

CLASS 10th CHEMISTRY

Unit 20 — Water

Notes • Diagrams • MCQs • Short & Constructed-Response Questions

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DESCRIPTIVE QUESTIONS

Q.1 How is water essential for life? Describe a simple test to identify the presence of water.

Key points: Water | Identification of Presence of Water

Water

Water is essential for all forms of life on earth.

- All living organisms contain plenty of water in them. They also need water every day to support life.
- About **60–70%** of the human body is made of H_2O .
- Water regulates body temperature.
- Plants need water for photosynthesis.
- It transports nutrients and oxygen to all cells of the body.

Identification of Presence of Water

Identifying the presence of water has many important applications, which include determining the purity of substances and analyzing chemical reactions.

Test for water: Testing water is important for the food and pharmaceutical industries, where the presence of water can affect product quality and safety.

Procedure: Hydrated copper(II) sulphate ($\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$) is **blue** in colour, but when it is heated, it loses water molecules to become anhydrous copper(II) sulphate, which is **white** in colour. A drop of water on the anhydrous sample of copper(II) sulphate changes its colour from white to blue. It is a very sensitive test and can detect even a small amount of water.

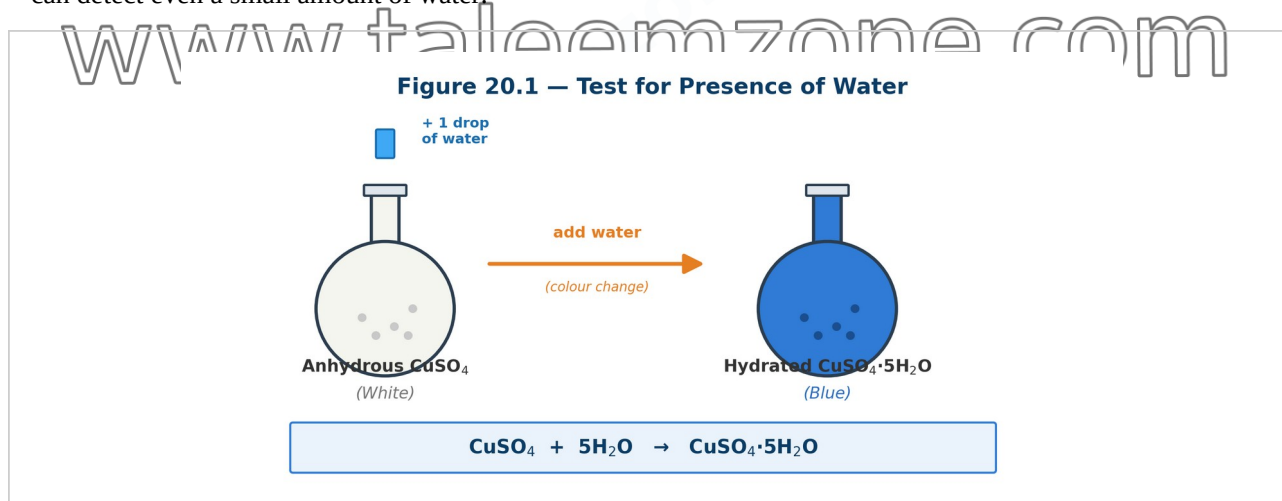


Figure 20.1 — Test for the presence of water using copper(II) sulphate.

Q.2 Describe two methods to check the purity of water.

Key points: Purity of water | Boiling Point Determination | Determination of Melting Point

Pure water boils at **100°C** and freezes at **0°C** under standard conditions of temperature and pressure. The impurities present in water change both these physical constants.

1. Boiling Point Determination

The purity of a sample of water can be checked by determining its boiling point at STP.

Type	Observation
Pure water	If it boils at 100°C it is a pure sample of water.
Impure water	The presence of impurities in water will slightly increase its boiling point.

2. Determination of Melting Point

Procedure: Cool the sample of water until it freezes. Observe and record the temperature at which the ice begins to melt.

Type	Observation
Pure water	If its melting point is 0°C it is pure water.
Impure water	A melting point below 0°C suggests the presence of impurities in the sample.

Note: Impurities present in water raise the boiling point but lower the melting point. Both these constants are specific to standard conditions — at high altitudes or lower pressure, these values change.

Quick Check 20.1 — How can purity of water be checked by determining its freezing point?

Ans. Pure water freezes at 0°C (32°F) under standard pressure. If water contains impurities such as salts or minerals, its freezing point drops. So we can check the purity of water by measuring its freezing point — if it is 0°C, the water is pure.

Q.3 How will you differentiate between distilled water and tap water?

Key points: Difference Between Tap Water and Distilled Water

Tap Water	Distilled Water
Source: Water supplied to our homes, shops and offices through taps; comes from rivers, lakes, ponds or underground sources.	Source: Obtained by distillation — heating water to steam and condensing it back into liquid water.
Purity: Contains minerals like calcium (Ca^{2+}) and magnesium (Mg^{2+}), plus chlorine/fluorine salts and particulate matter (dust, rust).	Purity: Distillation removes dissolved minerals, microorganisms and contaminants, leaving only pure water molecules.
pH: Ranges from 6.5 to 8.5 depending on source.	pH: Exactly 7.
Conductance: Conducts electricity due to free ions from dissolved minerals.	Conductance: Bad conductor of electricity due to absence of ions.
Uses: Cooking, washing, cleaning and drinking.	Uses: Laboratories, medical procedures, pharmaceutical industry; ensures accurate measurements and sterilization; safe to drink but lacks needed minerals.

