NATIONAL TALENT SEARCH EXAMINATION
NTSE STAGE-II (2016)
CLASS-X [SAT]

HINTS & SOLUTIONS

ANSWER KEY

Ques.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans	3	2	1	3	4	4	2	3	3	1	4	2	2	4	2
Ques.	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Ans	4	2	2	3	2	1	2	4	3	4	4	3	2	3	4
Ques.	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
Ans	1	3	3	1	2	1	4	3	3	1	1	4	1	4	4
Ques.	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
Ans	2	2	1	3	1	3	4	4	2	4	2	3	4	4	4
Ques.	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
Ans	Bonus	3	4	1	1	3	2	4	4	3	4	1	3	2	1
Ques.	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90
Ans	2	3	3	3	4	4	4	1	3	2	3	4	2	4	2
Ques.	91	92	93	94	95	96	97	98	99	100					
Ans	4	3	1	1	2	3	3	2	2,3	3					

CHEMISTRY

15. Ans. (2)

Neutrons present in one molecule of water = 8 $\left({}^{16}_{8}O\right)$

One mole of water contains = 8 N_A neutrons

So in 5 moles of water = 5 × 8 × N_A

= 5 × 8 × 6.023 × 10^{23}

= 2.409 × 10^{25}

16. Ans. (4)

Na & Fe both are more reactive than Cu but Fe is having more affinity to form sulphates so Fe is used to recover copper from copper sulphate solution.

$$Fe_{(s)} + CuSO_{4(aq)} \longrightarrow FeSO_{4(aq)} + Cu_{(s)}$$

17. Ans. (2)

In solution **A** path of light is visible and particles settle down at bottom, so it is **suspension**.

In solution **B** & **D** light path is visible and particles do not settle at bottom so these are **colloids**.

In solution **C** light path is invisible and particles do not settle down at bottom, so it is a **true solution**.

18. Ans. (2)

Both (A) & (R) are correct statement. But as Gold is most malleable, so it was used in α - particle scattering experiment.

19. Ans. (3)

Magnesium gets corrode with the layer of oxide. In order to remove the layer of oxide, it is rubbed

$$2Mg + O_2 \longrightarrow 2MgO$$

20. Ans. (2)

(i) $CaCO_3 \xrightarrow{\Delta} CaO + CO_2$

(ii) $2Al_2O_3 \xrightarrow{\text{electrolysis}} 4Al + 3O_2$

(iii) $2NaHCO_3 \xrightarrow{\Delta} Na_2CO_3 + CO_2 + H_2O$

(iv) $2HgO \xrightarrow{\Delta} 2Hg + O_2$

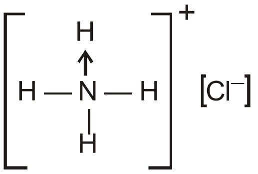
Eq.(i),(iii),(iv) are example of thermal decompostion but eq. (ii) is an example of electrolytic decompostion.

21. Ans. (1)

Oxide of X is amphoteric in nature so it can react with acids & bases both. Only metals can form amphoteric oxides so X is electropositive in nature

22. Ans. (2)
$X \rightarrow 2, 8, 1 \Rightarrow Na$
$Y \rightarrow 2, 8, 7 \Rightarrow Cl$
Compound $\Rightarrow$ NaCl $\Rightarrow$ It is good conductor of electricity in molten and fused state but not in solid state

23. Ans. (4)
Structure of NH_4Cl is



NH_4Cl contains, ionic, covalent bond & coordinate bond.

24. Ans. (3)
Sulphur is a non metal so it does not have tendency to lose electrons so it can not be used as reducing agent.

25. Ans. (4)
Given no. of oxygen atoms = 9.033×10^{23}

(i) moles of oxygen atoms = $\dfrac{9.033 \times 10^{23}}{6.023 \times 10^{23}}$

= 1.499 moles $\simeq$ 1.5 moles
(ii) mass of oxygen atoms
= 1.5 moles × 16 gm = 24 grams

(iii) $2H_2 + O_2 \longrightarrow 2H_2O$
2 moles of oxygen atoms requires
= 4 gm of H_2

1.5 moles of oxygen atoms requires = $\dfrac{1.5 \times 4}{2}$

= 3 moles of Hydrogen atom

26. Ans. (4)

$C_{13}H_{26}O_2, C_2H_4O_2, C_9H_{18}O_2 \longrightarrow$ Acids Contain (C–C) Single Bond ($C_nH_{2n}O_2$)

$C_7H_{12}O_2 \longrightarrow$ This acid contains (C = C) double bond.($C_nH_{2n-2}O_2$)

27. Ans. (3)
Foam of soap is a large bunch of bubbles which are made of very thin film of soap solution and some air. Bubbles allow some light to pass through them and scatter the rest. If no specific colour is reflected, we consider this state of colourlessness as white.

