

SEAL

DO NOT OPEN THE SEAL UNTIL INSTRUCTED TO DO SO

Test Booklet Number

00099

Subject Code : 2301

**MATHEMATICS
AND
SCIENCE**

Roll Number

Time Allowed : 2 Hours

Maximum Marks : 300

INSTRUCTIONS FOR CANDIDATES

Read the following instructions carefully before you answer the questions given in this Test Booklet :

1. Answers to questions in this Test Booklet are to be given on an **OMR Answer Sheet** provided to the candidate **separately**.
2. Candidate must fill up Name, Category, Test Booklet Number, Subject Code and Roll Number in the **OMR Answer Sheet** carefully as per instructions given.
3. This Test Booklet consists of **75 questions**. All questions are compulsory and carry equal marks.
4. Each question in this Test Booklet has four possible alternative answers namely, [A], [B], [C] and [D], one of which is correct. Candidate should choose the correct answer against each question out of four alternative answers.
5. Candidate is instructed to answer the questions by **darkening (●)** with **Ballpoint pen** only in the circle bearing the correct answer.
6. Candidate should not attempt more than one answer in each question. More than one attempt in any form against a question shall be treated as incorrect.
7. Marking of answer other than darkening shall be cancelled and darkening should remain within the circle otherwise computer shall not accept during evaluation of the **OMR Answer Sheet**.
8. Rough work must not be done on the **OMR Answer Sheet**. Use the blank space given in this Test Booklet for rough work.
9. Candidate is to hand over the **OMR Answer Sheet** to the Invigilator before leaving the Examination Hall.
10. **NEGATIVE MARKING** : Each question carries **4 (four)** marks for correct response. For each incorrect response, **1 (one)** mark will be deducted from the total score. More than one answer indicated against a question will be deemed as incorrect response and will be negatively marked.

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SPACE FOR ROUGH WORK

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MATHEMATICS
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INSTRUCTIONS FOR CANDIDATES

Read the following instructions carefully before attempting to answer the questions in this test booklet.

1. Answers to questions in this test are to be marked on the OMR Answer Sheet provided.

2. The test is divided into two parts: Part A and Part B. Part A contains 10 questions and Part B contains 10 questions.

3. The test is to be completed in 2 hours. You must finish the test within the time allowed.

4. Each question has four possible answers. Only one answer is correct. Mark the correct answer on the OMR Answer Sheet.

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MATHEMATICS

1. There is a circular path around a sports field. Sonia takes 18 minutes to drive one round of the field, while Ravi takes 12 minutes for the same. They both start at the same point and at the same time and go in the same direction. After how many minutes will they meet again at the starting point.

[A] 12

[B] 18

[C] 36

[D] 30

2. The value of $(a + b)^3 + (a - b)^3 + 6a(a^2 - b^2)$ is

[A] $6a^3$

[B] $8a^3$

[C] $10a^3$

[D] $12a^3$

3. The quadratic polynomial with $\frac{1}{4}$ as the sum and -1 as product of its zeroes, is :

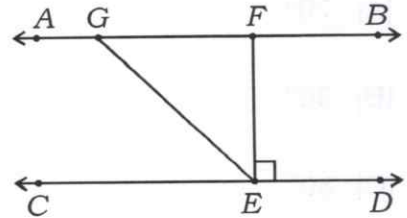
[A] $4x^2 - x - 4$

[B] $4x^2 + x - 4$

[C] $4x^2 + x + 4$

[D] $4x^2 - x + 4$

4. In the given figure, if $AB \parallel CD$, $EF \perp CD$ and $\angle GED = 126^\circ$, the measure of $\angle FGE$ is :



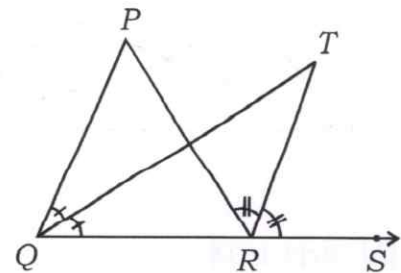
[A] 36°

[B] 126°

[C] 54°

[D] 64°

5. In the given figure, the side QR of $\triangle PQR$ is produced to a point S. If the bisectors of $\angle PQR$ and $\angle PRS$ meet at T, then $\angle QPR$ is equal to



