# Talent Search Exam. 2021

**TEST CODE** 1102

*for class XI (Non-Medical)*

**BOOKLET** B

| Duration : 2 Hours | Max. Marks : 280 |
|---|---|

*Please read the instructions carefully. You are alloted 5 minutes specifically for this purpose.*

## INSTRUCTIONS

### A. General :

1. This booklet is your Question Paper. DO NOT break seal of Booklet until the invigilator instructs to do so. Total Questions to be Attempted 70: **Chemistry : 20, Physics : 20, Mathematics : 20 & MAT : 10 Questions.**

2. The Answer Sheet is provided to you separately which is a machine readable Optical Response Sheet (ORS). You have to mark your answers in the ORS by darkening bubble, as per your answer choice, by using black & blue ball point pen.

3. Things NOT ALLOWED in EXAM HALL : Blank Paper, clipboard, log table, slide rule, calculator, camera, mobile and any electronic or electrical gadget. If you are carrying any of these then keep them at a place specified by invigilator at your own risk.

4. Do not use white-fluid or any other rubbing material on answer sheet. Before handing over the answer sheet to the invigilator, candidate should check that **Roll No, Test code and Book Code** have been filled and marked correctly. Immediately after the prescribed examination time is over, the **Answer sheet is to be returned to the invigilator.**

### B. Filling the Answer Sheet :

5. On Side-1 of Answer Sheet write your Name and Roll Number in the respective boxes. Do not write anything on Side-2.

6. **Marking Scheme:**

   a. If darkened bubble is RIGHT answer : 4 Marks.

   b. If no bubble is darkened in any question: No Mark.

   c. If darkened bubble is WRONG answer: –1 Mark (Minus One Mark).

7. Think wisely before darkening bubble as there is negative marking for wrong answer.

### PROCEDURE OF FILLING UP THE ANSWERS IN ANSWER SHEET

Avoid Improper Marking

Partially Filled    Lightly Filled    Tick-Cross Marked

Proper Marking

Fully darken

**Name of the candidate (In Capital Letters)**

**Roll Number**

I have read all the instruction and shall abide by them.

..........................................................

**(Signature of the candidate)**

I have verified all the information filled in by the candidate.

..........................................................

**(Signature of the Invigilator)**

## You can never quit. Winners never quit, and quitters never win.

# [ CHEMISTRY ]

1. Calculate the number of $Cl^-$ and $Ca^{2+}$ ions in 222 g anhydrous $CaCl_2$

(a) $2N_A$ ions of $Ca^{+2}$, $2N_A$ ions of $Cl^-$

(b) $2N_A$ ions of $Ca^{+2}$, $4N_A$ ions of $Cl^-$

(c) $2N_A$ ions of $Ca^{+2}$, $8N_A$ ions of $Cl^-$

(d) $4N_A$ ions of $Ca^{+2}$, $4N_A$ ions of $Cl^-$

2. Equal masses of oxygen, hydrogen and methane are taken in a container in identical condition. Find the ratio of the volumes of the gases.

(a) $O_2 : H_2 : CH_4$  $1 : 16 : 2$

(b) $O_2 : H_2 : CH_4$  $1 : 8 : 1$

(c) $O_2 : H_2 : CH_4$  $16 : 1 : 8$

(d) $O_2 : H_2 : CH_4$  $8 : 1 : 8$

3. The elements A and B form a compound that contains 60% A and 40% B by mass. The atomic mass of B is twice that of A. Find the empirical formula of the compound.

(a) $A_3B_2$

(b) $A_3B$

(c) $A_2B_3$

(d) $AB_3$

4. One litre of a mixture of CO and $CO_2$ is passed through red hot charcoal in tube. The new volume becomes 1.4 litre. Find out % composition of mixture by volume. All measurements are made at same P and T.

