INDIAN ASSOCIATION OF PHYSICS TEACHERS

Standard Examination in High School Science - 2025

Date of Examination November 30, 2025

Time: 10:00 am to 12:30 noon

Question Paper Code: H01

Student's Roll No:											

Write the Question Paper Code (mentioned above) on YOUR OMR Answer Sheet (in the space provided), otherwise your Answer Sheet will NOT be evaluated. Note that the same Question Paper Code appears on each page of the Question Paper.

Instructions to Candidates:

1. Use of mobile phone, smart watch, and iPad during examination is STRICTLY **PROHIBITED.**
2. In addition to this Question Paper, you are given OMR Answer Sheet along with candidate's copy.
3. On the OMR sheet, make all the entries carefully in the space provided **ONLY** in **BLOCK CAPITALS** as well as by properly darkening the appropriate bubbles.
   Incomplete/ incorrect/ carelessly filled information may disqualify your candidature.
4. On the OMR Answer Sheet, use only **BLUE or BLACK BALL POINT PEN** for making entries and filling the bubbles.
5. Your **Eleven-digit roll number and date of birth** entered on the OMR Answer Sheet shall remain your login credentials means login id and password respectively for accessing your performance / result in Standard Examination in High School Science 2025.
6. Question paper has two parts. In part A (Q. No.1 to 48) each question has four alternatives, out of which **only one** is correct. Choose the correct alternative and fill the appropriate bubble, as shown.

   Q.No.12 a ● c d

   In part B (Q. No. 49 to 60) each question has four alternatives out of which any number of alternative(s) (4, 3, 2, or 1) may be correct. You have to choose **all** correct alternative(s) and fill the appropriate bubble(s), as shown

   Q.No.52 a ● c ●

7. Attempt all sixty questions. For **Part A,** each correct answer carries 3 marks whereas 1 mark will be deducted for each wrong answer. In **Part B,** you get 6 marks if all the correct alternatives are marked and no incorrect. No negative marks in this part.
8. Rough work should be done in the space provided. There are **13** printed pages in this paper
9. Calculator is **not** allowed.
10. No candidate should leave the examination hall before the completion of the examination.
11. After submitting answer paper (the OMR), take away the question paper & candidate's copy of the OMR for your future reference.

Please DO NOT make any mark other than filling the appropriate bubbles properly in the space provided on the OMR Answer Sheet.

OMR Answer Sheets are evaluated using machine, hence CHANGE OF ENTRY IS NOT ALLOWED. Scratching or overwriting may result in a wrong score.

DO NOT WRITE ON THE BACK OF THE OMR ANSWER SHEET.

Instructions to Candidates (Continued) :
You may read the following instructions after submitting the Answer Sheet.

12. **Comments/ Inquiries/ Grievances regarding this question paper, if any, can be shared on the Inquiry/Grievance column on www.iapt.org.in on the specified format of SEHSS till Dec 10, 2025**

13. **The Answers/ Solutions to this Question Paper will be available under SEHSS link on the website: www.iapt.org.in by Dec 8, 2025.** The score card may be downloaded after Jan 10, 2026

14. **CERTIFICATES and AWARDS:**
Following certificates are awarded by IAPT to students, successful in the
STANDARD EXAMINATION IN HIGH SCHOOL SCIENCE – 2025

(i) "CENTRE TOP 10 %" To be downloaded from iapt.org.in after 30.01.26
(ii) "STATE TOP 1 %" Will be dispatched to the examinee
(iii) "NATIONAL TOP 1 %" Will be dispatched to the examinee
(iv) "GOLD MEDAL & MERIT CERTIFICATE" to all students who attend OCSE – 2026 Orientation Camp for Science Excellence organized by IAPT
Certificate for centre toppers shall be uploaded under SEHSS link on iapt.org.in

15. List of students (with centre number and roll number only) selected for OCSE – 2026 will be displayed under the link on the website: **www.iapt.org.in** by **Jan 15, 2026.**

Physical constants you may need….

