MAHARASHTRA
NATIONAL TALENT SEARCH EXAMINATION, 20 18 - 19
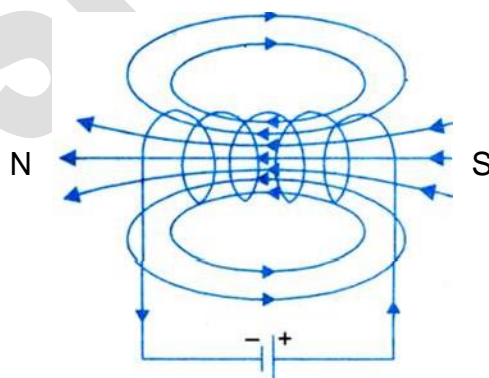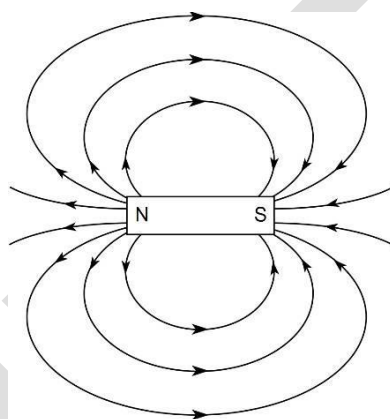## STAGE – 01

SCHOLASTIC APTITUDE TEST (SAT)

SOLUTIONS

PHYSICS

1. (1)

As $g \propto \dfrac{1}{R_e}$

$\therefore g_P > g_E$

2. (3)

3. (4)

First three can be explained by refraction.

4. (2)

$V = 3.14 \text{ km / s} \Rightarrow 3.14 \times 10^3 \text{ms}^{-1}$

$d = 2\pi r \Rightarrow 2\pi\left(R + 4\right)$

$d = 2\pi\left(6400 + 3600\right) \Rightarrow 2\pi \times 10000 \text{ km}$

$T = \dfrac{2\pi r}{V} \Rightarrow T = \dfrac{2\pi \times 10000 \times 10^3}{3.14 \times 10^3}$

$T = 20000 \text{ s}$

5. (3)

Let us suppose that time require to cover $1°$ angle is t

$\therefore T_{160°} = 160 \times t$ and $T_{10°} = 10 \times t$

As we know $T^2 \propto R^3$

$\therefore \left(\dfrac{T_{10}}{T_{160}}\right)^2 = \left(\dfrac{R_{10}}{R_0}\right)^2$

$\left(\dfrac{10 \times t}{160 \times t}\right)^2 \quad \dfrac{R^3}{140^3 \times 10^{18}} = \dfrac{\square_{10}}{}$

$\therefore R_{10}^3 = \dfrac{10 \times 10 \times 140 \times 140 \times 140 \times 10^{18}}{160 \times 160}$

$\Rightarrow R_{10} = 5.57 \times 10^8 \text{ kms}$

$\therefore R_{10} = 56 \times 10^7 \text{ kms}$

6. (4)

A-ii, B-iv, C-i, D-iii

7. (1)

$H = mC\Delta T$
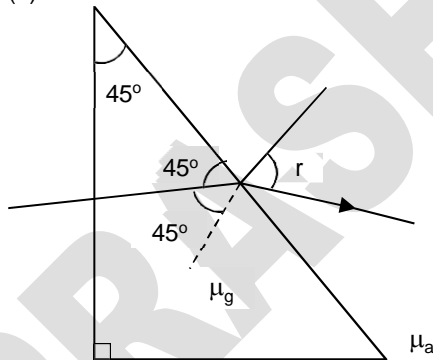
$H = 5 \times 4186 \times 80 \qquad\qquad \left(\because C = 4186 \text{ J / kg}\right)$

$H = 400 \times 4186$

$H = 1674400 \text{ J}$

$H = 1674.40 \text{ kJ}$

8. (2)

