short-term savings.

Case Study Based Assessment (water samples)

- Distilled water — a pure compound. Tap water — a homogeneous mixture (water with dissolved minerals). Fruit juice — a mixture (mostly homogeneous). Muddy water — a heterogeneous mixture (water + insoluble soil).



2. Filtration to remove insoluble solids (like mud), and distillation/evaporation-condensation to obtain pure water from dissolved impurities. (Sedimentation and decantation can also be used first.)
3. Pure water prevents waterborne diseases like cholera and typhoid, keeps people healthy and supports overall wellbeing and development of a community.

Learn Holistically / Performance Metrics (cross-curricular & competency)

Performance Metrics (sample answers).

1. Salt mixed in water → d. The mixture is homogeneous and salt can be recovered by evaporation.
2. Food adulteration most compromises → a. Its chemical composition.
3. Rainwater vs tap water → b. Tap water is a pure substance? No — rainwater is a mixture including dissolved impurities (rainwater carries dissolved gases/impurities).
4. Heating sugar gives water vapour then black carbon → b. Sugar is a compound made of multiple elements.
5. Metalloid in daily life → d. Installing a silicon chip in a computer.
6. Responsible citizenship → b. Spreading awareness about food adulteration and checking for purity.

Chapter 9: The Amazing World of Solute, Solvent and Solution

NCERT QUESTIONS

1. (i) False, oxygen gas is less soluble in hot water; solubility of gases in water generally decreases with increasing temperature.
(ii) False, a mixture of sand and water is a mixture not a solution because the sand does not dissolve in the water.

- (iii) False, the amount of space occupied by an object is called its volume. Mass is a measure of the amount of matter in an object.
(iv) False, an unsaturated solution has less solute dissolved than a saturated solution; a saturated solution contains the maximum amount of solute that can be dissolved at that temperature.
(v) True, the mixture of different gases in the atmosphere is a solution, with nitrogen often considered the solvent.

2. (i) immersed, rise
(ii) solute, solvent
(iii) decreases
(iv) saturated

3. (ii) Water is denser than oil

If oil floats on top of water, it tells you that water is denser than oil. When a substance floats on another, it means it has a lower density than the fluid it is floating in. Since oil floats on water, oil is less dense than water.

$$4. \text{Density} = \frac{\text{Mass}}{\text{Volume}}$$

Here, mass = 225 g and volume = 90 cm³

$$\text{Density} = 225 \text{ g} / 90 \text{ cm}^3 = 2.5 \text{ g/cm}^3$$

The density of water is approximately 1 g/cm³. Objects with a density greater than that of water (1 g/cm³) sink, while those with a lower density float. Since, the stone sculpture has a density of 2.5 g/cm³, which is greater than 1 g/cm³, it will sink in water.

5. (iii) No more solute can be dissolved into the saturated solution at that temperature.

A saturated solution is one where the maximum amount of solute has been dissolved and no more can dissolve at that temperature.

The other statements are not appropriate because:

- (i) A saturated solution cannot dissolve more solute at a given temperature.
(ii) An unsaturated solution can still dissolve more



solute, not the maximum amount.

(iv) Saturated solutions can form at any temperature, not only

6. The bottle has a volume of 2 litres, which is 2000 mL

(Since, 1 litre = 1000 mL).

You pour 500 mL of water into it.

Amount of water the bottle can still hold = 2000 mL – 500 mL = 1500 mL.

The bottle can hold 1500 mL more water.

7. The formula for density is:

$$\text{Density} = \frac{\text{Mass}}{\text{Volume}}$$

Given:

Mass = 400 g

Volume = 40 cm³

$$\text{Density} = \frac{400 \text{ g}}{40 \text{ cm}^3} = 10 \text{ g/cm}^3$$

8. In Fig. a, the unpeeled orange floats because its peel contains tiny air pockets.

These air pockets increase the volume of the orange without adding much mass, making the orange less dense than water. As a result, it floats.

In Fig. b, the peeled orange sinks because removing the peel reduces its volume but the mass remains almost the same.

This makes the peeled orange denser than water, so it sinks.

9. The formula for density is:

$$\text{Density} = \frac{\text{Mass}}{\text{Volume}}$$

For Object A: Mass = 200 g, Volume = 40 cm³

$$\text{Density} = \frac{200 \text{ g}}{40 \text{ cm}^3} = 5 \text{ g/cm}^3$$

For Object B: Mass = 240 g, Volume = 60 cm³

$$\text{Density} = \frac{240 \text{ g}}{60 \text{ cm}^3} = 4 \text{ g/cm}^3$$

Since, 5 g/cm³ (object A) is greater than 4 g/cm³ (object B). So, object A is denser.

