NTSE STAGE – II (2015)

SAT

Hints & Solutions

1. 3.

Sol. As per Chargaff's law
A = T
G = C
And A + G = C + T
Here, Adenine is 200 therefore cytosine is 400.

2. 1

Sol. Fungus are eukaryotic, multicellular, heterotrophic organisms. There cell wall is made up to chitin.

3. 2

Sol.

Draco	→	Flying lizard
Echidna	→	Egg laying mammal
Exocoetus	→	Flying fish
Struthio	→	Flightless bird

4. 4

Sol. The main functions of golgi bodies are secretion, packaging, modification.

5. 2

Sol. Since autoclave soil is devoid of bacteria so leguminous plant fails to produce root nodules.

6. 2

Sol. The causative agent of sleeping sickness is trypanosoma which is extracellular parasite found in blood plasma. It is transmitted through blood sucking insect (Tsetse fly).

7. 1

Sol. Haemophilia is x – linked recessive chromosomal disorder. If a haemophilic male marries a normal female their all son will be normal.
Haemophilic male - $x^h y$
Normal female – xx

$x^h y$ x xx

	x^h	y
x	xx^h	xy
x	xx^h	xy

xx^h – daughters are carrier
xy – normal sons

8. 4

Sol. In domestic sewage coliform bacterias are present in Abundance.

9. 3

Sol. Prolonged exposure to the fumes by incomplete combustion of coal causes death of human because of the formation of carboxyhaemoglobin in human blood.

10. 3

Sol. The phenomenon of normal breathing constitute both active inspiratory and expiratory phases.

11. 3
Sol. Stem of some plants having chlorophyll perform photosynthesis.

12. 1
Sol. Lateral meristem is responsible for the lateral growth of stem

13. 4
Sol. Reflex action follows the path of reflex arc, that is
Receptor $\rightarrow$ sensory nerve $\rightarrow$ spinal cord $\rightarrow$ motor nerve $\rightarrow$ muscle.

14. 2
Sol. Human female carry immature eggs in their ovary even before birth.

15. 4
Sol. At constant temperature if volume decreases, pressure increases. Pressure is a result of collision.

16. 4.
Sol. In 100 mL solution weight of S = 28.6 gm
In 50 mL solution weight of S = 14.3 gm] At 50^oC
At 40°C amount of S in 50 mL solution
= 14.3 – 2.4 = 11.9 gm in 50 mL

$$\%S = \frac{11.9 \times 100}{50} = 23.8\%\left(\frac{W}{V}\right)$$

17. 4
Sol. $\underset{12g}{C} + \underset{32g}{O_2} \longrightarrow \underset{44g}{CO_2}$

$\therefore$ 6 g C gives 22 g CO_2

18. 1
Sol. Law of conservation of mass is valid for the chemical reactions.

19. 3
Sol. α-particle is a nucleus of helium

$_2^4He^{++}$ $n^o = 4 - 2 = 2$

$p^+ = 2$

$e^- = 0$

20. 2
Sol. Average atomic mass of $z = \frac{69 \times 60 + 40 \times 71}{100}$ = 69.8

21. 4
Sol. $\underset{A}{2Pb(NO_3)_2} \xrightarrow{\Delta} \underset{\text{yellow residue}}{2PbO} + \underset{\text{Brown gas}}{4NO_2}\uparrow + O_2\uparrow$

$PbO + 2NaOH \longrightarrow \underset{\text{white}}{Na_2PbO_2} + H_2O$

22. 2
Sol. $\underset{(A)}{2HCl} + \underset{(B)}{Na_2CO_3} \longrightarrow \underset{(C)}{2NaCl} + \underset{(D)}{CO_2} + H_2O$

23. 1 & 2

Sol. $2\underset{x}{Cu_2S} + 3O_2 \longrightarrow 2\underset{y}{Cu_2O} + 2SO_2$

$2\underset{y}{Cu_2O} + \underset{x}{Cu_2S} \longrightarrow 6\ Cu + SO_2$

$2\underset{x}{HgS}(s) + 3O_2(g) \xrightarrow{Heat} 2\underset{y}{HgO}(s) + 2SO_2(g)$

$2\underset{y}{HgO}(s) + \underset{x}{HgS}(s) \longrightarrow 3Hg(l) + SO_2(g)$

24. 2

Sol. Mostly Nitrates ore are soluble in water so not found as an ore.