(a) $CO_2$ 40%, CO 60%

(b) $CO_2$ 60%, CO 40%

(c) $CO_2$ 25%, CO 75%

(d) $CO_2$ 30%, CO 70%

5. For a 3s orbital $\psi$ (3s) $= \dfrac{1}{9\sqrt{3}}\left(\dfrac{1}{a_0}\right)^{1/2}$

$(6 - 6\sigma + \sigma^2)\ \psi^{-\sigma/2}$

Where $\sigma = \dfrac{2Zr}{3a_0}$. What is the maximum radial distance of node from nucleus?

(a) $\dfrac{2}{3}\dfrac{(3+\sqrt{3})a_0}{Z}$

(b) $\dfrac{3}{2}\dfrac{(3+\sqrt{3})a_0}{Z}$

(c) $\dfrac{3}{2}\dfrac{(3-\sqrt{3})a_0}{Z}$

(d) $\dfrac{2}{3}\dfrac{(3-\sqrt{3})a_0}{Z}$

6. If the subsidiary quantum number of a sub-energy level is 4, the maximum and minimum values of the spin multiplicities are:

(a) 9, 1　　　　　　　(b) 10, 1

(c) 10, 2　　　　　　　(d) 4, –4

7. In which element shielding effect is not possible?

(a) H　　　　　　　(b) Be

(c) B　　　　　　　(d) N

8. Elements of which block in modern periodic table cannot have –ve oxidation state?

(a) s　　　　　　　(b) d

(c) p　　　　　　　(d) None of these

9. Which is true statement(s)?

(a) Larger is the value of ionization enthalpy, easier is the formation of cation

(b) Larger is the value of electron gain enthalpy, easier is the formation of anion

(c) Larger is the value of ionization energy as well as electron affinity, smaller is the Mulliken electronegativity of atom

(d) Larger is the $Z_{eff}$, larger is the size of atom

10. Atomic number of 15, 33, 51 represents the following family:

(a) Carbon family     (b) Nitrogen family

(c) Oxygen family     (d) None of these

11. A flask of methane $(CH_4)$ was weighed.
Methane was then pushed out and the flask again weighed when filled with oxygen at the same temperature and pressure. The mass of oxygen would be:

(a) The same as the methane

(b) Half of the methane

(c) Double of that of methane

(d) Negligible in comparison to that of methane

12. A gas can be liquefied by:

(a) Cooling     (b) Compressing

(c) Both     (d) None of these

13. Which of the following expressions of compression factor Z $(= pV_m /RT)$ of a real gas is applicable at high pressure?

(a) $Z = 1 - a/V_m\ RT$

(b) $Z = 1 + a/V_m\ RT$

(c) $Z = 1 + pb / RT$

(d) $Z = 1 - pb / RT$

14. $S_1 : [XeF_7]^+$ has $sp^3d^3$ hybridization

$S_2 : [PCl_4]^+$ has $sp^3d^2$ hybridization

$S_3 : [SF_6]$ has $sp^3d^2$ hybridization

$S_4 : [PF_4]^+$ has $sp^3$ hybridization

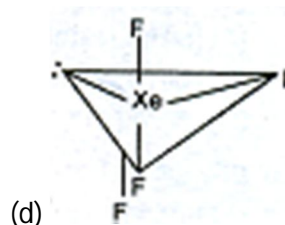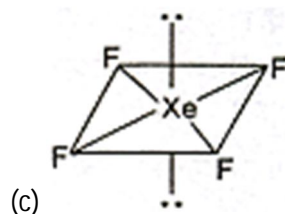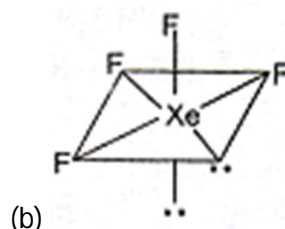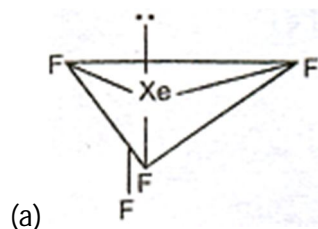(a) TFFT           (b) TTFT
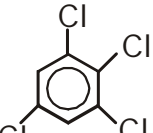
(c) TFTT           (d) FFFT

