NTSE STAGE II

CODE: 13 – 15

SAT

Held on: May 13, 2018

HINTS & SOLUTIONS

1. 4

Sol. The six carbon compound glucose molecule is broken down into 3 carbon compound molecule Pyruvic acid and Lactic acid in muscle cells during Anaerobic condition.

2. 4

Sol. The flow of impulse in a neuron is
Cell → Body → Axon → Nerve terminal

3. 1

Sol. The Medulla oblongata of brain regulates blood pressure of human.

4. 4

Sol. Edward Jenner's contribution for the eradication of small pox is his finding that the cow pox infection protects the person from subsequent infection from small pox.

5. 2

Sol. The correct sequence of events to the origin of life on earth is
II. Availability of water
I. Formation of Amino Acids and Nucleotides
IV. Formation of complex molecules.
III. Organization of cells.

6. 1

Sol. In a forest ecosystem, energy transfer in the biotic world proceeds from the autotrophs. Energy flow is unidirectional and some amount of energy lost from one trophic level to the other.

7. 2

Sol. In highly pesticide polluted pond the maximum amount of pesticide per gram of body mass accumulated in fishes due to Biomagnification.

8. 1

Sol. The paddy plants of backwater paddy field of Kerala wilt during noon onwards everyday because the rate of water absorption is less than the rate of transpiration in the afternoon.

9. 1

Sol. In the given experiment the shoot is showing positive Phototropism and root is showing positive Geotropism.

10. 1

Sol. Raw Banana has bitter taste while ripe Banana has sweet taste. It happens because of conversion of starch to sugar.

11. 2

Sol. The sequence of events during formation of fruit by sexual reproduction is as follows
Gamete → Fertilisation → Zygote → Embryo

12. 1

Sol. The phenotypic feature of

A. RrYY – Round & yellow

B. Rryy – Round and green

C. rrYy – Wrinkled & yellow

D. rryy – Wrinkled & green

13. 2

Sol. The selected combination of Eukaryotic organism in descending order is as follows:
Tissue, Cell, Nucleus, Chromosome, DNA

14. 1

Sol. The gaseous by-product O_2 of photosynthesis in plant is essential for Respiration that releases energy.

15. 3

Sol. $PV = nRT$ V & RT are constant

$P \alpha n$

16. 4

Sol. $r_{avg} \alpha \frac{1}{\sqrt{M}}$

$M\uparrow\ r_{avg}\downarrow$

$O_2 < NH_3 < He < H_2$

17. 1

Sol. $\underset{10\,g}{CaCO_3} \xrightarrow{\Delta} CaO + \underset{4.4\,g}{CO_2}\uparrow$

Weight of test tube + $CaCO_3$ = 30.08

Weight of test tube = 30.08 – 10 = 20.08

18. 4

Sol.

Mixture	**Method Used**
Petroleum products	→ Fractional distillation
Camphor and rock salts	→ Sublimation
Cream from milk	→ Centrifugation
Coloured components in a dye	→ Chromatography

19. 4

Sol. $3Pb(NO_3)_2 + 2AlCl_3 \longrightarrow 2Al(NO_3)_3 + 3PbCl_2$

20. 1

Sol. More is the atomic number i.e. nuclear charge more is the deflection.

21. 2

Sol. Basicity order: $NaCl < NaHCO_3 < Na_2CO_3 < Ca(OH)_2$

pH order is same.

22. 3

Sol. $2C_4H_6 + 11O_2 \longrightarrow 8CO_2 + 6H_2O$

$11 \times 32 = 352$ g

23. 3

Sol.

Position in activity series	**Reduction process**
The bottom of the series	→ Found in native state
The top of the series	→ Electrolysis
The lower regions of the series	→ Reduction by heat alone
The middle of the series	→ Reduction using carbon or some other reducing agent

24. 2

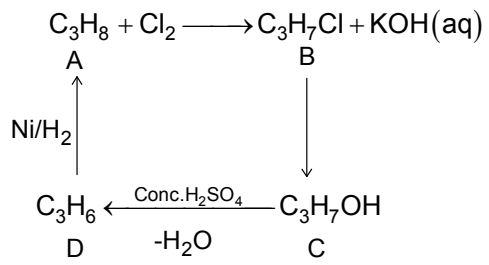
Sol. Chemical properties of element depends on
(a) Position of element in a period/group
(b) Atomic number of the element
(c) Electronic configuration

25. 3

Sol. A – Carbon B – Nitrogen
C – Silicon D – Phosphorus
Size of Si is highest , if we consider Electronegativity then Silicon has less capability to gain electron than Nitrogen. If we consider E_A than only 4th statement should be correct.

