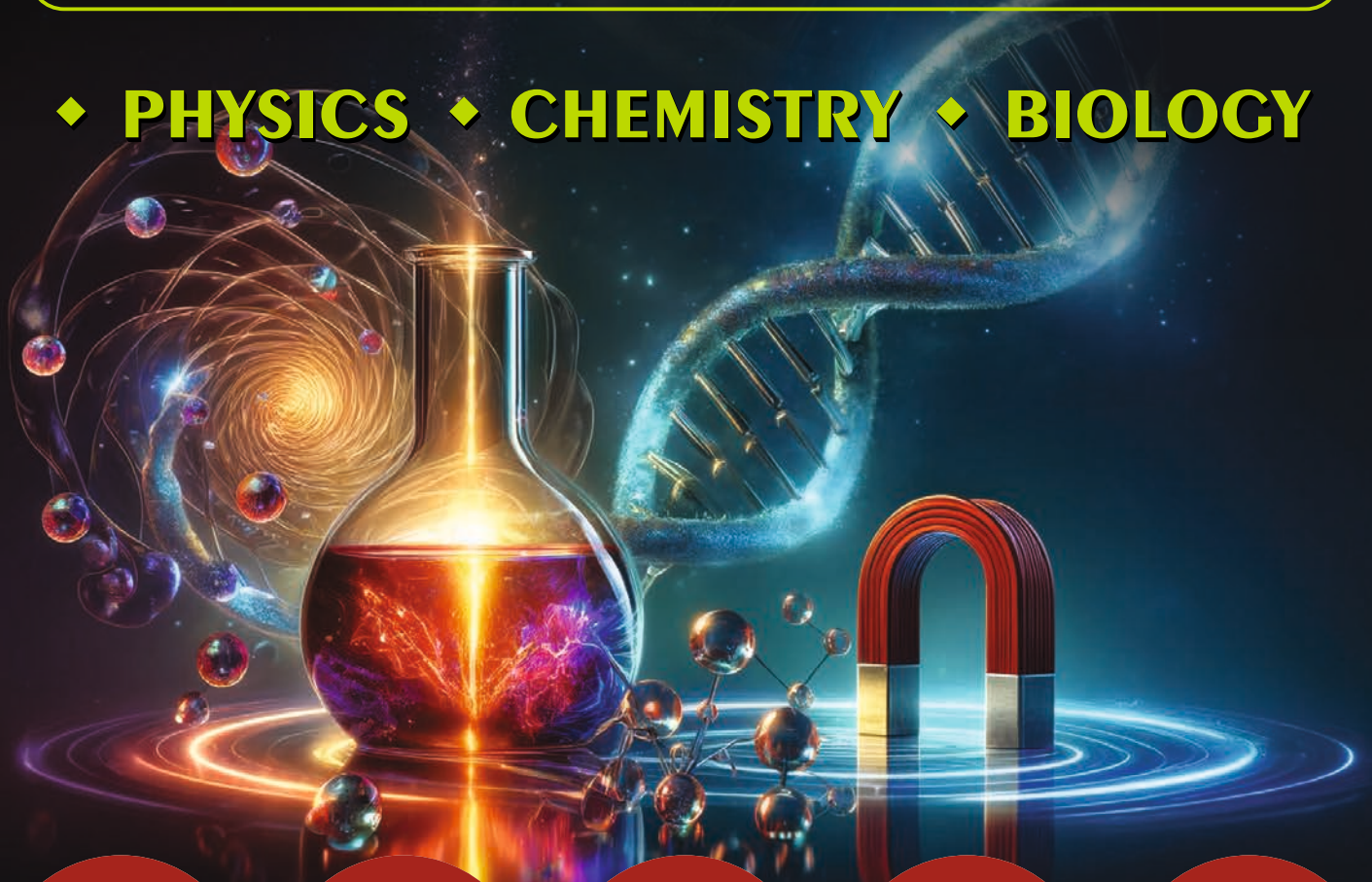
RRB

Railway Recruitment Board

GENERAL SCIENCE

For RRB ALP, Technician, NTPC Stage 1 & 2, Group D Level 1 and JE Exams

◆ PHYSICS ◆ CHEMISTRY ◆ BIOLOGY



Theory — Chapterwise Theory & Exercise

3000+ — Practice & Past Questions

4500+ — Important Facts

PYQs — of RRB ALP/NTPC/ Group D/JEE (2018 & 2021)

Daily Life — Everyday Science

Contents

SECTION

A

PHYSICS

CHAPTER

1

UNITS AND MEASUREMENTS

INTRODUCTION

Scientific research and everyday tasks from Walking to driving, involve units and measurements.

1. Quantity, Unit and Measurement

1. **Quantity:** A quantity is a property or aspect of a physical object or phenomenon that can be measured or calculated. It can be anything that we are able to measure. For example, length, mass, time, temperature, etc. are all quantities.
2. **Unit:** A unit is a specific measure used to represent a physical quantity. For example, the physical quantity 'length' can be measured in units like meters, centimeters, inches, etc. Units provide a standard for expressing and comparing these quantities.
3. **Measurement:** Measurement is the process of determining the ratio of a physical quantity, such as a length, time, temperature etc., to a unit of measurement, such as the meter, second or degree Celsius. For example, when we say a room is 10 meters long, we're expressing a measurement. The quantity is length, the unit is meters, and the measurement is 10 meters.

2. System of Units

1. **SI System (International System of Units):** This is the modern form of the metric system and is the most widely used system of measurement. It includes seven base units: kilogram (kg) for mass, meter (m) for length, second (s) for time, ampere (A) for electric current, kelvin (K) for temperature, mole (mol) for amount of substance, and candela (cd) for luminous intensity.
2. **FPS System (Foot-Pound-Second System):** This is an imperial system of units, which uses foot for length, pound for mass, and second for time. It's primarily used in the United States. For example, distances are measured in feet and miles rather than meters or kilometers.
3. **CGS System (Centimeter-Gram-Second System):** This is an older system of metric units. As the name suggests, it uses centimeter for length, gram for mass, and second for time. It was widely used in the sciences, but has been largely replaced by the SI system.
4. **MKS System (metre, kilogram, second system):** MKS is the system of units based on measuring lengths in meters, mass in kilograms, and time in seconds.

   MKS is generally used in engineering and beginning physics, where the so-called cgs system (based on the centimeter, gram, and second) is commonly used in theoretic physics.

   The real MKS lacked electrical units and used the obsolete kilogram force as the unit of force in place of the newton.

3. Base Units in SI system

Compound units derived from SI units

Physical Quantity	S.I Unit	Expression in terms of S.I. base unit	Symbol
Area	Square metre	m^2	m^2
Volume	Cubic metre	m^3	m^3
Density	kilogram per cubic metre	$kg \cdot m^{-3}$	kg/m^3
Velocity	metre per second	$m \cdot s^{-1}$	m/s
Acceleration	metre per second square	$m \cdot s^{-2}$	m/s^2
Force	Newton	$kg \cdot m \cdot s^{-2}$	N
Work, Energy	Joule	$kg \cdot m^2 \cdot s^{-2}$	J
Power	Watt	$kg \cdot m^2 \cdot s^{-3}$	W
Pressure	Newton per square metre	$kg \cdot m^{-1} \cdot s^{-2}$	N/m^2
Surface tension	Newton per metre	$kg \cdot s^{-2}$	N/m
Torque	Newton-metre	$kg \cdot m^2 \cdot s^{-2}$	Nm
Electric Charge	Coulomb	$A \cdot s$	C
Electric potential	Volt	$kg \cdot m^2 \cdot s^{-3} \cdot A^{-1}$	V
Electric resistance	Ohm	$kg \cdot m^2 \cdot s^{-3} \cdot A^{-2}$	Ω
Magnetic induction	Tesla	$kg \cdot s^{-2} \cdot A^{-1}$	T
Luminous flux	Lumen	Im	Im
Length	Metre	m	m
Mass	Kilogram	kg	kg
Time	Second	S	s
Temperature	Kelvin	K	K
Electric Current	Ampere	A	A
Luminous Intensity	Candela	cd	cd
Amount of substance	Mole	mol	mol

Following are the seven base units in the SI system:

a. Kilogram (kg): The kilogram is the unit of mass. It is defined by setting the Planck constant to $6.62607015 \times 10^{-34}$ kg.m²/s.

