# SAMPLE PAPER

**Aakash**

NATIONAL

## TALENT HUNT EXAM

# 2015

## SENIOR

(Class X Studying Students)

## Science, Mathematics & Mental Ability

# Aakash

Medical | IIT-JEE | Foundations

# Aakash National Talent Hunt Exam 2015 (Senior)
## Sample Paper

**Time : 2 Hours**                                                                                    **MM : 360**

### SECTION-A : SCIENCE

1. Four bulbs, each of rating (100 W, 220 V) and connected in parallel across a voltage supply of 220 V, are operated for five hours daily. If all the bulbs are replaced by LEDs of rating (8 W, 220 V), how many units of electrical energy will be saved every month (30 days)?

   (1) 55.2 units

   (2) 60 units

   (3) 4.8 units

   (4) 32 units

2. In the circuit given below, the potential difference across the arm $PQ$ will be
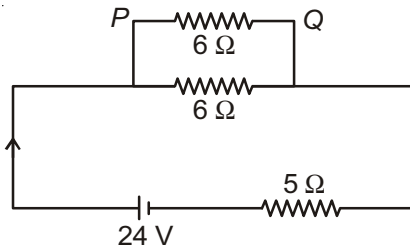


   (1) 4.5 V              (2) 12 V

   (3) 24 V               (4) 9 V

3. A real object is kept at a distance of $2f$, first in front of a convex lens and then in front of a concave mirror, each having focal length $f$. The ratio of magnifications produced by them will be

   (1) 1 : 1              (2) 1 : –1

   (3) 2 : 1              (4) 2 : –1

4. A rectangular glass slab having refractive index $\sqrt{3}$, is silvered at one surface as shown in the figure. If the angle of refraction of the light ray at the interface $AB$ is 30°, then the measure of angle $x$ will be
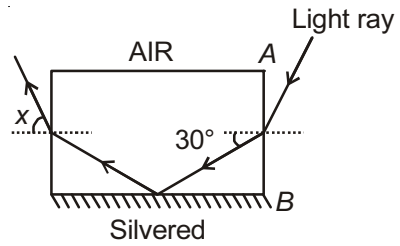


   (1) 45°               (2) 30°

   (3) 60°               (4) 90°

5. The effective focal length of two lenses in contact with each other, having focal lengths $f_1$ and $f_2$, is given by

   (1) $f_1 + f_2$       (2) $\dfrac{f_1 + f_2}{f_1 f_2}$

   (3) $\dfrac{f_1 f_2}{f_1 + f_2}$       (4) $\dfrac{f_1}{f_2}$

6. Same net force is applied on two different objects of masses $m$ and $3m$. If $x$ and $y$ are the magnitudes of their acceleration respectively, then the ratio $\dfrac{x}{y}$ will be
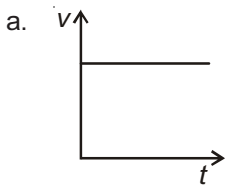
   (1) 1 : 3             (2) 1 : 1
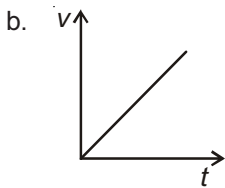
   (3) 3 : 1             (4) 9 : 1

**Space for Rough Work**

7. Match the following and choose the appropriate option. (Symbols have their usual meanings)
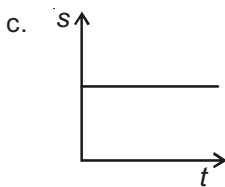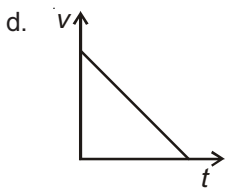
| Column (A) | Column (B) |
|---|---|
| a.  | (i) Particle undergoing uniform positive acceleration |
| b.  | (ii) Particle is at rest |
| c.  | (iii) Particle undergoing constant retardation |
| d.  | (iv) Particle moving with uniform velocity |

(1) a(ii), b(i), c(iv), d(iii)   (2) a(iv), b(i), c(ii), d(iii)

