MELUHA INTERNATIONAL SCHOOL

HYDERABAD

SR MPC JEE MAINS | **UNIT – VI ASSIGNMENT – 2** | **Date: 13-05-2020**

Time: | | **Max. Marks:**

MATHS

Syllabus: ***STATISTICS AND PROBABILITY:– 1. MEASURES OF CENTRAL TENDENCY, 2. MEASURES OF DISPERSION, 3. MATHEMATICAL REASONING, 4. SEQUENCE AND SERIES, 5. RANDOM VARIABLES AND DISTRIBUTION 6. PORBABALITY***

1. If $a_1, a_2, a_3, ...$ are in A.P. then a_p, a_q, a_r are in AP if p, q, r are in
   (A) AP (B) GP (C) HP (D) NOTA

2. If in a progression $a_1, a_2, a_3, ...$, etc., $(a_r - a_{r+1})$ bears a constant ratio with $a_r.a_{r+1}$ then the terms of the progression are in
   (A) AP (B) GP (C) HP (D) NOTA

3. If $\frac{a_2a_3}{a_1a_4} = \frac{a_2+a_3}{a_1+a_4} = 3\left(\frac{a_2-a_3}{a_1-a_4}\right)$ then a_1, a_2, a_3, a_4 are in
   (A) AP (B) GP (C) HP (D) NOTA

4. Let x, y, z be three positive prime numbers. The progression in which $\sqrt{x}, \sqrt{y}, \sqrt{z}$ can be three terms (not necessarily consecutive) is
   (A) AP (B) GP (C) HP (D) NOTA

5. Let $f(x) = 2x + 1$. Then the number of real values of x for which the three unequal numbers f(x), f(2x), f(4x) are in GP is
   (A) 1 (B) 2 (C) 0 (D) NOTA

6. Let $a_1, a_2, a_3, ...$ be in AP and a_p, a_q, a_r be in GP. Then $a_q : a_p$ is equal to
   (A) $\frac{r-p}{q-p}$ (B) $\frac{q-p}{r-q}$ (C) $\frac{r-q}{q-p}$ (D) NOTA

7. If a, b, c are in AP then $\frac{a}{bc}, \frac{1}{c}, \frac{2}{b}$ are in
   (A) AP (B) GP (C) HP (D) NOTA

8. If in an AP, $t_1 = \log_{10} a, t_{n+1} = \log_{10} b$ and $t_{2n+1} = \log_{10} c$ then a, b, c are in
   (A) AP (B) GP (C) HP (D) NOTA

9. The minimum number of terms of 1 + 3 + 5 + 7+… that add up to a number exceeding 1357 is
   (A) 15 (B) 37 (C) 35 (D) 17

10. In the sequence 1, 2, 2, 4, 4, 4, 4, 8, 8, 8, 8, 8, 8, 8, 8,…, where n consecutive terms have the value n, the 1025th term is
    (A) 2^9 (B) 2^{10} (C) 2^{11} (D) 2^8

11. If $\log\left(\frac{5c}{a}\right), \log\left(\frac{3b}{5c}\right)$ and $\log\left(\frac{a}{3b}\right)$ are in AP, where a, b, c are in GP, then a, b, c are the lengths of sides of
    (A) An isosceles triangle (B) An equilateral triangle
    (C) A scalene triangle (D) NOTA

12. Let S be the sum, P be the product and R be the sum of the reciprocals of n terms of a GP. Then $P^2R^n : S^n$ is equal to
    (A) 1 : 1 (B) (common ratio)^n : 1
    (C) (first term)^2 : (common ratio)^n (D) NOTA

13. The 10^{th} common term between the series 3 + 7 + 11 + … and 1 + 6 + 11 + … is
(A) 191 (B) 193 (C) 211 (D) NOTA

14. If a, b, c, d are four numbers such that the first three are in AP while the last three are in HP then
(A) bc = ad (B) ac = bd (C) ab = cd (D) NOTA

15. If a, x, b are in AP and a, y, b are in GP and a, z, b are in HP such that x = 9z and a > 0, b > 0 then
(A) $|y|=3z$ (B) $x=3|y|$ (C) 2y = x + z (D) NOTA

16. If the sum of the series $1+\frac{2}{x}+\frac{4}{x^2}+\frac{8}{x^3}+\ldots$ to ∞ is a finite number then
(A) x < 2 (B) x > 1/2 (C) x > – 2 (D) x < – 2 or x > 2

17. Let S_n denote the sum of the first n terms of an AP. If $S_{2n}=3S_n$ then $S_{3n}:S_n$ is equal to
(A) 4 (B) 6 (C) 8 (D) 10

18. In an AP, $S_p=q, S_q=p$ and S_r denotes the sum of the first r terms. Then S_{p+q} is equal to
(A) 0 (B) $-(p+q)$ (C) $p+q$ (D) pq

19. If a, b, c are in AP then $a+\frac{1}{bc}, b+\frac{1}{ca}, c+\frac{1}{ab}$ are in
(A) AP (B) GP (C) HP (D) NOTA

20. If $(1+x)(1+x^2)(1+x^4)\ldots(1+x^{128})=\sum_{r=0}^{n} x^r$ then n is
(A) 225 (B) 127 (D) 63 (D) NOTA

21. The sum of the products of the ten numbers $\pm1, \pm2, \pm3, \pm4, \pm5$ taking two at a time is
(A) 165 (B) – 55 (C) 55 (D) NOTA

22. The sum of the series $\frac{1}{\log_2 4}+\frac{1}{\log_4 4}+\frac{1}{\log_8 4}+\ldots+\frac{1}{\log_{2^n} 4}$ is
(A) $\frac{n(n+1)}{2}$ (B) $\frac{n(n+1)(2n+1)}{12}$ (C) $\frac{1}{n(n+1)}$ (D) $\frac{n(n+1)}{4}$

23. If $S_n=\sum_{n=1}^{n}\frac{1+2+2^2+\ldots \text{ to n terms}}{2^n}$ then S_n is equal to
(A) $2^n-(n+1)$ (B) $1-\frac{1}{2^n}$ (C) $n-1+\frac{1}{2^n}$ (D) 2^n-1

24. If t_n denotes the nth term of the series 2 + 3 + 6 + 11 + 18 +… then t_{50} is
(A) 49^2-1 (B) 49^2 (C) 50^2+1 (D) 49^2+2

25. $2^{1/4}.4^{1/8}.8^{1/16}\ldots$ to ∞ is equal to
(A) 1 (B) 2 (C) 3/2 (D) NOTA

26. The sum of n terms of the series $1^2+2.2^2+3^2+2.4^2+5^2+2.6^2+\ldots$ is $\frac{n(n+1)^2}{2}$ when n is even. When n is odd, then sum is
(A) $\frac{n^2(n+1)}{2}$ (B) $\frac{n(n^2-1)}{2}$ (C) $2(n+1)^2.(2n+1)$ (D) NOTA

27. If n is an odd integer greater than or equal to 1 then the value of
$n^3-(n-1)^3+(n-2)^3-\ldots+(-1)^{n-1}.1^3$ is
(A) $\frac{(n+1)^2.(2n-1)}{4}$ (B) $\frac{(n-1)^2.(2n-1)}{4}$ (C) $\frac{(n+1)^2.(2n+1)}{4}$ (D) NOTA

28. Let $t_r = 2^{r/2} + 2^{-r/2}$. Then $\sum_{r=1}^{10} t_r^2$ is equal to

(A) $\frac{2^{21}-1}{2^{10}}+20$ (B) $\frac{2^{21}-1}{2^{10}}+19$ (C) $\frac{2^{21}-1}{2^{20}}-1$ (D) NOTA

29. The sum of $\frac{3}{1.2}.\frac{1}{2}+\frac{4}{2.3}.\left(\frac{1}{2}\right)^2+\frac{5}{3.4}.\left(\frac{1}{2}\right)^3+...$ to n terms is equal to

(A) $1-\frac{1}{(n+1)2^n}$ (B) $1-\frac{1}{n.2^{n-1}}$ (C) $1+\frac{1}{(n+1)2^n}$ (D) NOTA

30. The lengths of three unequal edges of a rectangular solid block are in GP. The volume of the block is 216 cm^3 and the total surface area is 252 cm^2. The length of the longest edge is

(A) 12 cm (B) 6 cm (C) 18 cm (D) 3 cm

31. The minimum number of terms of 1 + 3 + 5 + 7 + … that add up to a number exceeding 1357 is

(A) 15 (B) 37 (C) 35 (D) 17

32. The AM of two given positive numbers is 2. If the larger number is increased by 1, the GM of the numbers becomes equal to the AM of the given numbers. Then the HM of the given numbers is

(A) 3/2 (B) 2/3 (C) 1/2 (D) NOTA

33. Let a, b be two positive numbers, where a > b and 4 × GM = 5 × HM for the numbers. Then a is

(A) 4b (B) ¼ b (C) 2b (D) b

34. If $a, a_1, a_2, a_3, ..., a_{2n}$, b are in AP and $a, g_1, g_2, g_3, ..., g_{2n}, b$ are in GP and h is the HM of a and b then $\frac{a_1+a_{2n}}{g_1g_{2n}}+\frac{a_2+a_{2n-1}}{g_2g_{2n-1}}+...+\frac{a_n+a_{n+1}}{g_ng_{n+1}}$ is equal to

(A) 2n/h (B) 2nh (C) nh (D) n/h

35. Let there be a GP whose first term is a and the common ratio is r. If A and H are the arithmetic mean and the harmonic mean respectively for the first n terms of the GP, then A. H is equal to

(A) a^2r^{n-1} (B) ar^n (C) a^2r^n (D) NOTA

36. If the first and the (2n – 1)th terms of an AP, a GP and an HP are equal and their nth terms are a, b and c respectively then

(A) a = b = c (B) $a \geq b \geq c$ (C) a + c = b (D) $ac-b^2=0$

37. $\frac{a^n+b^n}{a^{n-1}+b^{n-1}}$ is the HM between a and b if n is

(A) 0 (B) 1/2 (C) – 1/2 (D) 1

38. If the harmonic mean between P and Q be H then $H\left(\frac{1}{P}+\frac{1}{Q}\right)$ is equal to

(A) 2 (B) $\frac{PQ}{P+Q}$ (C) $\frac{P+Q}{PQ}$ (D) 1/2

39. Let x be the AM and y, z be two GMs between positive numbers. Then $\frac{y^3+z^3}{xyz}$ is equal to

(A) 1 (B) 2 (C) 1/2 (D) None

40. In a GP of alternately positive and negative terms, any term is the AM of the next two terms. Then the common ratio is

(A) – 1 (B) – 3 (C) – 2 (D) – 1/2

41. If $a_n > 1$ for all $n \in \mathbb{N}$ then $\log_{a_2} a_1 + \log_{a_3} a_2 + ... + \log_{a_n} a_{n-1} + \log_{a_1} a_n$ has the minimum value

(A) 1 (B) 2 (C) 0 (D) NOTA

42. The product of n positive numbers is 1. Their sum is

(A) A positive integer (B) Divisible by n

(C) Equal to n + 1/n (D) Greater than or equal to n

43. If $0<x<\pi/2$ then the minimum value of (sin x + cos x + cosec 2x)^3 is
(A) 27 (B) 13.5 (C) 6.75 (D) NOTA

44. a, b, c are three positive numbers and abc^2 has the greatest value 1/64. Then
(A) $a=b=\frac{1}{2}, c=\frac{1}{4}$ (B) $a=b=\frac{1}{4}, c=\frac{1}{2}$ (C) $a=b=c=\frac{1}{3}$ (D) NOTA

45. If a > 0, b > 0, c > 0 and the minimum value of $a\left(b^2+c^2\right)+b\left(c^2+a^2\right)+c\left(a^2+b^2\right)$ is λabc then λ is
(A) 2 (B) 1 (C) 6 (D) 3