10. Reema has a piece of modeling clay with a mass of 120 g and a volume of 60 cm³. Its density is:

$$\begin{aligned}\text{Density} &= \frac{\text{Mass}}{\text{Volume}} \\ &= \frac{120 \text{ g}}{60 \text{ cm}^3} = 2 \text{ g/cm}^3\end{aligned}$$

When she shapes it into a thin sheet, the mass and volume remain the same, so the density does not change, even though the shape is different.

11.

$$\text{Density} = \frac{\text{Mass}}{\text{Volume}}$$

Or $\text{Volume} = \frac{\text{Mass}}{\text{Density}}$

Given:

Mass = 600 g

Density = 7.9 g/cm³

Calculation:

$$\text{Volume} = \frac{600}{7.9 \text{ g/cm}^3}$$

= 75.95 cm³ (rounded to two decimal places).

Therefore, the volume of the iron block is approximately 75.95 cm³.

12. When the test tube is heated, the water expands as its volume increases while mass stays the same. This reduces the density, causing the water level in the glass tube to rise.

PRACTICE FOCUS —

A. Choose the most appropriate answer

1. b. Solute dissolves completely in solvent
2. b. It dissolves most solutes
3. b. Saturated
4. b. Increases with increase in temperature
5. b. kg/m³
6. b. Increases

7. b. Has less density

B. Fill in the blanks

1. Homogeneous
2. Solute
3. Solubility
4. Saturated
5. Less
6. No (it is unitless)
7. Millilitres / litres (mL)

C. State True / False (and correct the false ones)

1. False — Solubility of most solids increases with temperature.
2. False — A diluted solution contains less solute (more solvent).
3. True
4. False — Density of water is about 1 g/cm^3 .
5. False — Pressure affects gases much more than solids.
6. False — A saturated solution cannot dissolve more solute unless heated.
7. False — Relative density is a ratio and has no unit.

D. Answer in one word (VSA)

1. Relative density (specific gravity)
2. Displacement method (water displacement)
3. Density
4. Dilute (unsaturated) solution
5. Density
6. When pressure increases (or temperature decreases)
7. Least count

E. Assertion and Reason

1. a — Both true and R explains A.
2. d — A is false (relative density has no unit), R is true.
3. a — Both true and R explains A.

4. c — A is true, but R is false (hot air becomes less dense).
5. a — Both true and R explains A.
6. c — A is true, but R is false (under pressure gas particles move closer, not farther).

HOTS

1. Underwater, the weight of the water column above presses down, increasing pressure with depth (water is dense). This high pressure compresses the gas in his oxygen tank, increasing its density, which is why he feels heavy pressure and his air is used up faster at depth.
2. The log that floats is less dense than water; the one that sinks slightly is denser (its wood is heavier/contains more water). Same volume but different mass means different density, deciding floating or sinking.
3. The one with carbon dioxide is heavier, because CO_2 is denser (heavier per unit volume) than ordinary air, so the same volume has more mass.

Picture Based Assessment

The flask with little solute is a dilute (unsaturated) solution; the one with more dissolved solute is concentrated; the one with extra undissolved solute settled at the bottom is saturated/supersaturated. As solute increases, the solution becomes more concentrated until it is saturated and no more dissolves.

Value and Life Skill Based

Knowing that insoluble powders pollute water, people can choose natural, biodegradable colours and avoid throwing waste into ponds. Responsible actions — using safe products, cleaning up and spreading awareness — protect water sources and show environmental care.

Case Study Based Assessment (iceberg)

1. Ice is less dense than liquid water, so the buoyant force supports it and it floats despite its large mass.
2. The relative density of ice (about 0.9) is less than 1, meaning ice is lighter than the water it displaces, so it floats.



3. Because the densities are close, the iceberg must displace a large volume of water to balance its weight, so about 90% stays submerged and only ~10% shows above the surface.
4. Colder seawater is denser (sinks) and warmer seawater is less dense (rises); salt content also raises density.
5. Knowing most of an iceberg is hidden underwater, ships use sonar and density/temperature data to detect submerged ice and keep a safe distance.

Learn Holistically / Performance Metrics (cross-curricular & competency)

Learn Holistically — Hot air balloon (sample).

Heating the air inside lowers its density below the surrounding air, creating lift so the balloon rises; cooling the air increases its density and the balloon descends — this links density, temperature and buoyancy.

Performance Metrics (sample answers).

1. Solid rubber vs air-filled ball (same volume) → c. The rubber ball will sink and the air-filled ball will float due to density differences.
2. Ship floats, nail sinks → d. Ship lowers its overall density by enclosing air.
3. LPG cylinder feels heavier in winter → b. Temperature affects density and pressure inside the cylinder.
4. Submarine rises when water removed → c. Removing water decreases density.
5. Sealed bottle crushed at sea level → c. Outside air pressure is higher at sea level.
6. Lake freezes top to bottom → c. Water is densest at 4°C, causing colder water to rise and freeze.