The kilogram (the unit of mass in the SI system), was redefined in terms of fundamental constants, including the Planck constant. The current definition came into effect on May 20, 2019. The formula is based on the energy-mass equivalence principle from Einstein's theory of relativity ($E = mc^2$). The relationship involves the Planck constant (h) and the speed of light (c):

$E = h.f$

- where E is the energy of a particle or a system of particles,
- h is the Planck constant ($6.62607015 \times 10^{-34}$ J.s)
- f is the frequency of the associated electromagnetic wave.

Now, since $E=mc^2$,
where, m is mass,
c is the speed of light (3×10^8 m/s), and
E is the energy, **we can express mass in terms of the Planck constant and frequency:**

$$m = \frac{E}{c^2} = \frac{h \cdot f}{c^2}$$

For example, if an experiment contains a systematic error, then increasing the sample size generally increases precision but does not improve accuracy. The result would be a consistent yet inaccurate string of results from the flawed experiment. Eliminating the systematic error improves accuracy but does not change precision.

A measurement system is considered valid if it is both accurate and precise. Related terms include bias (non-random or directed effects caused by a factor or factors unrelated to the independent variable) and error (random variability).

Error

The measured value of a quantity typically deviates from the true value of the physical quantity. This disparity between the true value and the measured value is termed as an error, calculated as the difference between the true value and the measured value:

Error = true value – measured value.

Important Law

Scientist Name	Related Law
Archimedes	**Archimedes Principle**
Amedeo Avogadro	Avogadro's Law
Georg Simon Ohm	**Ohm's Law**
Charles-Augustin de Coulomb	**Coulomb's Law**
Josef Stefan	Stefan's Law
Blaise Pascal	Pascal's Law
Robert Hooke	Hooke's Law
Daniel Bernoulli	**Bernoulli's Principle**
Robert Boyle	Boyle's Law
Jacques Charles	Charles's Law
Johannes Kepler	Kepler's Law
John Tyndall	Tyndall effect
Thomas Graham	Graham's Law

SI Defining Constants

Symbol	Defining constant	Exact value
c	speed of light	299792458 m/s
h	Planck constant	$6.62607015 \times 10^{-34}$ J.s
e	elementary charge	$1.602176634 \times 10^{-19}$ C
k	Boltzmann constant	1.380649×10^{-23} J/K
NA	Avogadro constant	$6.02214076 \times 10^{23}$ mol^{-1}
Kcd	luminous efficacy of 540 THz radiation	683 lm/W

EXERCISE

Latest Practice Questions

1. What is the primary reason for the significance of units and measurements?
(*a*) Standardization for universal understanding
(*b*) Subjective description replacement
(*c*) Ease of quantifying complex data
(*d*) Personal preference in measurement

2. Which system of units is primarily used in the United States?
(*a*) SI System (*b*) FPS System
(*c*) CGS System (*d*) MKS System

3. What is the SI unit for measuring mass?
(*a*) Gram (*b*) Kilogram
(*c*) Pound (*d*) Ounce

4. Which unit is defined by setting the speed of light in vacuum to a specific value?
(*a*) Meter (*b*) Second
(*c*) Candela (*d*) Kelvin

5. The unit of electric current in the SI system is:
(*a*) Ampere (*b*) Ohm
(*c*) Watt (*d*) Volt

6. What is the derived unit for measuring force?
(*a*) Newton (*b*) Joule
(*c*) Watt (*d*) Ohm

7. The unit for measuring speed is derived from which base units?
(*a*) Mass and time
(*b*) Length and time
(*c*) Length and mass
(*d*) Mass, length, and time

8. The surface tension of a liquid is 70 dyne/cm. In MKS system its value is?
(*a*) 70 N/m (*b*) 7×10^{-2} N/m
(*c*) 7×10^{2} N/m (*d*) 7×10^{3} N/m

9. Which unit is used to measure the amount of substance?
(*a*) Mole (*b*) Candela
(*c*) Ampere (*d*) Kelvin

10. Accuracy in measurements refers to:
(*a*) How close measurements are to each other
(*b*) How close measurements are to the true value
(*c*) The repeatability of measurements
(*d*) The sensitivity of measurement tools

11. Precision in measurements indicates:
(*a*) How close measurements are to the true value
(*b*) The repeatability of measurements
(*c*) The sensitivity of measurement tools
(*d*) How close measurements are to each other

12. Systematic errors are:
(*a*) Consistent and repeatable
(*b*) Unpredictable and variable
(*c*) Result from the inability to take the same measurement
(*d*) Both (*a*) and (*c*)

13. Random errors occur:
(*a*) Consistently and predictably
(*b*) Due to the inability to take the same measurement
(*c*) Unpredictably and vary from one measurement to another
(*d*) Resulting from equipment faults

14. Which technique helps to minimize random errors in measurements?
(*a*) Calibration
(*b*) Using appropriate tools
(*c*) Conducting multiple trials
(*d*) Careful experimental design

15. What unit of time is employed to measure extremely short periods in femtochemistry?
(*a*) Nanosecond (*b*) Picosecond
(*c*) Femtosecond (*d*) Attosecond

16. The SI unit for measuring luminous intensity is:
(*a*) Kelvin (*b*) Candela
(*c*) Mole (*d*) Ampere

17. Which unit is used in astronomy to measure interstellar distances?
(*a*) Light Year
(*b*) Parsec
(*c*) Astronomical Unit
(*d*) Nanometer

18. Accuracy in measurement is primarily concerned with:
(*a*) How close measurements are to the true value
(*b*) The repeatability of measurements
(*c*) How close measurements are to each other
(*d*) The sensitivity of measurement tools

19. The primary advantage of using units and measurements in science is:
(*a*) Facilitation of communication and standardization
(*b*) Easier quantification of complex data
(*c*) Elimination of experimental errors
(*d*) Subjective description replacement

20. The SI unit for measuring temperature is:
(*a*) Kelvin (*b*) Celsius
(*c*) Fahrenheit (*d*) Rankine

21. What unit is employed to measure the force exerted on an object due to gravity?
(*a*) Newton (*b*) Watt
(*c*) Volt (*d*) Ampere

22. One watt-hour contains how many joules?
(*a*) 3.6×10^8 J (*b*) 3.6×10^2 J
(*c*) 3.6×10^3 J (*d*) 10^{-3} J

23. The unit for measuring angles in radians is utilized prominently in which field?
(*a*) Mathematics and Science
(*b*) Engineering
(*c*) Astronomy
(*d*) Chemistry

24. The SI unit for measuring the distance *x* is:
(*a*) kilometer (*b*) meter
(*c*) centimeter (*d*) Foot

25. Which unit of time is commonly used for short periods of time?
(*a*) Second (*b*) Millisecond
(*c*) Hour v (*d*) Week

Past Year Questions

26. Which of the following is not correctly matched: **[RRB JE 2015]**
(*a*) Decibel - unit of sound
(*b*) Horsepower - unit of power
(*c*) Nautical mile - unit of distance
(*d*) Celsius - unit of heat

27. The S.I. Unit of electric charge is: **[RRB NTPC Tier-1 2016]**
(*a*) Ampere (*b*) Coulomb
(*c*) E.S.U. (*d*) Kelvin

28. What is the SI unit of weight? **[RRB ALP 17 Aug 2018 S-2]**
(*a*) Gram (*b*) Kg
(*c*) Newton (*d*) Dyne

29. One nanometer is: **[RRB ALP 17 Aug 2018 S-3]**
(*a*) 10^{-11} m (*b*) 10^{-10} m
(*c*) 10^{-8} m (*d*) 10^{-9} m

30. Which of the following has NO unit? **[RRB ALP 29 Aug 2018 S-1]**
(*a*) Density (*b*) Relative density
(*c*) Displacement (*d*) Pressure

31. Which of the following is same as foot, inch and yard? **[RRB NTPC 10 Jan 2021 S-2]**
(*a*) Pound (*b*) Quart
(*c*) Mile (*d*) Gram

ANSWER KEY

1. (*a*)	**2.** (*b*)	**3.** (*b*)	**4.** (*a*)	**5.** (*a*)	**6.** (*a*)	**7.** (*b*)	**8.** (*b*)	**9.** (*a*)	**10.** (*b*)
11. (*b*)	**12.** (*a*)	**13.** (*c*)	**14.** (*c*)	**15.** (*c*)	**16.** (*b*)	**17.** (*b*)	**18.** (*a*)	**19.** (*a*)	**20.** (*a*)
21. (*a*)	**22.** (*c*)	**23.** (*a*)	**24.** (*b*)	**25.** (*a*)	**26.** (*d*)	**27.** (*b*)	**28.** (*c*)	**29.** (*d*)	**30.** (*b*)
31. (*c*)									

EXPLANATION

26. (*d*) The Celsius (°C) scale is used to measure temperature, not heat. Heat is a form of energy, while temperature is a measure of the average kinetic energy of particles in a substance. The Celsius scale is commonly used for temperature measurement, with 0°C representing the freezing point of water and 100°C representing the boiling point of water at standard atmospheric pressure.

