1. Chemical Reactions and Equations

1. $MnO_2 + xHCl \rightarrow MnCl_2 + yH_2O + zCl_2$

In order to balance the above chemical equation, the values of x, y and z respectively are: ***(1 M)*** **(2024, 2023)**

(*a*) 6, 2, 2 (*b*) 4, 1, 2
(*c*) 4, 2, 1 (*d*) 2, 2, 1

2. Which of the following statements about the reaction given below are correct?

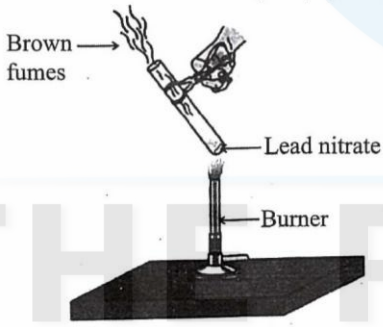
$MnO_2 + 4HCl \rightarrow MnCl_2 + 2H_2O + Cl_2$

(*i*) HCl is oxidized to Cl_2
(*ii*) MnO_2 is reduced to $MnCl_2$
(*iii*) $MnCl_2$ acts as an oxidizing agent
(*iv*) HCl acts as an oxidizing agent

(1 M) **(2024, 2023, 2022, 2016)**

(*a*) (*ii*), (*iii*) and (*iv*) (*b*) (*i*), (*ii*) and (*iii*)
(*c*) (*i*) and (*ii*) only (*d*) (*iii*) and (*iv*) only

3. The emission of brown fumes in the given experimental set-up is due to ***(1 M)*** **(2024, 2023, 2022)**



(*a*) thermal decomposition of lead nitrate which produces brown fumes of nitrogen dioxide.
(*b*) thermal decomposition of lead nitrate which produces brown fumes of lead oxide.
(*c*) oxidation of lead nitrate forming lead oxide and nitrogen dioxide.
(*d*) oxidation of lead nitrate forming lead oxide and oxygen.

4. **Assertion (A):** Reaction of Quicklime with water is an exothermic reaction.

Reason (R): Quicklime reacts vigorously with water releasing a large amount of heat.

(1 M) **(2024, 2023, 2020)**

5. While studying the double displacement reaction, the solutions of barium chloride and sodium sulphate are mixed together.

(*i*) What do you observe as soon as the two solutions are mixed together?
(*ii*) What will happen in the above observation made by you after ten minutes?

(2 M) **(2022, 2020 , 2019, 2016)**

6. (*i*) While electrolysing water before passing the current some drops of an acid are added. Why? Name the gases liberated at cathode and anode. Write the relationship between the volume of gas collected at anode and the volume of gas collected at cathode.
(*ii*) What is observed when silver chloride is exposed to sunlight? Give the type of reaction involved.

(3 M) **(2024, 2023)**

7. Decomposition reactions require energy either in the form of heat or light or electricity for breaking down the reactants. Write one equation each for decomposition reactions where energy is supplied in the form of heat, light and electricity. ***(3 M)*** **(2024, 2020, 2019, 2018)**

8. Select (*i*) combination reaction, (*ii*) decomposition reaction and (*iii*) displacement reaction from the following chemical equations: ***(3 M)*** **(2023, 2022, 2019, 2015)**

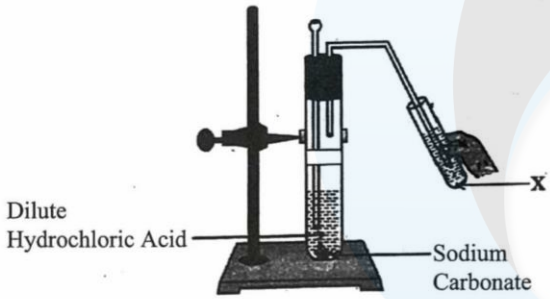
(*i*) $ZnCO_3(s) \rightarrow ZnO(s) + CO_2(g)$
(*ii*) $Pb(s) + CuCl_2(aq) \rightarrow PbCl_2(aq) + Cu(s)$
(*iii*) $NaBr(aq) + AgNO_3(aq) \rightarrow AgBr(s) + NaNO_3(aq)$
(*iv*) $H_2(g) + Cl_2(g) \rightarrow 2HCl(g)$
(*v*) $Fe_2O_3 + 2Al \rightarrow Al_2O_3 + 2Fe$
(*vi*) $3H_2(g) + N_2(g) \rightarrow 2NH_3(g)$
(*vii*) $CaCO_3(s) \xrightarrow{Heat} CaO(s) + CO_2(g)$

2. Acids, Bases and Salts

9. The table below has information regarding pH and the nature (acidic/basic) of four different solutions. Which one of the options in the table is correct? ***(1 M)*** **(2023, 2019)**

Option	Solution	Colour of pH paper	Approximate pH value	Nature of solution
(*a*)	Lemon juice	Orange	3	Basic
(*b*)	Milk of magnesia	Blue	10	Basic
(*c*)	Gastric juice	Red	6	Acidic
(*d*)	Pure water	Yellow	7	Neutral

10. In the experimental setup given below, it is observed that on passing the gas produced in the reaction in the solution 'X' the solution 'X' first turns milky and then colourless. ***(1 M)*** **(2023, 2022, 2019)**



The option that justifies the above stated observation is that 'X' is aqueous calcium hydroxide and

(*a*) it turns milky due to carbon dioxide gas liberated in the reaction and after sometime it becomes colourless due to formation of calcium carbonate.

(*b*) it turns milky due to formation of calcium carbonate and on passing excess of carbon dioxide it becomes colourless due to formation of calcium hydrogen carbonate which is soluble in water.

