INDIAN ASSOCIATION OF PHYSICS TEACHERS
NATIONAL STANDARD EXAMINATION IN JUNIOR SCIENCE (NSEJS) 2019 – 20
Question Paper Code: 54
Held on: November 17, 2019

ANSWER KEYS

1.	**c**	2.	**b**	3.	**c**	4.	**d**
5.	**a**	6.	**d**	7.	**d**	8.	**c**
9.	**c**	10.	**d**	11.	**b**	12.	**c**
13.	**d**	14.	**a**	15.	**d**	16.	**b**
17.	**b**	18.	**c**	19.	**d**	20.	**c**
21.	**c**	22.	**a**	23.	**b**	24.	**b**
25.	**c**	26.	**c**	27.	*	28.	**a**
29.	**b**	30.	**c**	31.	**c**	32.	**b**
33.	**a**	34.	**a**	35.	**a**	36.	**d**
37.	**b**	38.	**c**	39.	**d**	40.	**a**
41.	**c**	42.	**a**	43.	**b**	44.	**a**
45.	**b**	46.	**b**	47.	**c**	48.	**a**
49.	**c**	50.	**b**	51.	**a**	52.	**d**
53.	**a**	54.	**c**	55.	**b**	56.	**c**
57.	**d**	58.	**a**	59.	**c**	60.	**d**
61.	**d**	62.	**c**	63.	**c**	64.	**b**
65.	**a**	66.	**d**	67.	**d**	68.	**d**
69.	**b**	70.	**a**	71.	**a**	72.	**c**
73.	**a**	74.	**a**	75.	**a**	76.	**a**
77.	**a**	78.	**D**	79.	**c**	80.	**b**

27. ***No option is correct and it should be Q > P > R > S.**

27. $\underset{0.1\,M}{HCl} \longrightarrow H_3O^+ + Cl^-$

(P) $0.1 = 10^{-1}M$

$H_2SO_4 \longrightarrow 2H_3^+O + SO_4^{2-}$

0.1 M 2×0.1

(Q) $= 2 \times 10^{-1}\,M$

$\underset{10^{-3}}{NH_4OH} \longrightarrow NH_4^+ + \underset{10^{-3}M}{OH^-}$

(R)

$\left[H_3\overset{+}{O}\right] = \frac{10^{-14}}{10^{-3}} = 10^{-11}$ (considering complete ionization)

$\underset{10^{-3}\,M}{Ca(OH)_2} \longrightarrow Ca^{2+} + \underset{2\times10^{-3}}{2OH^-}$

(S)

$[OH^-] = 2 \times 10^{-3}$

$\left[H_3^+O\right] = \frac{10^{-14}}{2\times10^{-3}} = 5\times10^{-12}$

HINTS AND SOLUTIONS

1. c
1. The above mentioned features (in question) belongs to phylum Protochordata.

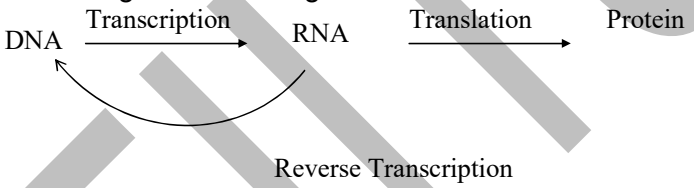
2. b
2. This is the case of multiple allelism, where Agouti is a dominant trait.
AA – agouti (yellow band on dark shaft)
Aa – agouti
aa – Recessive (no yellow band)
$A^Y A^Y$ – lethal
In a cross, of two yellow mice various possibilities arises and the most probable answer is 2.

3. c
3. The stain was tested on various tissues derived from an autopsy sample from a mammal. The organelles were counted. The result showed maximum number of golgi bodies reticulum in cells of brain, lesser in cells of heart, least in mature sperms and absent in erythrocytes.

4. d
4. Unsaturated lipid contains double bond which makes it harder for lipids to back together by putting links in otherwise straight lipid chain. Hence, it extremely low temperature, poly unsaturated lipids prevent membrane freezing and maintain fluidity.

5. a
5. Penicillum, an antibiotic that attack almost all microbes except viruses, belongs to blue green mold. Penicilium block peptidoglycan linking in cell wall. Fungal cell wall is made up of chitin, hence possible causative agent of disease can be virus or fungi.

6. d
6. According to central dogma mentioned below :



P is Reverse Transcription; Q is Replication; R is Transcription and S is Translation.

