TEST-13

TOPIC COVERED :

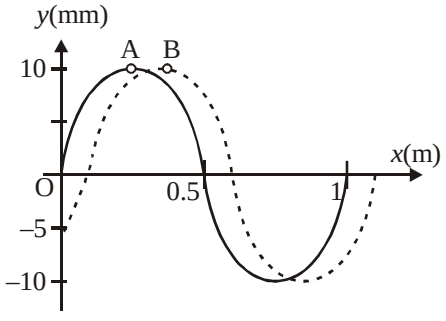
PHYSICS: Simple Harmonic Motion and Waves

CHEMISTRY: Isomerism and Reaction Mechanism

MATHEMATICS: Trigonometric Ratios and Identities, Inverse and Trigonometric Function.

PHYSICS

1. Two identical waves A and B are produced from the origin at different instants t_A and t_B along the positive x-axis, as shown in the figure. If the speed of wave is 5 m/s, then



(a) the wavelength of the wave is 1 m

(b) the amplitude of the waves is 12 mm

(c) the wave A leads B by 0.0167 s

(d) the wave B leads A by 1.67 s

2. A source emitting sound of frequency ν_0 starts moving at $t = 0$ towards an observer with acceleration a_0. Then the frequency of sound heard by the observer, just after the start of motion is:

(a) equal to ν_0 (b) less than ν_0 (c) more than ν_0 (d) nothing definite can be said

3. A glass tube 1.5m long and open at both ends is immersed vertically in a water tank completely. A tuning fork of 600 Hz is vibrated and kept at the upper end of tube and the tube is gradually raised out of water. The total number of resonances heard before when the tube comes out of water, (taking v = 330 m/s) is:

(a) 12 (b) 6 (c) 8 (d) 4

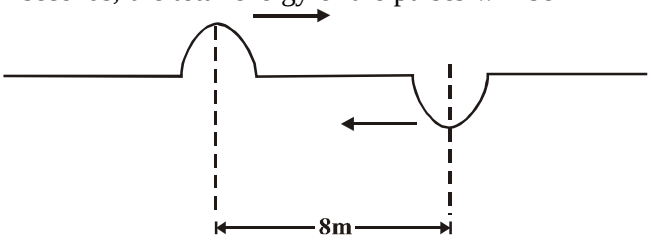
4. Two pulses in a stretched string whose centres are initially 8 cm. apart the moving towards each other as shown in the figure. The speed of each pulse is 2 cm/s. After 2 seconds, the total energy of the pulses will be

(a) zero

(b) purely kinetic

(c) purely potential

(d) partly kinetic and partly potential



5. In the experiment for the determination of the speed of sound in air using the resonance column method, the length of the air column that resonates in the fundamental mode, with a tuning fork is 0.1 m. When this length is changed to 0.35 m, the same tuning fork resonates with the first overtone. Calculate the end correction

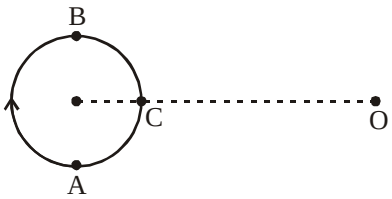
(a) 0.012 m (b) 0.025 m (c) 0.05 m (d) 0.024 m

6. A wave equation is given by $y = A\cos(\omega t - kx)$, where symbols have their usual meanings. If v_p is the maximum particle velocity and v is the wave velocity of the wave then

(a) v_p can never be equal to v (b) $v_p = v$ for $\lambda = 2\pi A$

(c) $v_p = v$ for $\lambda = \frac{A}{2\pi}$ (d) $v_p = v$ for $\lambda = \frac{A}{\pi}$

7. A small source of sound moves on a circle as shown in figure and an observer is sitting at O. Let v_1, v_2, v_3 be the frequencies heard when the source is at A, B and C respectively.