15. What is the right structure of $XeF_4$ ?


(a)


(b)


(c)


(d)

3

16. The dipole moment of 



is 1.5 D. The dipole moment of 



will be:

(a) 0 D

(b) 1.5 D

(c) 2.86 D

(d) 2.25 D

17. Statement-1: The electronic structure of azide ion ($N_3^-$) is $[:\ddot{N} \leftarrow N\equiv N:]^{\ominus}$.

Statement-2: 



is not a resonating structure of azide ion, because the position of atoms cannot be changed.

(a) Statement-1 is True, statement-2 is a correct explanation for Statement-1.

(b) Statement-1 is True, statement-2 is NOT a correct explanation for Statement-1.

(c) Statement-1 is True, statement-2 is False.

(d) Statement-1 is False, statement-2 is True.

18. In which of the following cyclic compound the nitrogen atom is $sp^3$ hybridized?



I.

II.



III.



IV.
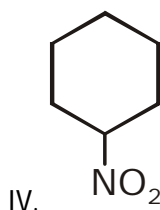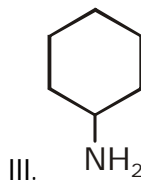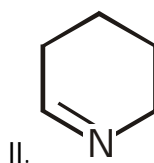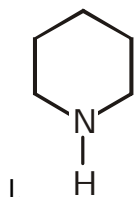


(a) I & III

(b) I, II, III

(c) III & IV

(d) I, III & IV

19. Which of the following contains both electrovalent and covalent bonds?

(a) $CH_4$

(b) $H_2O_2$

(c) $NH_4Cl$

(d) None of these

20. No. of mole of $CH_4$ gas present in 2.4 g of gas are:

(a) .15

(b) 1.5

(c) 15

(d) .015

# [ PHYSICS ]

21. A point moves rectilinearly. Its displacement x at time t is given by $x^2 = t^2 + 1$. Its acceleration at time t is:

(a) $\dfrac{1}{x^3}$

(b) $\dfrac{1}{x} - \dfrac{1}{x^2}$

(c) $-\dfrac{t}{x^2}$

(d) $-\dfrac{t^2}{x^3}$

22. The quantity $\int_{t_1}^{t_2} \vec{V} \, dt$ represents:

(a) Distance travelled during $t_1$ to $t_2$

(b) Displacement during $t_1$ to $t_2$

(c) Average acceleration during $t_1$ to $t_2$

(d) None of these

23. The position vector of a particle varies with time as $\vec{r} = \vec{r}_0(1 - \alpha t)t$ where $\vec{r}_0$ is a constant vector & $\alpha$ is a positive constant then the distance covered during the time interval in which particle returns to its initial position is:

(a) $r_0 / \alpha$

(b) $r_0 / 2\alpha$

(c) $\sqrt{r_0^2 + \dfrac{r_0}{\alpha}}$

(d) $\sqrt{r_0^2 + \dfrac{2r_0}{\alpha}}$

24. A plank is held at an angle $\alpha$ to the horizontal (Fig.) on two fixed supports A and B. The plank can slide against the supports (without friction) because of its weight Mg. With what acceleration and in what direction, a man of mass m should move so that the plank does not move.
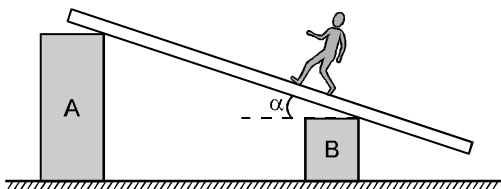