46. The sum of 0.2 + 0.004 + 0.00006 + 0.0000008 + … to ∞ is
(A) 200/891 (B) 2000/9801 (C) 1000/9801 (D) NOTA

47. If AM of the numbers 5^{1+x} and 5^{1-x} is 13 then the set of possible, real values of x is
(A) $\left\{5, \frac{1}{5}\right\}$ (B) $\{1, -1\}$ (C) $\left\{x \middle| x^2-1=0, x\in\mathbb{N}\right\}$ (D) NOTA

48. If the AM of two positive numbers be three times their geometric mean then the ratio of the numbers is
(A) $3\pm 2\sqrt{2}$ (B) $\sqrt{2}\pm 1$ (C) $17+12\sqrt{2}$ (D) NOTA

49. The numbers 1, 4, 16 can be three terms (not necessarily consecutive) of
(A) No AP (B) Only one GP
(C) Infinite number of APs (D) None

50. $1+\frac{3}{2}+\frac{5}{2^2}+\frac{7}{2^3}+\ldots\infty$ is equal to
(A) 3 (B) 6 (D) 9 (D) 12

51. Sum of the series $1+2.2+3.2^2+4.2^2+\ldots+100.2^{99}$ is
(A) $100.2^{100}+1$ (B) $99.2^{100}+1$ (C) $99.2^{100}-1$ (D) $100.2^{100}-1$

52. The sum of the series $3+33+333+\ldots$ n terms is
(A) $\frac{1}{27}\left(10^{n+1}+9n-28\right)$ (B) $\frac{1}{27}\left(10^{n+1}-9n-10\right)$ (C) $\frac{1}{27}\left(10^{n+1}+10n-9\right)$ (D) NOTA

53. The sum of n term of the following series $1+(1+x)+\left(1+x+x^2\right)+\ldots$ will be
(A) $\frac{1-x^n}{1-x}$ (B) $\frac{x\left(1-x^n\right)}{1-x}$ (C) $\frac{n(1-x)-x\left(1-x^n\right)}{(1-x)^2}$ (D) NOTA

54. The sum of n terms of the series 1 + 3 + 7 + 15 + 31 + … is
(A) $2^{n+1}-n$ (B) $2^{n+1}-n-2$ (C) 2^n-n-2 (D) NOTA

55. The sum of the series $1.2.3+2.3.4+3.4.5+\ldots$ to n terms is
(A) $n(n+1)(n+2)$ (B) $(n+1)(n+2)(n+3)$
(C) $\frac{1}{4}n(n+1)(n+2)(n+3)$ (D) $\frac{1}{4}(n+1)(n+2)(n-3)$

56. If the AM, GM and HM between two positive numbers a and b are equal, then
(A) a = b (B) ab = 1 (C) a > b (D) a < b

57. Let two numbers have arithmetic mean 9 and geometric mean 4. Then, these numbers are roots of the quadratic equation
(A) $x^2-18x-16=0$ (B) $x^2-18x+16=0$ (C) $x^2+18x-16=0$ (D) $x^2+18x+16=0$

58. If a, b, c are positive real numbers such that a + b + c + d = 2, then M = (a + b) (c + d) satisfies the relation
(A) $0<M\le 1$ (B) $1\le M\le 2$ (C) $2\le M\le 3$ (D) $3\le M\le 4$

59. If $a\in\left(0, \frac{\pi}{2}\right)$, then $\sqrt{x^2+x}+\frac{\tan^2\alpha}{\sqrt{x^2+x}}$ is always greater than or equal to
(A) $2\tan\alpha$ (B) 1 (C) 2 (D) $\sec^2\alpha$

60. The sum of first 9 terms of the series $\frac{1^3}{1}+\frac{1^3+2^3}{1+3}+\frac{1^3+2^3+3^3}{1+3+5}+...$ is

(A) 71 (B) 98 (C) 142 (D) 192

61. Three arithmetic means between 3 and 19 are

(A) 7, 11, 15 (B) 7, 10, 13 (C) 7, 12, 17 (D) NOTA

62. If (2n + r) r, $n\in\mathbb{N}, r\in\mathbb{N}$ is expressed in the sum of k consecutive odd natural numbers, then k is equal to

(A) r (B) n (C) r + 1 (D) n + 1

63. The five geometric means between 576 and 9 are

(A) 192, 96, 48, 24, 12 (B) 288, 144, 72, 36, 18

(C) 208, 104, 52, 26, 13 (D) None of these

64. If a is the AM of b and c and the two geometric means are G_1 and G_2, then $G_1^3+G_2^3$ is equal to

(A) abc (B) 2abc (C) 3abc (D) 5abc

65. In the sequence 1, 2, 2, 4, 4, 4, 4, 8, 8, 8, 8, 8, 8,…, where n consecutive terms have the value n, then 1025th term is

(A) 2^9 (B) 2^{10} (C) 2^{11} (D) 2^8

66. If 1, 5, 25, 125, 625, … forms a GP, then the sequence consisting odd term of the given GP, is

(A) AP (B) GP (C) HP (D) NOTA

67. If the arithmetic mean and geometric mean of a and b are A and G respectively; then the value of A – G will be

(A) $\frac{a-b}{2}$ (B) $\frac{a+b}{2}$ (C) $\left[\frac{\sqrt{a}-\sqrt{b}}{\sqrt{2}}\right]^2$ (D) $\frac{2ab}{a+b}$

68. The harmonic mean of the roots of the equation $\left(5+\sqrt{2}\right)x^2-\left(4+\sqrt{5}\right)x+8+2\sqrt{5}=0$ is

(A) 2 (B) 4 (C) 6 (D) 8

69. The minimum value of $4^x+4^{1-x}, x\in\mathbb{R}$, is

(A) 2 (B) 4 (C) 1 (D) NOTA

70. If $\sqrt{3}$, A and $\sqrt{2}$ are in AP, then $\frac{\sqrt{3}+\sqrt{2}}{2}$ is greater than or equal to

(A) $\sqrt{5}$ (B) $\sqrt{6}$ (C) $\sqrt{8}$ (D) NOTA

71. The sum of 10 terms of the sequence 1, 6, 27, 108,… is

(A) 280481 (B) 280482 (C) 280484 (D) 280483

72. The 8th term of the sequence 1, 4, 12, 32, 80, … is

(A) 1000 (B) 1200 (C) 1024 (D) NOTA

73. The sum of n terms of the series 5 + 7 + 13 + 31 + 85 + … is

(A) $\frac{1}{2}\left(3^n+8n-1\right)$ (B) $\frac{1}{2}\left(3^n+7n+1\right)$ (C) $\frac{1}{2}\left(3^n+5n\right)$ (D) $\frac{1}{2}\left(3^n+7n\right)$

74. Find the sum to n terms 1 + 4 + 10 + 22 + …

(A) 100 n (B) 5.2^n-7n (C) 8n (D) 3.2^n-2n-3

75. The sum of n terms of the series 1 + 5 + 12 + 22 + 35 + … is

(A) $\frac{n\left(n^2+1\right)}{2}$ (B) $\frac{n^2\left(n+1\right)}{2}$ (C) $\frac{n\left(n^2-1\right)}{4}$ (D) NOTA

76. Find the sum to n terms of series given below: $\frac{4}{1.2.3}+\frac{5}{2.3.4}+\frac{6}{3.4.5}+...$

(A) $\frac{5}{4}-\frac{1}{2(n+1)(n+2)}(2n+5)$ (B) $\frac{2n+5}{(n+1)(n+2)}$

(C) $\frac{5}{2}-\frac{n+5}{(n+2)(n-1)}$ (D) NOTA

77. Find the sum to n terms of the series 1 .2 + 2 . 3 + 3 . 4 +…

(A) 7n – 9 (B) $\frac{n}{5}(n+2)(n-9)$ (C) n (n + 1) (n + 2) (D) $\frac{n}{3}(n+1)(n+2)$

78. If $S_n=\sum_{r=1}^{n}t_r=\frac{1}{6}n\left(2n^2+9n+13\right)$, then $\sum_{r=1}^{n}\sqrt{t_r}$ is equal to

(A) $\frac{1}{2}n(n+1)$ (B) $\frac{1}{2}n(n+2)$ (C) $\frac{1}{2}n(n+3)$ (D) $\frac{1}{2}n(n+5)$

79. If $\sum_{k=1}^{n}\left(\sum_{m=1}^{k}m^2\right)=an^4+bn^3+cn^2+dn+e$, then

(A) $a=\frac{1}{12}$ (B) $b=\frac{1}{2}$ (C) $d=\frac{1}{5}$ (D) e = 1

80. If x + y + z = 1 and x, y and z are positive numbers such that (1 – x) (1 – y) (1 – z) $\geq kxyz$, then k is equal to

(A) 2 (B) 4 (D) 8 (D) 16

81. If a + b + c = 3 and a > 0, b > 0, c > 0, then the greatest value of $a^2b^3c^2$ is

(A) $\frac{3^{10}.2^4}{7^7}$ (B) $\frac{3^9.2^4}{7^7}$ (C) $\frac{3^8.2^4}{7^7}$ (D) NOTA

82. If a, b and c are digits, then the rational number represented by 0. cababab…, is

(A) $\frac{99c+ba}{990}$ (B) $\frac{99c+10a+b}{99}$ (C) $\frac{99c+10a+b}{990}$ (D) NOTA

83. The AM, HM and GM between two numbers are $\frac{144}{15}$, 15 and 12 but not necessarily in this order. Then HM, GM and AM respectively are

(A) $\frac{144}{15}$, 12, 15 (B) $\frac{144}{15}$, 15, 12 (C) 15, 12, $\frac{144}{15}$ (D) 12, 15, $\frac{144}{15}$

84. The sum of first n terms of the series $1^2+2.2^2+3^2+2.4^2+5^2+2.6^2+...$ is $\frac{n(n+1)^2}{2}$, where n is even. When n is odd, the sum is

(A) $\frac{n^2(n+1)}{2}$ (B) $\frac{n(n+1)^2}{2}$ (C) $\frac{n(n+1)^3}{2}$ (D) $\frac{n(n+1)}{2}$

85. If three positive real numbers a, b, c are in AP such that abc = 4, then the minimum possible value of b is

(A) $2^{3/2}$ (B) $2^{2/3}$ (C) $2^{1/3}$ (D) $2^{5/2}$

86. If a, b and c are three unequal positive quantities in HP, then

(A) $a^{100}+c^{100}>2b^{100}$ (B) $a^3+c^3>2b^3$ (C) $a^5+c^5>2b^5$ (D) All of these

87. If a + 2b + 3c = 1 and a > 0, b > 0, c > 0, then the greatest value of a^3b^2c is

(A) $\frac{1}{5184}$ (B) $\frac{1}{51}$ (C) $\frac{1}{518}$ (D) NOTA

88. Let $a_n=\underbrace{(111....1)}_{n\text{ times}}$, then

(A) a_{912} is not prime (B) a_{951} is not prime (C) a_{480} is not prime (D) All of these

89. Evaluate: $2^{1/4}.4^{1/8}.8^{1/16}.16^{1/32}....$

(A) 2 (B) 3/2 (C) 1 (D) 1/2

90. If a + b + c = 6, find maximum value of $\sqrt{4a+1}+\sqrt{4b+1}+\sqrt{4c+1}$ for a, b, c > 0

(A) 9 (B) 8 (C) 7 (D) 6

PHYSICS

Syllabus: ***MODEREN PHYSICS:– 1. ELECTROMAGNETIC WAVES, 2. DUAL NATURE OF MATTER, 3. ATOMS 4. NUCLEI, 5. SEMICONDUCTORS AND COMMUNICATION SYSTEMS***