25. 3

Sol. $C-C-C-C-Br$ $\qquad$ $C-C(-C)-C-Br$

$C-C(-Br)-C-C$ $\qquad$ $C-C(-C)-C-Br$

26. 1

Sol. Total e^- in C_2H_5CHO = 18 + 6 + 8 = 32

e^- involved in bonding = 4 + 4 + 6 + 4 + 2 = 20

27. 3

Sol. (1) X is most electropositive

(2) W is smaller than X.

28. 2

Sol. Suppose the bus is caught at a time t after its starts.

Distance travelled by bus during this interval is $S = \frac{1}{2}at^2$ …(i)

During this interval the man travels at a distance $(S + d) = u \times t$ …(ii)

From (i) and (ii)

$\frac{1}{2}at^2 - ut + d = 0$

$$\Rightarrow \quad t = \frac{u \pm \sqrt{u^2 - 4\left(\frac{a}{2}\right)d}}{2 \times \frac{a}{2}}$$

The man will catch the bus if t is real and positive. Therefore, $u^2 \geq 2ad$.

29. 3

Sol. Distance travelled in last 1 sec. of upward journey is equal to distance travelled in 1st sec. of downward journey and i.e. $S = \frac{1}{2}g(1)^2$.

30. 4

Sol. $g_A = \frac{GM_A}{R_A^2} = \frac{G\frac{4}{3}\pi R_A^3 \rho_A}{R_A^2}$ …(i)

$g_B = \frac{GM_B}{R_B^2} = \frac{G\frac{4}{3}\pi R_B^3 \rho_B}{R_B^2}$ …(ii)

From (i) and (ii)

$\frac{g_A}{g_B} = \frac{R_A \rho_A}{R_B \rho_B}$

31. 3

Sol. In all three cases force is perpendicular to displacement. Therefore $W_1 = W_2 = W_3 = 0$.

32. 4

Sol. In option 4 the sum of kinetic energy and potential energy is less than the total mechanical energy.

33. 2

Sol. The disc is making six rotations in 1 second. In one rotation of disc sixty holes are passing over the source. Therefore, in 1 second the fluctuation in sound is 360 times.

34. 4

Sol. Factual

35. 2

Sol. Equivalent resistance of circuit $\frac{4R}{3}$.

$I = \frac{3V}{4R}$

36. Let resistance of 12 W, 2 W and 6 W are R_1, R_2 and R_3 respectively.

Where $R_1 = \frac{V_1^2}{12}$, $R_2 = \frac{V_2^2}{2}$ and $R_3 = \frac{V_3^2}{6}$

Here V_1, V_2 and V_3 are voltage rating of the bulbs respectively.

Option 1 will be correct if rating of each bulb is 46.46 V.

Option 2 will be correct if rating of each bulb is 12 V.

$H = \frac{V^2}{R} \times t$

37. 2

Sol. Electric charges in motion produces magnetic field.

38. 2

Sol. $\vec{F} = i(\vec{\ell} \times \vec{B})$

39. 2

Sol. Factual

40. 3

Sol. Factual

41. x and y LCM = 720
12x and 5y LCM = 720
So y must have 12 and x must have 5
Let x = $x = 5 \times A$, $y = 12 \times B$
$5 \times A \times 12 \times B = 720 \quad A = 1, B = 12$
Hence y = $12 \times 12 = 144$
For other values of B option not matching.

42. $x = 5q_1 + 2$ and $y = 5q_2 + 4$
Now $x + y = 5(q_1 + q_2) + 6$
Remainder when $x + y$ is divided by 5 = 1
$\Rightarrow z = 1$
So value of $\frac{2z - 5}{3} = -1$

43. 1st zeros are a – d, a, a + d
Sum of zero $3a = \frac{144}{64} \Rightarrow a = \frac{3}{4}$
Also $(a - d) \times a \times (a + d) = \frac{15}{64}$
Putting $a = \frac{3}{4}$ in above equation and solving we get $d = \pm\frac{1}{2}$
So, zeros are $\frac{1}{4}, \frac{3}{4}, \frac{5}{4}$
Difference between largest and smallest zeros = 1

44. $2x + y = 10$
$x + y = 10 - y$
Keeping y = 0 $x + y = 10$ maximum
Keeping y, x = 5 since they cannot be negative.
$x + y = 10 - 5 = 5$ minimum
So sum $= 10 + 5 = 15$

45. Let $y + \frac{1}{y} = t \Rightarrow y^2 + \frac{1}{y^2} = t^2 = 2$
The given equation reduces to:
$7t - 2(t^2 - 2) = 9$
$\Rightarrow 2t^2 - 7t + 5 = 0$

$t = 1$, $y + \frac{1}{y} = 1$ $\Rightarrow y^2 - y + 1 = 0$ This equation has no real solutions	$t = \frac{5}{2}$ $y + \frac{1}{y} = \frac{5}{2}$ $\Rightarrow 2y^2 - 5y + 2 = 0$ $\Rightarrow y = \frac{1}{2}, y = 2$

So number of integral solutions = 1

46. Given $A + B = 16\pi \text{ cm}^2$ and $A = \pi r^2 \text{cm}^2$

$\Rightarrow B = \pi\left(16 - r^2\right)$

Now, A, B, A + B are in A.P.