Chapter 10: Mirrors and Lenses

NCERT QUESTIONS

1. (ii) If the incident ray makes a 40° angle with the normal, then:

Angle of incidence (i) = 40°

According to the law of reflection,

Angle of reflection (r) = Angle of incidence (i) = 40°

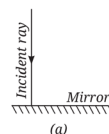
Now, angle between reflected ray and mirror

= 90° – angle of reflection

= 90° – 40°

= 50°

2. (i) Light ray falls along the normal

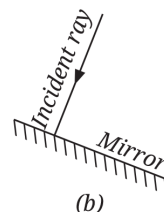


Angle of incidence = 0°

Angle of reflection = 0°

The ray retraces its path. It reflects straight back along the same line.

- (ii) The mirror is tilted, but the light ray still falls along the normal to the tilted surface



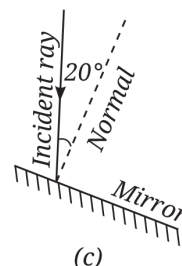
Even though the mirror is tilted, the ray is still perpendicular to the surface.

Angle of incidence = 0°

Angle of reflection = 0°

The ray again retraces its path — the tilt doesn't affect the reflection if the ray is normal to the surface.

- (iii) The mirror is tilted and the light ray falls at 20° from the normal



Angle of incidence = 20°

By the law of reflection:

Angle of reflection = 20°

The reflected ray will make a 20° angle with the normal, on the opposite side.

3.

Image	Mirror
(i)	Convex mirror
(ii)	Concave mirror
(iii)	Plane mirror

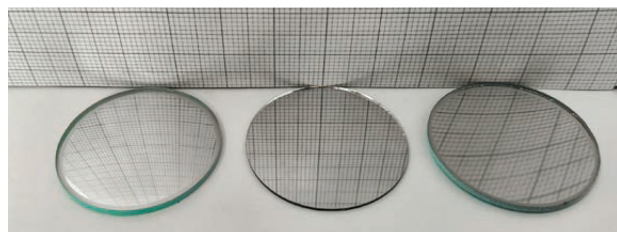
4.

Image	Mirror
Image (i)	Convex mirror
Image (ii)	Concave mirror
Image (iii)	Flat transparent glass piece

5. (ii) When light hits a surface at a 90° angle (perpendicular), it is considered to be incident normally.

Angle of incidence = Angle of reflection: In reflection, the angle of the reflected light is always equal to the angle of the incident light. Since the light is hitting the mirror normally (at a 0° angle), the reflected light will also be at a 0° angle.

6.



Convex Mirror Plane Mirror Concave Mirror

7. The correct answer is (i) her erect image keeps decreasing in size. Because a convex mirror always forms a virtual, erect and diminished image.
8. A magnifying glass uses a convex lens to make text appear larger. When we hold the magnifying glass close to the text and then slowly move it away,

the image of the text will first appear larger and sharper, then progressively get larger and more blurred and finally invert and appear smaller again.

9. (i) Concave mirror → (a) Spherical mirror with a reflecting surface that curves inwards
- (ii) Convex mirror → (b) It forms an image which is always erect and diminished in size.
- (iii) Convex lens → (c) Object placed behind it may appear inverted at some distance.
- (iv) Concave lens → (d) Object placed behind it always appears diminished in size.
10. (i) Both Assertion and Reason are correct and Reason is the correct explanation for Assertion.
11. (ii) Figure (a) indicates a convex mirror and Figure (b) indicates a concave mirror. Concave mirror shows enlarged image; convex mirror shows smaller image.
12. When we place a pencil behind a transparent glass tumbler and fill the tumbler halfway with water, the pencil will appear to be bent or broken at the point where it enters the water. The submerged portion of the pencil might also appear slightly thicker or shifted from its actual position. This phenomenon is called refraction of light.

PRACTICE FOCUS —

A. Choose the most appropriate answer

- b. Diverging mirrors
- b. Very close (between the pole and the focus).
- b. Concave mirror
- c. Angle of incidence
- b. Diminished and erect image
- b. Convex mirror
- d. All types of mirrors

B. Fill in the blanks

- Converging
- Incident



3. Erect (virtual) and diminished
4. Reflection
5. Concave
6. Wider (larger)
7. Plane

C. State True / False (and correct the false ones)

1. False — A convex mirror always forms a diminished image.
2. True
3. True
4. True
5. False — They apply to all mirrors (plane, concave and convex).
6. True
7. True

D. Answer in one word (VSA)

1. Convex mirror
2. Normal
3. Concave mirror
4. Concave (biconcave) lens
5. Virtual, erect and diminished image
6. Focus (principal focus)
7. Concave mirror

E. Assertion and Reason

1. a — Both true and R explains A.
2. d — A is false (concave lens forms diminished images), R is true.
3. a — Both true and R explains A.
4. c — A is true, but R is false (a convex mirror forms virtual images, not real).
5. a — Both true and R explains A.
6. a — Both true and R explains A.

