NTSE STAGE II

CODE: 13 – 15

SAT

ANSWER KEYS

Held on: May 14, 2017

ANSWER KEYS

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

HINTS & SOLUTIONS

1. 4

Sol. Combination of abscisic Acid + Auxin will show slowest growth

2. 3

Sol. Cardiac muscle cells are cylindrical and uninucleated

3. 2

Sol. Hypothalamus and cerbellum controls most of the involuntary actions.

4. 1

Sol. Arthropods are bilaterally symmetrical, have coelomic cavity, segmented body and jointed appendages.

5. 1

Sol. Nostoc are Bacteria are prokaryotes penicillin is fungi and spirogyra is green algae.

6. 1

Sol. Flower of given plant possess three sepal and no secondary vascular tissues

7. 2

Sol. The process of producing new varieties of living organisms is called Artificial selection.

8. 2

Sol. Wings of bat – wings of butterfly and wings of bird – wings of bat are pairs of analogous organs.

9. 4

Sol. Trichoderma is used as a bio pesticide

10. 4

Sol. Test cross involves the breeding of an individual with a phenotypically recessive individual

TT TT tt

↓

F_1 | Tt | X tt

11. 3

Sol. Elephantiasis is caused by nematode, acne is caused by Staphylococus, Kala azar is caused by leishmania and sleeping sickness by Trypanosoma

12. 4

Sol. Pancreatic juice contains trypsin and lipase.

13. 4

Sol. Plant which produces motile sperms and dominant generation has diploid cells. It belongs to pteridophyte

14. 3

Sol. $f = i \times 2^n$

Where f = final number of Bacteria

i = initial number of bacteria

n = number of generation

i.e. $n = \dfrac{\text{total time for division}}{\text{time taken for one division}}$

i.e. $n = \dfrac{120\ \text{min}}{20\ \text{min}}$ $n = 6$

$\therefore f = i \times 2^n$

$f = 10 \times 2^6 = 10 \times 2^6$

15. 2

Sol. Metal (M) = Valency = 3
Nitride(N^{3-}) = Valency = 3
So, MN

16. 3

Sol. Brass is an alloy, alloy is a homogeneous mixture.

17. 1

Sol. No. of moles of glucose = 0.01
Total number of oxygen atom in 0.01 mole is $0.01 \times 6 \times 6.023 \times 10^{23} = 0.36 \times 10^{23}$
No. of mole of H_2O = 2
Total no. of oxygen atom in 2 moles of H_2O is $2 \times 1 \times 6.022 \times 10^{23} = 12.04 \times 10^{23}$
Thus total no. of oxygen atom in solution = 12.405×10^{23}

18. 4

Sol. Average atomic mass = $\dfrac{35 \times 1 + 37 \times 3}{1+3} = \dfrac{35+111}{4} = \dfrac{146}{4} = 36.5$

19. 1

Sol. Turmeric solution turns red colour in basic solution.

$$\underset{\text{W.A}}{CH_3COOH} + \underset{\text{S.B}}{KOH} \longrightarrow CH_3COOK + H_2O$$

20. 1

Sol.
$$\underset{X}{Cu_2S} + O_2 \longrightarrow \underset{Y}{Cu_2O}$$

$$Cu_2S + 2Cu_2O \longrightarrow 6Cu + SO_2$$

21. 4

Sol. Diamond & graphite are allotropes of carbon.

22. 2

Sol. $-COOH$ (Carboxylic acid)

$-\overset{\overset{O}{\|}}{C}-O$ (Ester)

23. 1

Sol. Element Q & R belongs to gr.16 i.e. non-metal. Non-metal form covalent compound.

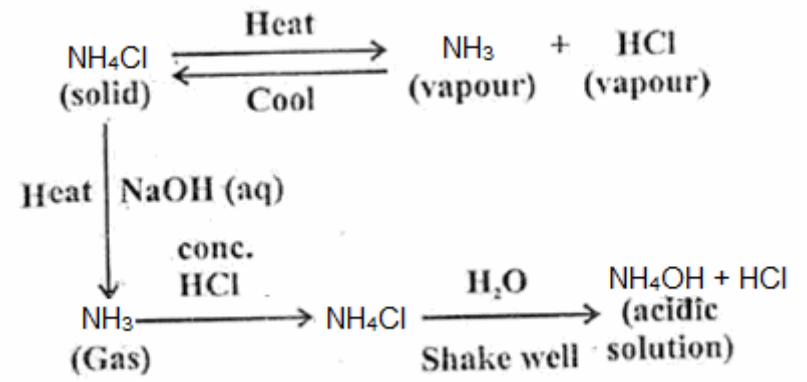
24. 2

Sol.
$$\underset{X}{CH_3COOH} + \underset{Y}{NaHCO_3} \longrightarrow CH_3COONa + H_2O + CO_2$$

$$CH_3COOH + CH_3OH \xrightarrow[H_2SO_4]{\text{Conc}} CH_3COOCH_3 + H_2O$$

25. 4

Sol.