(3) a(ii), b(iv), c(iii), d(i)   (4) a(iv), b(ii), c(iii), d(i)

8. A boy runs on a circular track of radius 20 m and stops after covering one sixth of the track. The magnitude of his displacement will be

(1) $20\pi$ m        (2) 20 m

(3) $40\pi$ m        (4) $\dfrac{20\pi}{3}$ m

9. A pistol of mass 2 kg fires a bullet of mass 50 g. The bullet strikes a stationary block of mass $\dfrac{1}{2}$ kg. If the block, with the bullet embedded in it, moves with a velocity of 4 m/s, the recoil velocity of the pistol will be (Ignore friction and air resistance)

(1) −1.10 m/s        (2) −0.5 m/s

(3) −0.55 m/s        (4) −1 m/s

10. A girl of mass 40 kg takes a staircase of 15 steps, each of height 20 cm. If she utilizes a power of 80 W to climb the staircase, the time taken by her is [Take $g = 10$ m/s$^2$]

(1) Half a minute        (2) 40 s

(3) 45 s        (4) 15 s

11. Two copper wires $A$ and $B$ have their cross sectional areas in the ratio 1 : 2 and lengths in the ratio 2 : 1 respectively. The ratio of the resistivities of $A$ and $B$ will be

(1) 1 : 4        (2) 8 : 1

(3) 4 : 1        (4) 1 : 1

12. If ratios of masses and velocities of two bodies are 2 : 3 and 4 : 5 respectively, then the ratio of magnitude of their momenta is

(1) 15 : 8        (2) 8 : 15

(3) 5 : 6        (4) 6 : 5

13. As shown in the figure, a 4 kg ball initially moving with horizontal velocity $v$ strikes the wall and rebounds with 75% of its initial speed. It then undergoes head on collision with the 6 kg ball and sticks to it. If both start moving with common speed of 6 m/s, then the value of $v$ is
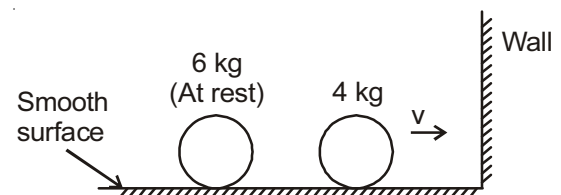


(1) 20 m/s        (2) 15 m/s

(3) 60 m/s        (4) 12 m/s

**Space for Rough Work**

14. Choose the pair of quantities having same unit.

    (1) Power and energy

    (2) Current and potential difference

    (3) Work and energy

    (4) Magnification and power

15. When a ball is thrown vertically upwards, then at the highest point

    (1) Acceleration is zero but velocity is non-zero

    (2) Acceleration is non-zero but velocity is zero

    (3) Both acceleration and velocity are zero

    (4) Both acceleration and velocity are non-zero

16. A colourless and odourless gas P is evolved during thermal decomposition of lead nitrate. P reacts with the main component of biogas to form compounds Q and R. P, Q and R respectively are

    (1) $N_2O$, $O_2$ and $H_2O$   (2) $CO_2$, $O_2$ and $Cl_2$

    (3) $O_2$, $CO_2$ and $H_2O$   (4) $O_2$, $CO_2$ and $H_2$

17. The number of C – H bonds present in propanol is

    (1) 8   (2) 9

    (3) 10   (4) 7

18. Identify which of the following statements is/are true and choose the appropriate option.

    (i) Unsaturated hydrocarbons generally burn with a sooty flame.

    (ii) The possible structural isomers for butane are three.

