CBSE 2024 Science — Set 1

English Medium

Time Allowed: 3 Hours | Maximum Marks: 80

General Instructions:

1. This question paper contains 39 questions. All questions are compulsory.
2. Section A has 20 MCQs carrying 1 mark each.
3. Section B has 6 questions carrying 2 marks each.
4. Section C has 7 questions carrying 3 marks each.
5. Section D has 3 questions carrying 5 marks each.
6. Section E has 3 case-study based questions carrying 4 marks each.
7. Draw neat diagrams wherever required.

Section A

Multiple Choice Questions (1 mark each)

Q.1 [1 mark]

When 2 mL of sodium hydroxide solution is added to few pieces of granulated zinc in a test tube and then warmed, the reaction that occurs can be written in the form of a balanced chemical equation as:

(a) $NaOH + Zn \rightarrow Na_2ZnO_2 + H_2O$

(b) $2NaOH + Zn \rightarrow Na_2ZnO_2 + H_2$

(c) $2NaOH + Zn \rightarrow Na_2ZnO_2 + H_2$

(d) $2NaOH + Zn \rightarrow Na_2ZnO_2 + H_2O$

Q.2 [1 mark]

Select from the following a decomposition reaction in which source of energy for decomposition is light:

(a) $2FeSO_4 \rightarrow Fe_2O_3 + SO_2 + SO_3$

(b) $2H_2O \rightarrow 2H_2 + O_2$

(c) $2AgBr \rightarrow 2Ag + Br_2$

(d) $CaCO_3 \rightarrow CaO + CO_2$

Q.3 [1 mark]

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

(a) Bromine and Mercury

(b) Mercury and Iodine

(c) Mercury and Bromine

(d) Iodine and Mercury

Q.4 [1 mark]

Carbon compounds:

(i) are good conductors of electricity.

(ii) are bad conductors of electricity.
(iii) have strong forces of attraction between their molecules.
(iv) have weak forces of attraction between their molecules.
The correct statements are:

(a) (i) and (ii)
(b) (ii) and (iii)
(c) (ii) and (iv)
(d) (i) and (iii)

Q.5 [1 mark]

Consider the following compounds:
$FeSO_4$; $CuSO_4$; $CaSO_4$; Na_2CO_3
The compound having maximum number of water of crystallisation in its crystalline form in one molecule is:

(a) $FeSO_4$
(b) $CuSO_4$
(c) $CaSO_4$
(d) Na_2CO_3

Q.6 [1 mark]

Oxides of aluminium and zinc are:

(a) acidic
(b) basic
(c) amphoteric
(d) neutral

Q.7 [1 mark]

$MnO_2 + 4HCl \rightarrow MnCl_2 + 2H_2O + Cl_2$
The reaction given above is a redox reaction because in this case:

(a) MnO_2 is oxidised and HCl is reduced.
(b) HCl is oxidised.

(c) MnO_2 is reduced.

(d) MnO_2 is reduced and HCl is oxidised.

Q.8 [1 mark]

Consider the following statements:

(i) The sex of a child is determined by what it inherits from the mother.

(ii) The sex of a child is determined by what it inherits from the father.

(iii) The probability of having a male child is more than that of a female child.

(iv) The sex of a child is determined at the time of fertilisation when male and female gametes fuse to form a zygote.

The correct statements are:

(a) (i) and (iii)

(b) (ii) and (iv)

(c) (iii) and (iv)

(d) (i) and (iii)

Q.9 [1 mark]

Chromosomes:

(i) carry hereditary information from parents to the next generation.

(ii) are thread like structures located inside the nucleus of an animal cell.

(iii) always exist in pairs in human reproductive cells.

(iv) are involved in the process of cell division.

The correct statements are:

(a) (i) and (ii)

(b) (iii) and (iv)

(c) (i), (ii) and (iv)

(d) (i) and (iv)

Q.10 [1 mark]

In a nerve cell, the site where the electrical impulse is converted into a chemical signal is known as:

(a) Axon
(b) Dendrites
(c) Neuromuscular junction
(d) Cell body

Q.11 [1 mark]

A stomata closes when:
(i) it needs carbon dioxide for photosynthesis.
(ii) it does not need carbon dioxide for photosynthesis.
(iii) water flows out of the guard cells.
(iv) water flows into the guard cells.
The correct reason(s) in this process is/are:

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

Q.12 [1 mark]

At what distance from a convex lens should an object be placed to get an image of the same size as that of the object on a screen?

(a) Beyond twice the focal length of the lens.
(b) At the principal focus of the lens.
(c) At twice the focal length of the lens.
(d) Between the optical centre of the lens and its principal focus.