HOTS

1. A convex mirror is used. It always forms a small, erect image and covers a wide field of view, letting

the driver see more traffic behind in a small mirror — improving safety.

2. A concave mirror is a converging mirror — it focuses parallel sun rays to a single point (focus), concentrating heat there. The food placed at the focus gets very hot and cooks.
3. As the tree (object) moves closer, the image moves farther from the lens, becomes larger, and remains real and inverted — until the object is very close, when the image becomes virtual, erect and magnified.
4. A concave mirror forms a magnified image and only a narrow field of view, and can form inverted/real images, giving a wrong idea of the distance and position of vehicles — which is unsafe. A convex mirror, giving an erect, diminished, wide-angle view, is the correct choice.

Picture Based Assessment

The mirror that converges parallel rays to a real focus in front is a concave mirror; the one that makes parallel rays diverge (appearing to come from a focus behind) is a convex mirror. Label: incident rays, reflected rays, principal axis, normal, and focus (F).

Value and Life Skill Based

Convex mirrors give a wide field of view, letting drivers and pedestrians see around blind corners and avoid collisions. Installing them shows the authorities care for public safety, accident prevention and community well-being.

Case Study Based Assessment (school crosswalk mirror)

1. A convex mirror is installed, because it gives a wide field of view and an erect image, letting road users see approaching vehicles from many directions — which a flat (plane) mirror cannot.
2. Its outward-curved (diverging) surface spreads the reflected rays, covering a large area in a small mirror so people can spot vehicles at the blind crossing and stop in time.

- Water stains, blur and dirt make the image unclear, so road users cannot see approaching vehicles properly — increasing the risk of accidents at the crossing.

Learn Holistically / Performance Metrics (cross-curricular & competency)

Learn Holistically (sample).

Light follows the laws of reflection at mirrors, forming real or virtual images: concave mirrors can magnify (used in torches, shaving and dentist mirrors) while convex mirrors give smaller, wider views (used in vehicles). Lenses bend light by refraction — convex lenses converge and magnify, concave lenses diverge and diminish.

Performance Metrics (sample answers).

Typical competency items: choose the right mirror/lens for a given use (rear-view → convex; solar cooker/dentist → concave; magnifier → convex lens); explain why, using converging/diverging behaviour and the nature of the image (real/virtual, erect/inverted, enlarged/diminished).

Chapter 11: Keeping Time with The Skies

NCERT QUESTIONS

- True – We only see the part of the Moon that reflects sunlight.
 - False – Phases occur because we see different portions of the Moon's illuminated half, not due to Earth's shadow (that causes eclipses).
 - True – Calendars are based on repeating astronomical cycles like the Sun and Moon.
 - False – The Moon can also be seen during the day, depending on its position.
- No, Amol's birthday will not fall on full moon day every year because a full Moon follows the lunar cycle (one synodic month ≈ 29.5 days), while Amol's birthday (6 May) follows the solar/Gregorian calendar (one year ≈ 365.24 days). Twelve lunar months total ≈ 354 days, about 11 days shorter than a solar year. So the full Moon date shifts by ~ 11

days each year and it won't land on 6 May every year. It may coincide occasionally (roughly repeats near a 19-year Metonic cycle), but not annually.

- Two incorrect things are:

- Stars are shown near the Moon during the daytime, which is incorrect because stars are not visible in the daytime sky.
- The Moon's dark part is shaded incorrectly to show a phase. The shadow in the figure suggests it's caused by Earth's shadow, which is not true for regular Moon phases; they are caused by the Moon's position relative to the Earth and Sun, not a shadow.

- (i)

Picture label (e.g. A, B, C, etc.)	Mirror
C	Three days after New Moon
E	Full Moon
F	Three days after Full Moon
A	A week after Full Moon
B	Day of New Moon

- Picture B (New Moon phase) is never seen from Earth because the illuminated side of the Moon is facing away from us.
- At sunset, the Moon is overhead only during the first quarter (a week after New Moon), when the right half is illuminated. We will need draw a half Moon (right half bright, left half dark).



- Waxing phase (because it occurs after New Moon and the bright part is increasing).
- Kaushalya is telling the truth because gibbous moons can be seen in the East during the afternoon. Ravi's statement is incorrect because crescent moons do not rise in the East at sunset. A crescent Moon appears just after the new moon (waxing crescent) or just before the New Moon (waning



crescent). Waxing crescent is visible after sunset in the western sky, not rising in the east and waning crescent rise just before sunrise, not at sunset.

7. Luni-solar calendars will need an intercalary month more often as the Moon moves farther and slower and it takes longer to complete a cycle. So, a lunar year becomes even shorter compared to the solar year.