    (1) Both (i) & (ii) are correct

    (2) Both (i) & (ii) are incorrect

    (3) Only (i) is correct

    (4) Only (ii) is correct

19. Which of the following gases is evolved at cathode during the electrolysis of brine?

    (1) $Cl_2$   (2) $O_2$

    (3) $H_2$   (4) $NO_2$

20. On thermal decomposition of $CaCO_3$, a gas 'X' is obtained. The aqueous solution of X

    (1) Turns red litmus blue

    (2) Does not change the colour of phenolphthalein

    (3) Gives red colour with turmeric

    (4) Gives blue colour with methyl orange

21. $aMnO_2 + bHCl \longrightarrow cMnCl_2 + dH_2O + eCl_2$

    $pC_2H_5OH + qO_2 \longrightarrow rCO_2 + sH_2O$

    a, c, q and r in the above chemical equations respectively are

    (1) 2, 4, 2 and 1   (2) 1, 1, 3 and 2

    (3) 4, 2, 2 and 1   (4) 2, 1, 4 and 2

22. The number of moles of ammonia that have the same mass as that of 3 moles of carbon dioxide is

    (1) 0.19 mol   (2) 2.58 mol

    (3) 9.04 mol   (4) 7.76 mol

23. Two elements 'A' and 'B' have same number of electrons in their valence shells. The number of electrons present in the second last shell of atom 'A' is two times the number of electrons present in the second shell of atom 'B'. A and B respectively are

    (1) Aluminium and phosphorus

    (2) Magnesium and calcium

    (3) Silicon and carbon

    (4) Oxygen and sulphur

24. Match the following and choose the correct option.

    | Element | Valency |
    |---------|---------|
    | a. C    | (i) 3   |
    | b. B    | (ii) 4  |
    | c. K    | (iii) 2 |
    | d. Mg   | (iv) 1  |

    (1) a(ii), b(iv), c(i), d(iii)   (2) a(ii), b(i), c(iii), d(iv)

    (3) a(ii), b(i), c(iv), d(iii)   (4) a(ii), b(iii), c(i), d(iv)

25. Mass of $48.176 \times 10^{23}$ molecules of $CH_4$ will be

    (1) 68 g   (2) 92 g
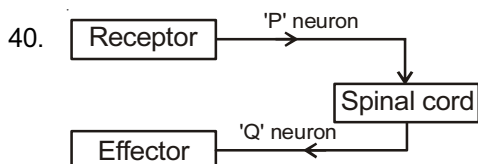
    (3) 128 g   (4) 188 g

**Space for Rough Work**

26. Dehydration of ethanol results in the formation of a compound 'X' along with water. Hydrogenation of 'X' forms another compound 'Y'. 'X' and 'Y' respectively are
    (1) Ethanoic acid and methane
    (2) Ethene and ethane
    (3) Ethanol and ethane
    (4) Ethane and methane

27. Which of the following contains the maximum number of atoms?
    (1) 48 g of helium
    (2) $3.011 \times 10^{21}$ molecules of ammonia
    (3) 48 molecules of methane
    (4) 3 mol of oxygen

28. Which of the following pairs of elements have same number of valence electrons?
    (1) Sodium and magnesium
    (2) Carbon and nitrogen
    (3) Oxygen and sulphur
    (4) Potassium and calcium

29. On thermal decomposition of baking soda, salt 'X' is obtained. The aqueous solution of 'X' will be
    (1) Acidic
    (2) Basic
    (3) Amphoteric
    (4) Neutral

30. Compound A on reacting with baking soda produces a colourless gas C, which when passed through lime water forms a solution D. On further passing the gas C through D, another solution E is formed. Identify the nature of A and the colour of the solution E.
    (1) Acidic, blue
    (2) Basic, red
    (3) Basic, yellow
    (4) Acidic, colourless

31. The green coloured pigment present in chloroplast helps in
    (1) Absorption of phosphorus from the soil
    (2) Absorption of light energy
    (3) Removal of excess water through lenticels
    (4) Exchange of respiratory gases

32. In humans, the centre associated with hunger is present in the
    (1) Fore brain
    (2) Hind brain
    (3) Mid brain
    (4) Spinal cord

33. In humans, _____ provides a surface where exchange of gases can take place.
    (1) Neuron
    (2) Villi
    (3) Nephron
    (4) Alveolus

34. **Statement-1 :** Carbon dioxide is insoluble in water.
    **Statement-2 :** Haemoglobin has a high affinity for oxygen.
    (1) Both the statements are true
    (2) Both the statements are false
    (3) Statement-1 is true and statement-2 is false
    (4) Statement-1 is false and statement-2 is true

