

ENGLISH PAPER 1 (LANGUAGE)
CLASS XI— SAMPLE QUESTION PAPER 2

Maximum Marks: 80

Time Allotted: 3 Hours

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 participated in a cleanliness drive organised in your locality. Describe the experience, the people you met and the changes you noticed afterwards. What did you learn from the experience?

(ii) Suppose you woke up one morning and discovered that you could understand the language of animals. Narrate what happened during that day and how the experience changed your outlook.

(iii) Social media has brought people closer, yet it has also made them more distant. Express your views either FOR or AGAINST the statement.

(iv) The Power of Silence

(v) Success is not measured by what we achieve, but by what we overcome. Present your reflections on this statement.

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

“The road was deserted, but the light at the end of it gave him hope.”

QUESTION 2

(a)

Write an article for your school magazine entitled:

“The Importance of Reading in the Digital Age”

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

Declining reading habits among young people

Benefits of reading books

Improvement in vocabulary, imagination and communication skills

Reading as a means of developing concentration and critical thinking

Role of libraries and reading clubs

Need to balance screen time with reading

Encouraging a culture of reading among students

(b)

As a member of the Students' Council of your school, you have been given the responsibility of setting up a "Literary 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 will not be able to attend the meeting unless he reaches on time.

(II) If

(b)

(I) Although she was tired, she continued working.

(II) In spite of

(c)

(I) I regret that I did not listen to my mother's advice.

(II) I wish

(d)

(I) "Please submit your assignments by tomorrow," the teacher said to the students.

(II) The teacher requested

(e)

(I) Mount Everest is the highest mountain in the world.

(II) No other

(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 principal called at the students to maintain discipline.

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

(c) The meeting was called off because of heavy rain.

(d) He came across his old school diary while cleaning the cupboard.

(e) The new project has brought about several difficulties.

(f) The boy could not get away with his mistake.

(g) We must keep on our promise.

(h) The teacher asked me to look into the matter carefully.

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

(j) She takes after her younger sister 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 centuries, people (1) _____ (depend) on rivers for their survival. Rivers (2) _____

(provide) water for drinking, farming and transportation. However, increasing pollution (3)

_____ (make) many rivers unsafe for human use. In recent years, several organisations (4)

_____ (work) to restore polluted rivers. When the campaign began last year, volunteers (5)

_____ (collect) large quantities of plastic waste from the riverbanks. They also (6) _____

(educate) local residents about the importance of keeping the water clean. If people (7) _____ (continue) to dispose of waste irresponsibly, the problem (8) _____ (become) more serious. It is therefore essential that every citizen (9) _____ (take) responsibility and (10) _____ (contribute) to protecting our rivers.

QUESTION 4

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

THE UNEXPECTED RESCUE

1. The storm had begun shortly after midnight. By dawn, the small coastal village was almost completely cut off from the rest of the town. Roads were flooded, electricity lines had fallen and the sea continued to roar against the embankment. Most people remained indoors, listening anxiously to the sound of the wind and rain.
2. Among them was sixteen-year-old Arjun, who lived with his grandmother in a small house near the village school. His parents worked in another city and had been unable to return because of the weather. Arjun spent most of the morning helping his grandmother move their belongings to a safer part of the house.
3. Around ten o'clock, Arjun heard a faint cry coming from outside. At first, he thought it was the sound of the wind. But when the cry came again, he went to the window and looked carefully through the rain. Near the school wall, he noticed a small figure standing on the roof of a shed.
4. Arjun immediately realised that it was Meera, a seven-year-old girl who lived nearby. She had apparently been separated from her family when floodwater entered their house. Arjun wanted to go outside, but his grandmother stopped him. The current was strong, and the road between their house and the school had disappeared beneath several feet of water.
5. Arjun quickly thought of a safer plan. He called the village emergency number and explained the situation. The rescue team said that they were trying to reach the village but could not cross the flooded road. They advised him to remain indoors until they arrived.
6. Arjun refused to give up. He remembered that the school had an old wooden boat stored behind the sports room. The boat had been used years ago during a school camping programme. With his grandmother's permission, he contacted his science teacher, who was sheltering in another part of the village. Together, they worked out a way to reach the school safely.
7. After nearly an hour, Arjun managed to reach the school building. He found the old boat, checked that it was still usable and carefully pushed it into the water. The journey was frightening, but he kept his eyes fixed on the shed. When he finally reached Meera, she was exhausted and frightened. Arjun reassured her and helped her into the boat.
8. They returned slowly towards the village. By then, the rescue team had reached the main road. Seeing the boat approaching, two rescuers waded through the shallowest part of the water and helped bring Meera and Arjun to safety. Meera was soon reunited with her family.
9. That evening, the rain finally stopped. The villagers gathered around Arjun, praising his courage. He smiled quietly and said that he had only done what anyone should do when another person's life was in danger. His grandmother looked at him proudly. For Arjun, the day's greatest reward was not the praise he received, but the knowledge that he had helped someone when she needed it most.

(i)

(a)

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

The manager was very worried and nervous about the unexpected inspection.

The old bridge was not connected to the main road after the floods.

The students were extremely tired after completing the long journey.

(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]

current

fixed

stored

(ii)

Answer the following questions in your own words:

(a)

Why was Arjun initially prevented from going outside? [2]

(b)

What made Arjun decide to use the old wooden boat? [2]

(c)

Why did Arjun consider the rescue of Meera his greatest reward? [2]

(iii)

Summarise what happened from the time Arjun heard Meera's cry until the time both Arjun and Meera were brought to safety (paragraphs 3 to 8).

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]

HALF YEARLY EXAMINATION 2026–27

Class XI

English Paper 2 (Literature in English)

Maximum Marks: 80

Time Allowed: Three Hours

(Candidates are allowed an additional 15 minutes for only reading the paper. They must NOT start writing during this time.)

Answer all questions in Section A and Section B.