7. d
7. Genetic imprinting is an epigenetic phenomenon that causes genes to be expressed in a parent-of-origin-specific manner. Forms of **genomic imprinting** have been demonstrated in fungi, plants and animals. **Imprinted genes are genes** whose expression **is** determined by the parent that contributed them.

8. c
8. $$\text{Magnification} = \frac{\text{Size of rectinal image seen with the instrument}}{\text{Size of rectinal image seen with the unaided eye}} = \frac{6\times10^{-2}}{4\times10^{-6}} = 1.5\times10^{4}$$

9. c
9. In the baking industry, when the dough is prepared, various ingredients are mixed together with the flour. At one instance, the dough was fermented, but failed to rise sufficiently during the baking process. The correct causes are
i. If salt was mixed before fermentation then it will result into exosmosis.
ii. Excess sugar also affect the raising dough by exosmosis.

iii. In activated yeast granules will not result into fermentation.

10. d
10. Statement I and III are incorrect.
In statement I eukaryotes may be unicellular or multicellular.
In statement III nucleoid contains the genetic material is present only in prokaroytes.

11. b
11. In Planaria every cut pieces will grow into complete organism so from three cut pieces three Planaria regenerates. In Asterias which was cut into six pieces only two pieces regrows which contains central disc.

12. c
12. All the three factors
i. Availability of food during breeding season
ii. Mode of fertilization
iii. Population density
Can regulate Fecundity.

13. d
13. Driving forces are increased pollution, stable transposition of a gene in moths, limitations of vision of birds and lichen growth.

14. a
14. Sample A has minimum p^H so it is gastric HCl.
Sample B is Venous blood.
Sample C is intracellular fluid.
Sample D is urine.

15. d
15. The most probable reasons for this may be receptive fields in fingers are smaller, number of receptor in forearm is less and finger tips release more prostaglandins.

16. b
16. Wavelength is the parameter which plotted on X axis (At certain wavelength (green colour) rate of photosynthesis decreases and then increases (red colour))

17. b
17. An organism has 27 pairs of homologous chromosomes. In each daughter cell after competition of meiosis II,54 and 27 chromosomes would be present respectively.

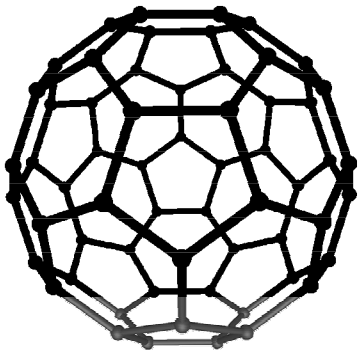
18. c
18. Gymnosperm are called 'naked seed bearing plants' because they lack ovary

19. d
19. The chemical 'X' might be Gibberellic acid.

20. c
20. On a study tour, plants with leathery leaves with thick cuticle, vivipary, salt glands, apogeotropic roots, and stomata limited to abaxial surface were observed. The plants might be Mangroves.

21. c
21. Y (Many Allotropic forms)
White translucent solid at room temperature.
$\Rightarrow$ Y = phosphorus and forms P_4O_6 and P_4O_{10}.

22. a

22. 

23. b

23. $4\text{g}\ (CaCO_3 + \text{Sand}) + HCl \text{ excess}$

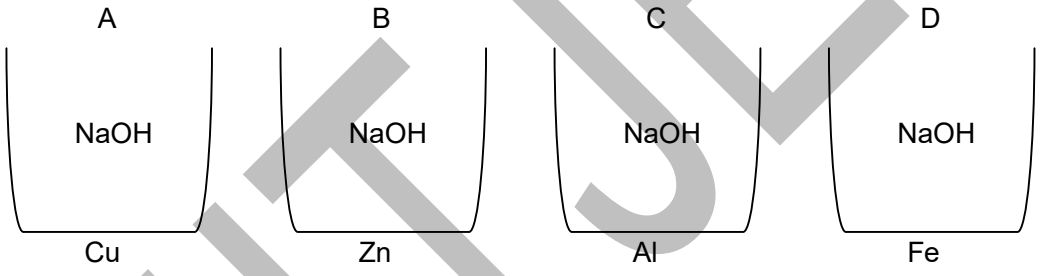
$$\underset{x\ g}{CaCO_3} + 2HCl \longrightarrow CaCl_2 + H_2O + \underset{0.880\ g}{CO_2}$$