35. Glucose $\xrightarrow{\text{In cytoplasm}}$ Pyruvate $\xrightarrow[\text{(in our muscle cells)}]{\text{Lack of oxygen}}$ P + Energy
    (6-Carbon molecule)  (3-Carbon molecule)

    The accumulation of 'P' in humans leads to
    (1) Dwarfism
    (2) Muscle cramps
    (3) Diabetes
    (4) Hepatitis A

36. Which of the following is not a part of excretory system in human beings?
    (1) Kidney
    (2) Ureter
    (3) Vas deferens
    (4) Urethra

37. In which of the following test tubes digestion of protein would not take place?

    | Pepsin + HCl + Protein | Pepsin + Alkali + Protein | Trypsin + Alkali + Protein | Trypsin + HCl + Protein |
    |---|---|---|---|
    | P | Q | R | S |

    (1) P and R
    (2) P and S
    (3) Q and S
    (4) R and Q

**Space for Rough Work**

38. In which part of the alimentary canal digestion of starch begins?

    (1) Stomach

    (2) Large intestine

    (3) Liver

    (4) Buccal cavity

39. The endocrine gland 'A' is located at the top of a human excretory organ 'B'. Identify the organ 'B' and the hormone secreted by 'A'

| | Organ 'B' | Hormone secreted by endocrine gland 'A' |
|---|---|---|
| (1) | Ureter | Adrenaline |
| (2) | Kidneys | Thyroxine |
| (3) | Kidneys | Adrenaline |
| (4) | Urethra | Thyroxine |

40. 

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Receptor ──'P' neuron──▶
                          │
                          ▼
                    ┌──────────┐
                    │Spinal cord│
                    └──────────┘
Effector ◀──'Q' neuron──
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    Identify 'P'.

    (1) Motor neuron       (2) Relay neuron

    (3) Sensory neuron     (4) Interneuron

41. 'X' and 'Y' are the two endocrine glands located in the brain. 'X' releases a hormone 'Z' which regulates growth in humans. 'X' and 'Y' are

    (1) X – Hypothalamus and Y – Pituitary gland

    (2) X – Thyroid gland and Y – Pineal gland

    (3) X – Pituitary gland and Y – Pineal gland

    (4) X – Pituitary gland and Y – Thyroid gland

42. Rings of cartilage are present in the throat to

    (1) Absorb more oxygen from the air

    (2) Filter the inhaled air

    (3) Prevent the air passage from collapsing

    (4) Produce more energy

43. Trypsin (Trypsinogen) is secreted from

    (1) Pancreas

    (2) Stomach

    (3) Small intestine

    (4) Liver

44. Which of the following is the first step of photosynthesis?

    (1) Splitting of water molecules into hydrogen and oxygen

    (2) Absorption of light energy by chlorophyll molecules

    (3) Reduction of carbon dioxide to carbohydrates

    (4) Conversion of light energy into chemical energy

45. The structure illustrated below is responsible for
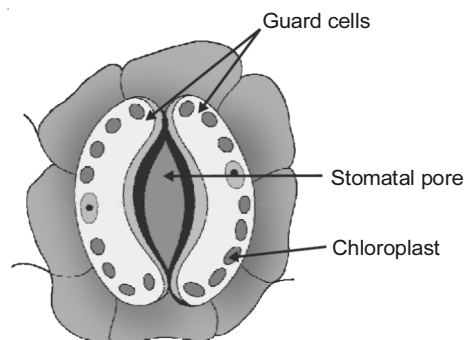


    (i) Gaseous exchange     (ii) Transpiration

    (iii) Storage of food     (iv) Transport of food

    (1) (ii) and (iv) only     (2) (i), (iii) and (iv)