[A] $\angle QTR$

[B] $2\angle QTR$

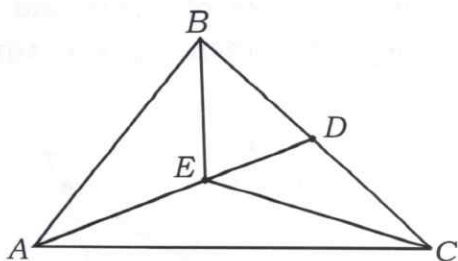
[C] $\frac{1}{2}\angle QTR$

[D] $3\angle QTR$

6. $ABCD$ is a cyclic quadrilateral whose diagonals intersect at the point E . If $\angle DBC = 70^\circ$, $\angle BAC = 30^\circ$ and $AB = BC$, then the measure of $\angle ECD$ is :

[A] 70°
 [B] 30°
 [C] 80°
 [D] 50°

7. In the given figure, AD is a median of $\triangle ABC$ and E is the mid-point of AD . Then $\text{ar}(\triangle BED)$



[A] $\text{ar}(\triangle ACD)$
 [B] $\frac{1}{2} \text{ar}(\triangle BAC)$
 [C] $\text{ar}(\triangle ABD)$
 [D] $\frac{1}{4} \text{ar}(\triangle ABC)$

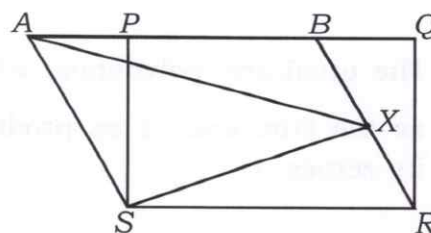
8. The inner diameter of a circular well is 3.5 m. It is 10 m deep. Cost of plastering the inner curved surface area at the rate of ₹40 per sq.m, is

[A] ₹8800
 [B] ₹4400
 [C] ₹2200
 [D] ₹440

9. The mean weight of 60 students in a class is 40 kg. The mean weight of boys is 50 kg while that of girls is 30 kg. The number of boys and girls respectively are :

[A] 30, 30
 [B] 35, 25
 [C] 25, 35
 [D] 20, 40

10. In the given figure, $PQRS$ and $ABRS$ are parallelograms and X is any point on side BR . Then $\text{ar}(\triangle AXS)$ is equal to



[A] $\text{ar}(\triangle ABR)$
 [B] $\text{ar}(\triangle PQRS)$
 [C] $\frac{1}{2} \text{ar}(\triangle PQRS)$
 [D] $2\text{ar}(\triangle PQRS)$

11. The coordinates of the point C dividing the join of points $A (2, 6)$ and $B (5, 1)$ in the ratio $2 : 3$ is

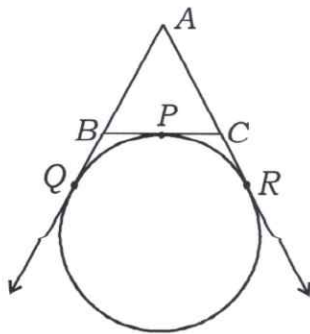
[A] $\left(4, \frac{16}{5}\right)$

[B] $\left(\frac{16}{5}, 4\right)$

[C] $\left(\frac{16}{5}, \frac{4}{5}\right)$

[D] $\left(\frac{4}{5}, \frac{16}{5}\right)$

12. In the given figure, a circle touches the side BC of $\triangle ABC$ at P and touches AB and AC produced at Q and R respectively. If $AR = 5$ cm, then the perimeter of $\triangle ABC$ is



- [A] 12 cm
[B] 11 cm
[C] 10 cm
[D] 8 cm

13. The value of k for which the system of equations $x + 2y - 3 = 0$ and $5x + ky + 7 = 0$ has no solution, is

[A] 10

[B] 6

[C] 4

[D] 1

14. If the mid-points of the sides of a square are joined successively, the figure so formed is

[A] rectangle

[B] trapezium

[C] square

[D] kite

15. If $\tan \theta = \frac{p}{q}$, then the value of

$$\frac{p \sin \theta - q \cos \theta}{p \sin \theta + q \cos \theta} \text{ is}$$