$\dfrac{\sin 1}{\sin r} = \dfrac{\mu_a}{\mu_g}$

$\dfrac{\sin 45°}{\sin r} = \dfrac{1}{1.5}$

$\dfrac{1}{\sqrt{2}} \times 1.5 = \sin r$

$\sin r = \dfrac{3}{2\sqrt{2}}$

*9. No option is matching

$\dfrac{40 \times 1.6 \times 10^{-19} + n \times 1.6 \times 10^{-19}}{1} = 8 \qquad\qquad \left(i = \dfrac{q}{t}\right)$

$6.4 - n \times 1.6 \times 10^{-19} = 8$

$n = 10^{19}$

10. (3)

Electromotor, voltmeter and ammeter convents electrical energy to mechanical energy as in ammeter and voltmeter needle will deflect.

11. (1)
Case I:

$$m = \frac{v}{u} = \frac{1}{2}$$

$$2v = -4$$

$$\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$$

$$\Rightarrow u = -3f \text{ and } v = \frac{3t}{2}$$

Case II:

$$-2 = \frac{V'}{(u+30)}$$

$$V' = -2(u+30)$$

$$\frac{1}{f} = \frac{1}{v'} - \frac{1}{(u+30)}$$

$$\frac{1}{f} = \frac{1}{-2(u+30)} - \frac{1}{(u+30)}$$

$$\frac{1}{f} = \frac{-3}{2(u+30)}$$

$$-3f = -6f + 60 \qquad (\because u = -3f)$$

$$f = 20 \text{ cm}$$

12. (3)

$$n \pm \frac{360}{\theta} \text{ (formula), Here } (n-1) = 6 \Rightarrow n = 6$$

$$\therefore 6 = \frac{360}{x} \Rightarrow x = 60°$$

$$\text{Now, } n = \frac{360}{x - 30} \Rightarrow n = \frac{360}{30}$$

$$n = 12 \text{ (even)}$$

$$\therefore \text{ number of images} = (n - 1) = 11$$

13. (2)
Since water has maximum density at $4°C$, therefore its volume must be minimum at $4°C$

CHEMISTRY

14. (1)
1950

15. (1)
Fe_2O_3

16. (3)
Catalyst

17. (3)
D Block

18. (2)
$Fe_2O_3 \cdot H_2O$

19. (4)
Bauxite formula - $Al_2O_3 \cdot 2H_2O$

% of Al_2O_3 in Bauxite $= \frac{102}{138} \times 100 = 73.91$

20. (2)

$CaCO_3$

21. (1)

$-OH$

22. (2)

Neon

23. (1)

Voting ink

24. (1)

Methanol

25. (2)

Na_3AlF_6

26. (2)

Cl, K, Br

BIOLOGY

27. (1)

28. (4)

Anaphase of mitosis, the sister chromosomes are separated in opposite direction.

29. (2)

Conjoined twins are two babies who are born physically connected to each other → the early embryo only partially separates to form two individuals.

30. (1)

Calyx − sepals ⎤
corolla − ⎦ accessory whorls

androceium → stamen ⎤ essential whorls
gynoceium → carpal / pistil ⎦

31. (3)

Tiger, Sundarbans sanctuary of west Bengal is a tiger reserve, known as man eating tiger.

32. (4)

Bat is a flying mammal.

33. (1)

Saccharomyces cerevisiae is as known yeast plays an important role in fermentation.

34. (4)

Interferon are produced by viral infected cells to protect the adjacent cells from viral infection. But hemophilia is X linked disorder, congenital disease.

35. (3)

Alcohol decreases the efficiency of nervous system liver as well as lifespan of a person.

36. (4)

37. (4)

Adrenal gland is present above the kidney (Renal of gland)

38. (1)
Glycolysis breaks down glucose into pyruvic acid, gets converted to acetyl-coA which together with oxaloacetic acid citrate. Enters into Krebs cycle.