(*c*) it turns milky due to passing of carbon dioxide through it. It turns colourless as on further passing carbon dioxide, sodium hydrogen carbonate is formed which is soluble in water.

(*d*) the carbon dioxide liberated during the reaction turns lime water milky due to formation of calcium hydrogen carbonate and after some time it turns colourless due to formation of calcium carbonate which is soluble in water.

11. (*a*) (*i*) A compound 'X' which is prepared from gypsum has the property of hardening when mixed with proper quantity of water.

Identify 'X' and write its chemical formula.

(*ii*) State the difference in chemical composition between baking soda and baking powder:

(2 M) **(2023, 2022, 2020, 2018)**

12. During electrolysis of brine, a gas 'G' is liberated at anode. When this gas 'G' is passed through slaked lime, a compound 'C' is formed, which is used for disinfecting drinking water.

(*i*) Write formula of 'G' and 'C'.

(*ii*) State the chemical equation involved.

(*iii*) What is common name of compound 'C'? Give its chemical name. ***(3 M)*** **(2023, 2020, 2019, 2016)**

13. (*i*) Suggest a safe procedure of diluting a strong concentrated acid.

(*ii*) Name the salt formed when sulphuric acid is added to sodium hydroxide and write its pH.

(*iii*) Dry HCl gas does not change the colour of dry blue litmus paper. Why? ***(3 M)*** **(2023, 2019, 2015)**

14. How is washing soda prepared from sodium carbonate? Give its chemical equation. State the type of this salt. Name the type of hardness of water which can be removed by it? ***(3 M)*** **(2023, 2020)**

15. Write the chemical composition of tooth enamel. Under what conditions of pH it starts corroding? Explain the reason of tooth decay and suggest one method to prevent it. ***(3 M)*** **(2024, 2023)**

16. Salts play a very important role in our daily life. Sodium chloride which is known as common salt is used almost in every kitchen. Baking soda is also a salt used in faster cooking as well as in baking industry. The family of salts is classified on the basis of cations and anions present in them. **(2024, 2023, 2022, 2019)**

(*a*) Identify the acid and base from which Sodium chloride is formed. ***(1 M)***

(*b*) Find the cation and the anion present in Calcium sulphate. ***(1 M)***

(*c*) "Sodium chloride and washing soda both belong to the same family of salts." Justify this statement. ***(2 M)***

OR

(*c*) Define the term pH scale. Name the salt obtained by the reaction of Potassium hydroxide and Sulphuric acid and give the pH value of its aqueous solution. ***(2 M)***

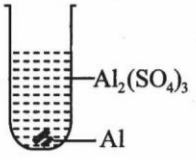
3. Metals and Non-metals

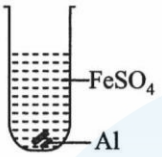
17. The oxide which can react with HCl as well as KOH to give corresponding salt and water is

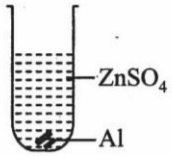
***(1 M)* (2024, 2022, 2019)**

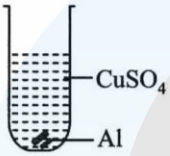
(*a*) CuO (*b*) Al_2O_3 (*c*) Na_2O (*d*) K_2O

18. Mrignayani was doing the experiment of comparing reactivity of metals in the laboratory. She was given aluminium metal and was told to check reactivity by using four solutions as shown below. She would observe that reaction takes place in: ***(1 M)* (2024, 2022, 2019, 2015)**

(A) 

(B) 

(C) 

(D) 

(*a*) A and B (*b*) B, C and D

(*c*) A, C and D (*d*) C and D

19. A metal and a non-metal that exists in liquid state at the room temperature are respectively:

***(1 M)* (2024, 2023, 2016)**

(*a*) Bromine and Mercury (*b*) Mercury and Iodine

(*c*) Mercury and Bromine (*d*) Iodine and Mercury

20. Silver articles become black when kept in open for some time, whereas copper vessels lose their shiny brown surfaces and gain a green coat when kept in open. Name the substances present in air with which these metals react and write the name of the products formed.

***(2 M)* (2019, 2016, 2015)**

21. Carbon cannot reduce the oxides of sodium, magnesium and aluminum to their respective metals. Why? Where are these metals placed in the reactivity series? How are these metals obtained from their ores? Take an example to explain the process of extraction along with chemical equations. ***(5 M)* (2020, 2018)**

22. The metals produced by various reduction processes are not very pure. They contain impurities, which must be removed to obtain pure metals. The most widely used method for refining impure metals is electrolytic refining. **(2024, 2018)**

(*i*) What is the cathode and anode made of in the refining of copper by this process? ***(1 M)***

(*ii*) Name the solution used in the above process and write its formula. ***(1 M)***

(*iii*) (A) How copper gets refined when electric current is passed in the electrolytic cell? ***(2 M)***

Or

(*iii*) (B) You have two beakers 'A' and 'B' containing copper sulphate solution. What would you observe after about 2 hours if you dip a strip of zinc in beaker 'A' and a strip of silver in beaker 'B '?
Give reason for your observations in each case.