(a) $v_1 > v_2 > v_3$ (b) $v_1 = v_2 > v_3$

(c) $v_2 > v_3 > v_1$ (d) $v_1 > v_3 > v_2$

8. The wavelength of light coming from a distant galaxy is found to be 0.5% more than that coming from a source on earth. The velocity of galaxy is

(a) 1.5×10^6 ms^{-1} towards the earth (b) 1.5×10^6 ms^{-1} away from earth

(c) 3×10^6 ms^{-1} towards the earth (d) 3×10^6 ms^{-1} away from earth

9. A source i moving along a circle of radius 10 metres with angular speed of 20 radians per sec. It is emitting sound of frequency 320 Hz. What is the minimum frequency heard by a stationary observer? Take velocity of sound as 340 ms^{-1}.

(a) 200 (b) 250 (c) 300 (d) 350

10. The displacement *y* of a particle in a medium can be expressed as $y = 10^{-6} \sin(100\,t + 20\,x + \pi/4)\,m$ where *t* is in second and *x* in meter. The speed of the wave is

(a) 2000 m/s (b) 5 π m/s (c) 20 m/s (d) 5 m/s

11. The tension of a stretched string is increased by 69%. In order to keep its frequency of vibration constant, its length must be increased by:

(a) 30% (b) 20% (c) 69% (d) $\sqrt{69}\%$

12. If the linear coefficient of expansion of the material of an organ pipe is equal to (1/546) per degree celsius, then with rise in temperature, the frequency of vibration of air column in the pipe:

(a) increases (b) decreases (c) remains unchanged (d) changes erratically

13. An object of specific gravity ρ is hung from a thin steel wire. The fundamental frequency for transverse standing waves in the wire is 300 Hz. The object is immersed in water so that one half of its volume is submerged. The new fundamental frequency in Hz is:

(a) $300\left(\frac{2\rho-1}{2\rho}\right)^{1/2}$ (b) $300\left(\frac{2\rho}{2\rho-1}\right)^{1/2}$ (c) $300\left(\frac{2\rho}{2\rho-1}\right)$ (d) $300\left(\frac{2\rho-1}{2\rho}\right)$

14. A travelling wave pulse is given by $y = \frac{6}{2 + (x + 3t)^2}$ where symbols have their usual meanings. x and y are in m and t is in s. Which one is wrong?

(a) The pulse is travelling along negative x-axis with velocity 3 m/s

(b) The pulse is travelling along negative x-axis with velocity 1.5 m/s

(c) The amplitude of the wave pulse is 3 m

(d) The pulse is a symmetric pulse

15. A string is fixed at both ends and transverse oscillations with amplitude a_0 are excited. Which of the following statements is correct?

(a) Energy of oscillations in the string is directly proportional to tension in the string.

(b) Energy of oscillations in nth overtone will be equal to n^2 times of that in first overtone.

(c) Both of these

(d) None of these

16. In a sonometer wire, the tension is maintained by suspending a 50.7 kg mass from the free end of the wire. The suspended mass has a volume of 0.0075 m^3. The fundamental frequency of the wire is 260 Hz. If the suspended mass is completely submerged in water, the fundamental frequency will become

(a) 200 Hz (b) 220 Hz (c) 230 Hz (d) 240 Hz

17. A train moves towards a stationary observer with speed 34 m/s. The train sounds a whistle and its frequency registered by the observer is f_1. If the train's speed is reduced to 17 m/s, the frequency registered is f_2. If the speed of sound is 340 m/s, then the ratio f_1/f_2 is

(a) 18/19 (b) 1/2 (c) 2 (d) 19/18

18. A tube closed at one end and containing air, produces, when excited, the fundamental note of frequency 512 Hz. If the tube is open at both ends, the fundamental frequency that can be excited is (in Hz)

(a) 1024 (b) 512 (c) 256 (d) 128

19. An open pipe is suddenly closed at one end with the result that the frequency of third harmonic of the closed pipe is found to be higher by 100 Hz than the fundamental frequency of the open pipe. The fundamental frequency of the open pipe is