Q. Why is tap water a conductor of electricity whereas distilled water is not?

Ans. Tap water is a conductor of electricity because of the presence of free ions from dissolved minerals in it, while distilled water is free from these ions, so it is a bad conductor of electricity.

Quick Check 20.2 — Why is tap water a conductor of electricity whereas distilled water is not?

Ans. Tap water is a conductor of electricity because of the presence of free ions from dissolved minerals in it, while distilled water is free from these ions, so it is a bad conductor of electricity.

Q.4 Describe useful and harmful substances present in water obtained from natural sources.

Key points: Substances Present in Water Obtained from Natural Sources | Useful Substances | Harmful Substances and their Effects

Water from natural sources such as rivers, lakes and aquifers contains a number of substances which may be useful or harmful for our health.

1. Useful Substances

Dissolved oxygen: Oxygen enters natural water from the atmosphere through diffusion. It is also produced by aquatic plants and algae during photosynthesis.

2. Harmful Substances and their Effects on Water Quality

(i) Harmful microbes

Both surface and ground water — vital sources of fresh water — can be contaminated by various human activities. Harmful microorganisms like bacteria, viruses and parasites enter natural water through human and animal wastes, landfills, agricultural runoff and industrial waste water. Sewage from treatment plants or faulty septic tanks can release pathogens directly into nearby water bodies.

Diseases caused by bacteria include:

- Dysentery
- Typhoid
- Hepatitis
- Cholera

(ii) Heavy metals and their compounds

Heavy metals like **lead, mercury, cadmium and chromium** can enter natural water through many routes:

- Waste water from factories, eventually released into rivers and other water bodies.
- Mining operations.
- Use of fertilizers and pesticides.

Harmful effects:

- Damage vital organs like the liver and kidney.
- Can also lead to neurological problems.
- **Arsenic and cadmium** are known to increase the risk of certain cancers.

(iii) Plastics

Very small particles of plastic called **microplastics** are present in both tap and bottled water.

Sources: wastewater, rainwater carrying plastic debris, and degradation of plastic waste.

Harmful effects: Microplastics have been found in some human organs like **lungs and blood**, and can disturb the **immune and reproductive systems**.

(iv) Nitrates and phosphates

Sources: weathering of rocks, and human sources such as agricultural fertilizers, detergents and industrial waste water. They are essential nutrients, but excess amounts affect water quality and cause **eutrophication**.

Eutrophication: the process that starts in a water body containing excess phosphorus and nitrogen nutrients. Excessive nutrients cause algae and aquatic plants to overgrow, which decreases the dissolved oxygen level in water — harmful to aquatic life and disruptive to the entire ecosystem.

Q.5 How can domestic water supply be made fit for drinking?

Key points: Treatment of Domestic Water Supply

Three types of impurities are mostly present in water obtained from natural sources: (1) Dissolved impurities, (2) Suspended impurities, (3) Microorganisms. These are removed by sedimentation, filtration, distillation and treatment with liquid chlorine, among other methods.

1. Sedimentation (Removal of Insoluble Impurities)

Insoluble impurities such as soil, pieces of plants and other organic matter, and sand are bigger in size and are often removed by **sedimentation**.

Sedimentation tanks: Water from natural sources is pumped into sedimentation tanks and allowed to stand for a few hours. Suspended particles settle at the bottom due to gravity, forming a layer of sediment, while cleaner water at the top is extracted for the next stage.

Figure 20.2 — Sedimentation Tank

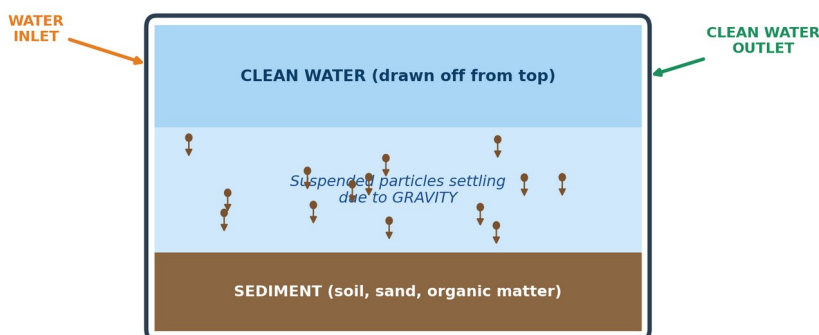


Figure 20.2 — Sedimentation tank: clean water is drawn off the top while sediment settles at the bottom.

2. Filtration (Removal of Suspended Impurities)

This process removes suspended particles of smaller size that are not removed by sedimentation. **Use of sand and gravel filters:** water is allowed to trickle through layers of sand and gravel filters which trap solid particles.

