SAINIK SCHOOL BHUBANESWAR
AUTUMN VACATION TASK 2025-26
SUBJECT-PHYSICS
CLASS-XI

1. State Newton's laws of motion. Hence define inertia.
2. A shopper pushes a grocery cart 20.0 m at constant speed on level ground, against a 35.0 N frictional force. He pushes in a direction 30^0 below the horizontal. (a) What is the work done on the cart by friction? (b) What is the work done on the cart by the gravitational force? (c) What is the work done on the cart by the shopper? (d) Find the force the shopper exerts, using energy considerations. (e) What is the total work done on the cart?
3. To maintain a rotor at a uniform angular speed of 200 rad/sec an engine needs to transmit a torque of 180 Nm. What is the power required by the engine?
4. Prove the relation torque is equal to rate of change of angular momentum.
5. What is the difference between center of mass and center of gravity?
6. A bullet of mass 0.02 kg is moving with a speed of 10m-1 s. It can penetrate 10 cm of a wooden block, and comes to rest. If the thickness of the target would be 6 cm only find the KE of the bullet when it comes out.
7. Explain why
   (a) A horse cannot pull a cart and run in empty space,
   (b) Passengers are thrown forward from their seats when a speeding bus stops suddenly,
   (c) It is easier to pull a lawn more than to push it,
   (d) A cricketer moves his hands backwards while holding a catch.
8. A man weighs 70 kgs. He stands on a weighing machine in a lift, which is moving
   (a) Upwards with a uniform speed of 10 m/s.
   (b) Downwards with a uniform acceleration of 5 m/s^2 .
   (c) Upwards with a uniform acceleration of 5 m/s^2 .
   What would be the readings on the scale in each case?
   (d) What would be the reading, if the lift mechanism failed and it came down freely under gravity?
9. Two bodies of mass m_1 and m_2 have equal kinetic energies. What is the ratio of their linear momenta?
10. A rocket explodes mid air. How does this affect (a) its total momentum and (b) its total kinetic energy?
11. Two ball bearings of mass m each moving in the opposite directions with equal speed v collide head on with each other. Predict the outcome of the collision, assuming it to be perfectly elastic.
12. A particle moves along the X-axis from x=0 to x=5m under the influence of a force given by $F= 7-2x+3x^2$. Find the work done in the process.
13. A body of mass 2 kg is resting on a rough horizontal surface. A force of 20 N is now applied to it for 10 s, parallel to the surface. If the co-efficient of kinetic friction between the surfaces in contact is 0.2, calculate (a) work done by the applied force in 10s. (b) Change in kinetic energy of the object in 10s.
14. A particle of mass m moves in a straight line with retardation proportional to its displacement. Find the expression for loss of kinetic energy for any displacement x.
15. A molecule in a gas container hits a horizontal wall with speed 200 m/s and angle $30^0$with the normal, and rebounds with the same speed. Is the momentum conserved in the collision? Is the collision elastic or inelastic?
16. A circular plate of uniform thickness has a diameter of 56 cm. A circular portion of diameter 42 cm is removed from one edge of the plate. Find CM of the remaining portion.
17. Three masses 3,4 and 5 kg are located at the corners of an equilateral triangle of side 1m. Locate the centre of mass of the system.
18. Two bodies of masses 1kg and 2 kg are located at (1,2) and (-1,3) respectively. Calculate the co-ordinates of the centre of mass.

19. What is law of conservation of angular momentum? Write 5 examples.
20. Prove that torque applied on an object is equal to the rate of change of angular momentum.
21. Derive the following equations of rotational motion under constant angular acceleration.
    (i) $\omega = \omega_0 + \alpha t$
    (ii) $\theta = \omega_0 + \frac{1}{2} \alpha t^2$
    (iii) $\omega^2 - \omega_0^2 = 2\alpha\, \theta$
    Where the symbols carry their usual meaning.
22. Find the radius of gyration of a circular ring and a uniform circular disc about
    (i) An axis perpendicular to the plane and passing through the centre
    (ii) A diameter
    (iii) Tangent perpendicular to the plane
    (iv) Tangent parallel to the plane
23. Four spheres of diameter 2a and mass M are placed with their centers on the four corners of the square of side b. Calculate the moment of inertia of the system about one side of the square taken as its axis.
24. Determine the position of centre of mass of a hemisphere of radius R.
25. In a circus, the diameter of globe of death is 20m. From what minimum height must a cyclist start in order to go round the globe successfully?

