NTSE STAGE II
CODE: 13 – 15
SAT
HINTS & SOLUTIONS

1. **3**
Sol. Aerobic respiration takes place in mitochondria.

2. **2**
Sol. Cow has a special additional part in their stomach to digest cellulose present in the food.

3. **1**
Sol. In touch me not plant leaflets are closed after contact due to change in Turgon pressure.

4. **3**
Sol. Pancreas is known as 'mixocrine or dual gland'.

5. **4**
Sol. Placenta provide nutrition to the foetus during pregnancy in human beings.

6. **4**
Sol. Endocrine glands pour their secretions directly in the blood.

7 **2**
Sol. Cell of meristematic tissues are actively dividing having dense cytoplasm, thin cell wall and no vacuoles or minute vacuole.

8. **3**
Sol. The 4 characteristics present in chordates are
– Notocord
– Pharyngeal gill slits or pouches
– Dorsal tubular nerve cord
– Post anal Tail

9. **3**
Sol. In symbiotic relationship between a bacterium and a root of leguminous plants the bacteria provide NH_4 to plant and the root provides carbon.

10. **1**
Sol. Biological magnification is the Accumulation of chemicals from lower trophic level to higher trophic level.

11. **4**
Sol. Ex – situ conservation–
Strategies include botanical gardens, zoos, conservation stands, gene, pollen, seed, seedling, tissue culture and DNA banks.

12. **2**
Sol. Temperature increases due to the entrapment of infra red radiations.

13. **2**
Sol. A. small pox caused by virus
B. cholera caused by bacteria.

C. the carrier organism of malaria is female anopheles mosquito
D. deficiency of iron leads to anaemia.

14. **4**

Sol. The phenotype ratio of dihybrid cross is 9:3:3:1

$\therefore \frac{240 \times 1}{16} = 15$

This shows wrinkled and green is the recessive character.

15. **2**

Sol. Number of neutrons in one molecule of water(H_2O) = 8

Number of neutrons in five moles of water $= 8 \times 5 \times 6.022 \times 10^{23}$

$= 240.88 \times 10^{23}$

$= 2.4088 \times 10^{25}$

$\simeq 2.409 \times 10^{25}$

16. **4**

Sol. Sodium is highly reactive, so it will form precipitation of $Cu(OH)_2$.
Iron is more reactive than copper
So, it displaces copper from aqueous solution of copper sulphate

$Fe + CuSO_4 \longrightarrow FeSO_4 + Cu$

17. **2**

Sol. A is suspension as particles are visible to naked eye and settle down.
C is solution as beam of light is invisible in it
B and D are colloids as particles are invisible and beam of light visible.

18. **2**

Sol. Alpha particles penetrate through thin aluminium foil and scattering cannot be observed.

19. **3**

Sol. Magnesium ribbon is rubbed with sand paper to remove magnesium oxide layer.

20. **2**

Sol. Formation of CaO from $CaCO_3$, Na_2CO_3 from $NaHCO_3$ and Hg from HgO are undergoing thermal decomposition.
Al from Al_2O_3 is electrolytic decomposition

21. **1**

Sol. X is amphoteric in nature and electropositive

22. **2**

Sol. Z is sodium chloride, which does not conduct electricity in its pure solid state.

23. **4**

Sol. Covalent bonds in NH_4^+ and ionic bond between NH_4^+ and Cl^-

24. **3**

Sol. Sulphur cannot be used as reducing agent

25. **4**

Sol. Number of oxygen atoms = 9.033×10^{23}

Number of moles of oxygen atoms = $\frac{9.033 \times 10^{23}}{6.022 \times 10^{23}} = 1.5$

Mass of 1.5 mole oxygen atoms = $1.5 \times 16 = 24$

$2H_2 + O_2 \longrightarrow 2H_2O$

Number of moles of hydrogen atoms = $1.5 \times 2 = 3$

26. **4**

Sol. $C_{13}H_{26}O_2$, $C_2H_4O_2$ and $C_9H_{18}O_2$ are in the forms of C_nH_{2n+1} COOH and $C_7H_{12}O_2$ is not in this form.

27. **3**

Sol. Soap foam appears white as it reflects light of all wavelengths

28. **2**

Sol. $\dfrac{(n + 4.8 \times 10^{18}) \times 1.6 \times 10^{-19}}{1} = 1.12$

$\Rightarrow$ $n = 2.2 \times 10^{18}$

29. **3**

Sol. A solenoid of finite length carrying current produces magnetic field like bar magnet.

30. **4**

Sol. $i = \dfrac{30}{10} = 3A$; $V - V_A = 10 \times 1 = 10$

$i_1 = 1A$ (upper branch) $V - V_B = 2 \times 10 = 20$

$i_2 = 2A$ (lower branch) $V_A - V_B = 10$ V

31. **1**

Sol. Magnetic force does not affect the magnitude of velocity. Because magnetic force always act perpendicular to velocity.

