

## Chemistry

### GENERAL INSTRUCTIONS

1. Answer all questions from Section A.
2. Answer any five questions from Section B.
3. Answer any four questions from Section C.
4. Answer any two questions from Section D.
5. All working, including rough work, should be shown clearly.
6. The use of calculators is not permitted.
7. Atomic masses may be taken as: H = 1, C = 12, N = 14, O = 16, Na = 23, Mg = 24, Cl = 35.5, K = 39, Ca = 40, Fe = 56.
8. Questions requiring balanced chemical equations must include appropriate conditions wherever necessary.

### SECTION A – 20 MARKS

**Question 1. Choose the correct option in each of the following: [10 × 1 = 10]**

- (i) The number of significant figures in 0.005060 is: (a) 3 (b) 4 (c) 5 (d) 6
- (ii) The empirical formula of a compound containing 40% carbon, 6.67% hydrogen and 53.33% oxygen is: (a) CHO (b) CH<sub>2</sub>O (c) C<sub>2</sub>H<sub>4</sub>O<sub>2</sub> (d) C<sub>6</sub>H<sub>12</sub>O<sub>6</sub>
- (iii) The maximum number of electrons that can be accommodated in the shell for which  $n = 3$  is: (a) 8 (b) 18 (c) 32 (d) 9
- (iv) Which of the following sets of quantum numbers is not permissible? (a)  $n = 2, l = 1, m = 0$  (b)  $n = 3, l = 2, m = -2$  (c)  $n = 2, l = 2, m = 0$  (d)  $n = 4, l = 3, m = +2$
- (v) The element having the highest first ionisation enthalpy among Li, Be, B and C is: (a) Li (b) Be (c) B (d) C
- (vi) The most electronegative element is: (a) O (b) Cl (c) F (d) N
- (vii) In  $\text{Zn} + \text{CuSO}_4 \rightarrow \text{ZnSO}_4 + \text{Cu}$ , zinc acts as: (a) oxidising agent (b) reducing agent (c) catalyst (d) acid
- (viii) The oxidation number of chromium in  $\text{K}_2\text{Cr}_2\text{O}_7$  is: (a) +3 (b) +4 (c) +6 (d) +7
- (ix) According to de Broglie's equation, the wavelength associated with a moving particle is inversely proportional to its: (a) velocity (b) mass only (c) momentum (d) kinetic energy
- (x) Which of the following has the smallest atomic radius? (a) Na (b) Mg (c) Al (d) Cl

**Question 2. Answer the following briefly: [5 × 2 = 10]**

- (i) Define molarity and molality. State one difference between them.
- (ii) Calculate the number of molecules present in 0.25 mol of CO<sub>2</sub>.
- (iii) State Heisenberg's uncertainty principle.
- (iv) Why does atomic radius generally decrease from left to right across a period?
- (v) Identify the species undergoing oxidation and reduction in:  $2\text{FeCl}_2 + \text{Cl}_2 \rightarrow 2\text{FeCl}_3$ .

## SECTION B – 20 MARKS

Answer any FIVE questions. [ $5 \times 4 = 20$ ]

### Question 3

- (a) Distinguish between accuracy and precision with one suitable example. [2]  
(b) A sample contains 4.4 g of  $\text{CO}_2$ . Calculate: 1. Number of moles of  $\text{CO}_2$ . 2. Number of molecules of  $\text{CO}_2$ . [2]

### Question 4

- (a) Explain the significance of the four quantum numbers. [2]  
(b) Write the electronic configuration of: 1. Fe 2.  $\text{Fe}^{3+}$ . Explain why electrons are removed from the 4s orbital before the 3d orbital during ionisation. [2]

### Question 5

The following elements are arranged according to their atomic numbers: Na, Mg, Al, Si, P, S, Cl.

- (a) Which element has the largest atomic radius? Give a reason. [1]  
(b) Which element has the highest first ionisation enthalpy? [1]  
(c) Explain why the first ionisation enthalpy of Mg is greater than that of Al. [2]

### Question 6

- (a) What is meant by disproportionation reaction? Give one example. [2]  
(b) Find the oxidation number of the underlined element: 1.  $\text{K}_2\text{MnO}_4$  2.  $\text{Na}_2\text{S}_2\text{O}_3$ . [2]

### Question 7

- (a) State Aufbau principle and Hund's rule of maximum multiplicity. [2]  
(b) Draw the orbital diagram for the 2p orbitals of nitrogen and explain why the three electrons occupy separate orbitals before pairing. [2]

### Question 8

A compound contains 52.17% carbon, 13.04% hydrogen and 34.79% oxygen.

- (a) Determine its empirical formula. [3]  
(b) If its molar mass is  $92 \text{ g mol}^{-1}$ , determine its molecular formula. [1]

### Question 9

- (a) Explain the following trends across a period: 1. Metallic character 2. Electronegativity. [2]  
(b) Why is the electron gain enthalpy of chlorine more negative than that of fluorine? [2]

### Question 10

Balance the following redox reaction by the oxidation number method:  $\text{MnO}_2 + \text{HCl} \rightarrow \text{MnCl}_2 + \text{Cl}_2 + \text{H}_2\text{O}$ .

Also identify: 1. The oxidising agent. 2. The reducing agent. [4]

## SECTION C – 16 MARKS

Answer any FOUR questions. [ $4 \times 4 = 16$ ]

### Question 11

(a) Explain the main observations of Rutherford's  $\alpha$ -particle scattering experiment and give its conclusions. [3]

(b) State one limitation of Rutherford's atomic model. [1]

#### Question 12

(a) Calculate the frequency of radiation having wavelength 600 nm. Given:  $c = 3 \times 10^8 \text{ m s}^{-1}$ . [2]

(b) Calculate the energy of one photon of this radiation. Given:  $h = 6.626 \times 10^{-34} \text{ J s}$ . [2]

#### Question 13

An element has atomic number 17.