(2 M)

23. Almost all metals combine with oxygen to form metal oxides. Metal oxides are generally basic as nature. But some metal oxides show both basic as well as acidic behaviour. Different metals show different reactivities towards oxygen. Some react vigorously while some do not react at all. **(2023, 2022, 2020, 2019)**

(*a*) What happens when copper is heated in air? (Give the equation of the reaction involved). ***(1 M)***

(*b*) Why are some metal oxides categorized as amphoteric? Give one example. ***(1 M)***

(*c*) Complete the following equations: ***(2 M)***

(*i*) $Na_2O_{(s)} + H_2O_{(l)} \rightarrow$

(*ii*) $Al_2O_3 + 2NaOH \rightarrow$

Or

(*c*) On burning Sulphur in oxygen a colourless gas is produced. ***(2 M)***

(*i*) Write chemical equation for the reaction.

(*ii*) Name the gas formed.

(*iii*) State the nature of the gas.

(*iv*) What will be the action of this on a dry litmus paper?

24. The melting points and boiling points of some ionic compounds are given below: **(2023, 2022, 2020)**

Compound	Melting Point (K)	Boiling Point (K)
NaCl	1074	1686
LiCl	887	1600
$CaCl_2$	1045	1900
CaO	2850	3120
$MgCl_2$	981	1685

These compounds are termed ionic because they are formed by the transfer of electrons from a metal to a non-metal. The electron transfer in such compounds is controlled by the electronic configuration of the elements involved. Every element tends to attain a completely filled valence shell of its nearest noble gas or a stable octet.

(*i*) Show the electron transfer in the formation of magnesium chloride. ***(1 M)***

(*ii*) List two properties of ionic compounds other than their high melting and boiling points. ***(1 M)***

(*iii*) (A) While forming an ionic compound, say sodium chloride, how does sodium atom attain its stable configuration? ***(2 M)***

Or

(B) Give reasons: ***(2 M)***

(*i*) Why do ionic compounds in the solid state not conduct electricity?

(*ii*) What happens at the cathode when electricity is passed through an aqueous solution of sodium chloride?

4. Carbon and its Compounds

25. A student took four test tubes P, Q, R and S and filled about 8 mL of distilled water in each. After that he dissolved an equal amount of Na_2SO_4 in P, K_2SO_4 in Q, $CaSO_4$ in R and $MgSO_4$ in S. On adding an equal amount of soap solution and shaking each test tube well, a good amount of lather will be obtained in the test tubes:

***(1 M)* (2019, 2017, 2016, 2015)**

(*a*) P and Q (*b*) P and R

(*c*) P, Q and S (*d*) Q, R and S

26. A gas is liberated immediately with a brisk effervescence, when you add acetic acid to sodium hydrogen carbonate powder in a test tube. Name the gas and describe the test that confirms the identity of the gas.

***(2 M)* (2019, 2017, 2016, 2015)**

27. (*a*) Why are most carbon compounds poor conductors of electricity?

(*b*) Write the name and structure of a saturated compound in which the carbon atoms are arranged in a ring. Give the number of single bonds present in this compound.

***(3 M)* (2024, 2019, 2018)**

28. (*a*) Draw the electron dot structure for ethyne.

(*b*) List two differences between the properties exhibited by covalent compounds and ionic compounds.

***(3 M)* (2023, 2022, 2019, 2015)**

29. Distinguish between esterification and saponification reactions with the help of the chemical equations for each. State one use of each (*i*) esters, and (*ii*) saponification process. ***(3 M)* (2023, 2017, 2016)**

30. (*a*) A saturated organic compound '*A*' belongs to the homologous series of alcohols.

On heating '*A*' with concentrated sulphuric acid at 443 *K*. it forms an unsaturated compound *B*' with molecular mass 28*u*.

The compound *B* on addition of one mole of hydrogen in the presence of Nickel, changes to a saturated hydrocarbon 'C'.

(*i*) Identify *A*, *B* and *C*.

(*ii*) Write the chemical equations showing the conversion of *A* into *B*.

(*iii*) What happens when compound *C* undergoes combustion?

(*iv*) State one industrial application of hydrogenation reaction.

(*v*) Name the products formed when compound *A* reacts with sodium.

***(5 M)* (2023, 2020, 2019, 2018, 2016)**

31. (*a*) (*i*) Give reason why carbon can neither form C^{4+} cations nor C^{4-} anions but form covalent compounds.

(*ii*) What is homologous series of carbon compound? Write the molecular formula of any two consecutive members of homologous series of aldehydes.

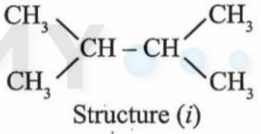
(*iii*) Draw the structure of the molecule of cyclohexane (C_6H_{12}). ***(5 M)* (2024, 2022, 2020)**

32. (*i*) Draw the structure of the following compounds:

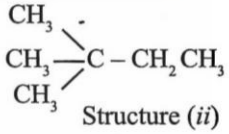
(*a*) Butanoic acid

(*b*) Chloropentane

(*ii*) How are structure (*i*) and structure (*ii*) given below related to one another? Give reason to justify your answer.



Structure (*i*)



Structure (*ii*)

Draw one more possible structure for above case.

(*iii*) Differentiate between saturated and unsaturated carbon compounds on the basis of their general formula.

***(5 M)* (2023, 2016)**

33. Soaps and detergents are both types of salts. State the difference between the two. Write the mechanism of the cleansing action of soaps. Why do soaps not form lather (foam) with hard water? Mention any two problems that arise due to the use of detergents instead of soaps.

(5 M) **(2023, 2020, 2017, 2015)**

5. Life Processes

34. Opening and closing of stomata is due to:

(1 M) **(2024, 2023, 2022, 2020)**

(*a*) High pressure of gases inside the cells.
(*b*) Movement of water in and out of the guard cells.
(*c*) Stimulus of light in the guard cells.
(*d*) Diffusion of CO_2 in and out of the guard cells.