PHYSICS

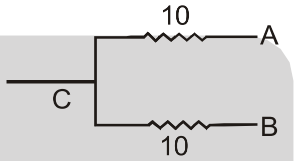
28. Ans. (2)
$(4.8 \times 10^{18} + x)1.6 \times 10^{-19} = 1.12$

$(4.8 \times 10^{18} + x) = \dfrac{1.12}{1.6 \times 10^{-19}}$

$4.8 \times 10^{18} + x = 7 \times 10^{18}$
$x = 7 \times 10^{18} - 4.8 \times 10^{18}$
$= 2.2 \times 10^{18}$

29. Ans. (3)

30. Ans. (4)

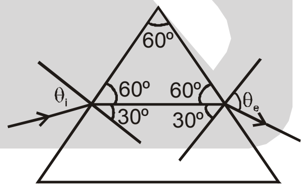


$R_{eff} = \dfrac{30 \times 15}{3 \times 15} = \dfrac{30 \times 15}{45} = 10\Omega$
i = 3A
In branch CA current = 1A
In branch CB current = 2A
$\therefore V_C - V_A = 10V$ ... (i)
& $V_C - V_B = 20V$ ... (ii)
Subtracting (i) from (ii)
$V_A - V_B = 10V$

31. Ans. (1)

32. Ans. (3)

33. Ans. (3)



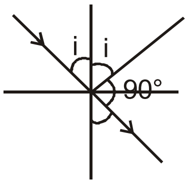
$r_1 = r_2 \therefore$ min deviation condition

$$\mu = \frac{\sin\left(\frac{A(\delta_m)}{2}\right)}{\sin\frac{A}{2}}$$

$$\mu = \frac{\sin\left(\frac{60+60}{2}\right)}{\sin\frac{60}{2}} = \frac{\sin 60}{\sin 30} = \sqrt{3}$$

34. Ans. (1)

35. Ans. (2)



$i + r = 90^\circ$

$${}_{d}\mu_{r} = \frac{\sin i}{\sin r}$$

$$\sqrt{3} = \frac{\mu_d}{\mu_r} = \frac{\sin i}{\sin(90 - i)}$$

$\sqrt{3}$ = tan i

i = 60° $\therefore$ r = 30°

36. Ans. (1)

(i) V = – 300

Case : u = $-\infty$

f = ?

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

$$\frac{1}{f} = -\frac{1}{300} - 0$$

f = – 300 cm

Case : II

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

$$-\frac{1}{300} = \frac{-1}{50} - \frac{1}{u}$$

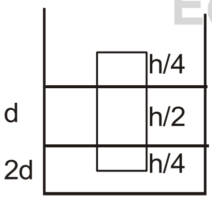
$$\frac{1}{u} = \frac{-1}{50} + \frac{1}{300}$$

$$\frac{1}{u} = \left(\frac{-6+1}{300}\right)$$

$$\frac{1}{u} = -\frac{1}{60} \qquad u = -60 \text{ cm}$$

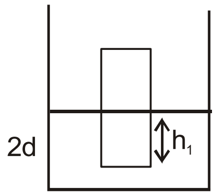
37. Ans. (4)

38. Ans. (3)



$$Vd_{Solid}\, g = \frac{V}{4} 2dg + \frac{V}{2} dg$$

$d_{solid} = d$



$Vd_{Solid}\, g = V_1 2dg$

$Ahdg = Ah_1 2dg$

$$\therefore h_1 = \frac{h}{2}$$

39. Ans. (3)

40. Ans. (1)

$w = K_f - K_i = Fx$

since K_f and K_i are same in both case and stopping force is also so x will be same for both.

MATHEMATICS

41. When Divided by 13 leaves remainder 3

When Divided by 21 leaves remainder 3

13 – 3 = 21 – 11 = 10 = k

LCM (13,21) – k = 546 – 10 = 536

536 = 19 $\times$ 8 + 4 $\therefore$ remainder = 4

42. $0.\overline{34} + 0.3\overline{4}$

0.343434... + 0.34444....

0.6878787....