[A] $\frac{q^2 - p^2}{q^2 + p^2}$

[B] $\frac{p^2 - q^2}{p^2 + q^2}$

[C] $\frac{p^2 + q^2}{p^2 - q^2}$

[D] $\frac{q^2 + p^2}{q^2 - p^2}$

16. If one root of the equation $ax^2 + bx + c = 0$ is three times the other, then

[A] $2b^2 = 9ac$

[B] $b^2 = 16ac$

[C] $b^2 = ac$

[D] $3b^2 = 16ac$

17. If the sum of first p terms of an AP is the same as the sum of its first q terms, ($p \neq q$), then the sum of its first $(p + q)$ terms is :

[A] 0

[B] 1

[C] pq

[D] $p + q$

18. The inner circumference of a circular track is 24π m. The track is 2 m wide from everywhere. The length of wire required to surround the path completely is

[A] 80 m

[B] 81 m

[C] 82 m

[D] 88 m

19. A cylindrical vessel of diameter 4 cm is partly filled with water. 300 lead balls are dropped in it and are immersed in water. The raise in water level is 0.8 cm. The diameter of each ball is :

[A] 0.8 cm

[B] 0.4 cm

[C] 0.2 cm

[D] 0.1 cm

20. The probability of getting 53 sundays and 53 Mondays in a randomly selected leap year is

[A] $\frac{1}{7}$

[B] $\frac{2}{7}$

[C] $\frac{3}{7}$

[D] $\frac{4}{7}$

SCIENCE

21. Iron and sulphur have been heated together and the following reaction is observed :



Which of the following statements is correct?

- [A] The product shows properties of Fe & S.
- [B] The product will always have a fixed composition.
- [C] The product is not a compound.
- [D] The product is a heterogeneous mixture.

22. Ice has been taken in a beaker and a thermometer is suspended in it. The beaker is kept on flame with constant stirring of the ice. Which is of the following statements is correct?

- [A] Temperature remains at 0°C
- [B] Temperature starts rising as soon as ice is getting heated.
- [C] Temperature will not rise till all the ice melts and will rise thereafter.
- [D] Temperature rises very slowly till the ice melts and then rises rapidly.

23. A cold drink bottle at room temperature is kept in water at 0°C and another bottle is kept in ice at 0°C for 15 minutes each. Which will cause better cooling effect?

- [A] Water at 0°C .
- [B] Ice at 0°C .
- [C] Both will cause the same amount of cooling.
- [D] It depends upon the room temperature.

24. Study the following substances :

(i) S_8 (ii) $\text{H}_2 + \text{O}_2$ (iii) CO_2

Choose the correct statement/s.

- (a) S_8 cannot be broken down to simpler substances further.
- (b) $\text{H}_2 + \text{O}_2$ is a heterogeneous mixture
- (c) The composition of CO_2 is fixed.
- (d) S_8 , H_2 and O_2 are elements but CO_2 is a compound.

- [A] (a), (c), (d) are correct statements
- [B] (a), (b), (c) are correct statements
- [C] Only (c) is a correct statement
- [D] (b) and (d) are correct statements

25. Which of the following has the highest mass?

[A] 10 mol of H_2O

[B] 12 mol of CH_4

[C] 2 mol of CO_2

[D] 5 mol of NH_3

26. Which of the following contains maximum number of molecules?

[A] 1 g of O_2

[B] 1 g of H_2

[C] 1 g of H_2O

[D] 1 g of SO_2

27. The electronic configuration of Element 'A' is 2, 8, 1 and Element 'B' is 2, 6. What will be the formula of the compound formed between A & B?

[A] AB_6

[B] AB_2

[C] A_3B

[D] A_2B

28. The reaction between sulphuric acid and sodium hydroxide is a :-

[A] Displacement reaction and exothermic in nature.

[B] Double displacement and exothermic in nature.

[C] Displacement reaction and endothermic in nature.

[D] Combination reaction and exothermic in nature.

29. If copper metal is exposed to moist air, it gets corroded. The colour of the layer formed and the formula of the compound respectively are :

[A] Reddish brown layer of copper oxide.

