MAHARASHTRA

NATIONAL TALENT SEARCH EXAMINATION, 2019-20

STAGE – 01

SCHOLASTIC APTITUDE TEST (SAT)

FIITJEE SOLUTIONS

PHYSICS SOLUTION

1. 4

Time of flight,

$T = \frac{2u}{g} \Rightarrow u = \frac{T \times g}{2}$

$u = \frac{8 \times 10}{2} \Rightarrow 40 \text{ ms}^{-1}$

Max. height reached, $H = \frac{u^2}{2g} = \frac{(40)^2}{2 \times 10} = 80 \text{ m}$

2.

Specific heat capacity of water = $1 \text{ cal/g}-^{o}\text{C}$

Latent heat of fusion of ice $= 80 \text{ cal/g}$

Latent heat of vaporization of water $= 540 \text{ cal/g}$

Lat final temperature of mixture be $T^{o}C$

Taking reference temperature as $0^{o}C$

Heat taken from steam $= 200 \times 540 + 200 \times 1 \times 100 = 128000 \text{ cal}$

Hat given to ice to convert into water at $0^{o}C$

$= 800 \times 80$

$= 64000 \text{ cal}$

Remaining heat to be given to mixture

$128000 - 64000$

$= 64000 \text{ cal}$

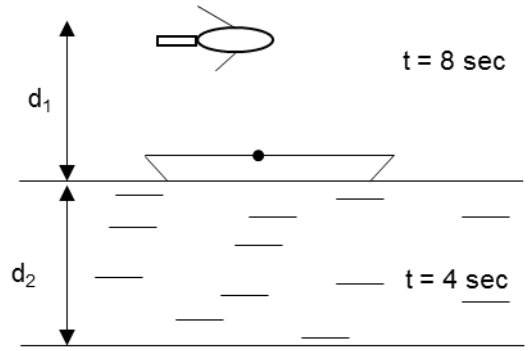
$\therefore 64000 = (800 + 200) \times 1 \times (T - 0)$

$T = 64^{o}C$

3. **2**

Rods work in low light conditions to help night vision, but cones work in day light and are responsible for colour discrimination.

4. **1**



$d = d_1 + d_2$

$= \frac{350 \times 8}{2} + \frac{1500 \times 4}{2}$

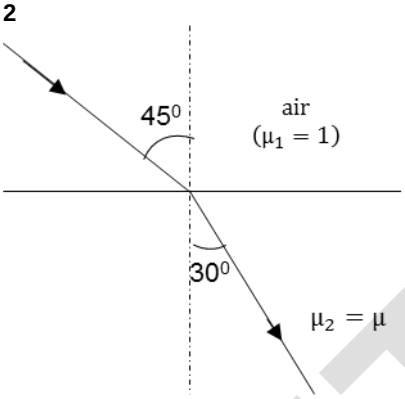
$= 4400$ M

$= 4.4$ KM

5. **3**

theoretical

6. **2**



Using Snall's law,

$1 \times \sin 45^o = \mu \times \sin 30^o$

$\mu = \sqrt{2} = \frac{C}{V}$

$V = \frac{3 \times 10^8}{\sqrt{2}}$

$V = 2.12 \times 10^6$ m / s

7. **2**

theoretical

8. **2**

$R = \frac{V^2}{P_1} = \frac{(220)^2}{1320}$

$i_1 = \frac{V}{R} = \frac{220 \times 1320}{(220)^2} \Rightarrow 6A$

Now, at low temp., $i_2 = i_1 / 3 = 2A$

$P_2 = Vi_2$

$\therefore$ Power used, $= 200 \times 2$

$= 440\,W$

9. **4**

m = 250 kg, t = 60 sec, h = 150 m

Power of pump, $P = \frac{mgh}{t} = \frac{250 \times 10 \times 150}{60}$

$P = \frac{250 \times 10 \times 150}{60 \times 746}(\text{H.P.})$

$= 8.38$ H.P.