Mass of electron $m_e = 9.11\times10^{-31}\,\text{kg} = 0.511\,\text{MeV}$	Magnitude of charge on electron $e = 1.60\times10^{-19}\,\text{C}$
Mass of proton $m_p = 1.67\times10^{-27}\,\text{kg}$	Planck's constant $h = 6.625\times10^{-34}\,\text{Js}$
Acceleration due to gravity $g = 9.80\ \text{ms}^{-2}$	Density of water is $\rho = 1.0\times10^{3}\,\text{kg m}^{-3}$
Universal gravitational constant $G = 6.67\times10^{-11}\,\text{Nm}^2\,\text{kg}^{-2}$	$(1+x)^n \approx 1+nx,$ if $\lvert x\rvert << 1$
Universal gas constant $R = 8.31\ \text{J mol}^{-1}\,\text{K}^{-1}$	$1\ \text{eV} = 1.6\times10^{-19}\ J$
Boltzmann constant $k = 1.38\times10^{-23}\,\text{JK}^{-1}$	$\sin(A\pm B) = \sin A\cos B \pm \cos A\sin B$
Avogadro's constant $A = 6.02\times10^{23}\ \text{mol}^{-1}$	$E = mc^2$ gives mass and energy equivalence.
Atmospheric pressure (at STP) = $1.013\times10^{5}\ \text{Nm}^{-2}$	One amu = 1 u = 931.5 MeV
Speed of light in free space $c = 3.0\times10^{8}\ \text{ms}^{-1}$	One unit of electric power = 1kWh

INDIAN ASSOCIATION OF PHYSICS TEACHERS
Standard Examination in High School Science
(SEHSS – 2025)

Time: 150 minute **Max. Marks: 216**

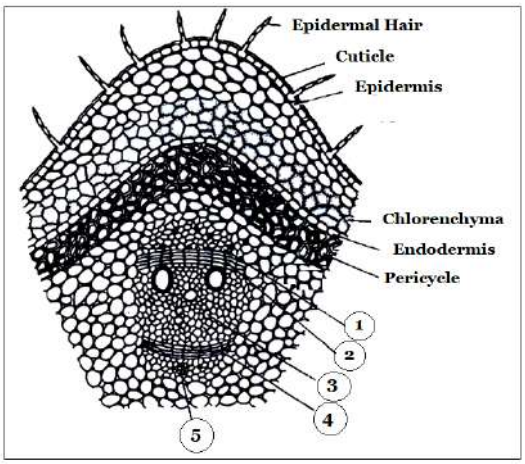
Attempt All Sixty Questions

Part A
Out of the Four Options only One is Correct. Bubble the Correct Option.

1. Which of the following forms 'Fried –egg' like structures during lab-culture?
   (a) Mycoplasma (b) Ricketts (c) Spirochaetes (d) *Escherichia coli*

2. Which of the following is India's first cloned Gir cow, born on March 16, 2023 at the National Dairy Research Institute (NDRI) Karnal (Haryana)?
   (a) Karishma (b) Garima (c) Mahima (d) Ganga

3. Study the following T.S. of Cucurbita stem:



   Choose the option showing the correct sequence of labeled parts 1 to 5:
   (a) Hypodermis, Outer Cambium, Xylem, Inner Cambium & Inner Xylem
   (b) Outer Phloem, Outer Cambium, Xylem, Inner Cambium & Inner Phloem
   (c) Inner Phloem, Inner Xylem, Cambium, Outer Xylem & Outer Phloem
   (d) Adaxial Phloem, Adaxial Cambium, Ground Tissue, Abaxial Cambium & Abaxial Phloem

4. Following is the list (COLUMN I) of characteristics related to some animals. Make the correct matches with the animals listed under COLUMN II:

CHARACTERISTICS	ANIMALS
(i) Brow Spot	(a) Viper
(ii) Coprophagy	(b) Man
(iii) Ambulacra	(c) Frog
(iv) Viviparous	(d) Rabbit
(v) Coccyx	(e) Ophioderma

   Choose the correct option:
   (a) (i)-(b); (ii)-(e); (iii)- (c); (iv)- (a); (v)-(d) (b) (i)-(c); (ii)-(d); (iii)- (e); (iv)- (a); (v)-(b)
   (c) (i)-(d); (ii)-(c); (iii)- (b); (iv)- (a); (v)-(e) (d) (i)-(c); (ii)-(a); (iii)- (d); (iv)- (c); (v)-(b)