27. (*b*) The SI unit of electric charge is the Coulomb (C). A coulomb is defined as the amount of charge that passed through an electrical conductor carrying one ampere per scond.

28. (*c*) Weight is defined as the force of gravity on an object.
It is denoted by the formula:
W = mg, where W= Weight, m = Mass of the object and g = Gravitational Acceleration
Since weight is actually a force, the S.I. unit of weight is Newton.

31. (*c*)
- Mile is the same as foot, inch, and yard.
- Some measuring length:
  - 1 foot = 12 inches.
  - 1 yard = 3 feet = 36 inches.
  - 1 mile = 1,760 yards = 5,280 feet = 63,360 inches

SECTION

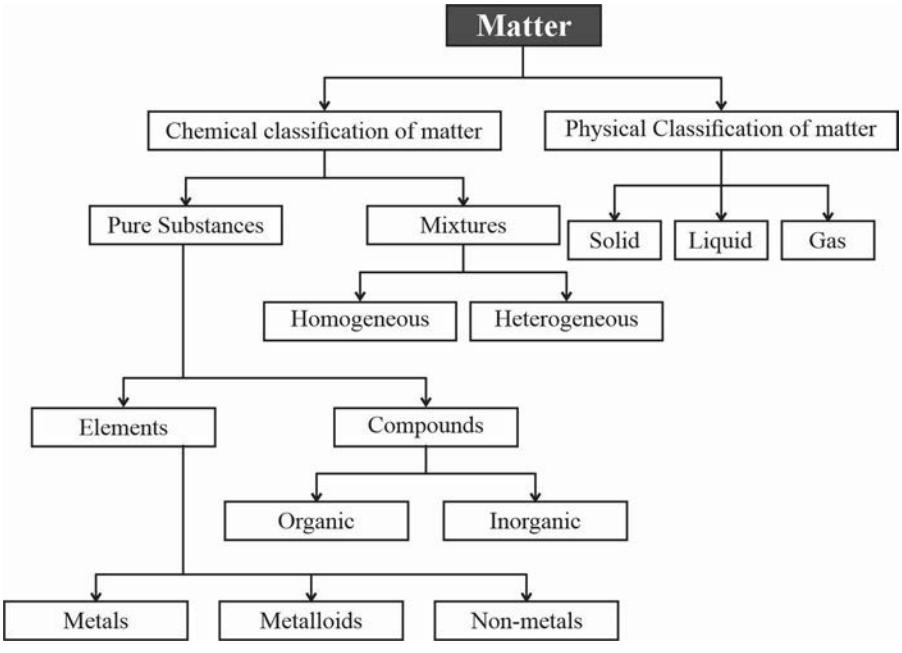
B

CHEMISTRY

CHAPTER

1

MATTER, ATOMS AND MOLECULES



Anything that occupies space and has mass is called **matter**. Air and water, hydrogen and oxygen, sugar and sand, silver and steel are all different kinds of matter. Matter is made up of small particles. It has three states which can be interconverted into each other by applying pressure and change in temperature. Matter shows different properties such as evaporation, condensation, freezing, sublimation etc.

Physical and Chemical Changes

Type of Change	Description	Examples
Physical Change	Changes that only affect the physical properties of matter without altering its chemical composition.	Crystallization, sublimation, boiling, melting, vaporization, cutting of trees, dissolving sugar or salt in water.
Chemical Change	Changes that affect both the composition and chemical properties of matter, resulting in the formation of new substances.	Burning of fuel, burning of candle and paper, electrolysis of water, photosynthesis, ripening of fruits.

Matter is classified into two types on the basis of their properties.

1. **Physical Classification:**

   On the basis of physical properties, matter has been classified as solids, liquids and gasses.

2. **Chemical Classification:** On the basis of chemical properties, matter has been classified as elements, compounds and mixture.

Classification of Matter based on Physical State :

Under normal conditions of temperature and pressure, matter can exist in any one of the following three states:

(a) Solids: A solid has a definite shape and definite volume. Examples are iron, copper, sugar, wood, rock, ice, etc.

(b) Liquid: A liquid has a definite volume but not no definite shape. Examples are milk, water, oil, petrol, kerosene, alcohol etc.

(c) Gasses: A gas has neither a definite shape nor a definite volume. It takes the shape and volume of the containing vessel. Examples are steam, oxygen, nitrogen, carbon dioxide, chlorine etc.

(d) Plasma: Plasma is the fourth state of matter which exists only at very high temperature about 10^7 K which is found only in the interior of the star. At this temperature basic units of the matter, atoms, are completely ionized.

Plasma can be artificially generated, for example, by heating a neutral gas or subjecting it to a strong electromagnetic field.

The response of plasma to electromagnetic fields is used in many modern devices and technologies, such as plasma televisions or plasma etching.

Plasma was first identified in laboratory by Sir William Crookes.

Langmuir also introduced the term "plasma" as a description of ionized gas in 1928.

EXERCISE

MCQs on Latest Pattern

1. What chemical substance is kept to safeguard clothes from insects and moths?
(*a*) Sodium chloride
(*b*) Naphthalene
(*c*) Iodine
(*d*) Ammonium chloride

2. The fifth state of matter is achieved through:
(*a*) Condensation of water vapors
(*b*) Evaporation of liquids
(*c*) Sublimation of substances
(*d*) Cooling of gas at super-low temperatures

3. At what temperature do Celsius and Fahrenheit scales display the same reading?
(*a*) 40° K (*b*) 100° F
(*c*) –40° C (*d*) –100° C

4. Which state of matter corresponds to super-energetic particles?
(*a*) Solid (*b*) Plasma
(*c*) Liquid (*d*) Gas

5. What substance is most effective for cooling?
(*a*) Water at 0°C (*b*) Water at 100°C
(*c*) Ice at 0°C (*d*) Gas at 0°C

6. The atomic mass of sodium is 23. The number of moles in 46g of sodium is _____.
(*a*) 4 (*b*) 2
(*c*) 0 (*d*) ½

7. The atomic number of carbon is 6 and its atomic mass is 12. How many protons are there in the nucleus of carbon?
(*a*) 6 (*b*) 12
(*c*) 18 (*d*) Zero

8. Identify the liquid from the options:
(*a*) Honey (*b*) Cotton wool
(*c*) Flour (*d*) Plasticine

9. Which type of clothing is comfortable in summer?
(*a*) Silk clothes (*b*) Cotton clothes
(*c*) Leather clothes (*d*) Rayon clothes

10. Which substance has both definite shape and volume?
(*a*) Water (*b*) Ice
(*c*) Oxygen (*d*) Steam

11. Compressed air is used in which of the following?
(*a*) Tyres of a bullock cart
(*b*) Juice cans
(*c*) Air guns
(*d*) Balloons

12. Which substance sublimes upon heating?
(*a*) Ice (*b*) Dry ice
(*c*) Water (*d*) Water vapors

13. Elements *A, B* and *C* occur as Dobereiner's triads. If the atomic mass of *A* is 40 and that of C is 180, what will be the atomic mass of *B*?
(*a*) 35 (*b*) 110
(*c*) 88 (*d*) 74

14. Which liquid has the highest rate of evaporation?
(*a*) Petrol (*b*) Honey
(*c*) Water (*d*) Alcohel

15. A gas that obeys gas laws is known as:
(*a*) An ideal gas (*b*) A heavier gas
(*c*) A lighter gas (*d*) A real gas

16. Diffusion, a property of matter, is based on:
(*a*) Motion of its particles
(*b*) Size of its particles
(*c*) Pressure
(*d*) Temperature

17. The process of changing liquid into solid is called:
(*a*) Evaporation (*b*) Freezing
(*c*) Condensation (*d*) Sublimation