8. Yes, at least two full Moons must happen in the same solar month.

A solar calendar has $12 \text{ months} \times 3 \text{ years} = 36 \text{ months}$.

37 full Moons in 36 months, at least one month must have 2 full Moons.

9. If the moon is visible from sunset to sunrise then it is a Full Moon.

10. One leap year adds ~1 day every 4 years.

Without leap years, the calendar shifts by 1 day every 4 years.

There are roughly 183 days between 15 August (monsoon) and winter (mid-February).

$183 \text{ days} \times 4 = 732 \text{ years}$

In approximately 730-732 years, 15 August would occur in winter.

11. Artificial satellites are launched to serve many important purposes that benefit science, technology and daily life.

Their main purposes include:

- Satellites relay signals for television, radio, internet and telephone across the globe.
- They observe clouds, winds, storms and cyclones, helping predict weather and natural disasters.
- GPS satellites guide ships, airplanes, vehicles and even smartphones for accurate location and travel directions.
- Satellites take pictures and collect data about land, oceans, forests, agriculture and climate change.
- They study space, stars, planets and cosmic phenomena, helping us understand the

universe.

- Satellites are used for surveillance, defence communication and border monitoring.

12.

- Based on the rotation of the Earth on its axis (one complete rotation ≈ 24 hours).
- Based on the revolution of the Moon around the Earth (one complete cycle of phases ≈ 29.5 days).
- Based on the revolution of the Earth around the Sun (one complete orbit ≈ 365.25 days).

So, day = Earth's rotation, month = Moon's revolution, year = Earth's revolution.

PRACTICE FOCUS —

A. Choose the most appropriate answer

1. c. Revolution of the Moon around Earth
2. b. 29.5 days
3. b. Solar cycle
4. b. Adhik Masa
5. b. 1957
6. a. Chaitra
7. c. The Moon's orbit is slightly tilted

B. Fill in the blanks

1. Waxing
2. A Full Moon
3. 24 hours (one day)
4. 365
5. February
6. New Moon
7. Natural satellite

C. Match the following

1. b. Increasing brightness
2. a. Decreasing brightness
3. c. Extra month added in luni-solar calendar
4. d. First month of Saka calendar
5. e. Occurs on new Moon day



6. f. Moon fully illuminated

D. Answer in one word (VSA)

1. Solar calendar
2. Luni-solar calendar
3. Phalguna
4. Full Moon
5. New Moon
6. Aryabhata
7. Lunar eclipse

E. Assertion and Reason

1. a — Both true and R explains A.
2. d — A is false (the Gregorian calendar does have leap years), R is true.
3. a — Both true and R explains A.
4. a — Both true and R explains A.
5. d — A is false (it begins with Chaitra, aligned to the spring equinox), R is false too — best fit: A false.
6. d — A is false (the lunar month ~29.5 days is shorter than the solar month ~30–31 days), R is true.

HOTS

1. She should observe the days between New Moon and Full Moon (roughly days 1–14), because in this period the bright part of the Moon grows larger each night — that is the waxing phase.
2. Knowing the Moon rises about 5 minutes (actually ~50 minutes) later daily, he can predict when it will appear each night and choose Moon-free nights for observing faint stars, or moonlit nights for observing the Moon.
3. He should follow the solar calendar, because it is tied to Earth's revolution around the Sun and so matches the seasons accurately, helping him sow at the right time.
4. Each National Calendar month corresponds to a fixed Gregorian period — e.g., Chaitra begins around 22 March, Vaishakh around 21 April, and so on. The school should map each Saka month to its Gregorian dates to schedule exams correctly.

Picture Based Assessment

Draw the Sun on one side and the eight Moon phases around the Earth: New Moon → Waxing Crescent → First Quarter → Waxing Gibbous → Full Moon → Waning Gibbous → Last Quarter → Waning Crescent, with the lit side always facing the Sun.

Value and Life Skill Based

Stargazing sparks curiosity about the universe, encourages students to work together to find and identify objects (teamwork), develops patience and observation skills, and inspires awe and wonder about nature — a healthy alternative to screen time.

Case Study Based Assessment (Chandrayaan / ISRO)

1. Missions like Chandrayaan send back close-up images and data about the Moon's surface, soil, minerals and water, revealing details (like the far side and craters) that we cannot see from Earth.
2. They show that hard work, teamwork and scientific dedication can achieve great things, inspiring students to study science, work together and feel proud of their country's achievements.

Learn Holistically / Performance Metrics (cross-curricular & competency)

Sample competency answers.

Day, month and year are each based on a periodic astronomical motion (rotation, Moon's revolution, Earth's revolution). Students should explain why festivals shift in the Gregorian calendar (luni-solar basis), why eclipses are not monthly (tilted Moon orbit), and why the same face of the Moon always faces Earth (synchronous rotation).