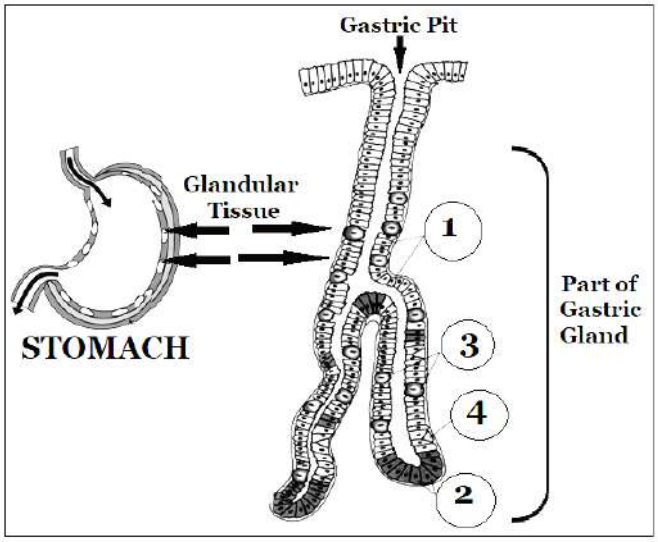
5. Which of the following has the largest number of protected wetlands designated under the Ramsar Convention?
   (a) Mexico (b) India (c) UK (d) China

6. Given below are two statements, one labeled as Assertion (A) and other labeled as Reason (R). Choose the correct option from the codes given below.
   Assertion (A): Complex food molecules, like proteins, carbohydrates and fats are broken down into simpler substances (*e.g.*, amino acids, glucose and fatty acids) through hydrolysis.
   Reason (R): The process of breaking down a water molecule (H_2O) into its components, hydrogen (H_2) and oxygen (O_2), is known as electrolysis. Hydrolysis, on the other hand, occurs when water reacts with another compound and splits it apart—like in the digestion of food or the breakdown of ATP in cells.
   Code:
   (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) R is true but A is false

7. Which of the following are known to possess two types of nuclei, Macro- and Micronuclei?
   (a) Sporozoans (b) Ciliates (c) Cnidarians (d) Cnidosporans

8. Cholesterol serves as the precursor for the synthesis of various steroid hormones. Which of the following is the source of C19 Steroidal Hormone, Androsterone?
   (a) Corpus Luteum (b) Kidneys (c) Testes (d) Adrenal Medulla

9. Given here is the histological diagram of the mammalian stomach. Its mucosal membrane is profusely folded and the pit-like infoldings distally form numerous simple or branched tubular gastric glands occurring in the fundus and corpus part. The principal type of cells found in each gland are labeled 1 – 4.



   Choose the correct option representing Pepsinogen, Hydrochloric Acid, Gastrin Hormone and Mucus-secreting cells, respectively (1 to 4):
   (a) 1, 2, 3 & 4 (b) 3, 2, 4 & 1 (c) 4, 2, 1 & 3 (d) 2, 3, 4 & 1

10. Translation is an important stage in the Central Dogma of Protein Synthesis. Which of the following is involved in the activation of Amino Acids?
    (a) Amino Peptidyl Transferase (b) Aminoacyl methionyl synthetase
    (c) Aminoacyl *tRNA* synthetase (d) Peptidyl Amino Transferase

11. Some characters of human beings follow a 'criss-cross' pattern of inheritance. Which of the following exemplifies this?
    (a) Sex-limited Inheritance (b) Sex-influenced Inheritance.
    (c) Sex-dominated Inheritance (d) Sex-linked Inheritance.