(a) g sin $\alpha \left(1 + \dfrac{m}{M}\right)$ down the incline

(b) g sin $\alpha \left(1 + \dfrac{M}{m}\right)$ down the incline

(c) g sin $\alpha \left(1 + \dfrac{m}{M}\right)$ up the incline

(d) g sin $\alpha \left(1 + \dfrac{M}{m}\right)$ up the incline

25. A particle of mass m is moving in a circular path of constant radius r such that its centripetal acceleration $a_c$ is varying with time t as $a_c = k^2 r t^2$ where k is a constant. The power delivered to the particle by the forces acting on it is:

(a) $2\pi m k^2 r^2 t$

(b) $m k^2 r^2 t$

(c) $(m k^4 r^2 t^5)/3$

(d) Zero

26. A block hangs freely from the end of a spring. A boy then slowly pushes the block upwards so that the string becomes strain free. The gain in gravitational potential energy of the block during the process is equal to:

(a) The work done by the boy against the gravitational force acting on the block

(b) The loss of energy stored in the spring minus the work done by the tension in the spring

(c) The work done on the block by the boy plus the loss of energy stored in the spring

(d) The work done on the block by the boy minus the work done by the tension in the spring plus the loss of energy stored in the spring

27. Two cylindrical vessels of equal cross-sectional area. A contains water up to height $h_1$ and $h_2$. The

5

vessels are interconnected so that the levels in them become equal. The work done by the force of gravity during the process is:

(a) Zero

(b) $\rho A \left( \dfrac{h_1 + h_2}{2} \right)^2 g$

(c) $\rho A \left( \dfrac{h_1 - h_2}{2} \right)^2 g$

(d) $\dfrac{\rho A h_1 h_2}{2} g$

28. The figure shows a man of mass 80 kg standing stationary with respect to a horizontal conveyor belt that is accelerating. If the coefficient of static friction between the man's shoes and the belt is 0.2. The maximum acceleration of the belt up to which man continue to be stationary relative to the belt, will be
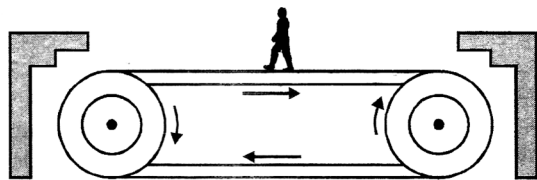


(a) $2 \ m/s^2$

(b) $4 \ m/s^2$

(c) $1 \ m/s^2$

(d) $0.2 \ m/s^2$

29. A body constrained to move along the z-axis of a coordinate system is subjected to a constant force $\vec{F}(N) = -\hat{i} + 2\hat{j} + 3\hat{k}$ where $\hat{i}$, $\hat{j}$ and $\hat{k}$ are unit vectors along x, y and z axes respectively. The work done by this force in moving the body by a distance 4 m along a z-axis is

(a) 8 joule

(b) 12 joule

(c) 6 joule

(d) Zero

30. A uniform chain of length $\ell$ rests on a rough table so that one end hangs over the edge. The chain slides off the table all by m itself when $\eta$ fraction of the length of the chain hangs, as shown in the figure. The chain starts sliding from rest. Find

the speed of the end A of the chain when it completely slides off the table.
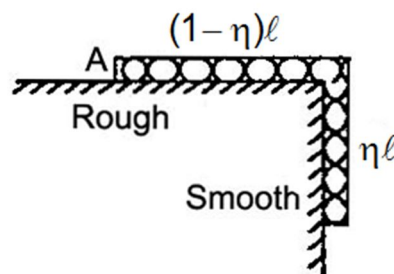


