FIITJEE

NATIONAL TALENT SEARCH EXAMINATION, 2015 - 16
(STATE LEVEL)
(FOR STUDENTS STUDYING IN CLASS X)
SAT – ANSWER KEY

1	**C**	11	**A**	21	**A**	31	**B**	41	**B**
2	**C**	12	**D**	22	**C**	32	**C**	42	**D**
3	**B**	13	**B**	23	**D**	33	**C**	43	**B**
4	**D**	14	**A**	24	**A**	34	**B**	44	**C**
5	**D**	15	**C**	25	**C**	35	**C**	45	**A**
6	**A**	16	**C**	26	**A**	36	**D**	46	**C**
7	**D**	17	**C**	27	**B**	37	**D**	47	**C**
8	**B**	18	**A**	28	**C**	38	**D**	48	**D**
9	**B**	19	**B**	29	**B**	39	**D**	49	**D**
10	**D**	20	**D**	30	**D**	40	**B**	50	**D**

51	**B**	61	**C**	71	**B**	81	**D**	91	**B**
52	**C**	62	**A/B**	72	**A**	82	**A**	92	**D**
53	**B**	63	**B**	73	**C**	83	**C**	93	**D**
54	**A**	64	**D**	74	**D**	84	**B**	94	**C**
55	**B**	65	**A**	75	**B**	85	**A**	95	**B**
56	**D**	66	**C**	76	**D**	86	**C**	96	**B**
57	**B**	67	**D**	77	**B**	87	**A**	97	**C**
58	**D**	68	**B**	78	**B**	88	**A**	98	**D**
59	**B**	69	**C**	79	**B**	89	**C**	99	**A**
60	**B**	70	**C**	80	**A**	90	**A**	100	**D**

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(STATE LEVEL)
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SAT – SOLUTION

MATHEMATICS

1. **Sol.**

$$f\left(2x+\frac{1}{x}\right)=\frac{1}{4}\left(4x^2+\frac{1}{x^2}\right)+1$$

$$=\frac{1}{4}\left[\left(2x+\frac{1}{x}\right)^2-4\right]+1$$

$$=\frac{1}{4}\left[\left(2x+\frac{1}{x}\right)^2\right]$$

$$f(x)=\frac{1}{4}\left(x^2\right)$$

2. **Sol.**

$$x-2\sqrt{x}=3$$

$$x-2\sqrt{x}-3=0$$

$$\left(\sqrt{x}-3\right)\left(\sqrt{x}+1\right)=0$$

$$\sqrt{x}=3, \qquad \left[\because \sqrt{x}\neq -1\right]$$

$$\Rightarrow x=9$$

3. **Sol.**

$$\sqrt{5-2\sqrt{6}}$$

$$=\sqrt{\left(\sqrt{3}\right)^2+\left(\sqrt{2}\right)^2-2\sqrt{6}}$$

$$=\sqrt{3}-\sqrt{2}$$

4. **Sol.**

$$a=\frac{x}{y} \qquad b=\frac{y}{x}$$

$$a+1=\frac{x+y}{y} \qquad b+1=\frac{x+y}{x}$$

$$\frac{1}{a+1}+\frac{1}{1+b}=1$$

5. **Sol.**

$$2\left(x^2-2x+1-1\right)+3\left(y^2-6y+9-9\right)+31$$

$$=2(x-1)^2-2+3(y-3)^2-27+31$$

Least value = 2

6. **Sol.**

$(2r-h)^2 = r^2 + h^2$

$4r^2 - 4rh = r^2$

$3r^2 = 4rh$

$\frac{r}{h} = 4:3$

7. **Sol.**

$y = c(cy + bz) + az$

$(1 - c^2)y = (bc + a)z$ …….(1)

$Z = b(cy + bz) + ay$

$(1 - b^2)z = (bc + a)y$ …….(2)

