CBSE 2023 Science — Set 2

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]

Which of the following is an example of endothermic process?

(a) Formation of slaked lime
(b) Decomposition of vegetable matter into compost
(c) Dissolution of ammonium chloride in water
(d) Digestion of food in our body

Q.2 [1 mark]

In the given experimental set-up, if the experiment is carried out separately with each of the following solutions the cases in which the bulb will glow is/are:

(i) Dilute hydrochloric acid
(ii) Dilute sulphuric acid
(iii) Glucose solution
(iv) Alcohol

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

Q.3 [1 mark]

In order to balance the following chemical equation, the values of the coefficients x and y respectively are:

$x\ Pb(NO_3)_2 \xrightarrow{Heat} 2\ PbO + y\ NO_2 + O_2$

(a) 2, 4
(b) 2, 2
(c) 2, 3
(d) 4, 2

Q.4 [1 mark]

When zinc reacts with sodium hydroxide, the product formed is:

(a) Sodium oxide
(b) Sodium zincate
(c) Zinc hydroxide
(d) Zinc oxide

Q.5 [1 mark]

Among the following, the metal with lowest density is:

(a) Lithium
(b) Lead
(c) Magnesium
(d) Aluminium

Q.6 [1 mark]

The number of electrons in the outermost shell of the atom of a non-metal can be:

(a) 1, 2 or 3
(b) 3, 4 or 5
(c) 5, 6 or 7
(d) 5, 6 or 8

Q.7 [1 mark]

The total number of electrons shared in the formation of an ethyne molecule is:

(a) 6
(b) 3
(c) 10
(d) 4

Q.8 [1 mark]

Sphincter muscles are present at the exit of:

(a) Stomach and small intestine
(b) Stomach and anus
(c) Small intestine and large intestine
(d) Oesophagus and stomach

Q.9 [1 mark]

In the following diagram, identify the cells through which massive amounts of gaseous exchange takes place for photosynthesis:

[Diagram shows cross-section of a leaf with labels I, II, III, IV pointing to different cell layers]

(a) I
(b) IV
(c) III
(d) II

Q.10 [1 mark]

During vigorous exercise, the occurrence of cramps in the outer muscles of an athlete is due to the conversion of pyruvate to:

(a) Glucose
(b) Ethanol
(c) Lactic acid
(d) Lactose

Q.11 [1 mark]

Plants that bear unisexual flowers are:

(a) Mustard and Papaya
(b) Hibiscus and Watermelon
(c) Mustard and Hibiscus
(d) Watermelon and Papaya

Q.12 [1 mark]

When an 'X' bearing sperm fertilises the egg, the resulting zygote has the following combination of chromosomes:

(a) 44 + XX
(b) 44 + XY
(c) 22 + XX
(d) 22 + XY

Q.13 [1 mark]

An object is placed in front of a convex mirror at infinity. According to the New Cartesian Sign Convention, the sign of the focal length and the sign of the image distance in this case are respectively:

(a) +, –
(b) –, +
(c) –, –
(d) +, +

Q.14 [1 mark]

For verifying Ohm's law, we design an electric circuit diagram in which we show the arrangement of different circuit components. We find that with respect to the resistor, the:

(a) ammeter is connected in parallel and the voltmeter in series.
(b) ammeter is connected in series and the voltmeter in parallel.
(c) ammeter and voltmeter are both connected in series.
(d) ammeter and voltmeter are both connected in parallel.

Q.15 [1 mark]

In a resistive circuit if the current is increased to two times, the percentage change in the amount of heat dissipated in the circuit would be:

(a) 400%
(b) 300%

(c) 200%
(d) 100%

Q.16 [1 mark]

A positron enters a uniform magnetic field at right angles to it as shown. The direction of force experienced by the positron will be:
[Diagram shows a positron moving to the right with magnetic field pointing into the page]

(a) to the right
(b) to the left
(c) into the page
(d) out of the page

Q.17 [1 mark]

Assertion (A): Sodium oxide is an amphoteric oxide.
Reason (R): Metal oxides which react with both acids as well as bases are known as amphoteric oxides.

(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): When a bacterium divides into two, and the resultant two bacteria divide again, the four bacteria produced would be almost similar.
Reason (R): DNA copying involves small inaccuracies in the reproduction process.

(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): A person suffering from myopia cannot see the distant objects clearly.

Reason (R): A converging lens is used for the correction of myopic eye as it can form real as well as virtual images of the objects placed in front of it.

(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): Magnetic field lines do not intersect each other.

Reason (R): Magnetic field lines are imaginary lines, the tangent to which at any point gives the direction of the field at that point.