(a) $\sqrt{g\ell(1 - \eta)}$

(b) $\sqrt{g\ell(1 + \eta)}$

(c) $\sqrt{2g\ell(1 + \eta)}$

(d) $\sqrt{g\ell(2 + \eta)}$

31. A ball of mass m when dropped from certain height as shown in figure strikes a wedge of mass M kept on a smooth horizontal surface and move horizontal just after impact. If the ball strikes the horizontal surface at a distance 2h from its initial line of fall, then the velocity of wedge just after the impact will be
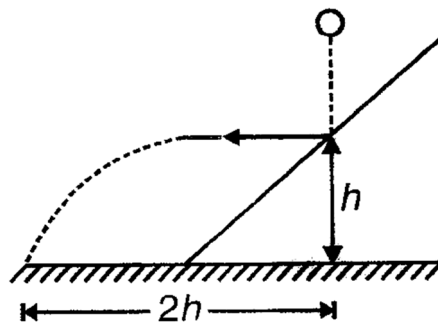


(a) $\sqrt{2gh}$

(b) $\dfrac{M}{m} \sqrt{2gh}$

(c) $\dfrac{m}{M} \sqrt{2gh}$

(d) $\dfrac{m}{M} \sqrt{gh}$

32. A particle of mass m is moving in a horizontal circle of radius r under a centripetal force equal to $\left(-\dfrac{k}{r^2}\right)$, where k is a positive constant. Then if kinetic energy, potential energy and mechanical energy of the particle are KE, PE and ME respectively. Which one is correct?
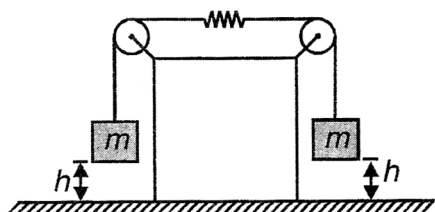
(a) $KE = \left(\dfrac{k}{2r}\right)$, $PE = -\left(\dfrac{k}{r}\right)$, $ME = -\left(\dfrac{k}{2r}\right)$

(b) $KE = \left(\dfrac{k}{2r}\right)$, $PE = -\left(\dfrac{k}{2r}\right)$, $ME = zero$

(c) $KE = zero$, $PE = zero$, $ME = zero$

(d) $KE = \left(\dfrac{k}{r}\right)$, $PE = -\left(\dfrac{k}{2r}\right)$, $ME = \left(\dfrac{k}{2r}\right)$

33. In the adjacent figure, spring is massless and surface of pulleys is smooth. At position shown in figure the spring is at its natural length and the system is released from rest. If both the blocks just miss to hit the horizontal plane then spring constant k is equal to



(a) $\dfrac{mg}{h}$

(b) $\dfrac{4mg}{h}$

(c) $\dfrac{2mg}{h}$

(d) $\dfrac{mg}{4h}$

34. A set of n identical cubical blocks lies at rest parallel to each other along a line on a smooth horizontal surface. The separation between the near surfaces of any two adjacent blocks in L. The block at one end is given a speed v towards the next one at time t = 0, all collisions are elastic then:

(a) The last block starts moving at $t = \dfrac{(n+1)L}{v}$

(b) The last block starts moving at $t = \dfrac{n(n-1)L}{2v}$

(c) The center of mass of the system will have the final speed v

(d) The center of mass of the system will have the final speed $\dfrac{v}{n}$

35. A solid sphere is rolling without slipping on rough ground as shown in figure. It collides elastically with an identical another sphere at rest. There is no friction between two spheres. Radius of each sphere is R and mass is m. Then linear velocity of first sphere after it again start rolling without slipping is



Rough
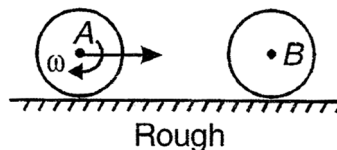
(a) $\dfrac{2}{5}\omega R$

(b) $\dfrac{2}{7}\omega R$

(c) $\dfrac{7}{10}\omega R$

(d) $\dfrac{7}{5}\omega R$

36. A moving sphere A of mass $m_1$ experience a perfectly elastic collision with a stationary sphere B of mass $m_2$ as shown in the figure. At the instant of collision the velocity vectors of A makes an angle of 30° with the line joining the centres of A and B. After collision the spheres fly apart symmetrically relative to the initial motion direction of the sphere A with the angle of divergence 60°. Find the ratio $\dfrac{m_1}{m_2}$.
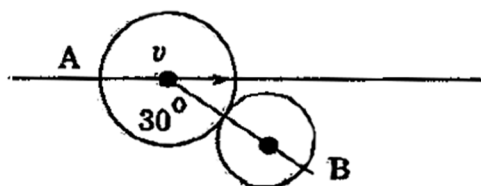


