# class 10
## SAT
**Scholastic Aptitude Test**

# TARGET
# NTSE
**National Talent Search Examination**

## Solved Paper
# 2019
## Stage 2

**Time : 120 Minutes**                                **Max. Marks : 100**

## INSTRUCTIONS FOR CANDIDATES

*Read the following instructions carefully before you answer the questions :*

1.  Answers are to be given on a separate answer-sheet.

2.  Write your eight-digit Roll Number very clearly on the test-booklet and answer-sheet as given in your letter/ admission card.

3.  Write down the Booklet Number in the appropriate box on the answer sheet.

4.  There are 100 questions in this test. All are compulsory. The questions number 1 to 40 belong to Social Science, 41 to 60 belong to Mathematics and 61 to 100 are on Science.

5.  Please follow the instructions for marking the answers given on the answer sheet.

6.  For questions 1 – 100, put a cross mark (X) on the number of the correct alternative on the answer-sheet against the corresponding question number.

7.  If you do not know the answer to any question, do not spend much time on it and pass on to the next one. Time permitting, you can come back to the questions, which you have left in the first instance and try them again.

8.  Since the time allotted for this question paper is very limited you should make the best use of it by not spending too much time on any one question.

9.  Rough work can be done anywhere in the booklet but not on the answer sheet/loose paper.

10. Every correct answer will be awarded one mark.

11. Please return the Test-booklet and answer-sheet to the invigilator after the test.

1. A set of guidelines called a model code of conduct is enforced during Parliamentary elections in India to avert corrupt practices. This is applied to _____.
   (1) Political parties only
   (2) Political parties and voters
   (3) Political parties and candidates
   (4) Candidates contesting elections only

2. A country has the ultimate rights and power to make decisions on internal and external matters. Also it is not dictated by any external power on its decisions relating to its relation with other country.
   Which feature is reflected in these statements?
   (1) Republic
   (2) Socialism
   (3) Sovereignty
   (4) Authoritarian

3. Anti-defection law is an important feature of Indian party system. The final authority to decide on the disqualification of a member of the Parliament with respect to anti-defection lies with the _____.
   (1) President
   (2) Prime Minister
   (3) Chief Justice the Supreme Court of India
   (4) Speaker of the Lok Sabha or the Chairman of the Rajya Sabha

4. Which of the following statements exemplify the independence of judiciary in India?
   I. Judiciary is not under the control of executive and legislature.
   II. There is less scope for interference in the working of judiciary by the political executive.
   III. A judge of higher judiciary can be removed only through a resolution which requires 2/3rd majority of both the houses of parliament.
   Choose the correct option.
   (1) I and II
   (2) I and III
   (3) I, II and III
   (4) II and III

5. Rajya Sabha is also called the upper house, elders house and permanent house. Which of the statement/s given below is/are true about it?
   I. Rajya Sabha has more power related to financial matters.
   II. Rajya Sabha members continue to be in office till the next general election.
   III. Resolution for removing the Vice-President and the President originates in Rajya Sabha.
   IV. Number of seats allotted to a state in the Rajya Sabha is directly proportionate to its population.
   (1) I, II and III
   (2) III and IV
   (3) I and IV
   (4) IV only

6. In the context of Indian elections, the parties which fail to gain majority in the Parliament play the role of opposition. Consider the following statements and choose which statement/s is/are is NOT true.
   I. Opposition parties in India play an important role in building public opinion.
   II. Opposition parties are not constitutionally recognized.
   III. Opposition immediately assumes power of government, if the majority party loses its vote of confidence in the Parliament.
   IV. Opposition parties keep a close check on the activities of the government.
   (1) I and II only
   (2) II and III only
   (3) III only
   (4) IV only

7. Consider the following statements :
   **Statement I :** All countries that are democratic have written constitution.
   **Statement II :** All countries that have written constitution are not necessarily democratic.
   Which of the above statement/s is/are correct?
   (1) I only
   (2) II only
   (3) Both I and II
   (4) Neither I nor II

8. China exports a toy to India at `150, whereas the same toy is manufactured and available in India for `250. When China continues to export this toy to India, this trade practice isnown as _____.
   (1) Dumping
   (2) Export promotion
   (3) Import substitution
   (4) Export subsidisation

9. Shruti and Gautami were discussing about India's GDP and Kerala's SDP. Some of the observations made were :
   I. Kerala's per capita SDP is India's GDP divided by Kerala's population in a particular year.
   II. Since Kerala has best literacy rate and excellent quality of life indices, it must have the highest SDP.
   III. In a federal structure if we know all the SDPs we can have a fair idea of how big India's GDP will be in that year.
   IV. Kerala's per capita SDP in a particular year is the value of all final goods and services produced by the Kerala state in that year divided by Kerala's population in that year.
   Which of the above statements are correct?
   (1) I and III
   (2) II and III
   (3) III and IV
   (4) I, III and IV

10. Shehnaaz joined a coaching institute for a professional course. At the time of joining the course, she paid a lump sum fee for the entire course of two years. However, she did not find the quality of teaching satisfactory and decided to quit after one year. When she asked for a refund of the fee for one year, she was refused. Which of the following rights of Shehnaaz was/were violated?
    I. Right to choose
    II. Right to represent
    III. Right to be informed
    IV. Right to seek redressal
    (1) Only I
    (2) I and IV
    (3) III and IV
    (4) Only IV

11. Which of the following reflects situation where a person is employed but do not contribute in adding to the total product?

   I.   Open unemployment

   II.  Disguised unemployment

   III. Seasonal unemployment

   IV. Frictional unemployment

   (1) I and II          (2) Only II

   (3) III and IV      (4) Only IV

12. There are 100 households in the village of Awangkhul, of which the loan taken by 20 households are from the State Bank of India, another 20 households from their friends and relatives, 5 households from Indian Bank, 10 households from a Regional Rural Bank, 15 households from businessmen, 10 households from village headmen and 20 households from cooperative societies. Which of the following inference(s) is/are correct?

   I.   Formal sources of credit are lower than the others.

   II.  Institutional sources of credit are higher than others.

   III. Non-institutional sources of credit are higher than others.

   IV. Informal sources of credit are slightly higher than others.

   (1) Only I         (2) I and II

   (3) Only II        (4) III and IV

13. Which of the following statements are true about food security?

   I.   Landless people always have food insecurity.

   II.  Those who do not have enough nutritious food are food insecure.

   III. Those who have enough food but not the requisite nutrition are food secure.

   IV. Those who do not have enough purchasing power to buy sufficient food are food insecure.

   (1) I and III       (2) I and IV

   (3) II and III     (4) II and IV

14. Siddhik issues a cheque of ` 19,000 in favour of Hanush. What happens when the cheque is received and processed in Hanush's bank?

   I.   There is no change in their bank accounts.

   II.  Both their bank balances increase by ` 19,000.

   III. Siddhik's bank balance decreases by ` 19,000 and Hanush's bank balance increases by the same amount.

   IV. There is no change in Siddhik's bank balance although Hanush's bank balance sees an increase.

   Based on the above statements which option is correct?

   (1) Only I         (2) I and III

   (3) Only III       (4) III and IV

15. The daily wage of a person in rural area is ` 180. Arrange the following households in descending order of vulnerability to poverty.

| Name of the Household | Person-days of employment | Size of the Household | Working members of the family |
|---|---|---|---|
| Ruldoo | 14 | 4 | 2 |
| Mulkha | 15 | 7 | 2 |
| Fakira | 10 | 5 | 4 |
| Preeto | 12 | 6 | 3 |

   (1) Preeto > Mulkha> Fakira > Ruldoo

   (2) Mulkha > Preeto > Ruldoo > Fakira

   (3) Mulkha > Ruldoo > Preeto > Fakira

   (4) Ruldoo > Fakira > Mulkha > Preeto

16. The following graph shows the distribution of mean monthly temperature and average rainfall of a particular city during the year.
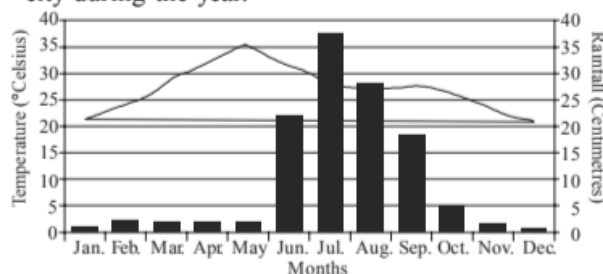


Which one of the following cities shows the climatic conditions presented in the above graph?

   (1) Nagpur        (2) Chennai

   (3) Jodhpur       (4) Bengaluru

17. The average mean monthly temperatures of four stations are given in the following table. The temperature is influenced by the movements of land and sea breezes.

| | | | | | MONTHS Temperature in Degree Celsius | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Stations | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
| A | 14.4 | 16.7 | 29.3 | 30.0 | 33.3 | 33.3 | 30.0 | 29.4 | 28.9 | 25.6 | 19.4 | 15.6 |
| B | 16.8 | 19.2 | 26.6 | 29.8 | 33.3 | 33.9 | 31.3 | 29.0 | 20.1 | 27.0 | 20.1 | 14.9 |
| C | 24.5 | 25.7 | 27.7 | 30.4 | 33.0 | 32.5 | 31.0 | 30.2 | 29.8 | 28.0 | 25.9 | 24.7 |
| D | 21.5 | 23.9 | 28.3 | 32.5 | 35.5 | 32.0 | 27.7 | 27.3 | 27.9 | 26.7 | 23.1 | 20.7 |

Which one of these stations experiences maximum moderating influence of the land and sea breezes?

   (1) A           (2) B

   (3) C           (4) D

18. Observe the data given in the following table.

| City | Female Literacy Rate (%) | Male Literacy Rate (%) | Sex-Ratio |
|---|---|---|---|
| A | 66.77 | 85.38 | 960 |
| B | 71.16 | 82.67 | 980 |
| C | 73.78 | 77.17 | 989 |
| D | 59.26 | 79.24 | 972 |

Based on the above table, identify the city which has the extent of equality between male and female better than the rest in terms of the given parameters?

   (1) A           (2) B

   (3) C           (4) D

19. Ruhani observes sequential change in relation to altitudinal zones and natural vegetation types dominated by *oak-chestnut; pine-deodar* and *silver fir-birch*. Identify the proper sequence of vegetation type she has observed from the following.
(1) Alpine to Temperate to Subtropical
(2) Subtropical to Temperate to Alpine
(3) Subtropical to Alpine to Temperate
(4) Temperate to Alpine to Subtropical

20. Observe the map given below.
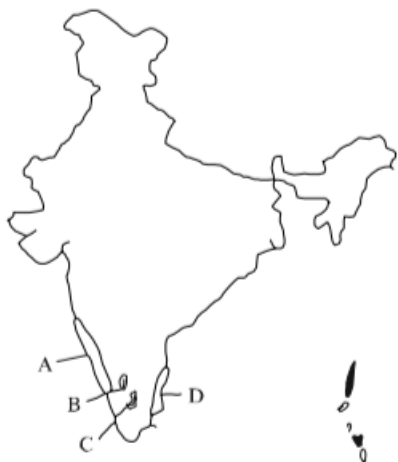


Identify the shaded regions with their corresponding geographical features and select the correct option using the codes given below.
(1) A = Zone of laterite soil, B = Coffee producing area. C = Cotton textile industries, D= Evergreen forest cover
(2) A = Evergreen forest cover, B = Coffee producing area, C = Zone of laterite soil, D = Cotton textile industries
(3) A = Evergreen forest cover, B = Zone of laterite soil, C = Coffee producing area. D = Cotton textile industries
(4) A = Cotton textile industries, B = Coffee producing area, C = Zone of laterite soil, D = Evergreen forest cover

21. Which of the following geological sequence properly matches the tectonic events from old to recent time periods?
(1) Formation of Aravalli - Deccan volcanism - formation of Shiwalik - upliftment of Himadri
(2) Deccan volcanism - Formation of Aravalli - Upliftment of Himadri - formation of Shiwalik
(3) Deccan volcanism - Formation of Shiwalik - Upliftment of Himadri - formation of Aravalli
(4) Formation of Aravalli - Deccan volcanism - Upliftment of Himadri - formation of Shiwalik

22. The given map shows location of different mountain peaks in India.



A mountaineer wants to scale the mountain peaks in Peninsular India starting from North to South. Identify the correct sequence of peaks the mountaineer will follow?
(1) A = Mahendragiri; B = Anaimudi; C = Dodabetta; D = Mahabaleshwar
(2) A = Dodabetta; B = Mahabaleshwar; C = Mahendragiri; D = Anaimudi
(3) A = Anaimudi; B = Mahendragiri; C = Dodabetta; D = Mahabaleshwar
(4) A = Mahendragiri; B = Mahabaleshwar; C = Dodabetta; D = Anaimudi

23. While teaching a topic on agriculture, geography teacher had made the following statement about a particular crop in her class. "Mean Monthly Temperature of about 27°C, high relative humidity, rainfall of 150 cm in summer months and khaddar soils are the ideal physical requirements during the period of its vegetative growth." Which one of the following crops was stated by the teacher?
(1) Tea          (2) Jute
(3) Rubber       (4) Sugarcane

24. Bibhuti was travelling to study the traditional agricultural practices among various communities in Meghalaya, Jharkhand,Odisha and Western Ghats. Identify the correct sequence of forms of cultivation practised in these regions.
(1) Jhumming - Kumari - Pama Dabi - Kuruwa
(2) Kuruwa - Pama Dabi - Jhumming - Kumari
(3) Jhumming - Kuruwa - Pama Dabi - Kumari
(4) Pama Dabi - Kumari - Jhumming - Kuruwa

25. River Indus flows through Leh and Kargil districts in the state of Jammu and Kashmir. It has four major tributaries in India. Which one of the following is the correct sequence of the tributaries arranged from East to West in terms of their confluence with river Indus?
(1) Zaskar - Dras - Hunza - Shyok
(2) Zaskar - Hunza - Dras - Shyok
(3) Hunza - Dras - Zaskar - Shyok
(4) Zaskar - Dras - Shyok- Hunza

26. A tourist was travelling Indian States and came across *a famous Buddhist Monastery, farming of three rice crops within the same agricultural year, a cement factory and floating gardens on a lake.*

Identify the proper sequence of the States the tourist travelled.

