SOLUTIONS

NATIONAL TALENT SEARCH EXAMINATION 2019 STAGE-2

SCHOLASTIC APTITUDE TEST (SAT) (DATE : 16-06-19)

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

Ans. ***(3)***

Sol. A set of guidelines called a model code of conduct is enforced during Parliamentary elections in India to avert corrupt practices, is applied to Political parties and candidates

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

Ans. ***(3)***

Sol. 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 are related to Sovereignty.

3. Anti-defection law is an important features 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

Ans. ***(4)***

Sol. Anti-defection law is an important features 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 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

Ans. ***(3)***

Sol. Following are the features of 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.

SOLUTIONS
NATIONAL TALENT SEARCH EXAMINATION 2019 STAGE-2
SCHOLASTIC APTITUDE TEST (SAT) (DATE : 16-06-19)

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

Ans. (4)

Sol. Number of seats allotted to a state in the Rajya Sabha is directly proportionate to its population

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 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 govemment.

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

Ans. (2)

Sol. Opposition parties in India play an important role in building public opinion & keep a close check on the activities of the govemment.

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 statements is/are correct?

(1) I only (2) II only (3) Both I and II (4) Neither I nor II

Ans. (2)

Sol. All countries that have written constitution are not necessarily democratic.

8. China exports a toy to India at Rs. 150, whereas the same toy is manufactured and available in India for Rs. 250. When China continues to export this toy to India, this trade practice is known as _____

(1) dumping (2) export promotion (3) import substitution (4) export subsidisation

Ans. (1)

Sol. Excessive export to a nation on very low prices is called dumping.

SOLUTIONS
NATIONAL TALENT SEARCH EXAMINATION 2019 STAGE-2
SCHOLASTIC APTITUDE TEST (SAT) (DATE : 16-06-19)

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.

Whiih of the above statements are correct?

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

Ans. (3)

Sol. Per capita SDP of a state in a particular year is the value of all final goods and services produced by the state in that year divided by state's population in that year.

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

Ans. (1)

Sol. This case shows the violation of consumer's right to choose.

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

Ans. (2)

Sol. Disguised unemployment reflects situation where a person is employed but do not contribute in adding to the total product.

SOLUTIONS
NATIONAL TALENT SEARCH EXAMINATION 2019 STAGE-2
SCHOLASTIC APTITUDE TEST (SAT) (DATE : 16-06-19)

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

Ans. (3)

Sol. Calculation based on concepts.

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

Ans. (2 and 4)

Sol. Those who have enough food but not the requisite nutrition are said to be food insecure.

14. Siddhik issues a cheque of Rs. 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 Rs. 19,000.

III. Siddhik's bank balance decreases by Rs. 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

Ans. (3)

Sol. It is clear that Siddhik payes to Hanush with a cheque, so the amount would be deducted from Siddhik's account, and will be credited to Hanush's A/c.

SOLUTIONS
NATIONAL TALENT SEARCH EXAMINATION 2019 STAGE-2
SCHOLASTIC APTITUDE TEST (SAT) (DATE : 16-06-19)

15. The daily wage of a person in rural area is Rs. 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

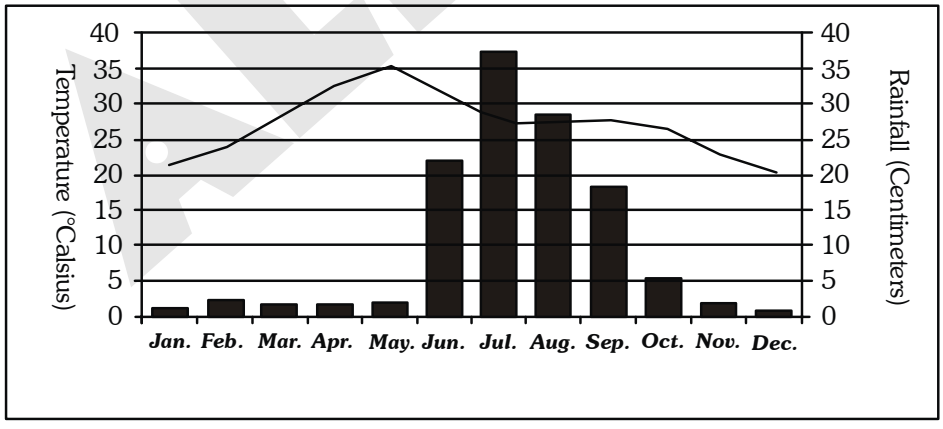
(1) Preeto > Mulkha > Fakira > Ruldoo (2) Mulkha > Preeto > Ruldoo > Fakira

(3) Mulkha > Ruldoo > Preeto > Fakira (4) Ruldoo > Fakira > Mulkha > Preeto

Ans. (2)

Sol. Calculate based on concepts.

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) Bengalura

Ans. (1)

Sol. Nagpur city shows the climatic conditions presented in the above graph.

SOLUTIONS
NATIONAL TALENT SEARCH EXAMINATION 2019 STAGE-2
SCHOLASTIC APTITUDE TEST (SAT) (DATE : 16-06-19)

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

Ans. ***(3)***

Sol. Calcution based on concepts.

18. Observe the data given in the following table.

City	***Female Literacy Rete (%)***	***Male Literacy Rate (%)***	***Sex-Retio)***
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

Ans. ***(3)***

Sol. From above data it is clearly seen that is related to city C.

19. Ruhani observes sequential change in relation to altitudinal zones and natural vegetation types dominated by *oak-chestnut: pinedeodar 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

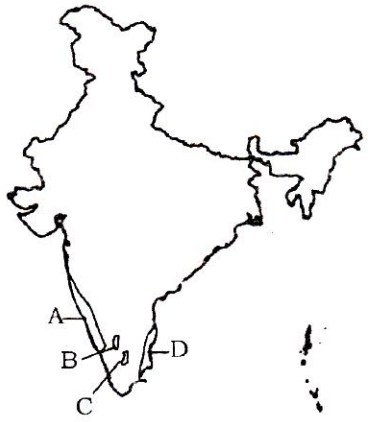
(3) Subtropical to Alpine to Temperate (4) Temperate to Alpine to Subtropical

Ans. ***(2)***

Sol. Sequential change in relation to altitudinal zones and natural vegetation types dominated by *oak-chestnut: pinedeodar and silver fir-birch* reflect the change in vegetation from Subtropical to Temperate to Alpine.

SOLUTIONS
NATIONAL TALENT SEARCH EXAMINATION 2019 STAGE-2
SCHOLASTIC APTITUDE TEST (SAT) (DATE : 16-06-19)

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

Ans. (1)

Sol. A= Zone of laterite soil, B = Coffee producing area, C = Cotton textile industries, 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

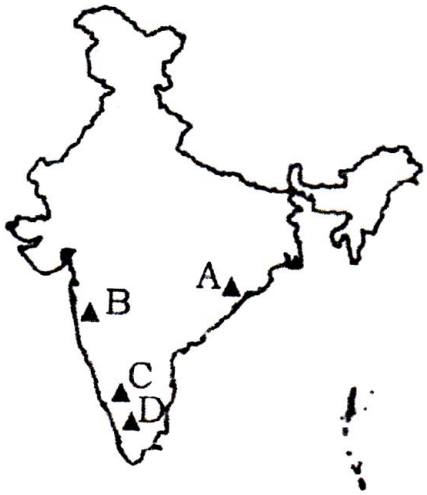
(4) Formation of Aravalli- Deccan volcanism - upliflment of Himadri-formation of Shiwalik.