$\therefore$ Required power should be 9 H.P.

10. **3**

Constant temperature $= \frac{80+50}{2} = 65^{\circ}C$

On touching, heat exchange by conduction without touching, heat exchange by radiation.

11. **1**

For lens,

$V = \frac{uf}{u+f} \Rightarrow \frac{12 \times 20}{-12+20}$

$V = -30$ cm

for mirror, object distance $= 30+10 \Rightarrow 40$ cm

$\therefore$ Final image = 40 cm behind mirror.

12. **4**

theoretical

13. **1**

Power of combination :

$P = P_1 + P_2 + P_3$

$2.7 = 2.5 + 1.7 + P_3$

$P_8 = -1.5$ D

$\therefore F_8 = \frac{100}{P_8} = \frac{10.0}{-1.5}$

$= -66.66$ cm

NOTE:
Answer of Q.NO. 2 is coming 64ºC.
Q.NO. 5, 7, 12 are theoretical and hence no solutions are required for these questions.

CHEMISTRY SOLUTION

14. 3

(Group 13 – 18) P-block elements.

15. 2

Platinum exist in free state.

16. 4

Ethanoic acid is known as Glacial Acetic Acid.

17. 3

Trans Uranic element.

18. 3

C_2H_2 ethyne

19. 1

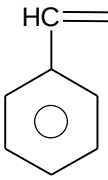
3422 melting point of Tungsten.

20. 3

NH_4OH - Weak base due to less ionisation

21. **2** C_6H_6

22. **1**



C_6H_5-CH=CH_2 Styrene

23. 4
60 – 70 carbon % in lignite.

24. 4
Copper sulphate solution

25. 4
Aqua regia (HCl : HNO_3)

26. 2
Colourless due to formation of $ZnSO_4$ (Bonus)

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BIOLOGY SOLUTION

27. (2)
Mutation is a sudden change which occurs in any nucleotide sequence

28. (3)
During Anaphase step of mitosis, centromeres split and thereby sister chromatids of each chromosome separate and they are pulled apart in opposite direction.

29. (3)
In the given figure, labelled part C is Cowper's gland.

30. (1)
Zygote formation step takes place during sexual reproduction while other three are types of asexual reproduction.

31. (3)
Red panda and musk deer are rare species.

32. (2)
Planaria is an example of animal is phylum Platyhelminthes.

33. (4)
Octopus belonging to phylum Mollusca can perform three types of locomotion swimming, creeping and walking.

34. (1)
Saccharomyces cerevisiae is used in preparing beverage cider by fermenting juice in apple.

35. (3)
Aspergillus niger is used to prepare chocolates and toffees from sugar molasses and salt.

36. (2)
Golden Rice is a variety of rice produced through genetic engineering to synthesize vitamin A (Beta Carotene)

37. (4)
Maharashtra is the first state to start a separate cyber crime unit.

38. (1)
Impact of disaster $\rightarrow$ Response $\rightarrow$ Resurgence $\rightarrow$ Preparation $\rightarrow$ Redemption $\rightarrow$ Preparedness

39. (1)
Turner's syndrome is a chromosomal disorder in which a female is born with only one X chromosome, 44+ X0

40. (3)
Clostridium bacteria causes spoilage of cooked/tinned food causing food poisoning.

SOCIAL STUDIES

41. 1
42. 4
43. 2
44. 4
45. 3
46. 4
47. 1
48. 2
49. Bonus
50. 4
51. 3
52. 2
53. 1
54. 1
55. 4
56. 2
57. 3
58. 1
59. 4
60. 2
61. 4
62. 1
63. 4
64. 4
65. 2
66. 3
67. 4
68. 2
69. 3
70. 2
71. 4
72. 1
73. 3
74. 4
75. 4
76. 2
77. 3
78. 3
79. 1
80. 2