[B] Green layer of copper hydroxide.

[C] Green layer of basic copper carbonate.

[D] Black layer of basic copper carbonate.

30. The pH value of five solutions A, B, C, D & E is given below :

A - 7, B - 10, C - 14, D - 1, E - 3

Choose the correct option of the decreasing order of Hydrogen ion concentration in these solutions:-

- [A] $C > B > A > E > D$
- [B] $B > C > E > A > D$
- [C] $D > E > A > B > C$
- [D] $A > E > D > C > B$
31. Which of the following methods is safe and correct when a concentrated acid has to be diluted?
- [A] Add water to acid at room temperature.
- [B] Add acid to water while heating the mixture constantly.
- [C] Add water to acid while heating the mixture constantly.
- [D] Add acid to water slowly at room temperature.

32. Which of the following is the second member of the alkyne homologous series :-

- [A] C_3H_4
- [B] C_2H_2
- [C] C_2H_4
- [D] C_2H_6

33. A soap molecule has a head and a tail. Which of the following is true about the nature of the head and tail :-

- [A] Head is hydrophobic, tail is hydrophilic
- [B] Head is hydrophilic, tail is hydrophobic
- [C] Head is hydrophilic, tail is hydrophilic
- [D] Head is hydrophobic, tail is hydrophobic

34. Which reducing agent can be used to obtain a moderately reactive metal from its oxide?

- [A] Platinum
- [B] Carbon
- [C] Copper
- [D] Mercury

35. An element has atomic number '16'. In which period and group of the Modern Periodic Table one may locate this element?

- [A] Group 6, Period 3
- [B] Group 16, Period 2
- [C] Group 16, Period 3
- [D] Group 6, Period 2

36. Which of the following is not true about a homologous series?

- [A] Two consecutive members differ by $-\text{CH}_2$ group.
- [B] The chemical properties of all the members are different.
- [C] The physical properties show regular gradation as the molecular mass increases.
- [D] The molecular mass of two consecutive members differ by 14 u.

37. Plant cells have many small golgi complexes called

- [A] Ribosomes
- [B] Dictyosomes
- [C] Aerosome
- [D] Lysosomes

38. Dry raisins when put in water swell after a few minutes. This is due to

- [A] Diffusion
- [B] Plasmolysis
- [C] Endosmosis
- [D] Exosmosis

39. Striated muscles are

- [A] Multinucleate and unbranched
- [B] Uninucleate and spindle shaped
- [C] Uninucleate and branched
- [D] Multinucleate and branched

40. Find the odd one out.

Smooth muscles are found in

- [A] Iris of the eye
- [B] Bronchi of lungs
- [C] Ureters
- [D] Limbs

41. Choose the correct option :

An organism has the following features :

Streamlined body, skin is covered with scales or plates, obtains oxygen dissolved in water and lays eggs. It may be

- [A] Salamander
- [B] Rohu
- [C] Turtle
- [D] Scoliodon

42. Which one of the following feature is not found in Protochordata?

- [A] Presence of circulatory system
- [B] Bilaterally symmetrical and triploblastic
- [C] Presence of notochord
- [D] Jointed legs

43. Renal artery coming out of the glomerulus branches into capillaries all over the tubular part of the nephron and later joins to form

- [A] Renal vein
- [B] Vena cava
- [C] Aorta
- [D] Asterioles

44. Blood does not flow back into the atrium from the ventricles because

- [A] Pressure of blood in ventricles is low.
- [B] Valves present between atrium and ventricle do not allow blood to enter atrium.
- [C] Atrium pushes the blood back into ventricles
- [D] Ventricles have thicker walls than atria.

