

**MAHARASHTRA**  
**NATIONAL TALENT SEARCH EXAMINATION , 2019-20**  
**STAGE – 01**

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**SCHOLASTIC APTITUDE TEST (SAT)**  
**SOLUTIONS**

**PHYSICS SOLUTION**

1.

4

Time of flight,

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

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

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

2.

Specific heat capacity of water = 1 cal/g-°C

Latent heat of fusion of ice = 80 cal/g

Latent heat of vaporization of water = 540 cal/g

Let final temperature of mixture be T°C

Taking reference temperature as 0°C

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

Heat given to ice to convert into water at 0°C

$$= 800 \times 80$$

$$= 64000 \text{ cal}$$

Remaining heat to be given to mixture

$$128000 - 64000$$

$$= 64000 \text{ cal}$$

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

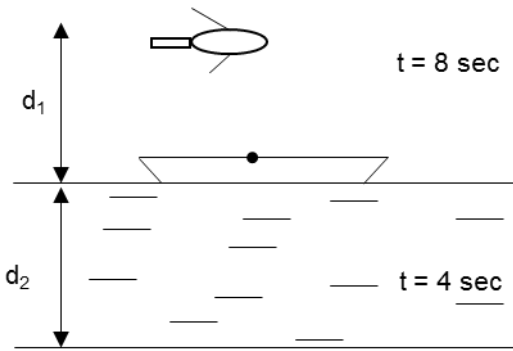
$$T = 64^\circ\text{C}$$

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



$$d = d_1 + d_2$$

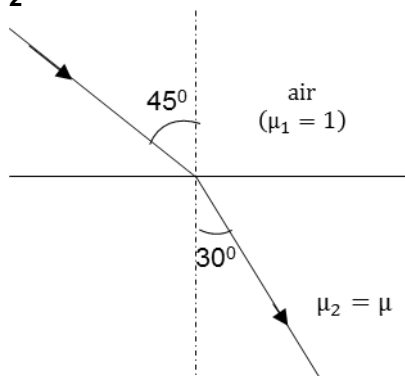
$$= \frac{350 \times 8}{2} + \frac{1500 \times 4}{2}$$

$$= 4400 \text{ M}$$

$$= 4.4 \text{ KM}$$

5. 3  
theoretical

6. 2



Using Snell's law,  
 $1 \times \sin 45^\circ = \mu \times \sin 30^\circ$

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

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

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

7. 2  
theoretical

8. 2

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

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

Now, at low temp.,  $i_2 = i_1 / 3 = 2 \text{ A}$

$$P_2 = Vi_2$$

$$\therefore \text{Power used, } = 200 \times 2$$

$$= 440 \text{ W}$$

9. 4

$m = 250 \text{ kg}$ ,  $t = 60 \text{ sec}$ ,  $h = 150 \text{ m}$

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

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

$$= 8.38 \text{ H.P.}$$

∴ Required power should be 9 H.P.

10. 3

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

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

11. 1

For lens,

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

$$V = -30 \text{ cm}$$

for mirror, object distance = 30 + 10 ⇒ 40 cm

∴ Final image = 40 cm behind mirror.

12. 4

theoretical

13. 1

Power of combination :

$$P = P_1 + P_2 + P_3$$

$$2.7 = 2.5 + 1.7 + P_3$$

$$P_3 = -1.5 \text{ D}$$

$$\therefore F_3 = \frac{100}{P_3} = \frac{10.0}{-1.5}$$

$$= -66.66 \text{ cm}$$

NOTE:

Answer of Q.NO. 2 is coming 64°C.

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<sub>2</sub>H<sub>2</sub> ethyne

19. 1

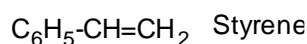
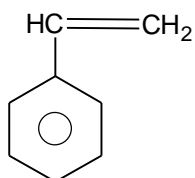
3422 melting point of Tungsten.

20. 3

NH<sub>4</sub>OH - Weak base due to less ionisation

21. 2 C<sub>6</sub>H<sub>6</sub>

22. 1



23. 4  
60 – 70 carbon % in lignite.
24. 4  
Copper sulphate solution
25. 4  
Aqua regia (HCl : HNO<sub>3</sub>)
26. 2  
Colourless due to formation of ZnSO<sub>4</sub> (Bonus)

### 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 in 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 → Response → Resurgence → Preparation → Redemption → 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, ..... 994  
 $\therefore a_n = 7 + (n-1)7$   
 $994 = 7[1+n-1]$   
 $n = 142$   
 $\therefore S_{142} = \frac{142}{2}[7+994]$   
 $= 71071$
82. Dividend  
 $= 20\% \text{ of } 100 \times 160$   
 $= 20 \times 160$   
 $= 3200$   
Return % =  $\frac{3200}{19200} \times 100$   
 $= 16.67\%$