12. The periplastdial and perimitochondrial spaces are:
    (a) 100-300Å and 40-70 Å, respectively (b) 400-450 Å and 80-100 Å, respectively
    (c) 350-550 and 10-20 Å, respectively (d) 50-100 Å and 20-30 Å, respectively

13. An alkane having 16 covalent bonds is the m^{th} member of alkane homologous series. The ratio of carbon to hydrogen by weight in the m^{th} member of alkyne homologous series is
    (a) 15 : 2 (b) 5 : 1 (c) 36 : 5 (d) 6 : 1

14. The IUPAC nomenclature of organic compound 'A' is But-2-enoic acid. The weight of carbon dioxide produced by complete combustion of 44 g of the organic compound 'A' would be
    (a) 44 g (b) 88 g
    (c) greater than 88 g (d) greater than 44 g, but less than 88 g

15. A solid compound 'X' on heating gives CO_2 gas and a residue. The residue when mixed with water forms compound 'Y'. On passing an excess of CO_2 through 'Y' in water, a clear solution of 'Z' is obtained. On boiling 'Z', the compound 'X' is reformed. The pH of aqueous solution of compound 'X' at 25^oC is
    (a) 7 (b) less than 7 (c) more than 7 (d) cannot predict

16. In an organic compound of molar mass greater than 100 containing only C, H and N, the percentage of C is 6 times the percentage of H while the sum of the percentages of C and H is 1.5 times the percentage of N. Knowing that the percentage is taken by mass, the least value of the molar mass of the organic compound is
    (a) 105 (b) 140 (c) 175 (d) 210

17. A hypothetical element 'Coronium' has two isotopes A_1 and A_2. The mass of 3×10^{22} atoms of A_1 is 20 g while the mass of 1.5×10^{22} atoms of A_2 is 10.5 g. Then average atomic weight of element 'Coronium' in isotopic mixture (3×10^{22} atoms of A_1 and 1.5×10^{22} atoms of A_2) would be approximately
    (a) 418.30 (b) 408.23 (c) 406.67 (d) data insufficient

18. For an experiment in the laboratory only two solutions are available ;
    Solution A : 250 g of 40% (w/w) NaCl solution and
    Solution B : 300 g of 60% (w/w) NaCl solution
    The Maximum weight of a solution (having exactly 55% (w/w) NaCl concentration) that can be prepared by the mixing of Solution A and Solution B only can be
    (a) 500 g (b) 400 g (c) 450 g (d) 550 g

19. The nucleus of the element X with mass number 81 contains 31% more neutrons as compared to protons. Then the relationship between the nuclei of element X with nuclei of element ^{79}As is that they are
    (a) Isotopes (b) Isotones (c) Isobars (d) Isoelectronic

20. If the atomic weight of the most stable isotope of the element M is 40 times that of the lightest element, then formula of the compound of its phosphate is
    (a) $M_3(PO_4)_2$ (b) $M_2(PO_4)_3$ (c) MPO_4 (d) M_3PO_4

21. An oxide of nitrogen has molecular weight 30. The total number of electrons, in a sample containing three molecules of the oxide would be (assuming that nitrogen and oxygen are present in their most stable isotopic state)
    (a) 15 (b) 30 (c) 90 (d) 45

22. Elements P, Q, R and S belong to the same group in periodic table. The oxide of P is acidic, oxide of Q and R are amphoteric while the oxide of S is basic. The most electropositive element among them is
    (a) P (b) Q (c) R (d) S

23. An element X, which is a yellow solid at room temperature, shows catenation and allotropy. The element X forms mainly two oxides which are also formed during the thermal decomposition of ferrous sulphate crystals and are the major air pollutants. Most likely the element X is
    (a) Carbon (b) Silicon (c) Nitrogen (d) Sulphur

24. Ram treated a lustrous divalent element M with potassium hydroxide. He observed the formation of bubbles in the reaction mixture. He made the same observations when this element was treated with sulphuric acid. Then element M would be
    (a) Zinc (b) Calcium (c) Aluminium (d) Copper

25. The unit digit of 3^{27} is
    (a) 3 (b) 1 (c) 7 (d) 9

26. The given function $f(x) = 2x^4 - 6x^3 + 3x^2 + 3x - 2$ is not divisible by $g(x)$, where the function $g(x)$ is
    (a) $g(x) = x^2 - 3x + 2$ (b) $g(x) = x - 2$ (c) $g(x) = x - 1$ (d) $g(x) = x^2 - 2x + 2$