CHEMISTRY

1. An element 'X' belongs to the third period and group 15 of the periodic table.
   Find out
   (a) the number of valence electrons in its atom.
   (b) is it a metal or non-metal?
   (c) name of the element and its electronic configuration.

2. An element 'X' belongs to the fourth period and group 1 of the periodic table.
   Find out
   (a) the number of valence electrons in its atom.
   (b) is it a metal or non-metal?
   (c) name of the element and its electronic configuration.

3. Write the state of hybridization of
   (a) Beryllium in $BeCl_2$ (b) nitrogen in NH_3
   (c) oxygen in H_2O (d) sulphur in SF_6
   (e) carbon in CO_3^{2-}

4. (a) The first ionization enthalpy values (in KJ/mol) of group 13 elements are

B	Al	Ga	In	Tl
801	577	579	558	589

   How would you explain this deviation from the general trend?
   (b) How would you explain the fact that the first ionization enthalpy of sodium is lower than that of magnesium but its second ionization enthalpy is higher than that of magnesium?

5. Diborane is a potential fuel which undergoes combustion according to the following reaction.
   $B_2H_6(g) + 3\ O_2(g) \rightarrow B_2O_3(s) + 3\ H_2O(g)$
   From the following data, calculate the enthalpy change for the combustion of diborane.
   (i) $2\ B(s) + 3/2\ O_2(g) \rightarrow B_2O_3(s)$ $\Delta_fH = (-1273 kj/mol)$
   (ii) $H_2(g) + 1/2 O_2(g) \rightarrow H_2O(l)$ $\Delta_fH = (-286 kj/mol)$
   (iii) $H_2O(l) \rightarrow H_2O(g)$ $\Delta_fH = (+44 kj/mol)$
   (iv) $2B(s) + 3H_2(g) \rightarrow B_2H_6(g)$ $\Delta_fH = (+36.0\ KJ/mol)$

6. $2\ A(g) + B(g) \rightarrow 2D(g)$
   $\Delta U_{298} = -10.5$ kj, $\Delta S = -44.1\ jk^{-1}$
   Calculate ΔG_{298} for the reaction and predict whether the reaction is spontaneous or not.

7. For an isolated system, $\Delta U = 0$, What will be ΔS?
8. For the reaction, $2Cl(g) \rightarrow Cl_2(g)$, What are the signs of ΔH and ΔS?

9. Calculate the enthalpy change on freezing of 1 mol of water at 10^0C to ice at -10^0C.
   $\Delta fus\ H = 6.03 KJ/mol$ at 0^0C. $C_p[H_2O(l)] = 75.3 Jmol^{-1}K^{-1}$, $C_p[H_2O(s)] = 36.8 Jmol^{-1}K^{-1}$.

10. If the water vapour is assumed to be a perfect gas, molar enthalpy change for vaporization of 1 mol of water at 1 bar and 100^0C is 41 KJ/mol. Calculate the internal energy change, when
    (a) 1 mol of water is vaporized at 1bar pressure and 100^0C.
    (b) 1 mol of water converted into ice.

11. The combustion of 1 mol of benzene takes place at 298K and 1 atm. After combustion, $CO_2(g)$ and $H_2O(l)$ are produced and 3267 KJ of heat is liberated. Calculate the standard enthalpy of formation,

$\Delta f H^0$ of benzene. Standard enthalpies of formation of $CO_2(g)$ and $H_2O(l)$ are —393.5 KJ/mol and —285.83 KJ/mol respectively.

12. Conjugate acid of a weak base is always stronger. What will be the decreasing order of basic strength of the following conjugate bases?
OH^-, RO^- , CH_3COO^- , Cl^-

13. pH of a solution of a strong acid is 5.0. What will be the pH of the solution obtained after diluting the given solution a 100 times?

14. A sparingly soluble salt gets precipitated only when the product of Concentration of its ions in the solution (Qsp) becomes greater than its solubility product. If the solubility of $BaSO_4$ in water is 8×10^{-4} mol dm^{-3}. Calculate its Solubility in 0.01 mol dm^{-3} of H_2SO_4.

15. Draw the structure of $C_2 H_4$, XeF_4 , ClF_3 by using VBT and mention their hybridization.

16. Write a relation between ΔG and Q and define the meaning of each term and answer the following :
(a)Why a reaction proceeds forward when $Q < K$ and no net reaction occurs when $Q = K$.
(b) Explain the effect of increase in pressure in terms of reaction quotient Q.
for the reaction : $CO(g) + 3H_2(g) \rightleftharpoons CH_4(g) + H_2O(g)$

17. At 473K the equilibrium constant Kc for the decomposition of PCl_5 is 8.3×10^{-3}. If decomposition proceeds as: $PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$ $\Delta H = (+124.0$ KJ/mol)
(a) What would be the effect on Kc if
(i) more of PCl_5 is added ?
(ii) temperature is increased?
(iii) pressure is increased?