32. **3**

Sol. Force due to electric field changes magnitude of velocity and hence momentum.

33. **3**

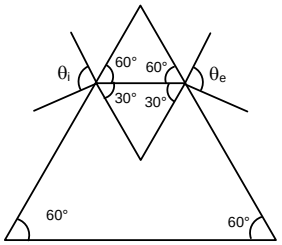
Sol. $\delta = (i_1 - r_1) + (i_2 - r_2)$

$60° = (\theta_i - 30°) + (\theta_e - 30°)$ (since $r_1 = r_2 = 30°$)

$\Rightarrow$ $\theta_i + \theta_e = 120°$

$2\theta_i = 120°$ (since, $\theta_i = \theta_e$)

$\theta_i = \theta_e = 60°$



34. **1**

Sol. SPEAR should be thrown at actual object which is below the image.

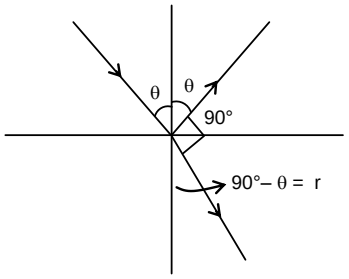
LASER will follow refraction of light hence it will bend. So it should be sent towards virtual image.

35. **2**

Sol. $\sin\theta = \mu \sin(90° - \theta)$

$\tan\theta = \mu = \sqrt{3}$

$\theta = 60°$, $r = 90° - \theta = 30°$



36. **1**

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

$\Rightarrow$ v = –300 ; u = ∞

$\Rightarrow \frac{1}{f}=\frac{1}{-300}-\frac{1}{\infty}$

$\Rightarrow$ f = –300

2nd case

$\frac{1}{-300}=\frac{1}{-50}-\frac{1}{-d} \Rightarrow$ d = 60 cm

37. **4**

Sol. From conservation of energy

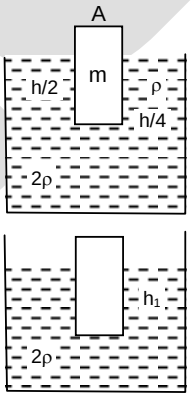
$\frac{1}{2}mv^2+mgh=\frac{1}{2}mv_1^2$

v_1 is the speed before hitting ground.

38. **3**

Sol. $A\frac{h}{2}\times\rho g+A\times\frac{h}{4}\times 2\rho g=mg$ …(i)

$Ah_1 \times 2\rho h = mg$ …(ii)



From (i) and (ii)