Ans. (2)

Sol. Geological sequence : Deccan volcanism - Formation of Aravalli - Upliftment of Himadri formation of Shiwalik properly matches the tectonic events from old to recent time periods.

SOLUTIONS
NATIONAL TALENT SEARCH EXAMINATION 2019 STAGE-2
SCHOLASTIC APTITUDE TEST (SAT) (DATE : 16-06-19)

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.

Ans. (4)

Sol. According to Map.
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

Ans. (2)

Sol. Above features are related to the cultivation of Jute.

SOLUTIONS
NATIONAL TALENT SEARCH EXAMINATION 2019 STAGE-2
SCHOLASTIC APTITUDE TEST (SAT) (DATE : 16-06-19)

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

Ans. (3)

Sol. Name of shifting cultivation in Meghalaya, Jharkhand, Odisha and Western Ghats are respectively Jhumming, Kuruwa, Pama Dabi & Kumari

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

Ans. (4)

Sol. Correct sequence of the tributaries arranged from East to West in terms of their confluence with river Indus is 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 froper 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

Ans. (3)

Sol. Famous Buddhist Monastery $\Rightarrow$ Arunachal Pradesh

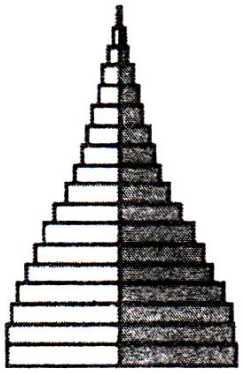
farming of three rice crops within the same agricultural year $\Rightarrow$ Assam

A cement factory $\Rightarrow$ Meghalaya

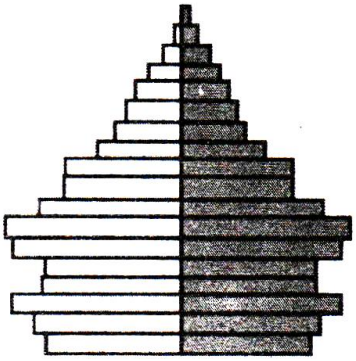
Floating gardens on a lake $\Rightarrow$ Manipur

SOLUTIONS
NATIONAL TALENT SEARCH EXAMINATION 2019 STAGE-2
SCHOLASTIC APTITUDE TEST (SAT) (DATE : 16-06-19)

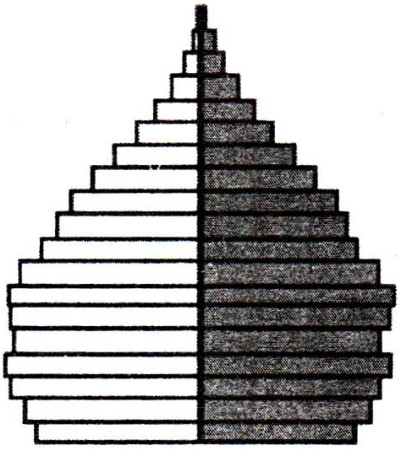
27. Observe the following diagrams carefully.



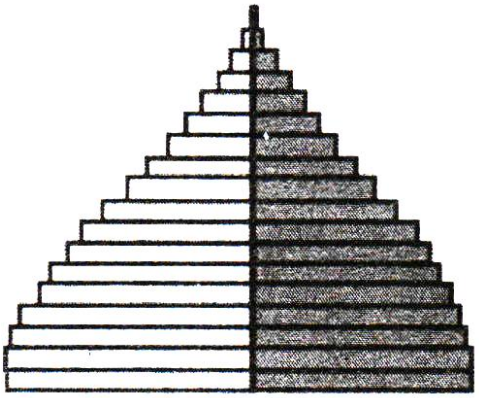
I



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

Ans. (3)

Sol. In Indian population

Adults = 58.7%

Aged = 6.9%

Children = 34.4%

This data is justified by only figure-III

SOLUTIONS
NATIONAL TALENT SEARCH EXAMINATION 2019 STAGE-2
SCHOLASTIC APTITUDE TEST (SAT) (DATE : 16-06-19)

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 rinting of books.

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

Ans. (1)

Sol. (a) Wood block printing reached Europe in the 13th Century.

(b) The aristocrats and monks criticized printed books as cheap vulgarities in the beginning.

(c) Printing did not entirely displace the art of producing books by hand.

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

Ans. (4)

Sol. Mahatma Gandhi's view on Satyagraha was not passive resistance, weapon of the people who are weak and based on truth as is the supreme dharma.

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 bumt 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

Ans. (2)

Sol. The 'Scorched Earth Policy' in Java is related to

(a) The Dutch destroyed the saw mills.

(b) Teak logs were bumt by the Dutch.

(c) Trees were cut freely to meet war needs.

SOLUTIONS
NATIONAL TALENT SEARCH EXAMINATION 2019 STAGE-2
SCHOLASTIC APTITUDE TEST (SAT) (DATE : 16-06-19)

31. Which of the following statements about opium cultivation in lndia 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. Peasarrts 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

Ans. (4)

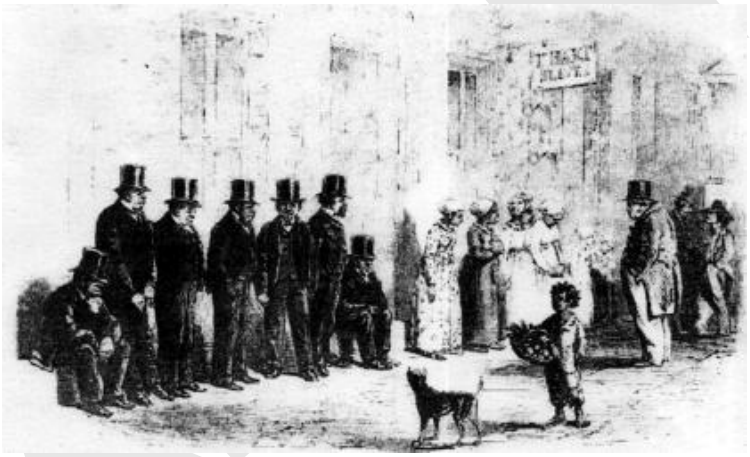
Sol. Features of opium cultivation in lndia during the British period :

(a) Local traders offered higher prices for opium.

(b) Opium production was increasing in territories that were not under the British.

(c) Peasarrts were getting money advances from the village headman to produce opium.

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



What does the picture represent?

(1) Mourning (2) Slave auction (3) Market place (4) Roadside gathering

Ans. (2)

Sol. The above picture shows Slave auction.

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.

Ans. (2)

Sol. Nghe An and Ha Tinh provinces were called 'electrical fuses' of Vietnam as these were the poorest provinces and had an old radical tradition. So they revolted against the French rule.

SOLUTIONS
NATIONAL TALENT SEARCH EXAMINATION 2019 STAGE-2
SCHOLASTIC APTITUDE TEST (SAT) (DATE : 16-06-19)

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

Ans. (2)

Sol. The rent of chawl was very high so number of people living in shared rooms to reduce their expense. The open spaces were used for variety of activities including liquor shops and Akharas.

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

Ans. (4)

Sol. Professional were workers who were paid by patronage or subscription or gate money. In english education system team sports like cricket was viewed as a way of teaching English boys discipline, importance of hierarchy and leadership qualities. The rich who played cricket were called amateurs as they did not play for money .

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

Ans. (4)

Sol. National Assembly feared opposition from businessmen in abolishing slavery. Plantation owners did not want to release slaves as they were labourers for them. In writing the constitution supported abolition of slavery but it did not practised in actual life.

