SEAL

Test Booklet Number	Subject Code - 1401	Roll Number
00928	**MATHEMATICS & SCIENCE**	

[Time : 2 Hours] [Maximum Marks : 300]

INSTRUCTIONS TO 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 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 **Ball Point 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 or otherwise computer shall not accept during evaluation of answer-script.
8. Rough work must not be done on the Answer Sheet. Use the blank space given in the Test Booklet for rough work.
9. Candidate is to hand over the 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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MATHEMATICS

1. If $\frac{a}{b}$ is a rational number such that $a < b$, then $\frac{a}{b}$

(A) is always less than 1

(B) is always greater than 1

(C) is always equal to 1

(D) may be less or greater than 1

2. The factors of $(2x - 3y)^3 + (3y - 4z)^3 - 8(x - 2z)^3$ are

(A) $2x \times 3y \times 4z$

(B) $3(2x - 3y)(3y - 4z)(x - 2z)$

(C) $2(2x - 3y)(3y - 4z)(2z - x)$

(D) $6(2x - 3y)(3y - 4z)(2z - x)$

3. The point whose abscissa is -8 and lies in the third quadrant is

(A) $(-8, 0)$

(B) $(0, -8)$

(C) $(-8, 2)$

(D) $(-8, -3)$

4. Given five distinct points in a plane, no three of them are collinear. The number of lines that can be drawn through them is

(A) 5

(B) 10

(C) 15

(D) 20

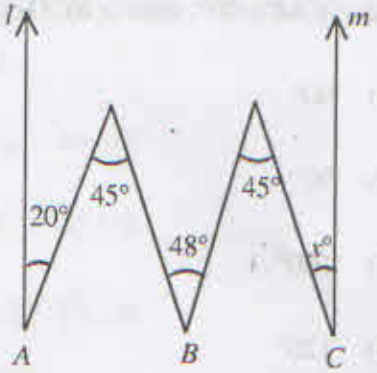
5. In the figure $l \parallel m$, then x equals

(A) 20°

(B) 22°

(C) 25°

(D) 30°



6. The lengths of diagonals of a rhombus are 24 cm and 18 cm. The length of the side of rhombus is

(A) 6 cm

(B) 9 cm

(C) 12 cm

(D) 15 cm

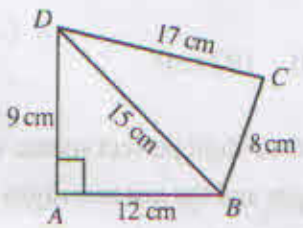
7. The area of quadrilateral $ABCD$ (as shown in figure) is

(A) 57 cm²

(B) 76 cm²

(C) 114 cm²

(D) 128 cm²



8. If the volume (in cm³) and surface area (in cm²) of a sphere are numerically equal, then the radius of the sphere is

(A) 2 cm

(B) 3 cm

(C) 3.5 cm

(D) 4 cm

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9. $ABCD$ is a cyclic quadrilateral whose diagonals intersect at P. If $\angle DBC = 60°$ and $\angle CAB = 20°$, then $\angle BCD$ equals

(A) 60°

(B) 90°

(C) 100°

(D) 120°

10. If the perimeter of a rhombus is 40 cm and one of the diagonals is 16 cm, the area of the rhombus is

(A) 64 cm^2

(B) 96 cm^2

(C) 160 cm^2

(D) 192 cm^2

11. A four-digit perfect square whose first two digits and the last two digits each represent squares is

(A) 1636

(B) 1681

(C) 3664

(D) 4964

12. If α, β are the zeroes of the polynomial $x^2 - 4x - 21$, then $(\alpha + 1)(\beta + 1)$ equals

(A) 16

(B) – 16

(C) 26

(D) –24

13. If $2x - 3y = 7$ and $(a + b)x - (a + b + 2)y = 4a + 2b$ represent coincident lines, then

(A) $a + b = 4$

(B) $3a + b = 0$

(C) $a + 3b = 0$

(D) $a + b = -4$

14. If $\alpha + \beta = 90°$ and $\alpha = 2\beta$, then $\cos^2\alpha + \sin^2\beta$ equals

(A) 0

(B) $\frac{1}{2}$

(C) 1

(D) 2

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15. The mean of 10 observations is x. If the first term is increased by 1, the second is increased by 2, the third by 3 and so on, then the new mean is