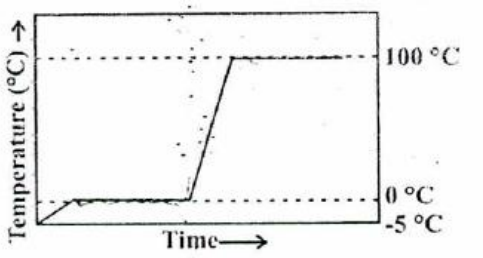
26. 2

Sol. $Zn(s) + AgNO_3(aq) \longrightarrow Zn(NO_3)_2 + 2Ag(s)$

Zn is more reactive than Ag.

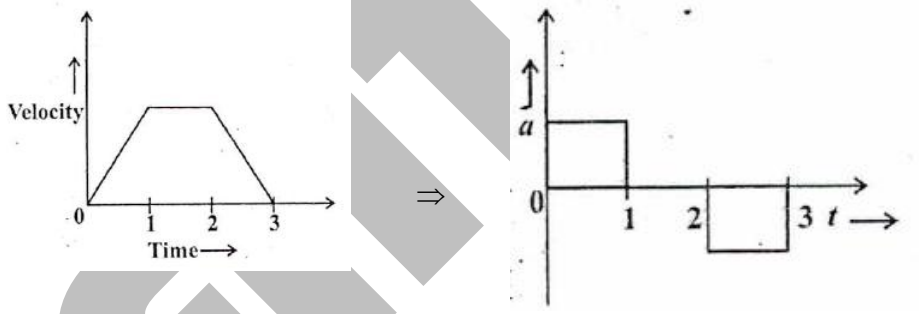
27. 3

Sol. The correct plot is:



28. 1

Sol.



29. 3

Sol. u = –2m, V = –0.4 m

$$\frac{1}{f} = \frac{1}{v} - \frac{1}{u} = \frac{1}{-0.4} + \frac{1}{2} = -2$$

f = –0.5 m

P = –2D (concave lens)

30. 2

Sol. $B \rightarrow C$

$\Rightarrow V^2 = U^2 + 2as$

$\Rightarrow 0 = 25 - 2(10)(h_1)$

$h_1 = \frac{25}{20} = \frac{5}{4}$ m.

$\Rightarrow t = \frac{U}{g} = \frac{5}{10} = \frac{1}{2}$ sec.

So, t_1 = 1 sec.

$\Rightarrow \quad H = \frac{1}{2} \times (10)\,(1)^2 = 5m$

So, displacement = $H - h_1 = \frac{15}{4}$.

31. 2

Sol. Area = $\pi r^2 = \pi\left(\frac{d}{2}\right)^2 = \frac{\pi d^2}{4}$.

$F = \frac{dp}{dt} = \frac{d(mv)}{dt} = \frac{\rho\pi d^2 v^2}{4}$.

32. 2

Sol. $15 = (10)\,a$

$a = \frac{3}{2}$.

$N = 2a$

$= 2\left(\frac{3}{2}\right) = 3$ newton.

33. 3

Sol. $Kx + \rho vg = mg$

$Kx = mg - \rho vg = (300)$ gm

$\rho vg = 500$ gm

Reading = 500 gm.

34. 3

Sol. $g = \frac{GM}{R^2} \quad ; \quad g' = \frac{G \times 2M}{4R^2}$

$\Rightarrow \quad g' = \frac{g}{2}$

$t = \sqrt{\frac{2H}{g}} = 50$ sec. $\quad ; \quad t' = \sqrt{\frac{2H}{g/2}} = \sqrt{2} \times t$

$t' = \sqrt{2} \times 50 = 70.7$ sec.

35. 1

Sol. Frequency remains constant and as velocity is decreasing so wavelength is also decreasing.

$V = f\lambda$

36. 4

Sol. Diameter is made $(1/5)^{th}$ so cross sectional area is made (1/25)th then length is made 25 time.

$R = \frac{\rho\ell}{A}$

$R' = \frac{\rho \times 25}{A/25} = 625\,R.$

37. 4

Sol. Initial K.E. = $\frac{1}{2}mu^2$

Final velocity = $\frac{mu}{m+M}$

Final K.E. = $\frac{1}{2}(M+m)\times\left(\frac{mu}{m+M}\right)^2$

Change in K.E. = $\frac{1}{2}\frac{Mmu^2}{(M+m)}$

38 4

Sol. $M=\frac{1}{\sin i}=\frac{\sqrt{433}}{12}$ = 1.73

39 3

Sol. Acceleration will be doubled as force is doubled.