39. (3)
Columnar epithelium – secretion of digestive juice
Wearing of organs – squamous epithelium
Reabsorption of useful material – cuboidal epithelium

40. (2)
1 Long cylindrical, metameric ally segmented
2 Triploblastic, bilaterally symmetrical, eucoelomate
3 They have setae or parapodia or suckers for locomotion.
Annelida

SOCIAL STUDIES

41. (1)
Voltaire

42. (4)
The Indian war of independence nationalist history.

43. (2)
Pune

44. (3)
Nagara style

45. (3)
James Augustus Hickey

46. (3)
Saint Namdev

47. (1)
Thaki

48. (2)
Books

49. (4)
Mumbai – Chhatrapati Shivaji Maharaj Vastu Sangrahalay / Ahmedabad – The Calico Museum of Textiles

50. (1)
Michel Foucault

51. (4)
Indo-Gothic

52. (2)
Journalist

53. (2)
29th August

54. (2)
Mrinal Gore

55. (2)
Automobile industry

56. (4)
Kapil Dev

57. (3)
73rd and 74th

58. (2)
Art. 324

59. (1)
President

60. (1)
Chota Nagpur – Kolam

61. (4)
Environmental Degradation

62. (2)
Decentralization of power

63. (2)
England

64. (3)
Dr. Manmohan Singh

65. (4)
North

66. (3)
Ice

67. (1)
The population of India is more

68. (4)
Lack of employment opportunities

69. (2)
120

70. (2)
Sabarmati

71. (3)
Dispersed

72. (4)
Encyclopedia

73. (1)
A-3, B-4, C-2, D-1

74. (2)
Myanmar

75. (4)
A-4, B-3, C-1, D-2

76. (3)
Uruguay

77. (2)
Marajo

78. (1)
A-3-R ,B-4-S, C-1-Q, D-2-P

79. (1)
Fertile Land – Plain land – Availability of water

80. (3)
Khasi Hill

MATHEMATICS

81. (4)

82. (3)
$\alpha + \beta = -3$

$\alpha\beta = \dfrac{-5}{2}$

Quadratic equation $x^2 - (\alpha + \beta) x + \alpha\beta = 0$

$x^2 + 3x - \dfrac{5}{2} = 0$

83. (3)
In ordinary year $\rightarrow$ 365 days
i.e., 52 weeks + 1 day

So, probability of having 53 thrusday $= \dfrac{1}{7}$

84. (2)
Number are in the Given $\rightarrow 6K + 5$
So list of numbers 17, 23, 29, ..., 497

$497 = 17 + (N - 1) 6$

$\Rightarrow N = 81$

85. (2)
$\begin{vmatrix} \dfrac{5}{3} & \dfrac{3}{2} \\ \dfrac{3}{4} & \dfrac{3}{2} \end{vmatrix} = \dfrac{5}{3} \times \dfrac{3}{2} - \dfrac{7}{2} \times \dfrac{3}{4} = \dfrac{-1}{8}$

86. (4)
$3ax^2 + 2bx + c = 0$
Let roots are α, β

$\alpha + \beta = \dfrac{-2b}{3a}$, $\alpha\beta = \dfrac{c}{3a}$, $\dfrac{\alpha}{\beta} = \dfrac{2}{3}$

So $\dfrac{\alpha + \beta}{\alpha - \beta} = \dfrac{5}{-1}$

$(\alpha + \beta)^2 = 25 (\alpha - \beta)^2$

$\dfrac{4b^2}{9a^2} = 25 \left[(\alpha + \beta)^2 - 4\alpha\beta \right]$

$\dfrac{4b^2}{9a^2} = 25 \left(\dfrac{4b^2}{9a^2} - \dfrac{4c}{3a} \right)$

$\dfrac{100c}{3a} = 24 \times \dfrac{4b^2}{9a^2}$

$8b^2 = 25ac$

87. (2)
In A.P. $a_1 + a_N = a_2 + a_{n-1} = 2$ middle tan

Now $S_N = \dfrac{N}{2} \left[a_1 + a_N \right]$

$S_N = \dfrac{N}{2} \left[2 \times m \right] = mN$

88. (3)