$\frac{1-c^2}{bc+a} = \frac{bc+a}{1-b^2}$

$1 - b^2 - c^2 + \cancel{b^2c^2} = \cancel{b^2c^2} + abc + abc + a^2$

$a^2 + b^2 + c^2 - 1 = -2abc$

8. Sol.

$x(x^3 - 1) < 0$

$x(x - 1)(x^2 + x + 1) < 0$

$x^2 + x + 1 > 0$ because discriminant is – ve

$x(x - 1) < 0 \Rightarrow 0 < x < 1$

9. **Sol.**

$2^{250} \quad 3^{200} \quad 4^{150} \quad 5^{100}$

$= (2^5)^{50} \quad (3^4)^{50} \quad (4^3)^{50} \quad (5^2)^{50}$

$= (32)^{50} \quad (81)^{50} \quad (64)^{50} \quad (25)^{50}$

10. **Sol.**

$4 * 5 + 5 * 6$

$= (4 + 5 - 4 \times 5) + (5 + 6 - 5 \times 6)$

$= -30$

11. **Sol.**

Let principal amount is A. then

$\frac{A \times \frac{25}{2} \times 1}{100} - \frac{A \times 10 \times 1}{100} = 1250 \Rightarrow A = 50,000$

12. **Sol.**

Net cost price $= \frac{198}{1 + \frac{10}{100}} + \frac{198}{1 - \frac{10}{100}}$

$= 198\left(\frac{10}{11} + \frac{10}{9}\right) = 400$

Selling price $= 2 \times 198 = 396$

loss $= 400 - 396 = 4$

$\%\,\text{loss} = \frac{4}{400} \times 100 = 1$

13. **Sol.**

Let the price two years before be P.

So, current price will be $P \times \left(1 + \frac{4}{100}\right)^2$

$$\therefore P\times\left(1\times\frac{4}{100}\right)^2=6,76,000$$

14. **Sol.**

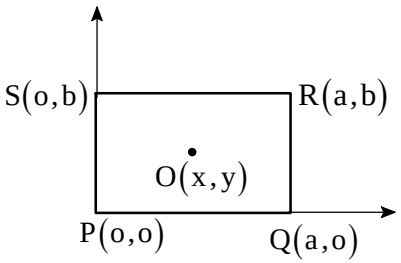
$OP^2 = x^2 + y^2$

$OR^2 = (x - a)^2 + (y - b)^2$

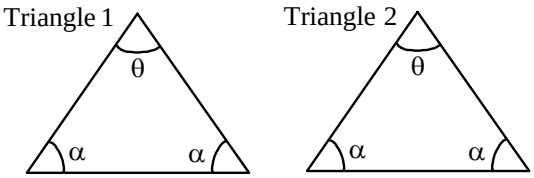
$OQ^2 = (x - a)^2 + y^2$

$OS^2 = x^2 + (y - b)^2$

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



15. **Sol.**



So, both the triangles are similar and in case of similar triangles, area of triangles are in ratio of square of their heights

$$\therefore\frac{h_1^2}{h_2^2}=\frac{9}{16}\Rightarrow\frac{h_1}{h_2}=\frac{3}{4}$$

16. **Sol.**

Volume of tetrahedron = $\frac{a^3}{6\sqrt{2}}$ where

$a\rightarrow$length of edge

17. **Sol.**

Volume of parallelopide = Number of coins × Volume of single coin

$\Rightarrow 11\times 9\times 6 = n\times\pi\times 1.5^2\times 0.25$

18. **Sol.**

$\sin^4 A = \cos^2 A$

$\tan^2 A - \tan^4 A$

$$=\frac{\sin^2 A}{\cos^2 A}-\frac{\sin^4 A}{\cos^4 A}$$

$$=\frac{\sin^2 A}{\sin^4 A}-\frac{\cos^2 A}{\cos^4 A}$$

$$=\operatorname{cosec}^2 A-\sec^2 A$$

$$\frac{\cos^2 A-\sin^2 A}{\sin^2 A\cos^2 A}$$

$$=\frac{\sin^4 A-\sin^2 A}{\sin^2 A\cos^2 A}=\frac{-\sin^2 A\cos^2 A}{\sin^2 A\cos^2 A}$$

$$=-1$$

19. **Sol.**

$2^{\sin^2 x}+2^{\cos^2 x}$

$$= 2^{\sin^2 x}+\frac{2}{2^{\sin^2 x}}$$

Applying A.M≥G.M

$$\frac{2^{\sin^2 x}+\frac{2}{2^{\sin^2 x}}}{2}\geq\sqrt{2^{\sin^2 x}\cdot\frac{2}{2^{\sin^2 x}}}$$