35. (*a*) State the role played by the following in the process of digestion.
(*i*) Enzyme trypsin
(*ii*) Enzyme lipase
(*b*) List two functions of finger-like projections present in the small intestine. ***(3 M)*** **(2024, 2020)**

36. (*i*) Why is respiratory pigment needed in multicellular organisms with large body size? ***(1 M)***
(*ii*) Give reasons for the following: ***(2 M)*** **(2024)**
(*a*) Rings of cartilage are present in the throat.
(*b*) Lungs always contain a residual volume of air.
(*c*) The diaphragm flattens and ribs are lifted up when we breathe in.
(*d*) Walls of alveoli contain an extensive network of blood vessels.

37. Mention the pathway of urine starting from the organ of its formation. Name four substances which are re-absorbed from the initial filtrate in the tubular part of the nephron. ***(3 M)*** **(2016)**

38. (*i*) What is double circulation?
(*ii*) Why is the separation of the right side and the left side of the heart useful? How does it help birds and mammals? ***(3 M)*** **(2023)**

39. (*a*) Define excretion.
(*b*) Name the basic filtration unit present in the kidney.
(*c*) Draw excretory system in human beings and label the following organs of excretory system which perform following functions:
(*i*) form urine.
(*ii*) is a long tube which collects urine from kidney.
(*iii*) store urine until it is passed out. ***(5 M)*** **(2018)**

40. (*a*) Why is there a difference in the rate of breathing between aquatic organisms and terrestrial organisms? Explain.
(*b*) Draw a diagram of human respiratory system and label-pharynx, trachea, lungs, diaphragm and alveolar sac on it. ***(5 M)*** **(2020, 2015, 2014)**

41. (*a*) Write the correct sequence of steps followed during journey of oxygen rich blood from lungs to various organs of human body.
(*b*) What happens when the system of blood vessels develop a leak? ***(5 M)*** **(2020)**

42. (*a*) Mention any two components of blood.
(*b*) Trace the movement of oxygenated blood in the body.
(*c*) Write the function of valves present in between atria and ventricles.
(*d*) Write one structural difference between the composition of artery and veins. ***(5 M)*** **(2018, 2016)**

43. (*a*) Draw a diagram of human alimentary canal and label - gall bladder, pancreas, liver and small intestine in it.
(*b*) Give two reasons to explain why absorption of digested food occurs mainly in the small intestine. ***(5 M)*** **(2020)**

44. (*i*) Name the process and explain the type of nutrition found in green plants. List the raw materials required for this process. Give chemical equation for the mentioned process.
(*ii*) Write three events that occur during this process. ***(5 M)*** **(2018)**

6. Control and Coordination

45. Name the part of brain which is responsible for the following actions: ***(2 M)*** **(2023, 2015)**
(*i*) Maintaining posture and balance
(*ii*) Beating of heart
(*iii*) Thinking
(*iv*) Blood pressure

46. Define reflex action. With the help of a flow chart show the path of a reflex action such as sneezing.

(3 M) **(2024, 2023, 2019, 2015)**

47. A squirrel is in a scary situation. Its body has to prepare for either fighting or running away. State the immediate changes that take place in its body so that the squirrel is able to either fight or run? ***(3 M)*** **(2020)**

48. Why is chemical communication better than electrical impulses as a means of communication between cells in a multi-cellular organism? ***(3 M)*** **(2020)**

49. Draw a diagram showing the correct positions of pancreas, thyroid gland, pituitary gland and adrenal gland in human being. ***(3 M)*** **(2016)**

50. What are plant hormones? Name the plant hormones responsible for the following: ***(3 M)*** **(2019, 2016)**

(*i*) Growth of stem

(*ii*) Promotion of cell division

(*iii*) Inhibition of growth

(*iv*) Elongation of cells

51. (*a*) Draw the structure of a neuron and label the following on it: ***(5 M)*** **(2016)**

(*i*) Dendrite

(*ii*) Cell body

(*iii*) Nucleus

(*iv*) Axon

(*b*) Name the parts of a neuron:

(*i*) Where information is acquired.

(*ii*) Through which information travels as an electrical impulse.

(*iii*) Where this impulse must be converted into a chemical signal for onward transmission.

(*c*) Define neuromuscular junction.

52. (*a*) Why is the use of iodised salt advisable? Name the disease caused due to deficiency of iodine in our diet and state its one symptom.

(*b*) How do nerve impulses travel in the body? Explain. ***(5 M)*** **(2019)**

7. How do Organisms Reproduce?

53. Mention the functions of (*a*) Placenta (*b*) Fallopian tubes (*c*) Uterus and (*d*) Ovary in the human female reproductive system. ***(2 M)*** **(2022)**

54. (*a*) Differentiate between binary fission in *Amoeba* and binary fission in *Leishmania*.

(*b*) How does reproduction take place in malarial parasite? ***(2 M)*** **(2022)**

55. What are the functions of testis in the human male reproductive system? Why are these located outside the abdominal cavity? Who is responsible for bringing about changes in appearance seen in boys at the time of puberty? ***(3 M)*** **(2016)**

56. Define the term pollination. Differentiate between self pollination and cross pollination. What is the significance of pollination? ***(3 M)*** **(2020, 2019)**

57. (*i*) Name and explain the two modes of asexual reproduction observed in hydra.

(*ii*) What is vegetative propagation? List two advantages of using this technique. ***(5 M)*** **(2024, 2023, 2022)**

58. (A) (*i*) Name three techniques/devices used by human females to avoid pregnancy. Mention the side effects caused by each.