(a) Write its electronic configuration. [1]

(b) Identify its group and period. [1]

(c) State its valency. [1]

(d) Compare its atomic radius and electronegativity with those of the element having atomic number 16. Give reasons. [1]

#### Question 14

(a) What is meant by a limiting reagent? [1]

(b) 10 g of  $\text{CaCO}_3$  is heated according to:  $\text{CaCO}_3 \rightarrow \text{CaO} + \text{CO}_2$ . Calculate the mass of  $\text{CO}_2$  produced. [3]

#### Question 15

Consider the reaction:  $2\text{KMnO}_4 + 16\text{HCl} \rightarrow 2\text{KCl} + 2\text{MnCl}_2 + 5\text{Cl}_2 + 8\text{H}_2\text{O}$ .

(a) Identify the element oxidised and the element reduced. [2]

(b) Identify the oxidising agent and reducing agent. [2]

#### Question 16

(a) Explain why the first ionisation enthalpy of nitrogen is greater than that of oxygen. [2]

(b) Why does ionisation enthalpy generally increase across a period but decrease down a group? [2]

### SECTION D – 14 MARKS

Answer any TWO questions. [ $2 \times 7 = 14$ ]

#### Question 17 – Structure of Atom

(a) State Bohr's postulates for the hydrogen atom. [3]

(b) Explain the meaning of: 1. Ground state 2. Excited state. [2]

(c) Calculate the wavelength of radiation emitted when an electron in a hydrogen atom falls from  $n = 3$  to  $n = 2$ . Given:  $R_H = 1.097 \times 10^7 \text{ m}^{-1}$ . Use:  $1/\lambda = R_H(1/n_1^2 - 1/n_2^2)$ . [2]

#### Question 18 – Periodicity

The following elements have atomic numbers: 11, 12, 13, 14, 15, 16, 17.

(a) Arrange them in increasing order of atomic radius. [2]

(b) Which element will have the highest electronegativity? Give a reason. [1]

(c) Explain the variation in first ionisation enthalpy across this series. [2]

(d) Which element is expected to have the most negative electron gain enthalpy? Explain. [2]

### Question 19 – Redox Reactions

(a) Define: 1. Oxidation 2. Reduction 3. Oxidising agent 4. Reducing agent. [4]

(b) Balance the following equation by the ion-electron method:  $\text{MnO}_4^- + \text{Fe}^{2+} + \text{H}^+ \rightarrow \text{Mn}^{2+} + \text{Fe}^{3+} + \text{H}_2\text{O}$ .  
[3]

### English

#### ### Instructions

- \* You are allowed an additional 15 minutes for only reading the question paper.
- \* You must NOT start writing during reading time.
- \* The paper has four questions in all.
- \* Answer all questions.
- \* You are advised to spend not more than 45 minutes on Question 1, 55 minutes on Question 2, 30 minutes on Question 3 and 50 minutes on Question 4.
- \* You should begin each answer on a fresh page.
- \* The intended marks for questions are given in brackets [ ].

#### ### QUESTION 1

Write a composition (in approximately 400–450 words) on any one of the following subjects.  
[20]

You are reminded that you will be rewarded for the orderly and coherent presentation of the matter, use of appropriate style and general accuracy of spelling, punctuation and grammar.

- (i) You recently visited a village fair with your family. Describe the sights, sounds and activities you witnessed. What made the experience memorable?
- (ii) Suppose you found an old diary in your school library that contained entries written by a student from fifty years ago. Narrate what happened after you began reading it and how it influenced your thoughts.
- (iii) “Technology has made education more accessible, but it cannot replace the importance of a teacher.” Express your views either FOR or AGAINST the statement.
- (iv) The Value of Time

(v) “The greatest lessons in life are often learnt from failure.” Present your reflections on this statement.

(vi) Write a story based on the following words:

> “The letter had arrived after twenty years, but its message was still important.”

### ### QUESTION 2

#### ### (a)

Write an article for your school magazine entitled:

“The Importance of Environmental Awareness Among Students”

Base your article on the following points. You may include other relevant details. \[15\]

- \* Growing environmental problems in modern society
- \* Importance of awareness among young people
- \* Conservation of water, energy and natural resources
- \* Reducing plastic waste and maintaining cleanliness
- \* Role of schools, teachers and eco-clubs
- \* Sustainable habits in daily life
- \* Encouraging students to become responsible citizens

#### ### (b)

As a member of the Students' Council of your school, you have been given the responsibility of setting up a “Community Service Club” in your school.

Write a proposal, in not more than 150 words, stating the steps you would take to establish and successfully run this club. \[10\]

### ### QUESTION 3

Answer sub-parts (i), (ii) and (iii).

### (i)

Rewrite the following sentences according to the instructions given after each of them. \[5\]

(a)

(I) He was too nervous to speak before the audience.

(II) He was so .....

(b)

(I) As soon as the bell rang, the students entered the classroom.

(II) No sooner .....

(c)

(I) I regret that I ignored my teacher's advice.

(II) I wish .....

(d)

(I) "Do not waste your time on unnecessary activities," the mentor said to the students.

(II) The mentor advised .....

(e)

(I) Very few cities in India are as ancient as Varanasi.

(II) Varanasi is .....

### (ii)

In the following sentences, replace the INCORRECT underlined words to make the sentences meaningful and grammatically correct. Do not copy the sentences. \[5\]

(a) The teacher called on the students to maintain discipline.

(b) She is looking for a solution to the problem.

(c) The principal called off the meeting due to heavy rain.

(d) He came across an interesting book while arranging the shelves.