(A) $x + 1$

(B) $x + 5$

(C) $x + 5.5$

(D) $x + 10$

16. If $2p+q$, $4q$ and $6p+q-2$ are consecutive terms of an AP and $q - p = 1$, then the values of p and q in order are

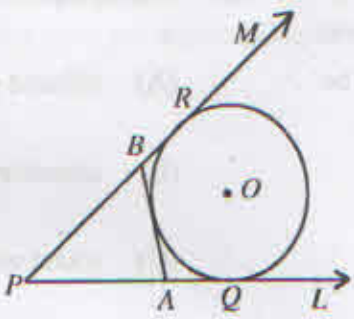
(A) 5, 4

(B) 4, 5

(C) 6, 3

(D) 3, 6

17. PQ, PR and AB are tangents to a circle with centre O and PQ = 12 cm as shown in figure. The perimeter of ΔPAB is



(A) 24 cm

(B) 25 cm

(C) 30 cm

(D) 40 cm

18. The radius of the base and the height of a right circular cylinder are each increased by 10%. The volume of the cylinder is increased by

(A) 30.4 %

(B) 40.5 %

(C) 45.2 %

(D) 33.1 %

19. One end of a diameter of a circle is (3, 4) and the centre is (–2, 3). The coordinates of the other end of the diameter is

(A) (–7, 2)

(B) (2, –7)

(C) (–3, 4)

(D) (3, –4)

20. The number of common tangents of two circles, which touch each other externally is

(A) 1

(B) 2

(C) 3

(D) 4

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21. Points P, Q and R in a vertical line such that $PQ = QR$. A ball at the top most point P is allowed to fall freely. What is the ratio of the times of descent through PQ and QR ?

(A) $\frac{3}{2}$

(B) $\frac{3}{\sqrt{2}+1}$

(C) $\frac{1}{\sqrt{2}-1}$

(D) $\frac{5}{2}$

22. While walking on ice, one should take small steps to avoid slippling. This is because smaller steps ensure

(A) larger friction

(B) smaller friction

(C) larger normal force

(D) smaller normal force

23. A lift is descending with a constant velocity v. A man in the lift drops a coin. The coin experiences an acceleration towards the floor equal to

(A) $g + v$

(B) $g - v$

(C) g

(D) zero

24. A steel needle can be made to float on water due to

(A) cohesion

(B) Archimedes principle

(C) adhesion

(D) surface tension

25. The velocity of the bob of a simple pendulum at its mean position if it is able to rise to a vertical height of 10 cm is

(A) 1.4 m/s

(B) 2.54 m/s

(C) 3.43 m/s

(D) 5.35 m/s

26. Waves used in sonography are

(A) infrared waves

(B) microwaves

(C) sound waves

(D) ultrasonic waves

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27. The sound from an open pipe is more pleasant than the sound from a closed pipe. This is because

(A) sound is heard from both the sides of an open pipe

(B) there are more overtone combinations in an open pipe than in a closed pipe

(C) it is very easy to operate an open pipe

(D) the length of the open pipe is shorter

28. If a diverging lens is to be used to form an image which is one-fourth of the size of the object where must the object be placed ?

(A) $4f$

(B) $3f$

(C) $2f$

(D) f

29. How many images of himself does an observer see if two adjacent walls of rectangular room are mirror surfaced ?

(A) 3

(B) 5

(C) 7

(D) 9

30. Critical angle of light passing from glass to air is minimum for

(A) red

(B) green

(C) violet

(D) yellow

31. No longitudinal wave will show

(A) interference

(B) diffraction

(C) total internal reflection

(D) polarisation

32. When the temperature of a metallic conductor is increased, its resistance

(A) decreases

(B) increases

(C) remains the same

(D) may increase or decrease depending on the length

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33. An electric bulb is rated 220 volts and 100 watts. Power consumed by it when operated on 110 volts is