1. When a nucleus with atomic number Z and mass number A undergoes a radioactive decay process
   (i) Both Z and A will decrease, if the process is α decay
   (ii) Z will decrease but A will not change, if the process is β^+ decay
   (iii) Z will increase but A will not change, if the process is β^- decay
   (iv) Z and A will remain unchanged, if the process is γ decay
   (A) i & ii are true (B) ii & id are true
   (B) i, ii & iii are true (D) i, ii, iii & iv are true
2. 1 g of a radioactive substance disintegrates at the rate of 3.7 ×10^{10} disintegrations per second. The atomic mass of the substance is 226. Calculate its mean life.
   (A) 1.2 × 10^5s (B) 1.39 × 10^{11}s (C) 21.2× 10^5s (D) 7.194 × 10^{10}s
3. Transistors are made of
   (A) Inslators (B) Conductors
   (C) Alloys (D) Doped semi-conductors
4. A nucleus X-initially at rest, undergoes alpha-decay, according to the equation.
   $${}^{A}_{92}X \rightarrow {}^{228}_{z}Y + \alpha$$
   The α-particle in the above process is found to move in a circular track of radius 1.1 × 10^2m in a uniform magnetic field of 3.0 × 10^3T.
   The energy (in MeV) released during the process is
   Given : m_y = 228.03 amu; m_α = 4.003 amu,
   $$m\left({}^{1}_{0}n\right) = 1.009amu; m\left({}^{1}_{0}H\right) = 1.008amu,$$
   1 amu = 1.66 × 10^{-27} kg≡ 931.5 MeV/c^2
   (A) 0.34MeV (B) 0.94 MeV (C) 1.82 MeV (D) 2.76 MeV
5. The following truth table corresponds to the logic gate

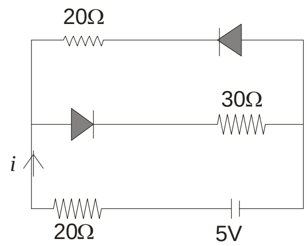
A	0	0	1	1
B	0	1	0	1
X	0	1	1	1

   (A) NAND (B) OR (C) AND (D) XOR
6. If M is the atomic mass and A is the mass number, packing fraction is given by
   (A) $\frac{A}{M-A}$ (B) $\frac{A-M}{A}$ (C) $\frac{M}{M-A}$ (D) $\frac{M-A}{A}$
7. A pieces of copper and the other of germanium are cooled from the room temperature to 80 K, then which of the following would be a correct statement
   (A) Resistance of each increases
   (B) Resistance of each decreases
   (C) Resistance of copper increases while that of germanium decreases
   (D) Resistance of copper decreases while that of germanium increases.
8. In the following reaction the value of ‘X’ is
   $${}_7N^{14} + {}_2He^4 \rightarrow X + {}_1H^1$$
   (A) ${}_8N^{17}$ (B) ${}_8O^{17}$ (C) ${}_7O^{16}$ (D) ${}_7N^{16}$
9. How many disintegrations per second will Occur in one gram of ${}^{238}_{92}U$, if its half-life against α-decay is 1.42 x 10^{17} s?
   (A) 1.23×10^4 dps (B) 4.23×10^4 dps (C) 0.16×10^4 dps (D) 6.28×10^4 dps

SECTION-II

(Numerical Value Answer Type)

10. current in the circuit will be (neglect the forward biased resistance and potential drop of diode)



(A) 0.125A (B) 0.100A (C) 0.500A (D) 0.250A

11. The binding energies per nucleon for deuterium and helium are 1.1 MeV and 7.0 MeV respectively. The energy liberated when 2 deuterons take part in the reaction ${}_1^2\text{H} + {}_1^2\text{H} \rightarrow {}_2^4\text{He} + \text{Q}$ (Q is energy released)

(A) 32.6 MeV (B) 27.8 MeV (C) 23.6 MeV (D) 18.4 Mev

12. The kinetic energy of α - particles emitted in the decay of ${}_{88}\text{Ra}^{226}$ into ${}_{86}\text{Rn}^{222}$ is measured to be 4.78 MeV. The total energy in the process approximately is

(A) 2.46 MeV (B) 8.54 MeV (C) 10.32 MeV (D) 4.87 MeV

13. A radioactive substance has 6.0×10^{18} active nuclei initially. The approximate time required is for the active nuclei of the same substance to become 1.0×10^{18} if its half-life is 40 s. (Given that $\log_{10} 6 = 0.7782$)

(A) 103s (B) 109s (C) 117 s (D) 92 s

14. After three half-lives what will be the fraction of initial substance

(A) 0.50 (B) 0.25 (C) 0.125 (D) 0.0625

15. Activity of a radioactive substance is R_1 and time t_1 and R_2 at time $\text{t}_2\left(\text{t}_2 > \text{t}_1\right)$. Then the ratio $\frac{\text{R}_2}{\text{R}_1}$ is :

(A) $\frac{\text{t}_2}{\text{t}_1}$ (B) $\text{e}^{-\lambda(t_1+t_2)}$ (C) $\text{e}\left(\frac{\text{t}_1-\text{t}_2}{\lambda}\right)$ (D) $e^{\lambda(t_1-t_2)}$

16. Two radioactive samples of different elements (half -lives t_1 and t_2 respectively) have same number of nuclei $t = 0$. The time after which their activities are same is.

(A) $\frac{t_1 t_2}{0.693(t_2-t_1)}\ln\frac{t_2}{t_1}$ (B) $\frac{t_1 t_2}{0.693}\ln\frac{t_2}{t_1}$ (C) $\frac{t_1 t_2}{0.693(t_1+t_2)}\ln\frac{t_2}{t_1}$ (D) None of these

17. The activity of a radioactive sample decreases to one tenth of the original activity A_o in a period of one year. After 9 more years its activity would be

(A) $\frac{\text{A}_o}{100}$ (B) $\frac{\text{A}_o}{90}$ (C) $\frac{\text{A}_o}{10^{10}}$ (D) None of these

18. The activity of a radioactive sample goes down to about 6% in a time of 2hours. The half-life of the sample in minute is about

(A)30 (B)15 (C) 60 (D) 120

19. Nuclei of radioactive element A are produced at rate 't^2' at any time t. The element A has decay constant λ. Let N be the number of nuclei of element A at any time t. At time $t = t_0, \frac{dN}{dt}$ is minimum. Then the number of nuclei of element A at time $t = t_0$ is

(A) $\frac{\lambda t^2 - 2t_0}{\lambda^2}$ (B) $\frac{t_0 - \lambda t_0^2}{\lambda^2}$ (C) $\frac{2t_0 - \lambda t_0^2}{\lambda}$ (D) $\frac{t_0 - \lambda t_0^2}{\lambda}$

20. An electron revolve round the nucleus of charge Ze. In order to excite the electron from state $n = 2$ to $n = 3$ the energy required is 47.2 eV. What is the value of Z ?

(A) $Z \equiv 5$ (B) $Z \equiv 4$ (C) $Z \equiv 3$ (D) $Z \equiv 2$

21. Three – fourths of the active nuclei present in a radio-active sample decay is 3/4 s. The half -life of the sample is

(A) 1 s (B) $\frac{1}{2}$ s (C) $\frac{3}{4}s$ (D) $\frac{3}{8}s$

22. A nucleus with mass number 220 initially at rest emits an α-particle. If the Q-value of the reaction is 5.5MeV, the kinetic energy of the α-particle is

(A) 4.4MeV (B) 5.4MeV (C) 5.6MeV (D) 6.5MeV

23. Two Radioactive substances X and Y emit α and β particles respectively. Their disintegration constants are in the ratio 2 : 3. To have equal rate of disintegration of getting emission of α and β particles., the ratio of number of atoms of X to that of Y at any time instant is

(A) 2 : 3 (B) 3 : 2 (C) e : 1 (D) (e – 1) : 1

24. A sample of radioactive material has mass m, decay constant λ, molecular weight M and Avogadro constant N_A. The initial activity of the sample is

(A) λm (B) $\frac{\lambda m}{M}$ (C) $\frac{\lambda m N_A}{M}$ (D) $mN_A e^{\lambda}$

25. The nuclear binding energies of the elements P and Q are E_P and E_Q respectively. Three nuclei of elements Q fuse to form one nucleus of element P. In this process the energy released is 'e'. The correct relation between E_P, E_Q and e will be

(A) $E_Q = 3E_P + e$ (B) $E_Q = 3E_P - e$ (C) $E_P = 3E_Q + e$ (D) $E_P = 3E_Q - e$

26. Half lives of two isotopes X and Y of a material are known to be 2×10^9 years and 4×10^9 years respectively. If a planet was formed with equal number of these isotopes, estimate the current age of the planet, given that currently the material has 20% of X and 80% of Y by number.

(A) 2×10^9 years (B) 4×10^9 years (C) 6×10^9 years (D) 8×10^9 years

27. The energy released in the fission reaction ${}_{92}U^{236} \rightarrow {}_{46}X^{117} + {}_{46}Y^{117} + 2\,{}_0n^1$, given that the binding energy per nucleon of X and Y is 8.5 MeV and that of ${}_{92}U^{236}$ is 7.6 MeV, is nearly

(A) 220 MeV (B)180 MeV (C)195 MeV (D)190 MeV

28. In the certain hypothetical radioactive decay process, species A decays into species B and species B decays into species C according to the reactions. $A \rightarrow 2B$ + particles+ energy ; $B \rightarrow 3C$ + particles + energy. The decay constant for the species A is $\lambda_1 = 1\ s^{-1}$ and that for the species B is $\lambda_2 = 100\ s^{-1}$. Initially 10^4 moles of species A are taken and species B reaches its maximum number at a time $t_0 = 2\ln(10)$ s. Then value of the maximum number of moles of B is $\left(e^{2.303} = 10\right)$

(A) 2 (B) 3 (C) 4 (D) 6

29.
$$A \xrightarrow{\lambda_1} B \xrightarrow{\lambda_2} C$$
$$t = 0 \quad N_0 \quad 0 \quad 0$$
$$t \quad N_1 \quad N_2 \quad N_3$$
. In the above radioactive decay C is stable nucleus. Then

(A) Number of nuclei of B will first increases and then decreases

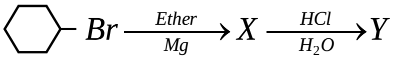
(B) Rate of decay of A will first increases and then decreases

(C) If $\lambda_2 > \lambda_1$, then activity of B will always be higher than activity of A.

