

## NCERT Solution for Class 9 Science - Chapter 1 Matter In Our Surroundings

### Exercise-1.1-1.2

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1. Which of the following are matter?

Chair, air, love, smell, hate, almonds, thought, cold, lemon water, smell of perfume.

**Solution:**

The following substances are matter:

Chair

Air

Almonds

Lemon water.

2. Give reasons for the following observation:

The smell of hot sizzling food reaches you several meters away, but to get the smell from cold food you have to go close. **Solution:**

Particles in the air, if fueled with higher temperatures, acquire high kinetic energy which aids them to move fast over a stretch. Hence the smell of hot sizzling food reaches a person even at a distance of several meters.

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

**Solution:**

The diver is able to easily cut through the water in the swimming pool because of the weak forces of attraction between water molecules. It is this property of water that attributes to easy diving.

4. What are the characteristics of the particles of matter?

**Solution:**

The characteristics of particles of matter are:

(a) Presence of intermolecular spaces between particles

(b) Particles are in constant motion

(c) They attract each other

### Exercise-1.3

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5. The mass per unit volume of a substance is called density. (density=mass/volume). Arrange the following in the order of increasing density - air, exhaust from the chimneys, honey, water, chalk, cotton and iron.

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### Solution:

The following substances are arranged in the increasing density:

Air

Exhaust from chimney

Cotton

Water

Honey

Chalk

Iron

### 6. Answer the following.

a) Tabulate the differences in the characteristics of matter.

b) Comment upon the following: rigidity, compressibility, fluidity, filling a gas container, shape, kinetic energy and density.

### Solution:

(a) The difference in the characteristics of the three states of matter.

Characteristics	Solid	Liquid	Gas
Shape	Fixed shape	No Fixed shape	No Fixed shape
Volume	Fixed volume	Fixed volume	No Fixed volume
Intermolecular force	Maximum	Less than solids	Very less
Intermolecular space	Very less	More than solids	maximum
Rigidity/Fluidity	Rigid/cannot flow	Can flow/not rigid	Can flow/not rigid

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Compressibility	negligible	compressible	Highly compressible
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(b) (i) **Rigidity:** It is the propensity of a substance to continue to remain in its shape when treated with an external force.

(ii) **Compressibility:** It is the attribute of the particles to contract its intermolecular space when exposed to an external force thereby escalating its density.

(iii) **Fluidity:** It is the ability of a substance to flow or move about freely.

(iv) **Filling the gas container:** The particles in a container take its shape as they randomly vibrate in all possible directions.

(v) **Shape:** It is the definite structure of an object within an external boundary

(vi) **Kinetic energy:** Motion allows particles to possess energy which is referred to as kinetic energy. The increasing order of kinetic energy possessed by various states of matter are:

Solids < Liquids < Gases

Mathematically, it can be expressed as  $K.E = \frac{1}{2}mv^2$ , where 'm' is the mass and 'v' is the velocity of the particle.

(vii) **Density:** It is the mass of a unit volume of a substance. It is expressed as:  $d = M/V$ , where 'd' is the density, 'M' is the mass and 'V' is the volume of the substance

### 7. Give reasons

a) A gas fills completely the vessel in which it is kept.

b) A gas exerts pressure on the walls of the container.

c) A wooden table should be called a solid.

d) We can easily move our hand in the air but to do the same through a solid block of wood we need a karate expert.

**Solution:**

a) Kinetic energy possessed by gas particles is very high which allows them to randomly move across all directions when contained, hence the particles fills the gas vessel entirely.

b) Gas molecules possess high kinetic energy, due to which they are under constant motion inside the container in random directions which causes them to hit the walls of the container and hence create vibrations. These collisions with the walls of the container generate pressure.

c) A wooden table should be called a solid as it possesses all the properties of a solid such as:

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- Definite size and shape
- Intermolecular attraction between closely packed particles.
- It is rigid and cannot be compressed

d) Molecules in gases are loosely packed as compared to solid molecules which are densely packed. Hence we are easily able to break the force of attraction when we move our hand through air but find it difficult to break through a solid (because of greater forces of attraction between molecules) which a karate expert is able to smash with the application of a lot of force.

8. **Liquids generally have a lower density than solids. But you must have observed that ice floats on water. Find out why.**

**Solution:**

Density of ice is less than the density of water. The low density of ice can be attributed to the small pores it has which allows it to trap air hence ice floats on water.

### Exercise-1.4

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9. **Convert the following temperature to Celsius scale:**

a. 300K      b. 573K

**Solution:**

a.  $0^{\circ}\text{C} = 273\text{K}$

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

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

10. **What is the physical state of water at:**

a.  $250^{\circ}\text{C}$       b.  $100^{\circ}\text{C}$  ?

**Solution:**

a. At  $250^{\circ}\text{C}$  - Gaseous state since it is beyond its boiling point.

b. At  $100^{\circ}\text{C}$  - It is at the transition state as the water is at its boiling point. Hence it would be present in both liquid and gaseous state.

11. **For any substance, why does the temperature remain constant during the change of state?**

**Solution:**

It is due to the latent heat as the heat supplied to increase the temperature of the substance is used up to transform the state of matter of the substance hence the temperature stays constant.

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**12. Suggest a method to liquefy atmospheric gases. Solution:**

It can be achieved by either increasing the pressure or decreasing the temperature which ultimately leads to the reduction of spaces between molecules.

### Exercise-1.5

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**13. Why does a desert cooler cool better on a hot dry day?**

**Solution:**

It is because the temperature is high and it is less humid on a hot dry day which enables better evaporation. High levels of this evaporation provide better cooling effects.