27. Mr. Venkat takes a trip from Chennai to Bengaluru and back. While going his speed is 40 km/hr half the way and 60 km/hr for the remaining half of the distance. When he returns he drives at 40 km/hr for half the time and at 60 km/hr for the remaining half time of travel back. His average speed in the entire trip is
    (a) 48 km/hr (b) 48.98 km/hr (c) 49.12 km/hr (d) 50 km/hr

28. The factorization over Z of $(a + b + c)^3 - (a^3 + b^3 + c^3)$ is
    (a) $(a + b)(b + c)(c + a)$ (b) $(a + 3b)(b + 3c)(c + 3a)$
    (c) $3(a + b)(b + c)(c + a)$ (d) $2(a + b + c)(a^2 + b^2 + c^2)$

29. The area of the square having end points of one of its diagonals as (1, 3) and (5, 1) in appropriate units, is
    (a) 100 (b) 10 (c) 20 (d) 40

30. How many total terms, 'the square terms' and 'the product terms' will the expansion of $(x_1 + x_2 + \cdots\cdots\cdots + x_{20})^2$ contain?
    (a) 1.8×10^2 (b) 20 + 170 (c) 200 (d) 210

31. Given that α and β are the roots of the quadratic equation $x^2 - 2bx + c = 0$. The value of $\alpha^4\beta^4 + \alpha^4\beta^3 + \alpha^3\beta^4$ is equal to
    (a) $c^3(c + 2b)$ (b) $c^3(c - 2b)$ (c) $c^3(2c + b)$ (d) $c^3(2c - b)$

32. The lengths of six non-collinear line-segments are 3, 4, 5, 6, 7 and 8 units. The maximum number of scalene triangles that can be formed by using these line segments is

(a) 15 (b) 17 (c) 19 (d) 20

33. Given that P is a point on the circum-circle (on arc AC) of an equilateral triangle ABC other than its vertices such that 2PA = PC, then PA : PB is

(a) 1 : 3 (b) 1 : 2 (c) 3 : 5 (d) 2 : 3

34. There are 2025 cards numbered from 01 to 2025 (i.e. 1, 2, 3….. 2025). One card is drawn at random, then the probability that the number on the selected card leaves remainder of 25 when it divides 2025, is

(a) $\frac{2}{405}$ (b) $\frac{11}{2025}$ (c) $\frac{4}{675}$ (d) $\frac{4}{405}$

35. ABCD is a parallelogram. The point E lies on diagonal AC such that EC is one-fifth of AE. Given that DE and AB meet at F, when produced further. The ratio CD : FB equals

(a) 1 : 5 (b) 5 : 1 (c) 1 : 4 (d) 4 : 1

36. If the two quadratic equations $ax^2 + 2bx + c = 0$ and $ax^2 + 8bx + 7c = 0$, have a common root, then a, b and c are in

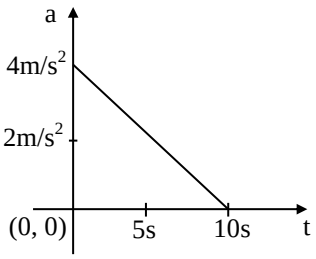
(a) Arithmetic Progression (b) Geometric Progression
(c) Harmonic Progression (d) None of the above

37. A point particle of mass m moving with velocity *u* in a straight line is subjected to a constant acceleration at an instant t = 0. Sometime later, at time t = *n*, its velocity is found to be *n* time the initial velocity. The distance covered by the particle during the time interval t = 0 to t = n is expressed as

(a) $\frac{n(n+1)u}{2}$ (b) $\frac{(n-1)u}{2}$ (c) $\frac{1}{2}nu^2$ (d) $\frac{2u(n-1)}{n}$

38. The following figure represents the acceleration verses time graph of a particle which starts its journey from the rest position at time t = 0. The velocity of the particle at t = 5 s is

(a) 80 m/s
(b) 40 m/s
(c) 25 m/s
(d) 15 m/s



39. The heart of an animal pumps 40 cc of blood per second under the pressure 15000 N/m^2. The power of the heart of the animal is