(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]

(a) What is observed when aqueous solutions of potassium iodide and lead nitrate are mixed together? Name the type of reaction and write the chemical equation for the reaction that occurs.

OR

Q.21 [2 marks]

OR: When copper powder is heated in a watch glass, a black substance is formed.

(i) Why is this black substance formed? Name it.

(ii) How can this black substance be reversed to its original form?

Q.22 [2 marks]

(a) Why is it important to prevent oxygenated and deoxygenated blood from mixing in birds and mammals?

(b) Which animals can tolerate some mixing of the oxygenated and deoxygenated blood streams? On what factor does the body temperature of these animals depend?

Q.23 [2 marks]

Mendel crossed a pure tall pea plant (TT) with a pure short pea plant (tt) and obtained all tall plants in F_1 generation.

(a) What is the gene combination present in the plants of F_1 generation?

(b) Give reason why only tall plants are observed in F_1 progeny.

(c) What will be the ratio of the plants obtained in the F_2 generation when F_1 plants are self-pollinated?

Q.24 [2 marks]

(a) When and where does a rainbow appear in the sky? Draw a labelled ray diagram to show its formation.

OR

Q.24 [2 marks]

OR: (b) What is scattering of light? Why does the clear sky appear blue?

Q.25 [2 marks]

V–I graph for two conducting wires A and B are as shown. If both wires are of the same length and same diameter, which of the two is made of a material of high resistivity? Give reasons to justify your answer.

[Graph shows two straight lines through origin; wire B has steeper slope than wire A]

Q.26 [2 marks]

We do not clean ponds or lakes but an aquarium needs to be cleaned regularly. Why?

Section C

Short Answer Questions (3 marks each)

Q.27 [3 marks]

Silver chloride kept in a china dish turns grey in sunlight.

(a) Write the colour of silver chloride when it was kept in the china dish.

(b) Name the type of chemical reaction taking place and write the chemical equation for the reaction.

(c) State one use of the reaction. Name one more chemical which can be used for the same purpose.

Q.28 [3 marks]

With the help of suitable chemical equations, list the two main differences between roasting and calcination. How is metal reduced from the product obtained after roasting/calcination of the ore? Write the chemical equation for the reaction involved.

Q.29 [3 marks]

(a) (i) What is the first step in the breakdown of glucose during aerobic and anaerobic respiration? Where does it take place?

(ii) ATP is called the energy currency of the cell. Why?

(iii) What is meant by "residual volume of air" in a breathing cycle?

OR

Q.29 [3 marks]

OR: (b) Write in sequence the steps for experimental verification of the fact that "sunlight is essential for photosynthesis".

Q.30 [3 marks]

Name the hormone released and the gland which secretes it in human beings during scary situations. How does the body respond to enable it to deal with the situation?

Q.31 [3 marks]

(a) A student has focussed the image of an object of height 3 cm on a white screen using a concave mirror of focal length 12 cm. If the distance of the object from the mirror is 18 cm, find the values of the following:

(i) Distance of the image from the mirror

(ii) Height of the image

OR

Q.31 [3 marks]

OR: (b) Define power of a lens. The focal length of a lens is -10 cm. Write the nature of the lens and find its power. If an object is placed at a distance of 20 cm from the optical centre of this lens, according to the New Cartesian Sign Convention, what will be the sign of magnification in this case?

Q.32 [3 marks]

Explain the meaning of overloading of an electrical circuit. List two possible causes due to which overloading may occur in household circuits. Write one preventive measure that should be taken to avoid overloading of domestic circuits.

Q.33 [3 marks]

Explain how some harmful chemicals enter our bodies through the food chain. Why is the concentration of these harmful chemicals found to be maximum in human beings?

Section D

Long Answer Questions (5 marks each)

Q.34 [5 marks]

(a) An acid 'X' and an alcohol 'Y' react with each other in the presence of an acid catalyst to form a sweet smelling substance 'Z'. Identify 'X', 'Y' and 'Z'. Write the chemical equation for the reaction involved and name it. The substance 'Z' on treatment with sodium hydroxide produces back the alcohol 'Y' and sodium ethanoate. Write the chemical equation for the reaction involved and name it, giving justification for the name.

OR

Q.34 [5 marks]

OR: (b)

(i) Name the simplest saturated hydrocarbon. Draw its electron dot structure. Which type of bonds exist in this compound?

(ii) Name any two mixtures of the carbon compound used as a fuel in daily life, of which the above mentioned compound is an important component.

(iii) In which homologous series of carbon compounds can this compound be placed? Write the general formula of the series.

(iv) Which type of flame is produced on burning it?

Q.35 [5 marks]

(a)

(i) List three points of difference between nervous and hormonal mechanisms for control and coordination in animals.