MATHS SOLUTION

81. Numbers divisible by 7 are

$7, 14, 21, \ldots .. 994$

$\therefore \quad a_n = 7 + (n-1)7$

$994 = 7[1+n-1]$

$n = 142$

$\therefore \quad S_{142} = \frac{142}{2}[7+994]$

$= 71071$

82. Dividend

= 20% of 100×160

= 20×160

= 3200

Return % = $\frac{3200}{19200} \times 100$

= 16.67%

83. $\dfrac{x^2(x+7)-1(x+7)}{(x-1)(x+7)}=\dfrac{(x-1)(x+1)(x+7)}{(x-1)(x+7)}$

$= \quad x+1$

84. Suppose speed of boat = $x\,km/hr$

Speed of stream = $y\,km/hr$

$\therefore \quad (x+y)3=30\Rightarrow x+y=10$

$(x-y)5=30\Rightarrow x-y=6$

On Adding

$\Rightarrow 2x=16$

$x=8$

Speed of boat = $8\,km/hr$

85. Difference = $5_{even}-5_{odd}$

$= (2+4+6+....+1000)-(1+3+5+....+999)$

$= \dfrac{500}{2}[2+1000]-\dfrac{500}{2}[1+999]$

$= \dfrac{500}{2}[1002-1000]$

$= 500$

86. Median = $L+\dfrac{\left[\dfrac{N}{2}-cf\right]}{f}\times h$

$= 50+\left[\dfrac{50-38}{18}\right]\times 10$

$= 50+6.67$

$= 56.67$

87. $(21-x)(35-x)=(27-x)^2$

$\Rightarrow 27^2-54x+x^2=21\times 35-21x-35x+x^2$

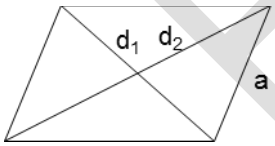
$\Rightarrow 2x=21\times 35-27^2$

$2x=6$

$x=3$

$x^2=9$

88. $d_1-d_2=4$



$\dfrac{1}{2}d_1d_2=96$

$d_1d_2=192$

$\therefore \left(\dfrac{d_1}{2}\right)^2+\left(\dfrac{d_2}{2}\right)=a^2\Rightarrow d_1^2+d_2^2=4a^2$

$\Rightarrow (d_1-d_2)^2+2d_1d_2=4a^2$

$a^2=100$

$\Rightarrow a=10$

89. Suppose speed of boat = $x\,km/hr$

Speed of stream **=** $y=km/hr$

$\therefore \ (x+y)3=30\Rightarrow x+y=10$

$(x-y)5=30\Rightarrow x-y=6$

On adding

$\Rightarrow 2x=16$

$x = 8$

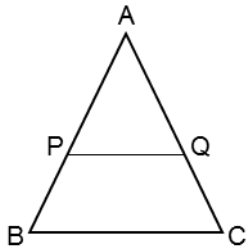
90. $\begin{vmatrix} 3\sqrt{5} & 6 \\ 5 & m \end{vmatrix} = 0$

$3\sqrt{5}m - 30 = 0$

$3\sqrt{5}m = 30$

$M = \frac{10}{\sqrt{5}} = 2\sqrt{5}$

91. Suppose



$AP = C$

$PB = a$

$AB = b$

$\therefore \frac{C^2}{b^2} = \frac{1}{2}$

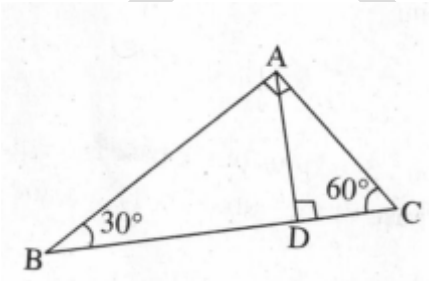
$\frac{C}{b} = \frac{1}{\sqrt{2}}$

$\frac{b-a}{b} = \frac{1}{\sqrt{2}}$

$1 - \frac{a}{b} = \frac{1}{\sqrt{2}}$

$\frac{a}{b} = 1 - \frac{1}{\sqrt{2}} = \frac{\sqrt{2}-1}{\sqrt{2}} = \frac{2-\sqrt{2}}{2}$