SOLUTIONS
NATIONAL TALENT SEARCH EXAMINATION 2019 STAGE-2
SCHOLASTIC APTITUDE TEST (SAT) (DATE : 16-06-19)

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

Ans. (1)

Sol. Liberals wanted all the above mention conditions in Europe. They did not want to give voting right to non propertied man and women.

Direction (Questions 38 – 40)

Read the statements and 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.

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.

Ans. (4)

Sol. Both the statements are true but the industrial nations got money and better economy after the establishement of the Bretton Woods Twins : The world bank and I.M.F.

39. ***Statement I*** : Potatoes had been discovered by the Euiropeans in the Americas.

Statement II : Poor people in Ireland were dependent on potatoes to escape starvation in the 19^{th} century

Ans. (4)

Sol. Both the statements are true but they are not explain each other.

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 the President of India.

Ans. (4)

Sol. The Prime Minister of India is directly elected by the people as the member of Lok Sabha and Leader of Ruling party so his power is more then the President who has nominal powers as the head of state. For the winning the post of the President, a candidate has to gain majority of the votes which are casted for his elections.

SOLUTIONS
NATIONAL TALENT SEARCH EXAMINATION 2019 STAGE-2
SCHOLASTIC APTITUDE TEST (SAT) (DATE : 16-06-19)

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

Ans. (2)

Sol. $m = n^2 - n,\ n \in I$

Now $m^2 - 2m$

$[n(n-1)]^2 - 2(n)(n-1)$

$\Rightarrow$ $(n-2)(n-1)n(n+1)$ This is product of 4 consecutive integer

$\therefore$ is divisible by 24

42. The value of $\sqrt{97 \times 98 \times 99 \times 100 + 1}$ is equal to :

(1) 9901 (2) 9891 (3) 9801 (4) 9701

Ans. (4)

Sol. $\sqrt{97 \times 98 \times 99 \times 100 + 1}$

This is equivalent to

$\sqrt{(x+1)(x+2)(x+3)(x+4)+1}$ where $x = 96$

$\sqrt{(x^2+5x+4)(x^2+5x+6)+1}$

$= |x^2 + 5x + 5|$

$= 96^2 + 5 \times 96 + 5 = 9701$

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

(1) 0 (2) $\frac{1}{5}$ (3) $-\frac{2}{5}$ (4) $\frac{3}{5}$

Ans. (1)

Sol. $P(n) = \frac{1}{n}$, $P(1) = 1$, $P(2) = \frac{1}{2}$, $P(3) = \frac{1}{3}$, $P(4) = \frac{1}{4}$

Let $g(x) = xP(x) - 1 = K(x-1)(x-2)(x-3)(x-4)$

$xP(x) = k(x-1)(x-2)(x-3)(x-4) + 1$

Since P(x) is 3 degree polynomial

so, one of the zero of $k(x-1)(x-2)(x-3)(x-4) + 1$ is 0

so, $k(-1)(-2)(-3)(-4) + 1 = 0$

so, $k(24) = -1$

$k = -\frac{1}{24}$

$P(x) = \frac{1}{x}\left[-\frac{1}{24}(x-1)(x-2)(x-3)(x-4)+1\right]$

SOLUTIONS

NATIONAL TALENT SEARCH EXAMINATION 2019 STAGE-2

SCHOLASTIC APTITUDE TEST (SAT) (DATE : 16-06-19)

$P(5) = \frac{1}{5}\left[-\frac{1}{24}(4)(3)(2)(1)+1\right]$

$\frac{1}{5}[1-1]$

$P(5) = 0$

44. If α and β 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) $3x^2 - 5x - 3 = 0$

Ans. (1)

Sol. $3x^2 - 5x + 3 = 0$

$\therefore \quad \alpha + \beta = \frac{5}{3}$

$\alpha\beta = 1$

Required quadratic equation = $x^2 - (\alpha^2\beta + \alpha\beta^2)x + (\alpha\beta)^3 = 0$

$\Rightarrow \quad x^2 - [\alpha\beta(\alpha+\beta)]x + [(\alpha\beta)^3] = 0$

$\Rightarrow \quad x^2 - 1\left(\frac{5}{3}\right)x + 1^3 = 0$

$\Rightarrow \quad 3x^2 - 5x + 3 = 0$

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

Ans. (1)

Sol. Let 1 women, 1 girl can paint in x, y hrs respectively

$\frac{8}{x} + \frac{12}{y} = \frac{1}{10}$

$\frac{6}{x} + \frac{8}{y} = \frac{1}{14}$

Solving for x, y

x = 140 hrs

y = 280 hrs

Required Number of days

$\frac{1}{\frac{7}{140} + \frac{14}{280}}$

$\frac{1}{\frac{1}{10}}$ = 10 days

SOLUTIONS
NATIONAL TALENT SEARCH EXAMINATION 2019 STAGE-2
SCHOLASTIC APTITUDE TEST (SAT) (DATE : 16-06-19)

46. If $x=\frac{3+\sqrt{5}}{2}$ 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) $y^2+18y-1=0$

Ans. (1)

Sol. $x=\frac{3+\sqrt{5}}{2}$ and $y = x^3$

$= \left(\frac{3+\sqrt{5}}{2}\right)^3$

$= 9+4\sqrt{5}$

$\therefore$ y will satisfy

$y^2 - 18y + 1 = 0$

$\because$ 1 root $= 9+4\sqrt{5}$

other $= 9-4\sqrt{5}$

(because coefficient in the options are rational numbers)

47. If $\tan^2\theta = 1-e^2$, then the value of $\sec\theta + \tan^3\theta \operatorname{cosec}\theta$ is equal to :

(1) $(1-e^2)^{1/2}$ (2) $(2-e^2)^{1/2}$ (3) $(2-e^2)^{3/2}$ (4) $(1-e^2)^{3/2}$

Ans. (3)

Sol. $\tan^2\theta = 1-e^2$

$\sec\theta + \tan^3\theta \cdot \operatorname{cosec}\theta$

$\frac{\cos^2\theta+\sin^2\theta}{\cos^3\theta} = \sec^3\theta$

$= (1+\tan^2\theta)^{\frac{3}{2}}$

$= (2-e^2)^{3/2}$

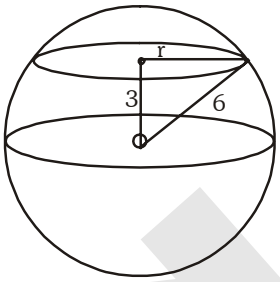
SOLUTIONS
NATIONAL TALENT SEARCH EXAMINATION 2019 STAGE-2
SCHOLASTIC APTITUDE TEST (SAT) (DATE : 16-06-19)

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) $144\ \pi$

Ans. (3)

Sol. Volume of sphere $= 288\ \pi\ cm^3$



$\therefore \quad \frac{4}{3}\pi r^3 = 288\pi$

$r = 6$

Total CSA of sphere $= 4\pi r^2$

$= 144\ \pi$

CSA of larger spherical part $= \frac{3}{4}144\,\pi = 108\ \pi$

from diagram, $6^2 = 3^2 + r^2$

$r = \sqrt{27}$

TSA of larger spherical part $= 108\ \pi + 27\pi = 135\pi$

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

Ans. (3)