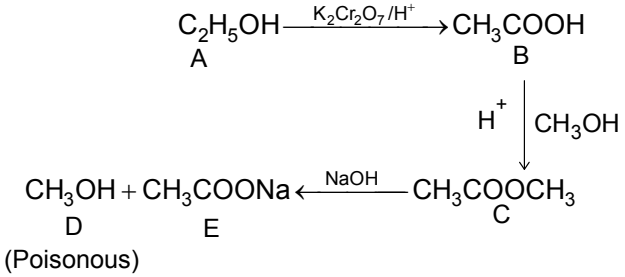
26. 2

Sol.



27. 2

Sol.



28. 3

Sol. $R_A = \frac{\rho\ell}{A} = R.$

$R_B = \frac{\rho\ell}{9A} = \frac{R}{9}.$

Ratio of potential drop = $R : \frac{R}{9}$

= 9 : 1.

29. 3

Sol. For lens A

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

$\Rightarrow \frac{1}{v} + \frac{1}{40} = \frac{1}{30}$

$\Rightarrow$ v = 120 cm

For lens B

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

$$\frac{1}{v}-\frac{1}{90}=\frac{1}{30}$$

v = 22.5 cm to right of B.

30. 4

Sol. Time taken for each L length is

$$\frac{L}{u}+\frac{3L}{2u}+\frac{2L}{u}+\frac{5L}{2u}+\frac{3L}{2u}=\frac{17L}{2u}$$

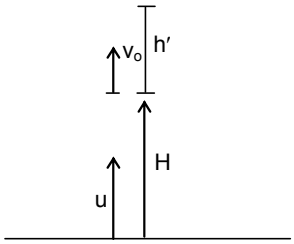
31. 3

Sol. $h'=\frac{1}{2}g\times\left(\frac{T}{2}\right)^2$

$$h'=\frac{gT^2}{8}$$

Maximum height = H + h′

$$= H+\frac{gT^2}{8}$$



$$\Rightarrow \quad \frac{u^2}{2g}=H+\frac{gT^2}{8}$$

$$\Rightarrow \quad u=\left(\sqrt{g^2T^2+8gH}\right)\Big/2$$

32. 3

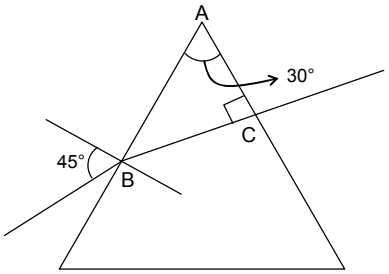
Sol. 9nD ABC

$\angle C = 90°$

$\angle ABC = 90 - 30° = 60°$

Angle of refraction = 30°

$$\therefore \quad \mu=\frac{\text{Sin i}}{\text{Sin r}}=\frac{\text{Sin } 45^o}{\text{Sin } 30^o}=\sqrt{2}$$

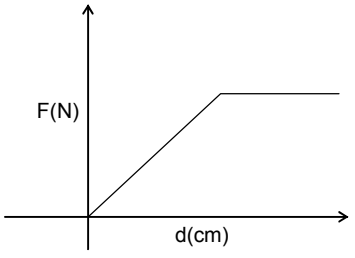


33. 3

Sol. Buoyant force (F) = V ρg

F = L^2dρg

F ∝ d



34. 4

Sol. As the gain in kinetic energy is proportional to their mass in all cases so speed will be same.

35. 2

Sol. Acceleration of system = $\frac{36}{9}$ = 4 m/s^2

∴ Force pulling the block = ma

= 1 × 4 = 4 N

36. 3

Sol. Acceleration is of two cars are equal to each other at an instant earlier than to as there will be a point where slope of car A and car B is same.

37. 2

Sol. Ratio of resistance of 40 W : 50 W : 100 W

is = $\frac{(200)^2}{40} : \frac{(200)^2}{50} : \frac{(200)^2}{100}$

= 5 : 4 : 2

$\therefore$ Potential drop across 40 W = $\frac{5}{11} \times 600$ = 272.7 V

Potential drop across 50 W = $\frac{4}{11} \times 600$ = 218.18 V

Potential drop across 100 W = $\frac{2}{11} \times 600$ = 109.09 V

So both 40 W and 50 W will fuse.

38. 2

Sol. Sound will have more velocity in the solid pipe as velocity of sound is more in solids.

39. 1

Sol. Force will be same in magnitude in both wires and will be in opposite direction.

40. 4

Sol. R_{eq} when k_1 is closed = $\frac{12 \times 3}{15} = \frac{12}{5}\Omega$

R_{eq} when k_2 is closed = $\frac{12 \times 4}{16} = \frac{12}{4}\Omega$

$\therefore$ Ratio of current = 5 : 4.