18. The tendency of non-reacting gasses to mix with each other is called:
(*a*) Chemical reaction
(*b*) Diffusion
(*c*) Effusion
(*d*) Explosion

19. By which property are gases and liquids different from solids?
(*a*) Volume (*b*) Mass
(*c*) Conductivity (*d*) Fluidity

20. When ice, floating on water in a beaker, completely melts, the water level:
(*a*) Increases
(*b*) Decreases
(*c*) Remains the same
(*d*) First increases, then decreases

21. The boiling point of a gas is –80°C. This temperature is equivalent to:
(*a*) –193 K (*b*) 193 K
(*c*) 353 K (*d*) –353 K

22. When a solid melts, its temperature:
(*a*) Increases
(*b*) Decreases
(*c*) Remains constant
(*d*) First increases, then decreases

23. Which of the following compounds, when dissolved in water, gives a colored solution?
(*a*) Barium chloride
(*b*) Sugar
(*c*) Sodium chloride
(*d*) Copper sulphate

24. On adding an aqueous solution of Barium chloride to that of sodium sulphate, we immediately observe that:
(*a*) A white precipitate is formed
(*b*) A yellow precipitate is formed
(*c*) A clear and colorless solution is formed
(*d*) No reaction takes place

25. What is observed when iron nails are added to copper sulphate solution?
(*a*) The solution becomes pale green, and a reddish-brown deposit is seen on the nails
(*b*) The solution becomes colorless
(*c*) There is no reaction
(*d*) The solution becomes pale green, and no change is observed in sand and the iron nails

Past Year Questions

26. The number of atoms in a body-centered unit cell is: **[RRB JE 2015]**
(*a*) 1 (*b*) 2 (*c*) 3 (*d*) 4

27. What is the value of X in the following equation? **[RRB JE 2015]**

$MnO_2 + XHCl \rightarrow MnC1_2 + 2H_2O + Cl_2$

(*a*) 2 (*b*) 3 (*c*) 4 (*d*) 5

28. A trivalent metal "M" was made to react with nitrogen to yield 0.5 mole of metal nitride. Which of the following is a correct statement about the product of this reaction? The reaction product contains: **[RRB JE 2015]**
(*a*) 3.0165×10^{23} molecules of oxide of formula M_3N
(*b*) 3.0165×10^{23} molecules of oxide of formula M_3N_2
(*c*) $3.0165 \times 10^{11.5}$ molecules of oxide of formula M_3N
(*d*) $3.0165 \times 10^{11.5}$ molecules of oxide of formula MN

29. Which element has the least number of valence electrons? **[RRB JE 2015]**
(*a*) Chlorine (*b*) Sodium
(*c*) Fluorine (*d*) Oxygen

30. When two liquids do not mix with each other to form a solution, what is it called? **[RRB NTPC Tier-1 2016]**
(*a*) Solvent (*b*) Solute
(*c*) Immiscible (*d*) Decantation

31. The value of Avogadro's constant is? **[RRB NTPC Tier-1 2016]**
(*a*) 6.022×10^{23} per mole
(*b*) 58.04×10^{-2} per mole

93. Which reaction is an example of a double displacement reaction?
(RRB Group D 9 Sept 2022 S-3)
(*a*) $Fe(s) + CuSO_4(aq) \rightarrow FeSO_4(aq) + Cu(s)$
(*b*) $Zn(s) + CuSO_4(aq) \rightarrow ZnSO_4(aq) + Cu(s)$
(*c*) $Na_2SO_4(aq) + BaCl_2(aq) \rightarrow BaSO_4(s) + 2NaCl(aq)$
(*d*) $Pb(s) + CuCl_2(aq) \rightarrow PbCl_2(aq) + Cu(s)$

94. Which of the following molecules has only single bonds?
(RRB Group D 9 Sept 2022 S-3)
(*a*) O_2 (*b*) CH_4 (*c*) CO_2 (*d*) N_2

95. Which atomic number is related with four valence electrons?
(RRB Group D 9 Sept 2022 S-1)
(*a*) 6 (*b*) 5 (*c*) 8 (*d*) 7

96. Which of the following statements is correct about oxidation reaction?
[RRB Group D 12 Sept 2022 S-2]
(*a*) Oxidation is gain of oxygen and hydrogen.
(*b*) Oxidation is loss of oxygen and hydrogen.
(*c*) Oxidation is gain of oxygen or loss of hydrogen.
(*d*) Oxidation is loss of oxygen or gain of hydrogen.

97. Which shell of the nitrogen atom participates in forming N_2 molecule?
[RRB Group D 12 Sept 2022 S-2]
(a) M (b) K (c) L (d) N

98. What is the nature of $BaSO_4$ formed by a reaction of SO_4^{2-} and Ba^{2+}?
[RRB Group D 12 Sept 2022 S-2]
(*a*) Water insoluble (*b*) Black crystals
(*c*) Red powder (*c*) Water soluble

99. A substance gains hydrogen during a chemical process called:
[RRB Group D 13 Sept 2022 S-1]
(*a*) decomposition (*b*) reduction
(*c*) Oxidation (*d*) Rusting

100. Which of the following displacement reactions is NOT possible?
[RRB Group D 13 Sept 2022 S-1]
(*a*) $Pb(s) + CuCl_2(aq) \rightarrow PbCl_2(aq) + Cu(s)$
(*b*) $Cu(s) + PbCl_2(aq) \rightarrow CuCl_2(aq) + Pb(s)$
(*c*) $Fe(s) + CuSO_4(aq) \rightarrow FeSO_4(aq) + Cu(s)$
(*d*) $Zn(s) + CuSO_4(aq) \rightarrow ZnSO_4(aq) + Cu(s)$

101. Which statement about effective nuclear charge is NOT correct?
[RRB Group D 13 Sept 2022 S-1]
(*a*) It decreases down a group.
(*b*) It acts on the valence shell electrons.
(*c*) It increases across a period from left to right.
(*d*) It depends only upon the nuclear charge.

102. Which of the following reactions is NOT a combination reaction?
[RRB Group D 14 Sept 2022 S-3]
(*a*) $C + O_2 \rightarrow CO_2$
(*b*) $HI \rightarrow H_2 + I_2$
(*c*) $H_2 + O_2 \rightarrow H_2O$
(*d*) $NH_3 + HCl \rightarrow NH_4Cl$

103. What is the difference between the molecular masses of two successive members of the homologous series?
[RRB Group D 17 Sept 2022 S-3]
(*a*) 8 u (*b*) 12 u
(*c*) 6 u (*d*) 14 u

104. After 2 to 3 days of whitewashing of walls with a solution of slaked lime, which of the following compounds is produced that gives a shiny finish to the walls?
[RRB Group D 29 Sept 2022 S-2]
(*a*) Calcium bicarbonate
(*b*) Calcium carbonate
(*c*) Calcium hydroxide
(*d*) Calcium dioxide

105. Double displacement reaction occurs between: **[RRB Group D 29 Sept 2022 S-2]**
(*a*) neither ionic nor covalent compounds
(*b*) ionic compounds
(*c*) covalent compounds
(*d*) both ionic and covalent compounds

106. Which of the following statements is/are correct? **(RRB Group D 6 Oct 2022 S-1)**
A. Classification is necessary in order to compare the physical and chemical properties of the elements.
B. Classification is necessary to arrange the same kind of elements in the same group.
C. Classification is not necessary to arrange the same kind of elements in the same group.
(*a*) A, B and C (*b*) Only B and C
(*c*) Only A and B (*d*) Only A

107. How many electrons are present in an L-Shell of a carbon atom?
[RRB Group D 30 Aug 2022 S-3]
(*a*) 2 (*b*) 8 (*c*) 6 (*d*) 4

108. In chemical reaction $N_2 + xH_2 \rightarrow 2NH_3$, what is the value of x?
[RRB Group D 24 Aug 2022 S-2]
(*a*) 1 (*b*) 4 (*c*) 3 (*d*) 2

109. $2\,AgCl \rightarrow 2Ag\,(s) + Cl_2\,(g)$
What is the suitable condition for the above reaction to take place?
[RRB Group D 24 Aug 2022 S-2]
(*a*) Sunlight
(*b*) Sunlight + Pressure
(*c*) Heat + Pressure
(*d*) Heat