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

Section A – 20 Marks

Question 1

Choose the correct option for each of the following: ($10 \times 1 = 10$)

(i) The title of Thane of Cawdor is bestowed upon Macbeth because he

(a) requests it from Duncan

(b) wins it in battle

(c) is recommended by Banquo

(d) inherits it from his father

(ii) Banquo's reaction to the witches' prophecies is one of

(a) unquestioning belief

- (b) fear and panic
- (c) caution and scepticism
- (d) complete indifference
- (iii) Lady Macbeth fears that Macbeth is
 - (a) too ambitious
 - (b) too kind-hearted
 - (c) too cowardly
 - (d) too old
- (iv) The witches meet Macbeth on
 - (a) a battlefield
 - (b) a heath
 - (c) a mountain
 - (d) a riverbank
- (v) In A Living God, Hamaguchi notices the coming disaster through
 - (a) a strange sound from the sea
 - (b) a violent storm
 - (c) an earthquake and receding sea
 - (d) a warning from villagers
- (vi) According to Mark Twain, obedience should be practised
 - (a) always
 - (b) only when convenient
 - (c) selectively and wisely
 - (d) never
- (vii) "Never handle firearms carelessly." This advice is given in order to
 - (a) encourage bravery
 - (b) prevent accidents
 - (c) impress elders
 - (d) avoid punishment
- (viii) Vasavadatta first meets Upagupta when she is
 - (a) old and ill
 - (b) wealthy and famous
 - (c) poor and lonely
 - (d) travelling with merchants
- (ix) The atmosphere in Why I Like the Hospital is mainly
 - (a) festive
 - (b) humorous
 - (c) serious and compassionate
 - (d) adventurous
- (x) Which statement is TRUE?
 - (a) Upagupta immediately accepts Vasavadatta's invitation.
 - (b) Hamaguchi ignores the danger approaching the village.
 - (c) Lady Macbeth encourages Macbeth to hide his intentions.
 - (d) Banquo receives the title of Thane of Cawdor.

Question 2

Complete the following sentences by providing a reason for each: (10 × 1 = 10)

- (i) Macbeth is surprised by Ross and Angus because _____.
- (ii) Duncan decides to visit Inverness because _____.
- (iii) Lady Macbeth asks the spirits to “unsex” her because _____.
- (iv) Banquo warns Macbeth about the witches because _____.
- (v) Hamaguchi looked towards the sea repeatedly because _____.
- (vi) The villagers rushed towards the burning rice stacks because _____.
- (vii) Mark Twain advises young people to obey their parents because _____.
- (viii) Twain's essay is humorous because _____.
- (ix) Upagupta tells Vasavadatta that the proper time has not yet come because _____.
- (x) The poet likes the hospital because _____.

Section B – 60 Marks

Question 3

Macbeth (Act I)

- (i) Describe the significance of the witches' prophecies for Macbeth and Banquo in Act I. [5]
- (ii) Explain Lady Macbeth's reaction after reading Macbeth's letter. [5]
- (iii) (a) Discuss the character of Lady Macbeth as presented in Act I. Support your answer with suitable references from the text. [10]

OR

- (b) Examine the theme of ambition in Act I of Macbeth. How is it revealed through Macbeth and Lady Macbeth? [10]

Question 4

PRISM: A Collection of Short Stories

- (i) Describe Hamaguchi's observation of the sea and explain how it helped him save the villagers in A Living God. [5]
- (ii) Why does Mark Twain present his advice in a humorous manner in Advice to Youth? [5]
- (iii) Explain how Hamaguchi's wisdom, courage and sacrifice make him a true hero in A Living God. [10]

OR

Discuss the various pieces of advice given by Mark Twain to young people and comment on their satirical nature. [10]

Question 5

RHAPSODY: A Collection of Poems

- (i) Describe the condition of the patients as portrayed in Why I Like the Hospital. [5]
- (ii) Explain the significance of Upagupta's words: "The time has not yet come." [5]
- (iii) Describe the second meeting between Upagupta and Vasavadatta in Abhisara: The Tryst. [10]

OR

Discuss how Rabindranath Tagore highlights the transitory nature of youth, beauty and worldly glory in Abhisara: The Tryst. [10]

End of Question Paper.

SUBJECT: CHEMISTRY

Time: 3 Hours

Maximum Marks: 70

General Instructions

This paper is divided into four sections – A, B, C and D.

All questions are compulsory.

Section A consists of one question having sub-parts of one mark each.

Section B consists of questions of two marks each.

Section C consists of questions of three marks each.

Section D consists of questions of five marks each.

Internal choices are provided in Sections B, C and D.

Give balanced chemical equations wherever required.

Show all essential calculations in numerical problems.

SECTION A – 14 MARKS

Question 1

(A) Fill in the blanks:

(4 × 1 = 4)

- a. One mole of any substance contains _____ particles.
- b. The maximum number of electrons that can be accommodated in an orbital is _____.
- c. The energy of an orbital is represented by the _____ quantum number.
- d. The electrons present in the outermost shell are called _____ electrons.

(B) Select the correct alternative:

(4 × 1 = 4)

The number of significant figures in 0.00520 is:

- a. 2
- b. 3
- c. 4
- d. 5

Which of the following has the highest first ionisation enthalpy?

- a. Li
- b. Na
- c. K
- d. Rb

The shape of BF_3 molecule is:

- a. Linear
- b. Trigonal planar
- c. Tetrahedral
- d. Pyramidal

The oxidation number of chlorine in KClO_3 is:

- a. +1
- b. +3
- c. +5
- d. -1

(C) Assertion and Reason:

(2 × 1 = 2)

i. Assertion: Atomic size decreases from left to right across a period.

Reason: Effective nuclear charge increases across the period.

a. Both Assertion and Reason are correct and Reason is the correct explanation.

b. Both are correct but Reason is not the correct explanation.

c. Assertion is correct but Reason is incorrect.

d. Both are incorrect.

ii. Assertion: NH_3 has a pyramidal shape.

Reason: Nitrogen has one lone pair of electrons.

a. Both Assertion and Reason are correct and Reason is the correct explanation.

b. Both are correct but Reason is not the correct explanation.

c. Assertion is correct but Reason is incorrect.

d. Both are incorrect.

(D) Match the following:

$(4 \times 1 = 4)$

Column I

Column II

i. Principal quantum number

a. Orientation of orbital

ii. Azimuthal quantum number

b. Spin of electron

iii. Magnetic quantum number

c. Size and energy

iv. Spin quantum number

d. Shape of orbital

SECTION B – 18 MARKS

Question 2.

Calculate the number of moles present in 11 g of CO_2 . [2]

Question 3.

State any two postulates of Dalton's atomic theory. [2]

Question 4.

Write the electronic configurations of:

a. Na^+

b. Cl^- [2]

Question 5.

Arrange the following in increasing order of ionisation enthalpy:

Na, Mg, Al, Si [2]

Question 6.