Chapter 12: How Nature Works in Harmony

NCERT QUESTIONS

1. (iii) An ecosystem is part of a community
2. Changes: Dead plants and animals would accumulate, nutrients would not return to the soil and plant growth would decline. This could lead to a reduction in herbivore and carnivore populations due to food scarcity.



Why Essential: Decomposers (e.g., fungi, bacteria) break down dead matter into simpler substances, recycling nutrients like nitrogen and carbon back into the soil for plants. Without them, the nutrient cycle would stop, disrupting the food web.

3. Yes, mangroves protected the village. Mangrove forests act as natural barriers, slowing down strong winds and waves during storms and tsunamis. Their roots stabilize soil, reducing erosion and they absorb water impact, protecting coastal areas. The Sundarbans' mangroves, a World Heritage Site, demonstrate this protective role.

4. **Grasshoppers:** The population would likely increase because frogs, their main predators, are gone, reducing predation pressure.

Snakes: The population would decrease because frogs are their primary food source, leading to food scarcity.

Why: In a food chain, the removal of a middle trophic level (frogs) disrupts the balance. Fewer predators allow prey (grasshoppers) to multiply, while the loss of prey affects higher predators (snakes).

5. Possible reasons: Possible causes include pesticide use killing larvae, loss of nectar plants or increased predators (e.g., birds). Monoculture or pollution might also reduce habitat quality.
6. An ecosystem needs consumers to regulate producer populations (e.g., herbivores eat plants) and decomposers to recycle dead matter into nutrients for producers. Without consumers, producers would overgrow and die from competition; without decomposers, nutrients would not cycle, collapsing the system.
7. We can see some common things near our home and school, such as
- Park: Living (trees, birds, squirrels, grass); Non-living (soil, water, benches, sunlight).
 - Roadside: Living (weeds, insects); Non-living (asphalt, dust, car exhaust).
 - Differences: The park is a designed ecosystem with diverse plants and animals, supported

by soil and water, while the roadside is a disturbed, human-altered area with fewer species and more pollution.

8. Agree. Agricultural fields provide food but often use unsustainable practices (e.g., synthetic fertilisers, monoculture) that degrade soil and harm biodiversity. Sustainable methods (e.g. organic farming, crop rotation) ensure long-term productivity and environmental health.
9. **Predators:** The numbers of foxes and eagles would decrease due to reduced prey (hares), leading to food scarcity.

Plants: Grass and plant populations might increase initially without hare grazing, but overgrowth could alter the habitat.

Deer: Since deer aren't preyed on by foxes or eagles, their role in this particular chain isn't disturbed directly.

Why: A decline in a key herbivore like the hare disrupts the food web, affecting both higher (predators) and lower (plants) trophic levels.

PRACTICE FOCUS —

A. Choose the most appropriate answer

1. b. Habitat
2. c. Population
3. c. Interlinked food chains
4. b. Nutrients
5. c. Resource sharing (niche use; avoiding competition).
6. c. Commensalism
7. c. Soil degradation

B. Fill in the blanks

1. Community
2. Producers
3. Herbivores
4. Recycling
5. Food web
6. Chemical fertilizers (and pesticides)

7. Mutualism

C. State True / False (and correct the false ones)

1. False — Plants also depend on abiotic components like sunlight, water, air and soil.
2. True
3. False — Food chains start with producers (plants).
4. False — Decomposers recycle nutrients and maintain soil fertility.
5. False — It is an example of predation.
6. False — Overuse of pesticides harms/reduces biodiversity.
7. False — Organisms in a community are interdependent.
8. False — In commensalism one benefits and the other is unaffected (neither is harmed).

D. Answer in one word (VSA)

1. Population
2. Nutrients (humus)
3. Food web
4. Mutualism
5. Producers (autotrophs)
6. Herbivores
7. Ecosystem

E. Assertion and Reason

1. c — A is true, but R is false (plants make their own food).
2. a — Both true and R explains A.
3. a — Both true and R explains A.
4. c — A is true, but R is false (chemical fertilizers reduce soil biodiversity).
5. c — A is true, but R is false (in parasitism one benefits and the other is harmed).
6. a — Both true and R explains A.
7. a — Both true and R explains A.

HOTS

1. Pesticides can kill helpful insects (bees, butterflies) and birds, reduce biodiversity, harm the soil and water, and let pests become resistant — upsetting the balance of the ecosystem over time.
2. Factory waste and pollution can poison the water, killing fish and driving away birds, and can make the water unsafe for villagers to drink or use — harming health and the whole ecosystem.
3. Decomposers break down kitchen and garden waste into nutrient-rich compost, reducing garbage and returning nutrients to the soil, which makes the garden plants healthier.
4. Honeybees pollinate flowers; without them, many fruit crops would not be pollinated, so yields would fall, hurting farmers, and plant biodiversity and the food web would suffer.