45. Sphincter muscle allows only a small quantity of food to pass from

- [A] Stomach to Duodenum
- [B] Mouth to Stomach
- [C] Oesophagus to Stomach
- [D] Small Intestine to Large Intestine

46. A potted plant is made to lie horizontally on the ground. After some time it is observed that the roots start growing downwards and the shoots grow upwards. This kind of movement is called

- [A] Phototropism
- [B] Geotropism
- [C] Hydrotropism
- [D] Chemotropism

47. The region of the brain associated with hunger is

- [A] Cerebellum
- [B] Hypothalamus
- [C] Pons
- [D] Medulla

48. Characters that are transmitted from parents to offsprings during reproduction show

- [A] Similarities between parents and offsprings
- [B] Variations between parents and offsprings
- [C] Both similarities and variations between parents and offsprings
- [D] Neither similarities nor variations between parents and offsprings

49. Which among the following events take place during sexual reproduction in Angiosperms?

- 1. Transfer of pollen from the stigma to the anther.
- 2. A tube grows out of the pollen grain and travels through the style to reach the ovary.
- 3. Sepals and petals protect the ovary so that it does not shrivel and fall off.
- 4. Development of zygote into embryo, ovule into seed and ovary into fruit takes place.

- [A] 1 and 3
- [B] 1 and 4
- [C] 2 and 3
- [D] 2 and 4

50. Which of the following statement(s) is incorrect about fossils?

- 1. Preserved traces of living organisms are called fossils.
- 2. Age of the fossils cannot be detected.
- 3. Older and older fossils are in the deeper layers of rocks.
- 4. Fossils do not provide any evidence of evolution.

[A] 1 and 2

[B] 4 only

[C] 2 and 3

[D] 2 and 4

51. Select amongst the following the trait that can be acquired in human beings.

- [A] Colour of the eye
- [B] Attached ear lobe
- [C] Larger muscle size
- [D] Curly Hair

52. The position of a moving object along the X-axis at different times are as shown below :

$t(s)$	0	1	2	3	4
$x(m)$	0	2	8	18	32

Select from the following the statement which describes the motion of the object correctly.

- [A] uniform motion, constant acceleration
 - [B] uniform motion, variable acceleration
 - [C] non-uniform motion, constant acceleration
 - [D] non-uniform motion, variable acceleration
53. A car travels a certain distance with a speed of 12 m/s and returns along the same path with a speed of 18 m/s. The average speed of the car for the whole journey is

- [A] 15.6 m/s
- [B] 15.2 m/s
- [C] 14.8 m/s
- [D] 14.4 m/s

54. "An object is moving with a constant speed." This statement means :

- [A] the position of the object remains constant as time passes.
- [B] the acceleration of the object is zero.
- [C] the direction of motion of the object does not change with time.
- [D] the object covers equal distances in equal intervals of time.

55. A car running on a national highway at 25 m/s slows down to 15 m/s over a distance of 20 m. The time for which brakes are applied is

- [A] 0.5 s
- [B] 0.75 s
- [C] 1.0 s
- [D] 2.0 s

56. A passenger in a fast moving train tosses a coin vertically upward. If the coin falls behind him, then it may be concluded that the train is moving with

- [A] a zero acceleration along a straight track
- [B] a non-uniform acceleration along a straight track
- [C] a uniform +ve acceleration along a straight track
- [D] a uniform -ve acceleration along a straight track

57. A number of forces are acting simultaneously on an object changes the state of motion of the object. These forces are

- [A] unbalanced
- [B] balanced
- [C] inclined
- [D] parallel or antiparallel

58. A system at rest explodes of its own in two equal fragments. These fragments move with the

- [A] same speed in the same direction
- [B] same speed in the opposite direction
- [C] different speeds in the same direction
- [D] different speeds in different direction

59. A force of 100 N acts on a trolley of mass 10 kg. The trolley is moving on a surface with a constant velocity of 5 m/s. If the surface is rough, the magnitude of the force of friction that must be between the trolley and the surface so that the trolley keeps on moving with the same velocity of 5 m/s over the surface is

- [A] 50 N
- [B] 100 N
- [C] 200 N
- [D] 400 N

60. A ball of mass 150 g moving with a speed of 30 m/s strikes a bat and returns in opposite direction with a speed of 40 m/s. If the time of impact is 0.1 s, the average force exerted by the bat on the ball is

- [A] 45 N
- [B] 60 N
- [C] 70 N
- [D] 105 N

61. The correct relationship between g and G is

[A] $g = G \frac{M^2}{R^2}$

[B] $g = G \frac{M}{R^2}$

[C] $G = g \frac{M}{R^2}$

[D] $G = g \frac{M^2}{R^2}$

62. Two objects of masses M_1 and M_2 are released simultaneously from heights h_1 and h_2 respectively. If they reach the ground after a time t_1 and t_2 and strike the ground with velocities of v_1 and v_2 respectively, then $\frac{v_1}{v_2}$ is