$44\text{g}\ CO_2 \rightarrow 100\ \text{g}\ CaCO_3$

$$0.88\ \text{g}\ CO_2 \longrightarrow \frac{100}{44} \times 0.88 = \frac{100 \times 88}{44 \times 100} = 2\,\text{g}\ CaCO_3$$

$$\%\ \text{of}\ CaCO_3 = \frac{2}{4} \times 100 = 50$$

24. b

24. 

$$Zn + 2NaOH \longrightarrow Na_2ZnO_2 + H_2 \uparrow$$

$$2Al + 2NaOH + 2H_2O \longrightarrow 2NaAlO_2 + 3H_2 \uparrow$$

$$\text{or}\ 2Al + 2NaOH + 6H_2O \longrightarrow 2Na\left[Al(OH)_4\right] + 3H_2 \uparrow$$

25. c

25. The note did not burn because the Rs 50 note failed to reach ignition temperature.

26. c

26. $C_6H_6 + 3Cl_2 \xrightarrow{h\nu} C_6H_6Cl_6$

213 g Cl_2 reacts with 78 g benzene to give 291 g gammaxene.

106.5 g Cl_2 reacts with 39 g benzene to give $\frac{291}{2} = 145.5$ g gammaxene.

27. *No option is correct and it should be Q > P > R > S.

27. $\overset{0.1\,M}{HCl} \longrightarrow H_3O^+ + Cl^-$

(P) $\quad 0.1 = 10^{-1}\,M$

$$H_2SO_4 \longrightarrow 2H_3^+O + SO_4^{2-}$$

0.1 M $\quad 2 \times 0.1$

(Q) $\quad = 2 \times 10^{-1}\,M$

$$\underset{10^{-3}}{NH_4OH} \longrightarrow NH_4^+ + \underset{10^{-3}M}{OH^-}$$
(R)

$$\left[H_3\overset{+}{O}\right] = \frac{10^{-14}}{10^{-3}} = 10^{-11}$$ (considering complete ionization)

$$\underset{10^{-3}M}{Ca(OH)_2} \longrightarrow Ca^{2+} + \underset{2\times10^{-3}}{2OH^-}$$
(S)

$[OH^-] = 2 \times 10^{-3}$

$$\left[H_3^+O\right] = \frac{10^{-14}}{2\times10^{-3}} = 5\times10^{-12}$$

28. a

28. $\underset{(s)}{Zn} + \underset{\substack{1M \\ 100\ ml}}{CuCl_2} \longrightarrow ZnCl_2 + Cu(s)$

$$\underset{100\times1=100\ M.Moles}{CuCl_2} \longrightarrow Cu^{2+} + \underset{\substack{2\times100\times1 \\ =200\ M.\ Moles}}{2Cl^-}$$

$$\text{Molarity of } Cl^- = \frac{200}{100} = 2M$$

29. b

29. Polyvinyl chloride and polythene are ideal for remoulding.

30. c

30. I. vinegar $\rightarrow CH_3COOH$ pH < 7, red
II. common salt $\rightarrow$ NaCl pH = 7 green
III. caustic soda $\rightarrow$ NaOH pH > 7 and strongly basic voilet
IV. baking soda $\rightarrow NaHCO_3$ pH > 7 and weakly basic, blue

31. c

31. $\underset{\substack{\text{white crystalline} \\ \text{solid}}}{X} \xrightarrow{\text{melts}}$ in 10 sec in flame.

$X + H_2O \Rightarrow$ soluble
$X + CCl_4 \Rightarrow$ insoluble.
and X is poor conductor. Hence it is a polar covalent compound.

32. b

32. $\underset{\substack{50\ ml \\ N=1}}{HCl} + \underset{x\ meq.}{NH_3} \longrightarrow NH_4Cl$

Number of meq of HCl = 50

$$NaOH = 60\ ml \times \frac{1}{2}N = 30\ meq.$$

Meq of NH_3 + Meq of NaOH = Meq of HCl
x + 30 = 50 meq.

$$x = 20\ meq. = \frac{wt.\times1000}{17}$$

$$wt = \frac{20\times17}{1000} = \frac{34}{100} = 0.34\ g$$

33. a

33. Hg (–38.83°C), Ga (29.8°C), Li (180.5°C), Ca(842°C)

34. a

34. Na_2WO_4 $Pb_3(PO_4)_2$

$\Rightarrow W^{+6}$ $\Rightarrow Pb^{+2}$

So, $Pb^{+2} + W^{+6} + 4O^{-2}$

$= Pb(WO_4)$

35. a

35. $2NH_3 + \frac{5}{2}O_2 \longrightarrow 2NO + 3H_2O$

or $\underset{R.A}{4NH_3} + \underset{O.A}{5O_2} \longrightarrow 4NO + 6H_2O$

36. d

36. $CO_2 \Rightarrow \ddot{\underset{\cdot\cdot}{O}} = C = \ddot{\underset{\cdot\cdot}{O}}$