(e) The new policy has brought about several positive changes.

(f) The dishonest employee tried to get away with his mistake.

(g) We must stand by our promise.

(h) The committee will look into the matter carefully.

(i) The car broke down before we reached the station.

(j) The child takes after his father in appearance and habits.

### (iii)

Fill in the blanks in the passage given below with the appropriate form of the verb given in brackets. Do not write the passage, but write the verbs in the correct order. \[5\]

For many years, people (1) \_\_\_\_\_ (ignore) the importance of preserving traditional crafts. Skilled artisans (2) \_\_\_\_\_ (pass) their knowledge from one generation to another. However, modern lifestyles (3) \_\_\_\_\_ (cause) many young people to lose interest in these crafts. In recent times, several organisations (4) \_\_\_\_\_ (work) to revive traditional art forms. When the exhibition opened last month, many visitors (5) \_\_\_\_\_ (admire) the beautiful handmade products. The organisers also (6) \_\_\_\_\_ (conduct) workshops for school students. If more people (7) \_\_\_\_\_ (support) local artisans, these crafts (8) \_\_\_\_\_ (survive) for future generations. It is therefore essential that everyone (9) \_\_\_\_\_ (recognise) their cultural value and (10) \_\_\_\_\_ (contribute) to their preservation.

### QUESTION 4

Read the passage given below and answer the questions (i), (ii) and (iii) that follow. \[20\]

### THE POWER OF DETERMINATION

1. The annual science exhibition at Green Valley School was only a week away. Students from different classes had been preparing models and experiments for several months. Among them was fourteen-year-old Rohan, who had decided to present a model of a water-saving irrigation system. He believed that the project could help farmers use water more efficiently.

2. Rohan had spent many evenings designing the model with the help of his science teacher. The system used a small pump, pipes and a moisture sensor to supply water only when the soil

became dry. Although the model was simple, Rohan was proud of his work. He hoped that it would encourage others to think about practical solutions to environmental problems.

3. Two days before the exhibition, Rohan switched on the model for its final test. To his disappointment, the pump stopped working after a few minutes. He checked the wires and connections, but nothing seemed to solve the problem. His classmates suggested that he abandon the project and prepare something easier.

4. Rohan felt discouraged, yet he refused to give up. He remembered his teacher's advice that every mistake could become an opportunity to learn. He carefully examined the model again and discovered that a small piece of dirt had blocked the pump. After cleaning it, he tested the system once more. This time, the pump worked, but the moisture sensor still failed to respond.

5. The next morning, Rohan visited a local electronics shop with his uncle. The shopkeeper examined the sensor and explained that one of its wires had been damaged. He gave Rohan a replacement wire and showed him how to connect it safely. Rohan thanked him and returned home with renewed confidence.

6. That evening, Rohan repaired the sensor and tested the entire system. The pump started automatically when the soil became dry and stopped when sufficient water had been supplied. Rohan was delighted. He also prepared a clear chart explaining how the system could reduce water wastage in farms and gardens.

7. On the day of the exhibition, many students and parents visited Rohan's stall. He demonstrated the working model and answered questions confidently. The judges appreciated the usefulness of his idea and the effort he had made to improve it. They awarded his project the first prize in the environmental innovation category.

8. When Rohan received the prize, he thanked his science teacher, his uncle and the shopkeeper. He said that the award was not merely a reward for success but also a reminder that patience and determination could turn difficulties into achievements. His experience inspired several younger students to approach their own projects with greater confidence.

#### (i)

#### (a)

Find a single word from the passage that will exactly replace the underlined word or words in the following sentences: \[3\]

\* The athlete was deeply disappointed and disheartened after losing the final.

\* The two villages were supplied with water through a new pipeline.

\* The engineer carefully examined the machine before repairing it.

### (b)

For each of the words given below, write a sentence of at least 10 words using the same word with a different meaning from that which it carries in the passage. \[3\]

\* model

\* chart

\* prize

### (ii)

Answer the following questions in your own words:

(a) Why did Rohan initially feel discouraged about his science project? \[2\]

(b) What helped Rohan repair the moisture sensor successfully? \[2\]

(c) Why did Rohan consider the prize more than a reward for winning? \[2\]

### (iii)

Summarise what happened from the time Rohan discovered that his model was not working until the time he received the first prize (paragraphs 3 to 7).

You are required to write the summary in the form of a connected passage in 100 words. Failure to keep within the word limit will be penalised. \[8\]

### Hindi

#### LANGUAGE – 50 Marks

##### Question 1

कसी एक वषय पर नबंध ल खए, जो 400 शब्दों से कम न हो:

- (1) “अनुशासन का महत्व” वषय पर अपने वचार ल खए।
- (2) आपने हाल ही में जो कोई एक सा हित्यक या सांस्कृ तक काय क्रम देखा हो, उसका वण न करते हुए बताइए क उसने आपको कस प्रकार प्रभा वत कया।
- (3) सूखा (अनावृष्टि) एक प्राकृ तक आपदा है जो जन-जीवन को बुरी तरह प्रभा वत करती है। इस वषय पर नबंध ल खए।
- (4) भारत की स्वतंत्रता में म हलाओं का योगदान।
- (5) इंटरनेट के बढ़ते प्रभाव से क्या हमारे पारंप रक मूल्यों को खतरा है? पक्ष या वपक्ष में अपने वचार

ल खए।

(6) नम्न ल खत में से कसी एक पर मौ लक कहानी ल खए:

(a) अचानक बजली चली गई और पूरा शहर अंधकार में डूब गया।

(b) एक ऐसी कहानी ल खए जिसका अं तम वाक्य हो — “तभी मुझे सच्चाई का पता चला।”

[10]