18. What will be the resultant pH of the solution when 200 ml of an aqueous solution of HCl (pH=2) is mixed with 300 ml of an aqueous solution of NaOH(pH=12)?

19. What will be the conjugate bases for the Bronstedacids?
H_2SO_4, HCO_3^-

20. (a) Why are the axial bonds of PCl_5 are longer as compared to equatorial bonds?

(b) Draw the resonating structures of O_3.

Biology

Part A – Competency-Based Questions:

(Answer briefly, with diagrams/examples where needed)

1. A gardener notices that mosses are growing in damp shady areas of his garden but not in sunny dry patches. Explain why.

2. A farmer finds both algae and fungi growing on moist walls. Which kingdom do they belong to? Give reasons.

3. Why are lichens considered ecological indicators?

4. Compare the reproductive strategies of bryophytes and pteridophytes with examples.

5. Gymnosperms thrive in cold regions. Which adaptations make this possible?

6. Differentiate between diploblastic and triploblastic animals with an example each.

7. An earthworm's body is segmented. Explain how segmentation provides an advantage.

8. Classify cockroach under phylum, class and give two features justifying the classification.

9. Why are sponges considered multicellular but without true tissues?

10. Students observed Hydra regenerating from a cut piece. Which biological property does this represent?

11. A man drinks unclean water and develops amoebiasis. Identify the pathogen and describe its mode of transmission.

12. How do annelids and arthropods differ in circulatory systems?

13. Why are reptiles considered better adapted to terrestrial life compared to amphibians?

14. In flowering plants, double fertilisation is unique. Explain its significance.

15. A botanist finds non-motile, unicellular organisms with chitinous cell wall. To which kingdom should they be placed? Why?

16. Distinguish between phloem transport in gymnosperms and angiosperms.

17. A zoologist classifies animals based on body cavity. Differentiate between coelomates, acoelomates and pseudocoelomates with examples.

18. Explain why viruses are placed on the border line of living and non-living organisms.

19. Name an animal that exhibits both bilateral and radial symmetry during its life cycle. Explain.

20. Compare the body plans of Cnidaria and Platyhelminthes in terms of organisation and symmetry.

Part B – Project Work

Project Title: Biodiversity in My Locality

☞ Instructions:

- Prepare a field-based report on 10 plant species and 10 animal species observed in your locality (garden, pond, park).
- For each organism, record:
  - Common name & Scientific name
  - Kingdom/Phylum/Division
  - One characteristic feature
  - Ecological/ Economic importance
- Present your work in tabular format with sketches/photographs.
- Write a conclusion highlighting biodiversity conservation in your area.

✧ Submission format: Notebook + Project file (A4 sheets / Chart paper with photos & tables).

MATHEMATICS

Insructions :

- *Answer all the questions mentioning proper Question number. Total Questions: 100*
- *Write the Answers in A4 sheet papers and the staple them.*
- *In the cover page mention the above Heading along with your Name and School Number.*
- *The symbol ^ indicates indices or power.*

Chapters: Trigonometry, Permutations & Combinations, Complex Numbers

Q1. Prove that (sin A + cos A)^2 + (sin A - cos A)^2 = 2.

Q2. Solve for θ: 2sin^2θ – 3sinθ + 1 = 0, where $0 \leq \theta \leq 360°$.

Q3. If sin A = 3/5, find the values of cos A and tan A.

Q4. Prove that: (1 + tan^2A) = sec^2A.

Q5. If sin θ + cos θ = √2, find sin^4θ + cos^4θ.

Q6. Solve for x: cos 2x = sin x, where $0 \leq x \leq 360°$.

Q7. If tan A = 3/4, find sin A and cos A.

Q8. Prove that: (1 + cot^2A) = cosec^2A.

Q9. Find the general solution of sin 2x = √3/2.

Q10. If cos θ = 12/13, find the value of tan θ.

Q11. Prove that: (sin A + cos A) / (sin A - cos A) = (1 + cot A) / (cot A - 1).

Q12. Solve for x: 2cos^2x – 3sin x = 0.

Q13. If cos A = 4/5, find sin 2A and cos 2A.

Q14. Prove that: (1 – sin A)(1 + sin A) = cos^2A.

Q15. Find the general solution of tan x = √3.

Q16. If sin A = 12/13, find cos 2A and sin 2A.