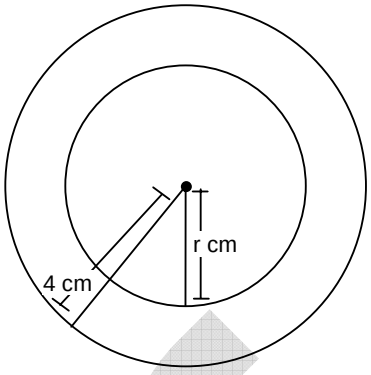
$\Rightarrow 2B = A + (A + B)$

$\Rightarrow B = 2A$

$\Rightarrow \pi\left[16 - r^2\right] = 2\pi r^2$

$\Rightarrow r = \dfrac{4\sqrt{3}}{3}$ cm.

So, diameter $= \dfrac{8\sqrt{3}}{3}$cm



47. $a + b - c = 8$

$b + c - a = 8$

$a + c - b = 8$

$a + b - c = a + c - b$

$2b = 2c$

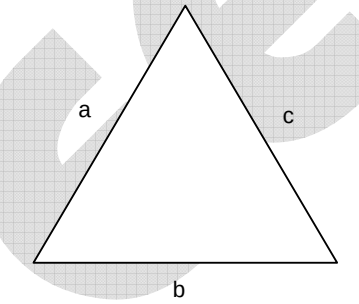
$b = c$

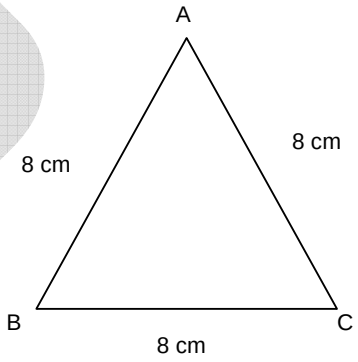
$a = b = c$

Hence $a = b = c = 8$,

Area of equilateral triangle $= \dfrac{\sqrt{3}}{4}(8)^2$

$= \dfrac{\sqrt{3}}{4} \times 64 = 16\sqrt{3} \text{ cm}^2$





48. $\cos ec\, x - \cot x = \dfrac{1}{3}$

$\Rightarrow \dfrac{1}{\sin x} - \dfrac{\cos x}{\sin x} = \dfrac{1}{3}$

$\Rightarrow \dfrac{1 - \cos x}{\sin x} = \dfrac{1}{3}$

$\Rightarrow 3(1 - \cos x) = \sin x$

– Squaring both sides

$\Rightarrow 9\left(1 + \cos^2 x - 2\cos x\right) = \sin^2 x$

$\Rightarrow 10\cos^2 x - 18\cos x + 8 = 0$

$\Rightarrow 5\cos^2 x - 9\cos x + 4 = 0$

$\Rightarrow 5\cos^2 x - 5\cos x - 4\cos x + 4 = 0$

$\Rightarrow 5\cos x(\cos x - 1) - 4(\cos x - 1) = 0$

$\Rightarrow \cos x = 1$ and $\cos x = \dfrac{4}{5}$

$\Rightarrow \cos^2 x - \sin^2 x$

$$= \frac{16}{25} - \frac{9}{25} = \frac{7}{25}$$

49. $AC = \frac{14}{2} = 7$

$AM = \frac{7}{2}$

OA = Radius

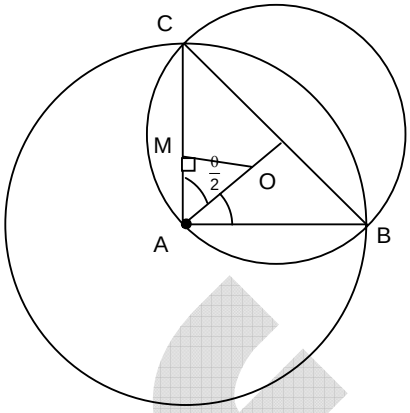
$\cos\frac{\theta}{2} = \frac{AM}{OA}$

OA = r = AM $\sec\frac{\theta}{2} = \frac{7}{2}\sec\frac{\theta}{2}$

Area of circle with centre O

$= \frac{22}{7} \times \frac{7}{2} \times \frac{7}{2} \times \sec^2\frac{\theta}{2}$