92. $\frac{AD}{BD} = \tan 30^0 = \frac{1}{\sqrt{3}}$



$AD = K$

$BD = \sqrt{3}K$

$AB^2 = K^2 + \left(\sqrt{3}K\right)^2$

$AB = 2K$

Now

$\frac{AD}{DC} = \tan 60^0 = \sqrt{3}$

$\frac{K}{DC} = \sqrt{2} \Rightarrow DC = \frac{K}{\sqrt{3}}$

$AC = \sqrt{\frac{K^2}{3} + K^2} = K.\frac{2}{\sqrt{3}}$

$$\therefore \quad \frac{\text{Per}(\Delta ABD)}{\text{Per}(\Delta ACD)} = \frac{K+\sqrt{3}K+2K}{\frac{2}{\sqrt{3}}K+\frac{K}{\sqrt{3}}+K}$$

$$= \frac{(3+\sqrt{3})}{3+\sqrt{3}}\sqrt{3}$$

$$= \sqrt{3}:1$$

93. $\angle APT = \angle TQB$

Which are alternate angles

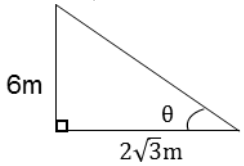
$\therefore PA \| QB$

94. On x-axis, ordinate is zero

$\therefore$ Q and S lie on X-axis

So, P, R, T don't lie on X-axis

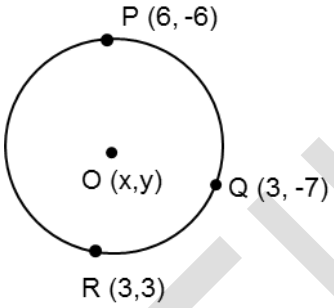
95. $\tan\theta = \frac{6}{2\sqrt{3}}$



$= \sqrt{3}$

$\theta = 60^0$

96. Suppose centre is $O(x,y)$



$\therefore OP^2 = OQ^2 = OR^2$

$\Rightarrow (x-6)^2+(y+6)^2 = (x-3)^2+(y+7)^2 = (x-3)^2+(y-3)^2$

$\Rightarrow x^2+36-12x+y^2+36+12y$

$= \quad x^2+9-6x+y^2+9-6y$ I

$= \quad x^2+9-6x+y^2+49+14y$ II

Comparing I and II

$\Rightarrow -6x+18y = -54$

$-x+3y = -9$

And taking last two

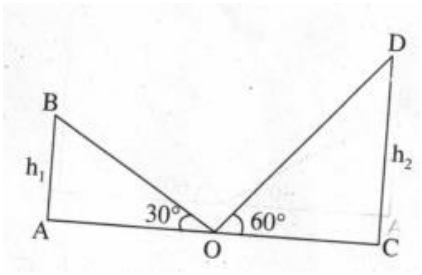
$-20y = 40$

$y = -2$

97. $\frac{1}{3}\pi(7)^2 \times 9 = 11\times 6\times h$

$h = 7\,\text{cm}$

98. $\frac{h_1}{x} = \tan 30^0$



$h_1 = x \times \frac{1}{\sqrt{3}} = \frac{x}{\sqrt{3}}$

And

$\frac{h_2}{x} = \tan 60^0 = \sqrt{3}$

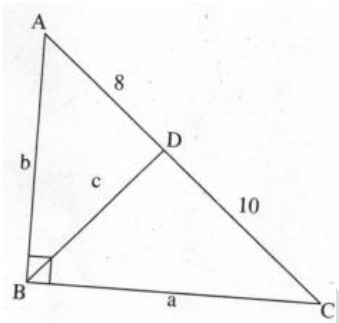
$h_2 = \sqrt{3}x$

$\therefore \frac{h_1}{h_2} = \frac{x/\sqrt{3}}{\sqrt{3}x} = \frac{1}{3}$

99. $\frac{4}{3}\pi(3)^3 = \pi\left(\frac{2}{10}\right)^2 h$

$h = 9\,m$

100. $\Delta ABD \sim \Delta ACB$



$\frac{AB}{AC} = \frac{BD}{CB} = \frac{AD}{AB}$

$\frac{b}{18} = \frac{C}{a} = \frac{8}{b}$

$b^2 = 18 \times 8$

$b = 12$

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NATIONAL TALENT SEARCH EXAMINATION, 2019-20