### Question 2

नम्न ल खत अवतरण को पढ़कर अंत में दए गए प्रश्नों के उत्तर अपने शब्दों में दीजए।

अयोध्या के राजा ह रश्चंद्र अपने सत्यवचन और दानशीलता के लए प्रसद्ध थे। उन्होंने अपने जीवन में कभी असत्य का सहारा नहीं लिया, चाहे परिस्थितियाँ कतनी भी कठिन क्यों न हो जाएँ। एक बार ऋष वशवा मंत्र ने उनकी परीक्षा लेने का नश्चय किया और स्वप्न में राजा से उनका संपूर्ण राज्य दान में माँग लिया। जागने पर राजा ह रश्चंद्र ने अपने दए गए वचन को सत्य मानकर अपना राज्य, धन-संपत्ति और महल — सब कुछ वशवा मंत्र को दान कर दिया। इतना ही नहीं, वशवा मंत्र ने दक्षिणा के रूप में और धन की माँग की। राजा के पास अब कुछ भी शेष नहीं था, इस लए उन्होंने अपनी पत्नी तारामती और पुत्र रोहताश्व के साथ काशी जाकर स्वयं को एक श्मशान घाट के रक्षक के यहाँ बेच दिया। वहाँ उन्हें कठोर श्रम करना पड़ता था और शव जलाने के बदले शुल्क वसूलना पड़ता था। दुःख से उनके पुत्र रोहताश्व की सप्त-दंश से मृत्यु हो गई, और जब उनकी पत्नी उसका शव लेकर श्मशान आई, तो राजा ने उसे पहचानकर भी शुल्क लए बना दाह-संस्कार करने से इनकार कर दिया, क्योंकि अपने स्वामी से लए वचन का पालन करना उनका धर्म था। इस अटूट सत्य नष्ठा को देखकर देवता प्रसन्न हुए, उनके पुत्र को पुनर्जन्त कर दिया और राजा ह रश्चंद्र को उनका राज्य पुनः लौटा दिया।

प्रश्न

(i) राजा ह रश्चंद्र कस गुण के लए प्रसद्ध थे?

(ii) वशवा मंत्र ने राजा की परीक्षा कस प्रकार ली?

[4]

(iii) अपना राज्य दान करने के बाद राजा ह रश्चंद्र को क्या करना पड़ा?

(iv) श्मशान घाट पर राजा ह रश्चंद्र के सामने कौन-सी कठिन परीक्षा आई, और उन्होंने क्या किया? [4]

(v) प्रस्तुत गद्यांश से आपको क्या शिक्षा मिलती है? समझाकर ल खए। [4]

### Question 3

a) नम्न ल खत वाक्यों को शुद्ध करके ल खए।

(i) राधा घर को जा रही है।

(ii) यह मेरी पुस्तकें हैं।

(iii) बच्ची रोटी खा रहा है।

(iv) सड़क पर बहुत सारा भीड़ है।

(v) मोहन की माता जी बहुत अच्छा है।

(b) नम्न ल खत मुहावरों का वाक्य में प्रयोग करें।

(i) उल्टी गंगा बहाना

(ii) मुँह की खाना

(iii) दूध का दूध पानी का पानी करना

- (iv) हाथ मलना  
(v) कलेजा मुँह को आना

खंड ग

सारा आकाश ( कसी एक प्रश्न के उत्तर दीजिए )

[10]

प्रश्न 9)

समर की माँ अथवा समर के पता का चरित्र-चित्रण 'सारा आकाश' के आधार पर कीजिए।

प्रश्न 10)

'सारा आकाश' उपन्यास में चरित्र संयुक्त परिवार व्यवस्था पर एक लेख लिखिए।

प्रश्न 11)

समर और प्रभा के दांपत्य जीवन में आए तनाव के आधार पर निम्नलिखित प्रश्नों के उत्तर अपने शब्दों में दीजिए।

(क) समर और प्रभा के बीच शुरुआती दूरी के क्या कारण थे?

(ख) यह दूरी धीरे-धीरे कन परिस्थितियों के कारण कम होती है?

(ग) उपन्यास में प्रभा के चरित्र का क्या महत्व है?

(घ) इस उपन्यास के माध्यम से लेखक हमें दांपत्य जीवन के विषय में क्या संदेश देना चाहते हैं?

**Math**

## **ISC CLASS XI – MATHEMATICS**

### **ANNUAL EXAMINATION**

**Maximum Marks: 80    Time Allotted: 3 Hours**

*Reading Time: Additional 15 Minutes*

Chapters: Sets; Relations and Functions; Trigonometric Functions; Complex Numbers and Quadratic Equations; Linear Inequalities; Permutations and Combinations; Binomial Theorem; Sequences and Series.

#### **GENERAL INSTRUCTIONS**

1. You are allowed an additional fifteen minutes for reading the paper.
2. You must NOT start writing during the reading time.
3. The question paper consists of 20 questions divided into four sections: A, B, C and D.
4. All questions are compulsory.
5. Show all necessary steps and working.
6. Internal choices are provided in selected questions.