(D) If $\lambda_1 >> \lambda_2$, then number of nucleus of C will always be less than number of nucleus of B

CHEMISTRY

Syllabus: ***SECOND YEAR ORGANIC CHEMISTRY:–*** ***1.HALO - ALKANES AND HALOARENES, 2. ORGANIC COMPOUNDS CONATINING C,H AND O (ALCOHOLS,PHENOLS,ETHER) , ALDEHYDES AND KETONES, CARBOXYLIC ACIDS 3.ORGANIC COMPOUNDS CONTAINING NITROGENAMINES DIAZONIUM SALTS CYANIDES AND ISO-CYANIDES, 4. POLYMERS , 5. BIOMOLECULES 6. CHEMISTRY IN EVERY DAY LIFE***

1. 1-Butanol on treatment with alkaline $KMnO_4$ gives
   (A) $CH_3CH_2CH_2COOH$ (B) $CH_3CH_2CH_2CHO$
   (C) $CH_3COCH_2CH_3$ (D) CH_3COOH
2. Given reaction, 'Y' in the reaction is  (Main product)
   (A) hexane (B) cyclohexane
   (C) cyclohexylcyclohexane (D) cyclohexyl ether
3. Among the following compounds which can be dehydrated very easily?
   (A) $CH_3CH_2CH_2CH_2CH_2OH$ (B) $CH_3CH_2CH_2\underset{}{\overset{OH}{|}}{C}HCH_3$
   (C) $CH_3CH_2-\overset{CH_3}{\underset{OH}{C}}-CH_2CH_3$ (D) $CH_3CH_2\underset{CH_3}{CH}CH_2CH_2OH$
4. Which of the following reagents will give alkyl chloride from alcohol?
   (A) HCl/Anhy $ZnCl_2$ (B) $SOCl_2$ (C) PCl_3 (D) All of these
5. Which of the following metals is most reactive with alcohol?
   (A) Al (B) Zn (C) Hg (D) Fe
6. Compound(A) reacts with $SOCl_2$ to give compound (B) the compound (B) reacts with Mg metal to give Grignard reagent, which is treated with acetone and the product is hydrolysed to give 2-methyl-2-butanal. What is A?
   (A) CH_3OH (B) C_2H_5OH
   (C) $CH_3CH(OH)CH_3$ (D) $CH_3CH_2CH_2OH$
7. In the given reaction, correct order of reactivity of HX in
   $$ROH + HX \rightarrow R-X + HOH$$
   Decreasing order is:
   (A) HCl > HBr > HI (B) HI > HCl > HBr (C) HI > HBr > HCl (D) HBr > HCl > HI
8. An organic compound on treatment with conc. Sulphuric acid; gives an intermediate compound which on further boiling with water gives propan-2-ol. The organic compound is and the process is called
   (A) $CH_3CH_2CH_3$; elimination (B) $CH_3CH_2CH_3$; dehydration
   (C) $CH_3CH=CH_2$; substitution (D) $CH_2=CHCH_3$; hydration
9. The order of reactivity of methyl alcohol (I), isopropyl alcohol (II) tertiary butyl alcohol (III) and ethyl alcohol (IV) for esterification in decreasing order will be:
   (A) I > II > III > IV (B) IV > III > II > I (C) I > IV > II > III (D) I > IV > III > II
10. The reagent used to convert ethnic acid to ethanol is
   (A) $LiAlH_4$ (B) BH_3 (C) PCl_3 (D) $K_2Cr_2O_7/H_2SO_4$
11. Consider the following reaction : $C_6H_5-\overset{CH_3}{\underset{H}{C}}-Br + H_2O \rightarrow HO-\overset{CH_3}{\underset{H}{C}}-C_6H_5 + HBr$. The reaction proceeds with 98 % recemisation. The reaction may follow:
   (A) S_N1 mechanism (B) S_N2 mechanism (C) E_1 mechanism (D) E_2 mechanism

12. Arrange the following compounds in order of their reactive towards S_N2 reaction.

(i) $CH_3(CH_2)_3CH_2Br$ (ii) $(CH_3)_2CHCH_2CH_2Br$

(iii) $CH_3CH_2-\underset{|}{\overset{CH_3}{\overset{|}{C}}}H-CH_2Br$ (iv) $CH_3-\underset{CH_3}{\underset{|}{\overset{CH_3}{\overset{|}{C}}}}-CH_2Br$

(A) (i) > (ii) > (iii) > (iv) (B) (ii) > (iii) > (iv) > (i)
(C) (iii) > (i) > (ii) > (iv) (D) (iv) > (ii) > (i) > (iii)

13. On treating a mixture of two alkyl halides with sodium metal in dry ether, 2-methylpropane was obtained. The alkyl halides are:

(A) 2-chloropropane and chloromethane (B) 2-chloropropane and chloroethane
(C) chloromethane and chloroethane (D) chloromethane and 1-chloropropane

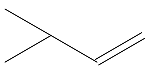
14. Which of the following will give enantiomer pair on reaction with water due to presence of asymmetric carbon atom?

(A) $C_2H_5-\underset{C_2H_5}{\underset{|}{\overset{C_2H_5}{\overset{|}{C}}}}-Br$ (B) $C_2H_5-\underset{CH_3}{\underset{|}{\overset{C_2H_5}{\overset{|}{C}}}}-Cl$ (C) $C_2H_5-\underset{CH_3}{\underset{|}{\overset{H}{\overset{|}{C}}}}-I$ (D) $CH_3-\underset{C_2H_5}{\underset{|}{\overset{CH_3}{\overset{|}{C}}}}-Br$

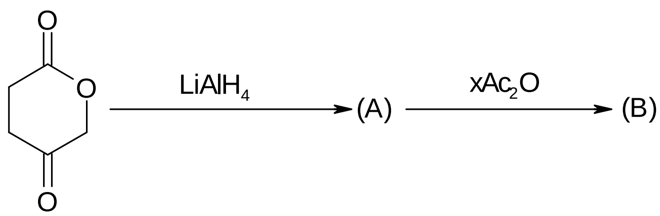
15. Butane nitrile can be prepared by heating:

(1) propyl alcohol with KCN (B) butyl chloride with KCN
(C) butyl alcohol with KCN (D) propyl chloride with KCN

16. $Ph-\underset{OH}{\underset{|}{\overset{Ph}{\overset{|}{C}}}}-\underset{OH}{\underset{|}{\overset{CH_3}{\overset{|}{C}}}}-CH_3 \xrightarrow[\Delta]{H^+} (A)$ Product (A) is

(A) $Ph-\underset{CH_3}{\underset{|}{\overset{Ph}{\overset{|}{C}}}}-\overset{O}{\overset{||}{C}}-CH_3$ (B) $CH_3-\underset{CH_3}{\underset{|}{\overset{CH_3}{\overset{|}{C}}}}-\overset{O}{\overset{||}{C}}-Ph$ (C) $Ph-\overset{O}{\overset{||}{C}}-\underset{Ph}{\underset{|}{\overset{CH_3}{\overset{|}{C}}}}-CH_3$ (D) 

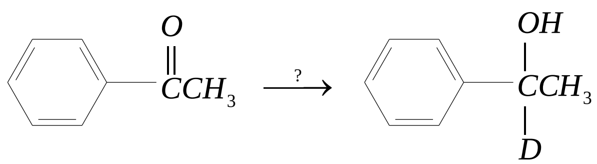
17.



x (moles of anhydride consumed)is,

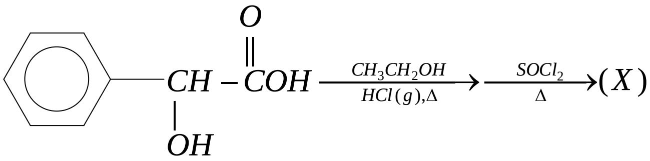
(A) 1 (B) 2 (C) 3 (D) 4

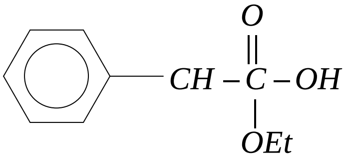
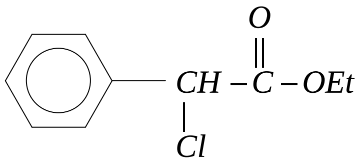
18.

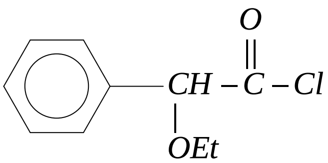
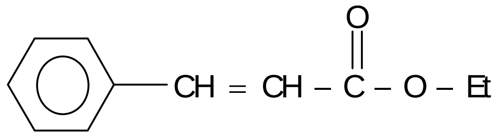


(A) $NaBD_4$ in CH_3 OH (B) $LiA1H_4$, then D_2O
(C) $NaBD_4$ in CH_3OD (D) $LiA1D_4$, then D_2O

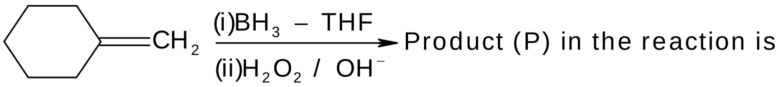
19. Assign the structure of major product (X) of the reaction given below.

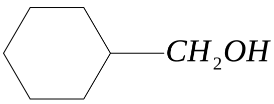
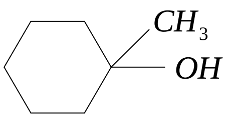
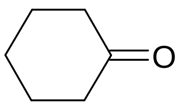
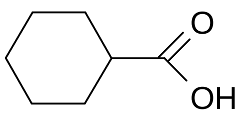


(A) 
(B) 

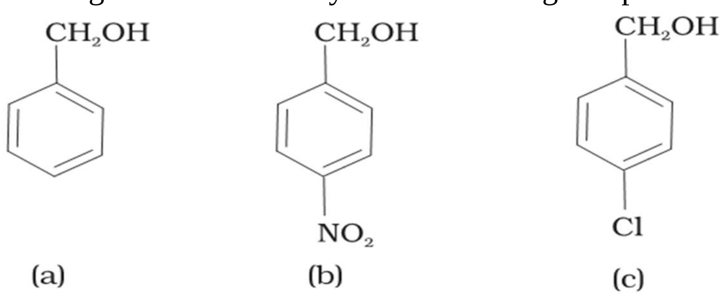
(C) 
(D) 

20.



(A)  (B)  (C)  (D) 

21. Mark the correct increasing order of reactivity of the following compounds with HBr/HCl.



(A) a < b < c (B) b < a < c (C) b < c < a (D) c < b < a

22. Glycerol $\xrightarrow{KHSO_4}$ A $\xrightarrow{LiAlH_4}$ B; A and B are:
(A) Acrolein, allyl alcohol
(B) Glyceryl sulphate, acrylic acid
(C) Allyl alcohol, acrolein
(D) Only acrolein (B is not formed)

23. The ease of dehydration of alcohols is
(A) tertiary > secondary > primary
(B) tertiary < secondary < primary
(C) tertiary > secondary < primary
(D) tertiary < secondary > primary

24. The dehydration of 1-butanol gives
(A) 1-butene as the main product
(B) 2-butene as the main product
(C) equal amounts of 1-butene and 2-butene
(D) 2-methylpropene

25. Reaction of tertiary butyl alcohol with hot Cu at 350°C produces
(A) butanol (B) butanal (C) 2-butene (D) 2-methylpropene

26. In the esterification reaction the correct order of reactivity of alcohols is
(A) $CH_3OH > CH_3CH_2OH > (CH_3)_2\,CHOH$
(B) $CH_3OH > (CH_3)_2\,CHOH > CH_3CH_2OH$
(C) $CH_3CH_2OH > (CH_3)_2\,CHOH > CH_3OH$
(D) $(CH_3)_2\,CHOH > CH_3CH_2OH > CH_2OH$

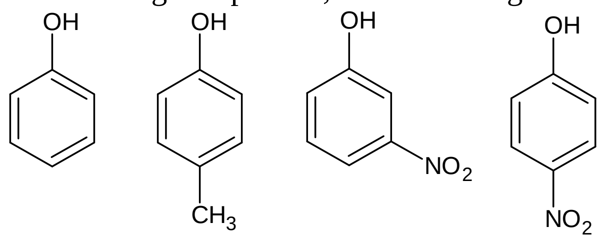
27. In the Victor-Meyer test, blue colouration is shown by
(A) primary alcohol (B) secondary alcohol (C) tertiary alcohol (D) diol

28. Lucas reagent is
(A) anhydrous $AlCl_3$ with conc. HCl (B) anhydrous $ZnCl_2$ with conc. H_2SO_4
(C) anhydrous $ZnCl_2$ with conc. HCl (D) anhydrous $CaCl_2$ with conc. HCl

29. A molecule consumes 2 molecules of HIO_4. The number of carbon-carbon bond broken by this acid is
(A) one (B) two (C) three (D) none

30. Which of the following statements is not correct?
(A) The molecule $\underset{OH}{\underset{|}{RCH}}CH_2\underset{OH}{\underset{|}{CHR'}}$ is cleaved by HIO_4 giving $RCHO$ and $R'CHO$
(B) Tertiary alcohols are more readily dehydrated than the secondary alcohols.
(C) Tertiary butyl alcohol when passed over hot metallic Cu at 570 K produces isobutene.
(D) Primary alcohols do not show positive Lucas test.