$= \frac{77}{2}\sec^2\frac{\theta}{2}$



50. Join O to Q

$\angle OPQ = 45^o = \angle OQP \Rightarrow \angle POQ = 90^o$

$\Rightarrow \angle POQ = 90^o$

Also, $\angle SQP = 90^o$

$\Rightarrow \angle SQO = 45^o = \angle SOQ$

$\Rightarrow \Delta OSQ$ is isosceles

$\Rightarrow OS = 6\sqrt{2}\,cm = QS$

Area of trapezium OSQP

= area (ΔPOQ) + area (ΔOSQ)

$= \frac{1}{2} \times 12 \times 12 + \frac{1}{2} \times 6\sqrt{2} \times 6\sqrt{2}$

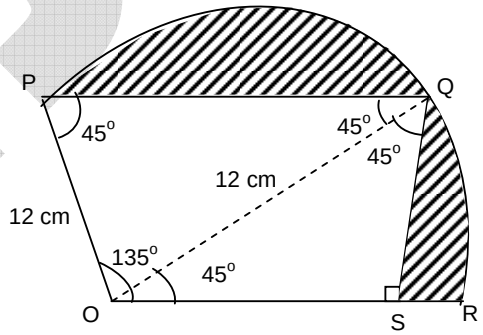
= 108 cm^2

Shaded area

= Area of sector – Area of trapezium

$= \frac{135^o}{360^o} \times \frac{22}{7} \times 12 \times 12 - 108$

$= 61\frac{5}{7}\ cm^2$



51. When a solid sphere is cut into identical pieces by three mutually perpendicular planes then there will be total 8 identical pieces and each piece will have 4 surfaces. 3 of these surfaces are quadrants and one is curved.

So, total area of 8 pieces

$= 4\pi r^2 + 3 \times \frac{90^o}{360^o} \times \pi r^2 \times 8$

$= 10\pi r^2$

Increase in surface area $= 6\pi r^2$

Increase % $= \frac{6\pi r^2}{4\pi r^2} \times 100 = 150\%$

52. ΔOCD and ΔDEB are similar

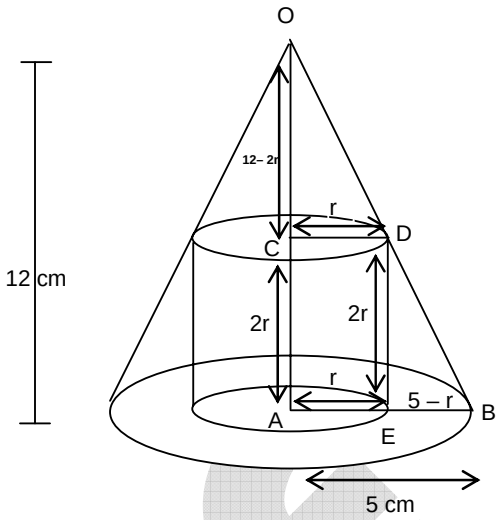
$\Rightarrow \dfrac{12-2r}{r} = \dfrac{2r}{5-r}$

$\Rightarrow r = \dfrac{30}{11}$ cm

$\Rightarrow$ height of cylinder $= \dfrac{60}{11}$ cm

Volume of cylinder $= \dfrac{22}{7} \times \dfrac{30}{11} \times \dfrac{30}{11} \times \dfrac{60}{11}$