## SECTION A – 20 MARKS

- 1(i). If  $A=\{1,2,3\}$ , then the number of elements in  $P(A)$  is: (a) 3 (b) 6 (c) 8 (d) 9 [1]
- 1(ii). If  $A=\{1,2\}$  and  $B=\{a,b,c\}$ , then  $n(A \times B)$  is: (a) 5 (b) 6 (c) 8 (d) 9 [1]
- 1(iii). If  $f(x)=2x-3$ , then  $f(4)$  is: (a) 3 (b) 5 (c) 8 (d) 11 [1]
- 1(iv). The range of  $f(x)=\sin x$  is: (a)  $[0,1]$  (b)  $[-1,1]$  (c)  $(-1,1)$  (d)  $[-\infty,\infty]$  [1]
- 1(v). Find  $\sin 30^\circ \cos 60^\circ + \cos 30^\circ \sin 60^\circ$ . (a) 0 (b)  $1/2$  (c) 1 (d)  $\sqrt{3}$  [1]
- 1(vi). If  $z=3-4i$ , find  $|z|$ . (a) 3 (b) 4 (c) 5 (d) 7 [1]
- 1(vii). The roots of  $x^2+4x+5=0$  are: (a) real and equal (b) real and distinct (c) non-real complex (d) irrational real [1]
- 1(viii). The solution of  $3x-5>7$  is: (a)  $x>4$  (b)  $x<4$  (c)  $x>-4/3$  (d)  $x<-4/3$  [1]
- 1(ix). The number of ways of arranging 5 distinct objects is: (a) 20 (b) 25 (c) 100 (d) 120 [1]
- 1(x). The value of  ${}^6C_2$  is: (a) 10 (b) 12 (c) 15 (d) 30 [1]
- 1(xi). The coefficient of  $x^2$  in  $(1+x)^5$  is: (a) 5 (b) 10 (c) 15 (d) 20 [1]
- 1(xii). The middle term in the expansion of  $(x+a)^6$  is: (a) 3rd term (b) 4th term (c) 5th term (d) 6th term [1]
- 1(xiii). If  $a_n=3n+2$ , then  $a_{10}$  is: (a) 30 (b) 32 (c) 35 (d) 38 [1]
- 1(xiv). The common difference of 7,11,15,19,... is: (a) 2 (b) 3 (c) 4 (d) 5 [1]
- 1(xv). If  $a,b,c$  are in G.P., then: (a)  $b=a+c$  (b)  $b^2=ac$  (c)  $a^2=bc$  (d)  $c^2=ab$  [1]
- 1(xvi). Assertion: If  $A \subseteq B$ , then  $A \cap B = A$ . Reason: Every element of  $A$  belongs to  $B$ . Choose: (a) Both true and R explains A (b) Both true but R does not explain A (c) A true, R false (d) A false, R true. [1]
- 1(xvii). Assertion:  $x^2+2x+5=0$  has no real roots. Reason: Its discriminant is negative. Choose: (a) Both true and R explains A (b) Both true but R does not explain A (c) A true, R false (d) A false, R true. [1]
- 1(xviii). Find the principal argument of  $i$ . [1]
- 1(xix). Find the number of subsets of a set containing 4 elements. [1]
- 1(xx). Find the sum of the first 10 natural numbers. [1]

## SECTION B – 14 MARKS

2. Let  $A=\{1,2,3,4,5\}$ ,  $B=\{2,4,6,8\}$ . Find  $A \cup B$ ,  $A \cap B$  and  $A-B$ . [2]
3. If  $f(x)=(x-2)/(x+3)$ , find  $f(2)$  and state the value of  $x$  for which  $f(x)$  is not defined. [2]

4. Prove that  $(1-\cos 2\theta)/\sin 2\theta = \tan \theta$ , where defined. [2]
5. Solve  $2x^2-5x-3=0$  using the quadratic formula. [2]
6. (i) Solve  $-3 < 2x+1 \leq 7$ . OR (ii) Solve  $(x-2)/(x+1) \geq 0$ . [2]
7. In how many ways can 4 boys and 3 girls be arranged in a row if all the girls must sit together? [2]
8. Find the coefficient of  $x^4$  in  $(2x+1/x)^8$ . [2]

### SECTION C – 21 MARKS

9. Let  $A=\{1,2,3,4\}$ ,  $B=\{2,4,6\}$ . Define  $R$  from  $A$  to  $B$  by  $aRb$  if  $b=2a$ . (i) Write  $R$  as ordered pairs. (ii) State whether  $R$  is a function from  $A$  to  $B$ , giving a reason. [3]
10. Prove that  $(\sin A + \sin B)/(\cos A + \cos B) = \tan((A+B)/2)$ . [3]
11. If  $z=(2+i)/(1-i)$ , express  $z$  in the form  $a+ib$ . [3]
12. Solve and represent on the number line:  $2x-3 < 5x+6$  and  $3x+2 \geq x-4$ . [3]
13. (i) How many 5-digit numbers can be formed using 1,2,3,4,5,6 without repetition and divisible by 5? OR (ii) In how many ways can a committee of 4 be selected from 7 men and 5 women if exactly 2 women are required? [3]
14. Find the term independent of  $x$  in  $(x^2+2/x)^9$ . [3]
15. If the first term of a G.P. is 3 and common ratio is 2, find (i) the 8th term and (ii) the sum of the first 8 terms. [3]

### SECTION D – 25 MARKS

16. (i) Let  $A=\{1,2,3,4\}$ ,  $B=\{2,4,6,8\}$ , and  $f:A \rightarrow B$  be  $f(x)=2x$ . Show that  $f$  is one-one and onto. Hence state whether  $f$  is bijective. OR (ii) If  $f(x)=(2x+3)/(x-1)$ , find  $f^{-1}(x)$ , stating the necessary restrictions on  $x$ . [5]
17. (i) Prove that  $\sin 3A/\sin A = 3-4\sin^2 A$ . Hence find its value when  $A=30^\circ$ . OR (ii) Solve, for  $0 \leq x \leq 2\pi$ :  $2\cos^2 x - 3\cos x + 1 = 0$ . [5]
18. (i) If the roots of  $x^2-(2a+1)x+(a^2+a)=0$  are equal, find  $a$  and hence the repeated root. OR (ii) If  $z+1/z=2\cos \theta$ , prove that  $z^{n+1}/z^n=2\cos n\theta$  for  $z=\cos \theta + i \sin \theta$ . [5]
19. A school has 8 different Mathematics books and 5 different Physics books. (i) In how many ways can 3 Mathematics and 2 Physics books be selected? (ii) In how many ways can the selected 5 books be arranged if all Mathematics books must be together? [5]
20. Let  $S_n = 1+2+3+\dots+n$ . (i) Find  $S_n$ . (ii) Hence prove that  $1+3+5+\dots+(2n-1)=n^2$ . [5]

### Biology

**Maximum Marks: 70**

- **General Instructions:**
  - All questions are compulsory.
  - Section A consists of 14 one-mark questions (MCQs, assertion-reason, one-word, and fill-in-the-blanks).
  - Section B consists of 7 two-mark questions.
  - Section C consists of 7 three-mark questions.
  - Section D consists of 3 five-mark questions with internal choices.