(1) Sikkim - West Bengal - Assam - Meghalaya

(2) Sikkim - Arunachal Pradesh - Assam - Manipur

(3) Arunachal Pradesh - Assam - Meghalaya - Manipur

(4) Arunachal Pradesh - West Bengal -Manipur - Meghalaya

27. Observe the following diagrams carefully.



I  II  III  IV
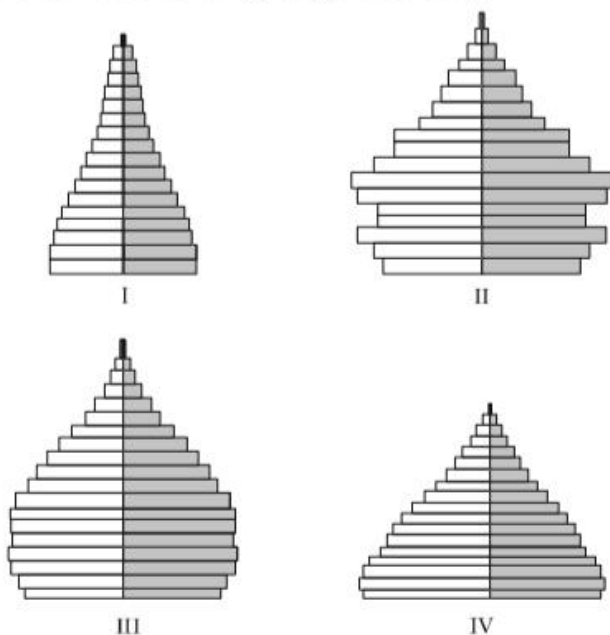
Which one of the above population pyramids is an ideal representation of India's population?

(1) I            (2) II

(3) III          (4) IV

28. Which of the following statements regarding printing in Medieval Europe are correct?

I. Wood block printing reached Europe in the 13th Century.

II. The aristocrats and monks criticized printed books as cheap vulgarities in the beginning.

III. Printing did not entirely displace the art of producing books by hand.

IV. Martin Luther had reservations against printing of books.

(1) I, II and III

(2) I, II and IV

(3) I, II and IV

(4) I, III and IV

29. Which of the following statements related to Mahatma Gandhi's view on Satyagraha are correct?

I. The movement in South Africa was not passive resistance.

II. It is the weapon of the people, who are not weak.

III. India could not militarily face Britain.

IV. Truth is the supreme dharma.

(1) I, II and III

(2) I, II and IV

(3) II, III and IV

(4) I, III and IV

30. Which of the following statements relating to the 'Scorched Earth Policy' in Java are correct?

I. The Dutch destroyed the saw mills.

II. Teak logs were burnt by the Dutch.

III. Trees were cut freely to meet war needs.

IV. The villagers were encouraged to expand cultivation in the forest areas.

(1) I and II            (2) I, II and III

(3) I and IV           (4) II, III and IV

31. Which of the following statements about opium cultivation in India during the British period are correct?

I. The peasants could sell off the produce freely.

II. Local traders offered higher prices for opium.

III. Opium production was increasing in territories that were not under the British.

IV. Peasants were getting money advances from the village headman to produce opium.

(1) I, II and III          (2) I, II and IV

(3) I, III and IV         (4) II, III and IV

32. Observe the given picture taken from New Orleans, Illustrated London News, 1851.
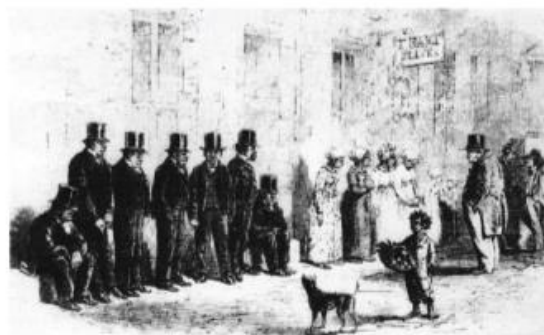


What does the picture represent?

(1) Mourning

(2) Slave auction

(3) Market place

(4) Roadside gathering

33. Why were Nghe An and Ha Tinh provinces called 'electrical fuses' of Vietnam?

(1) They were near to the capital city and were centres of power.

(2) They were among the poorest provinces and had an old radical tradition.

(3) They were very rich and had strong trade links with the outer world.

(4) They were at the borders and were in conflicts with the neighbouring countries.

34. Which of the following would be the part of the surroundings in a chawl in Bombay during the colonial period?
   I. Large number of people living in shared rooms.
   II. A large population of people belonging to depressed and lower classes.
   III. Streets and neighbourhood being used for a variety of activities such as cooking, washing and sleeping.
   IV. Liquor shops and Akharas in any open spot.
   (1) I, II and III
   (2) I, III and IV
   (3) II and III
   (4) II, III and IV

35. Which of the following statements are true in the context of Cricket in Victorian England?
   I. The rules of cricket were made to favour those who were described as "Players".
   II The wages of professionals were paid by patronage or subscription or gate money.
   III. Cricket was viewed as a way of teaching English boys discipline, importance of hierarchy and leadership qualities.
   IV The rich who played were called amateurs.
   (1) I, II and III
   (2) I, II and IV
   (3) I, III and IV
   (4) II, III and IV

36. Which of the following statements are true for eighteenth century France?
   I. There was much criticism of slavery.
   II. The National Assembly feared opposition from businessmen who were dependant on slave trade.
   III. Plantation owners understood their freedom as including the right to enslave Africans.
   IV The Convention of 1791 legislated to free all slaves in the French overseas possessions.
   (1) I and II
   (2) I, II and IV
   (3) II and III
   (4) II, III and IV

37. Which of the following statements are true in the context of Liberals in Modern Europe?
   I. They opposed the uncontrolled power of dynastic rulers.
   II. They wanted to safeguard the rights of individuals against governments.
   III. They argued for Independent judiciary.
   IV They believed in universal adult franchise for all men and women with property.
   (1) I, II and III
   (2) I, II and IV
   (3) I, III and IV
   (4) II, III and IV

**Directions: (Questions 38 - 40)**
   Read the statements and select the correct answer from the options given below.
   (1) Statement 1 is true, Statement II is false.
   (2) Statement 1 is false, Statement II is true.
   (3) Both statements are true, and Statement II provides explanation to Statement I.
   (4) Both Statements are true but Statement II does not provides explanation to Statement I.

38. **Statement I:** The Bretton Woods System came up during the post-World War Period.
   **Statement II:** The industrial nations had massive growth of trade and incomes.

39. **Statement I:** Potatoes had been discovered by the Europeans in the Americas.
   **Statement II:** Poor people in Ireland were dependent on potatoes to escape starvation in the 19th century.

40. **Statement I:** The President of India cannot claim the kind of direct mandate that the Prime Minister of India can.
   **Statement II:** A candidate contesting for the post of President has to gain a majority of votes to be elected as President of India.

41. If $m = n^2 - n$, where $n$ is an integer, then $m^2 - 2m$ is divisible by
   (1) 20
   (2) 24
   (3) 30
   (4) 16

42. The value of $\sqrt{97 \times 98 \times 99 \times 100 + 1}$ is equal to
   (1) 9901
   (2) 9891
   (3) 9801
   (4) 9701

43. Let $P(x)$ be a polynomial of degree 3 and $P(n) = \dfrac{1}{2}$ for $n = 1, 2, 3, 4$. Then the value of $P(5)$ is
   (1) 0
   (2) $\dfrac{1}{5}$
   (3) $-\dfrac{2}{5}$
   (4) $\dfrac{3}{5}$

44. If $\alpha$ and $\beta$ are the roots of the equation $3x^2 - 5x + 3 = 0$, then the quadratic equation whose roots are $\alpha^2\beta$ and $\alpha\beta^2$ is
   (1) $3x^2 - 5x + 3 = 0$
   (2) $3x^2 - 8x + 5 = 0$
   (3) $3x^2 - 8x + 3 = 0$
   (4) $3x^2 - 5x - 3 = 0$

45. In village Madhubani 8 women and 12 girls can paint a large mural in 10 hours. 6 women and 8 girls can paint it in 14 hours. The number of hours taken by 7 women and 14 girls to paint the mural is
   (1) 10
   (2) 15
   (3) 20
   (4) 35

46. If $x = \dfrac{3+\sqrt{5}}{2}$ and $y = x^3$, then $y$ satisfies the quadratic equation
   (1) $y^2 - 18y + 1 = 0$
   (2) $y^2 + 18y + 1 = 0$
   (3) $y^2 - 18y - 1 = 0$
   (4) $y^2 + 18y - 1 = 0$

47. If $\tan^2\theta = 1 - e^2$, then the value of $\sec\theta + \tan^3\theta \csc\theta$ is equal to
   (1) $(1 - e^2)^{1/2}$
   (2) $(2 - e^2)^{1/2}$
   (3) $(2 - e^2)^{3/2}$
   (4) $(1 - e^2)^{3/2}$

48. Let the volume of a solid sphere be $288\pi$ cm$^3$. A horizontal plane cuts the sphere at a distance of 3 cm from the centre so that the ratio of the curved surface areas of the two parts of the sphere is 3 : 1. The total surface area of the bigger part of the sphere (in cm$^2$) is
   (1) $36\pi$
   (2) $108\pi$
   (3) $135\pi$
   (4) $144\pi$

49. A solid metallic cylinder of height 10 cm and diameter 14 cm is melted to make two cones in the proportion of their volumes as 3 : 4, keeping the height 10 cm, what would be the percentage increase in the flat surface area?