Q.13 [1 mark]

The lens system of human eye forms an image on a light sensitive screen, which is called as:

(a) Cornea
(b) Ciliary muscles
(c) Optic nerves

(d) Retina

Q.14 [1 mark]

The pattern of the magnetic field produced inside a current carrying solenoid is: (Options show diagrams)

(a) Parallel straight lines

(b) Concentric circles

(c) Parallel straight lines (like a bar magnet)

(d) Diverging lines from both ends

(a) Pattern (a) - parallel lines going in one direction

(b) Pattern (b) - concentric circular field

(c) Pattern (c) - uniform parallel lines inside the solenoid

(d) Pattern (d) - lines diverging from both poles

Q.15 [1 mark]

Identify the food chain in which the organisms of the second trophic level are missing:

(a) Grass, goat, lion

(b) Zooplankton, Phytoplankton, small fish, large fish

(c) Tiger, grass, snake, frog

(d) Grasshopper, grass, snake, frog, eagle

Q.16 [1 mark]

In which of the following organisms, multiple fission is a means of asexual reproduction?

(a) Yeast

(b) Leishmania

(c) Paramoecium

(d) Plasmodium

Q.17 [1 mark]

Assertion (A): Hydrogen gas is not evolved when zinc reacts with nitric acid.

Reason (R): Nitric acid oxidises the hydrogen gas produced to water and itself gets reduced.

Select the correct option:

(a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).
(b) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).
(c) Assertion (A) is true, but Reason (R) is false.
(d) Assertion (A) is false, but Reason (R) is true.

Q.18 [1 mark]

Assertion (A): Accumulation of harmful chemicals is maximum in the organisms at the highest trophic level of a food chain.

Reason (R): Harmful chemicals are sprayed on the crops to protect them from diseases and pests.

Select the correct option:

(a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).
(b) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).
(c) Assertion (A) is true, but Reason (R) is false.
(d) Assertion (A) is false, but Reason (R) is true.

Q.19 [1 mark]

Assertion (A): The rate of breathing in aquatic organisms is much faster than in terrestrial organisms.

Reason (R): The amount of oxygen dissolved in water is very high as compared to the amount of oxygen in air.

Select the correct option:

(a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).
(b) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).
(c) Assertion (A) is true, but Reason (R) is false.
(d) Assertion (A) is false, but Reason (R) is true.

Q.20 [1 mark]

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.
Select the correct option:

(a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).
(b) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).
(c) Assertion (A) is true, but Reason (R) is false.
(d) Assertion (A) is false, but Reason (R) is true.

Section B

Very Short Answer Questions (2 marks each)

Q.21 [2 marks]

Name the type of chemical reaction in which calcium oxide reacts with water. Justify your answer by giving a balanced chemical equation for the chemical reaction.

Q.22 [2 marks]

State one role of each of the following in human digestive system:
(i) Hydrochloric acid
(ii) Villi

(iii) Anal Sphincter

(iv) Lipase

Q.23 [2 marks]

(A) How is the movement of leaves of a sensitive plant different from the downward movement of the roots?

OR

Q.23 [2 marks]

(B) (OR for Q23) There is a hormone which regulates carbohydrate, protein and fat metabolism in our body. Name the hormone and the gland which secretes it. Why is it important for us to have iodised salt in our diet?

Q.24 [2 marks]

An object is placed at a distance of 10 cm from a convex mirror of focal length 15 cm. Find the position of the image formed by the mirror.

Q.25 [2 marks]

(A) Show how you would connect three resistors each of resistance 6 Ω, so that the combination has a resistance of 9 Ω. Also justify your answer.

OR

Q.25 [2 marks]

(B) (OR for Q25) In the given circuit, two resistors of 1 Ω and 2 Ω are connected in series and the combination is connected in parallel with a 2 Ω resistor. Calculate the equivalent resistance of the circuit.

Q.26(a) [2 marks]

(i) Two magnetic field lines do not intersect each other. Why?

(ii) How is a uniform magnetic field in a given region represented? Draw a diagram in support of your answer.

Section C

Short Answer Questions (3 marks each)

Q.27 [3 marks]

Write one chemical equation each for the chemical reaction in which the following have taken place:

(i) Change in colour

(ii) Change in temperature

(iii) Formation of precipitate

Mention colour change/temperature change (rise/fall)/compound precipitated along with equation.

Q.28(a) [3 marks]

(i) The pH of a sample of tomato juice is 4.6. How is this juice likely to be in taste?

(ii) How do we differentiate between a strong acid and a weak base in terms of ion-formation in aqueous solutions?

(iii) The acid rain can make the survival of aquatic animals difficult. How?

Q.29(a) [3 marks]

(i) Why is respiratory pigment needed in multicellular organisms with large body size?

(ii) Give reasons for the following:

(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.

Q.30 [3 marks]

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

Q.31 [3 marks]

Study the diagram given below and answer the questions that follow:

(The diagram shows an eye with two focal points N and N, representing a vision defect)

(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.

Q.32 [3 marks]

Name and state the rule to determine the direction of:

(i) magnetic field produced around a current carrying straight conductor.