31. In the following compounds, the decreasing order of acidity is

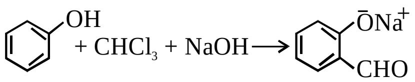


I II III IV

(A) I > IV > III > II (B) II > IV > I > II (C) II > I > III > IV (D) IV > III > I > II

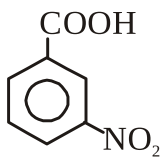
32. Phenols does not react with
(A) sodium bicarbonate (B) sodium hydroxide
(C) potassium hydroxide (D) ferric chloride

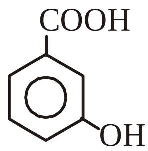
33.

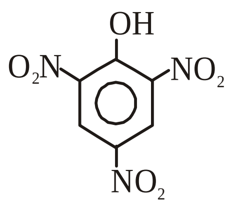


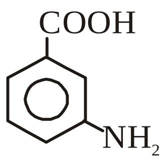
The electrophile involved in the above reaction is
(A) dichloromethyl cation $\left(\overset{\oplus}{C}HCl_2\right)$ (B) dichlorocarbene $(:CCl_2)$
(C) trichloromethyl anion $\left(\bar{C}Cl_3\right)$ (D) formyl cation $\left(\overset{\oplus}{C}HO\right)$

34. Picric acid is

(A) 

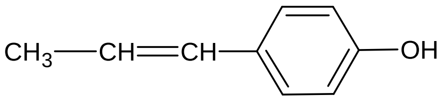
(B) 

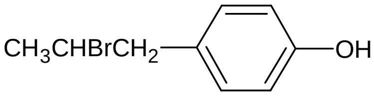
(C) 

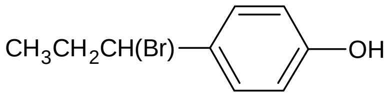
(D) 

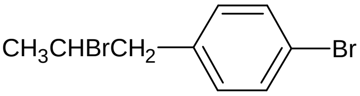
35. Consider the following reaction:
$$\text{Phenol} \xrightarrow{\text{Zn dust}} X \xrightarrow[\text{Anhydrous AlCl}_3]{\text{CH}_3\text{Cl}} Y$$
the product Y is
(A) Toluene (B) Benzaldehyde (C) Benzoic acid (D) Benzene

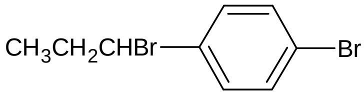
36. The reaction of

 with HBr gives

(A) 

(B) 

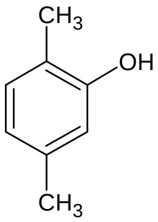
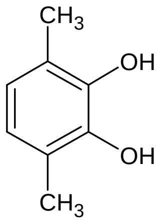
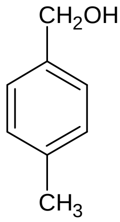
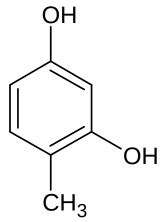
(C) 

(D) 

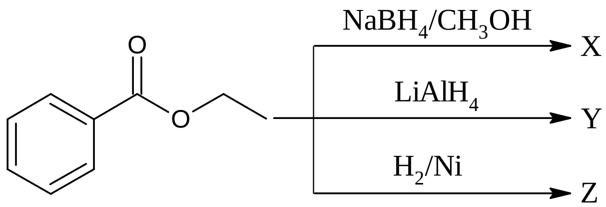
37. Phenol reacts with bromine water in carbon disulphide at low temperature to give:

(A) *o*-Bromophenol
(B) *o*-and *p*-Bromophenols
(C) *p*-Bromophenol
(D) 2, 4, 6-Tribromophenol

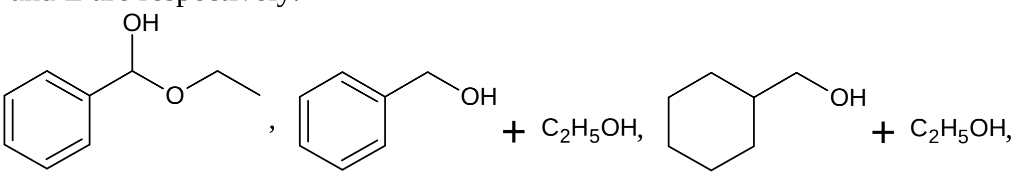
38. *p*-xylene $\xrightarrow{H_2SO_4\text{ conc.}}$ A $\xrightarrow{\text{NaOH, fuse}}$ B, B is

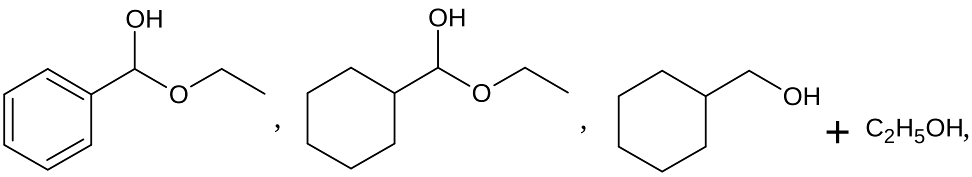
(A) 
(B) 
(C) 
(D) 

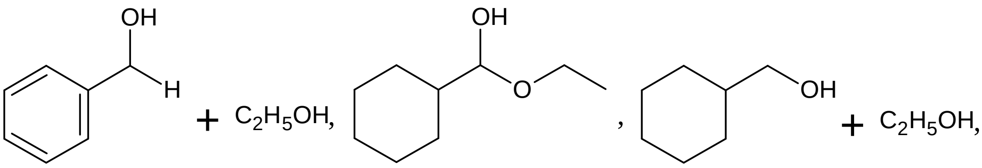
39. Consider the reduction:

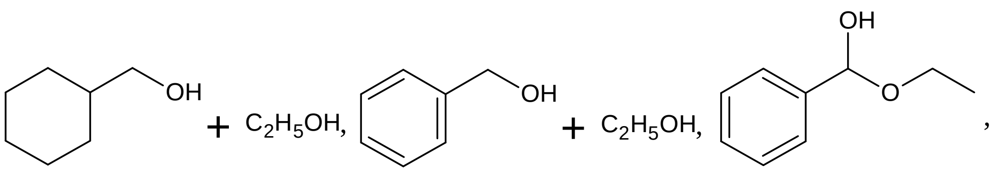


X, Y and Z are respectively:

(A) 

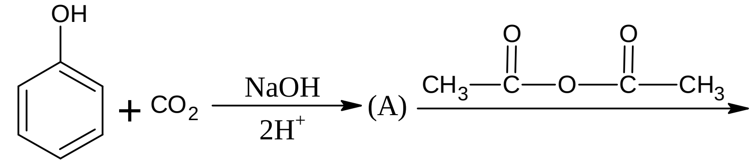
(B) 

(C) 

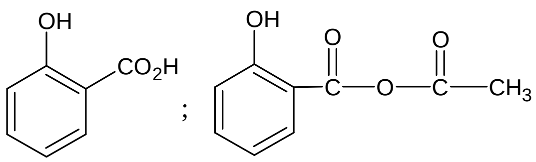
(D) 

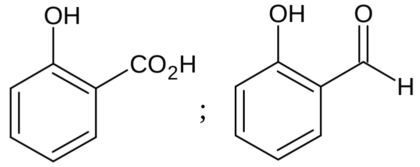
40. The correct method for synthesizing methyl *t*-butyl ether is:

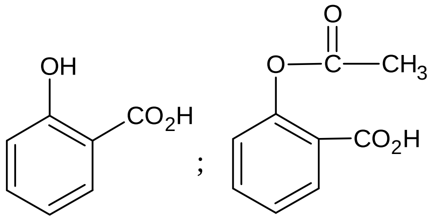
(A) $(CH_3)_3CBr$ + NaOMe $\rightarrow$
(B) CH_3Br + NaO-*t*-Bu $\rightarrow$
(C) Both of these
(D) None of these.

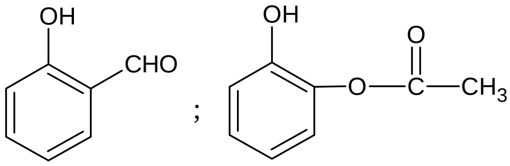
41. 

; Products (A) and (B) respectively are:

(A) 

(B) 

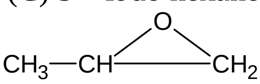
(C) 

(D) 

42. 1,5 – epoxy pentane $\xrightarrow{HI(\text{excess})/\Delta}$ product is

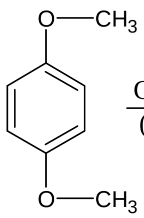
(A) 1, 5 – diiodo hexane (B) 1, 2 – diiodo hexane

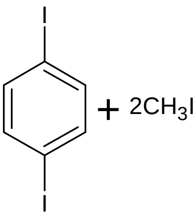
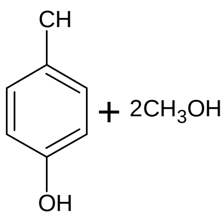
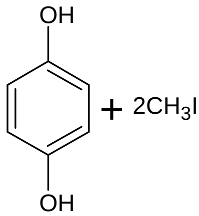
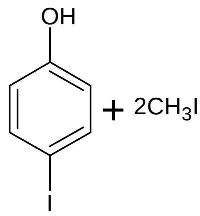
(C) 5 – iodo hexanol (D) 1, 5 – diiodo pentane

43.  $\xrightarrow{CH_3OH/H^+}$ A (major) , A is

(A) $CH_3\underset{\substack{|\\OCH_3}}{CH}-CH_2OH$ (B) $CH_3\underset{\substack{|\\OH}}{CH}-CH_2OCH_3$

(C) $CH_3\underset{\substack{|\\CH_3}}{CH}-CH_2OH$ (D) $CH_3\underset{\substack{|\\CH_3}}{CH}-CH_2CH_3$

44.  $\xrightarrow[\text{(excess)}]{\text{Conc. HI}}$ Products; Products of this reaction are:

(A)  $+ 2CH_3I$ (B)  $+ 2CH_3OH$ (C)  $+ 2CH_3I$ (D)  $+ 2CH_3I$

45. The treatment of phenol with phthalic anhydride in the presence of concentrated H_2SO_4 produces

(A) aspirin (B) methyl red (C) methyl orange (D) phenolphthalein

46. The reaction of $PhOCH_2CH_3$ with one equivalent of HI produces

(A) $PhI + CH_3CH_2OH$ (B) $PhI + CH_3CH_3$

(C) $C_6H_6 + ICH_2CH_3$ (D) $PhOH + ICH_2CH_3$

47. The major product obtained on interaction of phenol with sodium hydroxide and carbon dioxide is

(A) benzoic acid (B) salicylaldehyde (C) salicylic acid (D) phthalic acid

48. Which of the following statements is not correct?

(A) when vapours of phenol are passed over Zn dust benzene is formed

(B) The penolic – OH group is ortho-and para-directing

(C) o-Nitrophenol has a lower boiling point as compared to that of p-nitrophenol.

(D) Phenol is less acidic than o-cresol.