(1) 9  
(2) 16  
(3) 50  
(4) 200  

50. Each vertical face of square based vertical pillar of height 3 m has 7 equal, semi-cylindrical surfaces in such a way that its horizontal cross-section is as shown in the figure.
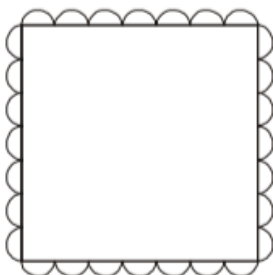


If the radius of each semi circle is 10 cm, the volume (in m$^3$) of the pillar so designed (taking $\pi = \dfrac{22}{7}$) is

(1) 5.88  
(2) 6.14  
(3) 6.42  
(4) 7.2  

51. Let $ABCD$ be a square of side 20 cm. The area of the square $PQRS$ (in cm$^2$) interior to $ABCD$, shown in the figure is
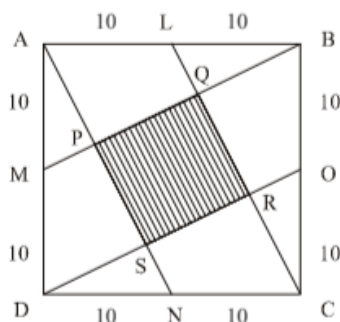


(1) 60  
(2) 80  
(3) 100  
(4) 400  

52. A circle is inscribed in a right angled triangle of perimeter $7\pi$. Then the ratio of numerical values of circumference of the circle to the area of the right angled triangle is

(1) 4 : 7  
(2) 3 : 7  
(3) 2 : 7  
(4) 1 : 7  

53. It is known that area of a cyclic quadrilateral is $\sqrt{(s-a)(s-b)(s-c)(s-d)}$ where $a$, $b$, $c$, $d$ are the sides and $s = \dfrac{a+b+c+d}{2}$

If a circle can also be inscribed in the cyclic quadrilateral then the area of this quadrilateral is

(1) $\sqrt{(ab)^2 + (cd)^2}$  
(2) $\sqrt{abcd}$  
(3) $\sqrt{(ac)^2 + (ac)^2}$  
(4) $\sqrt{(ad)^2 + (ac)^2}$  

54. Two circles, both of radii $a$ touch each other and each of them touches internally a circle of radius $2a$. Then the radius of the circle which touches all the three circles is

(1) $\dfrac{1}{2}a$  
(2) $\dfrac{2}{3}a$  
(3) $\dfrac{3}{4}a$  
(4) $a$  

55. Let $D$ be a point on the side $BC$ of a triangle $ABC$ such that $\angle ADC = \angle BAC$. If $AC = 21$ cm, then the side of an equilateral triangle whose area is equal to the area of the rectangle with sides $BC$ and $DC$ is

(1) $14 \times 3^{1/2}$  
(2) $42 \times 3^{-1/2}$  
(3) $14 \times 3^{3/4}$  
(4) $42 \times 3^{1/2}$  

56. Let $ABC$ be a triangle with sides $a$, $b$, $c$. Then lengths of medians of the triangle formed by the medians of the triangle $ABC$ are

(1) $\dfrac{1}{2}a, \dfrac{1}{2}b, \dfrac{1}{2}c$  
(2) $\dfrac{2}{3}a, \dfrac{2}{3}b, \dfrac{2}{3}c$  
(3) $\dfrac{2}{4}a, \dfrac{2}{4}b, \dfrac{2}{4}c$  
(4) $\dfrac{5}{6}a, \dfrac{5}{6}b, \dfrac{5}{6}c$  

57. $(x + 1)^4$ is divided by $(x - 1)^3$. Then the value of the remainder at $x = 1$ is

(1) $-16$  
(2) 0  
(3) 16  
(4) 32  

58. A circle passes through the vertices of a triangle ABC. If the vertices are A(−2, 5), B(−2, −3), C(2, −3), then the centre of the circle is

(1) (0, 0)  
(2) (0, 1)  
(3) (−2, 1)  
(4) (0, −3)  

59. If two dice are thrown together, the probability that the difference of the numbers appearing on them is a prime number

(1) $\dfrac{2}{9}$  
(2) $\dfrac{4}{9}$  
(3) $\dfrac{5}{12}$  
(4) $\dfrac{17}{36}$  

60. Observe the following data.

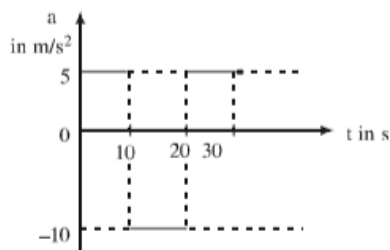| Class | 0-20 | 20-40 | 40-60 | 60-80 | 80-100 | Total |
|---|---|---|---|---|---|---|
| Frequency | 17 | $f_1$ | 32 | $f_2$ | 19 | 120 |

If the above data has mean 50, then missing frequencies $f_1$ and $f_2$ are respectively

(1) 28 and 24  
(2) 24 and 28  
(3) 28 and 30  
(4) 30 and 28

**Directions (Questions 61-62)**

Suppose that the acceleration versus time graph of a particle that starts from rest at t = 0 is as shown in the figure.



61. At what instant does the particle come to rest for the first time?
    (1) 5 s
    (2) 10 s
    (3) 15 s
    (4) The particle never comes to rest

62. What is the total distance travelled by the particle during 30 s?
    (1) 0 m                 (2) 500 m
    (3) 750 m               (4) 1000 m

63. An object of mass 2 kg is moving under the action of a force which varies with time as shown in the figure.
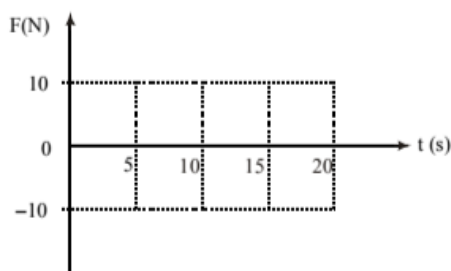


    Which one of the following statements is correct for the interval from 0 to 20 s?
    (1) The momentum of the object decreases by 75 kg m/s.
    (2) The momentum of the object increases by 75 kg m/s.
    (3) The momentum of the object increases by 125 kg m/s.
    (4) The change in momentum cannot be found as initial speed is unknown.

64. Two cars '$A$' and '$B$' of same mass start from the same location at the same time out on different straight roads. Car '$A$' travels on a road that has greater angle of inclination with horizontal compared to the road on which '$B$'travels.
    At any instant both cars '$A$' and '$B$' have the same height above the starting point. If $E_A$ and $E_B$ are total energies of cars '$A$' and '$B$'respectively, then
    (1) $E_A < E_B$
    (2) $E_A = E_B$
    (3) $E_A > E_B$
    (4) Relation between $E_A$ and $E_B$ cannot be decided based on given information.

65. The gravitational potential energy difference per unit mass between the surface of a planet and a point 100 m above it is 1000 J/kg. How much work is required to be done in moving a 5 kg object 100 m on a slope at 30° to the horizontal on this planet?
    (1) 1250 J               (2) 2500 J
    (3) 4350 J               (4) 5000 J

**Directions : (Questions 66 - 67)**

Two identical objects A and B each of mass m start moving along the same vertical line in opposite directions at the same instant. Object A is dropped from rest from a height H above the ground and object B is projected vertically upward from the ground with speed $u = \sqrt{2gh}$.

66. At what height above the ground do they collide?
    (1) (1/4) H              (2) (1/2) H
    (3) (2/3) H              (4) (3/4) H

67. After they collide, they stick to each other. What is the loss in their total energy?
    (1) 0                    (2) (1/2) mgH
    (3) (3/2) mgH            (4) 2 mgH

68. Given below are two different graphs of variation of density (or pressure) of the medium with position (Fig.1) and with time (Fig.2) as a wave passes through the medium.
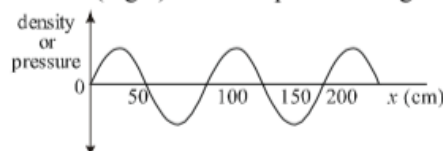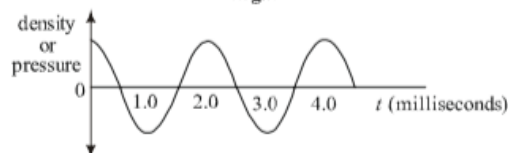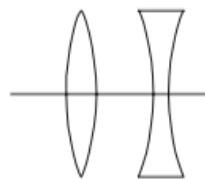


Fig.1



Fig. 2

    What will be the speed of the wave in the given medium?
    (1) 25 m/s               (2) 50 m/s
    (3) 250 m/s              (4) 500 m/s

69. A convex lens and a concave lens, each of focal length 10 cm, are kept separated by a distance of 2 cm as shown in the figure. If the light is incident from left, the combinations of lenses will be_____.



    (1) Converging
    (2) Diverging
    (3) Behaving like a glass slab
    (4) Converging or diverging depending on whether the lenses are arranged as shown in the figure or in the reverse order.

**70.** In the circuit given, the ratio of work done by the battery to maintain the current between point A and B to the work done for the whole circuit is
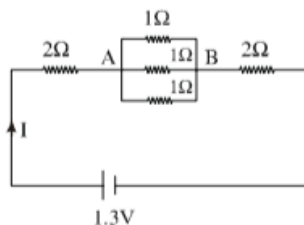


(1) $\dfrac{1}{117}$

(2) $\dfrac{1}{13}$

(3) $\dfrac{1}{12}$

(4) 1

**71.** Magnetic field at the centre of a circular coil of radius R carrying current 'i' is $B \propto \dfrac{i}{R}$ and its direction is given by right-hand thumb rule. Magnetic field at the centre of a circular arc subtending an angle θ (in degree) is $B \propto \dfrac{i}{R}\left(\dfrac{\theta}{360^o}\right)$ and its direction can be found using right hand rule.
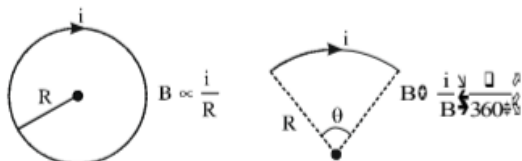


Consider two circular coils made of uniform conductors as shown in figure 3 and 4. In figure 3 points $C$ and $D$ are diametrically opposite to each other and in figure 4 $\angle PO_2Q = 120°$. Then magnetic fields_____.
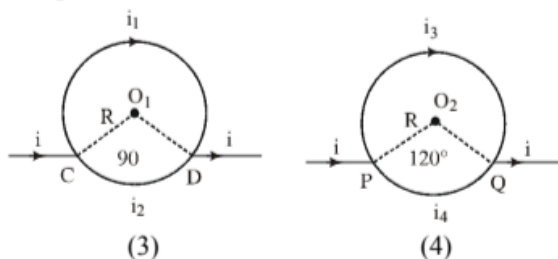


(1) At both $O_1$ and $O_2$ are zero.

(2) At both $O_1$ and $O_2$ are non-zero.

(3) At zero at $O_1$ but non-zero at $O_2$

(4) Is non-zero at $O_1$ but zero at $O_2$

**72.** A pin $AB$ of length 2 cm is kept on the axis of a convex lens between 18 cm and 20 cm as shown in figure. Focal length of convex lens is 10 cm. Find magnification produced for the image of the pin.
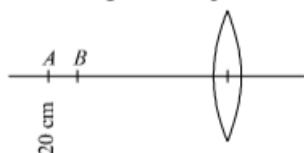


(1) 0.83

(2) 1.00

(3) 1.25

(4) 6.78

**73.** What is the current supplied by the battery in the circuit shown below? Each resistance used in circuit is of 1 kΩ and potential difference $V_{AB}$= 8V
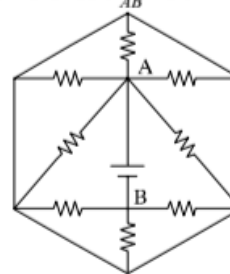


(1) 64 mA

(2) 15 mA

(3) 9.87 mA

(4) 1 mA

**74.** Read the following statements.

**Statement I:** Sodium metal reacts violently with water to produce heat and fire.

**Statement II:** Potassium metal reacts violently with water to form potassium hydroxide and hydrogen gas.

Select the correct answer from the options given below.

(1) Statement I is true, Statement II is false.

(2) Statement I is false, Statement II is true.

(3) Both Statements are true and Statement II provides explanation to Statement I.

(4) Both Statements are true but Statement II does not provides explanation to Statement I.

**75.** You are provided with 18 g each of $O_2$, $N_2$, $CH_4$ and $H_2O$. Which of the following is the correct decreasing order of number of atoms present in these samples?

(1) $CH_4 > H_2O > N_2 > O_2$

(2) $O_2 > N_2 > H_2O > CH_4$

(3) $CH_4 > N_2 > O_2 > H_2O$

(4) $N_2 > H_2O > O_2 > CH_4$

**76.** Manya, Kartik, Gurnoor and Sheena had arranged the ions $F^-$, $Na^+$, $O^{2-}$ and $Mg^{2+}$ in decreasing orders of their ionic radii.

Manya  –  $O^{2-} > Mg^{2+} > F^- > Na^+$

Kartik  –  $Mg^{2+} > Na^+ > O^{2-} > F^-$

Gurnoor –  $O^{2-} > F^- > Na^+ > Mg^{2+}$

Sheena  –  $F^- > Na^+ > O^{2-} > Mg^{2+}$

Who had provided the correct order of their decreasing ionic radii?