$$2^{\sin^2 x}+2^{\cos^2 x}\geq 2\sqrt{2}$$

Least value = $2\sqrt{2}$

20. **Sol.**

$A+C=\pi$

$B+D=\pi$

L.H.S = $\tan\frac{A}{2}\tan\frac{C}{2}+\tan\frac{B}{2}\tan\frac{D}{2}$

$$\tan\left(\frac{\pi}{2}-\frac{C}{2}\right)\tan\frac{C}{2}+\tan\left(\frac{\pi}{2}-\frac{D}{2}\right)\tan\frac{D}{2}$$

$$=C+\frac{C}{2}\tan\frac{C}{2}+C+\frac{D}{2}\tan\frac{D}{2}$$

$=2$

PHYSICS

21. **Sol.**

$E=\frac{1}{2}mv^2$

$\Rightarrow E=\frac{1}{2}\frac{P^2}{m}$

$P=\sqrt{2mE}$

22. Sol.

$\therefore Pv=nRT$

$v=\frac{nR}{P}T$

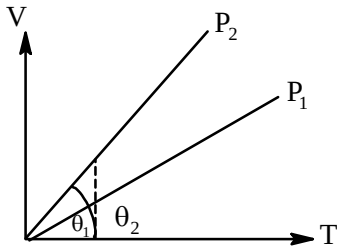
$\frac{nR}{P}=\tan\theta$

$\tan\theta\propto\frac{1}{P}$

$\theta_2>\theta_1$

$\tan\theta_2>\tan\theta_1$

$\therefore \boxed{P_1>P_2}$



23. **Sol.**

Harmonics are multiple of fundamental frequencies.

24. **Sol.**

$E=\frac{1}{2}kA^2$

$E\propto A^2$

25. **Sol.**

Sinc = $\frac{1}{\mu}$

$C = 45^o$

26. **Sol.**

In the absence of atmosphere, no scattering of light.

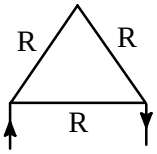
27. **Sol.**

$$\frac{1}{f} \propto \left(\frac{\mu_{lens}}{\mu_{medium}} - 1 \right) K$$

28. **Sol.**
E = ev
$= 100 \times 1.6 \times 10^{-19}$ J

29. **Sol.**
$$I_2 = \frac{140}{280} \times I_1$$
$$= 4/2 = 2A$$

30. **Sol.**



$$R_{eq} = \frac{2R \times R}{2R + R}$$
$$= 2R/3$$

31. **Sol.**
By balancing mass number and atomic number $_2He^4$

32. **Sol.**
Gamma ray lies in the electro magnetic spectrum.

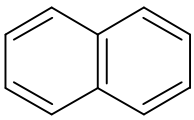
33. **Sol.**
$R \propto A^{\frac{1}{3}}$

CHEMISTRY

34. No of molecules in 0.1 mol = $6.023 \times 10^{23} \times 0.1$
No of atoms for a triatomic gas = $6.023 \times 10^{23} \times 0.1 \times 3$
$= 1.806 \times 10^{23}$

35. No of protons = 26
No of neutrons = 30
No of electrons = 23
Ion is Fe^{+3}

36. Anionic radius > Covalent radius &
Covalent radius > Cationic radius.

37. 
No of σ bonds = 19
No of π bonds = 5

38. At const V & T
$P \propto n$

39. $C_3H_4 + 2H_2 \rightarrow C_3H_8$
$0.25mol \quad 0.5mol \quad 0.25mol$

40. Alcohols and ethers are functional isomers.

41. Refer Text

42. H_2 is getting oxidised and Br_2 is getting reduced.

43. At const. P & V, $n \propto \frac{1}{T}$

44. $[H^+]$ in 0.005 M H_2SO_4 solution = $2 \times 0.005 = 0.01$
Therefore pH = 2

45. y = q

46. C_2H_2 is absorbed in basic copper (I) chloride solution.