41. 3

Sol. $\frac{1}{7} = 0.\overline{142857}$

$\frac{1}{13} = 0.\overline{076923}$

$\frac{1}{21} = 0.\overline{047619}$

$\Rightarrow x = 7 + 13 + 21 = 41$

42. 1

Sol. Unit's digit of 12^n can be 2, 4, 8 or 6 $\Rightarrow$ unit's digit of $12^n + 1$ can be 3, 5, 9 or 7 only.

43. **No option is applicable**

Sol. As per the question, the roots are in the ratio 1 : 2 : 4. So, the roots may be p, 2p, 4p where p (the ratio constant) is the h.c.f of all the roots and p is a Natural Number.
If k=0, then the all the 3 roots become equal to zero which violates the given condition.
So the data given in the question is ambiguous.

44. 1

Sol. Sum of numbers in 10^{th} group = (sum of 110 odd numbers) – (sum of 90 odd numbers)

$= 110^2 - 90^2$

$= 200 \times 20$

$= 4000$

45. 2

Sol. $x^4 - 6x^3 + 16x^2 - 25x + 10 = \left(x^2 - 2x + k\right)\left(x^2 - 4x + (8 - k)\right)$

$+ (2k - 9)x + k^2 - 8k + 10$

$\Rightarrow x + a = (2k - 9)x + k^2 - 8k + 10$

$\Rightarrow 2k - 9 = 1$

$\Rightarrow k = 5$

$\therefore a = k^2 - 8k + 10$

$= 25 - 40 + 10$

$= -5$

46. 3

Sol. $x^2 - 3x - 4 = 0$

Roots $\rightarrow -1, 4$

If common root = –1

$2 - k - 5 = 0$

$k = -3$

If common root = 4

$32 + 4h - 5 = 0$

$h = \dfrac{-27}{4}$

47. 2

Sol. $0 \le x < 45, \cos x > \sin x$

$\Rightarrow \cos x - \sin x > 0$

48. 1

Sol. $\tan 30^\circ = \dfrac{10}{\sqrt{\ell^2 + b^2}}$

$\sqrt{\ell^2 + b^2} = 10\sqrt{3}$

$\ell^2 + b^2 = 300$

$\tan 60^\circ = \dfrac{10}{\ell}$

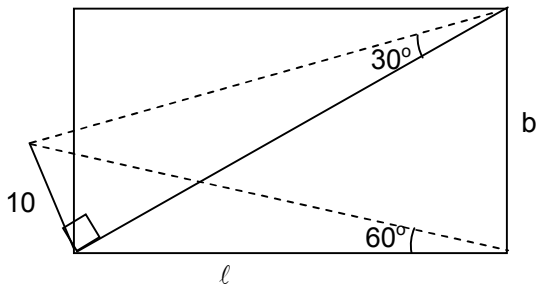
$\ell = \dfrac{10}{\sqrt{3}}$

$\ell^2 = \dfrac{100}{3}$

$\Rightarrow b^2 = \dfrac{800}{3}$

$\Rightarrow b = \dfrac{20\sqrt{2}}{\sqrt{3}}$

$\therefore$ Area $= \ell \times b = \dfrac{200\sqrt{2}}{3}$



49. 1

Sol. Let side of square = x

Then radius of incircle $= \frac{x}{2}$

Radius of circum circle $= \frac{\sqrt{2}}{2}x$

$\Rightarrow$ Ratio of area $= \frac{\left(\frac{x}{2}\right)^2}{\left(\frac{\sqrt{2}}{2}x\right)^2} = \frac{1}{2}$

50. 3

Sol. Time to fill pool

$$= \frac{\frac{1}{2} \times 2.75 \times 36 \times 10.5}{\frac{22}{7} \times \frac{7}{100} \times \frac{7}{100} \times 5000} = 6\frac{3}{4} \text{hours}$$

51. 4

Sol. height of cone = h

$\Rightarrow$ radius of cone $= \frac{h}{\sqrt{3}}$ [$\because$ vertical angle is 60°]

$\Rightarrow$ radius of sphere $= \frac{h}{3}$

$\Rightarrow$ volume of sphere $= \frac{4\pi h^3}{81}$

52. 3

Sol. Let the heights of the smaller and larger part be h_1 and h_2 respectively.