**SECTION A (14 Marks)**

**Q1. Answer the following questions as directed: [ $14 \times 1 = 14$ ]**

**i. The numerical system of classification based on all observable characteristics of plants is known as:**

- (a) Cytotaxonomy**
- (b) Chemotaxonomy**
- (c) Phenetics / Numerical Taxonomy**
- (d) Phylogenetics**

**ii. In frogs, the organ that acts as a common chamber for the alimentary canal, urinary tract, and reproductive tract is the:**

- (a) Cloaca**
- (b) Ureter**
- (c) Duodenum**
- (d) Rectum**

**iii. A floral diagram lacks information regarding which of the following?**

- (a) Number of floral parts**
- (b) Position of the ovary relative to the receptacle**
- (c) Cohesion of stamens**
- (d) Aestivation of petals**

**iv. Fluidity of the cell membrane according to the Fluid Mosaic Model is primarily due to the presence of:**

- (a) Saturated lipids**
- (b) Unsaturated lipids**
- (c) Extrinsic proteins**
- (d) Carbohydrate side chains**

**v. Assertion (A): Archaeobacteria can survive under extreme hyper-saline conditions.**

**Reason (R): They possess a specialized cell wall structure distinct from other bacteria.**

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

**vi. Water vascular system is a characteristic feature of which phylum?**

- (a) Porifera**
- (b) Echinodermata**
- (c) Mollusca**
- (d) Coelenterata**

**vii. Name the living component of xylem tissue responsible for lateral conduction of water.**

**viii. Define the term *Heterospory* with an example from Pteridophytes.**

**ix. Which organelle is referred to as the "suicide bag" of the cell, and which hydrolytic enzyme does it contain abundantly?**

**x. State the exact respiratory surface used by a frog during its period of aestivation and hibernation.**

**xi. Fill in the blank: In a racemose inflorescence, the main axis continues to grow and flowers are borne in an \_\_\_\_\_ succession.**

**xii. Give one characteristic feature that distinguishes Class Chondrichthyes from Class Osteichthyes based on their endoskeleton and gill covers (operculum).**

xiii. What is the technical term used for the arrangement of leaves on a stem or branch?

xiv. Name the taxonomical aid that uses contrasting pairs of characters called 'couplets' for identification.

### **SECTION B (14 Marks)**

Q2. Differentiate between the cell wall composition of Kingdom Fungi and Kingdom Plantae. [2]

Q3. Describe the two distinct body forms (Polyp and Medusa) observed in Cnidarians. Mention the phenomenon when both forms alternate in a single life cycle. [2]

Q4. Define *Aestivation*. Draw a neat, labeled diagram showing valvate and imbricate aestivation in corolla. [2]

Q5. Briefly explain the structural organization of a eukaryotic 80S ribosome, mentioning its two subunits. [2]

Q6. Distinguish between Metamerism and Pseudometamerism with one example of an animal for each. [2]

Q7. How does cutaneous respiration differ from pulmonary respiration in an adult frog? [2]

Q8. List two key defining features of living organisms that separate them from non-living entities without exception. [2]

### **SECTION C (21 Marks)**

Q9. Explain the Five Kingdom Classification proposed by R.H. Whittaker. Outline the primary criteria used by him for classifying organisms into these kingdoms. [3]

Q10. Draw a well-labeled diagram of the Singer and Nicolson Fluid Mosaic Model of the plasma membrane. Briefly state the function of intrinsic proteins. [3]

Q11. Compare the life cycles of Bryophytes and Pteridophytes based on: [3]

- Dominant phase
- Nature of the main plant body (haploid/diploid)
- Vascular tissue presence

Q12. Describe the digestive system of a frog with specific emphasis on: [3]

- Structure of the stomach and liver
- Action of bile and pancreatic juice in the intestine

Q13. Define modification of roots. Describe the structural features and functions of: [3]

- Prop roots of *Ficus*
- Pneumatophores of *Rhizophora*

**Q14. Tabulate three major distinctions between Prokaryotic and Eukaryotic cells based on nuclear region, membrane-bound organelles, and cell division mechanisms. [3]**

**Q15. Give one characteristic feature and one example for each of the following animal classes: [3]**

- Cyclostomata
- Amphibia
- Mammalia

## **SECTION D (15 Marks)**

**Q16.**

**(a) What is a Placentation? Explain five different types of placentation found in flowering plants with suitable labeled diagrams and examples for each. [5]**

**OR**

**(b) Describe the technical floral characters of the family Fabaceae or Solanaceae under the following headings:**

- Inflorescence and Calyx
- Corolla and Androecium
- Gynoecium and Fruit
- Write the standard Floral Formula and draw the Floral Diagram of the chosen family. [5]

**Q17.**

**(a) Give an account of the fine structure of a Mitochondrion. Explain why it is designated as the "Powerhouse of the Cell" and an "Semi-autonomous organelle." [5]**