$A\frac{h}{2}\times\rho g+A\frac{h}{4}\times 2\rho g=Ah_1\times 2\rho g$

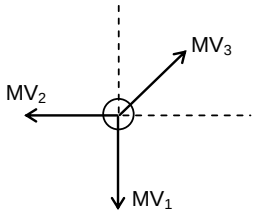
$\Rightarrow h_1=\frac{h}{2}$

39. **3**

Sol. $F_{net} = 0$

$\vec{P}_1+\vec{P}_2+\vec{P}_3=0$

$\Rightarrow V_3=\sqrt{V_1^2+V_2^2}$



40. **1**

Sol. $F \times x_1 = KE$

$F \times x_2 = KE$

$\Rightarrow \quad x_1 = x_2$

41. 1

Sol. $N=13Q_1+3$

$N=21Q_2+11$

Number lies between 500 and 600. So the only number is 536

$\therefore$ Remainder by 19 = 4

42. 4

Sol. $0.\overline{34}+0.3\overline{4}=0.68787.....=0.6\overline{87}$

43. 1

Sol. $P(x) = k(x+1)^2$

$P(-2) \equiv k(-1)^2 = 2$

$\Rightarrow k = 2$

$\therefore P(2) = 2(2+1)^2$

= 18

44. 4

Sol. $x - y = 2$

$kx + y = 3$

$x = \frac{5}{1+k}, y = \frac{3-2k}{1+k}$

$\Rightarrow 1+k > 0$ and $3-2k > 0$

$k > -1$ and $k < \frac{3}{2}$

45. 4

Sol. $\frac{a_{10} - 2a_8}{2a_9}$

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

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

$= \frac{\alpha^8(6\alpha) - \beta^8(6\beta)}{2(\alpha^9 - \beta^9)}$

$= \frac{6(\alpha^9 - \beta^9)}{2(\alpha^9 - \beta^9)}$

= 3

46. 2

Sol. $S_1 + S_2 + ... + S_r$

$= n(1+2+.....+r) + \frac{n^2}{2}\left[1+3+5+.....+(2r-1)\right]$

$-\frac{n}{2}(1+3+5+.....(2r-1))$

$= \frac{r.(r+1)}{2}.n + \frac{n^2r^2}{2} - \frac{nr^2}{2}$

$= \frac{nr(1+nr)}{2}$

47. 2

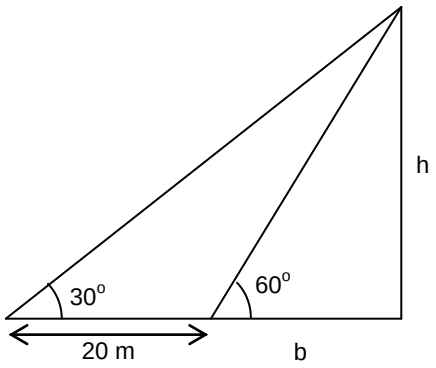
Sol. $\tan 60 = \frac{h}{b} \Rightarrow h = \sqrt{3}b$

$\tan 30 = \frac{h}{b+20} \quad h = \frac{b+20}{\sqrt{3}}$

So, $\sqrt{3}b = \frac{b+20}{\sqrt{3}}$

$3b = b + 20$

$b = 10\,m$



48. 1

Sol. $\operatorname{cosec} x - \sin x = a$

$1 - \sin^2 x = a\sin x$

$\cos^2 x = a\sin x$

Again, $\sec x - \cos x = b$

$1 - \cos^2 x = b\cos x$

$\sin^2 x = b\cos x$

$\left(\frac{\sin^2 x}{b}\right)^2 = a\sin x$

So, $\sin^3 x = ab^2$

$\cos^3 x = a^2 b$

$\sin^2 x + \cos^2 x = 1$

$\left(ab^2\right)^{\frac{2}{3}} + \left(a^2 b\right)^{\frac{2}{3}} = 1$

49. 3

Sol. When rope = 12 m, area $= \frac{1}{4}\pi\left(12^2\right)$

When rope = 23 m, area $= \frac{1}{4}\pi\left(23^2\right)$

$\therefore$ Increase in area $= \frac{1}{4}\pi\left(23^2 - 12^2\right)$

$= \frac{1}{4}.\frac{22}{7}.35.11$

$= 302.5\ m^2$

50. 1

Sol. Area of triangular field $= 924\,m^2$

$\therefore$ Area of circular field $= 1848\ m^2$

$\therefore$ Radius of circular field $= 14\sqrt{3}\,m$

51. 3

Sol. $r_1 : r_2 = 1:2$

$\Rightarrow \theta = 120^{O}$ (comparing sector circumference)

$\therefore r_1 = \frac{\ell}{3}$

$\therefore r_2 = \frac{2\ell}{3}$

$h_1^2 = \frac{5}{4} r_1^2$

$h_2^2 = 8 r_2^2$

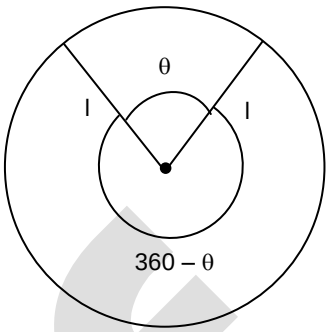
$\therefore \frac{v_1}{v_2} = \frac{r_1^2 . h_1}{r_2^2 . h_2}$

$= \sqrt{\frac{r_1^4 . h_1^2}{r_2^4 . h_2^2}}$

$= \sqrt{\frac{32}{5} \times \frac{1}{64}}$

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

$= 1 : \sqrt{10}$



52. 4

Sol. Size of biggest cube $= \frac{1}{3}$m

$\therefore$ Weight of cube $= \frac{1}{27} \times 90 =$

$= 3\frac{1}{3}$kg

53. 4

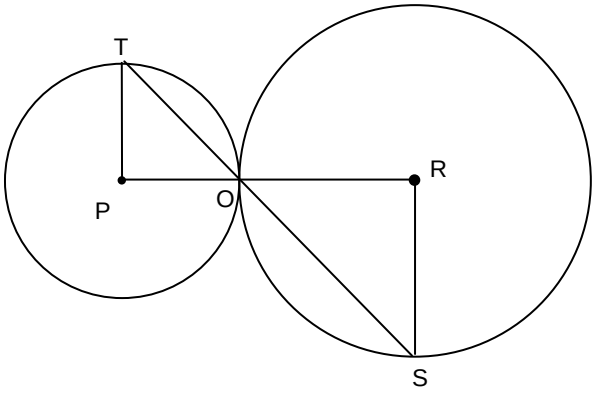
Sol. $\angle POT = \angle PTO$ (angles opposite to equal sides)