(a) 200 Hz (b) 300 Hz (c) 240 Hz (d) None

20. The extension in a string, obeying Hooke's law is *x*. The speed of sound in the string is v. If the extension in the string is increased to 1.5 *x*, the speed of sound will be

(a) 1.22 v (b) 0.61 v (c) 1.50 v (d) 0.75 v

21. Two vibrating strings of the same material but lengths L and 2L have radii 2 *r* and *r* respectively. Thy are stretched under the same tension. Both the strings vibrate in their fundamental modes, the one of length L with frequency n_1 and the other with frequency n_2. The ratio n_1/n_2 is given by

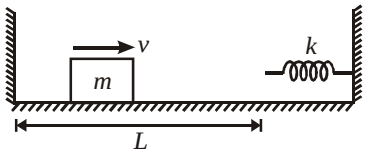
(a) 2 (b) 4 (c) 8 (d) 1

22. If n_1, n_2 and n_3 are fundamental frequencies of the three segments into which a string is divided by balancing a number of bridges below it, then the original fundamental frequency of the string is given by

(a) $\sqrt{n} = \sqrt{n_1} + \sqrt{n_2} + \sqrt{n_3}$ (b) $n = n_1 + n_2 + n_3$

(c) $\frac{1}{n} = \frac{1}{n_1} + \frac{1}{n_2} + \frac{1}{n_3}$ (d) $\frac{1}{\sqrt{n}} = \frac{1}{\sqrt{n_1}} + \frac{1}{\sqrt{n_2}} + \frac{1}{\sqrt{n_3}}$

23. The time period of mass m shown in figure is given by



(a) $T = \left\{\pi\sqrt{\left(\frac{m}{k}\right)} + \frac{2L}{v}\right\}$ (b) $T = \left\{\pi\sqrt{\left(\frac{k}{m}\right)} + \frac{2L}{v}\right\}$

(c) $T = \left\{\pi\sqrt{\left(\frac{m}{k}\right)} + \frac{2L}{v}\right\}^{1/2}$ (d) $T = \left\{\pi\sqrt{\left(\frac{k}{m}\right)} + \frac{2L}{v}\right\}^{1/2}$

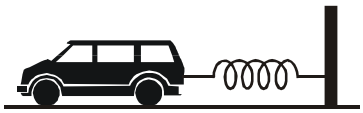
24. Two masses of 10 gm and 90 gm are joined by a massless spring of force constant 10^3N/m, the frequency of small oscillations is approximately

(a) 50 Hz (b) 60 Hz (c) 100 Hz (d) 120 Hz

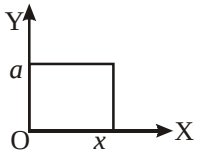
25. The total energy of a particle executing simple harmonic motion is *E*. When the particle has displacement equal to half of amplitude, the kinetics energy of the particle will be

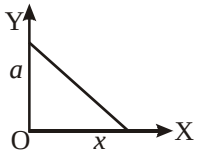
(a) 3*E*/4 (b) *E*/2 (c) *E*/3 (d) *E*/4

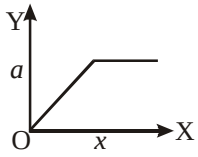
26. A light spring is compressed and placed horizontally between a vertical fixed wall and a toy car, free to slide over smooth horizontal table.

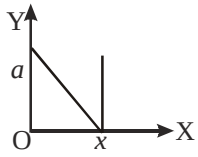


If the system is released from rest, which of the following graphs best represents relation between acceleration a and distance *x* covered by the car?