Sol. Volume of the cylinder will be 490π

Therefore volume of cones $= 210\ \pi$ and $280\ \pi$

Let r_1 and r_2 be radius of two cones,

$r_1 = 3\sqrt{7}$

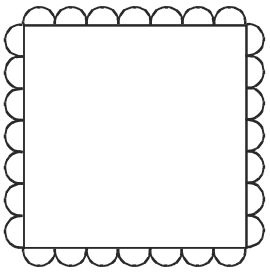
$r_2 = 2\sqrt{21}$

$$\% \text{ increase} = \frac{\pi(2\sqrt{21})^2 + \pi(3\sqrt{7})^2 - 2\pi(7^2)}{2\pi(7)^2} \times 100$$

$$= \frac{49}{98} \times 100 = 50\%$$

SOLUTIONS
NATIONAL TALENT SEARCH EXAMINATION 2019 STAGE-2
SCHOLASTIC APTITUDE TEST (SAT) (DATE : 16-06-19)

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 corss-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 $\pi=\frac{22}{7}$) is :

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

Ans. (4)

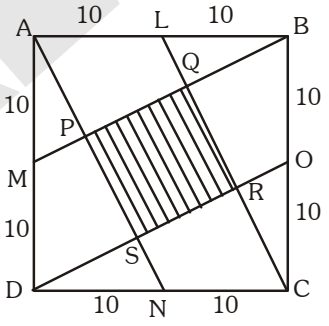
Sol. Total volume = Volume of square based pillar + 14 × volume of cylinder

$= 140^2 \times 300 + 14\times\pi\times10^2\times300$

$= 72\times10^5$

$= 7.2\times10^6\ cm^3 = 7.2\ m^3$

51. Let ABCD be 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

Ans. (2)

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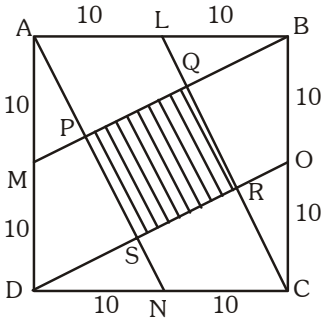
NATIONAL TALENT SEARCH EXAMINATION 2019 STAGE-2
SCHOLASTIC APTITUDE TEST (SAT) (DATE : 16-06-19)

Sol.



Since, ABCD is square, quadrilateral MDOB and quadrilateral ALCN are parallelograms so, quadrilateral PQRS is also a square

$MB^2 = 10^2 + 20^2$

$MB = \sqrt{500} = 10\sqrt{5}$

Let MP = x

DS = 2x (by M.P.T.)

SN = x (ΔDSN is congruent to ΔAPM)

$4x^2 + x^2 = 100$

$5x^2 = 100$

$x = \sqrt{20}$

side of PQRS = SR = DS $= 2x = 2\sqrt{20}$

area of PQRS $= 2\sqrt{20} \times 2\sqrt{20} = 4 \times 20$ = 80sq. units

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

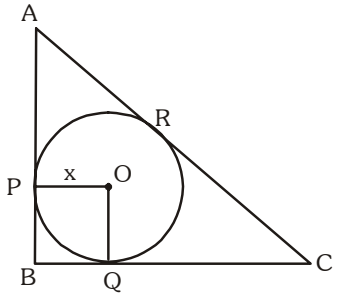
(1) 4 : 7 (2) 3 : 7 (3) 2 : 7 (4) 1 : 7

Ans. (1)

Sol. Let radius of circle = x

since quadrilateral PBQO is square

PB = BQ = x



area of $\Delta ABC = \frac{1}{2}x(AB) + \frac{1}{2}x(BC) + \frac{1}{2}x(AC)$

$$\frac{\text{circumference of circle}}{\text{area of circle}} = \frac{2\pi x}{\frac{7\pi}{2}x} = \frac{4}{7}$$

SOLUTIONS
NATIONAL TALENT SEARCH EXAMINATION 2019 STAGE-2
SCHOLASTIC APTITUDE TEST (SAT) (DATE : 16-06-19)

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 $s=\frac{a+b+c+d}{2}$. 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) $\sqrt{(ad)^2+(bc)^2}$

Ans. (2)

Sol. area of cyclic quadrilateral = $\sqrt{(s-a)(s-b)(s-c)(s-d)}$

as circle is inscribed in a quadrilateral

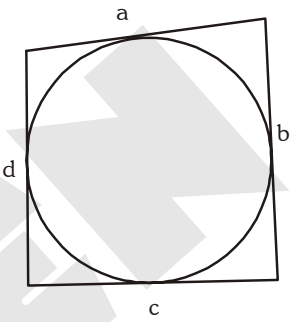
$a + c = b + d$

$2s = a + b + c + d$

$s = a + c = b + d$

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

$\sqrt{c.d.a.b} = \sqrt{abcd}$



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

Ans. (2)

Sol. Let radius of the circle be r

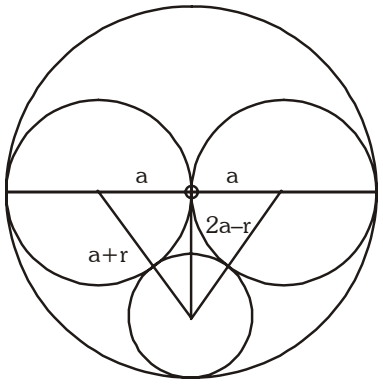
$(a+r)^2=(2a-r)^2+a^2$

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

$6ar = 4a^2$

$r = \frac{4}{6}\frac{a^2}{a}$

$r = \frac{2}{3}a$



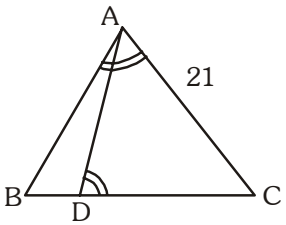
SOLUTIONS
NATIONAL TALENT SEARCH EXAMINATION 2019 STAGE-2
SCHOLASTIC APTITUDE TEST (SAT) (DATE : 16-06-19)

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) $42 \times 3^{1/2}$

Ans. (3)

Sol. $\Delta ADC \sim \Delta BAC$



So $\frac{BC}{21} = \frac{21}{DC}$

$BC \cdot DC = 441$

Area of Equilateral Δ = Area of rectangle = $441 cm^2$

$\frac{\sqrt{3}}{4} x^2 = 441$

$x = 14 \times 3^{3/4}$

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

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

Ans. (3)

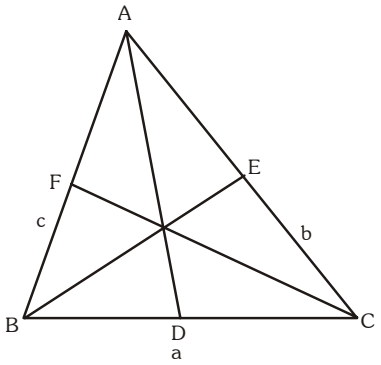
Sol. By Apollonius theorem

$b^2 + c^2 = 2AD^2 + \frac{a^2}{2}$

$\sqrt{\frac{1}{2}\left(b^2 + c^2 - \frac{a^2}{2}\right)} = AD$

$p = AD = \sqrt{\frac{b^2}{2} + \frac{c^2}{2} - \frac{a^2}{4}}$, $q = BE = \sqrt{\frac{a^2}{2} + \frac{c^2}{2} - \frac{b^2}{4}}$