$\angle RSO = \angle ROS$ (angles opposite to equal sides)

$\angle POT = \angle ROS$ (Vertically opposite angles)

$\therefore \angle PTO = \angle RSO$

$PT \parallel RS$ (Converse of alternate angle theorem)

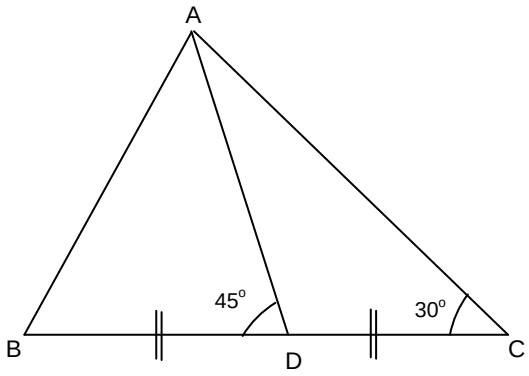


54. 2

Sol. $\angle ADC = 135^o$

$\therefore \angle BAD + \angle ABC = 135^o$

$\therefore$ option (2) is the valid answer.



55. 4

Sol. $PM = 2\sqrt{R_1 r}$ (direct common tangent)

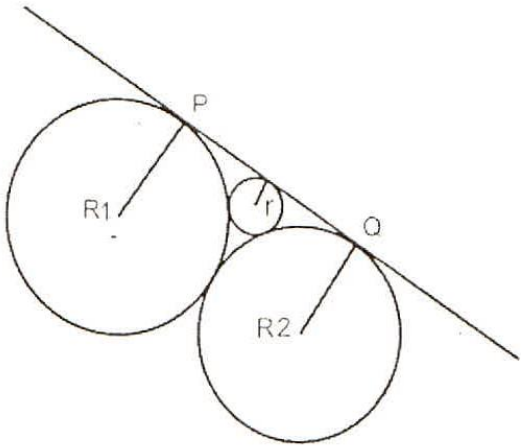
$PQ = 2\sqrt{R_1 . R_2}$

$MQ = 2\sqrt{r . R_2}$

$MP + MQ = PQ$

$2\sqrt{R_1 r} + 2\sqrt{r R_2} = 2\sqrt{R_1 . R_2}$

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



56. 2

Sol. Let BP = x cm = BQ

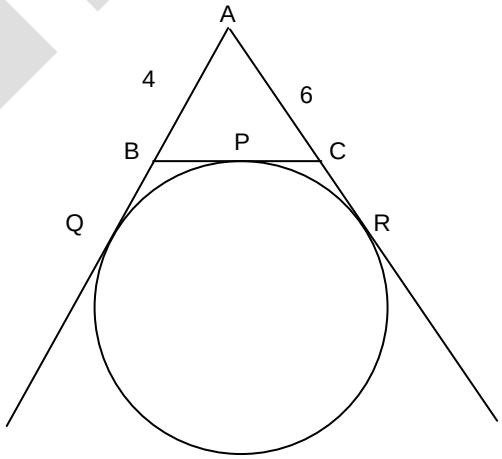
Then, CP = 5 – x cm = CR

AQ = AR (tangents from a point to a circle are equal)

$4 + x = 6 + (5 - x)$

$x = 3.5$

$\therefore AQ = 7.5$



57. 3

Sol. Let the centre be (x, y)

$$\sqrt{(x-6)^2 + (y+6)^2} = \sqrt{(x-3)^2 + (y+7)^2}$$

$\Rightarrow 12y - 12x + 72 = 14y - 6x + 58$

$\Rightarrow 2y + 6x - 14 = 0$

$\Rightarrow 3x + y = 7$ (1)

Again

$$\sqrt{(x-6)^2 + (y+6)^2} = \sqrt{(x-3)^2 + (y-3)^2}$$

$12y - 12x + 72 = -6x - 6y + 18$

$6x - 18y = 54$

$x - 3y = 9$ (2)

$\therefore x = 3,\ y = -2$

58. 4

Sol. Using section formula

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

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

$x + 2y = k$

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

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

59. 4

Sol. Let the three numbers be x, 5, y (arranged in ascending order)

$$10 + x = \frac{5 + x + y}{3}$$

$30 + 3x = 5 + x + y$

$2x - y = -25$ (1)

Again, $y - 15 = \frac{5 + x + y}{3}$

$3y - 45 = 5 + x + y$

$x - 2y = -50$ (2)

Solving, we get x = 0 and y = 25

$$\therefore \text{ Mean of squares } = \frac{0 + 25 + 625}{3}$$

$$= \frac{650}{3} = 216\frac{2}{3}$$

60. 4

Sol. Favourable case = 212

Total cases = 216

$$\therefore \text{ Probability } = \frac{53}{54}$$