(*ii*) What will happen if in a human female (*a*) fertilisation takes place, (*b*) an egg is not fertilised? ***(5 M)*** **(2024, 2023, 2017)**

59. (*a*) Draw a diagram to show spore formation in *Rhizopus*.

(*b*) With the help of an example differentiate between the process of Budding and Fragmentation.

(*c*) Why is vegetative propagation practiced for growing some type's of plants? ***(5 M)*** **(2020)**

60. (*a*) Draw a diagram showing germination of pollen on stigma of a flower and mark on it the following organs/parts:

(*i*) Pollen Grain

(*ii*) Pollen tube

(*iii*) Stigma

(*iv*) Female germ cell

(*b*) State the significance of pollen tube.

(*c*) Name the parts of flower that develop after fertilization into

(*i*) Seed

(*ii*) Fruit

(5 M) **(2022, 2020, 2015)**

8. Heredity

61. Sex of an individual is determined by different factors in various species. Some animals rely entirely on the environmental cues, while in some other animals the individuals can change their sex during their lifetime indicating that sex of some species is not genetically determined. However, in human beings, the sex of an individual is largely determined genetically. ***(4 M)*** **(2022)**

(*a*) In what way are the sex chromosomes 'X' and 'Y' different in size? Name the mismatched pair of sex chromosomes in humans.

(*b*) Write the number of pair/pairs of sex chromosomes present in human beings. In which one of the parent (male / female) perfect pair/pairs of sex chromosomes are present?

(*c*) Citing two examples, justify the statement "Sex of an individual is not always determined genetically".

Or

Draw a flow chart to show that sex is determined genetically in human beings.

62. The most obvious outcome of the reproductive process is the generation of individuals of similar design, but in sexual reproduction they may not be exactly alike. The resemblances as well as differences are marked. The rules of heredity determine the process by which traits and characteristics are reliably inherited. Many experiments have been done to study the rules of inheritance. **(2023)**

(*i*) Why an offspring of human being is not a true copy of his parents in sexual reproduction? ***(1 M)***

(*ii*) While performing experiments on inheritance in plants, what is the difference between F_1 and F_2 generation? ***(1 M)***

(*iii*) (A) Why do we say that variations are useful for the survival of a species over time? ***(2 M)***

Or

(*iii*) (B) Study Mendel's cross between two plants with a pair of contrasting characters.

RRYY	×	rryy
Round Yellow		Wrinkled Green

He observed 4 types of combinations in F_2 generation. Which of these were new combinations? Why do new features which are not present in the parents, appear in F_2 generation? ***(2 M)***

63. In order to trace the inheritance of traits Mendel crossed pea plants having one contrasting character or a pair of contrasting characters. When he crossed pea plants having round and yellow seeds with pea plants having wrinkled and green seeds, he observed that no plants with wrinkled and green seeds were obtained in the F_1 generation. When the F_1 generation pea plants were cross-bred by self-pollination, the F_2 generation had seeds with different combinations of shape and colour also. **(2023)**

(*a*) Write any two pairs of contrasting characteristics of pea plant used by Mendel other than those mentioned above. ***(1 M)***

(*b*) Differentiate between dominant and recessive traits. ***(1 M)***

(*c*) State the ratio of the combinations observed in the seeds of F_2 generation (in the above case). What do you interpret from this result? ***(2 M)***

Or

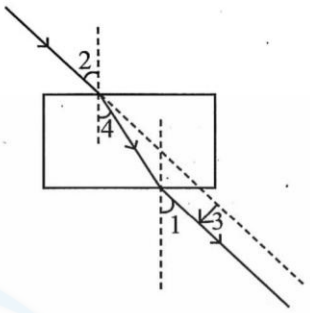
(*c*) Given below is a cross between a pure violet flowered pea plant (V) and a pure white flowered pea plant (v). Diagrammatically explain what type of progeny is obtained in F_1 generation and F_2 generation:

Pure violet flowered plant × Pure white flowered plant.

(V V) (v v) ***(2 M)***

9. Light-Reflection and Refraction

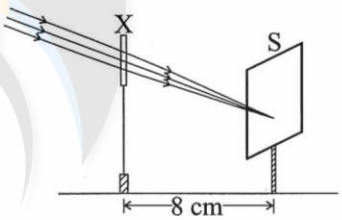
64. The correct sequencing of angle of incidence, angle of emergence, angle of refraction and lateral displacement shown in the following diagram by digits 1, 2, 3 and 4 is: ***(1 M)*** **(2017)**



(*a*) 2, 4, 1, 3 (*b*) 2, 1, 4, 3

(*c*) 1, 2, 4, 3 (*d*) 2, 1, 3, 4

65. A student used a device (X) to obtain/focus the image of a well illuminated distant building on a screen (S) as shown below in the diagram. Select the correct statement about the device (X). ***(1 M)*** **(2015)**



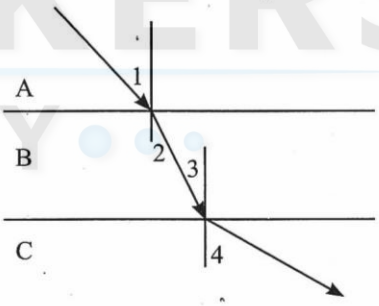
(*a*) The device is a concave lens of focal length 8 cm.

(*b*) This device is a convex mirror of focal length 8 cm.

(*c*) This device is a convex lens of focal length 4 cm.