110. What is sublimation?
[RRB NTPC 9 May 2022 S-1]
(*a*) direct change of a substance from a gas to a liquid state
(*b*) direct change of a substance from a gas to a solid state
(*c*) direct change of a substance from a liquid to a gas state
(*d*) direct change of a substance from a solid to a gas state

ANSWER KEY

1. (*b*)	**2.** (*d*)	**3.** (*c*)	**4.** (*b*)	**5.** (*c*)	**6.** (*b*)	**7.** (*a*)	**8.** (*a*)	**9.** (*b*)	**10.** (*b*)
11. (*c*)	**12.** (*b*)	**13.** (*b*)	**14.** (*a*)	**15.** (*a*)	**16.** (*a*)	**17.** (*b*)	**18.** (*b*)	**19.** (*d*)	**20.** (*c*)
21. (*b*)	**22.** (*c*)	**23.** (*d*)	**24.** (*a*)	**25.** (*a*)	**26.** (*b*)	**27.** (*c*)	**28.** (*b*)	**29.** (*b*)	**30.** (*c*)
31. (*a*)	**32.** (*a*)	**33.** (*c*)	**34.** (*b*)	**35.** (*c*)	**36.** (*d*)	**37.** (*b*)	**38.** (*d*)	**39.** (*a*)	**40.** (*c*)
41. (*c*)	**42.** (*b*)	**43.** (*a*)	**44.** (*d*)	**45.** (*a*)	**46.** (*c*)	**47.** (*a*)	**48.** (*a*)	**49.** (*a*)	**50.** (*c*)
51. (*c*)	**52.** (*d*)	**53.** (*b*)	**54.** (*a*)	**55.** (*d*)	**56.** (*d*)	**57.** (*c*)	**58.** (*c*)	**59.** (*a*)	**60.** (*a*)
61. (*d*)	**62.** (*a*)	**63.** (*c*)	**64.** (*d*)	**65.** (*d*)	**66.** (*d*)	**67.** (*d*)	**68.** (*a*)	**69.** (*c*)	**70.** (*d*)
71. (*b*)	**72.** (*d*)	**73.** (*a*)	**74.** (*c*)	**75.** (*b*)	**76.** (*d*)	**77.** (*d*)	**78.** (*c*)	**79.** (*b*)	**80.** (*c*)
81. (*d*)	**82.** (*b*)	**83.** (*a*)	**84.** (*c*)	**85.** (*c*)	**86.** (*b*)	**87.** (*a*)	**88.** (*c*)	**89.** (*b*)	**90.** (*d*)
91. (*c*)	**92.** (*a*)	**93.** (*c*)	**94.** (*b*)	**95.** (*a*)	**96.** (*c*)	**97.** (*c*)	**98.** (*a*)	**99.** (*b*)	**100.** (*b*)
101. (*d*)	**102.** (*b*)	**103.** (*d*)	**104.** (*b*)	**105.** (*b*)	**106.** (*c*)	**107.** (*d*)	**108.** (*c*)	**109.** (*a*)	**110.** (*d*)

EXPLANATION

26. (*b*) In a body-centered cubic (BCC) unit cell, there are two atoms per unit cell. One atom is located at each of the eight corners of the cube, and an additional atom is located at the center of the cube.

27. (*c*) There are 4Cl and 4H on product side. If we put X = 4 on reactant side, reaction becomes balanced.

28. (*b*) Since 0.5 moles of metal nitride (M_3N_2) are produced, it implies that the number of moles of metal (M) is $3 \times 0.5 = 1.5$ moles. When a trivalent metal reacts with nitrogen, the resulting compound will have the formula M_3N_2 to balance the valencies (3 metals each with +3 charge and 2 nitrogen atoms each with –3 charge)
The number of molecules in 1 mole of any substance is Avogadro's number, which is approximately 6.022×10^{23}. $0.5 \times 6.022 \times 10^{23} = 3.011 \times 10^{23}$

29. (*b*) Sodium (Na) has one valence electron in its outermost electron shell. Valence electrons are the electrons located in the outermost shell of an atom and are involved in chemical bonding. Sodium belongs to group 1 of the periodic table, which contains elements known as alkali metals, all of which have one valence electron.

30. (*c*) When two liquids do not mix and form separate layers, they are said to be immiscible. Examples include oil and water.

31. (*a*) Avogadro's constant, often denoted as 6.022×10^{23} per mole. It represents the number of atoms, ions, or molecules in one mole of a substance.

32. (*a*) Plaster of Paris has the chemical formula $2CaSO_4.2H_2O$. It is obtained by heating gypsum at a specific temperature to remove the water of crystallization.

33. (*c*) The Law of Conservation of Mass states that matter cannot be created or destroyed in a chemical reaction. It can only change forms or be rearranged.

34. (*b*) Oxygen is the most abundant element in the Earth's crust, making up about 46.6% of its mass by weight. It is followed by silicon, which makes up about 27.7%.

35. (*c*) Silver halides are sensitive to light and undergo a chemical reaction (reduction) when exposed to light, which forms the latent image on photographic plates.

36. (*d*) Antoine Laurent Lavoisier, a French chemist, is credited with formulating two fundamental laws of chemical combinations and contributing to the development of the modern system for naming chemical substances. He is widely recognized as "The Father of Modern Chemistry."

37. (*b*) 3 atoms of oxygen are present in one molecule of **Ozone**.
Ozone, also known as '**trioxygen**', has the chemical formula as $\mathbf{O_3}$.
The formula was given by **Jacques-Louis Soret** in 1865.
The word ozone has been derived from the Greek word '**ozein**' which means '**to smell**'.
It is an **allotrope** of oxygen and is a **pale blue gas** with a **distinct pungent smell**.
It is **less stable than diatomic oxygen $\mathbf{O_2}$ gas**.
Ozone is an excellent **oxidizing agent** as it breaks down into oxygen gas and nascent oxygen. $\{O_3 \rightarrow O_2 + [O]\}$
A layer **of ozone** is present in the **stratosphere** of Earth and prevents the UV rays from reaching the Earth›s surface.

38. (*d*) Out of the given options, the correct statement is: 1 mole of Carbon will contain the same number of atoms as present in 1 mole of Helium.
Thus, 1 mole of Carbon and 1 mole of Helium will contain the same number of atoms i.e. **$\underline{6.022 \times 10^{23}}$ $\underline{\text{atoms}}$**.
A **mole** is the SI unit of **measurement for the amount of substance**.
1 mole = 6.022×10^{23}
6.022×10^{23} is known as the **Avagadro number**.
A mole does not depend on the atomic number, it's just a unit.

39. (*a*) An atom of a compound is the wrong response because a compound is a molecule composed of atoms from various elements. Although not every molecule is a compound, all compounds are molecules. For instance, hydrogen gas (H_2) is composed of just one element, so it is an element rather than a compound. Because water (H_2O) is composed of the elements hydrogen and oxygen, it is referred to as a molecule and compound. A particle of matter, an atom, is the smallest unit of that matter. It is composed of protons, neutrons, and electrons. When a material is composed entirely of one atom, it is referred to as an element. A molecule is created when two or more atoms combine chemically to form one whole.

40. (*c*) When Magnesium (Mg) ribbon is burnt in air, Magnesium Oxide (MgO) is formed. A bright white light is produced when the ribbon is burnt and powdery ash i.e. MgO is formed.
The reaction is a highly exothermic reaction, i.e. a lot of heat is produced.
The oxygen in the air reacts with Mg to form MgO.
$2Mg + O_2 \rightarrow 2MgO$ + energy; is the balanced equation for this reaction.

41. (*c*)
- **Ammonium is a cation**.
- Cation is an ion (charged particles) that has a positive charge on it, whereas an anion has a negative charge on it.
- Atoms loose or gain electron in order to become stable, therefore they acquire positive or negative charge respectively.
- **Ammoniumion: NH_4^+** . The cation has a charge of +1.
- **Carbonate ion:** CO_3^{2-} . The anion has a charge of –2.
- **Nitrate ion:** NO_3^- . The anion has a charge of –1.
- **Hydroxide ion:** OH^-. The anion has a charge of –1.

42. (*b*) Ammonium nitrate (NH_4NO_3), on thermal decomposition, produce N_2O and H_2O.
$NH_4NO_3 \rightarrow N_2O + 2H_2O$

43. (*a*)

44. (*d*) The lowest mass of the elements is hydrogen.
Then alomic mass of hydrogen is 1 unit.