STAGE – 01

MENTAL ABILITY (MAT)

FIITJEE SOLUTIONS

1. 1
   Sum of digits are multiple of 3.

2. 1
   $5^3+7=132$, $9^3+7=736$, $7^3+7=350$
   $\therefore 6^3+7=223$

3. 2
   Sum of digits = 13 $(1+9+3=13, 4+5+4=13, 4+5+4=13, 2+6+5=13)$

4. 4
   Alternate letter has difference of 2, except 4(AWCZ)

5. 3 $\rightarrow$
   sum of all letter position is multiple of 3.

6. 4
   Save $\rightarrow$ EVAS

7. Bonus all ig. are incorrect order.

8. 3
   By observation $\mathcal{S} \rightarrow$ reverse order in option 3

9. Bonus [all fig. are possible]

10. 1
    The sum of the digits of the no. in each pair is the same
    $1+1+5+2+9=10, 7+2+1+3+5=18$
    Similarly, $1+5+2+9+4+3=24$, $2+1+3+5+4+9=24$

11. 2
    Opposite element = "-" so it cannot be adjacent to it".

12. 3
    < is opposite of D

13. 4
    Opposite elements cannot be adjacent.

14. 3
    Outer element comes inside.

15. Bonus 1, 2, 3, are same option

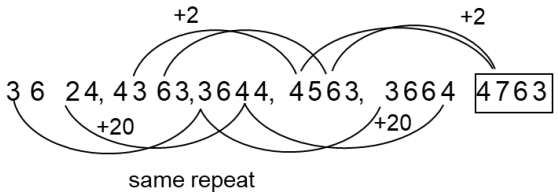
16. 3
Analogical figure.

17. 4
$4\times2-2=6, 6\times3-2=16, 16\times4-2=62, 62\times5=310, -2=308, 308\times6-2=1846$

18. 3
Alternate series of $+12, +24, +48$

19. 1
$+6, +12, +18, +24, +30$

20. 4



21. 1

22. 4

23. 4

ATUL	TUSHAR	AMAR	NISHANT
CRICKET	CRICKET	CRICKET	⊗
FOOTBALL	FOOTBALL	FOOTBALL	⊗
⊗	KABBADI	KABBADI	KABBADI
⊗	⊗	KHO – KHO	KHO – KHO

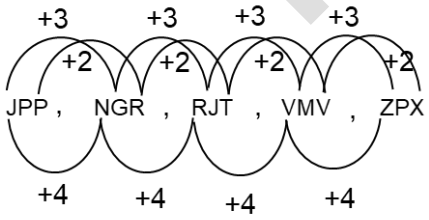
24. 3
abc | bca | cab | abc

25. 2
abba | baab | abba | baab

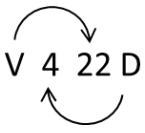
26. 3
By observation

27. 2
By observation

28. 3



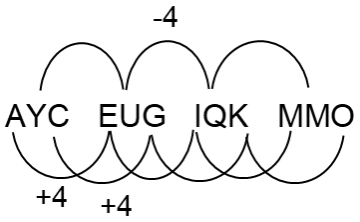
29. 2
$J_{1610}P$ $J=10, P=16$



30. 1
Addition of place of letter

$\therefore 29 = A + Y + C = 1 + 25 + 3$

$\therefore MMO = 13 + 13 + 15, MMO = 41$



31. 4
Needs to check initial 2 terms are matching.

32. 4

33. 2

34. 4

35. 1
By putting the value.