Calculate the oxidation number of:

a. Cr in $\text{K}_2\text{Cr}_2\text{O}_7$

b. S in H_2SO_3 [2]

Question 7.

What is meant by:

a. Electronegativity

b. Electron gain enthalpy [2]

OR

Define atomic radius and ionic radius. [2]

Question 8.

Using Lewis structures, explain the formation of Cl_2 molecule. [2]

Question 9.

Calculate the number of molecules present in 9 g of water. [2]

Question 10.

For an electron in the 4th shell:

- Write the possible values of l .
- How many orbitals are present in this shell? [2]

Question 11.

Why is the bond angle in H_2O smaller than that in NH_3 ? [2]

SECTION C – 21 MARKS

Question 12.

An element has atomic number 17 and mass number 35.

- Find the number of protons, electrons and neutrons.
- Write its electronic configuration.
- Identify the element. [3]

Question 13.

Calculate the percentage composition of calcium carbonate, CaCO_3 .

Given: $\text{Ca} = 40$, $\text{C} = 12$, $\text{O} = 16$. [3]

Question 14.

Using the value of $n = 4$, write:

- The possible values of l .
- The number of subshells.
- The total number of orbitals in the shell. [3]

Question 15.

Explain the following periodic trends:

- Atomic radius
- Ionisation enthalpy
- Electronegativity [3]

Question 16.

Draw Lewis structures of:

- CO_2
- NH_3
- H_2O [3]

Question 17.

Give reasons:

- Noble gases have very high ionisation enthalpy.
- Cation is smaller than its parent atom.
- Fluorine is the most electronegative element. [3]

Question 18.

What is hybridisation? Explain the hybridisation and geometry of CH_4 . [3]

SECTION D – 15 MARKS

Question 19. [5]

- State and explain the Aufbau principle, Pauli's exclusion principle and Hund's rule.
- Write the electronic configuration of nitrogen using these principles.

OR

Explain the four quantum numbers and write their significance. [5]

Question 20. [5]

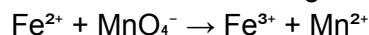
- Explain the formation of NaCl using the concept of electron transfer.
- What is lattice enthalpy?
- Why does NaCl have a high melting point? [5]

OR

Explain the formation of covalent bonds in N_2 using Lewis dot structures and calculate its bond order using molecular orbital theory. [5]

Question 21. [5]

- Balance the following redox reaction by the oxidation-number method:



- Calculate the volume occupied by 0.25 mol of an ideal gas at STP.

OR

- Calculate the molarity of a solution prepared by dissolving 5.85 g of NaCl in water to make 500 mL solution.
- State the relation between molarity and number of moles. [5]

SUBJECT – HINDI

Time: 3 Hrs.

SECTION A

LANGUAGE – 50 Marks

Question 1

किसी एक विषय पर निबंध लिखिए, जो 400 शब्दों से कम न हो:

- (1) “समय का महत्व” विषय पर अपने विचार लिखिए।
- (2) आपने हाल ही में जो कोई एक खेल-प्रतियोगिता देखी हो, उसका वर्णन करते हुए बताइए कि उसने आपको किस प्रकार प्रभावित किया।
- (3) बाढ़ एक प्राकृतिक आपदा है जो जन-जीवन को बुरी तरह प्रभावित करती है। इस विषय पर निबंध लिखिए।
- (4) भारत के स्वतंत्रता संग्राम में युवाओं का योगदान।
- (5) सोशल मीडिया के बढ़ते प्रभाव से क्या हमारे पारिवारिक संबंध कमजोर हो रहे हैं? पक्ष या विपक्ष में अपने विचार लिखिए।
- (6) निम्नलिखित में से किसी एक पर मौलिक कहानी लिखिए:
 - (a) अचानक तेज़ बारिश शुरू हो गई और पूरा शहर जलमग्न हो गया।
 - (b) एक ऐसी कहानी लिखिए जिसका अंतिम वाक्य हो — “तब जाकर मुझे अपनी गलती का एहसास हुआ।”

[10]

Question 2

निम्नलिखित अवतरण को पढ़कर अंत में दिए गए प्रश्नों के उत्तर अपने शब्दों में दीजिए।

प्राचीन काल में राजा शिवि अपनी दानशीलता और करुणा के लिए विख्यात थे। एक दिन उनकी सभा में एक भयभीत कबूतर उड़ता हुआ आया और राजा की गोद में छिपकर बैठ गया। उसके पीछे-पीछे एक बाज़ भी वहाँ पहुँचा और राजा से बोला कि वह कबूतर उसका आहार है, अतः उसे लौटा दिया जाए। राजा शिवि ने कबूतर को शरण देने का वचन दे दिया था, इसलिए उन्होंने बाज़ को कबूतर सौंपने से इनकार कर दिया। बाज़ ने कहा कि यदि वह भूखा रहेगा तो मर जाएगा, और यह भी अन्याय होगा। राजा ने विचार करके प्रस्ताव रखा कि कबूतर के भार के बराबर अपने ही शरीर का मांस काटकर वे बाज़ को दे देंगे, जिससे कबूतर की रक्षा भी हो जाए और बाज़ को भी भोजन मिल जाए। तराजू पर जब कबूतर को रखा गया, तो राजा जितना भी मांस काटकर रखते, तराजू का पलड़ा बराबर नहीं होता था। अंततः राजा स्वयं तराजू पर बैठ गए। उनके इस महान त्याग को देखकर देवता प्रकट हुए और उन्होंने राजा को बताया कि वह बाज़ और कबूतर दोनों केवल उनकी परीक्षा लेने आए देवता ही थे। राजा शिवि की करुणा और त्याग से प्रसन्न होकर देवताओं ने उन्हें आशीर्वाद दिया।

प्रश्न

- (i) राजा शिवि किस गुण के लिए प्रसिद्ध थे? [4]
- (ii) बाज़ ने राजा से क्या माँग की और क्यों? [4]
- (iii) कबूतर की रक्षा के लिए राजा ने क्या प्रस्ताव रखा? [4]
- (iv) तराजू का पलड़ा बराबर न होने पर राजा ने अंततः क्या किया? [4]
- (v) प्रस्तुत गद्यांश से आपको क्या शिक्षा मिलती है? समझाकर लिखिए। [4]