(1) Manya

(2) Kartik

(3) Gurnoor

(4) Sheena

**77.** An organic compound $A$ on heating with concentrated $H_2SO_4$ gave product $B$ and on warming with alkaline $KMnO_4$ gave compound $C$. Compound $A$ on heating with compound $C$ in presence of concentrated $H_2SO_4$ formed compound $D$, which has fruity smell. Identify the compounds $A$, $B$, $C$ and $D$:

(1) A = Alcohol, B = Carboxylic acid,
C = Alkene, D = Ester

(2) A = Carboxylic acid, B = Ester,
C = Alkene, D = Alcohol

(3) A = Alcohol, B = Alkene,
C = Carboxylic acid, D = Ester

(4) A = Alkene, B = Alcohol, C = Ester,
D = Carboxylic acid

78. Match List-I (Mixture) and List-II (Type) with the List-III (Example) and select the correct answer from the combinations given below:

| List-I (Mixture) | List-II (Type) | List-III (Example) |
|---|---|---|
| A. Liquid in gas | 1. Emulsion | I. Mist |
| B. Liquid in liquid | 2. Aerosol | II. Sponge |
| C. Gas in solid | 3. Foam | III. Face cream |
| | 4. Gel | IV. Butter |

(1) A-3-II, B-2-III, C-4-IV

(2) A-2-I, B-1-III, C-3-II

(3) A-1-III, B-2-II, C-3-I

(4) A-1-II, B-4-I, C-2-III

79. Which of the following set of reactions will NOT occur?

I. $MgSO_4$ (aq) + Fe(s) $\longrightarrow$ $FeSO_4$ (aq) + Mg(s)

II. $CuSO_4$ (aq) + Fe(s) $\longrightarrow$ $FeSO_4$ (aq) + Cu(s)

III. $MgSO_4$ (aq) + Cu(s) $\longrightarrow$ $CuSO_4$ (aq) + Mg(s)

IV. $CuSO_4$ (aq) + Zn(s) $\longrightarrow$ $ZnSO_4$ (aq) + Cu(s)

(1) I and III          (2) II and IV

(3) I, II and III          (4) II, III and IV

80. Two organic compounds 'A' and 'B' react with sodium metal and both produce the same gas 'X', but with sodium hydrogen carbonate only compound B reacts to give a gas 'Y'. Identify 'A', 'B', 'X' and 'Y':

(1) A = Ethylene, B = Ethyl alcohol, X = Carbon dioxide, Y = Hydrogen

(2) A = Ethyl alcohol, B = Acetic acid, X = Hydrogen, Y = Carbon dioxide

(3) A = Methyl alcohol, B = Ethyl alcohol, X = Hydrogen, Y = Carbon dioxide

(4) A = Acetic acid, B = Formic acid, X = Carbon dioxide, Y = Hydrogen

81. Consider the elements A, B, C and D with atomic numbers 11, 12, 16 and 17, respectively. Which among the following

statements regarding these elements are correct?

I. The element C will gain electron more easily than element D.

II. The element B tends to lose electron more readily than C.

III. The oxide of A will be least basic while that of D will be most basic.

IV. The energy required to remove an electron from outermost shell from A will be minimum while that from D will be maximum.

(1) I and III only          (2) I and IV only

(3) II and III only          (4) II and IV only

82. The following observations are given for four metals:

I. Metal H does not react with dilute HCl.

II. Metal K reacts with warm water.

III. Metal L does not react with water but displaces metal H from its aqueous salt solution.

IV. Metal M reacts with cold water.

Choose the correct decreasing order of reactivity of these metals amongst the following:

(1) M > L > H > K          (2) K > M > H > L

(3) M > K > L > H          (4) L > H > K > M

83. Match chemical reactions given in the List I with the type of chemical reactions given in List II and select the correct answer using the options given below:

| List I (Chemical reactions) | List II (Type of Chemical reactions) |
|---|---|
| A. Formation of $NH_3$ from $N_2$ and $H_2$ | I. Decomposition |
| B. Calcination of zinc carbonate. | II. Double displacement |
| C. Reaction of aqueous $BaCl_2$ solution with dilute $H_2SO_4$ | III. Combination |
| D. Rancidity of oils | IV. Redox |
| | V. Displacement |

(1) A-I, B-V, C-III, D-IV          (2) A-III, B-IV, C-V, D-I

(3) A-IV, B-III, C-V, D-I          (4) A-III, B-I, C-II, D-IV

84. You are provided with aqueous solutions of three salts — A, B and C, 2-3 drops of blue litmus solution, red litmus solution and phenolphthalein were added to each of these solution in separate experiments. The change in colours of different indicators were recorded in the following table:

| Sample | With blue litmus solution | With red litmus solution | With phenolphthalein solution |
|---|---|---|---|
| A | No change | No change | No change |
| B | Turns red | No change | No change |
| C | No change | Turns blue | Turns pink |

On the basis of above observations, identify A, B, and C from the following options:

(1) A = $NH_4$Cl, B = NaCl, C = $CH_3COONa$

(2) A = $NH_4$Cl, B = $CH_3$ COONa, C = NaCl

(3) A = NaCl, B = $NH_4$Cl, C = $CH_3$ COONa

(4) A = $CH_3$ COONa, B = $NH_4$Cl, C = NaCl

85. Match List-I (mixture to be separated) with the List-II (method used) and select the correct answer using the options given below.

| List-I (Mixture to be separated) | List-II (Method used) |
|---|---|
| A. Liquid $N_2$ and liquid $O_2$ | I. Chromatography |
| B. Red and Blue inks | II. Sublimation |
| C. Solution of NaCl in water | III. Fractional Distillation |
| D. Naphthalene and NaCl | IV. Evaporation |
| | V. Crystallisation |

(1) A – I, B – II, C – IV, D – V

(2) A – III, B – V, C – II, D – IV

(3) A – III, B – I, C – IV, D – II

(4) A – III, B – IV, C – I, D – II

**86.** Select the correct set of statements regarding change in properties, as we move down the second group in periodic table.

I. Atomic size increases.
II. Electronegativity increases.
III. Tendency to loose electrons increases.
IV. Valency remains same.

(1) I, II and III
(2) II, III and IV
(3) I, II and IV
(4) I, III and IV

**87.** Which of the following options containing formula, bonding and nature of aqueous solution respectively is correct for the compound formed by two elements A and B having atomic numbers 1 and 17, respectively?

(1) AB, Ionic, Acidic
(2) $AB_2$, Ionic, Basic
(3) AB, Covalent, Acidic
(4) $AB_2$, Covalent, Neutral

**88.** Choose one of the following alternative statements given below which correctly explains the process of osmosis.

(1) Movement of water from regions of concentrated to dilute solutions.
(2) The passage of solute from weak solution to strong solution through a selectively permeable membrane.
(3) A passive transport of a solvent through a selectively permeable membrane from a region of low solute concentration to a region of high solute concentration.
(4) An energy dependent transport of a solvent through a selectively permeable membrane from a region of low solute concentration to a region of high solute concentration.

**89.** In meiosis, each of the four daughter cells has one set of chromosomes. Due to randomness of process of chromosome separation in meiosis, large number of chromosome combinations can form gametes. How many such chromosome combinations in the gametes are possible in case of humans, assuming there is no crossing over taking place?

(1) $2^{22}$
(2) $2^{23}$
(3) $2^{46}$
(4) $2^{34}$

**90.** Sclerenchyma in plants is an example of simple permanent tissue comprising of two types of cells, sclereids and fibres. Why these cells are functionally important to the plants even after they die?

Choose the correct alternative from the options given below.

(1) Both are thin walled cells lacking intercellular spaces.
(2) Walls in both the types of cells are thick and cutinized.
(3) Walls in both the cell types are thick and usually lignified.
(4) Both the cells are used for conducting solutes and providing strength to the plant.

**91.** Which one of the following organisms has a cellular respiratory pigment dissolved in plasma and is also a predaceous carnivore and shows matriphagy?

(1) Scorpion
(2) Cockroach
(3) Earthworm
(4) Sea cucumber

**92.** Lichens are sensitive to certain air pollutants and are often replaced by other plants. From the given options choose the best combination of sensitivity and replacement of lichens.

(1) Sulphur dioxide and moss
(2) Sulphur dioxide and algae
(3) Carbon dioxide and ferns
(4) Sulphur dioxide and grass

**93.** A student was performing an experiment to understand the enzyme-substrate reaction. The student measured the formation of coloured product using a colorimeter. The student plotted the graph below which shows the reaction rate versus the substrate concentration.
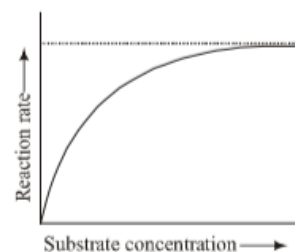


Following interpretations were drawn by the student:

A. The higher concentration of substrate acts as an enzyme inhibitor.
B. It is a sigmoidal curve with sharp transition from low to high reaction rates over the increasing substrate concentration.
C. The curve reaches a plateau and does not further increase with increasing substrate concentrations due to saturation of enzyme with the substrate.

Choose which of the interpretations of the graph are correct.

(1) A and B
(2) A and C
(3) B only
(4) B and C

**94.** Glucose is the prime source of energy in our body. However, it is stored in the form of glycogen in the muscle and liver of animals and in the form of starch in plants. As a result, everytime a cell requires glucose, it must hydrolyze glycogen which is an energy consuming process. Why does the cell store glycogen instead of glucose in free form ?

(1) Glycogen is more compact and more hydrophilic.
(2) Storage of glucose in free form will consume more ATP.
(3) Glucose in the free form creates more osmotic pressure.
(4) Glucose is highly reactive molecule hence storing in the free form can result in unwanted reactions in the cells.

**95.** The figure given below is designed to show yeast respiration. In one of the tubes, there is yeast suspension in glucose solution. This solution was boiled before yeast was added to it. Which one of the following is the possible reason for boiling of sugar solution?

Oil

Glucose + Yeast suspension

Bicarbonate indicator
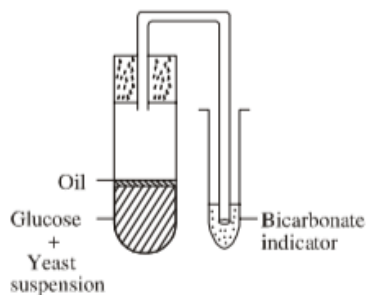
(1) To ensure aerobic fermentation.

(2) To provide the initial warmth for the yeast to become active.

(3) To remove the dissolved oxygen and carbon dioxide from the solution.

(4) To remove dissolved carbon dioxide and trap the oxygen from the atmosphere.

96. A squirrel was eating a fruit on the ground. Suddenly, it was attacked by a dog. The squirrel rushed to the tree immediately and saved itself from the dangerous attack. What immediate changes are most likely to have taken place in the body of the squirrel?

A. Blood flows to the stomach for rapid digestion.

B. Adrenaline was secreted in the blood by the adrenal glands.

C. Heart beat becomes faster and pumps more blood so that muscles get more oxygen.

D. Adrenocorticotropic hormone is secreted in the blood and blood flows more towards the vital organs.

Select the correct combination of options given below:

(1) A and B          (2) A and C

(3) B and C          (4) C and D

97. Stimulus from the environment is detected by the nerve cells. The stimulus acquired is transmitted in the form of electrical impulse. From the options given below choose the correct scheme showing the direction in which the nerve impulse travels. (Arrows shows the direction of impulse flow).



98. "Double fertilization" is a complex mechanism of flowering plants that is also unique to angiosperms. Choose the most appropriate statement from the options listed below that explains this phenomenon.

(1) Fertilization in two flowers of the same plant forming endosperms.

(2) Two male gametes fertilize two eggs inside the ovule as a result the ovary gives rise to bigger fruits.

(3) Two fertilizations occur in a flower-one fertilization results in the formation of a diploid zygote and the second fertilization results in the formation of a triploid endosperm.

(4) Two pollen grains sending two pollen tubes inside the ovary, resulting in the formation of two seeds inside the fruit .

99. It is generally observed that malaria is rampant in areas where construction work and/or stagnant water are usually seen. *Plasmodium* species are known to cause malaria. The parasite when injected by the mosquito into the human blood stream goes through specific life cycle stages. Select from below the correct sequence of stages.

(1) Mosquito (sporozoites) → human liver (merozoites) → human RBC (gametes) → mosquito (zygote-oocyst-sporozoites)

(2) Mosquito (merozoites) → human RBC (gametes) → human liver (sporozoites) → mosquito (oocyst-zygote-sporozoites)

(3) Mosquito (merozoites) → human liver (sporozoites) → human RBC (gametes) → mosquito (oocyst-zygote-sporozoites)

(4) Mosquito (sporozoites) → human liver (sporozoites) → human RBC (merozoites) → mosquito (zygote-oocyst-sporozoites)

100. A plant with red coloured flowers is crossed with a plant having white flowers. The red and white colour of the flower is controlled by a single gene. Red is dominant over white. The F1 progeny is self-pollinated and the flower

colour in F2 is observed. Given the above information, what is the expected phenotypic ratio of plants with different flower colours?