36. 2
By putting the value.

37. 3.

38. 2
[Substituting value at the place of symbol and after mathematical operation again replacing value with symbol.]

39. 2
Continuous sequence.

40. 3
By observation

41. 2
10 is common in all four.

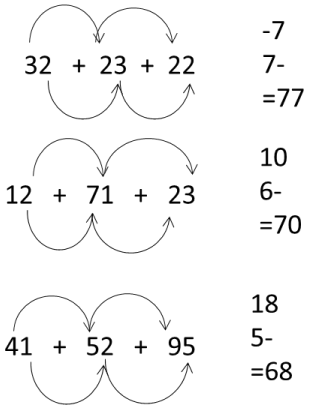
42. 4
32 only in ACTING.

43. 2
$97 = 21 + 14 + 12 + 15 + 35$

44. 2
By observation

45. 4
By observation

46. 2



47. 4

$8\times9+7\times5$

$72+35$

$=107\times2=214$

$7\times3+6\times4$

$=21+24$

$=45\times2$

$=90$

$3\times6+4\times9$

$18+36$

$=54\times2$

$=108$

48. 3

$98-64=34\Rightarrow$ By pattern given in question.

49. 4

$7+4=11\rightarrow11^2=121$

By pattern given in question.

50. 2

$45+81=126$

By pattern given in question.

51. 2

52. 4

53. 2

K M F : L L H :: R M S :

1113 6 1212 8 1813 19

$|_{+1}\ |_{-1}|_{+2}$ | | |

12128 19121 21

S L U

54. 2

ADE : F G J : K N O : P Q T

1 4 5 6 7 10 11 14 15 16 17 20

PQT

55. 4

2 : A L K L O :: W O U L D :: T L R I A

1 12 11 12 15 23 15 21 12 4 20 12 18 9 1

$\underset{+3}{}$ $\underset{+3}{}$

4 15 14 15 18

D O N O R

56. 1

4, 9 $(5)^2$ 5

$\underset{6}{F}\ \underset{10}{J}$ 25 16 NS $\Rightarrow(F-J)=(4)^2=16$

$\underset{12}{L}\ \underset{16}{Z}$ 25 196 SX

NQ ? ? W% $\Rightarrow N-Q$

$(N-Q)^2=(14-17)^2=9$

$(W-Y)^2=(23-25)^2=4$

NQ 4 9 W%

57. 3

$\underset{1+2}{1}$ A $\underset{1+8}{M}(13)$ Q17

3 C $\underset{1+10}{Li}(21)$ E $5(31)|_{+14}$

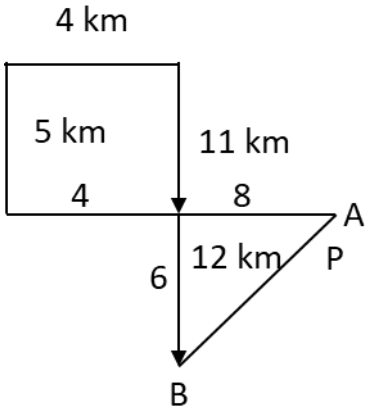
$\underset{1+4}{}$ G E5(31) (47)(21) = U

58. 2

59. 3

60. 3

North



.61. 4

$OA = (12-4) = 8$ km

$OB = (11-5) = 6$ km

$AB = \sqrt{(8)^2 + (6)^2} = \sqrt{100} = 10$ km

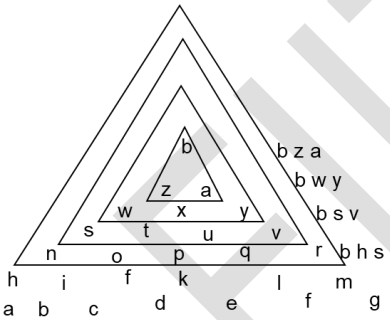
62. 1

hab : mgf :: jicd : ?