(*d*) This device is a convex lens of focal length 8 cm

66. A ray of light is incident as shown. If A, B and C are three different transparent media, then which among the following options is true for the given diagram? ***(1 M)*** **(2022)**



(*a*) $\angle 1 > \angle 4$ (*b*) $\angle 1 < \angle 2$

(*c*) $\angle 3 = \angle 2$ (*d*) $\angle 3 > \angle 4$

67. **Assertion (A):** The rainbow is a natural spectrum of sunlight in the sky.

Reason (R): Rainbow is formed in the sky when the sun is overhead and water droplets are also present in air.

(1 M) **(2024)**

68. The absolute refractive indices of glass and water are 4/3 and 3/2 respectively. If the speed of light in glass is 2×10^8 m/s, calculate the speed of light in (*i*) vacuum, (*ii*) water. ***(2 M)*** **(2023, 2015)**

69. (*a*) A security mirror used in a big showroom has radius of curvature 5 m. If a customer is standing at a distance of 20 m from the cash counter, find the position, nature and size of the image formed in the security mirror.

(*b*) Neha visited a dentist in his clinic. She observed that the dentist was holding an instrument fitted with a mirror. State the nature of this mirror and reason for its use in the instrument used by dentist. ***(5 M)*** **(2020)**

70. Draw a ray diagram in each of the following cases to show the formation of image, when the object is placed:

(*i*) between optical centre and principal focus of a convex lens.

(*ii*) anywhere in front of a concave lens.

(*iii*) at 2F of a convex lens.

State the signs and values of magnifications in the above mentioned cases (*i*) and (*ii*). ***(5 M)*** **(2020)**

71. Analyse the following observation table showing variation of image distance (v) with object distance (u) in case of a convex lens and answer the questions that follow, without doing any calculations: ***(5 M)*** **(2017)**

S. No.	Object distance u (cm)	Image distance v (cm)
1	–90	+18
2	–60	+20
3	–30	+30
4	–20	+60
5	–18	+90
6	–10	+100

(*a*) What is the focal length of the convex lens? Give reason in support of your answer.

(*b*) Write the serial number of that observation which is not correct. How did you arrive at this conclusion?

(*c*) Take an appropriate scale to draw ray diagram for the observation at S. No. 4 and find the approximate value of magnification.

72. "A convex lens can form a magnified erect as well as magnified inverted image of an object placed in front of it." Draw ray diagram to justify this statement stating the position of the object with respect to the lens in each case.

An object of height 4 cm is placed at a distance of 20 cm from a concave lens of focal length 10 cm. Use lens formula to determine the position of the image formed.

(5 M) **(2015, 2022, 2016)**

73. The ability of a medium to refract light is expressed in terms of its optical density. Optical density has a definite connotation. It is not the same as mass density. On comparing two media, the one with the large refractive index is optically denser medium than the other. The other medium with a lower refractive index is optically rarer. Also the speed of light through a given medium is inversely proportional to its optical density. **(2023)**

(*i*) Determine the speed of light in diamond if the refractive index of diamond with respect to vacuum is 2.42. Speed of light in vacuum is 3×10^8 m/s. ***(1 M)***

(*ii*) Refractive indices of glass, water and carbon disulphide are 1.5, 1.33 and 1.62 respectively. If a ray of light is incident in these media at the same angle (say θ), then write the increasing order of the angle of refraction in these media. ***(1 M)***

(*iii*) (A) The speed of light in glass is 2×10^8 m/s and in water is 2.25×10^8 m/s. ***(2 M)***

(*a*) Which one of the two is optically denser and why?

(*b*) A ray of light is incident normally at the water-glass interface when it enters a thick glass container filled with water. What will happen to the path of the ray after entering the glass? Give reason.

Or

(B) The absolute refractive indices of water and glass are 4/3 and 3/2 respectively. If the speed of light in glass is 2×10^8 m/s, find the speed of light in (*i*) vacuum and (*ii*) water.

74. Study the data given below showing the focal length of three concave mirrors A, B and C and the respective distances of objects placed in front of the mirrors: **(2024)**

Case	Mirror	Focal Length (cm)	Object Distance (cm)
1	A	20	45
2	B	15	30
3	C	30	20

(*i*) In which one of the above cases the mirror will form a diminished image of the object? Justify your answer.

(1 M)

(*ii*) List two properties of the image formed in case 2.

(1 M)

(*iii*) (A) What is the nature and size of the image formed by mirror C? Draw ray diagram to justify your answer. ***(2 M)***

Or

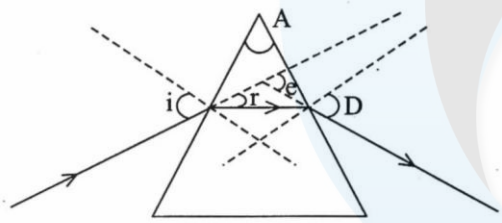
(*iii*) (B) An object is placed at a distance of 18 cm from the pole of a concave mirror of focal length 12 cm. Find the position of the image formed in this case.

(2 M)

10. The Human Eye and The Colourful World

75. Study the following figure in which a student has marked the angle of incidence ($\angle i$), angle of refraction ($\angle r$), angle of emergence ($\angle e$), angle of prism ($\angle A$) and the angle of deviation ($\angle D$). The correctly marked angles are:

***(1 M)* (2016, 2017, 2015)**



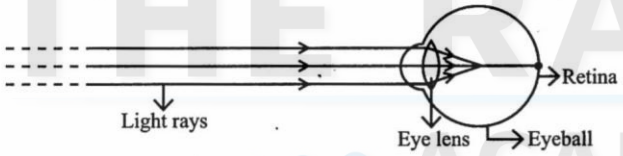
(*a*) $\angle A$ and $\angle i$

(*b*) $\angle A$, $\angle i$ and $\angle r$

(*c*) $\angle A$, $\angle i$, $\angle e$ and $\angle D$

(*d*) $\angle A$, $\angle i$, $\angle r$ and $\angle D$

76. Observe the following diagram and answer the questions following it: ***(2 M)* (2023)**



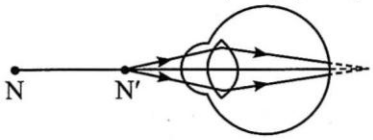
(*i*) Identify the defect of vision shown.