Q17. Prove that: (sec A – tan A)(sec A + tan A) = 1.

Q18. Solve for θ: cos^2θ – 3sin θ cos θ = 0.

Q19. If sin A = 0.6, find the value of cos A + tan A.

Q20. Prove that: (1 + tan A)(1 – tan A) = 1 – tan^2A.

Q21. Find the general solution of cot 2x = 1.

Q22. If sin θ = 0.8, find cos θ and tan θ.

Q23. Solve for x: sin^2x – 3sin x + 2 = 0.

Q24. If cos A = 5/13, find sin A and tan A.

Q25. Prove that: (cosec A – sin A)(sec A – cos A) = 1 / (tan A + cot A).

Q26. If tan A = 7/24, find sin A and cos A.

Q27. Solve for θ: sin 2θ = cos θ.

Q28. Prove that: (1 + tan^2A) / (1 + cot^2A) = tan^2A.

Q29. If cos A = 0.9, find the value of sin A and tan A.

Q30. Find the general solution of sin x = 0.

Q31. If sin A = 5/13, find cos 2A and sin 2A.

Q32. Solve for x: 2sin^2x + 3cos x = 0.

Q33. Prove that: (1 – cos A)(1 + cos A) = sin^2A.

Q34. How many different words can be formed using all the letters of the word 'MATHEMATICS'?

Q35. In how many ways can 5 boys be seated in a row of 8 chairs?

Q36. How many numbers greater than 4000 can be formed using digits 2, 3, 4, 5, 6 without repetition?

Q37. How many ways can the letters of the word 'ARRANGE' be arranged?

Q38. In how many ways can 7 people be seated at a round table?

Q39. How many different signals can be made using 4 flags of different colours taken at a time from 7?

Q40. How many 3-digit numbers can be formed using digits 1, 2, 3, 4, 5 if repetition is allowed?

Q41. Find the number of ways of arranging the letters of the word 'SUCCESS'.

Q42. In how many ways can a committee of 4 persons be selected out of 10 persons?

Q43. How many ways can 12 players be selected out of 15 players to form a cricket team?

Q44. How many 5-digit even numbers can be formed using digits 1, 2, 3, 4, 5, 6 without repetition?

Q45. How many ways can 6 different books be arranged on a shelf?

Q46. How many ways can a president and a vice-president be selected from 10 candidates?

Q47. How many different 4-digit numbers can be formed using digits 1, 2, 3, 4, 5 with repetition allowed?

Q48. How many permutations of the letters of the word 'COMMITTEE' are possible?

Q49. Find the number of different ways in which 5 balls can be distributed among 3 children.

Q50. How many different passwords can be formed using 4 different letters chosen from the first 10 alphabets?

Q51. How many arrangements can be made using all the letters of the word 'PROBABILITY'?

Q52. How many different 3-digit numbers can be formed from digits 2, 4, 6, 8, 9 without repetition?

Q53. In how many ways can 6 different toys be distributed among 4 children if each child gets at least one toy?

Q54. How many ways can 4 boys and 3 girls be seated in a row such that boys and girls sit alternately?

Q55. How many different license plates can be formed using 2 letters followed by 4 digits?

Q56. How many ways can 10 people be seated in a row if two particular persons always sit together?

Q57. How many different words can be formed using all the letters of the word 'STATISTICS'?

Q58. Find the number of ways of arranging 6 men and 5 women in a row such that no two women sit together.

Q59. In how many ways can 3 students be selected from a group of 12 students?

Q60. How many 6-digit numbers can be formed using digits 1 to 9 if repetition of digits is not allowed?

Q61. How many ways can 8 persons be seated around a round table if two particular persons never sit together?

Q62. Find the number of different words that can be formed using the letters of the word 'BANANA'.

Q63. How many different 5-digit odd numbers can be formed using digits 1, 3, 5, 7, 9 without repetition?

Q64. How many ways can 12 balls be distributed among 4 children if each child gets at least 2 balls?

Q65. How many different 7-digit telephone numbers can be formed using digits 0–9?

Q66. How many ways can a team of 11 players be selected out of 16 players including a captain?

Q67. How many arrangements can be made using all the letters of the word 'EQUATION'?

Q68. Find the square roots of –16.

Q69. Express $(1 + i)^4$ in the form a + ib.

Q70. If $z1 = 3 + 2i$ and $z2 = 1 – 4i$, find $z1 + z2$ and $z1 \cdot z2$.

Q71. Express $1/(1 – i)$ in the form a + ib.

Q72. If $z = 2 + 3i$, find $|z|$ and $\arg(z)$.