Ranking of respective letter from left side is equal to ranking of letter from right.

jicd : kled

63. 1



bza : bwy :: bsv : bnr

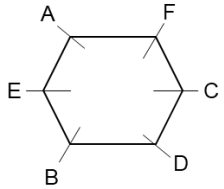
64. 2

wsop : yvqp : ptw :

Ranking of letter from left side is equal to ranking of letter from right.

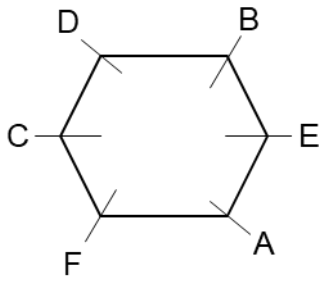
ptw = puy p

65 – 67

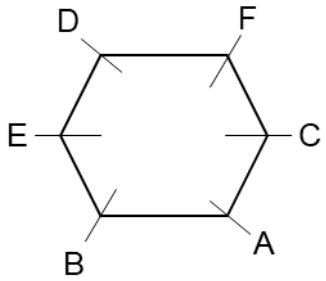


65. 1 (A)

66. 4(C)



67. 1(A)



68. 2

69. 1

70 – 71

SOL. Ten years ago, the ratio of ages of sunil and anil was 1 : 7.
Let their ages would be x & 7x.
So, present age of Sunil and Anil are $(x+10)\&(7x+10)$
Ten years hence, the ratio of their ages will be 1 : 2.
So,

$$\frac{x+20}{7x+20}=\frac{1}{2}$$

$$2x+40=7x+20$$

$$20=5x$$

$$x=4$$

70. 1
Sunil's present age $x+10=4+10=14$ years

71. 2 Ten years before Anil's age = 7x = 7 x 4 = 28.
(2) 28 years

72. - 73
AMRUTA (11) ↓
SUNEETA (26) ↑
Total 60.
Amrita is 11th from front.
Suneeta is at 26th place from behind, so
Suneeta is $60+1-26=35$th from front.
Sapna is at central place between Amrita & Suneeta.

72. Sapna is at $\frac{11+35}{2}=\frac{46}{2}=23$th from front.
Ans (3) 23

73. Sapna's is ranking from behind $=60+1-23=38$
Ans(2) 38

74. Ans (2)

75. Ans (3)

76. 4

17 (68) 28

11 (22) 14

49 9

Sol $\frac{17\times 28}{7}=68$

$\frac{11\times 14}{7}=22$

$\frac{49\times 9}{7}=63$

77. 3

$24(7)67$

$53(6)25$

82 35

$\frac{24+67}{13}=\frac{91}{13}=7$

$\frac{53+25}{13}=\frac{78}{13}=6$

$\frac{82+35}{13}=\frac{117}{13}=9$

Ans.(3)9

78 TO 80

78. 2

AUEFG EOVWX IAPQR

Sol. First two letters are vowed and next three letters are consecutive

So, Ans 2 UEJKL which have same property.

79. 3

XZAVT WUESQ TRUPN

$\underset{2}{\underline{26\ 24}}\ \underset{2}{\underline{20\ 20}}\ \underset{2}{\underline{23\ 21}}\ \underset{2}{\underline{19\ 17}}\ \underset{2}{\underline{20\ 18}}\ \underset{2}{\underline{16\ 17}}$

First two letter have difference of 2 and same as last two letters & middle one is vowed.