(1) All plants with red flowers

(2) Red : white in the ratio of 3 : 1

(3) Pink : white in the ratio of 3 : 1

(4) Red : pink : white in a ratio of 1 : 2 : 1

| 1 | (3) | 11 | (2) | 21. | (4) | 31 | (4) | 41 | (2) | 51 | (2) | 61 | (3) | 71. | (1) | 81. | (4) | 91 | (1) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | (3) | 12 | (3) | 22 | (4) | 32 | (2) | 42 | (4) | 52 | (1) | 62 | (3) | 72. | (3) | 82. | (3) | 92 | (1) |
| 3 | (4) | 13 | (2) | 23 | (2) | 33 | (2) | 43 | (1) | 53 | (2) | 63 | (2) | 73. | (2) | 83. | (4) | 93 | (2) |
| 4 | (3) | 14 | (3) | 24 | (3) | 34 | (2) | 44 | (1) | 54 | (2) | 64 | (1) | 74 | (4) | 84. | (3) | 94 | (3) |
| 5 | (4) | 15 | (2) | 25 | (4) | 35 | (4) | 45 | (1) | 55 | (3) | 65 | (2) | 75. | (1) | 85. | (3) | 95 | (3) |
| 6 | (3) | 16 | (4) | 26 | (3) | 36 | (3) | 46 | (1) | 56 | (3) | 66 | (4) | 76. | (3) | 86. | (4) | 96 | (3) |
| 7 | (2) | 17 | (3) | 27 | (1) | 37 | (1) | 47 | (3) | 57 | (3) | 67 | (2) | 77. | (3) | 87. | (3) | 97 | (3) |
| 8 | (1) | 18 | (3) | 28 | (1) | 38 | (4) | 48 | (3) | 58 | (2) | 68 | (4) | 78. | (2) | 88. | (3) | 98 | (3) |
| 9 | (3) | 19 | (2) | 29 | (1) | 39 | (4) | 49 | (3) | 59 | (2) | 69 | (1) | 79. | (3) | 89. | (2) | 99 | (1) |
| 10. | (4) | 20 | (1) | 30 | (1) | 40. | (4) | 50 | (4) | 60 | (1) | 70. | (2) | 80. | (2) | 90. | (4) | 100 | (2) |

# Hints & Explanations

**1. (3)** The Model Code of Conduct for guidance of political parties and candidates is a set of norms which has been evolved with the consensus of political parties who have consented to abide by the principles embodied in the said code and also binds them to respect and observe it in its letter and spirit.

**2. (3)** Foreign Policy includes all interactions of individual nation - states with other states. In the wake of globalization, in the 21$^{st}$ century it is particularly important, owing to the interdependence of states. The fundamental goals of this policy are to preserve Nation's independence, sovereignty and territorial integrity, create a favourable international environment for Its reform and opening up and modernization construction, maintain world peace and propel common development.

**3. (4)** Anti-Defection Law is contained in the Tenth Schedule of the Constitution, which was introduced by the 52$^{nd}$ Amendment in 1985. It lays down the process by which legislators may be disqualified on grounds of defection by the Presiding Officer of a legislature (Speaker of the Lok Sabha or the Chairman of the Rajya Sabha) based on a petition by any other member of the House.The Chairman or the Speaker of the House takes the decision to disqualify a member.

**4. (3)** The Indian Constitution protects the citizens from any partial judgment. And, this gives the power to the judiciary to make decisions based on the rules of the law, in case of any dispute. The courts of India are not controlled by the government and do not represent any political authority. Supreme Court is the highest authority of justice for the country, the decisions made by the Supreme Court stands above all other courts.

**5. (4)** The 'Council of States' which is also known as Rajya Sabha, a nomenclature that was announced by the chair in the House on the 23$^{rd}$ August, 1954 has its own distinctive features. Article 80 of the Constitution lays down the strength of Rajya Sabha. The Fourth Schedule to the Constitution provides for allocation of seats to the States and Union Territories in Rajya Sabha. The allocation of seats is made on the basis of the population of each State. A member who is elected for a full term serves for a period of six years. There is no provision in the Constitution for a joint sitting of both Houses as Lok Sabha clearly enjoys pre-eminence over Rajya Sabha in financial matters. Other important matters in respect of which both Houses enjoy equal powers are election and impeachment of the President, election of the Vice-President.

**6. (3)** The Leader of the Opposition similarly holds an Office which arose in England out of practice and which has no official functions either according to legislation or to the rules of the House. The duty of the Opposition is to oppose. That duty is the major check upon corruption and defective administration. It is also the means by which individual injustices are prevented.

**7. (2)** Most democratic countries have a written constitution, but it's not a requirement. Israel is generally considered democratic, but has no constitution. New Zealand has also no codified constitution.

**8. (1)** Dumping, in economics, is a kind of injuring pricing, especially in the context of international trade. It occurs when manufacturers export a product to another country at a price below the normal price

with an injuring effect. In other words, Dumping is, in general, a situation of international price discrimination, where the price of a product when sold in the importing country is less than the price of that product in the market of the exporting country. Thus, in the simplest of cases, one identifies dumping simply by comparing prices in two markets.

9. **(3)**

10. **(4)** The consumer has the Right to Seek Redressal against unfair trade practices and exploitation. It includes right to fair settlement of the genuine grievances of the consumer. Consumers can make complaint for their genuine grievances. They can also take the help of consumer organisations in seeking redressal of their grievances

11. **(2)** Disguised Unemployment is a situation of employment with surplus manpower in which some workers have zero marginal productivity. Their removal will not affect the volume of total production.

12. **(3)** There are five major sources of rural credit in India. They are:
    i. Co-Operative Credit Societies
    ii. Land Development Banks
    iii. Commercial Banks
    iv. Regional Rural Banks
    v. The Government.

    Due to extension of institutional credit facilities since 1950-51 the monopoly position of the village moneylender has been challenged. The institutional sources meet about 80% of the rural credit needs. Due to progressive institutionalization of credit, private sources now meet barely 20% of the short and medium-term credit needs of the farmers or rural peoples.

13. **(2)** Food security, as defined by the United Nations' Committee on World Food Security, means that all people, at all times, have physical, social, and economic access to sufficient, safe, and nutritious food that meets their food preferences and dietary needs for an active and healthy life. Over the coming decades, a changing climate, growing global population, rising food prices, and environmental stressors will have significant yet uncertain impacts on food security.

14. **(3)** Issuing a cheque to a person or an entity is a written order to the bank to pay a specific amount of money from the drawer's account to an entity or a person whose details are mentioned on it.

15. **(2)** Mulkha > Preeto > Ruldoo > Fakira

16. **(4)**

17. **(3)**

18. **(3)** As per the data given in the above table city 'C' has the extent of equality between male and female comparing with the other cities. The margin of literacy is comparatively less and sex ratio of the city 'C' is also better than the other given cities.

19. **(2)**

20. **(1)** Laterite soils in India are found in the Eastern Ghat of Orissa, the Southern parts of Western Ghat, Malabar Coastal plains and Ratnagiri of Maharashtra and some part of Andhra Pradesh, Tamil Nadu, Karnataka, Meghalaya, western part of West Bengal. The shaded regions marked as 'A' is Malabar region. Coffee production in India is dominated in the hill tracts of South Indian states, with Karnataka, which is marked as 'B' on given map.

21. **(4)** The Correct geological sequence from old to recent is, Formation of Aravalli, Deccan Volcanism, Upliftment of Himadri and at last formation of Shiwalik.

22. **(4)** The Correct sequence of marked mountain peaks in the given map starting from north to south is, A=Mahendragiri, B= Mahabaleshwar, C=Dodabetta, D= Anaimudi

23. **(2)** The statement given by the teacher indicates about the Jute. It grows well on well-drained fertile Khaddar soils in the flood plains where soils are renewed every year and need a relative high temperature, high humidity and high rainfall.

24. **(3)** Traditional agricultural practices in India include like 'Jhumming' in the North Eastern states like Meghalaya, Kuruwa' in Jharkhand, 'Pama Dabi' in Odisha, Kumari' in the Western Ghats.

25. **(4)** The Correct sequence of tributaries of River Indus in terms of their confluence with the River from East to West is Zaskar, Dras, Shyok and Hunza.

26. **(3)** The Correct sequence of the states the tourists visited is Arunachal Pradesh (Buddhist Monastery), Assam (Three rice crops in same agricultural year), Meghalaya (Cement factory) and Manipur (Floating gardens on a lake).

27. **(1)** The diagram 1 only represents the correct representation of India's Population.

28. **(1)** All the statements except statement IV are correct.

29. **(1)** All the statements except statement IV are correct.

30. **(1)** During the Second World War in Java , the Dutch followed the 'Scorched Earth Policy', destroying saw mills and burning huge piles of giant teak logs so that they did not fall into Japanese hands. The Japanese also recklessly cut down forests to meet war needs.

31. **(4)** All the statements except statement I are correct.

32. **(2)** The Picture represents auction of slaves in New Orleans.

33. **(2)** Nghe An and Hi Tinh provinces of Vietnam were among the poorest provinces and had an old radical tradition. These provinces were called Electrical

fuses since were first to be affected by high debts, unemployment and rural uprising etc.

34. **(2)** All the statements except statement II are correct.

35. **(4)** The wages of professionals were paid by patronage; cricket was viewed also as a way of teaching discipline and other qualities. The amateurs were the rich who played the game for entertainment only.

36. **(3)** Throughout the eighteenth century there was little criticism of slavery in France and slavery was prevalent. It was in the year 1792, when France abolished slavery in the French colonies.

37. **(1)** Liberals in modern Europe were against the uncontrolled powers of dynastic rulers and supported the rights of people and advocated for independent judiciary.

38. **(4)** The Bretton Woods system came up during the post WW period in 1944. It was organized for the purpose of monetary relations among independent states. It was not linked to the massive growth of income and trade in Industrial nations

39. **(4)** Both the statements are correct but not interlinked with each other.

40. **(4)** The president of India is not elected directly by Citizens of India but by the members of electoral hence cannot claim the direct mandate like the Indian Prime Minister. The election is held in accordance with the system of proportional representation by means of the single transferable vote it ensures that the successful candidate is returned by the absolute majority of votes

41. **(2)** $\because \quad m = n^2 - n = n(n-1)$

Now, $m^2 - 2m = m(m-2)$
$$= n(n-1)(n^2 - n - 2)$$
$$= n(n-1)(n-2)(n+1)$$

Since we know that product of any four consecutive integers is always divisible by 24.

$\therefore m^2 - 2m$ is divisible by 24.

42. **(4)** Let $x = 97$

$\therefore \quad \sqrt{97 \times 98 \times 99 \times 100 + 1}$

$= \sqrt{x(x+1)(x+2)(x+3)+1}$

$= \sqrt{(x^2 + 3x)(x^2 + 3x + 2)+1}$

$= \sqrt{(x^2 + 3x)^2 + 2(x^2 + 3x)+1}$

$= \sqrt{(x^2 + 3x + 1)^2} \quad [\because a^2 + 2ab + b^2 = (a+b)^2]$

$= x^2 + 3x + 1$

$= (97)^2 + 3 \times 97 + 1 \qquad [\because x = 97]$

$= 9701$

43. **(1)** $P(x)$ is a polynomial of degree 3.

and $P(n) = \dfrac{1}{n} \Rightarrow n\,P(n) - 1 = 0$

$n(P(n))$ is a polynomial of degree 4

$\therefore n\,P(n) - 1 = k(n-1)(n-2)(n-3)(n-4)$

For $n = 0$; $-1 = 24\,k \Rightarrow k = \dfrac{-1}{24}$

For $n = 5$; $5 \cdot P(5) - 1 = \dfrac{-1}{24}(4)(3)(2)(1)$

$\Rightarrow 5 \cdot P(5) - 1 = -1 \Rightarrow P(5) = 0$

44. **(1)** $\because 3x^2 - 5x + 3 = 0$ and $\alpha$ & $\beta$ are its roots.