$r = CF = \sqrt{\frac{a^2}{2} + \frac{b^2}{2} - \frac{c^2}{4}}$



Triangle formed by AD, BE and CF be ΔPQR

$PM = \sqrt{\frac{q^2}{2} + \frac{r^2}{2} - \frac{p^2}{4}}$

SOLUTIONS

NATIONAL TALENT SEARCH EXAMINATION 2019 STAGE-2

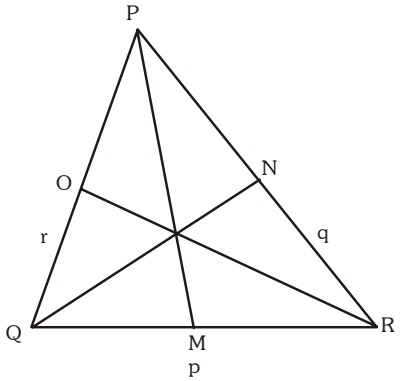
SCHOLASTIC APTITUDE TEST (SAT) (DATE : 16-06-19)

$$= \sqrt{\frac{1}{2}\left(a^2+\frac{c^2}{4}+\frac{b^2}{4}\right)-\frac{b^2}{8}-\frac{c^2}{8}+\frac{a^2}{16}}$$

$$= \sqrt{\frac{9a^2}{16}+\frac{c^2}{8}+\frac{b^2}{8}-\frac{b^2}{8}-\frac{c^2}{8}} = \frac{3}{4}a$$

similarly QN = $\frac{3}{4}b$

RO = $\frac{3}{4}c$



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

Ans. (3)

Sol. Let remainder be $R(x) = ax^2 + bx + c$

at x = 1, R(1) = a + b + c

$(x+1)^4 = (x-1)^3 . q(x) + ax^2 + bx + c$

at x = 1

$(1+1)^4 = 0 + a + b + c$

a+b +c = 16

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)

Ans. (2)

Sol. Let centre be O(x, y)

OA = OB = OC

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

on solving above equation x = 0 and y = 1

center (0, 1)

SOLUTIONS
NATIONAL TALENT SEARCH EXAMINATION 2019 STAGE-2
SCHOLASTIC APTITUDE TEST (SAT) (DATE : 16-06-19)

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

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

Ans. (2)

Sol. Total case = 36

Favourable case = 16 e.g.(1, 3) (2, 4).....

Probability = $\frac{16}{36}=\frac{4}{9}$

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

Ans. (1)

Sol.

Class	x_i	frequency	f_ix_i
0-20	10	17	170
20-40	30	f_1	$30f_1$
40-60	50	32	1600
60-80	70	f_2	$70f_2$
80-100	90	19	1710
Total		**120**	

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

$f_1 + f_2 = 52$ .....(1)

SOLUTIONS

NATIONAL TALENT SEARCH EXAMINATION 2019 STAGE-2

SCHOLASTIC APTITUDE TEST (SAT) (DATE : 16-06-19)

$\Sigma f_i x_i = 3480 + 30f_1 + 70f_2$

$\frac{\Sigma f_i x_i}{\Sigma f_i} = 50$

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

$3f_1 + 7f_2 = 252$ ....(2)

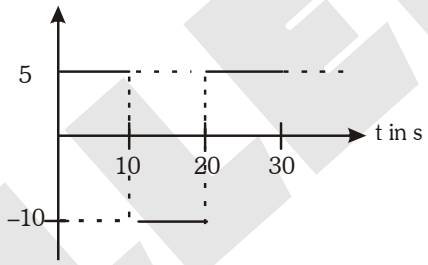
solving (1) and (2)

$f_1 = 28$

$f_2 = 24$

Directions (Questionss 61-62)

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



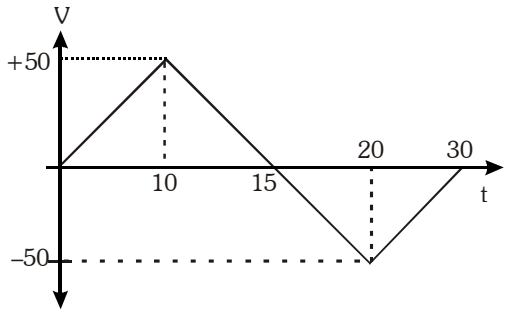
61. At what instant does the particle come to rest for the first time ?

(1) 5 s (2) 10 s

(3) 15 s (4) The particle never comes to rest

Ans. (3)

Sol. v - t graph of the given situation is,



At t = 15, v = 0

SOLUTIONS
NATIONAL TALENT SEARCH EXAMINATION 2019 STAGE-2
SCHOLASTIC APTITUDE TEST (SAT) (DATE : 16-06-19)

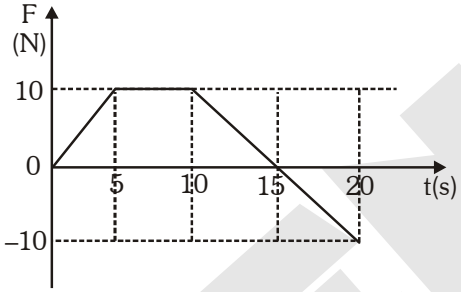
62. What is the total distance travelled by the particle in 30 s?

(1) 0 m (2) 500 m (3) 750 m (4) 1000 m

Ans. (3)

Sol. Distance = Area under v-t graph = $\frac{750}{2}+\frac{750}{2}=750\text{m}$

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 20s?

(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 intial speed is unknown.

Ans. (2)

Sol. Area under F-t graph = change in momentum

$=\frac{1}{2}(15+5)(10)-\frac{1}{2}(5)(10)=$ 75 kg-m/s

64. Two cars 'A' and 'B' of same mass start from the same location at the same time but on different straight roads. Car 'A' travels on a road that has greater angle of inclination with horizontal compared to the rod 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

Ans. (1)

SOLUTIONS

NATIONAL TALENT SEARCH EXAMINATION 2019 STAGE-2

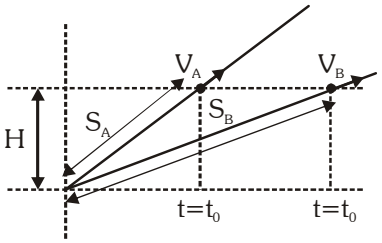
SCHOLASTIC APTITUDE TEST (SAT) (DATE : 16-06-19)

Sol. Given, $H_A = H_B = H$

$\Rightarrow S_A < S_B$

As, $\frac{2S_A}{t^2} = a_A$

$\frac{2S_B}{t^2} = a_B$



$\Rightarrow a_A < a_B$

$\Rightarrow V_A < V_B$

$\Rightarrow K.E_A < K.E_B$

Now, $P.E_A = P.E_B$

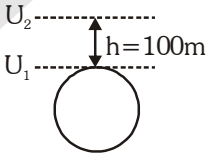
$\Rightarrow T.E_A < T.E_B$

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

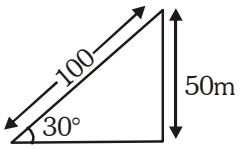
Ans. (2)

Sol. As per question, $\frac{U_2 - U_1}{m} = 1000$



$\frac{mgh - 0}{m} = 1000 \Rightarrow gh = 1000 \Rightarrow g = \frac{1000}{100} = 10\ m/s^2$

Now, $w = mgh = 5(10)(50) = 2500\ J$



Direction : (Q. 66 to 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 $u = \sqrt{2gH}$

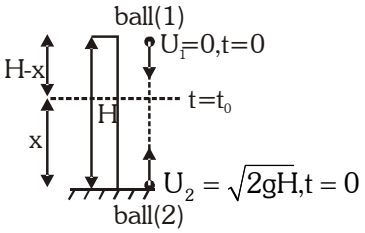
SOLUTIONS
NATIONAL TALENT SEARCH EXAMINATION 2019 STAGE-2
SCHOLASTIC APTITUDE TEST (SAT) (DATE : 16-06-19)

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

Ans. (4)

Sol. $H-x=\frac{1}{2}gt_0^2$ ...(1)



$x=\sqrt{2gH}(t_0)-\frac{1}{2}gt_0^2$ ...(2)

From (1) and (2) we have,

$t_0=\sqrt{\frac{H}{2g}} \Rightarrow x=\frac{3H}{4}$

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

Ans. (2)

Sol. $V_1=\sqrt{2g(H-x)}=\sqrt{\frac{gH}{2}}$

$V_2=\sqrt{2gH-2\times g\times\frac{3H}{4}}=\sqrt{\frac{gH}{2}}$

By C.O.L.M

$m\sqrt{\frac{gH}{2}}-m\sqrt{\frac{gH}{2}}=(2m)v$

$\Rightarrow v=0$

so loss in energy $=\frac{1}{2}m\left(\sqrt{\frac{gH}{2}}\right)^2+\frac{1}{2}m\left(\sqrt{\frac{gH}{2}}\right)^2=\frac{mgH}{2}$

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.