49. Nylon-6 is made from

(A) Butadiene (B) Chloroprene (C) Adipic acid (D) Caprolactum

50. A polymer containing nitrogen is

(A) Bakelite (B) Dacron (C) Rubber (D) Nylon-66

51. Cellulose acetate is a

(A) Natural polymer (B) Semisynthetic polymer

(C) Synthetic polymer (D) Plasticiser

52. Ethylene-propylene rubber can be

(A) Vulcanized by sulphur (B) Vulcanized by peroxides

(C) Both (a) and (b) (D) Non-vulcanizable

53. Buna-S is a polymer of

(A) Butadiene and styrene (B) Butadiene

(C) Styrene (D) Butadiene and chloroprene

54. Nylon is generic name for all synthetic fibre forming

(A) Polyesters (B) Polymeric amides

(C) Polystyrene (D) Polyethylene

55. Polymerisation in which two or more chemically different monomers take part is called

(A) Addition polymerisation (B) Copolymerisation

(C) Chain polymerisation (D) Homopolymerisation

56. Whether small molecules liberate in addition polymerisation

(A) Yes (B) No (C) Sometimes (D) Only H_2O

57. Orlon has a unit

(A) Vinyl cyanide (B) Acrolein (C) Glycol (D) Isoprene

58. The common acid used in the manufacture of rayon and plastics is

(A) Methanoic acid (B) Ethanoic acid (C) Propanoic acid (D) Butanoic acid

59. Buna-s rubber is which of the following of 1-3-butadiene and styrene

(A) Polymers (B) Copolymer

(C) Addition (D) Condensation polymer

60. Which one of the following polymers will not catch fire

(A) $(-CF_2-CF_2-)_n$ (B) $(-CH_2-CH_2-)_n$ (C) $(-\underset{Cl}{\underset{|}{CH}}-\underset{Cl}{\underset{|}{CH}}-)_n$ (D) $(-CH_2-\underset{Cl}{\underset{|}{CH}}-)_n$

******

MELUHA INTERNATIONAL SCHOOL

HYDERABAD

SR MPC JEE MAINS | **UNIT – VI ASSIGNMENT – 2** | **Date: 13-05-2020**

Time: | | **Max. Marks:**

MATHS

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

PHYSICS

1) **D**	2) **D**	3) **D**	4) **A**	5) **B**	6) **D**	7) **D**	8) **B**	9) **A**	10) **A**
11) **C**	12) **D**	13) **A**	14) **C**	15) **D**	16) **A**	17) **C**	18) **A**	19) **A**	20) **A**
21) **D**	22) **B**	23) **B**	24) **C**	25) **C**	26) **D**	27) **B**	28) **A**	29) **A**	30)

CHEMISTRY

1) **B**	2) **B**	3) **C**	4) **D**	5) **A**	6) **B**	7) **C**	8) **D**	9) **C**	10) **A**
11) **A**	12) **A**	13) **A**	14) **C**	15) **D**	16) **A**	17) **B**	18) **A**	19) **B**	20) **A**
21) **C**	22) **A**	23) **A**	24) **B**	25) **D**	26) **A**	27) **B**	28) **C**	29) **B**	30) **A**
31) **D**	32) **A**	33) **B**	34) **C**	35) **A**	36) **B**	37) **B**	38) **A**	39) **A**	40) **B**
41) **C**	42) **D**	43) **A**	44) **C**	45) **D**	46) **D**	47) **C**	48) **D**	49) **D**	50) **D**
51) **B**	52) **B**	53) **A**	54) **B**	55) **B**	56) **B**	57) **A**	58) **B**	59) **B**	60) **A**

HINTS & SOLUTIONS
MATHS

1. (A)

If p, q, r in AP then in an AP or a GP or an HP $a_1, a_2, a_3, \ldots$, etc., the terms a_p, a_q, a_r are in AP, GP or HP respectively.

2

3. (C)

$\frac{a_1+a_4}{a_1a_4}=\frac{a_2+a_3}{a_2a_3}$; so $\frac{1}{a_4}+\frac{1}{a_1}=\frac{1}{a_3}+\frac{1}{a_2}$ ....(A)

Also $\frac{3(a_2-a_3)}{a_2a_3}=\frac{a_1-a_4}{a_1a_4}$; so $3\left(\frac{1}{a_3}-\frac{1}{a_2}\right)=\frac{1}{a_4}-\frac{1}{a_1}$ ....(B)

Clearly, (A) and (B) $\Rightarrow \frac{1}{a_2}-\frac{1}{a_1}=\frac{1}{a_3}-\frac{1}{a_2}=\frac{1}{a_4}-\frac{1}{a_3}$; so $\frac{1}{a_1},\frac{1}{a_2},\frac{1}{a_3}$ are in AP

4. (D)

If in AP, $\sqrt{y}=\sqrt{x}+(n-1)d$ and $\sqrt{z}=\sqrt{x}+(m-1)d$

$\therefore \frac{\sqrt{y}-\sqrt{x}}{\sqrt{z}-\sqrt{x}}=\frac{n-1}{m-1}$, a rational number. As x, y, z are prime, $\frac{\sqrt{y}-\sqrt{x}}{\sqrt{z}-\sqrt{x}}$ is irrational.

$\therefore$ Irrational = rational (absurd). So $\sqrt{x},\sqrt{y},\sqrt{z}$ are not in AP.

Similarly, they are not in GP or HP.

5. (C)

2x + 1, 4x + 1, 8x + 1 are in GP $\Rightarrow (4x+1)^2=(2x+1)(8x+1)$

$\Rightarrow x=0$ and for this value f(x), f(2x), f(4x) are equal.

6. (C)

$a_1+(p-1)d, a_1+(q-1)d, a_1+(r-1)d$ are in GP.

$\therefore \frac{a_q}{a_p}=\frac{a_1+(q-1)d}{a_1+(p-1)d}=\frac{a_1+(r-1)d}{a_1+(q-1)d}=\frac{r-p}{q-p}$

10. (B)

Let the 1025th term = 2^n. Then

$1 + 2 + 4 + 8 + \ldots + 2^{n-1} < 1025 \le 1+2+4+8+\ldots+2^n$

$\therefore 2^n-1<1025<2^{n+1}-1$ or $2^n<1026<2^{n+1} \Rightarrow n=10$

11. (D)

$2\log\frac{3b}{5c}=\log\frac{5c}{a}+\log\frac{a}{3b} \Rightarrow \left(\frac{3b}{5c}\right)^2=\frac{5c}{a}.\frac{a}{3b} \Rightarrow 3b=5c$

Also $b^2=ac$; So, $9ac = 25c^2$ or $9a = 25c$

$\therefore \frac{9a}{5}=5c=3b \Rightarrow \frac{a}{5}=\frac{b}{3}=\frac{c}{\frac{9}{5}} \Rightarrow b+c<a$

20. (A)

n = index of the highest power of x = 1 + 2 + 4+ …+ 128

21. (B)

$(1-1+2-2+\ldots+5-5)^2=1^2+1^2+2^2+2^2+\ldots+5^2+5^2+2S$ (where S is the required sum)

Or $0=2(1^2+2^2+3^2+4^2+5^2)+2S$

24. (D)

t_n = 2 + 1 + 3 + 5 + 7+… to n terms = 2 + $(n-1)^2$.

25. (A)

Value = $2^{1/4+2/8+3/16+\ldots\text{to}\infty}$

26. (A)

When n is even, let n = 2m. From the question,

$1^2+2.2^2+3^2+2.4^2+5^2+2.6^2+...$ to 2m terms = $\frac{2m(2m+1)^2}{2}$

Where n is odd, let n = 2m + 1

$\therefore\ (1^2+2.2^2+3^2+2.4^2+5^2+2.6^2+...+\text{to}\,2m\,\text{terms})+(2m+1)^2$

$=\frac{2m(2m+1)^2}{2}+(2m+1)^2=\frac{(n-1)n^2}{2}+n^2$

27. (A)

As n is odd, the value of the given expression

$=1^3-2^3+3^3-...+n^3$

$=(1^3+2^3+3^3+...+n^3)-2\{2^3+4^3+...(n-1)^3\}$

$=\left\{\frac{n(n+1)}{2}\right\}^2-16\left\{1^3+2^3+...+\left(\frac{n-1}{2}\right)^3\right\}\Rightarrow\ \frac{n^2(n+1)^2}{4}-16\left\{\frac{\frac{n-1}{2}.\frac{n+1}{2}}{2}\right\}^2$

29. (A)

$t_n=\frac{n+2}{n(n+1)}.\left(\frac{1}{2}\right)^n=\frac{2(n+1)-n}{n(n+1)}.\left(\frac{1}{2}\right)^n=\frac{1}{n}.\left(\frac{1}{2}\right)^{n-1}-\frac{1}{n+1}.\left(\frac{1}{2}\right)^n$

30. (A)

Let the edges be a/r, a, ar, where r > 1

From the question, a/r . a . ar = 216 i.e., a^3 = 216, i.e., a = 6 and

2(a/r . a + a . ar + a/r . ar) = 252; $\therefore$ 1/r + r + 1 = 7/2 $\Rightarrow$ r = ½, 2

$\therefore$ a = 6, r = 2; so the longest side = ar = 12

34. (A)

Here, $a+b=a_1+a_{2n}=a_2+a_{2n-1}=...=a_n+a_{n+1}$

and ab = $g_1.g_{2n}=g_2.g_{2n-1}=...=g_n.g_{n+1}$ and $h=\frac{2ab}{a+b}$

35. (A)

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

$H=\frac{1}{\frac{\frac{1}{a}+\frac{1}{ar}+...+\frac{1}{ar^{n-1}}}{n}}=\frac{n(r-1)r^n}{\frac{r}{a}(r^n-1)}$

36. (D)

nth term is the middle term in each case. So a, b, c are the AM, GM, HM respectively of the same two numbers. For any two numbers AM, GM, HM are in GP.

37. (A)

$HM=\frac{2ab}{a+b}=\frac{2}{a^{-1}+b^{-1}}=\frac{a^n+b^n}{a^{n-1}+b^{n-1}}$, where n = 0

41. (D)

$A\geq G\ \Rightarrow\ \frac{\log_{a_2}a_1+\log_{a_3}a_2+...+\log_{a_1}a_n}{n}\geq\sqrt[n]{\log_{a_2}a_1.\log_{a_3}a_2...\log_{a_1}a_n}=1$

42. (D)

$A=\frac{a_1+a_2+...+a_n}{n},G=\sqrt[n]{a_1a_2...a_n}=1$;

$A \geq G \Rightarrow a_1 + a_2 + ... + a_n \geq n$

43. (B)

$$\frac{\sin x + \cos x + \operatorname{cosec} 2x}{3} \geq \sqrt[3]{\sin x . \cos x . \operatorname{cosec} 2x} = \sqrt[3]{\frac{1}{2}}$$

45. (C)

Use $A \geq G$ for the numbers $ab^2, ac^2, bc^2, ba^2, ca^2, cb^2$.

46. (B)

Sum = $\frac{2}{10} + \frac{4}{10^3} + \frac{6}{10^5} + \frac{8}{10^7} + ... \text{to } \infty$ which is an arithmetico-geometric series.

50. (B)

$$S = 1 + \frac{3}{2} + \frac{5}{2^2} + \frac{7}{2^3} + ...\infty$$

$$\frac{1}{2}S = \frac{1}{2} + \frac{3}{2^2} + \frac{5}{2^3} + ...\infty$$

By subtracting $\frac{1}{2}S = 1 + \frac{2}{2} + \frac{2}{2^2} + \frac{2}{2^3} + ... \Rightarrow \frac{S}{2} = 1 + 2\left(\frac{1}{2} + \frac{1}{2^2} + \frac{1}{2^3} + ...\infty\right) \Rightarrow \frac{S}{2} = 1 + 2x$

Hence S = 6

51. (B)

Let S = $1 + 2.2 + 3.2^2 + 4.2^3 + ... + 100.2^{99}$ ….. (i)

$2S = 1.2 + 2.2^2 + 3.2^3 + ... + 99.2^{99} + 100.2^{100}$ … (ii)

Eq. (i) – (ii)

$$-S = 1 + \left(1.2 + 1.2^2 + 1.2^3 + ... \text{upto } 99 \text{ terms}\right) - 100.2^{100}$$

$$= 1 + \frac{2\left(2^{99} - 1\right)}{2 - 1} - 100.2^{100}$$

$$\Rightarrow S = -1 - 2^{100} + 2 + 100.2^{100} = 1 + 99.2^{100}$$

55. (C)

$T_n = n(n+1)(n+2) = n^3 + 3n^2 + 2n$

Therefore, $S = 1.2.3 + 2.3.4 + 3.4.5 + ... \text{to n terms}$

$$\sum_{n=1}^{n}\left(n^3 + 3n^2 + 2n\right) = \sum_{n=1}^{n} n^3 + 3\sum_{n=1}^{n} n^2 + 2\sum_{n=1}^{n} n$$

$$S = \left(\frac{n(n+1)}{2}\right)^2 + 3\frac{n(n+1)(2n+1)}{6} + 2\frac{n(n+1)}{2} = \frac{1}{4}n(n+1)$$

$$= \frac{1}{4}n(n+1)\left[n^2 + 5n + 6\right] = \frac{1}{4}n(n+1)(n+2)(n+3)$$

56. (A)