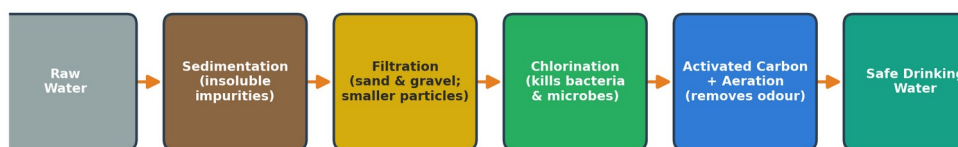
3. Chlorination (Sterilization)

Water must be sterilized before humans can use it — all harmful bacteria and microbes must be killed. A small amount of **liquid chlorine** is added, which has the power to kill these germs.

4. Removal of Odours

Water is passed through powdered **activated carbon** (charcoal) to remove tastes and odours; activated carbon removes a wide range of organic compounds responsible for taste and odour through absorption. **Aeration** — exposing water to air — can also remove odour.

Treatment of Domestic Water Supply — Process Flow



Overall process flow for treatment of domestic water supply.

Q.6 How can you avoid the negative effects of pollutants present in water?

Key points: Effects of Pollutants Present in Water

Water pollution affects human health, ecosystems, aquatic organisms, and industries dependent on good water quality. Pollutants can disrupt aquatic ecosystems through eutrophication and destruction of habitats, lower crop yields, and contaminate food sources.

Methods to control negative effects of pollutants:

- Sewage and industrial waste water should be treated before it is discharged into water bodies.
- Plastics must be reused or recycled to minimize their production.
- Chemical cleaners, fats, oils and grease should never be thrown down the drain.
- Minimize the use of pesticides and fertilizers in agriculture.
- General public should be made aware of the harmful effects of water pollution through public campaigns.
- Implement and enforce laws for the strict control of all types of water pollution.

Quick Check 20.3

Q.1 Which pollutants are harmful for aquatic life?

Ans. Many pollutants are harmful to aquatic life, including heavy metals (lead, mercury, cadmium), pesticides and herbicides from agriculture, industrial and human wastes, plastic waste and microplastics, and excess nutrients causing eutrophication.

Q.2 How to identify if water is polluted?

Ans. Polluted water can be identified by an unusual colour or odour, excessive algae growth, dead fish or aquatic life, floating debris or oil slicks, and suspended particles like dust or rust, or foaming.

Q.7 Discuss water-borne diseases. Which measures should be taken to avoid water-borne disease?

Key points: Water Borne Diseases | Prevention of Water-Borne Disease

The World Health Organization (WHO) has estimated that **80%** of the sickness and diseases in the world are caused by polluted water and lack of sanitation. Nearly **500 million** people suffer from water-borne diseases every year in the world.

Water-borne diseases include:

- Cholera
- Typhoid
- Malaria
- Nausea
- Leprosy

Trachoma: millions of people suffer from trachoma, which often causes blindness — particularly prevalent among babies and children in developing countries.

Liver disease: viral hepatitis is also caused by drinking contaminated water.

Prevention of water-borne disease:

- Drink clean water after removing impurities and boiling to kill the germs.
- Practice hygiene by keeping the body, especially hands, clean; ensure proper sanitation facilities are available.

Q.8 Why is Pakistan facing a severe shortage of water? What are the steps to overcome this problem?

Key points: Water Scarcity in Pakistan | Causes of Water Scarcity | Steps to Remove Water Scarcity

Pakistan is included in a **semi-arid region** and hence receives low rainfall annually.

Region	Rainfall
Northern Pakistan including Punjab	250–600 mm per year (mostly during monsoon season)
Southern Pakistan	Below 200 mm per year

Causes of water scarcity:

- Less rainfall
- Growth in population
- Flood irrigation
- Climate change
- Depleting aquifers
- Poor water management

Warning: If the current situation continues, Pakistan could face very serious challenges in the coming years.

Steps to remove water scarcity:

- Collecting rainwater, especially during the monsoon season, by constructing water reservoirs and other storage facilities.
- Using better crop irrigation techniques.
- Taking appropriate measures to address the effects of climate change.
- Effective management of water resources.

Q. How can we conserve water at home?

Ans. We should use water carefully as we are all facing water scarcity. Ways to conserve water at home: fix leaky taps as they waste a lot of water; take shorter showers; turn off the tap while brushing or using soap; use a bucket to wash cars or water plants.

Q.9 How can elements essential for plant growth be classified into different categories?

Key points: Elements Essential for Plant Growth

Plants need nutrients from the soil for healthy growth. Essential elements are classified as **micro-nutrients** and **macronutrients**.

(i) Micro-nutrients (Trace elements): required in a very small amount for plant growth.

- Boron
- Copper
- Iron

- Manganese
- Zinc
- Molybdenum
- Chlorine

Only minute amounts of these elements are needed; too much can be dangerous, as they are poisonous in larger quantities. **Range:** 6 grams to 200 grams per acre.

(ii) Macro-nutrients: required in a large amount for plant growth.

- Nitrogen
- Phosphorous
- Potassium
- Calcium
- Magnesium
- Sulphur
- Carbon
- Hydrogen
- Oxygen

Range: 5 Kg to 200 Kg per acre.

Q.10 What are fertilizers? Mention the essential qualities of a good fertilizer.