So, Ans LJOHF

80. 2

BYMN DWJZ GTKP

All letters are consonants

So, Ans (2) CXHS

81 – 83

ACTIVE = 91) CEVKXG

A C T I V E $=(1)$ C E V K X G

1 3 20 9 22 5 $\xrightarrow[+2]{}$ 3 5 22 11 24 7

A C T I V E $=(2)$ E F V K Y I

1 3 20 9 22 5 5 6 22 11 25 9

$\xrightarrow[+4+3+2+2+3+4]{}$

A C T I V E $=(3)$ X Z Q F S B

$\xrightarrow[-3/+23]{}$

1 3 201 22 5 24 26 17 6 19 2

$\xrightarrow{2+3+4+5+6+7}$

81. 2

G O L D E N = K R N F H R

7 15 12 4 5 14 1118 14 6 8 18

$\xrightarrow[+4+3+2+2+3+4]{}$

82. 3

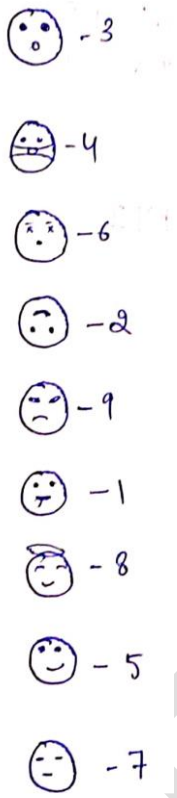
O R A N G E = L O X K D B
15 13 11 4 7 5 12 15 24 11 4 2
$\xrightarrow[-3/+23]{}$

83. 1
P U R P L E = R W T R N G
16 21 18 16 12 5 18 23 2 9 18 14 7
$\xrightarrow[+2]{}$
(1)

84. 1

85. 2

86 – 87



86. 3 (2356)

87. 4

88. 3
Letter : A T M G O D N R S
Digits: 9 8 7 6 5 4 3 2 1
Donar = 4 5 3 9 2
Ans .3

89. 3

90. 1

91.
$88-7=39 \Rightarrow 88-(7)^2=88-49=39$
$77-6=41 \Rightarrow 77-(6)^2=77-36=41$
$99-25=94 \Rightarrow 99-(5)^2=99-25=74$
$\text{So}, 55-4 \Rightarrow 55-(4)^2=55-16=39$
Ans(2)39

92.

$8+6=42 \Rightarrow 8\times6-6=42$

$7+5=30 \Rightarrow 7\times5-5=30$

$9+3=24 \Rightarrow 9\times3-3=24$

So,

$6+4=24-4=20$

Ans(2)20

93 – 95

93. 2

94. 3

Sol. Total no. of cubes = 60

cubes have one face coloured = 24

cubes have no face coloured = 8

So, cubes have attenst two faces coloured

$=60-(24+8)$

$=60-32$

$=28$

95. 3

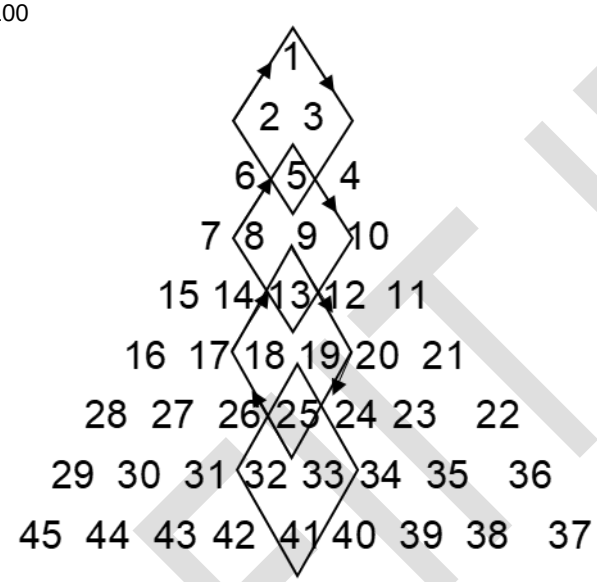
24

96 – 97

96. 2

97. 2

98 – 100



98. 1

1352 : 13 19 25 18 :: 5 9 13 8 :: 25 33 41 32

25334132

99. 16 30 44 : 21 35 38 :: 17 31 43 : 20 34 39

Sol. Rank of digit from left side is equal to rank of digit from right side.

Ans. (2) 20 39 39

100. 28 16 27 : 22 21 23 :: 29 28 30 : 36 22 35

Rank of digit from left side is equal to rank of digit from right side in a same line.