Q73. Find the modulus and argument of –3 + 4i.

Q74. Express $\cos \theta + i \sin \theta$ in exponential form.

Q75. If $z1 = 2 + i$ and $z2 = 3 – 2i$, find $z1/z2$.

Q76. Solve the equation $x^2 + 4 = 0$ in complex numbers.

Q77. Find the cube roots of unity.

Q78. If $z = \cos \theta + i \sin \theta$, prove that $z^n = \cos n\theta + i \sin n\theta$.

Q79. Express $(2 – 3i)(2 + 3i)$ in the form a + ib.

Q80. If $z = 5(\cos 60° + i \sin 60°)$, find z^3.

Q81. Solve for x: $x^2 + x + 1 = 0$.

Q82. Find the value of $(1 + i)^{10}$.

Q83. If $z1 = 4 + 3i$, find $1/z1$ in the form $a + ib$.

Q84. Find the conjugate of $(7 – 24i)/(7 + 24i)$.

Q85. If $z = 3(\cos 120° + i \sin 120°)$, find z^6.

Q86. Express $(1 – i)^6$ in the form $a + ib$.

Q87. If $z1 = 2 – 3i$ and $z2 = –1 + 4i$, find $z1/z2$.

Q88. Find the roots of the equation $x^2 + 2x + 5 = 0$.

Q89. If $z = 1 + i\sqrt{3}$, find $|z|$ and $\arg(z)$.

Q90. Find the value of $(\cos 30° + i \sin 30°)^6$.

Q91. If $z = 4(\cos 45° + i \sin 45°)$, find z^4.

Q92. Express $(3 + 4i)/(3 – 4i)$ in the form $a + ib$.

Q93. If $z1 = 2 + 2i$, find $(z1)^5$ in polar form.

Q94. Find the cube roots of $8(\cos 0° + i \sin 0°)$.

Q95. Solve for x: $x^2 – 6x + 25 = 0$.

Q96. Express $(\cos 72° + i \sin 72°)^5$ in rectangular form.

Q97. If $z = –2 + 2\sqrt{3}i$, find $|z|$ and $\arg(z)$.

Q98. Find the square roots of $7 – 24i$.

Q99. If $z = \cos \theta + i \sin \theta$, prove that $|z| = 1$.

Q100. COMPLETE ALL THE ACTIVITIES OF XI MATHEMATICS IN YOUR ACTIVITY NOTEBOOK.

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English

The Portrait of a Lady

1. How does Khushwant Singh portray his grandmother in 'The Portrait of a Lady'?
2. Describe the relationship between the author and his grandmother. How does it change over time?

We're Not Afraid to Die… if We can all be together

1. How does the author describe the struggle of his family against the sea?
2. What role did courage and unity play in the survival of the family?

Discovering Tut: The Saga Continues

1. What were the scientific advancements that helped in the new study of Tutankhamun's remains?
2. How does the discovery of Tut provide insights into ancient Egyptian civilization?

The Summer of the Beautiful White Horse

1. What values do Aram and Mourad represent in the story?
2. How does the story highlight the themes of honesty and trust?

The Address

1. How does the story 'The Address' depict the impact of war on human relationships?
2. Why does the narrator decide not to take back her belongings from Mrs. Dorling's?

Classified Advertisement

1. Draft a classified advertisement to sell your old motorbike.
2. Draft a classified advertisement for a tuition teacher required for Class X Mathematics.

Poster

1. Design a poster on the topic 'Say No to Plastic'.
2. Design a poster to create awareness about 'Road Safety'.

Speech

1. Write a speech on the importance of time management for students.
2. Write a speech on the role of technology in education.

Debate

1. Write a debate for or against the motion: 'Online learning is better than classroom learning'.
2. Write a debate for or against the motion: 'Mobile phones should be banned in schools'.

Computer Science

1. What is the difference between if-else and if-elif-else?
2. Explain the use of `break` and `continue` statements with examples.
3. What is the difference between `while` and `for` loop?
4. Define infinite loop with an example.
5. Write a program to display the Fibonacci series up to N terms.
6. What is a string in Python?
7. Write all string function. (ref. Text Book,SumitaArora)
8. Explain immutability of strings with an example.
9. What is string slicing? Give an example.
10. Differentiate between `find()` and `index()` methods.
11. What is the difference between `isalpha()` and `isalnum()`?
12. Write a program to count the number of vowels in a given string.
13. Write a program to check whether a string is a palindrome.
14. Write a program to count the frequency of each character in a string.
15. Write a program to remove all punctuations from a string.