Key points: Fertilizers | Essential Qualities of a Good Fertilizer

Fertilizers are substances added to the soil to make up the deficiency of essential elements like **nitrogen, phosphorus and potassium (NPK)** required for the proper growth of plants. They enhance the natural fertility of the soil and provide the chemical elements taken up from the soil by previous crops.

Requirements of a fertilizer: the desired elements should be present in **water-soluble form**, readily available to plants. The compound used as fertilizer should be **stable** in soil and storage — it should not absorb moisture or set into hard stony material, and should be **cheap** to manufacture.

Essential qualities of a good fertilizer:

- The nutrient elements present in it must be **readily available** to plants.
- It must be **fairly soluble** in water so it thoroughly mixes with the soil.
- It should **not be injurious** to plants.
- It should be **inexpensive**.
- It must be **stable** so it is available for a longer time to growing plants.
- It should **not alter the pH** of the soil.
- By rain or water, it should be converted into a form the plant can easily absorb.

Q.11 How are fertilizers classified on the basis of the nature of desired elements? What are the main functions of nitrogenous fertilizers?

Key points: Classification of Fertilizers | Nitrogenous Fertilizers

Fertilizers are classified according to the nature of the elements — nitrogen, phosphorus and potassium — that they provide to the soil:

- Nitrogenous fertilizers
- Phosphatic fertilizers
- Potassium fertilizers

Nitrogenous fertilizers supply nitrogen to plants or soil.

Importance of nitrogen:

- Necessary during the **early stage** of plant growth for development of stem and leaves.
- It is the **main constituent of proteins**.
- It imparts **green colour** to the leaves.
- It enhances the **yield and quality** of the plants.

Examples: Ammonium sulphate, Calcium cyanamide, Ammonia, Ammonium nitrate, Ammonium phosphate, Ammonium chloride, Urea.

(a) Urea — a high-quality nitrogenous fertilizer; contains about **46% nitrogen**; the most concentrated solid nitrogen fertilizer; the most widely used nitrogen fertilizer in Pakistan.

(b) Ammonium nitrate — a useful fertilizer for many crops except **paddy rice**, because microbial bacteria in flooded fields decompose it into nitrogen gas. It is also used in combination with limestone and is **hygroscopic** in nature.

Interesting Information — Biofertilizers: Biofertilizers are environment friendly. They provide the soil essential nutrients as well as microbes required for plant growth, improve soil health and structure, increase biodiversity, reduce the need for harmful chemicals, and prevent soil degradation.

Q.12 What are the main functions of phosphatic and potassium fertilizers?

Key points: Phosphatic Fertilizers | Potassium Fertilizers

Phosphatic fertilizers provide phosphorus to plants or soil.

Importance of phosphorus:

- Required to **stimulate early growth**.
- Accelerates **seed and fruit formation** during later stages of growth.
- Also **increases resistance to diseases**.

Examples: Super phosphate (calcium super phosphate) — $\text{Ca}(\text{H}_2\text{PO}_4)_2$; Triple phosphate (diammonium phosphate) — $(\text{NH}_4)_2\text{HPO}_4$. Super phosphate and triple phosphate are the two most important water-soluble phosphatic fertilizers.

Potassium fertilizers provide potassium to plants or soil.

Importance of potassium:

- Required for the formation of **starch, sugar and fibrous material** of plants.
- Increases resistance to diseases and makes plants strong by helping in **healthy root development**.
- Helps in **ripening of seeds, fruits and cereals**.
- Especially useful for tobacco, coffee, potato and corn.

Examples: Potassium chloride, Potassium sulphate, Potassium nitrate.

Quick Check 20.5 — Which is the most concentrated solid nitrogen fertilizer?

Ans. Urea is a high-quality nitrogenous fertilizer. It contains about **46% nitrogen** and is the most concentrated solid nitrogen fertilizer.

MULTIPLE CHOICE QUESTIONS (EXERCISE)

Choose and tick (✓) the correct answer from the given choices.

1. The pH of distilled water is:

- (a) 6.5
- (b) 8.5
- (c) 7 ✓
- (d) 7.5

2. The unpleasant odours in water can be removed by:

- (a) Adding chlorine
- (b) Treating it with activated charcoal ✓
- (c) Sedimentation
- (d) Filtration

3. The source of harmful microbes in natural water:

- (a) Human and animal wastes ✓
- (b) Fertilizers used for crops
- (c) Industrial waste-water
- (d) Microbes in rocks

4. Which gases are dissolved in natural water from the atmosphere through diffusion?

- (a) O₂ and CO₂
- (b) N₂ and CO₂
- (c) O₂ and N₂
- (d) O₂, N₂ and CO₂ ✓

5. The fertilizer harmful to paddy rice is:

- (a) Super phosphate
- (b) Ammonium nitrate ✓
- (c) Urea
- (d) Potassium sulphate

6. Fertilizers which increase the resistance of plants towards diseases and make plants strong by healthy root development are:

- (a) Nitrogenous fertilizers
- (b) Phosphate fertilizers
- (c) Potassium fertilizers ✓
- (d) Magnesium fertilizers

7. Which liquid is essential for all form of life on earth?

- (a) Ammonia
- (b) Methanol
- (c) Water ✓
- (d) Liquid air

8. In what amount water is present in all living organisms?

- (a) Small
- (b) Minor
- (c) Plenty ✓
- (d) Minimum

9. Identifying the presence of water has many important applications which include:

- (a) Determining the purity of substances

- (b) Analyzing chemical reaction
- (c) Finding a medium for chemical reactions to occur
- (d) All of these ✓**