**OR**

**(b) Describe the ultra-structure of a Cilium/Flagellum based on its axoneme layout (9+2 pattern). Support your answer with a detailed cross-sectional diagram showing radial spokes, central sheath, and peripheral doublets. [5]**

**Q18.**

**(a) Provide a comparative overview of Phylum Aschelminthes (Nematoda) and Phylum Annelida based on the following parameters: [5]**

- Body symmetry and Germ layers
- Coelom type

- Digestive tract
- Circulatory system
- Excretory organs OR (b) Outline the male reproductive system of a frog (*Rana tigrina*). Trace the pathway of sperm movement from the testes to the exterior through a schematic flow chart. [5]

physical education

*Answer all questions in Section A and Section B.*

*Answer all questions on any two games in Section C.*

*The intended marks for questions or parts of questions are given in brackets [ ].*

## SECTION A-15 MARKS

### Question 1

(i) physical education is the activity related with

(a) Reading and writing

(b) playing video game

(c) activities of big muscles

(d) watching sports matches

(ii) Motivation depends upon:

(a) Internal factors

(b) External factors

(c) Reward and honour to do better

(d) All of the above

**(iii) in game the movement changes according to**

**(a)** own team members

(b) opponent

(c) pre decided

(d) all

**(iv) Energy source for long workout in players is :**

**(a)** Simple Carbohydrates

(b) Complex Carbohydrates

(c) Essential Proteins

(d) Non-essential proteins

**(v) What should be the healthy person(Man) BMI score ?**

(a) Less than 20

(b) Between 21 to 25

(c) Between 26 to 30

(d) Above 31

**(vi) play is.....**

**(vii) ..... helps the person to stimulate the activity  
its attainment.**

**(viii) The pancreas Glands helps in the digestion  
of.....**

**(ix) Roughage.....food.**

**(x) Cause of obesity.....**

**(xi) How would you define interest?**

**(xii) What do you mean by good Leader.**

**(xiii) What is the importance of Vitamin C ?**

**(xiv) state the working of heart.**

**(xv) Write a note on Modern Olympic.**

## **SECTION -B (25 MARKS)**

**(230-270 words)**

**Question-2 Explain the aim and objective of physical education**

**[5]**

**Question -3 Explain the role of Micronutrients in our diet ?**

**[5]**

**Question -4 How would you check the Minimum General Motor Fitness of the person?**

**[5]**

**Question -5 Explain the following terms:**

**A. IOA.      B. IOC.      C. NOC.      D. IFs.      E. SAI**

**[5]**

**Question -6 A Leader's responsibility is to see that the plans of the groups are put into execution.**

**Elaborate.**

**[5]**

.

**SECTION - C (30 MARKS)**

## **(BADMINTON)**

### **Question -7.**

**(i)** Answer the following question -

**A. Define the following:**

**(a).Deuce. (b). Back gallery. (c). Net Drop**

**[3]**

**B. What is the height of the net. [1]**

**C. What is the size of badminton court (singles)**

**[1]**

**(ii)** What is the difference between Drop and Smash? **[5]**

**(iii)** What are the duties of an Umpire ? Explain any 5 duties **[5]**

### **Question -8. (VOLLYBALL)**

**(i)** Answer the following question.

**A. Mention only three duties of the lineman. [3]**

**B. How many timeouts is a team allowed per game ?**  
[1]

**C. What will be the decision of the referee if the ball touches the net and falls into the opponent's court during service?** [1]

**(ii) Explain the following terms :**

**(a) Libero. (b) Setter. (c) Attack line.**

**(d) Service-Zone (e). Block** [5]

**(iii) Draw a well -labelled diagram of volleyball court along with free zone area.** [5]

## Physics

### General Instructions:

- Answers to this Paper must be written on the paper provided separately.
- You will not be allowed to write during the first 15 minutes. This time is to be spent in reading the question paper.
- The time given at the head of this Paper is the time allowed for writing the answers.
- Section A is compulsory. Attempt all questions from Section A.
- Section B contains six questions. Attempt any four questions from Section B.
- The intended marks for questions or parts of questions are given in brackets [ ].

### SECTION A (40 Marks)

(Attempt all questions from this section)

#### Question 1

Choose the correct option for each of the following questions:  $[15 \times 1 = 15]$

1. Which of the following is a fundamental unit?

- (a) Newton
- (b) Pascal
- (c) Kelvin
- (d) Joule

2. The pitch of a screw gauge is 1 mm and its circular scale has 100 divisions. Its least count is:

- (a) 0.01 cm
- (b) 0.001 cm
- (c) 0.1 mm
- (d) 0.001 mm

3. The time period of a simple pendulum depends upon:

- (a) Mass of the bob
- (b) Length of the pendulum
- (c) Amplitude of oscillation
- (d) Material of the bob

4. The slope of a velocity-time graph gives:

- (a) Distance
- (b) Displacement
- (c) Speed
- (d) Acceleration

5. A body falls freely under gravity. Its acceleration is:

- (a) Zero
- (b) Variable
- (c) Uniform
- (d) Infinite

6. Inertia of a body depends directly on its:

- (a) Velocity
- (b) Acceleration
- (c) Mass
- (d) Volume

7. The SI unit of linear momentum is:

- (a)  $\text{kg m s}^{-1}$
- (b)  $\text{kg m s}^{-2}$
- (c)  $\text{N s}^{-1}$
- (d) J s

8. When a bus suddenly takes a sharp turn, passengers are thrown outwards due to:

- (a) Inertia of rest
- (b) Inertia of motion

- (c) Inertia of direction
- (d) Centripetal force

9. The pressure exerted by a liquid column of height  $h$  and density  $\rho$  is given by:

- (a)  $h \rho g$
- (b)  $h / (\rho g)$
- (c)  $(h \rho) / g$
- (d)  $h^2 \rho g$

10. The barometric height at sea level under normal conditions is approximately:

- (a) 76 mm of Hg
- (b) 76 cm of Hg
- (c) 0.76 cm of Hg
- (d) 760 cm of Hg

11. An object experiences maximum upthrust when it is:

- (a) Partially immersed in a liquid
- (b) Fully immersed in a liquid
- (c) Placed on the surface of a liquid
- (d) Floating in air

12. The buoyant force acting on a body submerged in a liquid acts:

- (a) Vertically downward
- (b) Horizontally
- (c) Vertically upward
- (d) In all directions equally

13. A solid of density  $\rho_s$  floats in a liquid of density  $\rho_l$  with a part of its volume submerged. Which condition must be true?