$\therefore \alpha + \beta = \dfrac{5}{3}$ and $\alpha\beta = 1$

$\therefore$ equation whose roots are $\alpha^2\beta$ & $\alpha\beta^2$ is:
$x^2 - (\alpha^2\beta + \beta^2\alpha)x + (\alpha\beta^2 - \alpha^2\beta) = 0$
or $x^2 - [\alpha\beta(\alpha + \beta)]x + (\alpha\beta)^3 = 0$

or $x^2 - \dfrac{5}{3}x + 1 = 0$ or $3x^2 - 5x + 3 = 0$

45. **(1)** Let one woman can paint a large mural in $W$ hours and one girl can paint it in $G$ hours

According to question,

$\dfrac{8}{W} + \dfrac{12}{G} = \dfrac{1}{10} \Rightarrow \dfrac{2}{W} + \dfrac{3}{G} = \dfrac{1}{40}$ ...(i)

Also, $\dfrac{6}{W} + \dfrac{8}{G} = \dfrac{1}{14} \Rightarrow \dfrac{3}{W} + \dfrac{4}{G} = \dfrac{1}{28}$ ...(ii)

On solving equation (i) and (ii), we get
$W = 140$ and $G = 280$

Now, $\dfrac{7}{140} + \dfrac{14}{280} = \dfrac{1}{\text{Time taken}} = \dfrac{1}{t}$ (say)

$\Rightarrow \dfrac{1}{t} = \dfrac{1}{20} + \dfrac{1}{20} \Rightarrow t = 10$ hours

46. **(1)** $x = \dfrac{3 + \sqrt{5}}{2}$

$\Rightarrow x^3 = \left(\dfrac{3+\sqrt{5}}{2}\right)^3 = \dfrac{27 + 5\sqrt{5} + 9\sqrt{5}(3+\sqrt{5})}{8} = 9 + 4\sqrt{5}$

$\Rightarrow y = x^3 = 9 + 4\sqrt{5}$

$\Rightarrow$ One root is $9 + 4\sqrt{5}$ $\therefore$ other is root $9 - 4\sqrt{5}$

$\therefore$ Sum of roots $= 9 + 4\sqrt{5} + 9 - 4\sqrt{5} = 18$

Product of roots $= (9 + 4\sqrt{5})(9 - 4\sqrt{5}) = 1$

$\therefore$ Required equation is: $y^2 - 18y + 1 = 0$

**47. (3)** $\because \tan^2\theta = 1 - e^2$

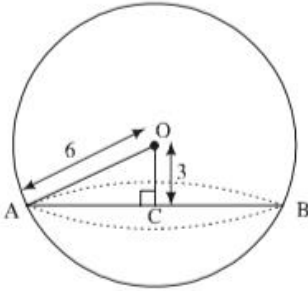$\Rightarrow \sec\theta = \sqrt{1+\tan^2\theta} = \sqrt{1+1-e^2}$

$\Rightarrow \sec\theta = \sqrt{2-e^2}$ ...(a)

$\therefore \sec\theta + \tan^3\theta\,\mathrm{cosec}\,\theta = \dfrac{1}{\cos\theta} + \tan^2\theta.\dfrac{\sin\theta}{\cos\theta}.\dfrac{1}{\sin\theta}$

$= \dfrac{1}{\cos\theta}(1+\tan^2\theta) = \dfrac{\sec^2\theta}{\cos\theta}$

$= \sec^3\theta = (2-e^2)^{3/2}$ [from (a)]

**48. (3)**



$\dfrac{4}{3}\pi r^3 = 288\pi$ ($\because r$ = radius of sphere)

$\Rightarrow r = 6$ ...(i)

OA is the radius of sphere

In $\triangle AOC$, $OA^2 = AC^2 + OC^2 \Rightarrow AC^2 = 6^2 - 3^2$

$\Rightarrow AC = 3\sqrt{3}$ cm (radius of circle formed)

Curved surface area of bigger part = $3x$

Curved surface area of smaller part = $x$

$\Rightarrow 3x + x = 4\pi r^2 \Rightarrow x = \pi r^2$

$\Rightarrow x = 36\pi$ [From (i)]

Total surface area of bigger part

$= 3x + \pi(AC)^2 = 108\pi + \pi(3\sqrt{3})^2$

$= (108 + 27)\pi = 135\pi$ cm$^2$

**49. (3)** Let $r_1$ and $r_2$ be the radii of two cones.

Volume of cylinder = Sum of volume of two cones

$\pi \times 7^2 \times 10 = \dfrac{\pi}{3} \times 10\,(r_1^2 + r_2^2)$

$\Rightarrow r_1^2 + r_2^2 = 49 \times 3$ ...(i)

$\therefore$ Percentage increase

$= \dfrac{\pi r_1^2 + \pi r_2^2 - 2\pi \times 7^2}{2\times\pi\times 7^2}\times 100$

$= \dfrac{r_1^2 + r_2^2 - 2\times 49}{2\times 49}\times 100$

$= \dfrac{(49\times 3 - 49\times 2)}{49\times 2}\times 100$ [From (i)]

$= 50\%$

**50. (4)** Area of square $= (7 \times$ diameter of semicircle$)^2$

$= (7 \times 20)^2 = 19600$ cm$^2$

Area of semicircle $= \dfrac{\pi}{2}(10)^2 = \dfrac{1100}{7}$ cm$^2$
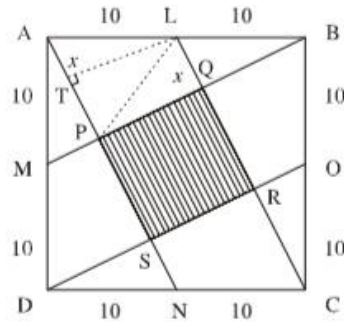
$\therefore$ Volume of Pillar = (Area of figure) × height

$= 300\left(1900 + 28\times\dfrac{1100}{7}\right)$

$= 300\,(19600 + 4400) = 300 \times 24000$

$= 7200000$ cm$^3$ = 7.2 cm$^3$

**51. (2)**



Lat area of square $PQRS = A$ cm$^2$

$BODM$ is a parallelogram

$M$ is the mid-point of $AD$

$\therefore P$ is also the mid-point of $AS$ (By mid-point theorem)

$AP = PS = k$ [Let]

Draw $LT \perp AP$

$\triangle AMP \cong \triangle LAT$

(By RHS congruence criterion)

$\Rightarrow MP = AT = x$

Join $LP$.

It is clear that

ar $\triangle ALT$ = ar $\triangle AMP$ = ar $\triangle LAT$ = ar $\triangle LPQ$

$= 3$ ar (trap $APQL$)
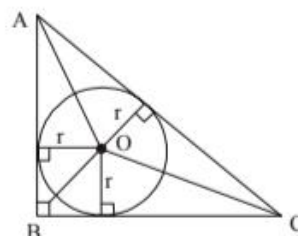
Let ar($\triangle AMP$) = a cm$^2$

ar ($\triangle ADN$) = 5a

$\Rightarrow \dfrac{1}{2}\times 10 \times 20 = 5a \Rightarrow a = 20$ cm$^2$

Now area of square $ABCD$ = 16a + area of sq. $PQRS$

$\Rightarrow 20 \times 20 = 16\,(20) + A^2$
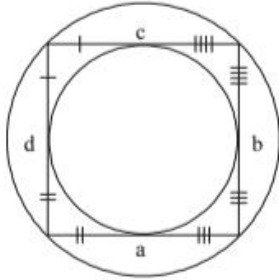
$\Rightarrow A^2 = 400 - 320 = 80$ cm$^2$

**52. (1)**

Area of $\triangle ABC = [ar(\triangle AOB) + ar(\triangle BOC) + ar(\triangle AOC)]$

$= \dfrac{1}{2} AB \times r + \dfrac{1}{2} \times BC \times r + AC \times r$

$= \dfrac{1}{2} r [AB + BC + AC]$

$= \dfrac{1}{2} r \times 7\pi$

$\therefore \dfrac{\text{Circmference of circle}}{\text{Area of triangle}} = \dfrac{2\pi r}{\dfrac{1}{2} r \times 7\pi} = \dfrac{4}{7}$

**53. (2)**



since the given quadrilateral is a tangential quadrilateral.
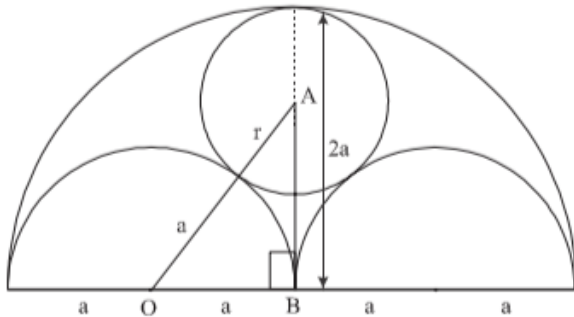
$\therefore a + c = b + d = x$ (say)          (Pitot Theorem)

$s = \dfrac{a+b+c+d}{2} = \dfrac{2x}{2} = x$

Area $= \sqrt{(s-a)(s-b)(s-c)(s-d)}$

$= \sqrt{(a+c-a)(b+d-b)(a+c-c)(b+d-d)}$

$= \sqrt{(c)(d)(a)(b)} = \sqrt{abcd}$

**54. (2)**

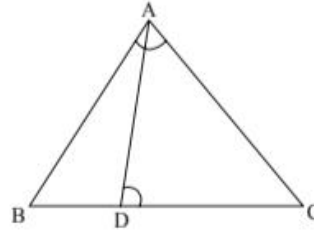

Since, in figure, $\triangle AOB$ is a right angled triangle

$\therefore OA^2 = AB^2 + OB^2$

$\Rightarrow (a+r)^2 = (2a-r)^2 + a^2$

$\Rightarrow a^2 + 2ar + r^2 = 4a^2 + r^2 - 4ar + a^2$

$\Rightarrow 6ar = 4a^2 \Rightarrow r = \dfrac{2a}{3}$

**55. (3)**



$\because \angle BAC = \angle ADC$
    (given)

$\angle C = \angle C$
    (common)

$\therefore \triangle ABC \sim \triangle DAC$
(by AA similarity criterion)

$\Rightarrow \dfrac{BC}{AC} = \dfrac{AC}{DC}$

$\Rightarrow BC \times DC = AC^2$

$\Rightarrow BC \times DC = (21)^2 = $ area of rectangle with sides $BC$ & $DC$

Now, Area of equilateral triangle = area of rectangle

$\Rightarrow \dfrac{\sqrt{3}}{4} (\text{side})^2 = (21)^2 \Rightarrow$ Side $= 14 \times 3^{3/4}$

**56. (3)** According to parallelogram law, Lengths of medians of $\triangle ABC$ is given as:

$M_a = \dfrac{1}{2}\sqrt{2b^2 + 2c^2 - a^2}$

$M_b = \dfrac{1}{2}\sqrt{2c^2 + 2a^2 - b^2}$

$M_c = \dfrac{1}{2}\sqrt{2a^2 + 2b^2 - c^2}$

Let length of median of triangle formed by these medians $p$, $q$, $r$

$p = \dfrac{1}{2}\sqrt{2M_b^2 + 2M_c^2 - M_a^2}$

$= \dfrac{1}{2}\sqrt{\dfrac{1}{2}(2c^2 + 2a^2 - b^2) + \dfrac{1}{2}(2a^2 + 2b^2 - c^2) - \dfrac{1}{4}(2b^2 + 2c^2 - a^2)}$

$= \dfrac{1}{2}\sqrt{c^2 + a^2 - \dfrac{b^2}{2} + a^2 + b^2 - \dfrac{c^2}{2} - \dfrac{b^2}{2} - \dfrac{c^2}{2} + \dfrac{a^2}{4}}$

$= \dfrac{1}{2}\sqrt{\dfrac{9a^2}{4}}$

$$\Rightarrow p = \frac{3}{4}a$$
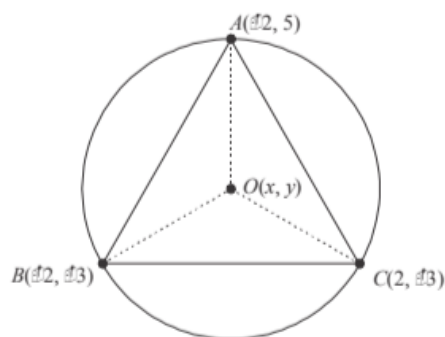
Similarly, $q = \frac{3}{4}b$ and $r = \frac{3}{4}c$

**57. (3)** $(x+1)^4 = x^4 + 4x^3 + 6x^2 + 4x + 1$

$(x-1)^3 = x^3 - 3x^2 + 3x - 1$

$$x^3 - 3x^2 + 3x - 1 \overline{)x^4 + 4x^3 + 6x^2 + 4x + 1}(x + 7$$

$$\underline{x4 - 3x^3 + 3x^2 - x}$$
$$- \quad + \quad - \quad +$$
$$\overline{7x^3 + 3x^2 + 5x + 1}$$
$$\underline{7x^3 - 21x^2 + 21x - 7}$$
$$- \quad + \quad - \quad +$$
$$\overline{24x^2 - 16x + 8}$$

At $x = 1$, remainder $= 24 - 16 + 8 = 16$

**58. (2)**



Let $O(x, y)$ is the centre of the given circle.

Join $OA$, $OB$ & $OC$.

$\because OA = OB = OC$

$\therefore OA^2 = OB^2$

$$\Rightarrow \sqrt{(x+2)^2 + (y-5)^2} = \sqrt{(x+2)^2 + (y+3)^2}$$

$$\Rightarrow x^2 + 4 + 4x + y^2 + 25 - 10y = x^2 + 4 + 4x + y^2 + 9 + 6x$$

$$\Rightarrow 16y = 16 \Rightarrow y = 1$$

Again: $OB^2 = OC^2$

$$\Rightarrow \sqrt{(x+2)^2 + (y+3)^2} = \sqrt{(x-2)^2 + (y+3)^2}$$

$$\Rightarrow x^2 + 4 + 4x + (y+3)^2 = x^2 + 4 - 4x + (y+3)^2$$

$$\Rightarrow 8x = 0 \Rightarrow x = 0$$

$\therefore$ centre of the circle is $(0, 1)$.