[A] $\sqrt{\frac{M_1 h_1}{M_2 h_2}}$

[B] $\frac{h_1 t_1}{h_2 t_2}$

[C] $\sqrt{\frac{h_1}{h_2}}$

[D] $\sqrt{\frac{h_2}{h_1}}$

63. SI units of pressure

[A] newton-metre

[B] newton per metre

[C] pascal

[D] joule-metre

64. The force exerted by a liquid of relative density 1.8 on the base of container of base area 0.5 m^2 when filled with the liquid upto a height of 1 m is :

(Density of water 1000 kg/m^3 and $g = 10 \text{ m/s}^2$)

[A] 4500 N

[B] 9000 N

[C] 45000 N

[D] 90000 N

65. A metallic cylinder weighs 1600 N in air and 1400 N when completely immersed in water. If on completely immersing the same cylinder in an unknown liquid the cylinder weighs 1440 N, the relative density of the liquid is

[A] 1.25

[B] 1.20

[C] 0.9

[D] 0.8

66. The objects of masses 1 kg and 4 kg have same momentum. The ratio of their kinetic energies is

[A] $\sqrt{2} : 1$

[B] 2 : 1

[C] 4 : 1

[D] 16 : 1

67. An electric pump takes 20 s to lift 100 kg of water from a well to a reservoir situated at a height of 20 m from the well. The power of the pump is

[A] 200 W

[B] 400 W

[C] 1000 W

[D] 2000 W

68. Two spheres A and B have same diameter. The mass of A is 30 kg and of B is 12 kg. These spheres are dropped simultaneously from a cliff. When they are 5 m from the ground they have the same

[A] momentum

[B] kinetic energy

[C] potential energy

[D] acceleration

69. When a sound wave propagates in a medium the physical quantity which is transferred from one place to the other is

[A] mass

[B] pressure

[C] density

[D] energy

70. An object is 3.0 km below the sea level. A research vessel sends down a sonar signal to verify this depth of the object. If the speed of sound in sea water is 1500 m/s, the echo of the signal will be received after a time interval of

[A] 8.0 s

[B] 4.0 s

[C] 2.0 s

[D] 1.5 s

71. An object is placed 20 cm in front of a spherical mirror. If its erect image is formed 15 cm behind the mirror, the type of the mirror and its focal length is

- [A] concave mirror of focal length 30 cm
- [B] concave mirror of focal length 60 cm
- [C] convex mirror of focal length 60 cm
- [D] convex mirror of focal length 30 cm

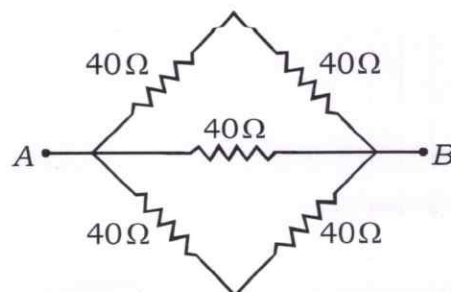
72. In case of human eye the focal length of the eye lens increases when

- [A] ciliary muscles contract
- [B] ciliary muscles expand
- [C] the eye is focussed on a nearly object
- [D] iris contracts

73. Area of cross-sections of three wires A, B and C of constantan are in the ratio of 1:3:5 and their lengths are in the ratio of 5:3:1. The ratio of the electrical resistances of the three wires i.e., $R_A : R_B : R_C$ is

- [A] $5 : 1 : \frac{1}{5}$
- [B] $\frac{1}{5} : 1 : 5$
- [C] $25 : 9 : 1$
- [D] $1 : 9 : 25$

74. Equivalent resistance between the terminals A and B of the circuit shown is



- [A] 10Ω
- [B] 20Ω
- [C] 40Ω
- [D] 60Ω

75. The direction of magnetic field at the centre of a coil carrying current in clockwise direction is

- [A] towards the centre of the coil
- [B] away from the centre of the coil
- [C] towards you
- [D] away from you

SPACE FOR ROUGH WORK

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