- (a)  $\rho_s > \rho_l$
- (b)  $\rho_s = \rho_l$
- (c)  $\rho_s < \rho_l$
- (d)  $\rho_s \geq \rho_l$

14. SI unit of relative density is:

- (a)  $\text{kg m}^{-3}$
- (b)  $\text{g cm}^{-3}$
- (c)  $\text{N m}^{-2}$
- (d) It has no unit

15. Hydraulic press works on the principle of:

- (a) Archimedes' Principle
- (b) Pascal's Law
- (c) Law of Floatation
- (d) Newton's Third Law

## Question 2

- (a) Differentiate between fundamental quantities and derived quantities with one example of each. [2]
- (b) A pendulum completes 40 oscillations in 80 seconds. Calculate its:
- Time period
  - Frequency [2]
- (c) State Newton's Second Law of Motion. Write its mathematical expression. [2]
- (d) Explain why a swimmer pushes water backward to swim forward. [2]
- (e) State Pascal's Law of liquid pressure transmission. [2]

## Question 3

- (a) Why are atmospheric pressure measurements taken in terms of mercury column height rather than water column height? Give two reasons. [2]
- (b) A block of wood of mass 12 kg floating in water displaces  $0.012 \text{ m}^3$  of water. Calculate the upthrust acting on the block. (Take  $g = 10 \text{ m s}^{-2}$ ) [2]
- (c) What is meant by backlash error in a screw gauge? How can it be avoided? [2]
- (d) Draw a displacement-time graph for a body moving with uniform velocity. [2]
- (e) Define Relative Density. How is it related to the density of a substance in SI units? [2]

## SECTION B (40 Marks)

(Attempt any four questions from this section)

### Question 4

- (a) What is zero error in a Vernier Caliper? Explain positive zero error with a neat diagrammatic explanation or description. [3]
- (b) A car starting from rest acquires a velocity of  $72 \text{ km h}^{-1}$  in 10 seconds. Calculate:
- Acceleration of the car in  $\text{m s}^{-2}$
  - Total distance traveled by the car in this time interval [3]
- (c) Derive the second equation of motion,  $s = ut + \frac{1}{2}at^2$ , graphically or analytically. [4]

### Question 5

- (a) Define force. Distinguish between contact forces and non-contact forces with two examples of each. [3]
- (b) A force of 50 N acts on a body of mass 10 kg initially at rest for 4 seconds. Calculate:
- Final velocity attained by the body
  - Change in linear momentum of the body [3]
- (c) State the Law of Conservation of Linear Momentum. Derive the expression  $m_1u_1 + m_2u_2 = m_1v_1 + m_2v_2$  for a direct collision of two bodies. [4]

### Question 6

- (a) Mention three factors on which the pressure at a point inside a liquid depends. [3]
- (b) The area of the small piston of a hydraulic press is  $5 \text{ cm}^2$  and that of the large piston is  $100 \text{ cm}^2$ . A force of 50 N is applied to the small piston. Calculate:
- The pressure exerted on the small piston
  - The force exerted on the large piston [3]
- (c) What is a simple barometer? Describe its construction with a labeled diagram, and state one main drawback of a simple barometer. [4]

### Question 7

- (a) State Archimedes' Principle. Mention two applications of Archimedes' principle in daily life. [3]
- (b) A solid body weighs 2.0 N in air and 1.5 N when completely immersed in water. Calculate:
- Upthrust on the body
  - Volume of the body (Density of water =  $1000 \text{ kg m}^{-3}$ ,  $g = 10 \text{ m s}^{-2}$ )
  - Relative density of the solid [3]
- (c) State the Law of Floatation. Derive the relation between the fraction of the volume of a floating body immersed in a liquid and the densities of the body and the liquid:
- $$V_{\text{immersed}} / V_{\text{total}} = \rho_{\text{body}} / \rho_{\text{liquid}} \text{ [4]}$$

### Question 8

(a) Give reasons for the following:

- i. An egg sinks in fresh water but floats in a strong salt solution.
- ii. It is easier to pull a bucket of water out of a well as long as it remains inside the water. [3]

(b) A body of volume  $100 \text{ cm}^3$  is immersed in alcohol of density  $0.8 \text{ g cm}^{-3}$ . Calculate:

- i. Weight of alcohol displaced
- ii. Upthrust on the body in gf [3]

(c) Explain the working mechanism of a submarine in terms of the principle of floatation and buoyancy. How does it submerge and resurface? [4]

### Question 9

(a) Explain why:

- i. A athlete runs a short distance before taking a long jump.
- ii. High altitude climbers often suffer from nosebleeds. [3]

(b) The velocity-time graph of a moving body is shown below in concept: a body accelerates uniformly from rest to  $20 \text{ m s}^{-1}$  in 5 s, stays at  $20 \text{ m s}^{-1}$  for 10 s, and comes to rest in the next 5 s.

- i. Calculate total distance traveled.
- ii. Calculate average velocity for the whole journey. [3]

(c) Name two main types of errors present in a screw gauge. How are they identified and corrected? [4]