10. Testing water is important for industries:

- (a) Food
- (b) Pharmaceutical
- (c) Industrial products of chemicals
- (d) All of these ✓**

11. Maximum number of water of crystallization in copper sulphate is:

- (a) 2
- (b) 3
- (c) 4
- (d) 5 ✓**

12. The color of hydrated copper (II) sulphate is:

- (a) White
- (b) Blue ✓**
- (c) Pink
- (d) Orange

13. Color of anhydrous copper (II) sulphate is:

- (a) White ✓**
- (b) Blue
- (c) Pink
- (d) Purple

14. Water needed to change the color of copper (II) sulphate (anhydrous) to hydrated copper (II) sulphate:

- (a) 5cm³
- (b) One drop only ✓**
- (c) 100cm³
- (d) All of these

15. Freezing point of water at STP:

- (a) -16°C
- (b) 4°C
- (c) -40°C
- (d) 0°C ✓**

16. Boiling point of water varies with impurities:

- (a) Remains constant
- (b) Increases ✓**
- (c) Decreases
- (d) No effect

17. What is the effect of presence of impurities in water at its freezing point?

- (a) First increases then decrease
- (b) Increases
- (c) Decreases ✓**
- (d) Remain constant

18. Boiling point of water is also affected by:

- (a) Lowering volume
- (b) At high altitudes ✓**

- (c) Lowering temperature
- (d) Increasing temperature

19. Water supplied to our homes through pipes is?

- (a) Distilled water
- (b) Tap water ✓**
- (c) Heavy water
- (d) Pure water

20. Tap water contains minerals like salt which depend upon:

- (a) Source from where it is obtained ✓**
- (b) Solubility of salts in water
- (c) Concentration of ions
- (d) Pressure applied to water

21. pH of tap water is:

- (a) 7-8
- (b) 6.5-8.5 ✓**
- (c) 6.5-7.5
- (d) Above 8

22. Tap water is conductor of electricity due to:

- (a) Chlorine gas dissolved
- (b) Presence of free ions from dissolved minerals ✓**
- (c) Its pH
- (d) Purity

23. Distillation is a combination of two processes:

- (a) Boiling and cooling
- (b) Evaporation and condensation ✓**
- (c) Sublimation and condensation
- (d) Boiling and freezing

24. Distillation is responsible for removing of substances from water:

- (a) Dissolved minerals
- (b) Dissolved microorganisms
- (c) Contaminants
- (d) All of these ✓**

25. Distilled water is not used for:

- (a) Laboratory procedures
- (b) Medical procedures
- (c) Pharmaceutical industry
- (d) Drinking purpose ✓**

26. Which gas enters the natural water from the atmosphere?

- (a) Chlorine
- (b) Ammonia
- (c) Hydrogen
- (d) Oxygen ✓**

27. Bacterial contents in water produce various diseases except one:

- (a) Dysentery
- (b) Typhoid
- (c) Polio ✓**
- (d) Cholera

28. Heavy metals in natural water include:

- (a) Lead, mercury
- (b) Cadmium and chromium
- (c) Both (a) and (b) ✓**
- (d) Sodium and potassium

29. Which metals are considered to increase the risk of cancer disease:

- (a) Lead and mercury
- (b) Sodium and potassium
- (c) Arsenic and cadmium ✓**
- (d) Lithium and Beryllium

30. The human organs which have been noticed to have plastics are:

- (a) Eyes and Ears
- (b) Large and small intestine
- (c) Lungs and blood ✓**
- (d) Liver and Pancreas

31. Which process is responsible for entering nitrates and phosphates in natural water?

- (a) Lightning
- (b) Volcanic eruption
- (c) Weathering of rocks ✓**
- (d) Forest fire

32. Eutrophication is a process in which water contains excessive amounts of:

- (a) Oxygen
- (b) Chlorine
- (c) Microorganisms
- (d) Nitrogen and phosphorous ✓**

33. Dissolved oxygen level in water is decreased by:

- (a) Phosphate and nitrates
- (b) Mineral and salts in water
- (c) Overgrowth of algae ✓**
- (d) Dust and straws present in water

34. Which one is not an impurity of water obtained from natural sources?

- (a) Dissolved impurities
- (b) Chlorine ✓**
- (c) Suspended impurities
- (d) Microorganisms

35. Insoluble impurities present in water are:

- (a) Soil
- (b) Pieces of plants
- (c) Sand
- (d) All of these ✓**

36. The process of removing insoluble impurities of bigger size is called:

- (a) Filtration
- (b) Sedimentation ✓**
- (c) Crystallization
- (d) Distillation