$= 127.5 \text{ cm}^3$



53. $\tan\theta = \dfrac{1-x}{1}$

$\tan(45-\theta) = \dfrac{1-y}{1}$

$\dfrac{1-\tan\theta}{1+\tan\theta} = \tan(45-\theta)$

$\dfrac{1-(1-x)}{1+(1-x)} = 1-y$

$\dfrac{x}{2-x} = 1-y$

If $x = y$ $\dfrac{x}{2-x} = 1-x$

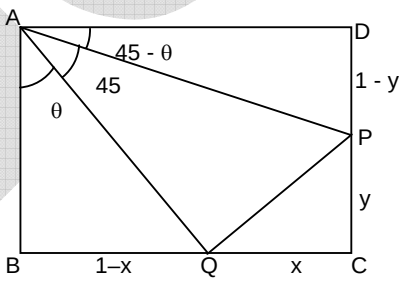
$\therefore x = 2-\sqrt{2}$

$QC = PC = 2-\sqrt{2}$

$PQ = \sqrt{2}\left(2-\sqrt{2}\right)$

$PQ + QC + PC = 2\left(2-\sqrt{2}\right) + \sqrt{2}\left(2-\sqrt{2}\right)$

$= 4 - 2\sqrt{2} + 2\sqrt{2} - 2 = 2$



54. $(1+x)^2 + 1^2 - 1^2 = 2(1+x)(1)\cos 36^\circ$

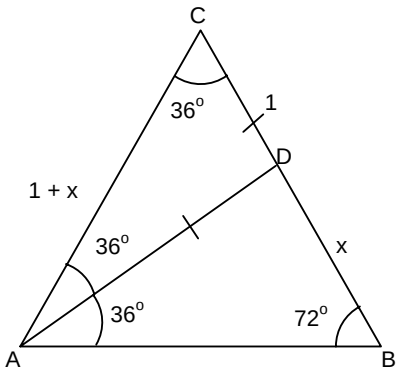
$\dfrac{(1+x)^2}{2(1+x)} = \cos 36^\circ$

$1 + x = 2\cos 36^\circ$

$x = 2\cos 36^\circ - 1$

$= 2\left(\dfrac{\sqrt{5}+1}{4}\right) - 1$

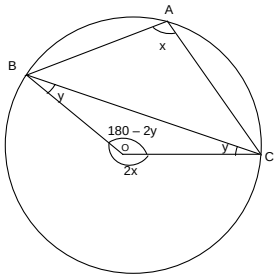
$= \dfrac{\sqrt{5}-1}{2}$



55. From figure, we have

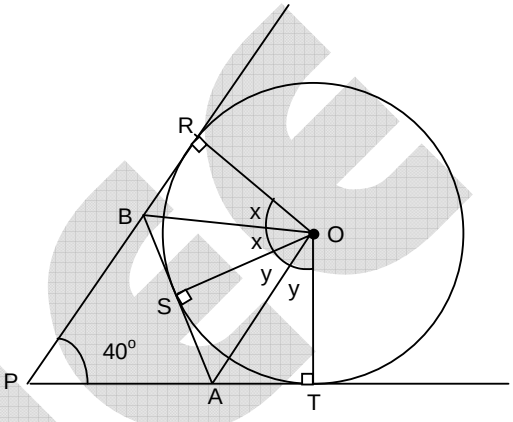
$180 - 2y + 2x = 360^o$

$\Rightarrow x - y = 90^o$



56. $2x + 2y = 140^o$

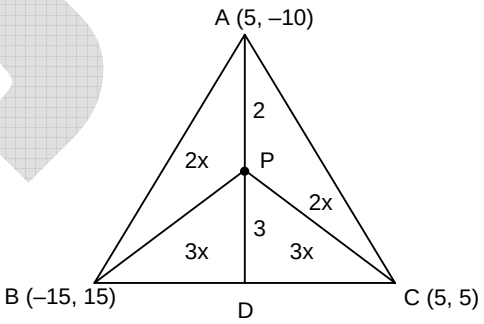
$x + y = 70^o$



57. Let $ar(\Delta PBD) = 3x = ar(\Delta PDC)$

$\Rightarrow ar(\Delta ABP) = 2x = ar(\Delta APC)$

Now, $\dfrac{ar(\Delta PBC)}{ar(\Delta ABC)} = \dfrac{6x}{10x} = \dfrac{3}{5}$



58. Let point P (k, 5 k + 3)

Mid point of $PQ = M\left(\dfrac{k+3}{2}, \dfrac{5k+3(-2)}{2}\right)$

$= M\left(\dfrac{k+3}{2}, \dfrac{5k+1}{2}\right)$

Now from given options equation $y = 5x - 7$ gets satisfied by point M.

59. 0, 1, 5, 2

Total number of 3 digits no $= 4! - 3! = 18$

Number divisible by 5

Case I When 0 is at unit place _ _0

3×2 ways = 6

Case II When 5 is at unit place_ _ 5

2×2 ways = 4

Total = 10

$P(E) = \dfrac{10}{18} = \dfrac{5}{9}$

60. Sum of 15 numbers $= 15 \times 13 = 195$
Minimum possible value of sum of first 13 numbers $= 1 + 2 + 3..... + 13 = 91$
Sum of largest two numbers $= 195 - 91 = 104$
Numbers can be 53 and 51
$\Rightarrow$ Second largest number = 51