(*ii*) List its two causes.

(*iii*) Name the type of lens used for the correction of this defect.

77. What is a rainbow? Draw a labeled diagram to show the formation of a rainbow. ***(3 M)* (2019, 2017)**

78. Study the diagram given below and answer the questions that follow: ***(3 M)* (2024, 2023, 2018)**



(*i*) Name the defect of vision represented in the diagram. Give reason for your answer.

(*ii*) List two causes of this defect

(*iii*) With the help of a diagram show how this defect of vision is corrected.

79. (*a*) With the help of labeled ray diagram show the path followed by a narrow beam of monochromatic light when it passes through a glass prism.

(*b*) What would happen if this beam is replaced by a narrow beam of white light? ***(3 M)* (2020)**

80. (*a*) A student suffering from myopia is not able to see distinctly the objects placed beyond 5 m. List two possible reasons due to which this defect of vision may have arisen. With the help of ray diagrams, explain

***(5 M)* (2017)**

(*i*) why the student is unable to see distinctly the objects placed beyond 5 m from his eyes.

(*ii*) the type of the corrective lens used to restore proper vision and how this defect is corrected by the use of this lens.

(*b*) If, in this case, the numerical value of the focal length of the corrective lens is 5 m, find the power of the lens as per the new Cartesian sign convention.

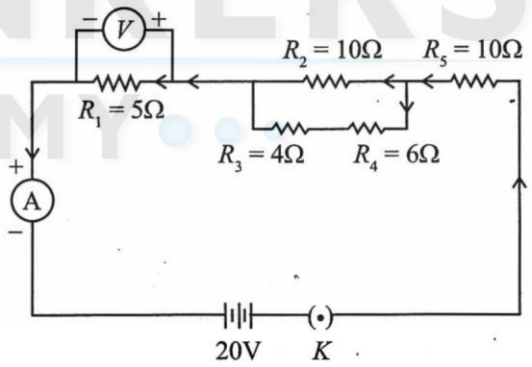
11. Electricity

81. Write the mathematical expression for Joule's law of heating. ***(1 M)* (2020, 2018)**

82. List the factors on which the resistance of a uniform cylindrical conductor of a given material depends.

***(2 M)* (2022, 2018, 2015, 2023)**

83. Study the following circuit and find:



(*i*) Effective resistance of the circuit

(*ii*) Current drawn from the battery

(*iii*) Potential difference across the 5Ω resistor

***(3 M)* (2022)**

84. (*i*) Write the relation between resistance R and electrical resistivity ρ of the material of a conductor in the shape of cylinder of length *l* and area of cross-section A. Hence derive the SI unit of electrical resistivity.

***(5 M)* (2024)**

(*ii*) The resistance of a metal wire of length 3 m is 60 Ω. If the area of cross-section of the wire is 4×10^{-7} m², calculate the electrical resistivity of the wire.

(*iii*) State how would electrical resistivity be affected if the wire (of part '*ii*') is stretched so that its length is doubled. Justify your answer.

85. (*i*) Define electric power. Express it m terms of potential difference (V) and resistance (R). ***(5 M)* (2024)**

(*ii*) An electric oven is designed to work on the mains voltage of 220 V. This oven consumes 11 units of electrical energy in 5 hours. Calculate:

(*a*) power rating of the oven

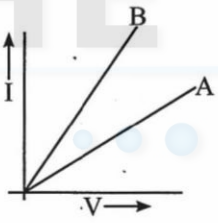
(*b*) current drawn by the oven

(*c*) resistance of the oven when it is red hot

86. (*i*) How is electric current related to the potential difference across the terminals of a conductor? Draw a labeled circuit diagram to verify this relationship.

(*ii*) Why should an ammeter have low resistance?

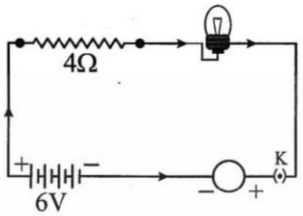
(*iii*) Two V - I graphs A and B for series and parallel combinations of two resistors are as shown. Giving reason state which graph shows (*a*) series, (*b*) parallel combination of the resistors. ***(5 M)* (2023)**



87. (*a*) With the help of a suitable circuit diagram prove that the reciprocal of the equivalent resistance of a group of resistances joined in parallel is equal to the sum of the reciprocals of the individual resistances.

(*b*) In an electric circuit two resistors of 12 Ω each are joined in parallel to a 6 V battery. Find the current drawn from the battery. ***(5 M)* (2019, 2015)**

88. An electric lamp of resistance 20 Ω and a conductor of resistance 4 Ω are connected to a 6 V battery as shown in the circuit. Calculate: ***(5 M)* (2019, 2015)**



(*a*) The total resistance of the circuit,

(*b*) The current through the circuit,

(*c*) The potential difference across the (*i*) electric lamp and (*ii*) conductor,

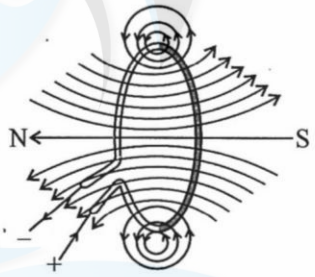
(*d*) Power of the lamp.