$N_2O \Rightarrow :\ddot{\underset{\cdot\cdot}{O}} \leftarrow N \equiv \ddot{N}$

37. b

37. H_2O 1 litre

$CaCl_2$ = 44.4 g

$\overset{1\,mol}{CaCl_2} \longrightarrow \overset{1\,mol}{Ca^{2+}} + \overset{2\,mol}{2Cl^-}$

40 + 71 = 111 g

$\frac{44.4}{111}\text{mol} = 0.4\,\text{mole of } CaCl_2$

1 mole $CaCl_2$ give 3 mole ions

0.4 mol give 3 × 0.4 = 1.2 mole

= 1.2 × 6.022 × 10^{23} number of ions

= 7.2264 × 10^{23} number of ions

$\Rightarrow$ 1 ml has 7.2264 × 10^{20} ions

38. c

38. Ne – 10

$N^{3-} \rightarrow 10$

$Mg^{2+} \rightarrow 10$

39. d

39. N_2 = 28 g mol^{-1}

CO = 12 + 16 = 28 g mol^{-1}

Under similar conditions of temperature and pressure, equal volume of gases contains equal number of moles.

40. a

40. $AlCl_3$ and LiCl are covalent in nature.

41. c

41. Every action has equal and opposite reaction.

42. a

42. Charge of shaded portion = $\frac{\text{Total charge}}{\text{Total area}} \times \text{Area of shaded portion}$

$$= \frac{420}{28\times14}\left[\frac{28\times14}{2}-\frac{22}{7}\times7\times7\right]$$

$= 45\ \mu C$

43. b

43. $R_p = R$ $\qquad$ $R_Q = 4R$

$V_P = 3V$ $\qquad$ $V_Q = NV$

$H_P = \frac{9V^2}{R}$ $\qquad$ $H_Q = \frac{N^2V^2}{4R}$

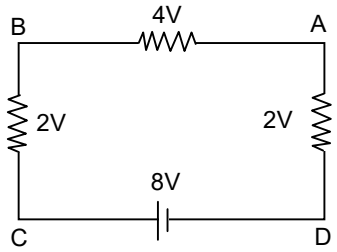
As, $H_p = H_Q$

$N = 6$

44. a

44. When ice melts, equilibrium temperature will be less than 4°C, hence density of water will be less that at 4°C. So, volume will increase.

45. b

45. 

Voltage across each resistor is shown.

Using $R = \frac{V}{I}$

$R_B = 2\ k\Omega$; $R_C = 1\ k\Omega$

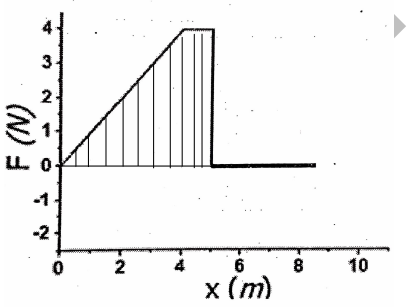
46. b

46. 

When wave having equal amplitude & opposite phases superimpose amplitude is zero.

When wave having equal amplitude & same phases superimpose amplitude doubles.

47. c

47. 

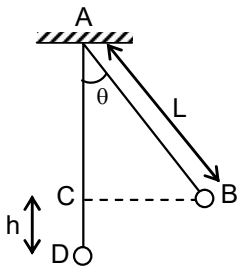
Area under F – x graph = ΔKE

$12 = \frac{1}{2}\times6\times v^2 - 0$

$\Rightarrow$ $v = 2$ m/s

At 5 sec v = 2m/s & after that force ceases to act, so body moves with same speed.

48. a

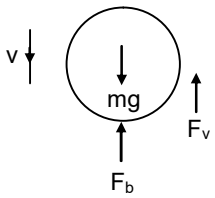
48. 

In ΔACB $AC = AB \cos\theta$
$= L \cos\theta$

$h = CD = L(1 - \cos\theta)$

$\Delta PE = mgh = mg\,L\,(1 - \cos\theta)$

49. c

49. 

By equilibrium of forces.