**59. (2)** Total number of outcomes $= 6 \times 6 = 36$

Favourable outcomes $= (1, 3)(2, 4)(3, 1)(4, 1)(5, 2)$
$(6, 1)(1, 4), (2, 5)(3, 5)(4, 2)(5, 3)(1, 6)(3, 6)(4, 6)$
$(6, 3)(6, 4)$

$\Rightarrow$ No. of favourable outcomes $= 16$

$\therefore$ Required probability $= \dfrac{16}{36} = \dfrac{4}{9}$

**60. (1)**

| Class | frequency($f_1$) | Mid-values ($x_1$) | $f_1 x_1$ |
|---|---|---|---|
| 0–20 | 17 | 10 | 170 |
| 20–40 | $f_1$ | 30 | $30f_1$ |
| 40–60 | 32 | 50 | 1600 |
| 60–80 | $f_2$ | 70 | $70f_2$ |
| 80–100 | 19 | 90 | 1710 |
| Total | 120 | | |

Here, $17 + 19 + 32 + f_1 + f_2 = 120$

$\Rightarrow f_1 + f_2 = 52$ ...(i)

$\because$ mean $= \dfrac{\sum f_i x_i}{\sum f_i}$

$$\Rightarrow \frac{3480 + 30f_1 + 70f_2}{120} = 50$$

$\Rightarrow 3f_1 + 7f_2 = 252$ ...(ii)

from (i) and (ii), we have:

$$3f_1 + 7f_2 = 252$$
$$\underline{3f_1 + 3f_2 = 156}$$
$$\Rightarrow \quad f_2 = 24$$
$$\Rightarrow \quad f_1 = 52 - f_2 = 52 - 24 = 28$$

**61. (3)** Since the area under the acceleration graph for a certain interval of time is equal to the change in velocity during that time interval.
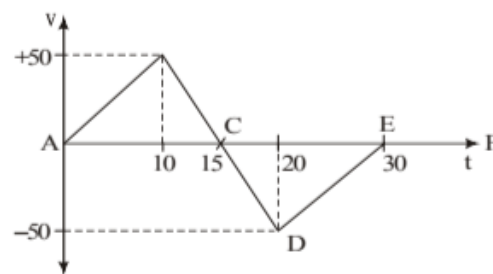
Let at time '$t$', speed become zero, then

$5 \times 10 - 10 \times (t - 10) = 0$

$50 - 10t + 100 = 0$

$$t = \frac{150}{10}$$

$t = 15$ s

**62. (3)** Drawing the $v$-$t$ graph of the given situation



Distance travelled = Area of v.f graph

$|$ area $ABC| + |$ area $CDE|$

$$= \frac{1}{2} \times 15 \times 50 + \frac{1}{2} \times 15 \times 50$$

$= 750$m

**63. (2)** Area under $F$-$t$ graph = change in momentum

$\therefore$ From the graph, $\Delta p = \dfrac{1}{2} \times (15 + 5) \times 10 - \dfrac{1}{2} \times 10 \times 5$

$\Delta p = 100 - 25$

$\Delta p = 75$ kg m/s

**64. (1)** Since cars $A$ and $B$ are at same height above the starting point.

$\therefore h = \frac{1}{2} a_A \sin\theta_A t^2 = \frac{1}{2} a_B \sin\theta_B t^2$

$\frac{a_A}{a_B} = \frac{\sin\theta_B}{\sin\theta_A}$

Given, $\sin\theta_A > \sin\theta_B$

$\therefore \frac{a_A}{a_B} < 1$

$\therefore a_A < a_B$ ...(i)

Along the plane, $v_A = a_A \times t$

$v_B = a_B \times t$

$\frac{v_A}{v_B} = \frac{a_A}{a_B} < 1$ ... [Using (i)]

$\therefore v_A < v_B$

$T \cdot E_A = mgh + \frac{1}{2} mv_A^2$

$T \cdot E_B = mgh + \frac{1}{2} mv_B^2$

At a given instant, height is same so potential energy will be same. But due to large speed of $B$, kinetic energy of $B$ will be more.

$\therefore T \cdot E_B > T \cdot E_A$

**65. (2)** Difference in gravitational potential energy per unit mass

$\frac{u_2 - u_1}{m} = \frac{\Delta U}{m} = \frac{mg'(h_2 - h_1)}{m} = g'h$

$\frac{\Delta U}{m} = g'h \Rightarrow 1000$ J/Kg

Work done (W) = mgh sin30°
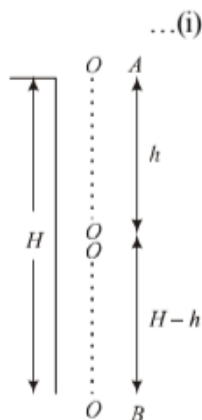
$W = 5 \times 10 \times 50$

$W = 2500$ J

**66. (4)** For object $A$, $h = \frac{1}{2} gt^2$ ...(i)

For object $B$,

$H - h = ut - \frac{1}{2} gt^2$

$H - h = \left(\sqrt{2gH}\right)t - \frac{1}{2} gt^2$ ...(ii)

By adding (i) and (ii), $t = \sqrt{\frac{H}{2g}}$

Height $(H - h) = H - \frac{1}{2} g\left(\sqrt{\frac{H}{2g}}\right)^2$

$= H - \frac{1}{2} \times g \times \frac{H}{2g}$

$= H - \frac{H}{4} \Rightarrow \frac{3H}{4}$

**67. (2)** $v_A = 2\sqrt{\frac{H}{2g}}$

$= \sqrt{\frac{gH}{2}}$

$v_B = \sqrt{2gH} - g \times \sqrt{\frac{H}{2g}}$

$= \sqrt{2gH} - g \times \sqrt{\frac{gH}{2g}}$

$= \sqrt{gH}\left(\sqrt{2} - \frac{1}{\sqrt{2}}\right)$

$v_B = \sqrt{\frac{gH}{2}}$

From the momentum conservation at time of collision

$m\sqrt{\frac{gH}{2}} - m\sqrt{\frac{gH}{2}} = 2mv_f$

$v_f = 0$

$T.E_i = mgH + \frac{1}{2} \times m \times \left(\sqrt{2gH}\right)^2$

$T.E_i = 2\ mgH$

$TE_f = (2m)\frac{3H}{4} \times g = \frac{3\ mgH}{2}$

So, loss in energy will be given as :

$\Delta E = \frac{1}{2} mgH$

**68. (4)** From the Fig. (1), it is clear that, $\lambda = 100$ cm

From Fig. (2), it is clear that, $T = 2 \times 10^{-3}$ s

As we know that the speed of wave,

$v = \frac{n\lambda}{T}$

$\Rightarrow \frac{100 \times 10^{-2}}{2 \times 10^{-3}} = 500$ m/s

**69. (1)** The focal length of combination of lenses is given

as, $\dfrac{1}{f} = \dfrac{1}{f_1} + \dfrac{1}{f_2} - \dfrac{d}{f_1 f_2}$

where, focal length of convex lens, $f_1 = 10$ cm
focal length of concave lens, $f_2 = -10$ cm
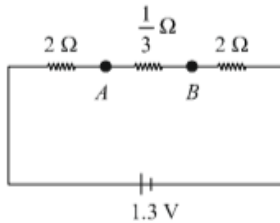distance between lenses, $d = 2$ cm
Then, focal length of the combination '$f$' will be given by,

$\dfrac{1}{f} = \dfrac{1}{10} - \dfrac{1}{10} + \dfrac{2}{100}$

$\dfrac{1}{f} = \dfrac{2}{100}$

$f = +50$ cm (converging lens)

**70. (2)** After simplifying the given circuit, we get,



$R_{AB} = \dfrac{1}{3}\,\Omega$

Then equivalent resistance across the battery,

$R_{eq} = 2 + \dfrac{1}{3} + 2 = \dfrac{13}{3}\,\Omega$

So current in circuit, $I = \dfrac{V}{R_{eq}} \Rightarrow \dfrac{1.3}{13} \times 1$ amp

$I = \dfrac{3}{10}$ amp

Power dissipated across arm $AB$,

$P_{AB} = I^2 \times R_{AB} = \left(\dfrac{3}{10}\right)^2 \times \dfrac{1}{3}$

$P_{AB} = \dfrac{3}{100} = 0.03$ Watt

Total power dissipated in circuit,

$P_{ckt} = I^2 \times R_{eq} = \left(\dfrac{3}{10}\right)^2 \times \dfrac{13}{3}$

$P_{ckt} = \dfrac{39}{100} = 0.39$ watt

Ratio of power across $A$ and $B$ to total power = Ratio of work done across $A$ and $B$ to total circuit

$\because\quad W = P \times t$

So, $\dfrac{P_{AB}}{P_{ckt}} = \dfrac{W_{AB}}{W_{ckt}} = \dfrac{0.03}{0.39} = \dfrac{1}{13}$

**71. (1)** According to the figure 3,

As $B \propto \dfrac{i}{R}\left[\dfrac{\theta}{360°}\right]$

So, according to figure 3,

$i_1 = i\left[\dfrac{\pi R_2}{2\pi R}\right] = \dfrac{i}{4}$

$i_2 = i\left[\dfrac{\frac{3\pi R}{2}}{2\pi R}\right] = \dfrac{3}{4}i$

Given that, $B \propto \dfrac{i}{R}\left[\dfrac{\theta}{360°}\right]$

So, $B_1 = K\dfrac{i_1}{R}\left[\dfrac{270°}{360°}\right]$ [into to plane]

$B_2 = K\dfrac{i_2}{R}\left[\dfrac{90°}{360°}\right]$ [out of the plane]

where, $2i_2 = 3i_1$

Now, $\dfrac{B_1}{B_2} = \dfrac{Ki_1 R}{R \cdot Ki_2}\left[\dfrac{270°}{360°}\right]\left[\dfrac{360°}{90°}\right]$

$\Rightarrow \dfrac{B_1}{B_2} = 1$

So, net field at $O_1$ is zero
Similarly, from figure 4, $i_4 = 2i_3$

and $B_3 = \dfrac{Ki_3}{R}\left[\dfrac{240°}{360°}\right]$ [into the plane]

$B_4 = \dfrac{Ki_4}{R}\left[\dfrac{120°}{360°}\right]$ [out of the plane]
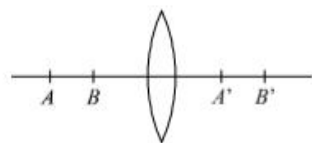
Now, $\dfrac{B_3}{B_4} = 1$

So net field at $O_2$ is zero.

**72. (3)** For the end $B$, image distance of end $B$ will be,

$f = 10$ cm

$u_B = -18$ cm

$v_B$ = image distance of end $B$



As we know,

$$\frac{1}{f} = \frac{1}{v_B} - \frac{1}{u_B}$$

$$\frac{1}{v_B} = \frac{1}{f} + \frac{1}{u_B}$$

$$\frac{1}{v_B} = \frac{1}{10} - \frac{1}{18} = \frac{8}{180}$$

$$v_B = \frac{180}{8} \Rightarrow 22.5 \text{ cm}$$

Similarly, for the end $A$, image distance of end $A$ will be,

$f = 10$ cm

$u_A = -20$ cm

$v_A$ = image distance of end $A$

$$\frac{1}{f} = \frac{1}{v_A} - \frac{1}{u_A}$$
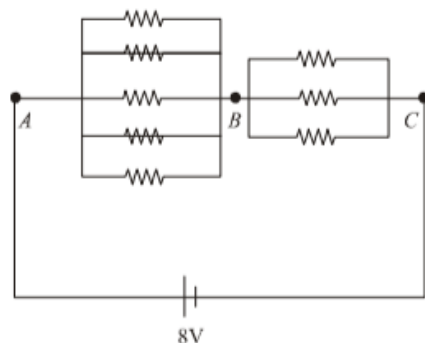
$$\frac{1}{v_A} = \frac{1}{f} + \frac{1}{u_A}$$

$$\frac{1}{v_A} = \frac{1}{10} - \frac{1}{20} = \frac{1}{20}$$

$v_A = 20$ cm

So, length of image $A'B' = v_B - v_A$

$= 22.5 - 20 = 2.5$ cm

So magnification, $m = \dfrac{A'B'}{AB} \Rightarrow \dfrac{2.5}{2} = 1.25$

**73. (2)** After sinplifying the given circuit, we get



Resistance between arm $AB$, $R_{net\ AB} = \dfrac{1}{5} K\Omega = \dfrac{1000}{5}\Omega$

Resistance between arm $BC$, $R_{net\ BC} = \dfrac{1}{3} K\Omega = \dfrac{1000}{3}\Omega$

So, $R_{net} = R_{net\ AB} + R_{net\ BC}$

We get, $R_{net} = \dfrac{1000}{5} + \dfrac{1000}{3}$

$$R_{net} = \frac{8000}{15}\Omega$$

According to ohm's law, $V = IR$

$$I = \frac{8 \times 15}{8000} = 15 mA$$

**74. (4)** Sodium metal reacts violently with water because it is much more active than hydrogen. When sodium is put into water, the delocalised electrons flow into the water leaving the positive ions to remain. The positive ions strongly repel each other and this repulsion causes the metal to explode.