$0.6\overline{87}$

43. Quadratic polynomial p(–2)= k (x +1)^2

p(–2) = k (–2 + 1)^2 = 2

k = 2

p(x) = 2 (x +1)^2

p(2) = 2(2 + 1)^2 = 2 $\times$ 3 $\times$ 3 = 18

44. x – y = 2 ..(1)

kx + y = 3 ..(2)

by adding (1) and (2)

kx + x = 5

x(k + 1) = 5

$$x = \frac{5}{k+1}$$

putting value of x in equation (1)

$$\frac{5}{k+1} - y = 2$$

$$\frac{5}{k+1} - 2 = y$$

$$\frac{5-2k-2}{k+1} = y$$

$$y = \frac{3-2k}{k+1}$$

y should be positive as they intersect in 1st quadrant therfore

$y > 0$

$$\frac{3-2k}{k+1} > 0 \Rightarrow \frac{2k-3}{k+1} < 0$$

$+ \qquad - \qquad +$

$\therefore$ k should lie between – 1 and 3/2

$\therefore$ Ans 4

45. $x^2 - 6x - 2 = 0$

$\alpha^2 - 2 = 6\alpha$

$\beta^2 - 2 = 6\beta$

$\alpha + \beta = 6 \;\; \alpha\beta = -2$

$d_n = \quad \alpha^n - \beta^n$

$$\frac{a_{10} - 2a_8}{2a_9} = \frac{\alpha^{10} - \beta^{10} - 2(\alpha^8 - \beta^8)}{2(\alpha^9 - \beta^9)}$$

$$\frac{\alpha^{10} - \beta^{10} + \alpha\beta(\alpha^8 - \beta^8)}{2(\alpha^9 - \beta^9)}$$

$$\frac{\alpha^{10} + \alpha^9\beta - (\alpha\beta^9 + \beta^{10})}{2(\alpha^9 - \beta^9)}$$

$$\frac{\alpha^9(\alpha+\beta) - \beta^9(\alpha+\beta)}{2(\alpha^9 - \beta^9)}$$

$$\frac{(\alpha+\beta)(\alpha^9 - \beta^9)}{2(\alpha^9 - \beta^9)}$$

$$\frac{6}{2} = 3$$

46. $S_1 = \frac{n}{2}\left[2(1) + (n-1)(1)\right]$

$S_2 = \frac{n}{2}\left[2(2) + (n-1)(3)\right]$

$S_3 = \frac{n}{2}\left[2(3) + (n+1)(5)\right]$

. .

. .

. .

$S_r = \frac{n}{2}\left[2(r) + (n-1)(2r-1)\right]$

(+) (+)

$S_1 + S_2 + \ldots + S_r = \frac{n}{2}$

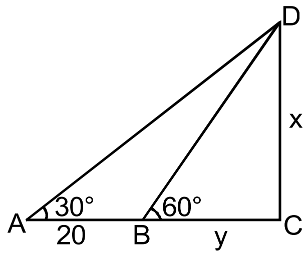
$$\left[(2)\frac{r(r+1)}{2} + (n-1)\frac{r}{2}[1 + 2r - 1]\right]$$

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

$$= \frac{nr}{2}\left[r + 1 + nr - r\right]$$

$$= \frac{nr}{2}\left[nr + 1\right]$$

47.



In ΔDBC

$\tan 60° = \frac{x}{y}$

$x = \sqrt{3}\,y \qquad ..(1)$

In ΔADC

$\tan 30° = \frac{x}{20+y}$

$\frac{1}{\sqrt{3}} = \frac{\sqrt{3}y}{20+y}$

$y + 20 = 3y$

$2y = 20$

$y = 10$

48. $\text{cosec}x - \sin x = a$; $\sec x - \cos x = b$

$\text{cosec}x - \frac{1}{\text{cosec}x} = a$; $\sec x - \frac{1}{\sec x} = b$

$\Rightarrow \frac{\text{cosec}^2 x - 1}{\text{cosec}\,x} = a$; $\frac{\sec^2 x - 1}{\sec x} = b$

$\Rightarrow \frac{\cot^2 x}{\text{cosec}\,x} = a$; $\frac{\tan^2 x}{\sec x} = b$