$mg = F_b + F_v$

50. b

50. $x = \frac{1}{10}m$ $E = 4 \times 10^{-3}$ J

$\frac{1}{2} \times k \times \left(\frac{1}{10}\right)^2 = 4 \times 10^{-3}$

$\Rightarrow$ $k = 0.8\ Nm^{-1}$

51. a

51. Using $s = ut + \frac{1}{2}at^2$

$S_1 = \frac{1}{2} \times a \times 100$ and

$S_2 = \frac{1}{2} \times a \times (400 - 100) = \frac{1}{2} \times a \times 300$

$\therefore$ $S_2 = 3S_1$

52. d

52. Given: $\frac{v_H}{v_D} = \frac{2}{1}$ and $\frac{m_H}{m_D} = \frac{1}{2}$

$\frac{r_H}{r_D} = \frac{m_H v_H}{m_D v_D} = \frac{1}{1}$

53. a

53. Safest place will be inside the car as the charges due to lightning tend to remain on the metal sheet / skin of the vehicle if struck by lightning.

54. c

54. Using $f = \sqrt{u_f v_f}$

Here, u_f and v_f are object and image distance from focus.

$\therefore$ $v_f = \frac{x^2}{4y}$

55. b

55. $m = \dfrac{f}{f+u}$

Given: f = 6 cm

Case-I. say u = –x

$\therefore \quad -3 = \dfrac{6}{6-x} \qquad \Rightarrow \quad x = 8.$

Case-II Now u = – [x + n(0.1)]

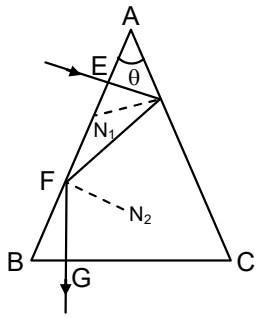
Here, n is number of rotations and 0.1 cm is linear distance travelled in each rotation.

$\therefore \quad -2 = \dfrac{6}{6-[x+n(0.1)]}$

$\Rightarrow$ n = 10

56. c

56.



Say A = θ

$\angle ADE = 90 - \theta$ (ΔADE)

$\therefore \quad \angle EDN_1 = \theta = \angle N_1DF$ ($\angle i = \angle r$)

$ED \parallel FN_2$

$\Rightarrow \quad \angle EDF = 2\theta = \angle DFN_2 = \angle N_2FG$ ($\angle i = \angle r$)

$\angle G = 90°$ $\angle BFG = 90 - 2\theta$

$\Rightarrow \quad \angle B = 2\theta$ (ΔFGB)

$\angle B = \angle C$ (isosceles triangle)

$\therefore \quad \angle A + \angle B + \angle C = 180°$

$\Rightarrow \quad \theta = 36°$

57. d

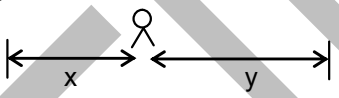
57. Loudness of sound is proportional to the square of the amplitude of the vibrating string.

58. a

58. Using Right Hand Thumb Rule.

59. c

59.



$x = \dfrac{340 \times 2.4}{2}$ & $y = \dfrac{340 \times 4.4}{2}$

Total distance = x + y = 1.16 km

60. d

60. $\dfrac{T-20}{200} = \dfrac{20° - 0°}{100}$

$\Rightarrow$ T = 60 Z.

61. d

61. α, β are roots of $x^2 - 5x + 3 = 0$

$\Rightarrow \alpha^2 - 5\alpha + 3 = 0$ and $\beta^2 - 5\beta + 3 = 0$

$\Rightarrow \alpha^2 + 3 = 5\alpha$ and $\beta^2 + 3 = 5\beta$

Now, $\dfrac{3a_6 + a_8}{a_7} = \dfrac{3\left(\alpha^6 - \beta^6\right) + \left(\alpha^8 - \beta^8\right)}{\alpha^7 - \beta^7}$

$$= \frac{\alpha^6\left(3+\alpha^2\right)-\beta^6\left(3+\beta^2\right)}{\alpha^7-\beta^7}$$

$$= \frac{5\alpha^7-5\beta^7}{\alpha^7-\beta^7} = 5$$

62. c

62. Clearly, ABCD is a square.

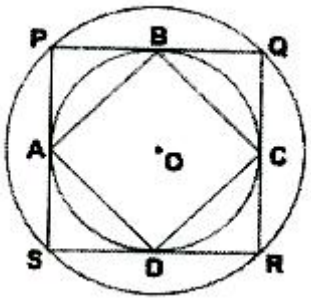
Let side of ABCD be S units

$\therefore$ radius of inner circle $= \frac{S}{\sqrt{2}}$

$\Rightarrow PQ = S\sqrt{2}$

$\therefore$ radius of outer circle = S

$\therefore \frac{\text{Perimeter of outer circle}}{\text{Perimeter of ABCD}} = \frac{2\pi S}{4S} = \frac{\pi}{2}$.