Picture Based Assessment

Producer: plants/berries. **Primary consumers (herbivores):** mouse, rabbit, squirrel, grasshopper. **Secondary consumers:** frog, snake. **Tertiary consumers:** owl, fox. If all secondary consumers are removed, the herbivores would increase unchecked (overeating plants), and the top predators would lose food and decline — unbalancing the web.

Value and Life Skill Based

Just as every organism — even a tiny grasshopper — is important for the food chain to work, every person's role matters in a family, school or community, even if their work seems small or less visible. Respecting and valuing each role keeps the whole system healthy and balanced.

Case Study Based Assessment (park vs parking)

1. Turning the plot into a biodiversity-rich park supports a healthier ecosystem, because trees, a pond and plants provide habitat, clean the air, cool the area, support birds and insects, and improve water and soil.
2. It reflects environmental responsibility, care for nature and future generations, and concern for community well-being over short-term convenience.



Learn Holistically / Performance Metrics (cross-curricular & competency)

Sample competency answers.

Students should classify biotic and abiotic components, trace energy flow through food chains/webs, predict the effect of removing one organism, and explain why human-made ecosystems must be sustainable — linking science with environmental responsibility and citizenship.

Chapter 13: Our Home: Earth, a Unique Life Sustaining Planet

NCERT QUESTIONS

1. (ii) It lacks a thick atmosphere and liquid water.
2. (ii) Different landforms like mountains, valleys, and deserts.
3. (ii) It would escape into space due to weaker gravity.
4. (iv) They get mixed instructions (genes) from both parents.
5. The seeds likely came from nearby plants, carried by wind, birds, or insects. For example, a bird eating a fruit may have dropped or excreted the seed into the crack. The monsoon provided water, which is essential for seed germination. The crack in the wall likely trapped some soil or organic matter, offering nutrients. Sunlight and air, available in the outdoor environment, support photosynthesis and respiration. The moist, sheltered crack created a microhabitat suitable for growth.
6. **Effects on Local Climate:** Deforestation reduces trees that absorb carbon dioxide, potentially increasing local temperatures due to less shade and a weakened greenhouse gas balance. It may also disrupt rainfall patterns, as trees contribute to water vapour for cloud formation.

Effects on Biodiversity: Loss of forest habitat threatens plants and animals, reducing biodiversity. For example, animals like deer or predators like tigers may lose food sources or habitats, disrupting ecosystems. Deforestation can reduce water

availability by disrupting the water cycle, as trees help retain soil moisture and contribute to rainfall. Soil erosion from cleared land can pollute nearby water bodies with sediment, affecting water quality.

7. While Earth has experienced natural climate changes in the past (e.g., ice ages), today's global warming is different because it is primarily driven by human activities, such as burning fossil fuels, which release large amounts of greenhouse gases like carbon dioxide and methane. These gases intensify the greenhouse effect, causing rapid warming, melting ice caps, rising sea levels, and extreme weather, unlike slower natural changes. The triple planetary crisis (climate change, biodiversity loss, pollution) shows how human actions are disrupting Earth's balance, threatening life. Unlike past changes, current warming requires urgent action, like using renewable energy, to protect ecosystems.
8. Without Earth's magnetic field, high-energy particles like cosmic rays and solar wind would directly hit the atmosphere, potentially depleting the ozone layer and allowing harmful UV rays to reach the surface. This could damage living cells, increasing risks like skin cancer in humans and harming plants and animals. The atmosphere might erode over time, reducing oxygen levels and altering the climate, making Earth less habitable. Satellites and communication systems could also be disrupted by unshielded particles, affecting human technology.
9. Three Things Needed:
 - Liquid Water: Essential for drinking, growing crops, and supporting life processes.
 - Breathable Atmosphere: An oxygen-rich atmosphere for respiration, protected from Mars' thin, carbon dioxide-heavy atmosphere.
 - Temperature Control: A system to maintain Earth-like temperatures, as Mars' average temperature is around -60°C.
 - Hardest to Replicate: Creating a breathable atmosphere is likely the hardest. Mars'



atmosphere is 100 times thinner than Earth's and is mostly carbon dioxide, requiring complex systems to produce and maintain oxygen at the right pressure for humans. Generating enough oxygen for a settlement, shielding it from radiation, and preventing leaks in a harsh environment is technologically challenging compared to providing water (which can be transported or extracted) or temperature control (achievable with insulated habitats).

10. Causes: The changes are likely due to climate change, driven by increased greenhouse gases from burning fossil fuels, leading to global warming and altered weather patterns. Deforestation or local land use changes could also reduce moisture and affect rainfall.

Adaptation Strategies: Water Conservation: Implement rainwater harvesting and efficient irrigation systems to store water during unpredictable rainfall.

Sustainable Farming: Use drought-resistant crops and sustainable farming practices to cope with higher temperatures and reduced water availability.