(a) 6 W (b) 0.6 W (c) 6×10^5 W (d) 0.06 W

40. A small metallic spherical ball is dropped from height h on the wet clay on the Earth surface. It travels distance S inside the wet clay before it stops. The uniform resistive force offered by the clay to the ball, as it penetrates a vertical distance S through the clay, is (the size of the ball is ignored as compared to S)

(a) $mg\left(1+\frac{S}{h}\right)$ (b) mg (c) $mg\left(1+\frac{h}{S}\right)$ (d) $mg\left(1+\frac{h}{S}\right)^2$

41. A bullet of mass 10 *g* is moving with a speed *u* when it enters a bunch of a certain identical fixed wooden blocks kept in sequence in line. The velocity of the bullet drops to zero as it just leaves the third plank. How many such planks will the same bullet can penetrate when the initial speed of the bullet is doubled (assume all the planks to be fixed on the floor and the bullet travels horizontally)

    (a) 4 (b) 6 (c) 12 (d) 10

42. An engine is going away from a hill with a constant speed. When it is at a distance of 900 m, it blows a whistle. The echo of the same is heard by the driver after 6 sec. If speed of sound in air is 330 m/s, the speed of engine is

    (a) 10 m/s (b) 20 m/s (c) 30 m/s (d) 40 m/s

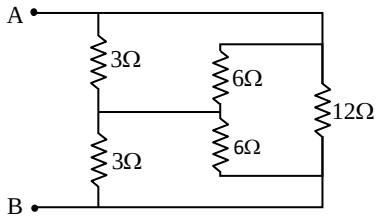
43. In the given network of resistances, the equivalent resistance across terminals A and B is estimated to be

    (a) 30 Ω

    (b) 3 Ω

    (c) 2 Ω

    (d) 16 Ω



44. The mass of the Moon is $\frac{1}{81}$ times the mass of Earth while the radius of the Moon is $\frac{1}{3.7}$ times the radius (R) of the Earth. At what height h above the surface of Earth, an object will have the same weight as it weighs on the surface of the Moon?

    (a) h = 21. 9 R (b) h = 3.68 R (c) h = 2.43 R (d) h = 1.43 R

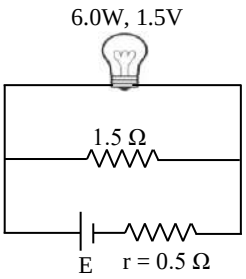
45. A torch bulb rated as 6 W, 1.5 V is connected in a circuit as shown in the figure. The *e.m.f.* of the cell needed to make the bulb glow normally is

    (a) 4.5 V

    (b) 4.0 V

    (c) 2.0 V

    (d) 1.5 V



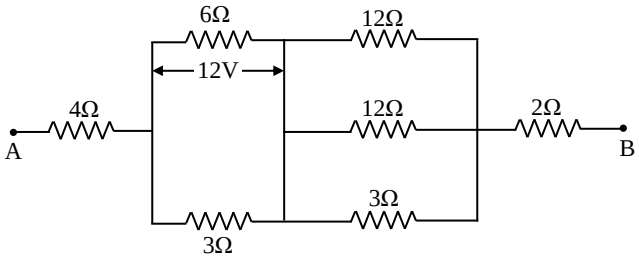
46. The given network of resistances is a part of an electric circuit containing the sources of EMF providing current. The potential difference across 6 Ω resistance is measured to be 12 volt as shown in the figure. The value of potential difference across the terminal A and B is

    (a) 120 volt

    (b) 60 volt

    (c) 48 volt

    (d) 24 volt



47. A solid cylinder, made up of a material of resistivity ρ, has length ℓ and radius $r\sqrt{3}$. Three coaxial cylinders A, B and C of equal length ℓ have been cut from this thick cylinder. The cylinder *A* is a solid cylinder of radius r. *B* is a hollow cylinder with inner radius r and uniform wall thickness $\left(\sqrt{2}-1\right)r$ while the hollow cylinder C has inner radius $r\sqrt{2}$ and outer radius $r\sqrt{3}$. The relationship between their end-to-end resistance is

(a) $R_A = R_B = R_C$ (b) $R_A > R_B > R_C$ (c) $R_A < R_B < R_C$ (d) $R_A = 2R_B = 3R_C$

48. Two plane mirrors are inclined at an angle of 60° with each other. A ray of light is incident on one of the mirrors at an arbitrary angle of incidence $\angle i$. The ray is reflected from this mirror and falls on the second mirror where it further gets reflected parallel to the first mirror. The angle of incidence $\angle i$ is