63. c

63. $\frac{ar(\Delta AEB)}{ar(\Delta FEG)} = \left(\frac{5}{2}\right)^2 = \frac{25}{4}$ $\quad[\because \Delta EFG \sim \Delta EAB]$

$\therefore \frac{ar(\Delta FEG)}{ar(\square AFGB)} = \frac{4}{21}$

$ar(\square AFGB) = ar(\square ABCD) - ar(\Delta AFD) - ar(\Delta BCG)$

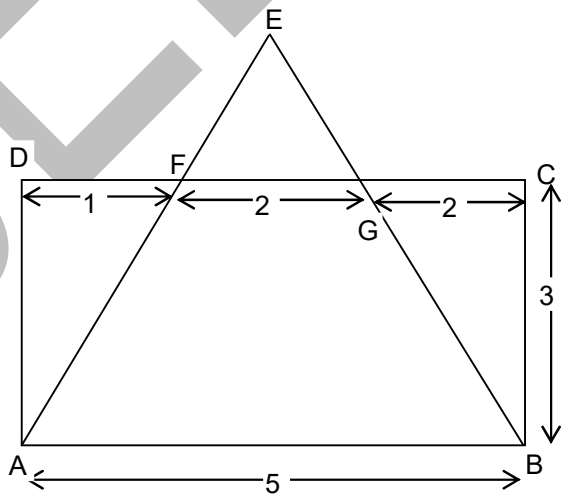
$= 15 - \left(\frac{1}{2}\times 1\times 3\right) - \left(\frac{1}{2}\times 2\times 3\right)$

$= 15 - \frac{9}{2}$

$= \frac{21}{2}$ sq. units

$\therefore ar(\Delta EFG) = \frac{4}{21}\times\frac{21}{2} = 2$ sq.units

$\therefore ar(\Delta AEB) = \frac{25}{4}\times 2 = \frac{25}{2}$ sq.units



64. b

64. $x + yz = 2$ and $y + xz = 2$ and $z + xy = 2$

$\Rightarrow x + yz = y + xz = z + xy$

Now $x + yz = y + xz$

$\Rightarrow x - y - z(x - y) = 0$

$\Rightarrow (x - y)(1 - z) = 0$

$\Rightarrow x = y$ or $z = 1$

Similarly $y + xz = z + xy \Rightarrow y = z$ or $x = 1$

and $z + xy = x + yz \Rightarrow z = x$ or $y = 1$

$\Rightarrow$ either $x = y = z = k$ (let) or $x = y = z = 1$

when $x = y = z = k$

then given equation reduces to $k^2 + k - 2 = 0 \Rightarrow k = -2$ or $k = 1$

So, there are two triples (–2, –2, –2) and (1, 1, 1)

65. a

65. $\sqrt{5|x|+8}=\sqrt{x^2-16}$

$\Rightarrow 5|x|+8=x^2-16$

$\Rightarrow x^2-5|x|-24=0$

$\Rightarrow p^2-5p-24=0$ (Put $|x|=p$]

$\Rightarrow (p-8)(p+3)=0$

$\Rightarrow p=8\left[p=|x|\geq 0\right]$

$\therefore |x|=8$

$\Rightarrow x=8,-8$

$\therefore$ Products of all roots = –64

66. d

66. $2008=NQ_1+8$

$\Rightarrow NQ_1=2000$

$\Rightarrow$ N = number of factors of 2000 which are > 8.

= number of factors of $2^4\times5^3$ which are > 8

$=(4+1)(3+1)-5$

$=20-5=15$

67. d

67. HCF is always a factor of LCM

$5775=3\times5^2\times7\times11$

$175=7\times5^2$

$231=3\times7\times11$

$385=5\times7\times11$

$455=5\times7\times13$

$\therefore$ 455 cannot be the HCF as it is not a factor of 5775.