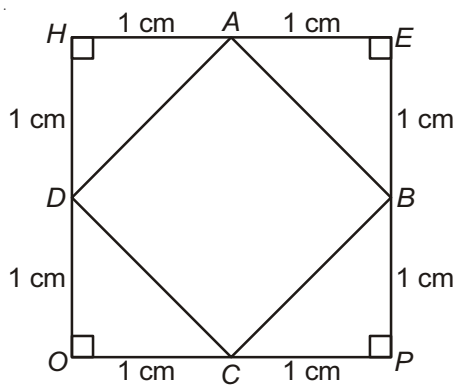    (3) (i) and (ii) only      (4) (i), (ii) and (iv)

**Space for Rough Work**

# SECTION-B : MATHEMATICS

46. If $\alpha$, $\beta$ and $\gamma$ are the zeroes of a cubic polynomial $ax^3 + cx + d$, then $\alpha(1 + \beta\gamma) + \beta + \gamma$ is equal to

    (1) $\dfrac{-2c}{a}$

    (2) $\dfrac{2d}{a}$

    (3) $\dfrac{-d}{a}$

    (4) $\dfrac{-c}{a}$

47. In the given figure, area of quadrilateral *ABCD* is

    

    (1) $2$ cm$^2$

    (2) $\dfrac{1}{2}$ cm$^2$

    (3) $\dfrac{1}{4}$ cm$^2$

    (4) $\dfrac{1}{8}$ cm$^2$

48. If $y^2 + 7y + 5p = 0$, then the integral value of *p* for which the given equation does not have real roots can be

    (1) 1

    (2) 2

    (3) 3

    (4) −1

49. If $(2^{\sqrt{a}})^{\sqrt{a}} = 16$, then the value of *a* is

    (1) 1

    (2) 2

    (3) 4

    (4) 16

50. In the given figure, *PRCB* is a square. If $\dfrac{AQ}{AC} = \dfrac{1}{3}$ and *BC* = 6 cm, then the length of *AP* is
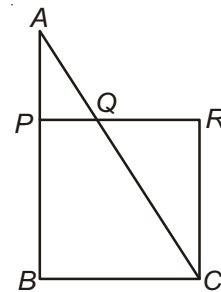
    

    (1) 2 cm

    (2) 1 cm

    (3) 4 cm

    (4) 3 cm

51. An English word consists of 9 alphabets. The sum of twice the number of vowels and three times the number of consonants present in the word is equal to four more than four times the total number of vowels in the English alphabets. The product of the number of vowels and consonants present in the word is

    (1) 9

    (2) 20

    (3) 18

    (4) 14

52. In the given figure, *O* is the centre of the circle. If $x + y = 180°$, then the value of *z* is
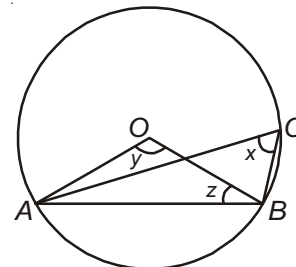
    

    (1) 120°
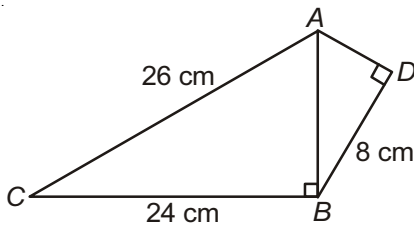
    (2) 30°

    (3) 60°

    (4) 90°

**Space for Rough Work**

53. The ratio of the radius of the base of a cylinder to its height is 7 : 6. If the volume of the cylinder is $294\pi$ cm³, then its base diameter is

    (1) 1 cm      (2) 14 cm

    (3) 7 cm      (4) 12 cm

54. If the product of HCF and LCM of two natural numbers is 378000, then which of the following can be their HCF?

    (1) 66      (2) 130

    (3) 34      (4) 20

55. In the given figure, the length of AD is

    