Since, AM = GM

$$\Rightarrow \frac{a+b}{2} = \sqrt{ab} \Rightarrow \frac{\left(\sqrt{a}\right)^2 - 2\sqrt{a}\sqrt{b} + \left(\sqrt{b}\right)^2}{2} \Rightarrow \frac{\left(\sqrt{a} - \sqrt{b}\right)^2}{2} = 0 \Rightarrow a = bz$$

Since GM = HM

$$\Rightarrow \sqrt{ab} = \frac{2ab}{a+b} \Rightarrow a + b - 2\sqrt{ab} = 0 \Rightarrow \left(\sqrt{a} - \sqrt{b}\right)^2 = 0$$

$$\Rightarrow \sqrt{a} = \sqrt{b} \quad \therefore \ a = b$$

57. (B)

A = 9, G = 4 are, respectively the AM and GM between two numbers, then the quadratic equation having its roots as the two numbers is given by $x^2 - 2Ax + G^2 = 0$ i.e. $x^2 - 18x + 16 = 0$

61. (A)

Let A_1, A_2, A_3 be three AM's between 3 and 19. Then 3, A_1, A_2, A_3 19 are in AP whose common difference is

$$d=\frac{19-3}{3+1}=4$$

$\therefore\ A_1 = 3+d = 3+4 = 7$

$A_2 = 3+2d = 3+8 = 11$

$A_3 = 3+3d = 3+12 = 15$

62. (A)

$(2n+r)r=(n+r)^2-n^2$

$=\{1+3+5+.....to(n+r)terms\}$– {1 + 3 + 5 +…. To n terms}

As $(n+r)^2-n^2$ = { 1 + 3 + 5 + …. (n + r) terms) – {1 + 3 + 5+ … n terms)

$\therefore$ Sum of r consecutive odd natural numbers,

$k=r$

65. (B)

Let the 1025th term be 2^n. Then,

$1+2+4+8+...+2^{n-1}<1025<1+2+4+8+...+2^n$

$\therefore\ 2^{n-1}<1025<2^{n+1}-1 \text{ or } 2^n<1026<2^{n+1}$

$\Rightarrow\ n=10$

66. (B)

Clearly, the sequence odd term of the given GP is 1, 25, 625, …, which is a GP as every term except the first term bears a constant ratio to the term immediately preceding it.

67. (C)

Arithmetic mean of a and b = A = $\frac{a+b}{2}$

Geometric mean of a and b = G = $\sqrt{ab}$

$$\therefore\ A-G=\frac{a+b}{2}-\sqrt{ab}=\frac{a+b-2\sqrt{ab}}{2}$$

$$=\frac{\left(\sqrt{a}\right)^2+\left(\sqrt{b}\right)^2-2\sqrt{a}\sqrt{b}}{2}=\left[\frac{\sqrt{a}-\sqrt{b}}{\sqrt{2}}\right]^2$$

68. (B)

Let α and β be the roots of given quadratic equation.

Then, $\alpha+\beta=\frac{4+\sqrt{5}}{5+\sqrt{2}}$ and $\alpha\beta=\frac{8+2\sqrt{5}}{5+\sqrt{2}}$

Let H be the harmonic mean between α and β, then

$$H=\frac{2\alpha\beta}{\alpha+\beta}=\frac{16+4\sqrt{5}}{4+\sqrt{5}}=4$$

69. (B)

$\because$ AM $\geq$ GM for positive numbers.

So, $$\frac{4^x+\frac{4}{4^x}}{2}\geq\sqrt{4^x.\frac{4}{4^x}}=2$$

$\Rightarrow\ 4^x+4^{1-x}\geq 4$

70. (B)

$\because\sqrt{3}$, A and $\sqrt{2}$ are in AP

$\therefore\ A=\frac{\sqrt{3}+\sqrt{2}}{2}$ is the AM of $\sqrt{3}$ and $\sqrt{2}$

Thus, $\frac{\sqrt{3}+\sqrt{2}}{2} \geq \sqrt{3}.\sqrt{2}=\sqrt{6}$

76. (A)

Let $T_r=\frac{r+3}{r(r+1)(r+2)}$

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

$\therefore\ S=\left[\frac{1}{2}-\frac{1}{n+2}\right]+\frac{3}{2}\left[\frac{1}{2}-\frac{1}{(n+1)(n+2)}\right]$

$=\frac{5}{4}-\frac{1}{2(n+1)(n+2)}[2n+5]$

79. (A)

$\sum_{k=1}^{n}\left(\sum_{m=1}^{k} m^2\right)=\sum_{k=1}^{n}\frac{k(k+1)(2k+1)}{6}$

$=\frac{1}{6}\sum_{k=1}^{n}\left(2k^3+3k^2+k\right)$

$=\frac{1}{3}.\left\{\frac{n(n+1)}{2}\right\}^2+\frac{1}{2}\left[\frac{n(n+1)(2n+1)}{6}\right]+\frac{1}{6}\left[\frac{n(n+1)}{2}\right]$

a = Coefficient of $n^4=\frac{1}{3}.\frac{1}{4}=\frac{1}{12}$

80. (C)

$AM \geq GM$

$\therefore\ \frac{y+z}{2} \geq \sqrt{yz}$ …………. (i)

$\frac{z+x}{2} \geq \sqrt{zx}$ ……………..(ii)

$\frac{x+y}{2} \geq \sqrt{xy}$ ……………(iii)

On multiplying (i), (ii) and (iii), we get

$\frac{(y+z)(z+x)(x+y)}{8} \geq xyz$

Or $(1-x)(1-y)(1-z) \geq 8xyz$

82. (C)

Let R = 0. cababab….

$=0.c+0.0ab+0.000ab+...$

$=\frac{c}{10}+\frac{ab}{10^3}+\frac{ab}{10^5}+...$

$=\frac{c}{10}+\left[\frac{\frac{ab}{10^3}}{1-\frac{1}{10^2}}\right]=\frac{c}{10}\left[\frac{ab}{10^3}\times\frac{10^2}{99}\right]$

$=\frac{c}{10}+\frac{ab}{990}=\frac{99c+10a+b}{990}$

83. (A)

Since A > G > H, i.e. H < G < A

$\therefore$ Required numbers are $\frac{144}{15}$,12,15

85. (B)

Let d be the common difference of an AP, then

4 = abc = (b – d) b (b + d) = $b(b^2 - d^2)$

$\Rightarrow \; b^3 = 4 + bd^2 \geq 4 \quad \left[\because \; b > 0, d^2 \geq 0\right] \quad \Rightarrow \; b = 2^{2/3}$

Thus, minimum possible value of b is $2^{2/3}$, that is the case when d = 0

PHYSICS

2. $\frac{dN}{dt} = \lambda N$ here N = avagadro no /226

$\lambda = \frac{1}{\tau}$

4. The given equation is ${}_{92}^{A}X \rightarrow {}_{z}^{228}Y + {}_{2}^{4}He$

A = 228 + 4 = 232 ; 92 = z + 2 $\quad \therefore$ z = 90

$\frac{m_\alpha v_\alpha^2}{r} = qv_\alpha B; v_\alpha = \sqrt{\frac{rqB}{m_\alpha}}$

$= \sqrt{\frac{1.1\times10^2 \times 2\times1.6\times10^{-19}\times3\times10^3}{4.003\times1.66\times10^{-27}}}$

= 4.0×10^6 m/s

From conservation of linear momentum, $m_\alpha v_\alpha = m_y v_y$

$v_y = \frac{m_\alpha v_\alpha}{m_y} = \frac{(4.003)(4.0\times10^6)}{(228.03)} = 7.0\times10^4 \, m/s$

Therefore, energy released during the process

$= \frac{1}{2}\left[m_\alpha v_\alpha^2 + m_y v_y^2\right] = \frac{\left(1.66\times10^{-27}\right)}{\left(2\times1.6\times10^{-13}\right)}$

$\left[(4.003)(4.0\times10^6)^2 + (228.03)(7.0\times10^4)^2\right]$MeV

$= 0.34$MeV

5. 'OR' gate X = A + B

i.e. 0 + 0 = 0, 0 + 1 = 1, 1 + 0 = 1, 1 + 1 = 1

7. Resistance of conductors (Cu) decrease with decrease in temperature while that of semi-conductors (Ge) increase with decrease in temperature.

8. ${}_7N^{14} + {}_2He^4 \rightarrow {}_8O^{17} + {}_1H^1$

9. Given Half-life period $(T) = \frac{0.693}{\lambda} = 1.42\times10^{17}\,s$

$\lambda = \frac{0.693}{1.42\times10^{17}} = 4.88\times10^{-18}$

Avagadro number (N) = 6.023×10^{23} atoms

n = Number of atoms present in 1 g of ${}_{92}^{238}U = \frac{N}{A}$

$= \frac{6.023\times10^{23}}{238} = 25.30 = \times10^{20}$

Number of disintegration = $\frac{dN}{dt} = \lambda n$

$= 4.88\times10^{-18}\times25.30\times10^{20}$

= 1.2346×10^4 disintegrates/sec

10. The diode in lower branch is forward biased and diode in upper branch is reverse biased

$$\therefore i = \frac{5}{20+30} = \frac{5}{50} A$$

11. Binding energy per nucleon of helium $({}^4_2\text{He}) = 7\text{MeV}$

Binding energy = 4 × 7 = 28 MeV

Binding energy per nucleon of deuterium $({}^2_1\text{H}) = 1.1\text{MeV}$

Binding energy = 2 × 1.1 = 2.2 MeV

Energy liberated (Q) = (28 – (2.2)2] = 23.6 MeV.

12. The standard relation between the kinetic energy of the α - particle (KE_α) and the Q-value (or total disintegration energy) is

$$KE_a = \left(\frac{A-4}{A}\right).Q \quad Q = \left(\frac{A}{A-4}\right).KE_a$$

$$= \left(\frac{226}{226-4}\right) \times 4.78\text{MeV} = \frac{226}{222} \times 4.78\text{MeV}$$

$$Q = 4.865\text{MeV} \approx 4.87\text{MeV}$$

13. The number of active nuclei at any instant of time t,

$$\frac{N_0}{N} = e^{\lambda t}; \log_e\left(\frac{N_0}{N}\right) = \lambda t$$

$$\therefore t = \frac{\log_e\left(\frac{N_0}{N}\right)}{\lambda} = \frac{2.303\log_{10}\left(\frac{N_0}{N}\right)}{\lambda}$$

In this problem, the initial number of active nuclei,

$$N_0 = 6.0\times10^{18}; N = 1.0\times10^{18}, T = 40s$$

$$\lambda = \frac{0.693}{T} = \frac{0.693}{40} = 1.733\times10^{-2}s^{-1}$$

$$t = \frac{2.303\log_{10}\left(\frac{6.0\times10^{18}}{1.0\times10^{18}}\right)}{1.733\times10^{-2}}$$

$$= \frac{2.303\log_{10}(6)}{1.733\times10^{-2}} = \frac{2.303\times0.7782}{1.733\times10^{-2}} = 103.4s$$

14. $\frac{N}{N_0} = \left(\frac{1}{2}\right)^n = \left(\frac{1}{2}\right)^3$

17.

$A = A_o e^{-\lambda t} \Rightarrow A_o / 10 = A_o e^{-t}$

$A' = A_o e^{-10t}$

Using these two equations,

$$A' = \frac{A_o}{(10)^{10}}$$

18. $\ln\left|\frac{6}{100}\right| = -\lambda t = \frac{-0.693(120)}{T}$ (or) t = 30 min.