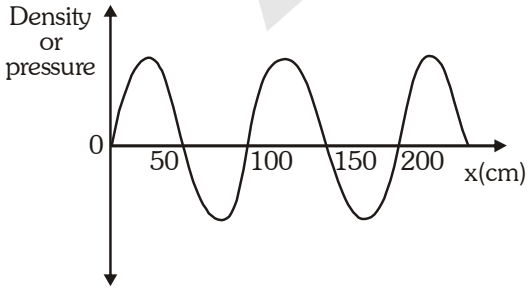


Fig. 1

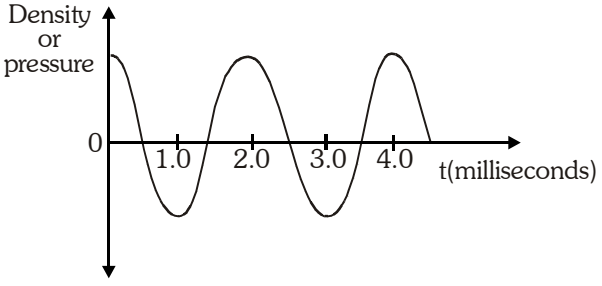


Fig.2

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

SOLUTIONS
NATIONAL TALENT SEARCH EXAMINATION 2019 STAGE-2
SCHOLASTIC APTITUDE TEST (SAT) (DATE : 16-06-19)

Ans. (4)

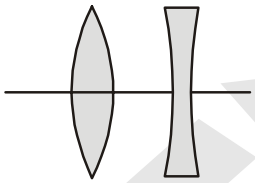
Sol. As per graph given,

$\lambda = 100\text{cm} = 1\text{m}$

$T = 2\text{ms} = 2\times10^{-3}\text{s}$

As we know $v = \frac{\lambda}{T} = \frac{1}{2\times10^{-3}} = 500\,\text{m/s}$

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.

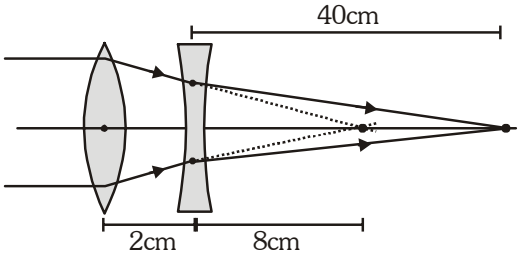
Ans. (1)

Sol. for concave lens

$u = +8\text{cm}$

$f = -10\text{ cm}$

$v = ?$



$\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$

$\frac{1}{v} = \frac{1}{8} - \frac{1}{10}$

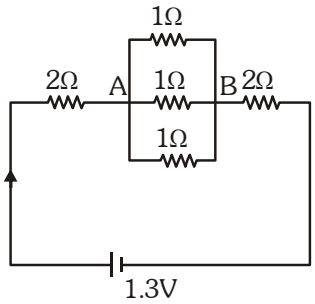
$\frac{1}{v} = \frac{10-8}{80} = \frac{2}{80}$

$v = 40\text{ cm}$

$\therefore$ Combination will behave like converging.

SOLUTIONS
NATIONAL TALENT SEARCH EXAMINATION 2019 STAGE-2
SCHOLASTIC APTITUDE TEST (SAT) (DATE : 16-06-19)

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) $\frac{1}{117}$ (2) $\frac{1}{13}$ (3) $\frac{1}{12}$ (4) 1

Ans. (2)

Sol. $W = p \times t$

Current in circuit $= \frac{3}{10}A$

Power dissipated across A and B

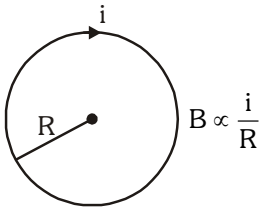
$P = I^2 \times R_{AB}$

$= \frac{9}{100} \times \frac{1}{3} = 0.03$ watt

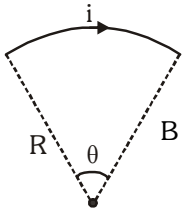
Total power $= I^2 \times R_{eq} = \frac{9}{100} \times \frac{13}{3} = 0.39$ watt

$\therefore$ Ratio of power across A and B, and total power is $= \frac{0.03}{0.39} = \frac{1}{13}$

71. Magnetic field at the centre of a circular coil of radius R carrying current i is $B \propto \frac{i}{R}$ 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 $B \propto \frac{i}{R}\left(\frac{\theta}{360^\circ}\right)$ and its direction can be found using right hand rule.



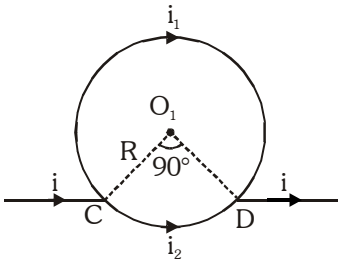
$B \propto \frac{i}{R}$

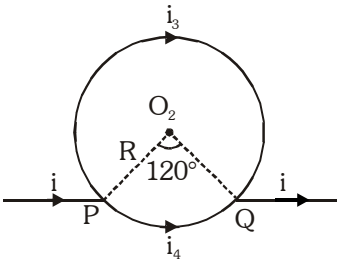


$B \propto \frac{i}{R}\left(\frac{\theta}{360^\circ}\right)$

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 $\angle PO_2Q = 120^\circ$. Then magnetic fields_____

SOLUTIONS
NATIONAL TALENT SEARCH EXAMINATION 2019 STAGE-2
SCHOLASTIC APTITUDE TEST (SAT) (DATE : 16-06-19)





(1) at both O_1 and O_2 are zero

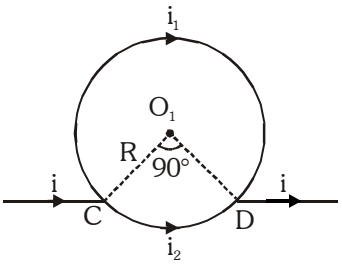
(2) at both O_1 and O_2 are non-zero

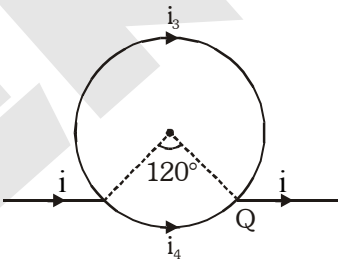
(3) is zero at O_1 but non-zero at O_2

(4) is non-zero at O_1 but zero at O_2

Ans. (1)

Sol.