45. (*a*) The reaction taking place is:
$BaCl_2 + H_2SO_4 \rightarrow BaSO_4 + 2HCl$
The mass of one mole of $BaCl_2$ will be = $137 + 35.52 \times 2$
$= 137 + 71.04 = 208$ g/mol
The molar mass of $BaSO_4$ is $137 + 32 + 16 \times 4 = 233$ g/mol
Now, from the above balanced reaction,
Since, 208g of $BaSO_2$ produces = 233 g of $BaSO_4$
So, 1 g of $BaCl_2$ produces = 233/208 g × 2.08 g of $BaSO_4$
Hence, 2.08 g of $BaCL_2$ will produce = 233/208 × 2.08 g of $BaSO_4$
2.08 g of $BaCL_2$ will produce
= 2.33 g of $BaSO_4$

46. (*c*) Evaporation is a process by which water is transformed from liquid to gaseous state. The temperature at which the water starts evaporating is known as the latent heat of vapourisation.
Evaporation is a surface phenomenon.

47. (*a*) The electronic configuration of carbon = (2, 4). Therefore, the Valency of carbon is 4.
Carbon atom forms four covalent bonds with other carbon atoms in a diamond. This phenomenon is termed as catenation. Hence there are no free electrons in outmost shell of carbon.

48. (*a*) **Fluorine (F)** and **Chlorine (Cl)** are chemically similar because both of them belong to the family of halogens.

SECTION

C

BIOLOGY
(LIFE SCIENCE)

CHAPTER

1

CELL: THE UNIT OF LIFE

Cells:

Cell is the structural and functional unit of all life forms. A single cell organism such as bacteria, *Amoeba* and *Chlamydomonas* are also a type of life forms. The microscopic study of cells is called Cytology. A cell may be defined as a unit of protoplasm surrounded by a membrane.

A.V. Leeuwenhoek (1632 – 1723): commonly known as **"the Father of Microbiology",** and one of the first microscopists and microbiologists. He discovered the minute forms of life such as bacteria and single-celled animals like Infusoria in a drop of water.

Cell was first discovered by Robert Hooke (1665), in a cork slice. He gave details about the cell in his book "Micrographia" and described cell as honeycomb lattice.

Leeuwenhoek (1674) with the improved microscope, discovered the free cells of bacteria for the first time.

Robert Brown in 1831, discovered the nucleus in the cell.

J. E. Purkinje in 1839 gave the term 'protoplasm' for the living fluid substance of the cell.

The **Cell Theory** was presented by a German botanist Matthias Schleiden (1838) and a British Zoologist Theodore Schwann(1839).

In **1855, Rudolf Virchow** said, "Omnis cellula -e cellula", (cells arise from pre-existing cells).

Types of Cell & Organism

(a) On the Basis of Number of Cells Organisms can be categorized as:

(i) Unicellular organisms: These are organisms which are made up of single cell only. This single cell Performs all the vital body functions of an organism. e.g. *Amoeba*.

(ii) Multicellular organisms: These are the organisms which are made up of numerous cells. These cells then combine to form an organ and a group of organs performing different functions forms an organ system which further forms an organism. e.g. plants and animals.

(b) On the basis of type of organization, cells are of two types:

(i) Prokaryotic cells: These are primitive and incomplete cells. They have less developed nucleus without nuclear membrane & nucleolus. e.g. Bacteria.

(ii) Eukaryotic cells: These are well developed cells. They have advanced nucleus with nuclear membrane and nucleolus. e.g. Plants & animals.

Difference Between Prokaryotic and Eukaryotic cell:

Property	Prokaryotic Cells	Eukaryotic Cells
Nucleus	No nucleus	Nucleus present
Organelles	No membrane-bound organelles	Membrane-bound organelles present
DNA Structure	Circular DNA	Linear DNA
Cell Wall Composition	Cell wall made of peptidoglycan	Cell wall made of cellulose (in plants) or absent (in animals)
Size	Smaller size (0.1-5 µm)	Larger size (10-100 µm)
Cellularity	Unicellular	Multicellular (mostly)
Cell Division	Binary fission	Mitosis or meiosis
Ribosomes	70S ribosomes	80S ribosomes

Size of Cells:

- The smallest cells (0.1 – 0.2 µm) are found as bacteria and pleuropneumonia-like organisms (PPLO), eg. *Mycoplasma gallisepteum*.
- The largest cell is the egg of an Ostrich which measures about 180 mm in diameter.
- The largest human cell is the female ovum (0.01 mm in diameter).
- The smallest human cell is the red blood cell (0.0075 mm or 7.5 µm).

Parts of a Cell:

1. **Plasma membrane or Cell membrane**
2. **Nucleus contain various cell organelles:**
   (a) Nuclear membrane (b) Nucleolus
   (c) Nucleoplasm (d) Chromatin material
3. **Cytoplasm contain various cell organelles:**
   (a) Endoplasmic Reticulum (b) Golgi Complex
   (c) Lysosome (d) Mitochondria
   (e) Plastid (plants only) (f) Ribosome
   (g) Centrosome (animals only)

Plasma membrane or Cell Membrane:

- Every living cell is externally covered by a thin, transparent, elastic, selectively-permeable membrane called- **plasma membrane** or cell membrane.
- Present on both prokaryotic and eukaryotic cells.
- Made up of protein and phospholipids.
- **Fluid-Mosaic model** of plasma membrane is most acceptable. It was proposed by Singer and Nicolson.

Plasma Membrane helps in exchange of gases i.e. CO_2, O_2 by the process of diffusion.

Osmosis

Is the process of movement of solvent molecules from the region of low concentration to the region of high concentration through semi-permeable membranes.

Cell wall:

Outermost, rigid, dead, protective and supportive layer found on all plant cells, bacteria, cyanobacteria and some protists but not found on animal cells.

Discovered by Robert Hooke (1665).

44. Which of the following plant tissues is capable of cell division?
[RRB ALP 17 Aug 2018 S-3]

(*a*) Meristem (*b*) Xylem
(*c*) Parenchyma (*d*) Sclerenchyma

45. Oparin's theory about 'Origin of life' is related to _____.
[RRB ALP 20 Aug 2018 S-2]

(*a*) chemical evolution
(*b*) biological evolution
(*c*) physical evolution
(*d*) artificial evolution

46. Which group of animals are exclusively free-living marine animals?
[RRB ALP 20 Aug 2018 S-3]

(*a*) Arthropoda
(*b*) Echinodermata
(*c*) Mollusca
(*d*) Nematoda

47. _____ is a multicellular organism.
[RRB ALP 21 Aug 2018 S-1]

(*a*) Agaricus (*b*) Cyanobacteria
(*c*) Mycoplasma (*d*) Paramecium

48. Which of the following is the largest group of animals? **[RRB ALP 21 Aug 2018 S-3]**

(*a*) Nematoda (*b*) Arthropoda
(*c*) Mollusca (*d*) Porifera

49. In which of the following permanent tissue are the cells dead?
[RRB ALP 29 Aug 2018 S-1]

(*a*) Parenchyma
(*b*) Collenchymas
(*c*) Sclerenchyma
(*d*) Aerenchyma

50. The smallest unit of life capable of independent existence is:
[RRB NTPC 7 Jan 2021 S-2]

(*a*) Protoplasm (*b*) Cytoplasm
(*c*) Cell (*d*) Vacuoles

51. _____ are a kind of waste disposal system of the cell. They help to keep the cell clean by digesting any foreign materials as well as worn-out cell organelles.
[RRB NTPC 16 Jan 2021 S-1]

(*a*) Mitochondria (*b*) Plastids
(*c*) Lysosomes (*d*) Golgi

52. What is the generic name given to members of the cat family?
[RRB NTPC 28 Jan 2021 S-1]

(*a*) Canine (*b*) Bovine
(*c*) Caprine (*d*) Feline

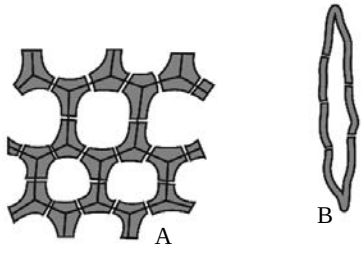
53. Alignment of chromosomes in the center of the cell at the equatorial plate constitutes which stage of mitosis?
[RRB NTPC 19 Jan 2021 S-1]

