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.**

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

$$= \sqrt{\sqrt{3}^2 + \sqrt{2}^2 - 2\sqrt{6}}$$

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

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.**

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

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

$$27 + 31 \text{ Least value} = 2$$

6. **Sol.**

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

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

$3r^2 = 4rh$

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

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)

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

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

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

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.**

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

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

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

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

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

12. **Sol.**

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

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

Selling price $= 2 \times 198 = 396$

loss $= 400 - 396 = 4$

%loss $= \dfrac{4}{400} \times 100 = 1$

13. **Sol.**

Let the price two years before be P.

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

$$\therefore P \times 1 \times \left(\frac{4}{100}\right)^2 = 6,76,000$$
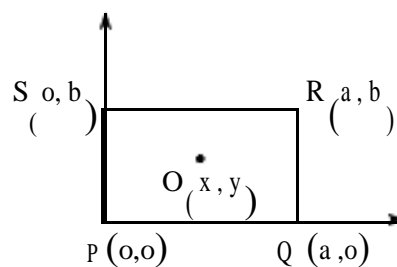
14. **Sol.**
$$OP^2 = x^2 + y^2$$
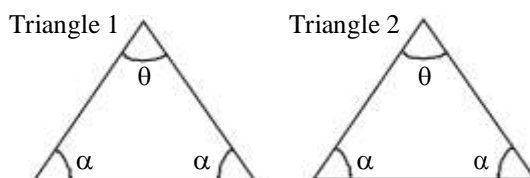$$OR^2 = (x - a)^2 + (y - b)^2$$
$$OQ^2 = (x - a)^2 + y^2$$
$$OS^2 = x^2 + (y - b)^2$$
$$\therefore OP^2 + OR^2 = OQ^2 + OS^2$$

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 = $\dfrac{a^3}{6\sqrt{2}}$ where

a → 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.**
$$\sin^4 A = \cos^2 A$$
$$\tan^2 A - \tan^4 A$$
$$= \frac{\sin^2 A}{\cos^2 A} - \frac{\sin^4 A}{\cos^4 A}$$
$$= \frac{\sin^2 A - \cos^2 A}{\sin^4 A \cos^4 A}$$
$$= \cos ec^2 A - \sec^2 A$$
$$\frac{\cos^2 A - \sin^2 A}{\sin^2 A \cos^2 A}$$
$$= \frac{\sin^4 A - \sin^2 A = -\sin^2 A \cos^2 A}{\sin^2 A \cos^2 A \sin^2 A \cos^2 A}$$
$$= -1$$

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=π

B+D=π

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.**

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

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

$P = \sqrt{2mE}$
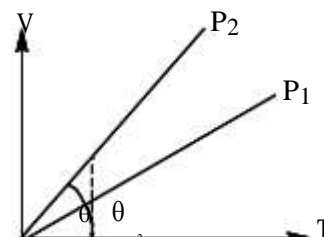
22. Sol.

$\therefore Pv = nRT$

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

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

$\theta_2 > \theta_1$

$\tan\theta_2 > \tan\theta_1$

$\therefore P_1 > P_2$

23. **Sol.**

Harmonics are multiple of fundamental frequencies.

24. **Sol.**

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

$E \propto A^2$

25. **Sol.** Sinc

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

$= 45^o$

26. **Sol.**

In the absence of atmosphere, no scattering of light.

27. **Sol.**

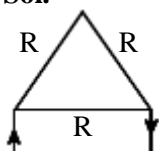$$\frac{1}{f} \propto \left(\frac{\mu_{lens}}{\mu_{medium}} - 1\right)K$$

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

29. **Sol.**

   $$I_2 = \frac{140}{280} \times I_1$$

   $$= \frac{4}{2} = 2A$$

30. **Sol.**

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

   $$= \frac{2R}{3}$$

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

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

33. **Sol.**

   $$R \propto A^{3^{-1}}$$

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 + $2H_2$ → C_3H_8
   0.25 mol   0.5 mol   0.25 mol

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, $n \propto \dfrac{1}{T}$

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

45. y = q

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