$2Na(s) + H_2O(l) \longrightarrow 2KOH + H_2(g) +$ Heat energy

Metals lime Na, K, Ca, Mg etc. react with water to produce metal oxide and hydrogen gas. Sodium and potassuim reacts violently with cold water and evolve hydrogen, which immediately catches fire.

$2K(s) + H_2O(l) \longrightarrow 2KOH + H_2(g) +$ Heat energy

**75. (1)** Given mass of $O_2$, $N_2$, $CH_4$ and $H_2O = 18$ gm

∵ Required number of atoms present in a molecule

= Number of Moles $\times N_A$ ($N_A$ = Avagadro number)

So, No. of atoms in $O_2 = \dfrac{18}{32} \times 2N_A = 1.12 N_A$

No. of atoms in $N_2 = \dfrac{18}{28} \times 2N_A = 1.28\ N_A$

No. of atoms in $CH_4 = \dfrac{18}{16} \times 5N_A = 5.62\ N_A$

No. of atoms in $H_2O = \dfrac{18}{18} \times 3N_A = 3.0\ N_A$

∴ The correct order will be $CH_4 > H_2O > N_2 > O_2$

**76. (3)** The ions $F^-$, $Na^+$, $O^{2-}$ and $Mg^{2+}$ are isoelectric species having same electronic configuration but their nuclear charges differ from each other because of their difference in the number of protons in the nucleus. With increase in the number of protons in the nucleus, the electrons are more attracted towards nucleus thereby causing the decrease in ionic radius. Therefore, the given ions are
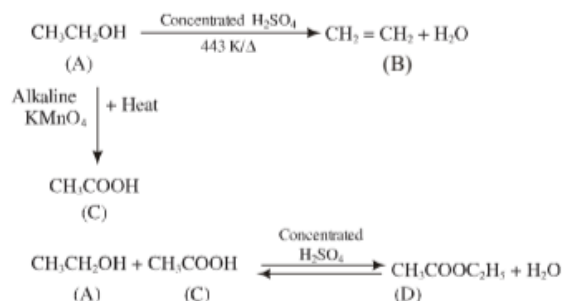
$F^-$ : no. of proton = 9 and no. of electron = 10

$Na^+$ : no. of proton = 11 and no. of electron = 10

$O^{2-}$ : no. of proton = 8 and no. of electron = 10

$Mg^{2+}$ : no. of proton = 12 and no. of electron = 10

**77. (3)** When ethanol (A) *i.e.* organic compound reacts with conc. $H_2SO_4$, it forms ethene (B) along with water. And when ethanol (A) reacts with alk. $KMnO_4$, it will get oxidised to ethanoic acid (C). Ethanol reacts with ethanoic acid to form an ester called ethyl ethanoate (D), which gives a fruity smell.
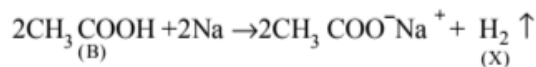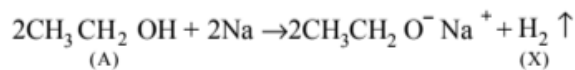
$$CH_3CH_2OH \xrightarrow[\text{443 K/}\Delta]{\text{Concentrated } H_2SO_4} CH_2 = CH_2 + H_2O$$
$$\text{(A)} \qquad\qquad\qquad\qquad \text{(B)}$$

$$\downarrow \text{Alkaline } KMnO_4 \mid + \text{Heat}$$

$$CH_3COOH$$
$$\text{(C)}$$

$$CH_3CH_2OH + CH_3COOH \xrightleftharpoons[]{\substack{\text{Concentrated}\\ H_2SO_4}} CH_3COOC_2H_5 + H_2O$$
$$\text{(A)} \qquad \text{(C)} \qquad\qquad\qquad \text{(D)}$$

**78. (2)**

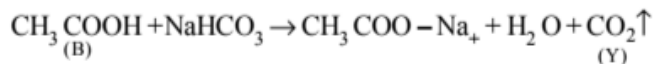| List-I (Mixture) | List-II (Type) | List-(III) Example |
|---|---|---|
| A. Liquid in gas | 2. Aerosol | I. Mist |
| B. Liquid in liqui | 1. Emulsion | III. Face cream |
| C. Gas in solid | 3. Foam | IV. Butter |
| | 4. Gel | |

**79. (3)** According to reactivity series, a more reactive metal displaces a less reactive metal from its salt solution (displacement reaction).

The order of the given metals in the reactivity series:

$Mg > Zn > Fe > Cu$

**80. (2)** When alcohol *i.e.* ethanol (A) and acid *i.e.* acitic acid (B) reacts with a sodium metal, then it liberates hydrogen gas (X).

$$2CH_3CH_2OH + 2Na \rightarrow 2CH_3CH_2O^-Na^+ + H_2\uparrow$$
$$\text{(A)} \qquad\qquad\qquad\qquad\qquad\qquad \text{(X)}$$

$$2CH_3COOH + 2Na \rightarrow 2CH_3COO^-Na^+ + H_2\uparrow$$
$$\text{(B)} \qquad\qquad\qquad\qquad\qquad\qquad \text{(X)}$$

When an acid reacts with carbonates or bicarbonates, it librates $CO_2$ gas. So, when acitic acid(B) reacts with $NaHCO_3$, it librates $CO_2$(Y) gas.

$$CH_3COOH + NaHCO_3 \rightarrow CH_3COO - Na_+ + H_2O + CO_2\uparrow$$
$$\text{(B)} \qquad\qquad\qquad\qquad\qquad\qquad\qquad \text{(Y)}$$

**81. (4)**

| Atomic number of an element | Element | Electronic configuration |
|---|---|---|
| A(11) | Na | 2, 8, 1 |
| B(12) | Mg | 2, 8, 2 |
| C(16) | S | 2, 8, 6 |
| D(17) | Cl | 2, 8, 7 |

From the above table it is clear that:

(a) Chlorine (D) will gain electrons more easily than sulphur (C).

(b) The oxide of sodium (A) which is an alkali metal, will be the most basic while that of chlorine (D) which is a halogen, will be the most acidic.

**82. (3)** Metals below hydrogen in a reactivity series does not react with dilute HCl. Medium reactive metals reacts with warm water and highly reactive metals react with cold water.

As per the given information H, K, L and M can be identified as Cu, Mg, Pb and K/Na respectively. So their reactivity order will be M > K > L > H i.e.

K > Mg > Pb > Cu.

**83. (4)**

| List-I (Chemical reactions) | List-II (Type of chemical reactions) |
|---|---|
| A. Formation of $NH_3$ from $N_2$ and $H_2$ $(N_2 + 3H_2 \rightleftharpoons 2NH_3)$ | III. Combination (The reaction in which two or more compounds/elements combine to form single compound) |
| B. Calcination of zinc carbonate $(ZnCO_3 \xrightarrow{\Delta} ZnO + CO_2)$ | I. Decomposition (The reaction in which a single chemical compound splits into its two or more elemental parts.) |
| C. Reaction of aqueous $BaCl_2$ solution with dilute $H_2SO_4$ $(BaCl_2 + H_2SO_4 \rightarrow BaSO_4 + 2HCl)$ | II. Double Displacement (The reaction in which two compounds reacts and cation and anion of the two reactants switch places forming two new products.) |
| D. Rancidity of oils | IV. Redox |

**84. (3)** A neutral salt brings no change with blue litmus solution, red litmus solution and with phenolphthalein solution. An acidic salt turns blue litmus to red litmus solution and brings no change in red litmus solution as well as in phenolphthalein solution.

Basic salt turns red litmus to blue litmus solution and also turns phenolphthalein solution pink.

| Sample | Aqueous solution | With blue litmus solution | With red litmus solution | With Phenolphthalein solution |
|---|---|---|---|---|
| A | Neutral salt (NaCI) | No change | No change | No change |
| B | Acidic salt ($NH_4CI$) | Turns red | No change | No change |
| C | Basic salt ($CH_3COONa$) | No change | Turns blue | Turns pink |

85. **(3)** Liquid nitrogen and liquid oxygen can be separated by the method known as fractional distillation. Ink is a mixture of several dyes and therefore it can be separated by using chromatography. By evaporating the salt solution, NaCl can be easily separated from water. By the help of sublimation, naphthalene and NaCl can be separated.

| (Mixture to be Separated) | (Method Used) |
|---|---|
| A. Liquid $N_2$ and liquid $O_2$ | III. Fractional Distillation |
| B. Red and Blue inks | I. Chromatography |
| C. Solution of NaCl in water | IV. Evaporation |
| D. Naphthalene and NaCl | II. Sublimation |

86. **(4)** The alkaline earth metals are six elements in second group of the periodic table. They are Be, Mg, Ca, Sr, Ba and Ra. The given table shows the trend in the properties down the group.

| Property | Trend down the group |
|---|---|
| Atomic size | Increases |
| Electronegativity | Decreases |
| Tendency to loose electrons | Increases |
| Valency | Remains same |

87. **(3)** Element having atomic number 1 is hydrogen (A) and 17 is chlorine (B).

Chemical formula – HCl (AB)

Bonding–The hydrogen (H) atom shares an electron with chlorine (Cl) to form covalent bond.

H(:)Cl or H–Cl
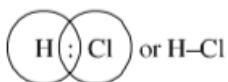
Nature of aqueous solution – The solution will be acidic in nature (Aqueous solution of HCl turns blue litmus red).

88. **(3)** Osmosis is the movement of a solvent through semipermeable membrane into a solution of higher solute concentration that tends to equalise the concentrations of solute on the two sides of the membrane.

89. **(2)** To compute the chromosome combinations, during gametes formation $= 2^n$, here $n =$ number of different chromosomes.

In case of humans, One set of chromosomes contain $= 23$ chromosomes.

So, the chromosome combinations in the gametes are possible in case of humans $= 2^{23}$

90. **(4)** Sclerenchyma cells (sclereids and fibres) have thickened lignified walls which make them strong and waterproof. They are commonly classified into support types and conducting forms.

91. **(1)** In scorpion, the respiratory pigment is dissolved in plasma and it is also a predaceous carnivore that shows matriphagy, (a process in which an organism feed on its own mother).

92. **(1)** A lichen is an association between one or two fungus species and an algae. They show a range of sensitivities to pollutants like sulphur, nitrogen, halogens, heavy metals and ozone.

93. **(2)** The given graph states that by increasing the concentration of substrate creates saturation in the enzyme-substrate reaction. As the higher concentration of substrate acts as an enzyme inhibitor so, the curve reaches a plateau and does not increase further.

94. **(3)** Glycogen is insoluble thus, storing it as glycogen will not upset the osmotic pressure rather than glucose which is soluble in water. And if cell store it as glucose, it will disturb the osmotic pressure (hypertonic) that will cause the cell to lyse.

95. **(3)** In yeast respiration experiment, glucose solution is boiled to sterilise it and to remove the traces of oxygen. It leaves behind the glucose needed for anaerobic respiration.

96. **(3)** In this condition, adrenaline is secreated by adranal gland into the blood stream which increases the heart rate, redistributing blood to the muscles and altering the blood metabolism, so as to maximise blood glucose levels primarily for the brain.

97. **(3)** The nerve has nerve endings at the end and dendrites at front. The nerve endings send signals through synapse and get transported to other neurons dendrites. In this way, the signals get transmitted.

**98. (3)** In double fertilization, one male gamete fuses with the egg and results in the formation of a diploid zygote and this process is called fertilization. The other male gamete fuses with the two polar nuclei to form a triploid endosperm. This process is called triple fusion. After fertilisation, the fertilized ovule forms the seed while the tissues of the ovary become the fruit.

**99. (1)** When female *Anopheles* bites, it injects sporozoites into the blood stream of a human. From the blood, they enter liver cells and multiply within cells (merozoites). Inside blood corpuscles, these merozoites form gametocytes. The female *Anopheles* takes up these gametocytes alongwith blood and meal.

**100. (2)** Phenotypic ratio can be determined by doing a test cross and identifying the frequency of a trait or trait combinations that will be expressed based on the genotypes of the offspring.

| Parents | Plant-1 | × | Plant-2 |
|---|---|---|---|
| Phenotype | Red coloured flowers | | White coloured flowers |
| Genotype | RR | × | rr |
| Gametes | R | | r |
| F1 generation | | Rr | |

(all red **coloured** flowers)

Self fertilization

Rr × Rr

F1 gametes: R  r  R  r

| F2 generation | ♀/♂ | R | r |
|---|---|---|---|
| | R | RR Red | Rr Red |
| | r | RR Red | rr white |

Phenotype : Red : White

3 : 1