$\frac{\cos^2 x}{\sin x} = a$; $\frac{\sin^2 x}{\cos x} = b$

$a^2b = \frac{\cos^4 x}{\sin^2 x} \cdot \frac{\sin^2 x}{\cos x} = \cos^3 x$

$\Rightarrow \cos x = (a^2b)^{1/2}$

$\cos^2 x = (a^2b)^{2/3}$

Similarly, $\sin^2 x = (ab^2)^{2/3}$

$\therefore \sin^2 x + \cos^2 x = 1 \Rightarrow (ab^2)^{2/3} + (a^2b)^{2/3} = 1$

49. increase in area

$\frac{\theta}{360°} \times \pi(23)^2 - \frac{\theta}{360°} \times \pi(12)^2$

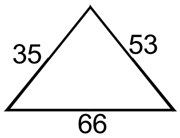
$\theta = 90°$

$= \frac{90°}{360°} \times \pi\left[(23)^2 - (12)^2\right]$

$= \frac{121 \times 5}{2}$

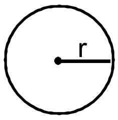
$= \frac{605}{2} = 302.5$

50.



Area of $\Delta = \sqrt{77(42)(24)(11)} = 924$

$\pi r^2 = 2(924)$

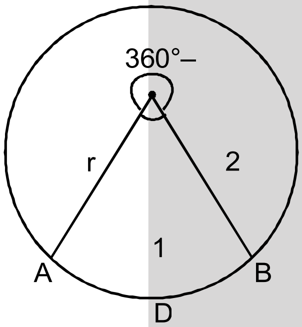


$r^2 = \dfrac{2 \times 924 \times 7}{22}$

$r^2 = 588$

$r = 14\sqrt{3}$

51.



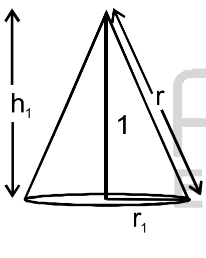
$$\frac{\text{Area of sector ADB}}{\text{Area of sector ACD}} = \frac{\frac{\theta}{360^\circ} \times \pi r^2}{\frac{360^\circ - \theta}{360^\circ} \times \pi r^2}$$

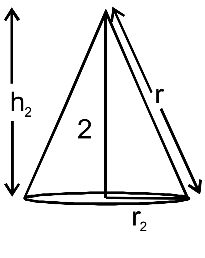
$\Rightarrow \dfrac{1}{2} = \dfrac{\theta}{360^\circ - \theta}$

$\Rightarrow q = 120^\circ$

$\therefore \widehat{ADB} = \dfrac{\theta}{360^\circ} \times 2\pi r = \dfrac{2\pi r}{3}$

$\Rightarrow \widehat{ACB} = \dfrac{4\pi r}{3}$





$\widehat{ADB}$ = circumference of base = $2\pi r_1$

$\dfrac{2\pi r}{3} = 2\pi r_1 \Rightarrow r_1 = \dfrac{r}{3}$

Similarly $r_2 = \dfrac{2r}{3}$

$h_1 = \sqrt{r^2 - r_1^2} = \sqrt{r^2 - \dfrac{r^2}{9}} = \dfrac{2\sqrt{2}r}{3}$

Similarly, $h_2 = \dfrac{\sqrt{5}r}{3}$

$$\frac{V_1}{V_2} = \frac{\frac{1}{3}\pi r_1^2 h_1}{\frac{1}{3}\pi r_2^2 h_2} = \left(\frac{r_1}{r_1}\right)^2 \left(\frac{h_1}{h_2}\right)^2 = \frac{1}{4} \times \frac{2\sqrt{2}}{\sqrt{5}}$$

$$= \frac{1}{\sqrt{10}}$$

52. Volume of metallic block = $1m^3$ ..(1)

let the side of the square base is x m

so, volume of the rectangular bar = $x^2 \times 9$ ..(2)

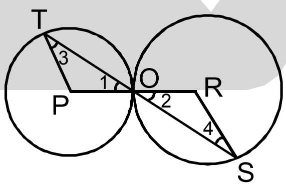
$9x^2 = 1 \Rightarrow x^2 = \dfrac{1}{9} \Rightarrow x = \dfrac{1}{3}$ m

side of cube possible = $\dfrac{1}{3}$ m

so, weight of the cube = weight of block $\times \left(\dfrac{1}{3}\right)^3$

$= 90 \times \dfrac{1}{27} = \dfrac{10}{3}$ kg $= 3\dfrac{1}{3}$ kg

53.



$\angle 1 = \angle 2$ (V.O.A.)