Question 3

(a) निम्नलिखित वाक्यों को शुद्ध करके लिखिए।

- (i) लड़की खेलने गया है।
- (ii) यह मेरा किताबें हैं।
- (iii) बच्चा दूध पी रही है।
- (iv) मैदान में बहुत सारी लोग खड़े हैं।
- (v) सीता के पिता जी बहुत अच्छा है।

[5]

(b) निम्नलिखित मुहावरों का वाक्य में प्रयोग करें।

- (i) आँखें चार होना
- (ii) नाकों चने चबवाना
- (iii) चिराग तले अंधेरा
- (iv) पानी-पानी होना
- (v) दाँतों तले उँगली दबाना

[5]

खंड ख

काव्य मंजरी एवं गद्य संकलन

(कोई 3 करें)

[10×3]

काव्य मंजरी

प्रश्न १)

“बुरा जो देखन मैं चला, बुरा न मिलिया कोय।

जो दिल खोजा अपना, मुझसे बुरा न कोय॥”

उपर्युक्त दोहे का अर्थ विस्तार में लिखें।

प्रश्न २)

कबीर की साखियों के आधार पर बताइए कि उन्होंने बाहरी आडंबर और पाखंड का किस प्रकार खंडन किया है।

प्रश्न ३)

सुरदास के वात्सल्य वर्णन के आधार पर बताइए कि उन्होंने माता यशोदा और बालक कृष्ण के संबंधों का चित्रण किस प्रकार किया है।

प्रश्न ४)

‘एक फूल की चाह’ कविता के आधार पर सुखिया के पिता की मनोदशा का वर्णन कीजिए।

(गद्य संकलन)

प्रश्न ५)

‘पुत्र प्रेम’ कहानी का उद्देश्य अपने शब्दों में लिखिए।

प्रश्न ६)

‘गौरी’ कहानी के आधार पर गौरी के चरित्र की प्रमुख विशेषताएँ बताइए।

प्रश्न ७)

निम्न शब्दों का अर्थ लिखें —

कातर, उन्मुक्त, विषाद, उद्विग्न, संकोच, निश्छल, अभिलाषा, विस्मय, ग्लानि, आश्वासन।

खंड ग

सारा आकाश (किसी एक प्रश्न के उत्तर दीजिए)

[10]

प्रश्न ८)

समर की माँ अथवा समर के पिता का चरित्र-चित्रण ‘सारा आकाश’ के आधार पर कीजिए।

प्रश्न ९)

‘सारा आकाश’ उपन्यास में चित्रित संयुक्त परिवार व्यवस्था पर एक लेख लिखिए।

प्रश्न १०)

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 किन 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?

Subject: Biology

Class: XI

Time Allowed: 3 Hours (plus 15 minutes reading time)

Maximum Marks: 70

Instructions to Candidates

- You are allowed an additional fifteen minutes for reading the question paper only.
- You must NOT start writing during the reading time.
- Answer all questions.
- There are four sections in the paper: **A, B, C, and D.**
- **Section A** consists of objective and short questions carrying 1 or 2 mark(s) each.
- **Section B** consists of seven questions carrying 2 marks each.
- **Section C** consists of seven questions carrying 3 marks each.
- **Section D** consists of three questions carrying 5 marks each.
- Diagrams should be drawn wherever necessary using a **pencil only**.
- The intended marks for questions are given in brackets [].

SECTION A (20 Marks)

Question 1

(i) Name the phylum of non-motile, aquatic animals that possess specialized stinging cells called cnidocytes for defense and capturing prey. [1]

(ii) Observe the relationship in the first pair and fill in the missing word:

Earthworm : Annelida :: Starfish : _____ [1]

(iii) In some plants like peas, leaves or parts of leaves get modified into long, coiled, thread-like structures that help in climbing. What are these structures called? [1]

(iv) Name the type of floral symmetry seen in Mustard and Datura, where the flower can be divided into two equal radial halves in any radial plane passing through the center. [1]

(v) Name the underground stem modification that is fleshy, swollen, and stores food material, possessing 'eyes' with nodes and buds (e.g., Potato). [1]

(vi) Name the kingdom under Five-Kingdom classification that includes unicellular, eukaryotic organisms like *Amoeba* and *Paramecium*. [1]

(vii) Identify the cell organelle known as the "powerhouse of the cell" due to its role in ATP synthesis via cellular respiration. [1]

(a) Lysosome

(b) Golgi body

(c) Mitochondrion

(d) Endoplasmic Reticulum

(viii) Which of the following animal groups is characterized by the presence of pneumatic (air-filled hollow) bones? **[1]**

- (a) Mammalia
- (b) Aves
- (c) Reptilia
- (d) Amphibia

(ix) Name the brown algae species commonly known as "kelps" which form massive marine underwater forests. **[1]**

(x) Name the infectious acellular agents composed only of protein, lacking any nucleic acid. **[1]**

(xi) Assertion (A): Gymnosperms are called "naked-seeded" plants.

Reason (R): The ovules of gymnosperms are not enclosed within an ovary wall before or after fertilization.

Select the correct option: [1]

- (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) A is false, but R is true.

(xii) Assertion (A): Mitochondria and Chloroplasts are called semi-autonomous organelles.

Reason (R): They possess their own circular DNA and 70S ribosomes, allowing them to synthesize some of their own proteins.

Select the correct option: [1]

- (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) A is false, but R is true.

(xiii) What is the biological significance of heterocysts found in certain cyanobacteria like *Nostoc* and *Anabaena*? **[1]**

(xiv) A biology student observes a flower where the margin of the thalamus grows upward, enclosing the ovary completely and getting fused with it, while other floral parts arise above the ovary. Which type of flower is this based on ovary position? [1]

(xv) Answer the following questions: [2]

A. Expand **ICZN**.

B. State any two universal rules used for defining taxa in Taxonomic Hierarchy.

(xvi) Both *Euglena* and *Chlamydomonas* can perform photosynthesis, yet *Euglena* is placed in Kingdom Protista while *Chlamydomonas* is classified under Kingdom Plantae (Algae). Justify this placement. [2]

(xvii) An aquatic organism shows metameric segmentation, possesses a closed circulatory system, and uses nephridia for excretion. Identify the phylum to which it belongs. [1]

(xviii) Give reasons for the following statements: [2]

A. "Fungi were moved out of Kingdom Plantae and placed into a separate kingdom in Whittaker's five-kingdom system."

B. "Pteridophytes are considered the first true terrestrial vascular plants."

SECTION B (14 Marks)