$B_1 = K\frac{i_1}{R}\times\frac{270°}{360°}$

$B_2 = K\frac{i_2}{R}\times\frac{90°}{360°}$

But $i_2 = 3i_1$

$B_2 = K\frac{3i_1}{R}\times\frac{90°}{360°} = K\frac{i_1}{R}\times\frac{270°}{360°}$

$\frac{B_1}{B_2} = 1$

B_1 is into the plane.

B_2 is out of the plane.

Net field at $O_1 = 0$

$B_3 = K\frac{i_3}{R}\times\frac{240°}{360°}$

$B_4 = K\frac{i_4}{R}\times\frac{120°}{360°}$

But $i_4 = 2i_3$

$B_4 = K\frac{2i_3}{R}\times\frac{120°}{360°} = K\frac{i_3}{R}\times\frac{240°}{360°}$

$\frac{B_3}{B_4} = 1$

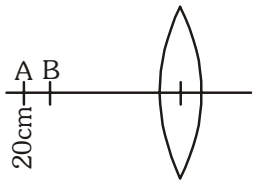
B_3 is into the plane.

B_4 is out of the plane.

Net field at $O_2 = 0$

SOLUTIONS
NATIONAL TALENT SEARCH EXAMINATION 2019 STAGE-2
SCHOLASTIC APTITUDE TEST (SAT) (DATE : 16-06-19)

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 l0 cm. Find magnification produced for the image of the pin.



(1) 0.83 (2) 1.00 (3) 1.25 (4) 6.78

Ans. (3)

Sol. Image distance for image B'

$$\frac{1}{V}-\frac{1}{U}=\frac{1}{f}$$

$$\frac{1}{V}-\frac{1}{(-18)}=\frac{1}{10}$$

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

$$V=\frac{180}{8}=22.5 \text{ cm}$$

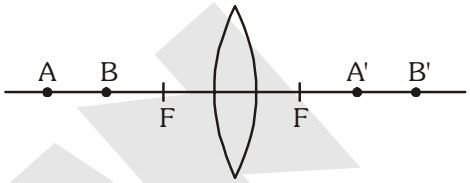


Image distance for image A'

$$\frac{1}{V}-\frac{1}{U}=\frac{1}{f}$$

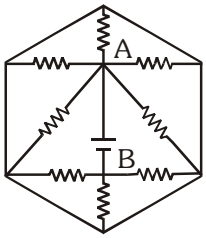
$$\frac{1}{V}-\frac{1}{(-20)}=\frac{1}{10}$$

$V = 20$ cm

$\therefore$ length of image A'B' = 2.5 cm

$$m=\frac{2.5}{2}=1.25$$

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



(1) 64 mA (2) 15 mA (3) 9.87 mA (4) 1 mA

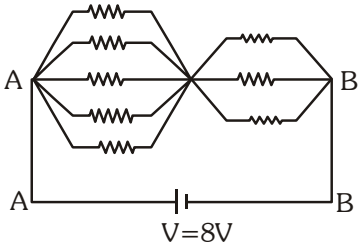
Ans. (2)

SOLUTIONS
NATIONAL TALENT SEARCH EXAMINATION 2019 STAGE-2
SCHOLASTIC APTITUDE TEST (SAT) (DATE : 16-06-19)

Sol. Each resistance = 1Ω

$$R_{eq} = \frac{1}{5} + \frac{1}{3} = \frac{8}{15}k\Omega = \frac{8000}{15}\Omega$$

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



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.

Ans. (4)

Sol. Na and K reacts violently with Cold water to produce metal hydroxide & hydrogen gas.

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) $N_2 > H_2O > O_2 > CH_4$

Ans. (1)

Sol. Number of O–atoms = $\frac{18}{32} \times 2 \times N_A = 1.125N_A$

Number of N–atoms = $\frac{18}{28} \times 2 \times N_A = 1.28N_A$

Number of Total atoms in CH_4 = $\frac{18}{16} \times 5 \times N_A = 5.625N_A$

Number of Total atoms in H_2O = $\frac{18}{18} \times 3 \times N_A = 3N_A$

Decreasing order $CH_4 > H_2O > N_2 > O_2$

SOLUTIONS
NATIONAL TALENT SEARCH EXAMINATION 2019 STAGE-2
SCHOLASTIC APTITUDE TEST (SAT) (DATE : 16-06-19)

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

Ans. (3)

Sol. F^-, Na^+, O^{2-} & Mg^{2+} are isoelectronic

So the correct order of their decreasing ionic radii is $O^{2-} > F^- > Na^+ > Mg^{2+}$.

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

Ans. (3)

Sol. $\underset{(A)}{C_2H_5OH} \xrightarrow[443K]{conc.H_2SO_4} \underset{(B)}{CH_2 = CH_2} + H_2O$

$\underset{(A)}{C_2H_5OH} \xrightarrow{alk.KMnO_4} \underset{(C)}{CH_3COOH}$

$\underset{(A)}{C_2H_5OH} + \underset{(C)}{CH_3COOH} \xrightarrow{conc.H_2SO_4} \underset{(D)}{CH_3COOC_2H_5} + H_2O$

78. Match List I (Mixture) and List II (Type) with the list III (Example) and select the correct answer from the combination 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

Ans. (2)

SOLUTIONS
NATIONAL TALENT SEARCH EXAMINATION 2019 STAGE-2
SCHOLASTIC APTITUDE TEST (SAT) (DATE : 16-06-19)

Sol. (A) Liquid in gas → (2) Aerosol → (III) Mist

(B) Liquid in liquid → (1) Emulsion → (III) Face cream

(C) Gas in solid → (3) Foam → (II) Sponge

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 IIII (4) II, III and IV

Ans. (1)

Sol. (I) Fe is less reactive than Mg.

(III) Cu is less reactive than Mg.

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

Ans. (2)

Sol. $\underset{(A)}{2CH_3 - CH_2 - OH} + 2Na \longrightarrow 2C_2H_5 - ONa + \underset{(X)}{H_2(g)}$

$\underset{(B)}{2CH_3COOH} + 2Na \longrightarrow 2CH_3COONa + \underset{(X)}{H_2(g)}$

$\underset{(B)}{CH_3COOH} + NaHCO_3 \longrightarrow CH_3COONa + H_2O + \underset{(Y)}{CO_2(g)}$

SOLUTIONS
NATIONAL TALENT SEARCH EXAMINATION 2019 STAGE-2
SCHOLASTIC APTITUDE TEST (SAT) (DATE : 16-06-19)

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

Ans. (4)

Sol.

	A	B	C	D
Atomic No.	11	12	16	17
Elements	Na	Mg	S	Cl

(II) Mg lose electron more readily than Sulphur(S). (Mg – metal $\rightarrow$ Lose e^-, S – Non- metal $\rightarrow$ gain/share e^-)
(IV) Energy required to remove electron from valence shell from Na will be minimum while that from Cl will be maximum.

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

Ans. (3)

Sol. Metal M reacts with Cold water and metal K reacts with warm water it shows metal M is more reactive than K.
Metal H and L does not react with dil.HCl & water respectively but metal L displaces metal H from its salt solution, it shows metal L is more reactive than H.
Hence M > K > L > H

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

SOLUTIONS
NATIONAL TALENT SEARCH EXAMINATION 2019 STAGE-2
SCHOLASTIC APTITUDE TEST (SAT) (DATE : 16-06-19)

Ans. (4)

Sol. (A) Formation of NH_3 from N_2 and H_2 → Combination reaction ($N_2 + 3H_2 \rightarrow 2NH_3$)

(B) Calcination of Zinc carbonate → Decomposition reaction ($ZnCO_3 \xrightarrow{\Delta} ZnO + CO_2$)

(C) Reaction of aqueous $BaCl_2$ solution with dilute H_2SO_4 → Double displacement reaction
($BaCl_2 + H_2SO_2 \rightarrow BaSO_4 + 2HCl$)

(D) Rancidity of oil → Redox reaction

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_4Cl, B = NaCl, C = CH_3COONa (2) A = NH_4Cl, B = CH_3COONa, C = NaCl

(3) A = NaCl, B = NH_4Cl, C = CH_3COONa (4) A = CH_3COONa, B = NH_4Cl, C = NaCl

Ans. (3)

Sol.