37. During sedimentation suspended particle settle down due to:

- (a) Pressure

- (b) Temperature difference
(c) Gravity ✓
(d) All of these
38. Process of removing of impurities of small size from water is called:
(a) Sedimentation
(b) Filtration ✓
(c) Distillation
(d) Ion-exchange
39. Which material is taken as filter during filtration of water?
(a) Sand and gravel ✓
(b) Marble stones
(c) Glass wood
(d) Pieces of filter paper
40. All harmful bacteria and microbes of water are killed during:
(a) Distillation
(b) Filtration
(c) Chlorination ✓
(d) Sublimation
41. Colour and odour of water is removed by using:
(a) Filter paper
(b) Absorbant
(c) Chlorine
(d) Activated carbon ✓
42. Exposing water to direct air in atmosphere is called:
(a) Distillation
(b) Condensation
(c) Aeration ✓
(d) Sublimation
43. Which type of ecosystem is disturbed by eutrophication?
(a) Glacier ecosystem
(b) Air ecosystem
(c) Water ecosystem ✓
(d) Soil ecosystem
44. The number of million people suffering from water borne diseases per annum is:
(a) 400
(b) 500 ✓
(c) 700
(d) 800
45. Millions of people are suffering from a water borne disease trachoma which causes:
(a) Cholera
(b) Typhoid
(c) Blindness ✓
(d) Malaria
46. Depending upon the annual rainfall every year Pakistan belongs to:
(a) Arid region
(b) Semi-arid region ✓
(c) Complete barren

(d) None of all

47. Which areas of Pakistan receive rainfall below 200mm per year?

(a) East of Pakistan

(b) Western areas

(c) Northern areas

(d) Southern areas ✓

48. Which one is not a cause of water scarcity in Pakistan?

(a) Less rainfall

(b) Growth in population

(c) Flood irrigation

(d) Building dams ✓

49. The nutrients required in very small amount for the growth of plants are called:

(a) Micro nutrients ✓

(b) Macro-nutrients

(c) Dissolved nutrients

(d) All of these

50. Range of micro-nutrients in grams per acre is:

(a) 2-6

(b) 6-100

(c) 6-200 ✓

(d) 6-300

51. Which one is not a macronutrient:

(a) Potassium

(b) Calcium

(c) Zinc ✓

(d) Sulphur

52. Macronutrients are required in kg per acre:

(a) 5-100

(b) 100-200

(c) 5-200 ✓

(d) 5-10

53. Essential elements for plant growth are:

(a) Nitrogen

(b) Phosphorous

(c) Potassium

(d) All of these ✓

54. Which one is not a role of fertilizers?

(a) Enhance natural fertility of soil

(b) Provide essential elements to soil

(c) Increase the yield of crop

(d) Kills unnecessary pests and plants ✓

55. Which one is a property of a good fertilizer?

(a) Injurious to plants

(b) Very expensive

(c) Must be insoluble in water

(d) It should not alter the pH of soil ✓

56. Ammonium nitrate is useful fertilizer for many crops except:

- (a) Wheat
- (b) Cotton
- (c) Paddy rice ✓**
- (d) Rice

57. Which fertilizer is required to stimulate early growth in plants?

- (a) Nitrogen fertilizer
- (b) Phosphate fertilizers ✓**
- (c) Potassium fertilizers
- (d) Biofertilizers

58. Which element is required for the formation of starch and sugar of plants?

- (a) Nitrogenous fertilizers
- (b) Potassium fertilizers ✓**
- (c) Biofertilizers
- (d) Phosphorous fertilizers

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Answer Key for MCQs

Q.No	Ans	Q.No	Ans	Q.No	Ans	Q.No	Ans
1	C	2	B	3	A	4	D
5	B	6	C	7	C	8	C
9	D	10	D	11	D	12	B
13	A	14	B	15	D	16	B
17	C	18	B	19	B	20	A
21	B	22	B	23	B	24	D
25	D	26	D	27	C	28	C
29	C	30	C	31	C	32	D
33	C	34	B	35	D	36	B
37	C	38	B	39	A	40	C
41	D	42	C	43	C	44	B
45	C	46	B	47	D	48	D
49	A	50	C	51	C	52	C
53	D	54	D	55	D	56	C
57	B	58	B				

SHORT ANSWER QUESTIONS

Write short answers.

Q.1 Name two methods to check the purity of water.

Ans. Methods used to check purity of water are: (1) Determining boiling point of water at STP. (2) Determining freezing point of water at STP.

Q.2 What is the main difference between tap water and distilled water?

Ans. Tap water is supplied to homes through pipes and may contain minerals, chlorine and ion salts, with pH 6.5–8.5, and it can conduct electricity. Distilled water is obtained by distillation, is free from minerals, ions and salts, has pH exactly 7, and is a bad conductor of electricity.

Q.3 How water is distilled in the laboratory?

Ans. Distillation of water: In a distillation flask water is taken and fitted with a long condenser. Water is boiled in the flask; the steam produced travels through the condenser where it is cooled down. The condensed (distilled) water is collected in a separate container while impurities like salts and minerals stay behind.

Q.4 Name useful and harmful substances present in water.

Ans. Useful: Dissolved oxygen from the atmosphere and aquatic plants. **Harmful:** Microplastics; nitrates and phosphates entering through weathering of rocks.

Q.5 How would you remove harmful bacteria and other microbes present in water?

Ans. Harmful bacteria and microbes can mostly be removed by boiling, since boiling kills most microbes. **Chlorination** — adding chlorine — also disinfects water effectively and removes bacteria and other microbes.

Q.6 What is the difference between sedimentation and filtration?