**14. How does the water kept in an earthen pot (matka) become cool during summer?**

**Solution:**

An earthen pot is porous in nature. These tiny pores facilitate penetration of water and hence their evaporation from the pot surface. The process of evaporation requires energy which is contributed by water in the pot as a result of which water turns cooler.

**15. Why does our palm feel cold when we put on some acetone or petrol or perfume on it?**

**Solution:**

Acetone, petrol, and perfume are volatile substances that get evaporated when they come in contact with air. Evaporation is facilitated as it uses energy from palm hence leaving a cooling effect on our palms.

**16. Why are we able to sip hot tea or milk faster from a saucer rather than a cup?**

**Solution:**

A saucer has a larger surface area than a cup which promotes quicker evaporation hence the tea or milk in a saucer cools down faster.

**17. What type of clothes should we wear in summer?**

**Solution:**

In summer, it is preferred to wear light-colored cotton clothes because light color reflects heat and cotton materials have pores that absorb sweat, facilitating their evaporation hence causing a cooling effect in the skin.

Exercise

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1. Convert the following temperature to Celsius scale.

(a) 293K (b) 470K **Solution:**

$$0^{\circ}\text{C} = 273\text{K}$$

$$(a) 293\text{K} = (293 - 273)^{\circ}\text{C} = 20^{\circ}\text{C}$$

$$(b) 470\text{K} = (470 - 273)^{\circ}\text{C} = 197^{\circ}\text{C}$$

2. Convert the following temperatures to the Kelvin scale. (a) 25°C

(b) 373°C **Solution:**

$$0^{\circ}\text{C} = 273\text{K}$$

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

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

3. Give reason for the following observations:

(a) Naphthalene balls disappear with time without leaving any solid.

(b) We can get the smell of perfume while sitting several metres away.

**Solution:**

(a) At room temperature, naphthalene balls undergo sublimation wherein they directly get converted from a solid to a gaseous state without having to undergo the intermediate state, i.e., the liquid state.

(b) Molecules of air move at a higher speed and have large intermolecular spaces. Perfumes comprise of flavoured substances that are volatile which scatters quickly in air, becoming less concentrated over a distance. Hence we are able to smell perfume sitting several metres away.

4. Arrange the following in increasing order of forces of attraction between the particles - water, sugar, oxygen.

**Solution:**

Oxygen (gas) < water (liquid) < sugar (solid)

5. What is the physical state of water at -

(a) 25°C (b) 0°C (c) 100°C?

**Solution:**

(a) At 25°C, the water will be in liquid form (normal room temperature)

(b) At 0°C, the water is at its freezing point, hence both solid and liquid phases are observed.

(c) At 100°C, the water is at its boiling point, hence both liquid and gaseous state of water (water vapor) are observed.

6. Give two reasons to justify -

(a) Water at room temperature is a liquid.

(b) An iron almirah is a solid at room temperature. **Solution:**

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(a) Transition in the states of matter of water occurs at  $0^{\circ}\text{C}$  and  $100^{\circ}\text{C}$ . At room temperature, water is in the liquid state, thereby exhibiting all the properties of a liquid such as • Water flows at this temperature

- It has a fixed volume and it takes the shape of its container

(b) The melting and boiling points of iron are as high as  $1538^{\circ}\text{C}$  and  $2862^{\circ}\text{C}$  respectively. The room temperature is about  $20\text{-}25^{\circ}\text{C}$ . Hence iron almirah is a solid at room temperature.

**7. Why is ice at  $273\text{K}$  more effective in cooling than water at the same temperature?**

**Solution:**

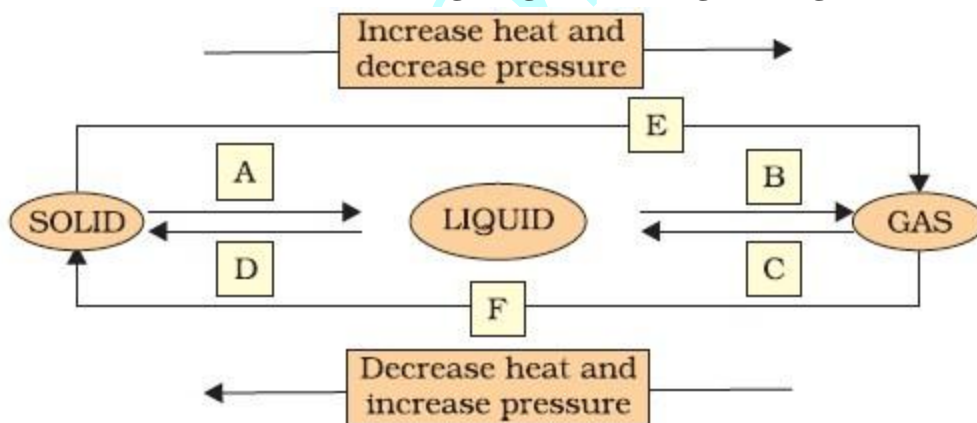
Water at this temperature ( $273\text{K}$ ) is less effective than ice as ice can readily form water through absorption of ambient heat energy as opposed to water which does not exhibit this property as it already possesses additional latent heat of fusion so does not require extra heat. Hence ice cools rapidly compared to water at the same temperature.

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

**Solution:**

Steam produces severe burns. It is because it is an exothermic reaction that releases high amount of heat which it had consumed during vaporization.

**9. Name A, B, C, D, E and F in the following diagram showing a change in its state.**



**Solution:**

- A: Melting (or) fusion (or) liquefaction
- B: Evaporation (or) vaporization
- C: Condensation
- D: Solidification
- E: Sublimation
- F: Sublimation

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