(a) 4

(b) 2

(c) 6

(d) 8

37. Each of the two blocks shown in the figure has a mass m. The coefficient of friction for all surfaces in contact is $\mu$. A horizontal force P is applied to move the bottom block. The value of P, for which acceleration of block A is same in both cases is
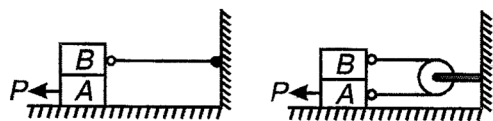


(a) $2\mu\ mg$

(b) $\mu\ mg$

(c) $3\mu\ mg$

(d) $\dfrac{2}{3}\mu\ mg$

38. In the arrangement shown in the figure $m_1 = 2$ kg, $m_2 = 1$ kg, $K_1 = 15$ N/cm and $K_2 = 5$ N/cm. The acceleration due to gravity is 10 $m/s^2$. Initially the system is in equilibrium. Find the work done by external agent in slowly pulling down $m_2$ by a distance of 8 cm.
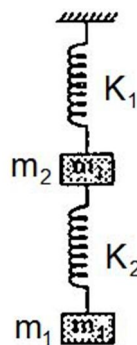


(a) 2.1 joule

(b) 0.1 joule

(c) 0.21 joule

(d) 4.8 joule

39. A sphere S rolls without slipping, moving with a constant speed on a plank P. The friction between the upper surface of P and the sphere is sufficient to prevent slipping, while the lower surface of P is smooth and rests on the ground. Initially, P is fixed to the ground by a pin N. If N is suddenly removed:
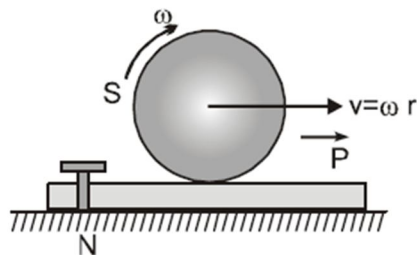


(a) S will begin to slip on P

(b) P will begin to move backwards

(c) The speed of S will decrease and its angular velocity with increase

(d) There will be no change in the motion of S and P will still be in rest

40. A uniform rope of mass M and total length 'L' is placed on smooth table as shown in figure. At the given position the massless spring is at its natural length. If the system is released from rest at the given position such that maximum extension in the spring is $\dfrac{L}{4}$, then find the spring constant k.

8
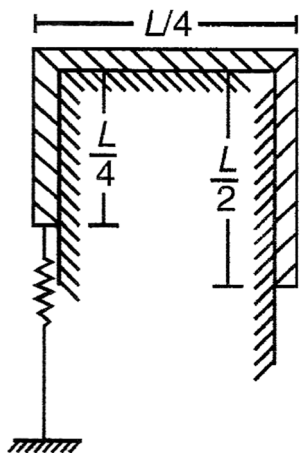
(a) $\dfrac{2\,Mg}{L}$

(b) $\dfrac{3\,Mg}{L}$

(c) $\dfrac{4\,Mg}{L}$

(d) $\dfrac{7\,Mg}{L}$

# [ MATHEMATICS ]

41. For every odd prime number P, $(P^2 - 1)$ is divisible by:

(a) 2                   (b) 3

(c) 8                   (d) 24

42. Find the number of digits in the number $(28)^{100}$ [log2 = 0.3010, log7 = 0.8450]

(a) 142              (b) 143

(c) 144              (d) 145

43. If $x \in \left[-\dfrac{1}{2}, \dfrac{1}{2}\right]$, then find the range of y = $3x - 4x^3$

(a) [−1, 1]          (b) [−2, 2]