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

$$= x+1$$

84. 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

$$\Rightarrow 2x = 16$$

$$x = 8$$

Speed of boat = 8 km/hr

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

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

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

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

$$= 500$$

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

$$= 50 + \frac{\left[\frac{50-38}{18}\right]}{1} \times 10$$

$$= 50 + 6.67$$

$$= 56.67$$

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

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

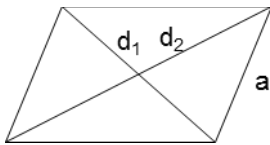
$$\Rightarrow 2x = 21 \times 35 - 27^2$$

$$2x = 6$$

$$x = 3$$

$$x^2 = 9$$

$$88. d_1 - d_2 = 4$$



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

$$d_1d_2 = 192$$

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

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

$$a^2 = 100$$

$$\Rightarrow a = 10$$

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

Speed of stream =  $y$  km/hr

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

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

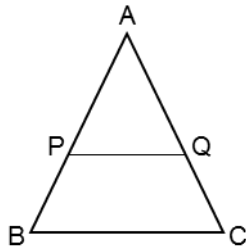
On adding

$$\Rightarrow 2x = 16$$

$$x = 8$$

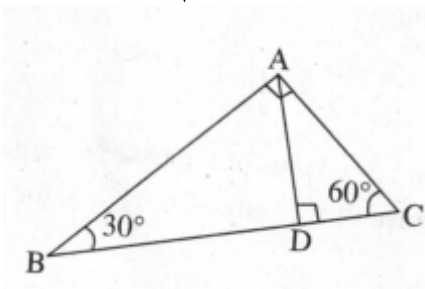
90.  $\begin{vmatrix} 3\sqrt{5} & 6 \\ 5 & m \end{vmatrix} = 0$   
 $3\sqrt{5}m - 30 = 0$   
 $3\sqrt{5}m = 30$   
 $M = \frac{10}{\sqrt{5}} = 2\sqrt{5}$

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



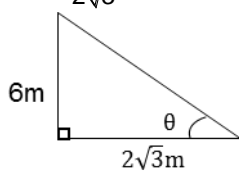
$AD = K$   
 $BD = \sqrt{3}K$   
 $AB^2 = K^2 + (\sqrt{3}K)^2$   
 $AB = 2K$   
 Now  
 $\frac{AD}{DC} = \tan 60^\circ = \sqrt{3}$   
 $\frac{K}{DC} = \sqrt{3} \Rightarrow DC = \frac{K}{\sqrt{3}}$   
 $AC = \sqrt{\frac{K^2}{3} + K^2} = K \cdot \frac{2}{\sqrt{3}}$

$$\begin{aligned} \therefore \frac{\text{Per}(\triangle ABD)}{\text{Per}(\triangle ACD)} &= \frac{K + \sqrt{3}K + 2K}{\frac{2}{\sqrt{3}}K + \frac{K}{\sqrt{3}} + K} \\ &= \frac{(3 + \sqrt{3})\sqrt{3}}{3 + \sqrt{3}} \\ &= \sqrt{3} : 1 \end{aligned}$$

93.  $\angle APT = \angle TQB$   
Which are alternate angles  
 $\therefore PA \parallel QB$

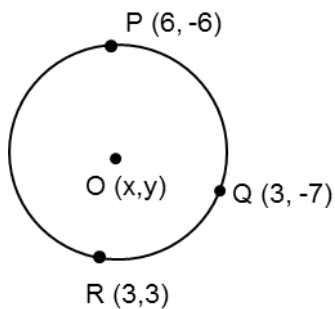
94. On x-axis, ordinate is zero  
 $\therefore Q$  and  $S$  lie on X-axis  
So,  $P, R, T$  don't lie on X-axis

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



$$\begin{aligned} &= \sqrt{3} \\ \theta &= 60^\circ \end{aligned}$$

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



$$\begin{aligned} \therefore OP^2 &= OQ^2 = OR^2 \\ \Rightarrow (x-6)^2 + (y+6)^2 &= (x-3)^2 + (y+7)^2 = (x-3)^2 + (y-3)^2 \\ \Rightarrow x^2 + 36 - 12x + y^2 + 36 + 12y & \\ = x^2 + 9 - 6x + y^2 + 9 - 6y & \quad \text{I} \\ = x^2 + 9 - 6x + y^2 + 49 + 14y & \quad \text{II} \end{aligned}$$

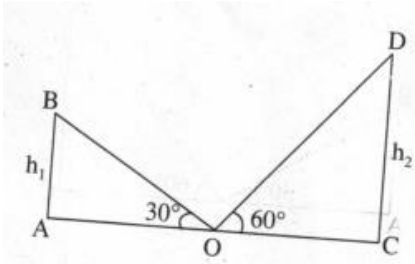
Comparing I and II  
 $\Rightarrow -6x + 18y = -54$   
 $-x + 3y = -9$

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





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

And

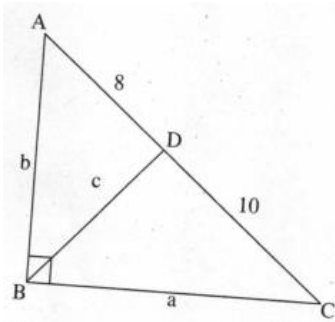
$$\frac{h_2}{x} = \tan 60^\circ = \sqrt{3}$$

$$h_2 = \sqrt{3}x$$

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

99.  $\frac{4}{3}\pi(3)^3 = \pi\left(\frac{2}{10}\right)^2 h$   
 $h = 9\text{m}$

100.  $\triangle ABD \sim \triangle ACB$



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

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

$$b^2 = 18 \times 8$$

$$b = 12$$