(ii) force experienced by a current carrying straight conductor placed in a magnetic field which is perpendicular to it.

Q.33 [3 marks]

(A) Plants → Deer → Lion

In the given food chain, what will be the impact of removing all the organisms of second trophic level on the first and third trophic level? Will the impact be the same for the organisms of the third trophic level in the above food chain if they were present in a food web? Justify.

OR

Q.33 [3 marks]

(B) (OR for Q33) A gas 'X' which is a deadly poison is found at the higher levels 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?

Section D

Long Answer Questions (5 marks each)

Q.34 [5 marks]

(A) (i) Define a homologous series of carbon compounds.

(ii) Why is the melting and boiling points of C_3H_8 higher than that of C_2H_6 or C_2H_4?

(iii) Why do we NOT see any gradation in chemical properties of a homologous series compounds?

(iv) Write the name and structures of (i) aldehyde and (ii) ketone with molecular formula C_3H_6O.

OR

Q.34 [5 marks]

(B) (OR for Q34) (i) Write the name and structure of an organic compound 'X' having two carbon atoms in its molecule and its name is suffixed with '-ol'.

(ii) What happens when 'X' is heated with excess concentrated sulphuric acid at 443 K? Write the chemical equation for the reaction stating the conditions for the reaction. Also state the role played by concentrated sulphuric acid in the reaction.

(iii) Name and draw the electron dot structure of hydrocarbon produced in the above reaction.

Q.35 [5 marks]

(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?

OR

Q.35 [5 marks]

(B) (OR for Q35) (i) Draw a diagram showing spore formation in Rhizopus

and label the (a) reproductive and (b) non-reproductive parts. Why does Rhizopus not multiply on a dry slice of bread?

(ii) Name and explain the process by which reproduction takes place in Hydra.

Q.36 [5 marks]

(A) (i) Define electric power. Express it in terms of potential difference (V) and resistance (R).

(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

OR

Q.36 [5 marks]

(B) (OR for Q36) (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.

(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} m^2, 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.

Q.37(a) [4 marks]

Case Study Q37 (A): In a particular village, people belonging to different castes, religions and backgrounds are living together. They have been following certain traditional practices from generation to generation. Some traditions may be scientifically justified while others cannot be.

(i) What tradition from the above is scientifically justified and which one is not? Give one example of each.

Q.37(b) [4 marks]

Case Study Q37 (A continued):

(ii) Justify your view on the tradition that is not scientifically justified.

Q.37(c) [4 marks]

Case Study Q37 (A continued):

(iii) (A) The trait that a particular person has, is it possible that it may not be expressed in future generations? Explain with an example.

Q.37(d) [4 marks]

Case Study Q37 (B): Ashwani's family goes on a holiday. At some place between 'A' and 'B' while travelling on a highway, a beautiful rainbow is seen. Ashwani's father stops the car and explains the formation of the rainbow to Ashwani.

(i) To see the rainbow, in which direction should Ashwani face — towards 'A' or towards 'B'? Explain.

(ii) What are the conditions for the rainbow to be seen?

Section E

Case Study Based Questions (4 marks each)

Q.38 [4 marks]

Case Study Q38: Mendel worked out the rules of heredity by working on garden pea using a number of visible contrasting characters. He conducted several experiments by making a cross with one or two pairs of contrasting characters of pea plant. On the basis of his observations he gave some interpretations which helped to study the mechanism of inheritance.

(i) When Mendel crossed pea plants with pure tall and pure short characteristics to produce F_1 progeny, which two observations were made by him in F_1 plants?

(ii) Write one difference between dominant and recessive trait.

(iii) (A) In a cross with two pairs of contrasting characters:

RRYY × rryy (Round Yellow × Wrinkled Green)

Mendel observed 4 types of combinations in F_2 generation. By which method did he obtain F_2 generation? Write the ratio of the parental combinations obtained and what conclusions were drawn from this experiment.

OR

Q.38 [4 marks]

Case Study Q38 (iii) (B) (OR): Justify the statement: 'It is possible that a trait is inherited but may not be expressed.'

Q.39(a) [4 marks]

Case Study Q39: 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:

Mirror A: Focal length = 20 cm, Object distance = 45 cm

Mirror B: Focal length = 15 cm, Object distance = 30 cm

Mirror C: Focal length = 10 cm, Object distance = 20 cm

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

Q.39(b) [4 marks]

Case Study Q39 continued:

(ii) List two properties of the image formed in case 2 (Mirror B: f = 15 cm,

object at 30 cm).

Q.39(c) [4 marks]

Case Study Q39 continued:

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

OR

Q.39(c) [4 marks]

Case Study Q39 (iii) (B) (OR): 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.

Q.0 [0 mark]

Case Study Q37 (Section E - Electrolytic Refining): 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.

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

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

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

Q.0 [0 mark]

Case Study Q37 (iii) (B) (OR): 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.