$\angle 1 = \angle 3$ (Same radius)

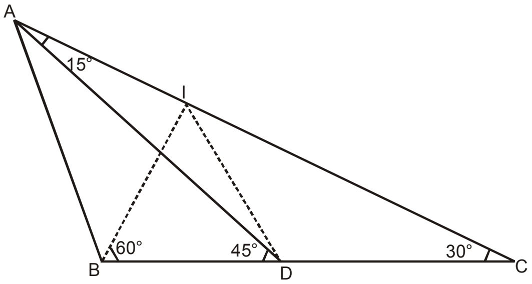
$\angle 2 = \angle 4$ (Same radius)

$\therefore \angle 3 = \angle 4$

As alternate interior angles are equal

$\therefore$ PT || RS

54.



Draw BL perpendicular to AC and join L to D. Since $\angle BCL = 30°$. we get $\angle CBL = 60°$. Since BLC is a right triangle with $\angle BCL = 30°$, we have BL = BC/2 = BD. Thus in triangle BLD, we observe that BL = BD and $\angle DBL = 60°$ and $\angle ADB = 45°$, we get $\angle ADL = 15°$

But $\angle DAL = 15°$. Thus LD = LA. We hence have LD = LA = LB. This implies that L is the circumcentre of the triangle BDA. Thus

$$\angle BAD = \frac{1}{2}\angle BLD = \frac{1}{2}\times 60° = 30°$$

$30° + 45° + \angle ABC = 180°$

hence $\angle ABC = 105°$

55. $PR = \sqrt{(R_1+r)^2-(R_1-r)^2} = \sqrt{4R_1r}$ ...(1)

$RQ = \sqrt{4R_2r}$ ...(2)

$PQ = \sqrt{4R_1R_2}$ ...(3)

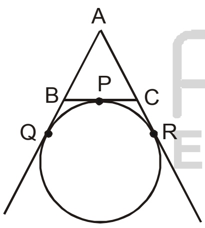
PQ = PR + RQ

$\Rightarrow \sqrt{4R_1R_2} = \sqrt{4R_1r} + \sqrt{4R_2r}$

$\sqrt{R_1R_2} = \sqrt{R_1r} + \sqrt{R_2r}$

$$\frac{1}{\sqrt{r}} = \frac{1}{\sqrt{R_2}} + \frac{1}{\sqrt{R_1}}$$

56.



Perimeter of triangle ABC = AB+BC+CA

15=(AQ–BQ)+(BP+PC)+(AR–CR)

15=2AQ

(BQ=BP, PC=RC,AQ=AR as tangent from extternal point to a circle are equal)

AQ=7.5 cm

57. $(x-6)^2 + (y+6)^2 = (x-3)^2 + (y+7)^2$ ..(1)

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

$y^2 - 6y + 9 = y^2 + 14y + 49$

$-20y = 40$

put y = –2 in equation (1)

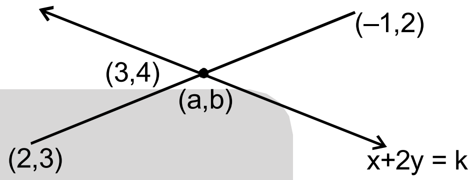
$(x-6)^2 + (4)^2 = (x-3)^2 + (5)^2$

$x^2 - 12x + 36 + 16 = x^2 - 6x + 9 + 25$

$-6x = -18$

x = 3

58.



$$a = \frac{-3+8}{3+4} = \frac{5}{7}$$

$$b = \frac{6+12}{7} = \frac{18}{7}$$

x + 2y = k

$$\frac{5}{7} + 2\times\frac{18}{7} = k$$

$$\frac{5}{7} + \frac{36}{7} = k$$

$$\frac{41}{7} = k$$

59. a > b > c

$$\frac{a+b+c}{3} = c + 10 = a - 15 = k$$

b = 5 c = k - 10

a = k + 15

a + b + c = 3k

k + 15 + 5 + k – 10 = 3k

10 = k

a = 25

b = 5

c = 0

$$\text{mean} = \frac{25^2+5^2+0^2}{3} = \frac{650}{3} = 216\frac{2}{3}$$

60. P(sum at least 5)=1–P(Getting sum 3 or 4)

no of ways getting sum 3 = 1 way i.e. (1,1,1,)

no of ways getting sum 4 = 3 ways i.e. (1,1,2,),(1,2,1),(2,1,1)

So $P(\text{sum at least }5) = 1 - \frac{1+3}{216} = \frac{212}{216} = \frac{53}{54}$