(ii) How are auxins related with the bending of plant shoot towards unidirectional light? Explain.

OR

Q.35 [5 marks]

OR: (b)

(i) Name the disorder that a person is likely to suffer from due to the following:

(I) Over-secretion of growth hormone

(II) Deficiency of oestrogen in females

(III) Less secretion of thyroxine

Also name the gland that secretes each of the hormones mentioned above.

(ii) How is the timing and amount of hormone released regulated? Explain with the help of an example.

Q.36 [5 marks]

(a) An object is placed in front of a convex lens of focal length f. If the distance of the object from the lens is 2f, draw a ray diagram to show the formation of the image. Write the value of magnification in this case.

(b) A student has focussed the image of a candle flame on a white screen using a convex lens. The situation is as given below:

Length of the flame = 2 cm

Focal length of the lens = 12 cm

Distance of the flame from the lens = 16 cm

If the flame is perpendicular to the principal axis of the lens, calculate the

values of the following:

(i) Distance of the image from the lens

(ii) Length of the image formed

Q.37(a) [4 marks]

Case Study: The teacher while conducting practicals in the laboratory divided the students into three groups and gave them various solutions to find out their pH and classify them into acidic, basic and neutral solutions.

Group A - Lemon juice, vinegar, colourless aerated drink

Group B - Tomato juice, coffee, ginger juice

Group C - Sodium hydroxide, sodium chloride, lime water

(a) For the solutions provided, which group is/are likely to have pH (i) less than 7, and (ii) greater than 7?

(a) Group A has pH < 7 for all; Group C has pH > 7 for NaOH and lime water

(b) Group B has pH < 7 for all; Group A has pH > 7 for all

(c) Group C has pH < 7 for all; Group A has pH > 7 for all

(d) Group A and B both have pH > 7; Group C has pH < 7

Q.37(b) [4 marks]

Case Study: The teacher while conducting practicals in the laboratory divided the students into three groups and gave them various solutions to find out their pH.

Group A - Lemon juice, vinegar, colourless aerated drink

Group B - Tomato juice, coffee, ginger juice

Group C - Sodium hydroxide, sodium chloride, lime water

(b) List two ways of determining pH of a solution.

Q.37(c) [4 marks]

Case Study: pH in daily life.

(c) Explain, why the sour substances such as lemon juice are effective in cleaning the tarnished copper vessels.

OR

Q.37(c) [4 marks]

OR: (c) "pH has great importance in our daily life." Justify this statement by giving two examples.

Q.38(a) [4 marks]

Case Study: All the reproductive methods of living organisms are broadly categorized into two types: 1. Asexual reproduction, and 2. Sexual reproduction. Asexual reproduction involves the participation of a single parent without the formation of gametes, fertilisation and transfer of genetic material. This method is a common means of rapidly increasing offsprings under favourable conditions.

(a) Name the type of fission that occurs in Leishmania and Plasmodium.

(a) Binary fission in both
(b) Multiple fission in both
(c) Binary fission in Leishmania; Multiple fission in Plasmodium
(d) Multiple fission in Leishmania; Binary fission in Plasmodium

Q.38(b) [4 marks]

Case Study: Asexual reproduction involves the participation of a single parent without the formation of gametes.

(b) Write one advantage of sexual mode of reproduction over asexual reproduction.

Q.38(c) [4 marks]

Case Study: Asexual reproduction is a common means of rapidly increasing offsprings under favourable conditions.

(c) Give reasons why:
(i) Colonies of yeast fail to multiply in water but multiply in sugar solution.
(ii) Rhizopus individuals do not grow on a dry slice of bread.

OR

Q.38(c) [4 marks]

OR: (c) Name the filamentous structures a student could identify when he collected water from a pond that appeared dark green. How do these organisms multiply? Explain.

Q.39(a) [4 marks]

Case Study: Consider the following electrical circuit diagram in which nine identical resistors of 3 Ω each are connected as shown. If the reading of the ammeter A_1 is 1 ampere, answer the following:
[Circuit shows three groups of three 3Ω resistors in parallel, connected in series with each other. Ammeters A_1, A_2, A_3 and voltmeters V_1, V_2 are connected.]

(a) What is the relationship between the readings of A_1 and A_3? Give reasons for your answer.

Q.39(b) [4 marks]

Case Study: Electrical circuit with nine identical 3 Ω resistors. A_1 reads 1 ampere.

(b) What is the relationship between the readings of A_2 and A_3?

Q.39(c) [4 marks]

Case Study: Electrical circuit with nine identical 3 Ω resistors. A_1 reads 1 ampere.

(c) Determine the reading of the voltmeter V_1.

OR

Q.39(c) [4 marks]

OR: (c) Find the total resistance of the circuit.