    (1) 6 cm      (2) 7 cm

    (3) 4 cm      (4) 5 cm

56. $\sqrt{2 - \sqrt{3}}$ can be expressed as

    (1) $2 - \dfrac{1}{\sqrt{3}}$      (2) $3 - \dfrac{1}{\sqrt{2}}$

    (3) $\dfrac{1 + \sqrt{3}}{\sqrt{2}}$      (4) $\dfrac{\sqrt{3} - 1}{\sqrt{2}}$

57. If the side x of a cube becomes 11 times of itself, then its volume increases by

    (1) $1330x^3$      (2) $1331x^3$

    (3) $1321x^3$      (4) $1320x^3$

58. If 5 is a root of the equation $2x^2 - 6x - 5a = 0$, then the value of $a^2 - 2a$ is

    (1) 24      (2) 12

    (3) 14      (4) 8

59. In the given figure, AB = AC. If P, Q, T and H are the midpoints of AB, AC, BR and CR respectively, then TH can be equal to
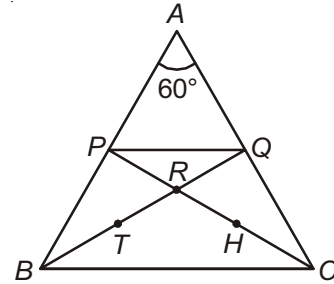
    

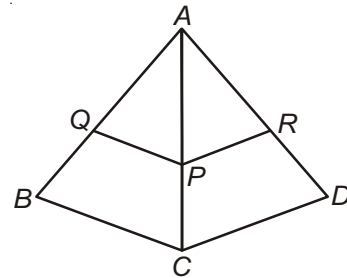    (1) $\dfrac{AB}{4}$      (2) $\dfrac{AC}{3}$

    (3) AP      (4) PC

60. If $p(x) = ax^3 + bx^2 + cx + d$ is a polynomial and $a + b + c + d = 0$, then which of the following must be a factor of $p(x)$?

    (1) $x + 1$      (2) $x - 1$

    (3) $x^2 - 1$      (4) $x$

61. If PQRS is a rhombus, $\angle P \neq \angle Q$ and O is the point of intersection of its diagonals, then which of the following is always false?

    (1) $PR \perp QS$      (2) $PO = RO$

    (3) $\angle PSO = \angle RSO$      (4) $QO = \dfrac{PR}{2}$

62. In the given figure, QP || BC and PR || CD. If AQ = 3 cm, QB = 2 cm and RD = 5 cm, then the length of AR is

    

    (1) 7 cm      (2) 7.5 cm

    (3) 6 cm      (4) 6.5 cm

**Space for Rough Work**

63. For the given system of equations $3x - 4y = 5$ and $5x + by = c$ to be inconsistent, one pair of values of $b$ and $c$ can be

    (1) $b = -\dfrac{20}{3}$ and $c = \dfrac{25}{3}$

    (2) $b = -6.4$ and $c = -20$

    (3) $b = 6.4$ and $c = 19$

    (4) $b = -\dfrac{20}{3}$ and $c = -19$

64. If three numbers are consecutive positive integers and five times the square of the largest number is greater than two times the sum of the squares of the other two numbers by 75, then the sum of the smallest and the largest of these numbers is

    (1) 12
    (2) 9
    (3) 8
    (4) 10

65. If $\dfrac{3}{p + q} = 1$ and $\dfrac{p - q}{8} = 1$, then $2p$ is equal to

    (1) $\dfrac{13}{7}$
    (2) 11
    (3) 10
    (4) 7

66. Which of the following numbers will completely divide $2^{61} + 2^{62} + 2^{63} + 2^{64}$?

    (1) 100
    (2) 10
    (3) 27
    (4) 17

67. The sum of all the zeroes of the polynomial $(y + 2)(y - 3)(y^2 - 1)$ is

    (1) 0
    (2) −1
    (3) 1
    (4) 6

68. A rectangular tank, 50 cm long and 30 cm wide, contains water upto a height of 9 cm. A box of dimensions 25 cm × 25 cm × 20 cm is now placed in the tank so that its square face rests on the bottom of the tank. The quantity of water (in L) that must be poured into the tank in order to just cover the box is
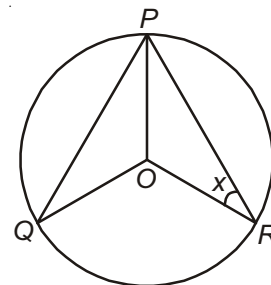
    (1) 0.4
    (2) 16.5
    (3) 12.5
    (4) 4