Question 2

In xerophytic plants like *Opuntia*, stems become green, flattened, and fleshy to take over photosynthetic functions, while leaves are reduced to spines. What are these stem modifications called, and what advantage do they offer? [2]

Question 3

The arrangement of ovules within the ovary is termed placentation. [2]

A. Define **Placentation**.

B. Briefly describe the following two types of placentation with one example each:

- Marginal Placentation
- Axile Placentation

Question 4

Enumerate four distinguishing features of organisms belonging to Phylum **Aschelminthes (Nematodes)**. [2]

Question 5

Differentiate between **Simple Leaves** and **Compound Leaves** based on incisions of the lamina and bud placement. [2]

Question 6

Identify the cell wall components and storage food material in the following plant groups: [2]

A. Chlorophyceae (Green Algae)

B. Phaeophyceae (Brown Algae)

Question 7

Mention any two structural differences between Prokaryotic cells and Eukaryotic cells. [2]

Question 8

Distinguish between **Tap Root System** and **Fibrous Root System** based on structural origin, presence of primary root, and plant examples. [2]

SECTION C (21 Marks)

Question 9

Define the following terms related to animal classification: [3]

A. Metamerism

B. Pseudocoelom

C. Open Circulatory System

Question 10

Describe the key characteristics of Kingdom **Monera**. Highlight two differences between Archaeobacteria and Eubacteria. [3]

Question 11

Draw a neat labeled diagram of a typical **Plant Cell** (or **Animal Cell**) and list two key structural differences between them. [3]

Question 12

Give four distinguishing features of **Bryophytes**, explaining why they require water for sexual reproduction despite living on land. [3]

Question 13

Compare **Chondrichthyes** (Cartilaginous Fishes) and **Osteichthyes** (Bony Fishes) on the basis of: [3]

- Endoskeleton composition
- Operculum presence/absence
- Position of mouth

Question 14

Explain the structure of a **Nucleus** in an interphase cell. Mention the functional roles of the Nuclear Envelope, Nucleolus, and Chromatin. [3]

Question 15

Write the correct scientific names (binomial nomenclature) for the following: [3]

- A. Mango
- B. Human Being
- C. Pea Plant

SECTION D (15 Marks)

Question 16

Describe the structure and functions of the **Endomembrane System** in eukaryotic cells. Detail the roles of the Endoplasmic Reticulum (RER & SER), Golgi Body, Lysosomes, and Vacuoles. [5]

OR

Explain the anatomical structure of a **Dicotyledonous Stem** as seen in a transverse section. Describe the functions of Epidermis, Cortex, Endodermis, Vascular Bundles, and Pith. (*Diagram to be drawn in pencil*) [5]

Question 17

Classify and detail the three major classes of Algae—**Chlorophyceae**, **Phaeophyceae**, and **Rhodophyceae**—on the basis of photosynthetic pigments, stored food, cell wall composition, and flagellar arrangement. [5]

Question 18

What is an **Inflorescence**? Differentiate cleanly between **Racemose Inflorescence** and **Cymose Inflorescence** based on main axis growth, floral order of development, and arrangement of flowers. (*Provide neat diagrams for both*) [5]

PHYSICAL EDUCATION

ISC XI

(THEORY)

Maximum Marks: 70

Time Allowed: Three Hours

(Candidates are allowed additional 15 minutes for only reading the paper.

*They must **NOT** start writing during this time.)*

*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) The aim of physical education

(a) physical development

(b) Wholesum development

(c) Organic development

(d) Good health

(ii) Motivation depends upon:

(a) Internal factors

(b) External factors

(c) Reward and honour to do better

(d) All of the above

(iii) Elbow joint is an example of :

(a) Immovable joint

(b) Hinge joint

(c) Pivot joint

(d) Ball and socket joint

(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) The first Olympic Torch was lit in.....

(vii) is the arousing, sustaining and regulating activity.

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

(ix) Roughage.....food.

(x) Cause of obesity.....

(xi) What do you mean by sports journalism?

(xii) What do you mean by good Leader.

(xiii) What is the importance of Vitamin C ?

(xiv) What do you mean by Good Health ?

(xv) Write a note on Modern Olympic.

SECTION -B (25 MARKS)

(230-270 words)

Question-2 Define physical education. Explain the aim and objective of physical education

[5]

Question -3 Explain the role of Micronutrients in our diet ? Also, mention their Deficiency Disease.

[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]**

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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]



Silver Grove School

Sample Paper

General instructions:

Read the following instructions very carefully and follow them:

- This question paper contains 38 questions. All questions are compulsory.
- Question paper is divided into 5 sections section A,B,C,D and E
- In section A, Question number 1 to 18 are Multiple Choice Questions (MCQ) type and Question number 19 and 20 are Assertion- Reason based questions of 1 mark each.
- In section B Question number 21 to 25 are Very Short Answer (VSA) type questions of 2 marks each
- In section C Question number 26 to 31 are Short Answer (SA) type questions carrying 3 marks each.
- In section D Question Number 32 to 35 are Long Answer a (LA) type questions carrying 5 marks each.
- In section E Question number 36 to 38 are case study-based questions carrying 4 marks
- There is no overall choice. However there internal choices in some questions.

SECTION – A (1x20=20)

- Two finite sets have m and n elements. Then number of subsets of the first set is 112 more than that of second set. The value of m and n are respectively.
(a) 4, 7 (b) 7, 4 (c) 4, 4 (d) 7, 7
- If $A = \{x: x \text{ is a multiple of } 3\}$ and $B = \{x: x \text{ is a multiple of } 5\}$, then $A - B$ is
(a) $A \cap B$ (b) $A \cap \bar{B}$ (c) $\bar{A} \cap \bar{B}$ (d) $\bar{A} \cup \bar{B}$
- If set A and set B are defined as
 $A = \{(x, y) : y = \frac{1}{x}, x \neq 0, x \in R\}$
 $B = \{(x, y) : y = -x, x \in R\}$, then
(a) $A \cap B = A$ (b) $A \cap B = B$ (c) $A \cap B = \emptyset$ (d) $A \cup B = A$
- Range of the function $f(x) = \frac{x^2}{x^2+1}$ is
(a) $(-1, 0)$ (b) $(-1, 1)$ (c) $[0, 1)$ (d) $(1, 1)$