(c) [0, 1]           (d) None of these

44. Find the sum of the series:

6 + 13 + 22 + 33 + .....n terms

(a) $\dfrac{n(n+1)(2n+13)}{12}$

(b) $\dfrac{n(n+1)(2n+13)}{6} + n$

(c) $\dfrac{n(n+1)(2n+13)}{6} + 2n$

(d) $\dfrac{n(n+1)(2n-13)}{6} + n$

45. The number of solutions of the equation sin(9x) + sin(3x) = 0 in the closed interval $[0, 2\pi]$ is

(a) 7                   (b) 13

(c) 19                 (d) 25

46. Let a > 0, a ≠ 1. Then, the set S of all positive real numbers b satisfying $(1+a^2)(1+b^2) = 4ab$ is

(a) An empty set

(b) A singleton set

(c) A finite set containing more than one element

(d) $(0, \infty)$

47. Let f(x) = $x^6 - 2x^5 + x^3 + x^2 - x - 1$ and g(x) = $x^4 - x^3 - x^2 - 1$ be two polynomials. Let a, b, c, d are the roots of g(x) = 0, find the value of f(a) + f(b) + f(c) + f(d).

(a) −5              (b) 0

(c) 4                (d) 5

48. Find the number of real solutions of the equation:

$$\cos^2(x(\sin 2x)) + \frac{1}{1+x^2} = \cos^2 x + \sec^2 x$$

(a) 0               (b) 1

(c) 2               (d) Infinite

49. Find the least value of the function y =

$$\frac{16x^2 - 96x + 153}{x - 3}.\ \text{If } x > 3$$

(a) 16             (b) 18

(c) 22             (d) 24

50. $\dfrac{1 + x^2 + x^4 + x^6 + .... + x^{32}}{1 + x + x^2 + x^3 + .... + x^{16}} =$

(a) $x - x^2 + x^3 - x^4 + .... + x^{16}$

(b) $x - x^3 + x^5 - x^7 + .... + x^{16}$

(c) $1 + x + x^2 + x^3 + .... + x^{16}$

(d) $1 - x + x^2 - x^3 + .... + x^{16}$

51. Ten ants are on the real number line. At time t = 0, the $k^{th}$ ant starts at the point $k^2$ and travelling at uniform speed, reaches the point $(11-k)^2$ at time t = 1. The number of distinct times (instants) at which at least 2 ants are at the same location is:

(a) 45             (b) 11

(c) 17             (d) 9

52. The number of solutions of the equation

$$\cos^4 x + \frac{1}{\cos^2 x} = \sin^4 x + \frac{1}{\sin^2 x}\ \text{in the interval } [0, 2\pi]\ \text{is:}$$

(a) 6              (b) 4

(c) 2              (d) 0

53. The angles $\alpha$, $\beta$, $\gamma$ of a triangle satisfy the equations

$$2\sin\alpha + 3\cos\beta = 3\sqrt{2}$$

and $3\sin\beta + 2\cos\alpha = 1$

then angle $\gamma$ equals:

(a) 150°          (b) 120°

(c) 60°           (d) 30°

54. For an integer n let $S_n = \{n+1, n+2, n+3..., n+18\}$. Which of the following is true for all $n \geq 10$?

(a) $S_n$ has a multiple of 19

(b) $S_n$ has a prime

(c) $S_n$ has at least 4 multiples of 5

(d) $S_n$ has at most 6 primes

55. Find the value of $\sum\limits_{r=1}^{n}(r^2 - r + 1)\underline{|r}$ (where $\underline{|n}$ represents factorial n)

(a) $\underline{|n+2}$

(b) $(n-1)\underline{|n+1} + 1$

(c) $\underline{|n+2} - 1$

(d) $n\underline{|n+1} - 1$

56. If x = $\sqrt{2} + \sqrt{3} + \sqrt{6}$, then find the value of

$$x^4 - 22x^2 - 48x$$

(a) 20

(b) 21

(c) 22

(d) 23

10

57. Find the number of solutions of the equation

$\sin x = \dfrac{6}{x}$ with $0 \le x \le 12\pi$ .