12. Magnetic Effects of Electric Current

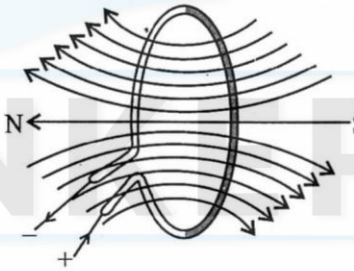
89. The correct pattern of magnetic field lines of the field produced by a current carrying circular loop is:

***(1 M)* (2023)**

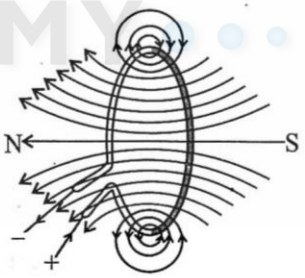
(*a*)

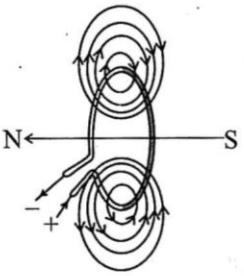


(*b*)

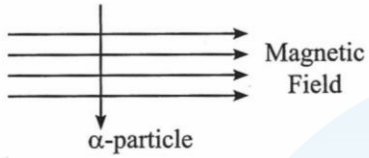


(*c*)



(*d*) 

90. An alpha particle enters a uniform magnetic field as shown. The direction of force experienced by the alpha particle is: ***(1 M)*** **(2023)**



(*a*) towards right

(*b*) towards left

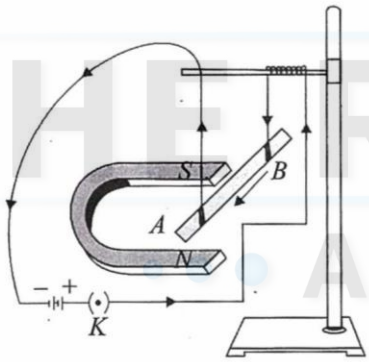
(*c*) into the page

(*d*) out of the page

91. **Assertion (A):** A current carrying straight conductor experiences a force when placed perpendicular to the direction of magnetic field.

Reason (R): The net charge on a current carrying conductor is always zero. ***(1 M)*** **(2023)**

92. As shown in the diagram an aluminum rod '*AB*' is suspended horizontally between the two poles of a strong horse shoe magnet in such a way that the axis of rod is horizontal and the direction of the magnetic field is vertically upward. The rod is connected in series with a battery and a key. ***(2 M)*** **(2022)**



State giving reason:

(*a*) What is observed when a current is passed through the aluminum rod from end *B* to end *A*?

(*b*) What change is observed in a situation in which the axis of the rod '*AB*' is moved and aligned parallel to the magnetic field and current is passed in the rod in the same direction?

93. "Magnetic field is a physical quantity that has both direction and magnitude." How can this statement be proved with the help of magnetic field lines of a bar magnet? ***(2 M)*** **(2022)**

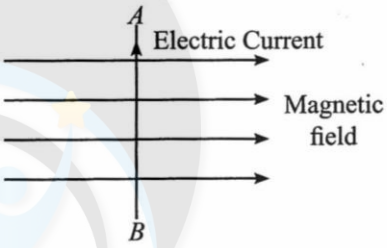
94. (*i*) Draw the pattern of magnetic field lines of

(1) a current carrying solenoid

(2) a bar magnet

(*ii*) List two distinguishing features between the two fields. ***(3 M)*** **(2023, 2022, 2019, 2015)**

95. (*a*) State Fleming's left hand rule. Apply this rule to determine the direction of force experienced by a straight current carrying conductor *AB* placed in a uniform magnetic field as shown.



(*b*) What will happen to an electron which enters in the same field in the same direction in which the current is flowing in the conductor *AB*? Give reason to justify your answer. ***(3 M)*** **(2024)**

13. Our Environment

96. Write one difference between biodegradable and non-biodegradable wastes. List two impacts of each type of the accumulated waste on environment if not disposed of properly. ***(3 M)*** **(2024, 2023, 2022)**

97. Use of pesticides to protect our crops affect organisms at various trophic levels especially human beings. Name the phenomenon involved and explain how does it happen. ***(3 M)*** **(2024, 2023)**

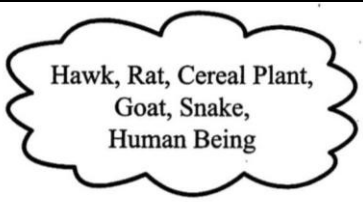
98. A gas 'X' which is a deadly poison is found at the higher level of atmosphere and performs an essential function.

Name the gas and write the function performed by this gas in the atmosphere. Which chemical is linked to the decrease in the level of this gas? What measures have been taken by an international organization to check the depletion of the layer containing this gas? ***(3 M)*** **(2024)**

99. (*i*) Construct a food chain of four trophic levels comprising the following:
Hawk, snake, plants, rat.

(*ii*) 20,000 J of energy was transferred by the producers to the organism of second trophic level. Calculate the amount of energy that will be transferred by organisms of the third trophic level to the organisms of the fourth trophic level. ***(3 M)*** **(2023, 2022, 2017)**

100. (*a*) From the following group of organisms create a food chain which is the most advantageous for Human beings in terms of energy.



(*b*) State the possible disadvantage if the cereal plant is growing in soil rich in pesticides.

(*c*) Construct a food web using the organisms mentioned above. ***(3 M)*** **(2020)**