5. If $x = \{a, b, c\}$, $y = \{1, 2, 3\}$ then which of the following is not a relation from x to y ?
 (a) $R_1 = \{(a, 1), (a, 2), (a, 3)\}$ (b) $R_2 = \{(a, 2), (b, 1), (c, 3)\}$
 (c) $R_3 = \{(3, c), (b, 3), (c, 3), (b, 1), (3, a)\}$ (d) None of these
6. If A lies in the second quadrant and $3 \tan A + 4 = 0$ then the value of $2 \cot A - 5 \cos A + \sin A$ is
 (a) $\frac{-53}{10}$ (b) $\frac{23}{10}$ (c) $\frac{37}{10}$ (d) $\frac{7}{10}$
7. If $\alpha + \beta = \frac{\pi}{4}$, then the value of $(1 + \tan \alpha)(1 + \tan \beta)$
 (a) 1 (b) 2 (c) -2 (d) None of these
8. The value of $\sin 50^\circ - \sin 70^\circ + \sin 10^\circ$ is
 (a) 1 (b) 0 (c) $\frac{1}{2}$ (d) 2
9. The value of $\cos 1^\circ \cos 2^\circ \cos 3^\circ \dots \cos 179^\circ$ is
 (a) $\frac{1}{\sqrt{2}}$ (b) 0 (c) 1 (d) -1
10. The value of $\frac{1 - \tan^2 15^\circ}{1 + \tan^2 15^\circ}$
 (a) 1 (b) $\sqrt{3}$ (c) $\frac{\sqrt{3}}{2}$ (d) 2
11. If $\tan A = \frac{1}{2}$ and $\tan B = \frac{1}{3}$ then the value of $A + B$ is
 (a) $\frac{\pi}{6}$ (b) π (c) 0 (d) $\frac{\pi}{4}$
12. If $\sin \theta = \frac{-4}{5}$ and θ lies in third quadrant the value of $\cos \frac{\theta}{2}$ is
 (a) $\frac{1}{5}$ (b) $-\frac{1}{\sqrt{10}}$ (c) $-\frac{1}{\sqrt{5}}$ (d) $-\frac{1}{10}$
13. If $z = \frac{1}{(2+3i)^2}$ then $|z|$ is equal to
 (a) $\frac{1}{13}$ (b) $\frac{1}{5}$ (c) $\frac{1}{12}$ (d) None of these
14. If $z = \frac{-2}{1+i\sqrt{3}}$, then the value of $\arg(z)$ is
 (a) π (b) $\frac{\pi}{3}$ (c) $\frac{2\pi}{3}$ (d) $\frac{\pi}{4}$
15. How many 10 – digit numbers can be formed by using the digits 1 and 2
 (a) 10_{p_2} (b) 10_{c_2} (c) 2^{10} (d) $10!$

16. The product of r consecutive positive integers is divisible by
 (a) $r!$ (b) $r! + 1$ (c) $(r + 1)!$ (d) None of these
17. There are 6 periods on each working day of a school. In how many ways can one arrange 5 subjects such that each subject is allowed at least one period
 (a) 360 (b) 720 (c) 3600 (d) 1800
18. The value of $(7_{c_0} + 7_{c_1}) + (7_{c_1} + 7_{c_2}) + \dots + (7_{c_6} + 7_{c_7})$
 (a) $2^7 - 1$ (b) $2^8 - 2$ (c) $2^8 - 1$ (d) 2^8

ASSERTION - REASON BASED QUESTIONS

In the following questions a statement of **Assertion (A)** is followed by a statement of **Reason (R)**. Choose the correct answer out of the following choices.

- (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) A is false but R is true.
19. Assertion (A) : $\sqrt{5}x^2 + x + \sqrt{5} = 0$ then $x = \frac{-1 \pm \sqrt{19}i}{2\sqrt{5}}$
 Reason (R) : If $ax^2 + bx + c = 0$ then $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$
20. Assertion (A) : If $A = \{1, 2, 3, 4, 5\}$, $B = \{2, 4, 6\}$ and $C = \{3, 4, 6\}$ then
 $(A \cup B) \cap C = \{3, 4, 6\}$
 Reason (R) : $(A \cup B)' = A' \cap B'$

SECTION – B (2x5=10)

21. If $U = \{x: x \leq 10, X \in N\}$
 $A = \{x: X \in N, x \text{ is a prime } \leq 10\}$
 $B = \{x: X \in N, x \text{ is even } \leq 10\}$ write $A \cap B'$ in roster form
OR
 If $P(A) = P(B)$, prove that $A = B$
22. If $A = \{2, 4, 6, 9\}$ and $B = \{4, 6, 18, 27, 54\}$ let R be a relation from set A to set B defined as $R = \{(a, b) : a < b \text{ and } a \text{ is a factor of } b\}$ Find domain and range of relation.
OR
 If $y = f(x) = \frac{ax-b}{bx-a}$, show that $x = f(y)$

23. If $x + iy = \frac{a+ib}{c+id}$, prove that $x^2 + y^2 = 1$

OR

Find the conjugate of $\frac{(3-2i)(2+3i)}{(1+2i)(2-i)}$

24. Solve for x and show the graph of solution on the number line

$$\frac{4}{x-1} \leq 3 \leq \frac{6}{x+1}$$

25. if $n_{pr} = 720$ and $n_{cr} = 120$ find the value of r

SECTION – C (3x6=18)

26. Find the domain and range of the function

If $A = \{1,2,3\}$, $B = \{3,4\}$ and $C = \{4,5,6\}$, find (i) $A \times (B \cap C)$ (ii) $(A \times B) \cap (A \times C)$

27. Prove that $\frac{\sin 5x - 2\sin 3x + \sin x}{\cos 5x - \cos x} = \tan x$

28. If $\tan x = \frac{3}{4}$ and x lies in third quadrant, find the value of $\sin \frac{x}{2}$, $\cos \frac{x}{2}$ and $\tan \frac{x}{2}$

OR

Show that $\sqrt{2 + \sqrt{2 + \sqrt{2 + 2\cos 8\theta}}} = 2\cos \theta$



29. Prove that $\cos 6x = 32\cos^6 x - 48\cos^4 x + 18\cos^2 x - 1$

OR

Prove that $\frac{\sin x}{\cos 3x} + \frac{\sin 3x}{\cos 9x} + \frac{\sin 9x}{\cos 27x} = \frac{1}{2}(\tan 27x - \tan x)$

30. Let $Z_1 = 2 - i$, $Z_2 = -2 + i$ find $\operatorname{Re} \left(\frac{Z_1 Z_2}{\bar{Z}_1} \right)$

31. A solution of 8% boric is to be diluted by adding 2% boric acid solution to it. The resulting mixture is to be more than 4% but less than 6% boric acid. If we have 640 litres of 8% solution, how many litres of the 2% solution will have to be added.