Ans. In **sedimentation**, bigger and heavier insoluble impurities settle down at the bottom due to gravity. In **filtration**, water is passed through filters such as sand or a membrane that trap smaller suspended particles not removed by sedimentation.

Q.7 Name any three water-borne diseases.

Ans. Water-borne diseases include: (1) Cholera (2) Typhoid (3) Malaria.

Q.8 Why fertilizers containing nitrogen element are added into the soil?

Ans. Nitrogenous fertilizers are added into the soil because nitrogen is required during the early stage of plant growth for the development of stem and leaves. It is the main constituent of proteins, imparts green colour to leaves, and increases the yield and quality of plants.

Q.9 What is trachoma disease?

Ans. Trachoma is a disease caused by drinking contaminated water. It is particularly prevalent among babies and children in developing countries and this disease causes blindness.

Q.10 Why is it important to check the presence of water in anything?

Ans. Identifying the presence of water has important applications, including determining the purity of substances and analysing chemical reactions. It is also important for pharmaceutical and industrial processes.

Q.11 Describe a test to identify the presence of water in a compound.

Ans. Test for water: Hydrated copper(II) sulphate ($\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$) is blue in colour, but when heated it loses water molecules and becomes anhydrous copper(II) sulphate, which is white. A drop of water on the anhydrous sample turns it back from white to blue. It is a very sensitive test that can detect even a small amount of water.

Q.12 How does presence of impurity in water is checked?

Ans. Pure water boils at 100°C and freezes at 0°C under standard conditions. Impurities in water slightly **increase** its boiling point, while a melting point **below 0°C** suggests the presence of impurities.

Q.13 What is the purity of distilled water for use in different fields?

Ans. The purity of distilled water makes it ideal for laboratories, medical procedures and the pharmaceutical industry, since it ensures accurate scientific measurements and sterilization of medical equipment.

Q.14 Why is distilled water a bad conductor of electricity?

Ans. Distilled water is free from ions; therefore it is a bad conductor of electricity.

Q.15 What is a useful substance dissolved in water? What is its purpose?

Ans. **Dissolved oxygen** is the useful gas dissolved in water. It enters through diffusion from the atmosphere and is also produced by aquatic plants and algae during photosynthesis. It is used by aquatic organisms to breathe and survive, maintaining the health and diversity of the ecosystem.

Q.16 How do harmful bacteria and microbes enter into natural water?

Ans. Harmful microorganisms such as bacteria, viruses and parasites enter natural water through human and animal waste, landfills, agricultural runoff and industrial effluents. Sewage from treatment plants or faulty septic tanks can also release pathogens directly into nearby water bodies.

Q.17 Write sources of heavy metals and their compounds into water bodies.

Ans. Heavy metals enter natural water through: waste water from factories, mining operations, and the use of fertilizers and pesticides.

Q.18 How are heavy metals harmful for us?

Ans. Heavy metals and their compounds damage vital organs like the liver and kidney, can lead to neurological problems, and arsenic and cadmium are known to increase the risk of certain cancers.

Q.19 How the use of plastic is becoming dangerous for us?

Ans. Microplastics have been found in some human organs such as the lungs and blood. These particles can disturb the immune and reproductive systems.

Q.20 What do you mean by eutrophication?

Ans. **Eutrophication** is the process that starts in a water body containing an excess of phosphorus and nitrogen nutrients, causing excessive algae growth.

Q.21 Name the impurities present in natural water.

Ans. Three types of impurities are mostly present in water from natural sources: (1) Dissolved impurities (2) Suspended impurities (3) Microorganisms.

Q.22 What is the purpose of sedimentation in water treatment?

Ans. Insoluble impurities such as soil, pieces of plants and sand are bigger in size and are removed by the process called sedimentation, where they settle at the bottom of the tank due to gravity.

Q.23 Draw a labelled diagram of sedimentation tank.

Ans. See Figure 20.2 (Sedimentation Tank) above, showing the water inlet, the clean water drawn off from the top layer, and the sediment settled at the bottom.

Q.24 How does filtration remove particles from water?

Ans. Filtration removes smaller suspended particles by passing water through a layer of sand and gravel filters that trap the solid particles; the clear water obtained is called the filtrate.

Q.25 Why water must be sterilized before human use?

Ans. Water must be sterilized so that all harmful bacteria and other microbes are killed. For this purpose, a small amount of liquid chlorine is added, which has the power to kill these germs.

Q.26 What does activated carbon do in water purification?

Ans. Water is passed through powdered activated carbon (charcoal) to remove taste and odour. It removes a wide range of organic compounds responsible for taste and odour through absorption.

Q.27 What does the WHO estimate about water borne sickness?

Ans. The World Health Organization (WHO) has estimated that **80%** of the sickness and diseases in the world are caused by polluted water and lack of sanitation, with nearly **500 million** people suffering from water-borne diseases every year.

Q.28 How water-borne diseases can be prevented?

Ans. Water-borne diseases can be avoided by: (1) drinking clean water after removing impurities and boiling to kill germs, and (2) practising hygiene by keeping the body, especially hands, clean and ensuring proper sanitation facilities.

Q.29 What is the distribution of annual rainfall in different parts of Pakistan?