(A) 50 watts

(B) 75 watts

(C) 90 watts

(D) 25 watts

34. The brightness of a bulb will be reduced if a resistance is connected in

(A) series with it

(B) parallel with it

(C) series or parallel with it

(D) Brightness cannot be reduced

35. Ampere rule is used to find the

(A) direction of current

(B) direction of magnetic field

(C) direction of motion of the conductor

(D) magnitude of current

36. By inserting a soft iron piece into a solenoid, the strength of the magnetic field

(A) increases

(B) decreases

(C) first increases and then decreases

(D) remains unchanged

37. The fractional distillation of coal tar yields

(A) carbon disulphide

(B) kerosene oil

(C) carbon tetrachloride

(D) benzene

38. Choose the source of energy which is different from others

(A) Gobar gas

(B) Vegetable refuse

(C) Plants

(D) Crude oil

39. The planet farthest from the Sun is

(A) Mercury

(B) Venus

(C) Pluto

(D) Earth

40. The temperature of the centre of the earth is about

(A) 4000 °C

(B) 6000 °C

(C) 10^4 °C

(D) 10^6 °C

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41. The species represented by $^{27}_{13}Al^{3+}$ contains

(A) 13 protons, 14 neutrons and 10 electrons

(B) 27 protons, 13 neutrons and 14 electrons

(C) 13 protons, 27 neutrons and 13 electrons

(D) 13 protons, 27 neutrons and 10 electrons

42. Hydrogen and oxygen react as follows :

$$H_2(g) + \frac{1}{2}O_2(g) \rightarrow H_2O(l)$$

0.5 mol of water will be obtained if

(A) 0.5 mol of hydrogen reacts with 0.5 mol of oxygen

(B) 0.5 mol of hydrogen reacts with 0.25 mol of oxygen

(C) 1 mol of hydrogen reacts with 0.5 mol of oxygen

(D) 0.5 mol of hydrogen reacts with 1 mol of oxygen

43. Three different substances A, B and Oxygen are mixed and a two-step reaction occurs

(i) $A + O_2 \rightarrow AO_2$

(ii) $B + AO_2 \rightarrow BO_2 + A$

Which substance is functioning as a catalyst ?

(A) B

(B) BO_2

(C) AO_2

(D) A

44. Which one of the following reactions involves oxidation-reduction ?

(A) $K_2SO_4(aq) + PbCl_2(aq) \rightarrow 2KCl(aq) + PbSO_4(s)$

(B) $2Na(s) + 2H_2O(l) \rightarrow 2NaOH(aq) + H_2(g)$

(C) $KCl(aq) + AgNO_3(aq) \rightarrow AgCl(s) + KNO_3(aq)$

(D) $CuSO_4(aq) + H_2S(aq) \rightarrow H_2SO_4(aq) + CuS(s)$

45. Identify from the given sub-atomic particles the one which is nearly 2000 times heavier than cathode ray particle but opposite in charge to it

(A) Neutron

(B) Deuterium

(C) α-Particle

(D) Proton

46. When an atom is changed to a negatively charged ion

(A) oxidation occurs

(B) protons are lost

(C) electrons are lost

(D) there is an increase in the radius of the ion

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47. HCl concentration is 1×10^{-5} *M*. The pH of the solution is

(A) 4

(B) 5

(C) 6

(D) 8

48. Which one of the following is an ionic compound ?

(A) NO_2

(B) SO_2

(C) MgO

(D) CO_2

49. Reactivity of the metals decreases in the order

(A) Mg > Al > Zn > Fe

(B) Al > Mg > Zn > Fe

(C) Zn > Al > Mg > Fe

(D) Fe > Al > Zn > Mg

50. What is the probable formula for the oxide of the element X placed in group-3 of the periodic table ?

(A) X_3O

(B) X_2O_3

(C) X_3O_2

(D) X_3O_4

51. In metallurgical processes limestone ($CaCO_3$) is added as a flux to

(A) remove metal from metal ore as metal carbonate

(B) supply CO_2 to stop reaction

(C) remove SiO_2 present as impurity in ore as $CaSiO_3$

(D) lower down the melting point of the ore

52. Which one of the following reactions is not a decomposition reaction ?

(A) $2Pb(NO_3)_2(s) \xrightarrow{heat} 2PbO(s) + 4NO_2(g) + O_2(g)$

(B) $CaCO_3(s) \xrightarrow{heat} CaO(s) + CO_2(g)$

(C) $2FeSO_4(s) \xrightarrow{heat} Fe_2O_3(s) + SO_2(g) + SO_3(g)$

(D) $Fe(s) + CuSO_4(aq) \rightarrow FeSO_4(aq) + Cu(s)$

53. Galvanization is a process in which iron is coated with

(A) Al

(B) Cr

(C) Cu

(D) Zn

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54. Which one of the following oxides is of acidic nature ?