68. d

68. $a+\frac{1}{b}=b+\frac{1}{c}=c+\frac{1}{a}$

$a+\frac{1}{b}=b+\frac{1}{c}\Rightarrow a-b=\frac{1}{c}-\frac{1}{b}\Rightarrow a-b=\frac{b-c}{bc}$ ……..(i)

Similarly $b+\frac{1}{c}=c+\frac{1}{a}\Rightarrow b-c=\frac{c-a}{ac}$ ……(ii)

and $c+\frac{1}{a}=a+\frac{1}{b}\Rightarrow c-a=\frac{a-b}{ab}$ ……(iii)

on multiplying equation (i), equation (ii), equation (iii)

$(a-b)(b-c)(c-a)=\frac{(b-c)(c-a)(a-b)}{(abc)^2}$

$\Rightarrow abc=\pm1$

69. b

69. Let the number on number plate be k

$\therefore$ (i) k is a 4 digit number

(ii) Last 2 digits of k cannot be 0.

(iii) k is the LCM of any 8 numbers from 1 to 9, and definitely, 9, 8, 1, 2 and 3 is not the number to be left out (as scan from option)

(iv) Since k is a multiple of 8 and 9, it is a multiple of 72 $\Rightarrow$ option (a) 4 and (c) 6 also get eliminated.
(v) The father specifies that last two digits are his age, so the number cannot have xy xy form.
Seeing all these conditions, the number k can have 2 forms xxyy or xyyx.
Let the 8^{th} number be 5 then units digit = 0
$\Rightarrow$ The number will have to by xx00 or 0yy0, both of which are not possible, according to previous conditions
So, we conclude, the 8^{th} number surely is not 5.
$\therefore$ The number on number plate is 5544.

70. a
70. Let $N = 21m + 12 = 18m + 9 + 3m + 3$
Now when N is divided by 9 it gives remainder of 6
$\Rightarrow 3m + 3$ gives remainder of 6 on division by 9 $\Rightarrow m$ can take values 1, 4, 7,…….which forms an AP with k^{th} term 3k –2
Now $11 < N < 1111 \Rightarrow 11 < 21m + 12 < 1111$
$\Rightarrow 0 \le m < \frac{1099}{21}$ ($m \in$ whole number)
So, $0 \le 3k - 2 < \frac{1099}{21}$
$\Rightarrow \frac{2}{3} \le k < \frac{1141}{63}$
$\Rightarrow 0.\bar{6} \le k < 18.\bar{1}$
So, k can take 18 values.

71. a
71. The given equation will have more than two roots, iff, it is an identity.
$\therefore \alpha^2 - 5\alpha + 6 = 0 \Rightarrow (\alpha - 3)(\alpha - 2) = 0$
$\alpha^2 - 3\alpha + 2 = 0 \Rightarrow (\alpha - 2)(\alpha - 1) = 0$
$\alpha^2 - 4 = 0 \Rightarrow (\alpha - 2)(\alpha + 2) = 0$
$\therefore$ At $\alpha = 2$, all the three coefficients equal 0.

72. c
72. $\frac{1}{x+a} + \frac{1}{x+b} = \frac{1}{c}$
$\Rightarrow x^2 + (a + b - 2c)x + ab - (a + b)c = 0$
Now sum of roots = 0
$\Rightarrow a + b = 2c$ or $c = \frac{a+b}{2}$
Product of roots $= ab - (a + b)c$
$= ab - (a + b)\frac{(a+b)}{2}$
$= -\frac{(a^2 + b^2)}{2}$

73. a
73. $1 + 4 + 7 + ... + x = 925$
$\Rightarrow \frac{n}{2}[2 + (n - 1)3] = 925$, here n is number of terms.
$\Rightarrow (n - 25)(3n + 74) = 0$

$\Rightarrow n = 25$

So, $x = 1 + (25 - 1)3$

$= 73$

74. a

74. P (sum is neither 7 nor 11)

$= 1 - P$ (sum is either 7 or 11)