SECTION – D (5x4=20)

32. If $af(x) + bf\left(\frac{1}{x}\right) = \frac{1}{x}$, where $a \neq b$, and $x \neq 0$ find $f(x)$

OR

(a) Find the domain and range of the function $f(x) = \sqrt{2-x}$

(b) Write the signum function with domain and range also draw the graph of the function.

33. If $a \cos 2\theta + b \sin 2\theta = c$ has α and β as its roots then prove that $\tan \alpha + \tan \beta = \frac{2b}{a+c}$

OR

$$\sin 20^\circ \cdot \sin 40^\circ \cdot \sin 60^\circ \cdot \sin 80^\circ = \frac{3}{16}$$

34. If $|z| = 1$, then prove that $\frac{z-1}{z+1}$ ($z \neq -1$) is a purely imaginary number. Type equation here.
35. Find the number of arrangements of the letters of the word INDEPENDENCE. In how many of these arrangements
- (i) Do the words start with P?
 - (ii) Do all the vowels always occur together?
 - (iii) Do all the vowels never occur together?
 - (iv) Do the words begin with I and end with P?

SECTION – E (4x3=12)

36. A mathematics teacher of class XI write two things about Mohan and Sohan, Which are below in figure.

	Mohan	Sohan
Age	${}^nP_r$	${}^nP_{r+1}$
Height (in feet)	${}^nC_r$	${}^nC_{r-1}$



Now answer the following question which are based on above data.

- (i) If the age of Mohan and Sohan are equal, then find the value of $(n-r)$ [1]
- (ii) If the height of Mohan and Sohan are equal, then find the value of $(n-2r)$. [1]
- (iii) Find the age of Mohan and the height of Sohan. [2]

OR

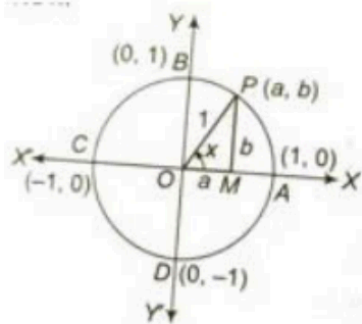
Prove that : $\frac{(2n)!}{n!} = \{1.3.5 \dots (2n-1)\}2^n$.

37. Consider the information given below

Let P (a,b) be any point on the unit circle given below, which has its centre at origin

o. It is given that $\angle AOP = x$ radian.

Now answer the questions based on figure given below.



- (i) If $a = \frac{\sqrt{3}}{2}$ and $b = \frac{-1}{2}$, Then find the value of x in radian. [1]
- (ii) If $x = 25^\circ$, then find the value of x in radian [1]
- (iii) If $x = 75^\circ$ and $y = 15^\circ$ then find the value of $\tan x + \tan y$ [2]

38. A quiz completion is very popular now-a-days. A director of an institute organized a quiz competition includes three subjects Mathematics, Physics and Chemistry for all his students. He issued form so that student could opt the subject(s) or not participate. Total 175 students filled the form and opted subject(s) as follows:
 Mathematics 100, Physics 70, Chemistry 46, Mathematics and Physics 30,
 Mathematics and Chemistry 28, Physics and Chemistry 23, Mathematics, Physics
 and Chemistry 18

On the basis of above information, answer the following

- (i) Find the number of students who participated in Mathematics only [1]
- (ii) Find the number of students who did not participate in the quiz competition [1]
- (iii) Find the number of students who participated in [2]
 - (a) Physics only
 - (b) Chemistry only

General Instructions:

- All questions are compulsory.
- The question paper consists of 4 Sections: Section A (14 Marks), Section B (14 Marks), Section C (27 Marks), and Section D (15 Marks).
- Section A contains sub-questions (MCQs, Assertion-Reason, and Very Short Answer questions).
- Section B contains 7 short answer questions of 2 marks each.
- Section C contains 9 short answer/numerical questions of 3 marks each.
- Section D contains 3 long answer questions of 5 marks each with internal choices.
- Physical constants to use where necessary: Acceleration due to gravity $g = 9.8 \text{ m/s}^2$, $\sin 30^\circ = 0.5$, $\cos 30^\circ = 0.866$, $\sin 45^\circ = 0.707$.

SECTION A (14 Marks)**Question 1**

(i) Choose the correct option for the following sub-questions: $[7 \times 1 = 7]$

1. The dimensional formula for the universal gravitational constant (G) is:

- (a) $[M^{-1} L^3 T^{-2}]$
- (b) $[M L^2 T^{-2}]$
- (c) $[M^{-2} L^3 T^{-1}]$
- (d) $[M^{-1} L^2 T^{-2}]$

2. A particle moves along a straight line such that its displacement x at any time t is given by $x = (3t^2 - 6t + 4) \text{ m}$. The velocity of the particle when its acceleration becomes zero is:

- (a) 3 m/s
- (b) -6 m/s
- (c) 0 m/s
- (d) 6 m/s

3. The angle between vector $A = \hat{i} + \hat{j}$ and vector $B = \hat{i} - \hat{j}$ is:

- (a) 0°
- (b) 45°
- (c) 90°
- (d) 180°

4. A body of mass 2 kg is resting on a rough horizontal surface with a coefficient of static friction $\mu_s = 0.4$. If a horizontal force of 5 N is applied, the magnitude of the static friction force acting on the body is ($g = 10 \text{ m/s}^2$):

- (a) 8 N
- (b) 5 N
- (c) 2 N
- (d) Zero

5. The horizontal range of a projectile fired at an angle of 15° with the horizontal is 50 m. If it is fired with the same speed at an angle of 45° , its range will be:

- (a) 50 m
- (b) 100 m
- (c) $50\sqrt{2}$ m
- (d) 200 m

6. Work done by a conservative force along any closed path is always equal to:

- (a) Positive value
- (b) Negative value
- (c) Zero
- (d) Infinity

7. Two bodies of masses m and $4m$ have equal kinetic energies. The ratio of their linear momenta ($p_1 : p_2$) is:

- (a) 1 : 4
- (b) 4 : 1
- (c) 1 : 2
- (d) 1 : 1

(ii) Assertion and Reason Questions: $[4 \times 1 = 4]$

Directions: Choose the correct option from:

- (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) A is false, but R is true.