69. In the given figure, $ABCD$ is a square of area 16 cm². If $O$ is the centre of the circle, then the length of $OP$ is
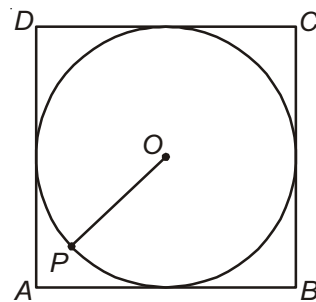


    (1) 4 cm
    (2) $\dfrac{8}{11}$ cm
    (3) 2 cm
    (4) 3 cm

70. In the given figure, if $\overset{\frown}{PQ} \cong \overset{\frown}{QR} \cong \overset{\frown}{RP}$ and $O$ is the centre of the circle, then the value of $x$ is



    (1) 30°
    (2) 60°
    (3) 45°
    (4) 15°

**Space for Rough Work**

## SECTION-C : MENTAL ABILITY

71. Choose the option from given alternatives that best fits the empty space.
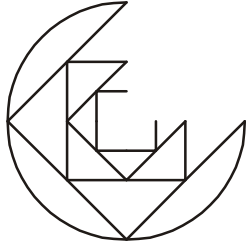


(1) 

(2) 

(3) 

(4) 

72. In a party, there are 15 members. Each shakes hand with one another. Total numbers of the handshakes is

    (1) 120
    (2) 105
    (3) 90
    (4) 15

73. If $x^3 - y^3 = (x - y)(x^2 + y^2 - xy)$ and $x^3 + y^3 = (x + y)(x^2 + y^2 + xy)$, then $(2^3 + 3^3) \div (3^3 - 2^3)$

    (1) $\dfrac{95}{7}$
    (2) $\dfrac{35}{19}$
    (3) $\dfrac{19}{35}$
    (4) 125

74. Find the odd one out.

    (1) (16, 30, 34)
    (2) (11, 40, 41)
    (3) (20, 21, 29)
    (4) (11, 60, 61)

75. 42 : 16 :: 32 : 9 :: 25 : ?

    (1) 42
    (2) 32
    (3) 52
    (4) 25

76. If rank of a student from last is 17th and 15th from beginning, then how many students are there?

    (1) 31
    (2) 32
    (3) 33
    (4) 17

77. Which digit will be the next in the given sequence?

    3 1 4 5 9 5 5 ?

    (1) 4
    (2) 5
    (3) 1
    (4) 9

*Directions (Q.78) : In a certain language, '45' is coded as 3, '35' is coded as 5, '6' is coded as 2.*

78. '34' will be coded as

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

79. Choose the alternative which is different from the others.

    (1) Einstein
    (2) Niels Bohr
    (3) CV Raman
    (4) Wright Brothers

*Directions (Q.80) : Any number from 0-9 can be displayed digitally using seven-segments on an LED display as shown below.*
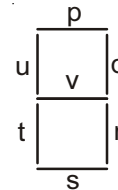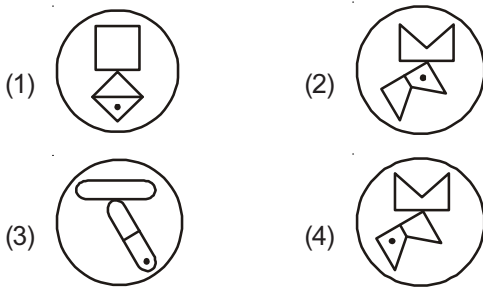