(a) 

(b) 

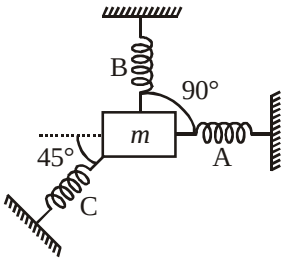
(c) 

(d) 

27. One end of a long metallic wire of length L is tied to the celling. The other end is tied to a massless spring of spring constant *k*. A mass *m* hangs freely from the free end of the spring. The area of cross-section and the Young's modulus of the wire are A and Y respectively. If the mass is slightly pulled down and released, it will oscillate with a time period T equal to

(a) $2\pi(m/k)^{1/2}$ (b) $2\pi\sqrt{\frac{m(YA+kL)}{YAk}}$ (c) $2\pi[(mYA/kL)^{1/2}$ (d) $2\pi(mL/YA)^{1/2}$

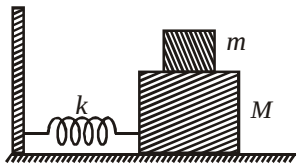
28. A particle of mass *m* is attached to three springs A, B and C of equal force constants *k*. The particle is pushed slightly against the spring *C* and released, the time period of oscillation will be



(a) $2\pi\sqrt{\left(\frac{m}{k}\right)}$ (b) $2\pi\sqrt{\left(\frac{m}{2k}\right)}$

(c) $2\pi\sqrt{\left(\frac{m}{3k}\right)}$ (d) $2\pi\sqrt{\left(\frac{2k}{m}\right)}$

29. A mass M is attached to a horizontal spring of force constant k fixed one side to a rigid support as shown in figure. The mass oscillates on a frictionless surface with time period T and amplitude A. When the mass is at equilibrium position, another mass m is gently placed on it. What will be the new time period of oscillations?



(a) $2\pi\sqrt{\left(\frac{M+m}{k}\right)}$ (b) $2\pi\sqrt{\left(\frac{M-m}{k}\right)}$ (c) $2\pi\sqrt{\left(\frac{M+m}{2k}\right)}$ (d) $2\pi\sqrt{\left(\frac{M-m}{2k}\right)}$

30. A particle of mass m is executing oscillation about the origin on the x-axis. Its potential energy is $U(x) = k|x|^3$, where k is a positive constant. If the amplitude of oscillation is a, then its time period T is

(a) proportional to $\frac{1}{\sqrt{a}}$ (b) independent of a (c) proportional to $\sqrt{a}$ (d) proportional to $a^{3/2}$

CHEMISTRY

31. The compound which is not isomeric with diethyl ether is:

(a) *n*-propyl methyl ether (b) 1-butanol

(c) 2-methyl-2-propanol (d) butanone

32. Which of the following compound will exhibit *cis-trans* (geometrical) isomerism?

(a) 2-Butene (b) 2-Butyne (c) 2-Butanol (d) Butanal

33. If two compounds have the same empirical formula but different molecular formulae they must have

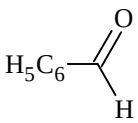
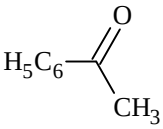
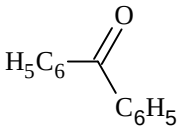
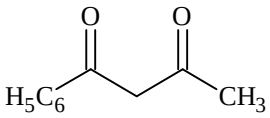
(a) different percentage composition (b) different molar mass

(c) same viscosity (d) same vapour density

34. The number of isomers of C_6H_{14} is

(a) 4 (b) 5 (c) 6 (d) 7

35. Keto-enol tautomerism is observed in

(a)  (b)  (c)  (d) 

36. The number of isomers for the compound with molecular formula $C_2BrClFI$ is

(a) 3 (b) 4 (c) 5 (d) 6

37. Monochlorination of 2-methylbutane produces the possible products

(a) 1 (b) 2 (c) 3 (d) 4

38. Which of the following statements is not correct?

(a) A meso compound has chiral centres but exhibits no optical activity

(b) A meso compound has no chiral centres and thus are optically inactive

(c) A meso compound has molecules which are superimposibale on their mirror images even through they contain chiral centres

(d) A meso compound is optically inactive because the rotation caused by any molecule is cancelled by an equal and opposite rotation caused by another molecule that is the mirror image of the first.