(a) 1          (b) 6

(c) 10        (d) 12

58. If $\log_x^8 = z$ , $\log_y^x = -1$ and $\log_z^y = 2$ , then

$\left(\dfrac{1}{x}+1\right)^{\log_{\sqrt{5}}(y^2+4z^2)}$   is equal to:

(a) $\sqrt{5}$        (b) 5

(c) 25        (d) 625

59. The quadratic equation $x^2 + ax + b + 1 = 0$ has roots which are positive integers, then $(a^2 + b^2)$ can be equal to:

(a) 50        (b) 37

(c) 61        (d) 19

60. Let, N = $2^{1224} - 1$

$\alpha = 2^{153} + 2^{77} + 1$

$\beta = 2^{408} - 2^{204} + 1$

then which of the following statements is correct?

(a) $\alpha$ divides N but $\beta$ does not

(b) $\beta$ divides N but $\alpha$ does not

(c) $\alpha$ and $\beta$ both divide N

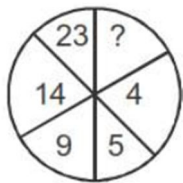(d) Neither $\alpha$ nor $\beta$ divides N

### [ MENTAL ABILITY ]

61. Find the missing term

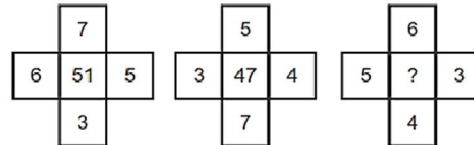200, 64, 100, 32, 50, 16, ?

(a) 25        (b) 35

(c) 8         (d) 45

62. Complete the figure replacing question mark (?) with suitable number logically.



(a) 27        (b) 37

(c) 25        (d) 9

63. Complete the figure replacing question mark (?) with suitable number logically.



(a) 43        (b) 49

(c) 39        (d) 45

64. Find the correct digital number/code for given English word

If WINDOW = 987659 and TREE = 3422 then WINTER = ?

(a) 987342

(b) 987432

(c) 987423

(d) 987324

11

65. If x stands for addition; ÷ stands for 'subtraction; + stands for 'multiplication' and – stands for 'division', then 40 × 4 ÷ 8 - 4 + 2 has the value equal to

(a) 25            (b) 5

(c) 30            (d) 40

66. Which of the four options given below shows the correct sequence of the given words?

(1) Service (Job)        (2) Examination

(3) Learning           (4) Admission

(5) Result

(a) 1, 4, 2, 3, 5         (b) 4, 3, 2, 5, 1

(c) 5, 4, 3, 2, 1         (d) 2, 3, 5, 1, 4

67. On 14th January 2014 is Saturday, the which day on 15th August 2014?

(a) Tuesday

(b) Thursday

(c) Friday

(d) Saturday

68. A statement and four predictions are given in the following question. Find a fair prediction. Some

Leader's like Nagesh are corrupt.

(a) Nagesh is not corrupt

(b) Leaders are corrupt

(c) Sometime Nagesh is not corrupt

(d) Some leaders are corrupt

69. Suresh and Mahesh were in opposite direction of each other in the evening on the Gujarat University ground. The shadow of Mahesh appears on his right side. Then in which direction Suresh's mouth will be?

(a) East            (b) South

(c) West           (d) North

70. Richa walks 4 km in the direction of sun of sunset time. Then she turns a right and walks 1km. She turns left and walks 1km then she turns left and walk 1km. Now how many km would she away from her origin?

(a) 3             (b) 4

(c) 5             (d) 6

SPACE FOR ROUGH WORK

SPACE FOR ROUGH WORK