(A) H_2O

(B) CO_2

(C) CO

(D) CaO

55. Which one is the most volatile fraction of petroleum ?

(A) Naphtha

(B) Kerosine

(C) Gasoline

(D) Diesel

56. Which one of the following organic compounds is not alkyne ?

(A) C_3H_4

(B) C_5H_8

(C) C_4H_6

(D) C_5H_{10}

57. Chemical name of vinegar is

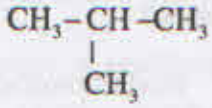
(A) lactic acid

(B) formic acid

(C) acetic acid

(D) butyric acid

58. IUPAC name of the compound



is

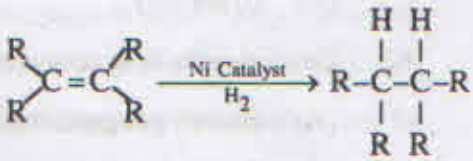
(A) 1-methyl propane

(B) 2-methyl propane

(C) 3-methyl butane

(D) 2-methyl butane

59. The reaction



is an example of

(A) substitution reaction

(B) decomposition reaction

(C) addition reaction

(D) combustion reaction

60. Which one of the following compounds possesses alcoholic group ?

(A) CH_3CHO

(B) CH_3CH_2Cl

(C) $CH_3COOC_2H_5$

(D) $CH_3CH(OH)CH_3$

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61. Which among the following are the functions of testes ?

(i) Production of sperms

(ii) Secretion of testosterone

(iii) Secretion of oestrogen

(iv) Production of ova

(A) (i) and (ii)

(B) (ii) and (iii)

(C) (iii) and (iv)

(D) (i) and (iv)

62. Decomposers in an ecosystem

(A) convert inorganic material to simpler forms

(B) convert organic material to simpler inorganic forms

(C) convert inorganic material into organic material

(D) convert atmospheric nitrogen to nitrogenous compounds

63. Asexual reproduction takes place through budding in

(A) *Amoeba*

(B) *Plasmodium*

(C) *Hydra*

(D) *Spirogyra*

64. The correct sequence of events of sexual reproduction in a flower is

(A) seedling, pollination, fertilization, embryo formation

(B) pollination, fertilization, embryo formation, seedling

(C) embryo formation, pollination, fertilization, seedling

(D) fertilization, embryo formation, pollination, seedling

65. Insulin hormone is secreted by group of cells (islets of Langerhans) situated in

(A) ovary

(B) adrenal gland

(C) wall of stomach

(D) pancreas

66. The temporary reservoir of urine in the body is

(A) urinary bladder

(B) ureter

(C) urethra

(D) urinary tubule

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67. Exchange of gases during respiration takes place in

(A) trachea and bronchi

(B) alveoli of lungs

(C) larynx and throat

(D) alveoli and trachea

68. The correct sequence of the components of a reflex arc is

(A) receptors → spinal cord → muscle → motor neuron → sensory neuron

(B) receptors → motor neuron → spinal cord → sensory neuron → muscle

(C) receptors → sensory neuron → spinal cord → motor neuron → muscle

(D) receptors → sensory neuron → spinal cord → muscle → motor neuron

69. Which of the following is the most economical agricultural enterprise for the farmers ?

(A) Inland fisheries

(B) Bee keeping

(C) Poultry farming

(D) Marine fisheries

70. Which of the following food chains is correctly represented ?

(A) Green plant → small insect → large insect → bird → hawk

(B) Small insect → green plant → large insect → hawk → bird

(C) Green plant → large insect → bird → small insect → hawk

(D) Hawk → bird → large insect → small insect → green plant

71. The percentage of solar energy (radiation) that falls on leave of green plants in a terrestrial ecosystem which is absorbed for the process of photosynthesis is about

(A) 1%

(B) 2%

(C) 5%

(D) 10%

72. Which of the following diseases is not caused by virus ?

(A) AIDS

(B) Influenza

(C) Dengue fever

(D) Cholera

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73. The wings of bat, bird and an insect are example of

(A) homologous organs

(B) modified organs

(C) vestigeal organs

(D) analogous organs

74. The undefined nuclear region of prokaryotes is termed as

(A) nucleus

(B) nucleolus

(C) nuclear membrane

(D) nucleoid

75. The transport of soluble products of photosynthesis occurs in

(A) tracheids

(B) vessels

(C) xylem

(D) phloem

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