39. The two enantiomers of a compound can be separated by

(a) fractional distillation (b) fractional crystallization

(c) chromatographic techniques (d) the use of a suitable optically active reagent

40. The two enantiomers of a compound have

(a) different direction of rotation but the same amount of rotation

(b) same direction of rotation but different amount of rotation

(c) same direction of rotation as well same amount of rotation

(d) different direction of rotation as well as different amount of rotation

41. The oxygen atom in phenol

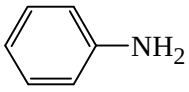
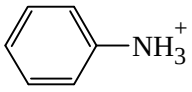
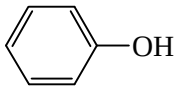
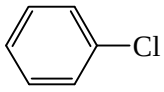
(a) exhibits only inductive effect

(b) exhibits only resonance effect

(c) has more dominating resonance effect than inductive effect

(d) has more dominating inductive effect than the resonance effect

42. In which of the following molecules, the resonance effect is not present?

(a)  (b)  (c)  (d) 

43. Which of the following orders is correct regarding the –I effect of the substituents?

(a) $-NR_2 > -OR > -F$ (b) $-NR_2 < -OR < -F$

(c) $-NR_2 > -OR < -F$ (d) $-NH_2 < -OR > -F$

44. For 1-methoxy-1, 3-butadiene, which of the following resonating structures is the least stable?

(a) $H_2C = CH - \overset{\oplus}{C}H - \overset{\ominus}{C}H - O - CH_3$ (b) $H_2C = CH - \overset{\ominus}{C}H - CH = \overset{\oplus}{O} - CH_3$

(c) $H_2\overset{\ominus}{C} - \overset{\oplus}{C}H - CH - CH = O - CH_3$ (d) $H_2\overset{\ominus}{C} - CH = CH - CH = \overset{\oplus}{O} - CH_3$

45. Hyperconjugation involves overlap of the following orbitals

(a) $\sigma - \sigma$ (b) $\sigma - p$ (c) $p - p$ (d) $\pi - \pi$

46. Which of the following orders of relative strength of acids is correct?

(a) $CH_3COOH > HCN > H_2O > C_2H_5OH$ (b) $CH_3COOH < HCN < H_2O < C_2H_5OH$

(c) $CH_3COOH > HCN < H_2O < C_2H_5OH$ (d) $CH_3COOH < HCN < H_2O > C_2H_5OH$

47. From the following reaction $RONa + H_2O \rightleftharpoons ROH + NaOH$

$ROH + NaNH_2 \rightleftharpoons RONa + NH_3$

predict which of the following orders regarding base strength is correct?

(a) $OH^- < NH_2^- > RO^-$ (b) $NH_2^- < OH^- < RO^-$ (c) $OH^- < RO^- < NH_2^-$ (d) $RO^- > NH_2^- > OH$

48. Which of the fallowing statements is not correct?

(a) NH_3 is a stronger base then PH_3 (b) SH^- is a weaker base than OH^-

(c) CH_3COO^- is a weaker base than CH_3O^- (d) $CH_3SO_3^-$ is a stronger base than $CH_3SeO_3^-$

49. The pK_a° values of four acids are given below. Which one will correspond to the weakest acid?

(a) – 1.3 (b) 4.72 (c) 9.2 (d) 16.0

50. Which of the following orders is correct regarding the acidity of carboxylic acids?

(a) $(CH_3)_3CCOOH > (CH_3)_2CHCOOH > CH_3CH_2COOH$

(b) $(CH_3)_3CCOOH > (CH_3)_2CHCOOH < CH_3CH_2COOH$

(c) $(CH_3)_3CCOOH < (CH_3)_2CHCOOH > CH_3CH_2COOH$

(d) $(CH_3)_3CCOOH < (CH_3)_2CHCOOH < CH_3CH_2COOH$

51. Which of the following is an electrophile?

(a) BF_3 (b) CO_2 (c) H_2O (d) NH_3

52. Which of the following is the most stable carbocation?

(a) $\overset{+}{C}H_3$ (b) $R\overset{+}{C}H_2$ (c) $R_2\overset{+}{C}H$ (d) $R_3\overset{+}{C}$