11. Without an atmosphere:

Life: Life would struggle to survive, as most organisms require oxygen for respiration. The absence of the ozone layer would allow harmful UV rays to damage cells, affecting plants, animals, and humans.

Temperature: Earth would lose heat to space without the greenhouse effect, becoming extremely cold, similar to the Moon. Daytime temperatures could soar due to unfiltered sunlight, and nights would be freezing.

Water: Liquid water would evaporate or freeze due to extreme temperature swings and low pressure, making it unavailable for life processes. The water cycle (rainfall, clouds) would cease without atmospheric water vapour.

12. Vegetative propagation is asexual reproduction where plant parts like stems, roots, or leaves grow into new plants.

Five examples:

Money Plant: A stem cutting with a node grows roots when placed in water or soil, forming a new plant.

Potato: The "eyes" (buds) on a sprouted potato can be planted to grow a new potato plant.

Ginger: A piece of ginger rhizome with a bud, when planted in soil, develops into a new plant.

Sugarcane: Stem cuttings with nodes are planted to produce new sugarcane plants, as sugarcane rarely produces seeds.

Bamboo: Sections of bamboo stems or rhizomes can be planted to grow new bamboo plants, relying on vegetative propagation.

PRACTICE FOCUS —

A. Choose the most appropriate answer

1. b. Presence of air, water and sunlight
2. b. Venus (thick CO₂ atmosphere causing extreme greenhouse effect).
3. c. Habitable zone
4. b. Asexual
5. c. Anther to stigma
6. b. Deforestation
7. c. Internal development

B. Fill in the blanks

1. Habitable (Goldilocks)
2. Crust
3. Carbon dioxide (CO₂)
4. Iron (metal)
5. Fertilisation
6. Extinct
7. Soil

C. State True / False (and correct the false ones)



1. False — Mercury, Venus and Mars are also rocky planets.
2. False — Venus is the hottest, due to its thick greenhouse atmosphere.
3. True
4. False — Asexual reproduction involves only one parent.
5. True
6. False — Greenhouse gases keep Earth warm; too much makes it too hot (global warming).
7. False — Pollution disturbs natural cycles like the water and carbon cycles.

D. Answer in one word (VSA)

1. Habitable zone (Goldilocks zone)
2. Crust
3. Carbon dioxide
4. Fertilisation (followed by seed development)
5. Flower (seed)
6. Decomposers
7. Greenhouse effect

E. Assertion and Reason

1. a — Both true and R explains A.
2. d — A is false (the mantle is thick), R is false too (it is made of hot semi-solid rock) — best fit: A false.
3. a — Both true and R explains A.
4. d — A is false (asexual reproduction does produce identical offspring), R is true.
5. a — Both true and R explains A.
6. d — A is false (fertilisation in mammals is internal), R is true (for external fertilisers like fish/frogs).
7. a — Both true and R explains A.

HOTS

1. It would become hotter, so liquid water would evaporate quickly and could turn to vapour/steam, and the oceans might dry up — because the temperature would rise above what keeps water liquid.

2. Decomposer microbes would be gone, so dead plants and animals would not rot. Nutrients would stay locked away, the soil would lose fertility, and nutrient recycling would stop — harming all life.
3. Air pollution (smoke, dust) settles on leaves and blocks sunlight and clogs the stomata, reducing the light and carbon dioxide the plant gets — so photosynthesis slows down and the plant makes less food.

Picture Based Assessment (structure of the Earth)

Label the layers from outside in: Crust → Mantle → Outer Core → Inner Core. (a) The molten iron outer core is responsible for Earth's magnetism. (b) Vegetation and life are found on the crust (the outer surface, the biosphere).

Value and Life Skill Based

Every small action — saving water, planting trees, reducing waste — adds up. When each person takes responsibility and many people act together (collective action), the combined effect greatly protects the environment, showing that individual responsibility and teamwork are both essential.

Case Study Based Assessment (pond clean-up drive)

1. Abiotic: clean water, oxygen and a healthy water cycle. Biotic: the return of fish, frogs, birds and plants and their feeding relationships (food web).
2. Responsibility, environmental awareness, teamwork, perseverance and a sense of caring for nature and the community.
3. It gave farmers a safer water source for fields, restored habitat for animals, and provided clean, healthy water and a pleasant environment for local residents.
4. Seeing the visible benefits — returning wildlife, clean water and an annual 'Eco-Day' — inspires other villages to copy the idea, showing that community effort can restore nature and improve everyone's life.

Learn Holistically / Performance Metrics (cross-curricular & competency)

Sample competency answers.

Students should explain why Earth is uniquely habitable (air, water, suitable temperature, magnetic field, habitable zone), distinguish sexual from asexual reproduction, identify causes and effects of biodiversity loss and climate change, and propose responsible actions — connecting science with environmental citizenship.