19. $\frac{dN}{dt} = t^2 - \lambda N, \frac{d2N}{dt^2} = 2t - \frac{\lambda dN}{dt}$

$= 2t - \lambda(t^2 - \lambda N)$

$$\frac{d2N}{dt^2} = 0$$

i.e., $2t - \lambda(t^2 - \lambda N] = 0$

$$\Rightarrow N = \frac{\lambda t^2 - 2t}{\lambda^2}$$

Q= [230.033927 – 229.033496 – 1.008665] × 931.5

= –7.7 MeV

For decay (ii)

Q= [230.033927 – 299.032089 – 1.007825] × 931.5

= – 5.6 MeV

$\therefore$ Q is negative for both the decay, so none of the decays are allowed.

$\therefore$ (D)

20. Energy of H atom = $13.6\left(\frac{1}{4} - \frac{1}{9}\right) = 1.89\text{eV}$

$$Z^2 = \frac{47.2}{1.89} = 24.47 \equiv 25 \Rightarrow Z \equiv 5$$

21. $\frac{N}{N_o} = \left(\frac{1}{2}\right)^{\frac{t}{T}} = \frac{1}{4}$

$$\frac{t}{T} = 2 \ \ or \ \ T = \frac{t}{2} = \frac{3}{4 \times 2} = \frac{3}{8} S.$$

22. Let $K_1 \& K_2$ and $P_1 \& P_2$ are the K.E and momentum of the α-particle and remaining nucleus, then $K_1 + K_2 = 5.5\text{MeV}$ --- (i)

From conservation of linear momentum $P_1 = P_2$

$\Rightarrow \sqrt{2K_1 \times 4m} = \sqrt{2K_2 \times 216m} \Rightarrow K_1 = 54K_2$ --- (ii)

From (i) and (ii) $K_1 = \frac{5.5 \times 54}{55} = 5.4\text{MeV}$

23. Since, $\frac{\lambda_x}{\lambda_y} = \frac{2}{3}$

$$N_x \lambda_x = N_y \lambda_y \Rightarrow \frac{N_x}{N_y} = \frac{3}{2}$$

24. Activity = number of disintegration per unit time

$= \left|\frac{dN}{dt}\right| = \lambda N$, where N = the total number of nuclei.

Also, N = number of moles $\times N_A = \left(\frac{m}{M}\right) N_A$

$$\therefore \text{Activity} = \left(\frac{\lambda m N_A}{M}\right)$$

25. Energy released = Binding energy of products

- Binding energy of reactants

e = E_p - $3E_Q$

26. Let the initial no be N_o

For X, $l_x = \frac{0.693}{T_x}$, $l_y = \frac{0.693}{T_y}$

$N_x = N_o e^{-\lambda xt}$, $N_y = N_o e^{-\lambda yt}$, $\frac{N_x}{N_y} = \frac{20}{80} = \frac{1}{4}$

27. 236 [-7.6] = 117 [-8.5] + 117 [-8.5] + Q

236 (76) = 117 (170) – 10Q

10Q = 117 (170) – 236 (76)

=19890 – 17936

=1954

Q = 195.4 M. V

28. $\frac{dB}{dt} = 2\left(-\frac{dA}{dt}\right) - \lambda_2 B$

When maximum $\frac{dB}{dt} = 0$

$\therefore B = \frac{2}{\lambda_2} \times 10^4 \lambda_1 e^{-\lambda_1 t}$ = 2

CHEMISTRY

1. 1-Butanol on treatment solution of anhydrous $ZnCl_2$ in conc. HCl. 1° alcohols gives cloudiness not at all at room temperature.
2° alcohols gives cloudiness within 5 minutes. 3° alcohols gives cloudiness immediately.

3.

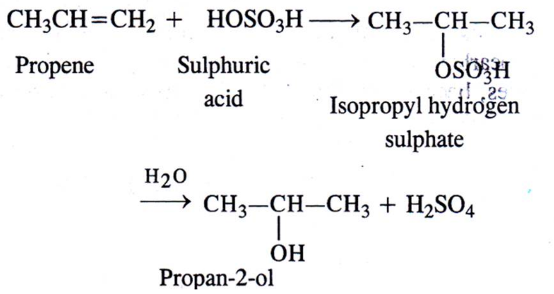
$$CH_3CH_2 - \underset{OH}{\overset{CH_3}{\underset{|}{\overset{|}{C}}}} - CH_2CH_3 \xrightarrow[(-H_2O)]{H^+} CH_3CH_2 - \underset{3^0\ carbocation}{\overset{CH_3}{\overset{|}{C}}} - CH_2CH_3$$

5. Aluminium has great affinity for oxygen.

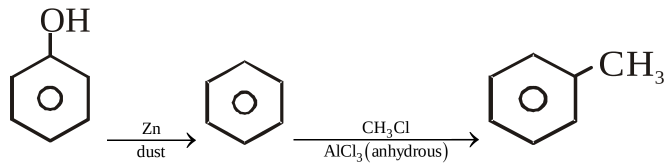
6. $CH_3CH_2OH \xrightarrow{SOcl_2} CH_3CH_2Cl \xrightarrow{Mg} CH_3CH_2MgCl$

$CH_3CH_2MgCl + CH_3COCH_3 \xrightarrow[H_3O^+]{\text{dry ether}} CH_3C(CH_3)OHCH_2CH_3$

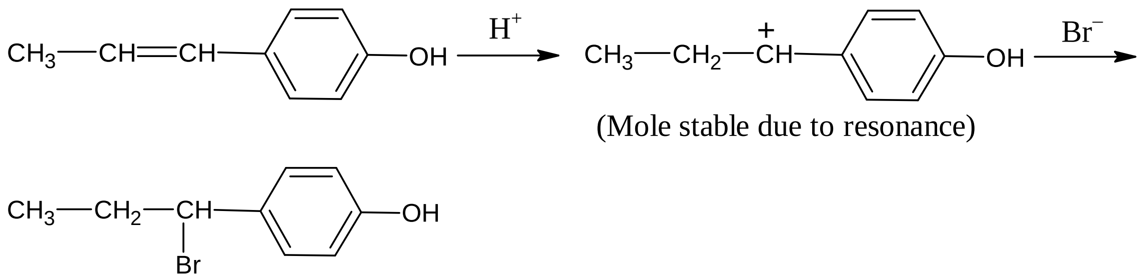
8. This process effectively results in addition of a molecule of water across a double bond. Hence it is a hydration reaction. Alkanes cannot undergo addition reactions.



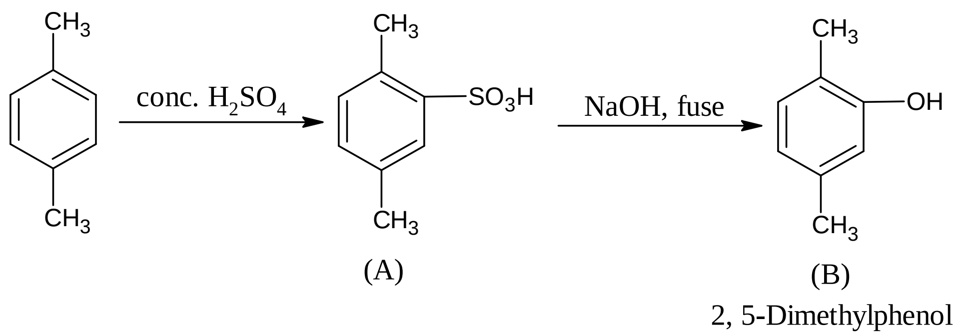
16. Pinacol – pinacolone rearrangement.
17. (A) contains three – OH groups.
19. Esterification followed by replacement of – OH by – Cl.
20. Hydroboration – oxidation.
21. Reactivity towards HBr/HCl α Stability of carbocation formed
23. The ease of dehydration is tertiary > secondary > primary.
24. The reaction occur with rearrangement as 2° carbocation is more stable than 1° Carbocation
27. Blue colour is obtained with secondary alcohol
29. The number of C – C bond broken is equal to the number of HIO_4 molecules used
31. The correct order of acidity IV > III > I > II
32. Phenol does not react with $NaHCO_3$
33. Reimer-Tiemann Reaction.
35.



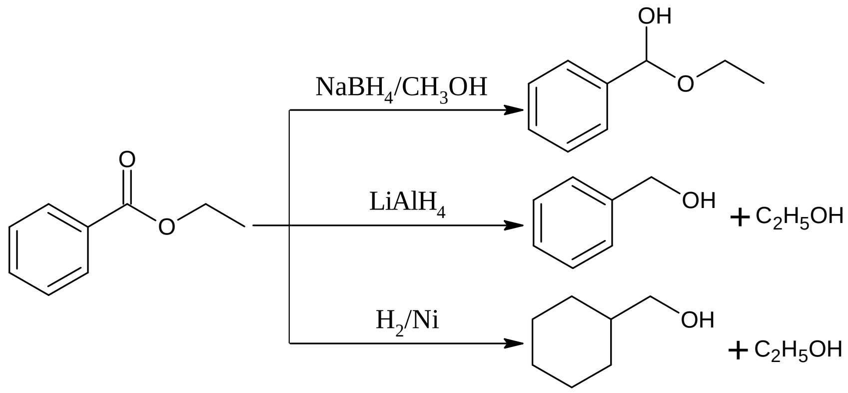
36.



37. Both *o*– and *p*– Bromophenols are formed but *p*-Bromophenol is the major product $(\approx 82\%)$ due to less stearic hinderance in case of *p*-substitution as compared to orthosubstitution.
38.



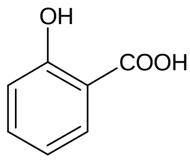
39.

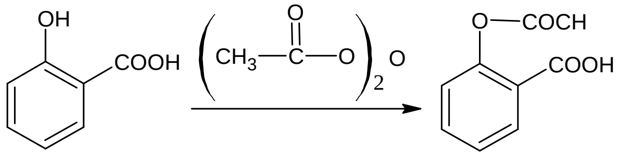


40.

Method ‘A’ cannot be used as tert. Halides preferably give elimination reaction. So the correct method is ‘B’

41.

A =  (Kolbe’s Reaction)

B =  (Asprin)

46. Aryl ethers do not cleave on the aromatic side but only on the alkyl side

49. Caprolactun is the monomer of nylon –6.

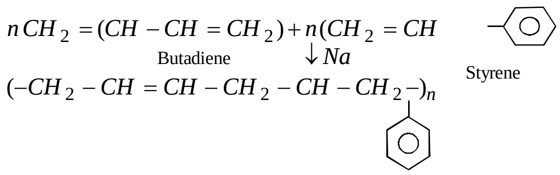
50. Nylon-66- It is a polymer containing alitrogen

$$\left[-\overset{H}{\underset{|}{N}}-(CH_2)_6-\overset{H}{\underset{|}{N}}-\underset{\underset{O}{\|}}{C}-(CH_2)_4-\overset{O}{\overset{\|}{C}}- \right]_n$$

Nylon-66

51. Because cellulose is a natural polymer.

52. It is vulcanized by peroxide because it requires the more electronegative element to form cross - link structure.

53. 

It is also called SBR (styrene butadiene rubber).

54. Nylon is a polyamide fibre representing the polyamide linkage.

55. *e.g.* Adipic acid + Hexamethylene diamine → Nylon - 6 6

56. In addition polymerization simple addition of monomer unit takes place without any loss of small molecules.

57. Orlon is prepared by polymerization of vinyl cyanide in presence of ferrous sulphate & hydrogen peroxide

$$nCH_2=CHCN \xrightarrow[FeSO_4+H_2O_2]{\text{Polymerisa tion}} \left[-CH_2-\underset{\underset{CN}{|}}{CH}- \right]_n$$

Orlon

58. Ethanoic acid is used in the manufacture of regin and plastics.

59. Buna-*S* is a coplymer of 1, 3- butadiene and styrene.

60. Teflon $(-CF_2-CF_2-)_n$ is stable upto 598 *K*.

******