(a) 60^o (b) 30^o (c) 45^o (d) 15^o

Part B

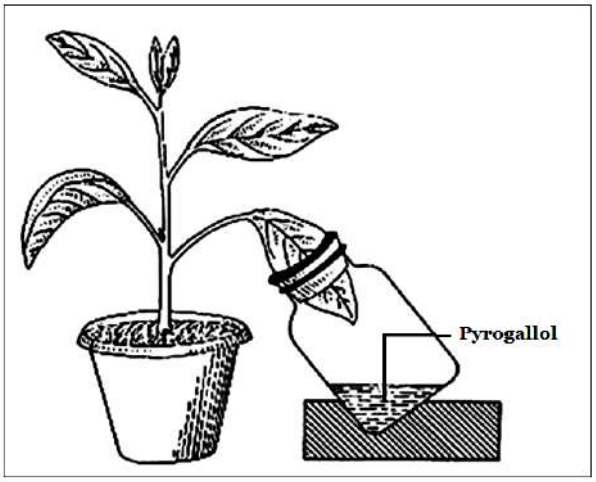
ANY NUMBER OF OPTIONS (4, 3, 2 or 1) MAY BE CORRECT

MARKS WILL BE AWARDED ONLY IF ALL THE CORRECT OPTIONS ARE BUBBLED AND NO INCORRECT.

49. In samara fruits, wings for dispersal are modified outgrowths of the pericarp. Which of the following winged fruits is/are not samara?
    (a) *Shorea* (Sal)
    (b) *Fraxinus* (Ash)
    (c) *Dipterocarpus* (New Guinea rosewood)
    (d) *Holoptelea* (Indian Elm)

50. Study the following statements and choose the correct option(s) :
    (a) Kupffer cells are found in pancreas.
    (b) Mast cells secrete a vasoconstrictor called Heparin.
    (c) Plasma cells superficially resemble lymphocytes.
    (d) Supporting framework of bone marrow is formed by reticular connective tissue.

51. In the following set-up the leaf was destarched by keeping it in dark overnight. The bottle contains a solution of Pyrogallol. After exposing the set-up to sun light for a few hours, the entire leaf was tested for the presence of starch by iodine test.



Choose the option(s) showing correct observation(s):
    (a) The leaf will not show any starch.
    (b) The part of leaf inside the bottle will show positive starch test.
    (c) The part of leaf outside the bottle will show positive starch test.
    (d) The part of leaf inside will show positive starch test while outer part will not show the presence of starch.

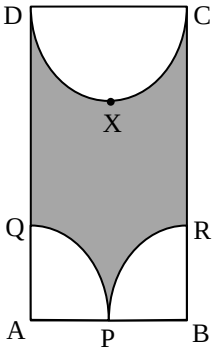
52. Which of the following statement(s) is /are correct regarding the different atom models?
    (a) Rutherford's atom model establishes that the α - particle is four times as heavy as a hydrogen atom.
    (b) Thomson's atom model assumes that the mass of the atom is uniformly distributed over the entire atom.
    (c) Bohr's atom model assumes that there are a large number of circular electron orbits around the nucleus.
    (d) Rutherford's α - particle scattering experiment establishes that most of the space in the atom is empty.

53. What happens when an iron nail is dipped into a copper sulphate solution?
    (a) The solution turns pale green
    (b) The iron nail dissolves in the solution
    (c) Copper (Cu) is deposited on the iron nail
    (d) A reddish-brown coating forms on the iron nail

54. Two solutions are available as sample:
    Solution A : 2 L of 0.1 M H_2SO_4 solution, and
    Solution B : 1 L of 0.2 M NaOH solution
    Then the correct statement(s) is /are
    (a) pH of Solution A increases and pH of Solution B decreases with increasing dilution.
    (b) final pH of both solutions would be approximately 7 after infinite dilution at 25°C temperature.
    (c) pH would be 7 after mixing of Solution A and Solution B at 25°C temperature.
    (d) pH of Solution A increases and pH of Solution B decreases with slight increase in temperature.