Ans. Pakistan lies in a semi-arid region and receives low rainfall annually. Northern Pakistan, including Punjab, generally receives 250–600 mm per year mostly during the monsoon season, while southern Pakistan receives scarce rainfall, below 200 mm per year.

Q.30 What are micronutrients for plant growth? Write their range of use.

Ans. Micro-nutrients (trace elements) are the nutrients required in a very small amount for plant growth, e.g. Boron, Copper, Iron, Manganese, Zinc, Molybdenum and Chlorine. Their range is from **6 grams to 200 grams per acre**.

Q.31 Why are micronutrients required in minute amounts?

Ans. They are needed only in small amounts because in larger quantities these elements become poisonous to plants.

Q.32 What are macro-nutrients? Give examples. Write their range.

Ans. Macronutrients are the nutrients required in a large amount for plant growth, e.g. Nitrogen, Phosphorous, Potassium, Calcium, Magnesium, Sulphur, Carbon, Hydrogen and Oxygen. They are generally required in a range of **5 kg to 200 kg per acre**.

Q.33 What are the bases of classification of fertilizers?

Ans. Fertilizers are classified according to the nature of the elements — nitrogen, phosphorous and potassium — that they provide to the soil, giving: (1) Nitrogenous fertilizers (2) Phosphatic fertilizers (3) Potassium fertilizers.

Q.34 Why fertilizers containing phosphorous are added to the soil?

Ans. Phosphatic fertilizers provide phosphorus, which is essential because it stimulates early growth, accelerates seed and fruit formation during later growth stages, and increases resistance to diseases.

Q.35 Describe the role of potassium fertilizers for plants.

Ans. Potassium fertilizers provide potassium, which is required for the formation of starch, sugar and fibrous material in plants. They increase resistance to diseases, help in healthy root development, and assist in the ripening of seeds, fruits and cereals.

CONSTRUCTED RESPONSE QUESTIONS

Q.1 Describe the negative effects of using plastics in everyday life.

- Plastic waste pollutes land, rivers and oceans.
- Microplastics enter the food chain and affect the ecosystem.
- Burning plastics is a serious problem as plastic is non-biodegradable.
- Microplastics have been found in human organs like lungs and blood, and can disturb the immune and reproductive systems.
- Plastics in soil reduce fertility and affect plant growth.

Q.2 Explain one method to remove dissolved impurities present in water.

Ans. **Distillation** separates pure water from dissolved impurities such as salt, sugar or minerals. The process involves heating water to produce steam and then condensing the steam back into liquid water by cooling. This effectively removes all dissolved minerals and contaminants, leaving behind only pure water.

Q.3 Why urea is regarded as a good nitrogenous fertilizer?

Ans. Urea is rich in nitrogen, an essential nutrient for plant growth. It contains about **46% nitrogen**, which is higher than most nitrogenous fertilizers. When added to soil it is converted by soil bacteria into ammonium and then nitrates, which are easily absorbed by plants, and urea is also highly soluble in water.

Q.4 Why Pakistan is facing a severe shortage of water?

Ans. Pakistan faces water shortage due to: (1) **Low and uneven rainfall** — a semi-arid region, with northern Pakistan receiving 250–600 mm/year and southern Pakistan below 200 mm/year; (2) **Climate change and melting glaciers**, altering river flow patterns; (3) **Rapid population growth**, raising demand for water; (4) **Lack of storage facilities** — although dams like Tarbela and Mangla exist, they cannot store enough water to prevent shortages.

DESCRIPTIVE QUESTIONS (EXERCISE)

Q.1 How can domestic water supply be made fit for drinking?

Ans. See Q.5 in Descriptive Questions.

Q.2 Which measures should be taken to avoid water-borne disease?

Ans. See Q.7 in Descriptive Questions.

Q.3 What are fertilizers? Mention the essential qualities of a good fertilizer.

Ans. See Q.10 in Descriptive Questions.

Q.4 What are the main functions of nitrogenous, phosphatic and potassium fertilizers?

Ans. See Q.11 and Q.12 in Descriptive Questions.

Q.5 How can you avoid the negative effects of pollutants present in water?

Ans. See Q.6 in Descriptive Questions.

FORMULAS AND EQUATIONS SUMMARY

Chemical Equations

Test for water:



Chemical Formulas

Compound	Formula
Water	H_2O
Hydrated Copper(II) sulphate	$\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$
Anhydrous Copper(II) sulphate	CuSO_4
Calcium super phosphate	$\text{Ca}(\text{H}_2\text{PO}_4)_2$
Diammonium phosphate	$(\text{NH}_4)_2\text{HPO}_4$

KEY TERMS GLOSSARY

Term	Definition
Anhydrous	A substance that contains no water.
Hydrated	A substance that contains water molecules in its structure.
Eutrophication	The process where excess nutrients cause excessive algae growth in water bodies.
Microplastics	Very small particles of plastics.
Trachoma	A disease caused by drinking contaminated water that leads to blindness.
NPK	Nitrogen, Phosphorus, Potassium — the three essential elements in fertilizers.
Biofertilizers	Environment-friendly fertilizers that provide soil essential nutrients and microbes.
Aeration	The process of exposing water to air to remove odours.
Chlorination	The process of adding chlorine to water to kill bacteria and microbes.

— End of Unit 20: Water —

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