80. Due to poor power supply, any two segments are not working. Which of the following numbers can be displayed properly?
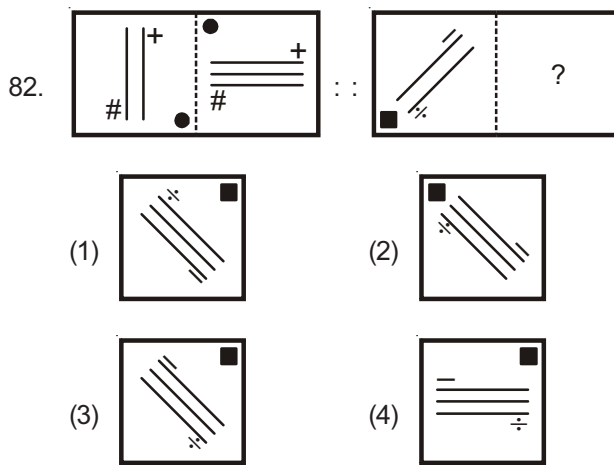
    (1) 8
    (2) 9
    (3) 6
    (4) 4

**Space for Rough Work**

81. Choose the odd one out.



(1)                     (2)

(3)                     (4)

***Directions (Q.82) :*** *The first and the second pair of figures bear a certain relationship among them. Find the missing one.*

82.



(1)                     (2)

(3)                     (4)

83. If 'cellphones' and 'TV' are represented by two small circles and 'coloured' is represented by a big circle, then which figure best represents the logical relationship between the three entities?



(1)                     (2)

(3)                     (4)
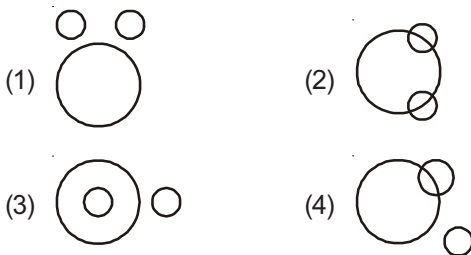
***Directions (Q.84 & Q.85) :*** *Read the following information carefully and answer the questions.*

Five members of a family are sitting on a dining table. L is the mother of M. M is the sister of N, who is the son of O. P is the only daughter-in-law of L.

84. How is P related to M?
    (1) Sister
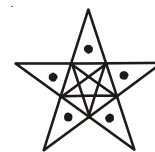    (2) Daughter
    (3) Sister-in-law
    (4) Daughter-in-law

85. O is M's _____ ?
    (1) Brother         (2) Sister
    (3) Father          (4) Uncle

86. Find the figure from the alternatives that completes the given series.



(1)                     (2)

(3)                     (4)
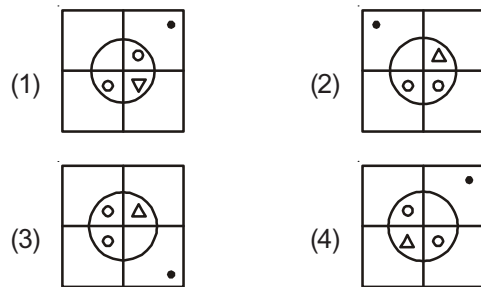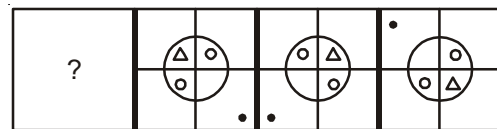
87. How many minimum number of line segments are required to make the figure given below?
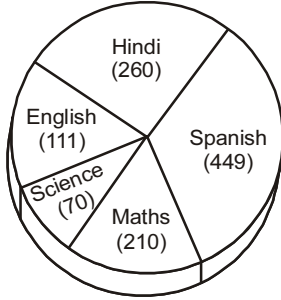


(1) 13            (2) 12
(3) 11            (4) 10

**Space for Rough Work**

88. From the letters given below, which one, when turned upside down and then reflected in a mirror, will represent the same letter?

(1) L              (2) B

(3) C             (4) N

***Directions (Q.89 & Q.90) :*** *Study the following pie-chart to answer the questions.*



Number of students specializing in a specific subject

89. By what percentage, the number of students specialising in Maths is more than that in Science?

(1) 200%            (2) 300%

(3) 400%            (4) 350%

90. The difference of the students specializing in Hindi and Maths is

(1) $\dfrac{1}{7}$ of Spanish

(2) $\dfrac{2}{3}$ of English

(3) $\dfrac{5}{7}$ of Science

(4) Less than that of Spanish but more than that of English

❑    ❑    ❑

**Space for Rough Work**