

CLASS 9

SCIENCE

NCERT SOLUTIONS

NCERT Solutions for Class 9 Science Matter in Our Surroundings (Legacy Chapter, Old Syllabus)

Matter in Our Surroundings — covers the particle nature of matter, the three states of matter and their properties, the effect of temperature and pressure on state changes, and evaporation. This chapter is entirely made of in-text questions spread through the chapter plus one end-of-chapter exercise (26 questions ...

Contents

NCERT Solutions for Class 9 Science Matter in Our Surroundings

Why This Chapter Matters

Class 9 Science Matter in Our Surroundings – Notes and Extra Questions

Note: NCERT has replaced this chapter in the current 2026-27 syllabus. If you're looking for the current curriculum, see [Chapter 1: Entering the World of Secondary Science — full solutions](#). This page is kept as a reference for the previous (pre-2026-27) syllabus.

Matter in Our Surroundings — covers the particle nature of matter, the three states of matter and their properties, the effect of temperature and pressure on state changes, and evaporation. This chapter is entirely made of in-text questions spread through the chapter plus one end-of-chapter exercise (26 questions total). Below are complete, original answers to all of them.

NCERT Solutions for Class 9 Science Matter in Our Surroundings

In-text Questions (Section 1: What is Matter Made Up Of?)

1. Which of the following are matter? Chair, air, love, smell, hate, almonds, thought, cold, cold drink, smell of perfume.

Matter is anything that has mass and occupies space. Of these, **chair, air, almonds, cold drink, and smell of perfume** are matter — even a smell is made of tiny vaporised particles with mass, dispersed in air. Love, hate, thought, and cold are not matter — they are emotions, mental states, or a relative description of temperature, not physical substances.

2. Give reasons: the smell of hot sizzling food reaches you several metres away, but for cold food you have to go close.

Aroma particles evaporate off food and diffuse through the air to reach your nose. Diffusion speed increases with the particles' kinetic energy, which rises with temperature. Hot food gives its aroma particles much more energy, so they diffuse rapidly and reach you from far away; cold food's aroma particles have little energy and diffuse slowly, so you must be close to smell them.

3. A diver is able to cut through water in a swimming pool. Which property of matter does this show?

It shows that particles of matter have spaces between them, and that in a liquid these particles are held by relatively weak intermolecular forces — not rigidly locked as in a solid — so the diver's body can push through and displace them.

4. What are the characteristics of particles of matter?

(a) Particles have spaces between them. (b) Particles are in continuous, random motion (increasing with temperature). (c) Particles attract each other with intermolecular forces, whose strength largely decides whether a substance is a solid, liquid, or gas.

In-text Questions (Section 2: How Can We Say That Particles of Matter Have Space Between Them, Are Continuously Moving, and Attract Each Other?)

1. Arrange in order of increasing density: air, exhaust from chimneys, honey, water, chalk, cotton, iron.

Air < exhaust from chimneys < cotton < water < honey < chalk < iron. Gases are least dense since their particles are far apart; cotton (bulky, with trapped air) is less dense than water; honey is denser than water due to dissolved sugars; among the solids, iron (a metal) is the densest.

2(a). Tabulate the differences in characteristics of the three states of matter.

Property	Solid	Liquid	Gas
Shape	Fixed	Takes container's shape	Takes container's shape
Volume	Fixed	Fixed	Not fixed
Interparticle force	Strongest	Moderate	Weakest
Compressibility	Negligible	Very slight	High
Density	Highest (usually)	Moderate	Lowest

2(b). Comment on: rigidity, compressibility, fluidity, filling a gas container, shape, kinetic energy, density.

Rigidity: a solid's tendency to keep its shape, from strong interparticle attraction. **Compressibility:** particles being pushed closer under pressure — greatest in gases, which have large empty spaces.

Fluidity: the ability to flow — shown by both liquids and gases. **Filling a gas container:** gas particles move fast and randomly with negligible attraction, so they spread to occupy all available space. **Shape:** solids are fixed; liquids and gases take their container's shape. **Kinetic energy:** rises with temperature, order gas > liquid > solid. **Density:** mass per volume, generally solid > liquid > gas (with exceptions like ice vs water).

3. Give reasons: (a) a gas fills its container completely. (b) a gas exerts pressure on its container's walls. (c) a wooden table should be called a solid. (d) moving a hand through air is easy, but through solid wood needs a karate expert.

(a) Gas particles have negligible mutual attraction and move rapidly and randomly in every direction, spreading to fill all available space. (b) Continuous random collisions of gas particles against the container walls produce a sustained force, which is the pressure. (c) A wooden table keeps a fixed shape and volume and strongly resists deformation — the defining properties of a solid. (d) Air particles are widely spaced with weak attraction, easily pushed aside; wood's particles are tightly packed with strong intermolecular forces, needing a huge force to displace.

4. Liquids generally have lower density than solids, but ice floats on water. Why?

When water freezes, its molecules form an open hexagonal hydrogen-bonded lattice with more empty space than liquid water has — making ice slightly less dense than liquid water, so it floats, unlike most substances whose solid form is denser than their liquid form.

In-text Questions (Section 3: What Happens When We Heat or Cool Matter?)