$= 1 - \frac{8}{36} = \frac{7}{9}$

75. a

75. In ΔABD, $\text{Tan}\alpha = \frac{H - h}{x}$ ....(i)

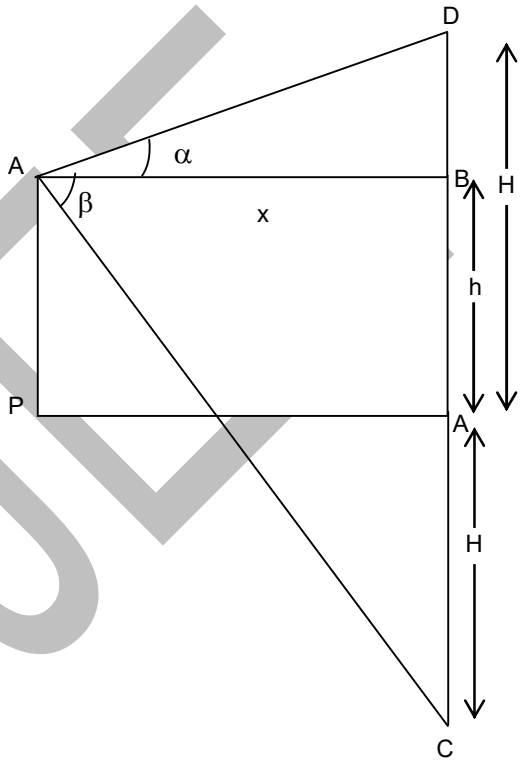
In ΔABC, $\text{Tan}\beta = \frac{H + h}{x}$.....(ii)

From (i) and (ii)

$\frac{H + h}{\text{Tan}\beta} = \frac{H - h}{\text{Tan}\alpha}$

$H(\text{Tan}\alpha - \text{Tan}\beta) = -h(\text{Tan}\beta + \text{Tan}\alpha)$

$h = \frac{H(\tan\beta - \tan\alpha)}{(\tan\beta + \tan\alpha)}$

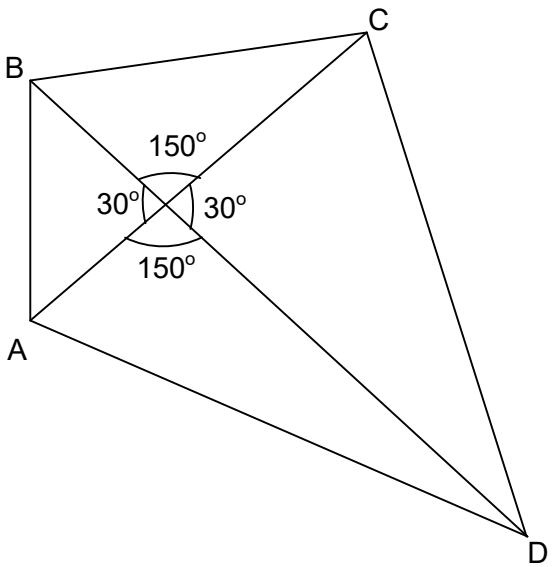


76. a

76. Area of quadrilateral

$\frac{1}{2} AC \times BD \sin 30^\circ = 1 + 2 + 8 + 4 = 15$

$\Rightarrow AC \times BD = 60$



77. a

77. $\tan\theta + \sec\theta = \frac{3}{2}$

$\Rightarrow -\tan\theta + \sec\theta = \frac{2}{3}$

On adding both equation we get

$\sec\theta = \frac{13}{12} \Rightarrow \sin\theta = \frac{5}{13}$

78. d

78. $\sin^2 x + \sin^2 y + \sin^2 z = 0$

$\Rightarrow \sin^2 x = \sin^2 y = \sin^2 z = 0$

$\Rightarrow \cos^2 x = \cos^2 y = \cos^2 z = 1$

$\therefore \cos x + \cos y + \cos z = 3$ (possible)

$\cos x + \cos y + \cos z = -3$ (possible)

If any 2 of $\cos x, \cos y$ and $\cos z = -1$, and the third be 1

then, $\cos x + \cos y + \cos z = -1$

If any 2 of $\cos x, \cos y$ and $\cos z = 1$, and the third be –1

Then, $\cos x + \cos y + \cos z = 1$

$\therefore$ –2 (option D) is NOT a possible value of $\cos x + \cos y + \cos z$

79. c

79. Let remainder be $ax + b, f(x) = x^{51}$

$x^{51} = (x^2 - 3x + 2)Q(x) + ax + b$

$\Rightarrow x^{51} = (x-1)(x-2)Q(x) + ax + b$

$f(1) = 1 = a + b$

$f(2) = 2^{51} = 2a + b$

$\Rightarrow a = 2^{51} - 1$

$\Rightarrow b = 2 - 2^{51}$

$\therefore$ Remainder $= (2^{51} - 1)x + (2 - 2^{51})$

80. b

80. radius of each circle = 1 unit

$\therefore$ side of equilateral $\Delta = 2\sqrt{3} + 2$

$\therefore$ area $(\Delta ABC) = \frac{\sqrt{3}}{4} \times 2^2 (\sqrt{3} + 1)^2$

$= \sqrt{3}(4 + 2\sqrt{3})$

$= 6 + 4\sqrt{3}$