Sample	With Blue Litmus Solution	With Red Litmus Solution	With Phenolphthalein Solution
NaCl	No change (Neutral)	No change (Neutral)	No change (Neutral)
NH_4Cl	Turns Red (Acidic solution)	No change	No change
CH_3COONa	No change	Turns blue (Basic solution)	Turns pink (Basic Solution)

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

Ans. (3)

Sol. (A) Liquid N_2 and liquid O_2 can be separated by fractional distillation.

(B) Red and Blue inks can be separated by chromatography.

(C) NaCl in water can be separated by evaporation.

(D) Naphathalene and NaCl can be separated by sublimation as naphathalene is sublime in nature.

SOLUTIONS
NATIONAL TALENT SEARCH EXAMINATION 2019 STAGE-2
SCHOLASTIC APTITUDE TEST (SAT) (DATE : 16-06-19)

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) Electro negativity 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

Ans. (4)

Sol. As we move down the second group in periodic table, then

$\Rightarrow$ Atomic size increases

$\Rightarrow$ Due to increases in size, it can easily loose electrons

$\Rightarrow$ Valency remains same i.e. 2

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

Ans. (3)

Sol. H(Z = 1) and Cl (Z = 17) forms covalent compound i.e, HCl.

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.

Ans. (3)

Sol. Osmosis is diffusion of water molecules from hypotonic (low solute concentration) to hypertonic solution (high solute concentration) through selectively–permeable membrane that can also work as semi-permeable membrane.

89. In meiosis, each of the four daughther 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}

Ans. (2)

Sol. During meiosis due to random separation of homologous chromosome 2^n number of gametes are formed, where n is number of homologous chromosome pairs (No. of Bivalents).

So in Human n = 23

SOLUTIONS
NATIONAL TALENT SEARCH EXAMINATION 2019 STAGE-2
SCHOLASTIC APTITUDE TEST (SAT) (DATE : 16-06-19)

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.

Ans. (3)

Sol. Sclerenchyma fibres and sclereids are both dead cells with lignified pitted cell wall and provide mechenical strength

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

Ans. (1)

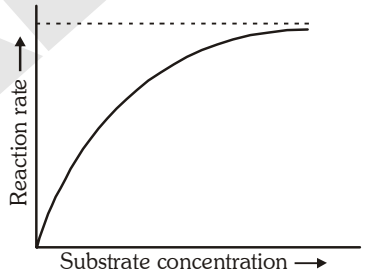
Sol. In scorpion respiratory pigment is dissolved in plasma. It is predaceous carnivore and it's offsprings consume mother within first few weeks of life (matriphagy)

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

Ans. (1)

Sol. Lichens are sensitive for Sulphur dioxide pollotion and are replaced by mosses. (Bryophytes)

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

Ans. (2)

SOLUTIONS
NATIONAL TALENT SEARCH EXAMINATION 2019 STAGE-2
SCHOLASTIC APTITUDE TEST (SAT) (DATE : 16-06-19)

Sol. From the given graph it can be concluded that it is hyperbolic curve. Concentration of substract is increasing the rate of reaction is also increasing but up to a certain point. After that rate become constant and this due to saturation of enzyme with substrate. So further increase in concentration of substrate will hinder the activity of enzyme.

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, every time 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.

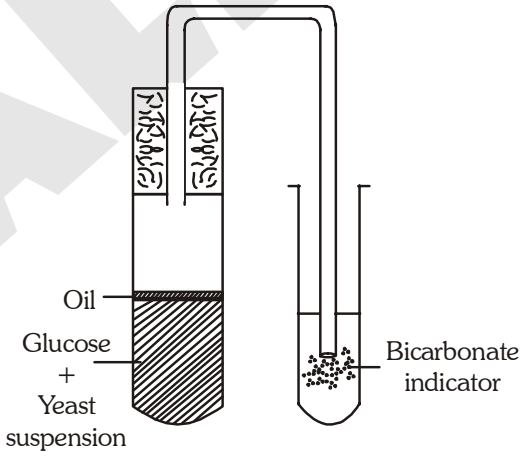
(3) Glucose in the free form creates more osmotic pressure.

(4) Glucose is highly reactive molecule hence storing in the free form can result in unwanted reactions in the cells.

Ans. (3)

Sol. Osmotic pressure is determined by molar concentration of the solute particles in solution so to maintain osmolarity food is stored as glycogen instead of glucose in free form as this will increase osmotic pressure.

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?



(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.

Ans. (3)

SOLUTIONS
NATIONAL TALENT SEARCH EXAMINATION 2019 STAGE-2
SCHOLASTIC APTITUDE TEST (SAT) (DATE : 16-06-19)

Sol. Sugar solution is boiled to remove the dissolved oxygen to ensure anaerobic fermentation and dissolved CO_2 to ensure CO_2 turning bicarbonate indicator to milky white is released in fermentation.

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. Adrenalin 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.

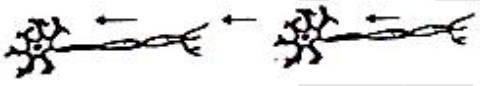
Select the correct combination of options given below:

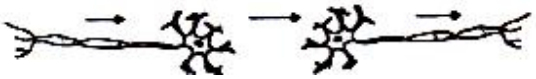
(1) A and B (2) A and C (3) B and C (4) C and D

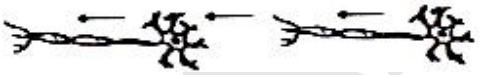
Ans. (3)

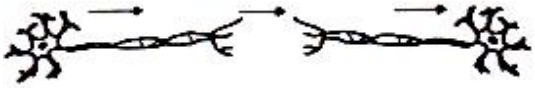
Sol. In emergency adrenalin hormone is secreted that increase heart beat to pump more oxygen to muscles. Hormone from adrenal medulla and neurons of sympathetic nervous system coming from medulla oblongata to SA node which increase heart beat.

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).

(1) 

(2) 

(3) 

(4) 

Ans. (3)

Sol. Transmission of impulse from one neuron to another is mediated by neurotransmitter so it always transfered from axon of one neuron to dendrite of another neuron.

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.

Ans. (3)

SOLUTIONS
NATIONAL TALENT SEARCH EXAMINATION 2019 STAGE-2
SCHOLASTIC APTITUDE TEST (SAT) (DATE : 16-06-19)

Sol. In angiosperms doubled fertilization occurs as two male gametes reach to ovule via pollen tube. One male gamete fuse with zygote to form diploid zygote and second male gamete fuse with secondary nucleus to form triploid endosperm.

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)

Ans. (1)

Sol. Plasmodium completed it's life cycle in two host, it's infectious stage sporozoite first multiply amitotically in liver cells and resultant merozoites entered in RBCs to produce gametocyte that further taken by mosquito and developed in mosquito intestine.

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 colour?

(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

Ans. (2)

Sol. Expected phenotype of monohybrid cross (in case of complete dominance) in F_2 generation is 3 red : 1 white.