$$\Rightarrow \pi\left(\frac{3}{2}\right)^2 h_1 + \pi \times 3^2 (24 - h_1) = \pi\left(3^2\right)h_2 + \pi\left(\frac{3}{2}\right)^2 (15 - h_2)$$

$$\Rightarrow \frac{27}{4}(h_1 + h_2) = \frac{729}{4}$$

$$\Rightarrow h_1 + h_2 = 27$$

53. 4

Sol. Let the height be h units

Base of original triangle $= 2\sqrt{\ell^2 - h^2}$

Base of new triangle $= 2\sqrt{4\ell^2 - h^2}$

$\therefore$ Difference of squares $= 12\ell^2$

54. 4

Sol. $IO_1 = DE = GF$

$= \sqrt{16-4} = 2\sqrt{3}$

Now, $\Delta CO,E \sim \Delta COD$

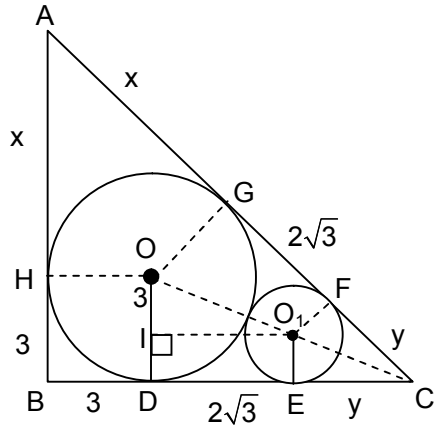
$$\frac{y}{y+2\sqrt{3}} = \frac{1}{3}$$

$$y = \sqrt{3}$$

$$(3+x)^2 + \left(3+3\sqrt{3}\right)^2 = \left(x+3\sqrt{3}\right)^2$$

$$x = 6+3\sqrt{3}$$

$$AB = 3+6+3\sqrt{3} = 9+3\sqrt{3}$$



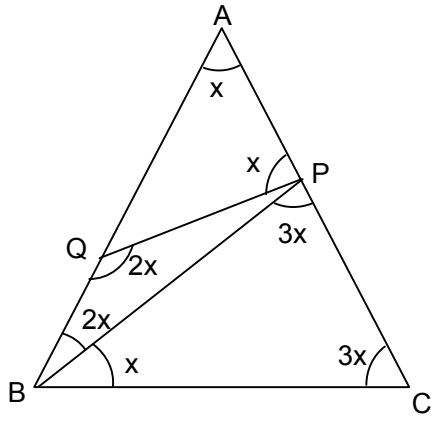
55. 4

Sol. $7x = \pi$

$$x = \frac{\pi}{7}$$

$$\angle AQP = \pi - \frac{2\pi}{7}$$

$$= \frac{5\pi}{7}$$

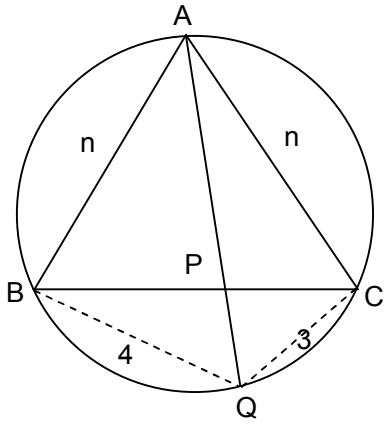


56. 3

Sol. We know $\frac{1}{PQ} = \frac{1}{BQ} + \frac{1}{QC}$

$$\frac{1}{PQ} = \frac{1}{4} + \frac{1}{3}$$

$$PQ = \frac{12}{7}$$



57. 4

Sol. $(x-1)^2 + (y-2)^2 = 4$

One of the part $(x-1)^2$, $(y-2)^2$ equal to 0

If $(x-1)^2 = 0$ then x = 1, and possible value for y are 4 and – 2

Similarly $(y-2)^2 = 0$ then y will be 2 and possible value for x are 3 and –1.

So total 4 pair (1, 4) (1, –2) (3, 2) (–1, 2)

58. 1

Sol. If coordinates are integers then triangle can not be equilateral.

59. 3

Sol. The possible product we get (1, 2, 3, 4), (1, 4, 9, 16)
= (1, 2, 3, 4, 4, 8, 12, 16, 1, 18, 27, 36, 16, 32, 48, 64)
greater than 16 are (18, 27, 36, 32, 48, 64)

So $\frac{6}{16}=\frac{3}{8}$

60. 4

Sol. Let 11 consecutive numbers are $x, x+1, x+2,.....x+10$

So $\frac{x+(x+1).....+(x+10)}{11}=m$

Now mean of $\frac{x+(x+1)+(x+2).....(x+16)}{17}$

$=\frac{17x+136}{17}$

$=\frac{17\times\left(\frac{11m}{11}-55\right)+136}{17}=m-5+8$

$=m+3$

Then % change $=\frac{m+3-m}{m}\times 100$

$=\frac{3}{m}\times 100$

$=\frac{300}{m}\%$