(*a*) Telophase (*b*) Anaphase
(*c*) Prophase (*d*) Metaphase

54. Who gave the term 'homo sapiens'?
[RRB NTPC 20 Jan 2021 S-1]

(*a*) G. J. Mendal (*b*) Linnaeus
(*c*) Miller (*d*) Darwin

55. Both the diagrams A and B given below are of Sclerenchyma tissue in plants, yet they look different. Why?
[RRB Group D 13 Sept 2022 S-1]



(*a*) A - Longitudinal section; B - Oblique section
(*b*) A - Longitudinal section; B - Transverse section
(*c*) A - Radial section; B - Transverse section
(*d*) A - Transverse section; B - Longitudinal section

56. Which of the following organelles is/are known as the 'suicide bags' of a cell?
[RRB Group D 13 Sept 2022 S-1]

(*a*) Lysosomes
(*b*) Ribosomes
(*c*) Endoplasmic reticulum
(*d*) Golgi apparatus

57. Parenchyma tissue is the most common simple permanent tissue in plants. Why is it known as Chlorenchyma and Aerenchyma in some plants?
[RRB Group D 14 Sept 2022 S-3]

(*a*) Chlorenchyma - Has air spaces (aquatic plants) and helps them to float
Aerenchyma - has chlorophyll for photosynthesis
(*b*) Chlorenchyma - Has air spaces (aquatic plants) and helps them to float
Aerenchyma - provides mechanical support
(*c*) Chlorenchyma - supports the plant
Aerenchyma - Has chlorophyll for photosynthesis (*l*eaves)
(*d*) Chlorenchyma - Has chlorophyll photosynthesis (leaves)
Aerenchyma - Has air spaces (aquatic plants) and helps them to float

58. Aerenchyma cells are present in _____.
[RRB Group D 24 Aug 2022 S-2]

(*a*) neem
(*b*) pea
(*c*) common water hyacinth
(*d*) Cactus

ANSWER KEY

1. (*d*)	**2.** (*b*)	**3.** (*b*)	**4.** (*d*)	**5.** (*b*)	**6.** (*d*)	**7.** (*a*)	**8.** (*a*)	**9.** (*d*)	**10.** (*d*)
11. (*b*)	**12.** (*b*)	**13.** (*a*)	**14.** (*a*)	**15.** (*c*)	**16.** (*a*)	**17.** (*b*)	**18.** (*b*)	**19.** (*c*)	**20.** (*d*)
21. (*c*)	**22.** (*b*)	**23.** (*a*)	**24.** (*d*)	**25.** (*a*)	**26.** (*d*)	**27.** (*a*)	**28.** (*b*)	**29.** (*b*)	**30.** (*a*)
31. (*c*)	**32.** (*b*)	**33.** (*b*)	**34.** (*b*)	**35.** (*a*)	**36.** (*a*)	**37.** (*b*)	**38.** (*d*)	**39.** (*d*)	**40.** (*c*)
41. (*c*)	**42.** (*a*)	**43.** (*b*)	**44.** (*a*)	**45.** (*a*)	**46.** (*b*)	**47.** (*a*)	**48.** (*b*)	**49.** (*c*)	**50.** (*d*)
51. (*c*)	**52.** (*c*)	**53.** (*d*)	**54.** (*d*)	**55.** (*b*)	**56.** (*a*)	**57.** (*d*)	**58.** (*c*)		

EXPLANATION

26. (*d*) Although often attributed to Charles Darwin, the phrase "survival of the fittest" was actually coined by the philosopher Herbert Spencer in his work "Principles of Biology" (1864).

27. (*a*) Gregor Johann Mendel, an Austrian monk, conducted experiments on pea plants in the mid-19th century. He discovered the

fundamental principles of inheritance, now known as Mendel's Laws of Inheritance, which laid the foundation for the science of genetics. He is often referred to as the "Father of Genetics."

28. (*b*) Cancer is a disease characterized by uncontrolled cell division and growth. When normal regulatory mechanisms that control cell division malfunction, cells can proliferate uncontrollably, forming tumors and interfering with the normal functioning of tissues and organs. Fever and inflammation are not direct consequences of uncontrolled cell division.

29. (*b*) A mutation is a sudden and permanent change in the DNA sequence of a gene or chromosome. Mutations can occur spontaneously due to errors in DNA replication, exposure to mutagens (such as radiation or certain chemicals), or through genetic recombination. Mutations can lead to variations in traits within a population and are a primary source of genetic diversity, which is essential for evolution to occur.

30. (*a*) Bacteria belong to the kingdom Monera, which includes unicellular prokaryotic organisms. Monera is one of the five kingdoms of life classification system, and it encompasses bacteria, archaea, and some other microorganisms. Bacteria are diverse and ubiquitous, inhabiting various environments and playing important roles in ecological processes, nutrient cycling, and human health.

31. (*c*) In binomial nomenclature, the system used for naming species in biology, the scientific name of an organism consists of two parts: the genus name (which is capitalized) and the species name (which is written in lowercase). For example, in Homo sapiens (the scientific name for humans), "Homo" is the genus name, and "sapiens" is the species name.

32. (*b*) Genetics is the branch of biology that deals with the study of genes, heredity, and genetic variation in organisms. By examining similarities and differences in traits among family members, such as facial features or physical characteristics, one can infer patterns of inheritance and genetic relationships. Therefore, genetics can explain why certain traits resemble those of specific family members.

33. (*b*) One of the key distinguishing features between plant and animal cells is the presence of a cell wall in plant cells and its absence in animal cells. Plant cells have a rigid cell wall composed primarily of cellulose, which provides structural support and protection to the cell. In contrast, animal cells lack a cell wall and instead have a flexible plasma membrane that surrounds the cell's cytoplasm and organelles. Additionally, both plant and animal cells have nuclei, although the size and shape of the nucleus may vary between cell types. Vacuoles, which are membrane-bound organelles involved in storage and waste management, are typically larger and more prominent in plant cells compared to animal cells.

34. (*b*) Gregor Mendel is considered the father of modern genetics. His experiments with pea plants in the 19th century led to the discovery of the basic principles of heredity and inheritance.

35. (*a*) The kiwi is a flightless bird and a vertebrate, meaning it has a backbone. Sponges, starfish, and threadworms are invertebrates and lack a backbone.

36. (*a*) The electron microscope was invented by Ernst Ruska and Max Knoll in 1931. They were awarded the Nobel Prize in Physics in 1986 for their work.

37. (*b*) The centromere is the point where chromatids are attached in a chromosome, facilitating spindle fiber attachment and sister chromatid separation during cell division.
Nucleosomes are units of DNA packaging consisting of DNA wrapped around histone proteins.
Centrosomes are organelles in animal cells responsible for organizing microtubules during cell division.
Genes are units of heredity containing instructions for specific traits.

38. (*d*) The group of the cell of similar origin, function, and structure is called tissue.
The plant tissue is of four types: Epidermal tissue, Vascular tissue, Ground tissue, and Meristematic tissue.
Human Body is made up of four types of tissue: Nervous, Muscle, Epithelial and Connective tissue.

39. (*d*)

Name of Tissue	Parenchyma	Sclerenchyma	Collenchyma
Structure of Cells	Living cells with **thin cellwall** and intercellular spaces.	**Dead and fibrous cells** with tapering ends, cell wall contains lignin.	**Elongated living cells with thickened cell wall at corners** due to cellulose and pectin.
Location	All parts like roots, stem, leaves, flowers and seeds.	Stem, veins of leaves, hard coats of seeds, outer covering of coconut.	At the base of leaf petiole, branches and stem.
Functions	Support, storage of food and filling vacant spaces.	Give strength and rigidity to parts of the plants.	Support and flexibility to various parts.

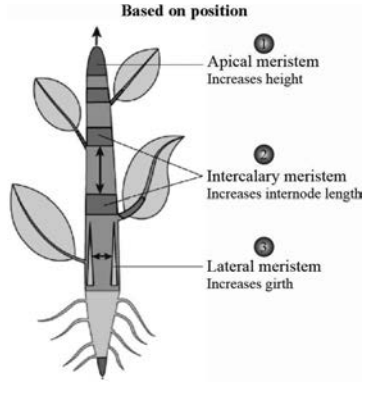
40. (*c*) Turtle - Reptiles
Crocodile - Reptiles
Toad - Amphibia
Snake – Reptiles

41. (*c*) A fungal cell wall is made up of a tough and complex sugar called 'Chitin'.
Fungi are non-green, eukaryotic, heterotrophic organisms. Most of them are saprotrophs. They feed upon decaying organic matter.
Examples: yeast, *Aspergillus*, *Penicillium*, Mushrooms.