1. Convert to Celsius: (a) 300 K (b) 573 K.

$^{\circ}\text{C} = \text{K} - 273$. (a) $300\text{ K} = 27^{\circ}\text{C}$. (b) $573\text{ K} = 300^{\circ}\text{C}$.

2. What is the physical state of water at (a) 250°C , (b) 100°C ?

(a) Well above the boiling point (100°C) — **steam/vapour (gas)**. (b) At exactly the boiling point — **both liquid and gas coexist**, with continued heating converting liquid to gas at constant temperature.

3. Why does temperature remain constant during a change of state?

The heat supplied during a change of state (latent heat) is used entirely to break intermolecular forces and rearrange particles, not to raise their average kinetic energy — and since temperature reflects kinetic energy, it stays constant until the change of state is complete.

4. Suggest a method to liquefy atmospheric gases.

Lower the temperature and/or raise the pressure — both reduce the gas particles' kinetic energy/spacing, letting intermolecular attraction pull them close enough to form a liquid.

In-text Questions (Section 4: Why Does Ice Appear Colder Than Water at the Same Temperature? / Evaporation)

1. Why does a desert cooler cool better on a hot, dry day?

A cooler works by evaporating water, which draws heat from the surroundings. On a hot, dry (low-humidity) day, the air can absorb far more moisture before saturating, so evaporation — and cooling — is much faster than on a humid day.

2. How does water in an earthen pot (matka) stay cool in summer?

Water seeps through the pot's tiny pores to the outer surface and evaporates there; evaporation draws its energy from the remaining water inside, continuously cooling it.

3. Why does our palm feel cold when we apply acetone, petrol, or perfume?

These liquids are highly volatile and evaporate quickly, absorbing the latent heat they need directly from the skin, producing a cooling sensation.

4. Why can we sip hot tea/milk faster from a saucer than a cup?

A saucer spreads the same liquid over a much larger surface area; since evaporation (and its cooling effect) happens at the surface, the larger area cools the liquid faster.

5. What type of clothes should we wear in summer?

Light-coloured cotton clothes — light colours reflect rather than absorb heat, and cotton's absorbent, porous fabric wicks sweat to the surface where it can evaporate and cool the body.

End-of-Chapter Exercise

1. Convert to Celsius: (a) 293 K (b) 470 K.

(a) $293\text{ K} = 20^\circ\text{C}$. (b) $470\text{ K} = 197^\circ\text{C}$.

2. Convert to Kelvin: (a) 25°C (b) 373°C .

$\text{K} = ^\circ\text{C} + 273$. (a) $25^\circ\text{C} = 298\text{ K}$. (b) $373^\circ\text{C} = 646\text{ K}$.

3. Give reasons: (a) naphthalene balls disappear without leaving residue. (b) we can smell perfume from several metres away.

(a) Naphthalene sublimates — it converts directly from solid to gas without a liquid stage, so the solid vaporises away completely, leaving no residue. (b) Perfume's volatile particles evaporate readily and diffuse quickly through air (gas particles move fast with large gaps between them), reaching your nose from far away.

4. Arrange in increasing order of force of attraction between particles: water, sugar, oxygen.

Oxygen (gas) < water (liquid) < sugar (solid) — gases have the weakest interparticle force, solids the strongest.

5. What is the physical state of water at (a) 25°C , (b) 0°C , (c) 100°C ?

(a) **Liquid** (between melting and boiling points). (b) Freezing/melting point — **solid and liquid together**. (c) Boiling point — **liquid and gas together**.

6. Give two reasons: (a) water at room temperature is a liquid. (b) an iron almirah is a solid at room temperature.

(a) Room temperature falls between water's melting point (0°C) and boiling point (100°C); also, water has a fixed volume but takes its container's shape and can flow — both defining liquid properties. (b) Iron's melting point is far above room temperature; also, an almirah keeps a fixed shape/volume and strongly

resists deformation — defining solid properties.

7. Why is ice at 273 K more effective at cooling than water at the same temperature?

Ice must first absorb extra energy (the latent heat of fusion) to melt into water before it can warm further; this extra heat is drawn from whatever it's cooling, giving ice a bigger cooling effect per gram than water already at 0°C.

8. What produces more severe burns — boiling water or steam?

Steam — it carries all the heat that boiling water has, plus the extra latent heat of vaporisation absorbed to become vapour; when it condenses on skin, it releases that extra heat too, causing worse burns.

9. Name the processes A–F shown in a diagram of changes of state.

A = **Fusion/Melting** (solid→liquid); B = **Vaporisation** (liquid→gas); C = **Condensation** (gas→liquid); D = **Solidification/Freezing** (liquid→solid); E = **Sublimation** (solid→gas); F = **Deposition** (gas→solid).

Why This Chapter Matters

This chapter builds the particle model of matter used throughout chemistry and physics — states of matter, latent heat, and evaporation reappear in later chapters on heat, and the Kelvin-Celsius conversion is a recurring numerical skill.

Class 9 Science Matter in Our Surroundings – Notes and Extra Questions

Along with these NCERT Solutions, students can also use the [Class 9 Science Chapter 1 Extra Questions](#) and [Class 9 Science Chapter 1 Revision Notes](#) for quick revision and extra practice.