$t=\sqrt{\frac{2d}{a}}$; $t'=\sqrt{\frac{2d}{2a}}$

$t'=\frac{t}{\sqrt{2}}$

40. 3

Sol. PQ and AB will attract and RS and AB will repel and forces will be different.

41. The cube of a natural number is of the form 9k, 9k+1 or 9k+8

$\therefore$ sum of remainders $=0+1+8=9$

42. $\therefore\ P(x)=k(x-1)(x-3)+x+2$

$\therefore r(x)=x+2$

$\therefore\ r(-2)=0$

43. $\frac{p}{12}=\frac{3}{p}=\frac{p-3}{p}$

From first 2 parts, $3p=p^2-3p$

$p^2-6p=0$

$p(p-6)=0$

$p=6,\ 0$

$\therefore p=6$ satisfies complete equality.

44. Let the roots of the first equation be $3\alpha,\beta$

$\therefore$ Roots of the second equation is $4\alpha,\beta$

$3\alpha+\beta=b$ and $4\alpha+\beta=6$

$3\alpha\beta=6$ and $4\alpha\beta=c$

Solving, we get $\beta=4$ or 2

Now if $\beta=4,\ \alpha=\frac{1}{2}$

and if $\beta=2,\ \alpha=1$

$\because 3\alpha,4\alpha,\ \beta\in I$

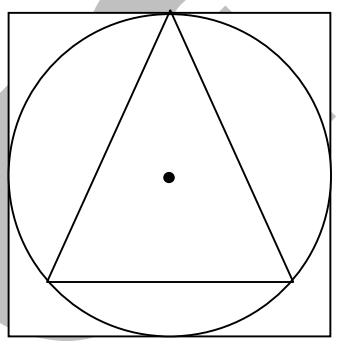
$\therefore\ \beta=2$

45. Let the AP be $2+(n-1)d$

$S_5=\frac{1}{4}(S_{10}-S_5)$

$$\frac{5}{4}S_5 = \frac{1}{4}S_{10}$$
$$5S_5 = S_{10}$$
$$5.\frac{5}{2}(2+4d+2) = \frac{10}{2}(2+2+9d)$$
$$25(4+4d) = 10(4+9d)$$
$$100d - 90d = 40 - 100$$
$$d = -6$$
$$\therefore S_{30} = \frac{30}{2}(2(2)+29(-6))$$
$$= 15(-170) = -2550$$

46. Let side of T be 2a.

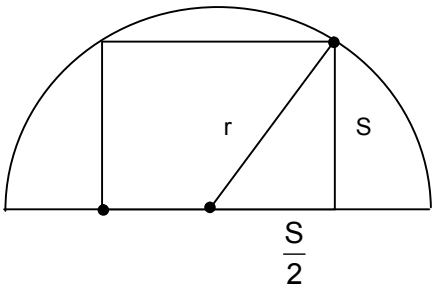


$$\therefore \text{ radius of } C = \frac{2}{3}\sqrt{3}\,a$$
$$= \frac{2}{\sqrt{3}}a$$
$$\therefore \text{ side of } S = \frac{4}{\sqrt{3}}a$$
$$k = \frac{ar(S)}{ar(T)} = \frac{\frac{16}{3}a^2}{\frac{\sqrt{3}}{4}\times 4a^2} = \frac{16}{3\sqrt{3}}$$

47. $8^2 = 4(x+4)$
$\Rightarrow x+4 = 16$
$\Rightarrow x = 12$
$\therefore (2r)^2 = 16^2 - 8^2 \Rightarrow r = 4\sqrt{3}$

48. $x^2 + bx + 72 = 0$
Let roots be α and β
$\alpha\beta = 72$
$\therefore$ 72 has 12 distinct integer factor pairs.
$\therefore$ b can take 12 values as the sum of roots

49. $S^2 = 2$
$S = \sqrt{2}$
$r^2 = \frac{5S^2}{4}$
$= \frac{10}{4}$
$r = \sqrt{\frac{5}{2}}$

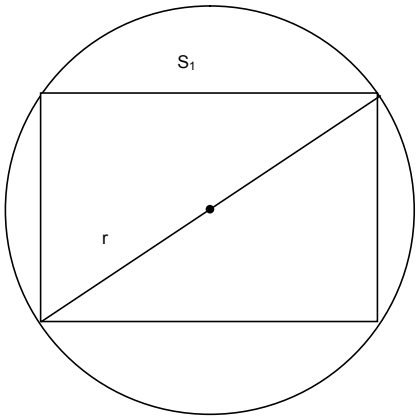


$\therefore 2S_1^2 = \left(2\sqrt{\frac{5}{2}}\right)^2$

$2S_1^2 = 4 \times \frac{5}{2}$

$S_1 = \sqrt{5}$

$\therefore$ area = 5 cm^2



50. $(x-1)(x-\alpha) = 0$

$(x-1)(x-\beta) = 0$

$\Rightarrow x^2 - (1+\alpha)x + \alpha = 0$ and $x^2 - (1+\beta)x + \beta = 0$

$\therefore$ discriminants are equal, $(1+\alpha)^2 - 4\alpha = (1+\beta)^2 - 4\beta$