55. ABCD is a rhombus with diagonals AC = 10 cm and BD = $10\sqrt{3}$ cm intersecting at point E. A circle is drawn passing through three points A, E and B with its center at O. Straight-line EF is drawn parallel to AB such that the point F lies on the side BC. Also there lies a point P somewhere inside the rhombus then,
    (a) OE : BC = 1 : 2
    (b) FB = 5.0 cm
    (c) The probability that the point P lies inside the trapezium AEFB is 0.375
    (d) The probability that the point P lies inside the triangle EFC is $\frac{1}{8}$

56. ABCD is a rectangle length ℓ and breadth b. The breath is two-seventh $\left(\frac{2}{7}\right)$ of its length ℓ. *P* is the mid-point of side AB. As shown in the figure, APQ & BPR are the two quadrants while CXD is a semicircle with X as the mid-point of the arc CXD, then



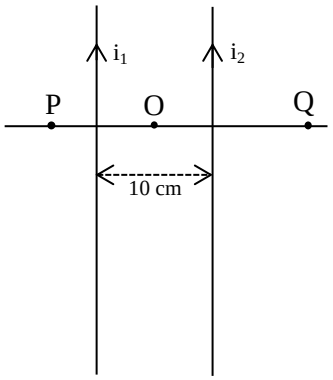
    (a) $CR : AB :: 3 : 1$
    (b) $XQ : AQ :: \sqrt{26} : 1$
    (c) Δ XQR is a scalene triangle
    (d) The ratio of area of rectangle to the area of shaded region is $14 : (14 - \pi)$

57. Given that k is the number of distinct ordered pair (x, y) of real numbers satisfying equations
    $x + y = xy$ and
    $x - y = 3xy$ then k is one of the roots of the quadratic equation(s)
    (a) $x^2 - 3x + 2 = 0$ (b) $x^2 - 4x + 3 = 0$ (c) $x^2 - 6x + 8 = 0$ (d) $x^2 - 7x + 12 = 0$

58. A ball of mass m = 100 g is thrown vertically up with an initial velocity $u = 98\ ms^{-1}$. The ball goes up in the space and falls back to the ground. During its motion, the ball is observed to be at a certain height h at time t_1 and at time t_2. Also the speed of the ball is equal after time t_3 and t_4 from the start of its journey. With the given observation one can conclude that
    (a) the algebraic sum $t_1 + t_2 = 20$ s
    (b) the algebraic sum $t_3 + t_4 = 20$ s
    (c) the ball can reach a maximum height of 980 m
    (d) if $t_1 t_2 = 50\ s^2$, the ball will rise to a height h = 245 m at time $t = t_1$

59. A 3 cm long object pin is kept vertical on the horizontal principal axis of a convex mirror in front of it. The distance of the object pin (standing above the principal axis) is 30 cm from the pole of the convex mirror. A plane mirror facing the pin is placed perpendicular to the principal axis at a distance of 10 cm from and in front of the same convex mirror covering just the lower half of it. The images of the object pin, formed by the two mirrors, are found to coincide. Then
    (a) the focal length of the convex mirror is f = 15 cm.
    (b) the linear magnification produced by convex mirror is $\frac{1}{3}$.
    (c) the image formed by the convex mirror is virtual and inverted.
    (d) the image formed by the plane mirror stands above the principal axis of the convex mirror.

60. Two long straight copper wires, carrying parallel currents of $i_1 = 2$ A and $i_2 = 5$ A respectively, lie 10 cm apart in the plane of paper as shown. Knowing that the steady current through a wire produces magnetic field, one can argue that
    (a) because of the magnetic field produced by current i_1, it attracts the wire carrying current i_2.
    (b) the resultant magnetic field produced by both the wires at the midpoint O is directed outward perpendicular to the plane of paper.
    (c) the resultant magnetic field produced by both the wires at point P on the left of the wire carrying current i_1 is directed outward perpendicular to the plane of paper.
    (d) the resultant magnetic field at point Q on the right of current i_2 is directed outward perpendicular to the plane of paper.



Rough Work