8. Assertion (A): Mass cannot be added to velocity to obtain a meaningful physical quantity.

Reason (R): Only physical quantities having the same dimensions can be added or subtracted.

9. Assertion (A): The area under the force-displacement graph gives the work done by the force.

Reason (R): Work done is defined as the scalar product of force and displacement vectors.

10. Assertion (A): When a person stands in a stationary lift, their apparent weight is equal to their actual weight.

Reason (R): In a stationary lift, normal reaction $N = mg$.

11. Assertion (A): In an inelastic collision, the total kinetic energy of the system is conserved.

Reason (R): Non-conservative forces like friction or deformation perform work during an inelastic collision.

(iii) Very Short Answer Questions: $[3 \times 1 = 3]$

12. State the number of significant figures in the measurement 0.005080 kg.
13. Can a body have zero velocity and still be accelerating? Give one real-life example.
14. What is the angle between centripetal acceleration and tangential velocity for a particle moving along a uniform circular path?

SECTION B (14 Marks)

Question 2: Check the dimensional correctness of the equation $T = 2\pi \sqrt{l/g}$, where T is the time period of a simple pendulum, l is its length, and g is acceleration due to gravity. [2]

Question 3: The length and breadth of a rectangular lamina are measured as (5.7 ± 0.1) cm and (3.4 ± 0.2) cm respectively. Calculate the percentage error in the area of the rectangle. [2]

Question 4: A car travelling along a straight highway at 72 km/h is brought to a stop within a distance of 200 m. Assuming uniform retardation, find the deceleration of the car and the time taken to stop. [2]

Question 5: State the Parallelogram Law of Vector Addition. Write the mathematical expression for the magnitude of the resultant vector formed by two vectors $\vec{P}$ and $\vec{Q}$ inclined at an angle θ . [2]

Question 6: Explain why a cyclist bends inward while negotiating a circular curve on a level road. Draw a neat force diagram showing the forces involved. [2]

Question 7: Distinguish clearly between conservative and non-conservative forces with one example of each. [2]

Question 8: A light body and a heavy body have the same linear momentum. Which of the two possesses greater kinetic energy? Justify your answer mathematically. [2]

SECTION C (27 Marks)

Question 9: Define relative velocity. Two parallel rail tracks run north-south. Train A moves north with a speed of 54 km/h, and Train B moves south with a speed of 90 km/h. Calculate:

- (i) The relative velocity of B with respect to A.
- (ii) The relative velocity of ground with respect to B. [3]

Question 10: A projectile is thrown with an initial velocity u making an angle θ with the horizontal. Derive expressions for:

- (i) Maximum height reached (H)
- (ii) Total time of flight (T) [3]

Question 11: State Newton's Second Law of Motion. Show how Newton's First Law can be deduced as a special case from the Second Law. [3]

Question 12: A block of mass 5 kg is placed on a rough horizontal plane. The coefficient of static friction between the block and the surface is 0.3.

- (i) Calculate the maximum horizontal force that can be applied to the block without moving it ($g = 9.8 \text{ m/s}^2$).
- (ii) If a horizontal force of 20 N is applied, calculate the acceleration of the block given that the kinetic friction coefficient is 0.25. [3]

Question 13: State the Work-Energy Theorem. Prove it for a constant force acting along a straight path. [3]

Question 14: A spring requires a force of 100 N to compress it by 0.02 m.

(i) Find the force constant (k) of the spring.

(ii) Calculate the potential energy stored in the spring when it is compressed by 0.05 m. [3]

Question 15: A body of mass 2 kg moving at 4 m/s collides head-on elastically with another stationary body of mass 1 kg. Find the velocities of both bodies after the collision. [3]

Question 16: Derive the expression for the maximum permissible speed of a vehicle moving on a banked circular road of radius r having a banking angle θ and coefficient of friction μ . [3]

Question 17: Using dimensional analysis, derive an expression for the centripetal force F acting on a particle of mass m moving with velocity v in a circular path of radius r . (Take dimensionless constant $k = 1$). [3]

SECTION D (15 Marks)

Question 18: (a) Prove that the path of a projectile fired at an angle θ with the horizontal from the ground is parabolic in nature.

(b) A stone is dropped from the top of a tower 100 m high, and at the same time another stone is projected vertically upwards from the ground with a speed of 25 m/s. Find when and where the two stones will meet ($g = 9.8 \text{ m/s}^2$). [5]

--- OR ---

(a) Define centripetal acceleration. Derive an expression for centripetal acceleration ($a_c = v^2/r$) for a particle undergoing uniform circular motion.

(b) An aircraft executes a horizontal loop of radius 1.0 km with a steady speed of 900 km/h. Compare its centripetal acceleration with the acceleration due to gravity ($g = 9.8 \text{ m/s}^2$).

Question 19: (a) State the Law of Conservation of Linear Momentum. Prove this law using Newton's Third Law of Motion.

(b) Two bodies of masses $m_1 = 3 \text{ kg}$ and $m_2 = 5 \text{ kg}$ are connected at the ends of a light inextensible string passing over a smooth frictionless pulley (Atwood machine). Find:

(i) The common acceleration of the system.

(ii) The tension in the string ($g = 9.8 \text{ m/s}^2$). [5]

--- OR ---

(a) Define limiting friction and state the laws of limiting friction.

(b) Derive an expression for the work done in pulling a body up a rough inclined plane of inclination θ with the horizontal.

(c) What is the angle of repose? Derive its relationship with the coefficient of static friction (μ).

Question 20: (a) Prove that the total mechanical energy of a body falling freely under gravity remains conserved at every point of its motion. Illustrate with a graphical representation of Kinetic Energy and Potential Energy vs. Height.

(b) An electric pump of power 2 kW is used to lift water from a well 20 m deep into a storage tank

located at a height of 10 m above the ground. Calculate the volume of water (in liters) pumped per minute ($g = 10 \text{ m/s}^2$, density of water = 1000 kg/m^3). **[5]**

--- OR ---

(a) Discuss elastic collision in one dimension. Derive expressions for the final velocities (v_1 and v_2) of two colliding bodies of masses m_1 and m_2 moving initially with velocities u_1 and u_2 .

(b) Show that when two equal masses undergo a 1D elastic collision, they simply exchange their velocities after impact.