$\Rightarrow \alpha^2 - 2\alpha = \beta^2 - 2\beta$

$\Rightarrow (\alpha-\beta)(\alpha+\beta-2) = 0$

$\Rightarrow \alpha = \beta$ or $\alpha + \beta = 2$

51. Let radius of 3 circles are 25 cm, 20 cm and 16 cm respectively
In 1 minutes c makes 32 rev. $\Rightarrow$ it covers $2\pi r \times 32$
$= 50\pi \times 32$
$= 1600\pi$

$\therefore$ In 1 minute A also covers 1600π

$\Rightarrow \frac{1600\pi}{2 \times 16\pi}$

$\Rightarrow$ 50 revolutions

52. Let coordinates of C be (x, y)
by distance formula, we get $6y = 2x$

$\Rightarrow$ x and y are either both positive or both negative

$\Rightarrow$ (x, y) cannot be in second quadrant

53. $1x \times 2x \times 3x < 400$

$6x^3 < 400$

$x^3 < 66\frac{2}{3}$

$x \leq 4$

$\therefore$ Max. value of x = 4

$\therefore$ Maximum number of cubes $= 6 \times 64$
384

54. The groups should have highest possible median. For group 1, Let median be 18. Then for group 2, highest possible median will be 14 and for group 3 it will be 10. Then highest possible mean = 14.

55. $2272 = NQ_1 + r$

$875 = NQ_2 + r$

$N(Q_1 - Q_2) = 1397$

N is a factor of 1397

$\therefore$ N can take values of 1, 11, 127, 1397
$\therefore$ N is 3 digit number N can be 127 only.
$\therefore$ Sum of digits = 10

56. Slope of line $\ell = \frac{3}{4}$

equation of line $\Rightarrow 4y - 3x = 0$

$\therefore$ equation of line perpendicular to ℓ

$\Rightarrow 3y + 4x = 0$

Let the point be (x_1, y_1)

$(x_1 - 0)^2 + (y_1 - 0)^2 = 1$

$x_1^2 + y_1^2 = 1$ and $4x_1 + 3y_1 = 0$

Solving, we get $x_1 = \frac{3}{5}$, $y_1 = -\frac{4}{5}$

57. $f(x) = x^2 + 5kx + k^2 + 5$

$f(-2) = 0$

$f(-3) \neq 0$

For $f(-2) = 0$,

$4 - 10k + k^2 + 5 = 0$

$k^2 - 10k + 9 = 0$

$k = +1, +9$

$f(-3) \neq 0$

$9 - 15k + k^2 + 5 \neq 0$

$k^2 - 15k + 14 \neq 0$

$k \neq 1, 14$

$\therefore k = 9$

58. $\cos^4\theta + \sin^2\theta = m$

$\cos^4\theta + 1 - \cos^2\theta = m$

$\cos^4\theta - \cos^2\theta + 1 = m$

$\cos^2\theta = t \Rightarrow 0 \leq t \leq 1$

$t^2 - t + 1 = m$

$\left(t - \frac{1}{2}\right)^2 + \frac{3}{4} = m$

$-\frac{1}{2} \leq t - \frac{1}{2} \leq \frac{1}{2}$

$\Rightarrow 0 \leq \left(t - \frac{1}{2}\right)^2 \leq \frac{1}{4}$

$\Rightarrow \frac{3}{4} \leq m \leq 1$

59. $2a + 3b + c = 26$ (i)

$3a + 2b + 2c = 35$ (ii)

$3 \times (1) + 2 \times (2)$

$\Rightarrow 6a + 9b + 3c = 78$

$+6a+4b+4c=70$

$\Rightarrow 12a+13b+7c=148$

60. $\tan(90-\theta)=\dfrac{20}{m}\Rightarrow \cot\theta=\dfrac{20}{m}$

$\tan\theta=\dfrac{45}{m}$

$\therefore \dfrac{45}{m}=\dfrac{m}{20}$

$m^2=45\times 20$

$m=30\Rightarrow x+y=30$

again, $\tan\alpha=\dfrac{45}{x}$ $\tan\alpha=\dfrac{20}{y}$

$\Rightarrow \dfrac{45}{x}=\dfrac{20}{y}$

$\Rightarrow \dfrac{x}{y}=\dfrac{9}{4}$

$\therefore x=\dfrac{9}{13}\times 30=\dfrac{270}{13}=20\dfrac{10}{13}m$