Median $= \ell + \dfrac{\dfrac{N}{2} - c.f.}{f} \times h$

$= 30 + \dfrac{35 - 22}{10} \times 10 = 43$

89. (2)
Favorable Cases:- (1,1)

      (1,2) (2,1)

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

      (1,6),(2,5), (3, 4),(4,3),(5, 2),(6,1)

      (5,6),(6, 5)

So probability $= \dfrac{15}{36} = \dfrac{5}{12}$

90. (1)
Let number is ab
So $8\left(a+b\right)-5 = 10\left(a-b\right)+3$

$\Rightarrow 3b - a = 1$
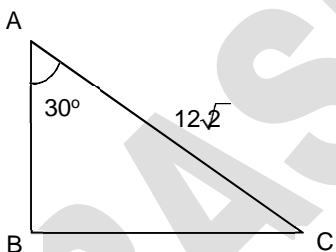
Only 83 is satisfying the above condition

91. (3)

$AD = BD = DC$

$\angle DBE = 20°$, $\angle DCC = 20°$

So, $\angle CPE = 7°$

$\Rightarrow \angle CDE - \angle DBE = 70 - 20 - 50°$

92. (2)

$\sin 30° = \dfrac{BC}{12\sqrt{2}} \Rightarrow BC = 6\sqrt{2}$

$\cos 30° = \dfrac{AB}{12\sqrt{2}} \Rightarrow AB = 6\sqrt{6}$

So perimeter $= 6\sqrt{2} + 6\sqrt{2} + 12\sqrt{2}$
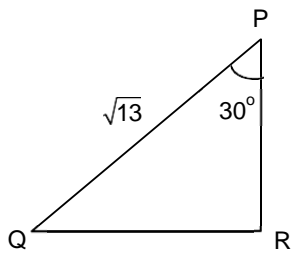
93. (3)
$\pi \rightarrow$ Irrational Number

94. (4)

95. (1)
$ED \parallel BC \Rightarrow 20° = \angle EBD = \angle DBC$
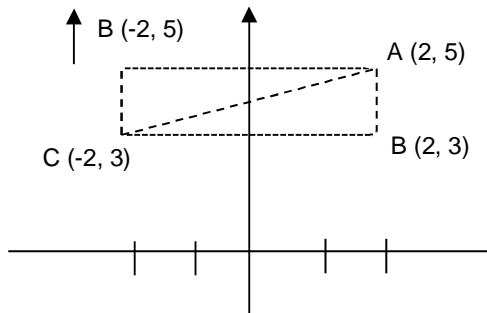
So $\angle EDB = 20°$ (exterior angle sum property)
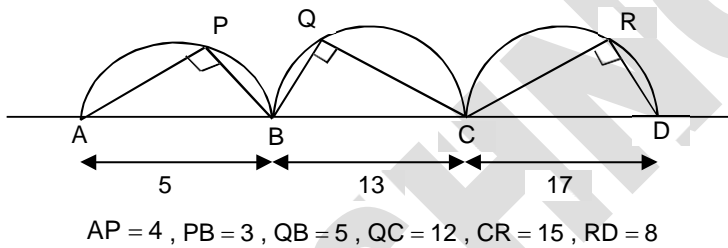
and $\angle DCB = 50°$ (angle sum property)

96. (4)

P

$\sqrt{13}$ $30°$

Q   R

$\text{cosec}60° - \sec 60°$

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

97. (1)

B (-2, 5)   A (2, 5)

C (-2, 3)   B (2, 3)

98. (4)

99. (4)

P   Q   R

A   B   C   D

5   13   17

$AP = 4$, $PB = 3$, $QB = 5$, $QC = 12$, $CR = 15$, $RD = 8$

*100. Option not Match