42. (*a*)
- **Prophase:** Chromosomes condense and become visible, the nuclear envelope breaks down, and spindle fibers begin to form.
- **Metaphase:** Chromosomes align at the equatorial plate, spindle fibers attach to the centromeres of each chromosome.
- **Anaphase:** Sister chromatids separate and move towards opposite poles of the cell.
- **Telophase:** Nuclear envelopes reform around the separated chromosomes, spindle fibers break down, and the cell begins to divide into two daughter cells.

43. (*b*) Sclerenchyma is the permanent tissue that makes a plant hard and stiff.
Collenchyma cells are those which have irregularly thick cell walls which provide support and structure.
Parenchyma are thin-walled tissues which are involved in food storage, photosynthesis, and other activities of plant life.
Aerenchyma are spongy tissues which form air channels in the leaves, stem, and roots of some plants.

44. (*a*) Only meristem is capable of cell division.



Every Day Science

- **What is the normal heart rate of a human?**
  The average heart rate for a human is 72 beats per minute.
- **How many bones in skull of a human?**
  Human skull is made of 22 bones.
- **What is the normal respiratory rate for humans?**
  The normal respiratory rate for humans is 12 to 16 breaths per minute.
- **What is the weight of brain in the human body?**
  The weight of the brain is approximately 1300 to 1400 grams.
- **What is the name of the largest part of brain?**
  The largest part of the brain is called the cerebrum. It is responsible for various higher brain functions, including thought, action, reasoning, perception, and sensory processing.
- **What is the weight of kidney?**
  The weight of the kidney is approximately 120-170 grams.
- **Which is the smallest bone in the human body?**
  The smallest bone in the human body is the stapes, located in the ear.
- **Which is the largest bone in the human body?**
  The largest bone in the human body is the femur (thigh bone).
- **What is the normal blood pressure of a human?**
  The normal blood pressure of a human is 120/80 mmHg.
- **What is the strongest bone in body?**
  The strongest bone in the human body is the femur (thigh bone).
- **What is the percentage of water in the human body?**
  The human body contains about 60% water.
- **How much blood is in a human body in liters?**
  The average human adult has nearly 5 liters of circulating blood.
- **What percentage of body weight is blood?**
  Around 7–8% of an adult's body weight is blood.
- **What is the pH value of human blood?**
  The pH value of human blood is 7.4, making it slightly alkaline or basic.
- **Which organ purifies blood in the human body?**
  The kidneys are responsible for purifying blood.
- **In which part of the body are the RBCs produced?**
  Red blood cells are formed in the red bone marrow of bones.
- **What is the lifespan of a red blood cell?**
  The life span of the RBC is 120 days.
- **What is another name for white blood cells?**
  White blood cells, also known as leukocytes, are responsible for protecting our body from infection.
- **What is another name for red blood cells?**
  Another name for red blood cells is erythrocyte. 'Erythro' means red; 'cyte' means cell.
- **Which gland regulates body temperature in human?**
  The hypothalamus regulates body temperature in humans.
  The hypothalamus is a small but vital part of the brain at the centre.
  Normal body temperature ranges from 97.5°F to 98.9°F.
- **What is the universal donor blood group?**
  The universal donor blood group is O negative.
- **What is the universal recipient blood group?**
  AB positive blood type is known as the “universal recipient” because AB positive patients can receive blood from all blood types.
- **Which device is used to measure blood pressure?**
  A sphygmomanometer is used to measure blood pressure.
- **Which organ is known as Graveyard of RBC in human body?**
  The spleen is known as the graveyard of RBCs in the human body because it removes old and damaged red blood cells.
- **Where does the digestion of food begin?**
  Digestion begins in the mouth with chewing and ends in the small intestine.
- **Where is digested food absorbed into blood in the human body?**
  The digested food passes through the walls of the small intestine and is absorbed by the villi present on the inner wall of small intestine and reaches into the bloodstream.
- **Where is bile secreted?**
  Bile is secreted in the liver.
- **Where is Vitamin A stored in the human body?**
  Vitamin A is a fat-soluble vitamin that is stored in the liver.
- **Which is the largest gland in human body?**
  Liver is the largest gland in the human body. It is in the upper-right portion of the abdominal cavity.
- **Which is the smallest gland in the body?**
  The smallest gland found in the body of a human being is the pineal gland.
- **How many pairs of ribs are present in the human body?**
  The rib cage has a total of 24 bones or 12 pairs of bones. It provides structure to the body and protects internal organs present inside the thoracic cavity, such as the heart and lungs.
- **What is the total number of bones in the human body?**
  An adult person has a total of 206 bones in their skeletal system, including 80 in the axial skeletal system and 126 in the appendicular skeletal system.
- **How many muscles are found in the human body?**
  The total number of muscles found in the human body is 639, which makes up about 40-50 percent of the body weight of a human.
- **Name an enzyme present in the saliva of human beings?**
  Ptyalin or salivary amylase is the starch hydrolyzing enzyme secreted by salivary glands in human beings.
- **Which chromosome determines sex in humans?**
  The Y chromosome of a male plays a pivotal role in sex determination.
- **How many chambers does human heart have?**
  The human heart has four chambers: two atria (left and right) and two ventricles (left and right).
- **How many chromosomes are present in a human body?**
  In humans, each cell normally contains 46 chromosomes, arranged in 23 pairs.
- **What is the largest organ in the human body?**
  The skin is the largest organ of the human body.
- **What is the longest cell in the body?**
  The longest cell in the body is the nerve cell.
- **What is the largest cell in the human body?**
  The largest cell in the human body is female ovum.
- **What is the smallest cell in the human body?**
  Smallest cell in the human body is male gametes, that is, sperm.
- **How many amino acids are present in human beings??**
  There are 20 amino acids that are commonly found in human proteins.
- **What is the yellow color of urine due to the presence of?**
  The yellow color of urine is due to the presence of a pigment called urochrome.

DICTIONARY

(4500+ Frequently Asked Facts)

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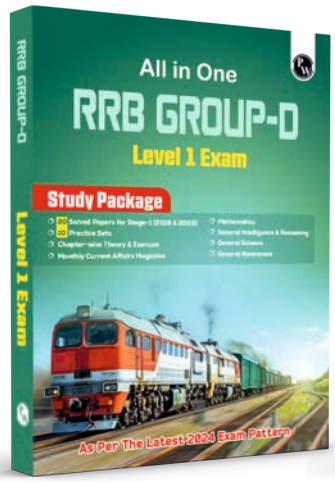

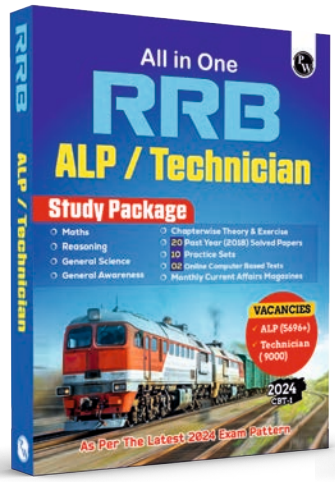

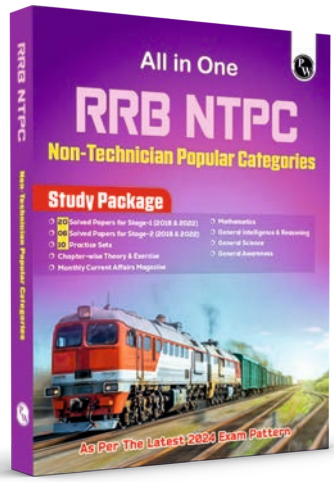

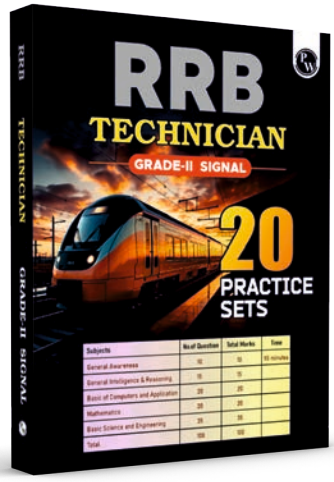

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