53. An electrophilic reagent must have

(a) a vacant orbital (b) an orbital containing one electron

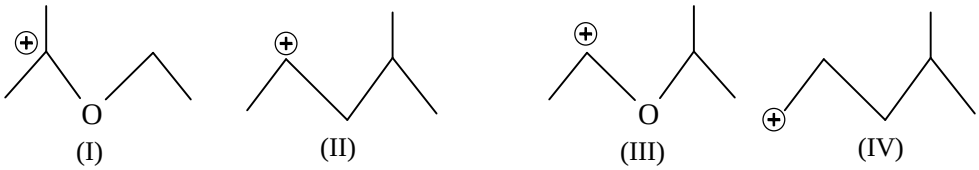
(c) an orbital containing two electrons (d) all completely filled atomic orbitals

54. Which of the following statements is correct?

(a) + I group stabilises a carbocation (b) +I group stabilises a carbanion

(c) – I group stabilises a carbocation (d) – I group destabilises a carbanion

55. The correct stability order for the following species is



(I) (II) (III) (IV)

(a) (II) > (IV) > (I) > (III) (b) (I) > (II) > (III) > (IV)

(c) (II) > (I) > (IV) > (III) (d) (I) > (III) > (II) > (IV)

56. For the following reaction

$CH_3Cl \rightarrow CH_3^+ + Cl^-$ $\Delta H_1°$ $(CH_3)_2CHCl \rightarrow (CH_3)_2CH^+ + Cl–$ $\Delta H_3°$

$CH_3CH_2Cl \rightarrow CH_3CH_2^+ + Cl^-$ $\Delta H_2°$ $(CH_3)_3CCl \rightarrow (CH_3)_3C^+ + Cl^-$ $\Delta H_4°$

the correct order of enthalpies of ionization is

(a) $\Delta H_1° > \Delta H_2° > \Delta H_3° > \Delta H_4°$ (b) $\Delta H_1° < \Delta H_2° < \Delta H_3° < \Delta H_4°$

(c) $\Delta H_1° > \Delta H_2° > \Delta H_3° < \Delta H_4°$ (d) $\Delta H_1° > \Delta H_2° < \Delta H_3° < \Delta H_4°$

57. The reaction $C_6H_6 + Br_2 \xrightarrow{FeBr_3} C_6H_5Br + HBr$ is

(a) an electrophilic addition reaction (b) a nucleophilic substitution reaction

(c) an electrophilic substitution reaction (d) a free redical substitution reaction

58. An S_N2 reaction at an asymmetric carbon of a compound always gives

(a) an enantiomer of the subtract (b) a product with opposite optical rotation

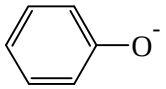
(c) a mixture of diastereomers (d) a single stereoisomer

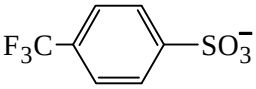
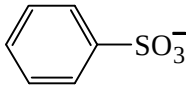
59. Amongst F^-, OH^-, I^- and $CF_3SO_3^-$, the order of tendency of leaving of a nucleophile in nucleophilic reactions is

(a) $F^- < OH^- < I^- < CF_3SO_3^-$ (b) $CF_3SO_3^- < OH^- < F^- < I^-$

(c) $OH^- < F^- < I^- < CF_3SO_3^-$ (d) $CF_3SO_3^- < I^- < F^- < OH^-$

60. Amongst the given species, the best leaving group in a nucleophilic substitution reaction is

(a) OH^- (b) 

(c)  (d) 

MATHEMATICS

61. Points D, E are taken on the side BC of a ΔABC, such that BD = DE = EC. If $\angle BAD = x$, $\angle DAE = y$, $\angle EAC = z$, then the value of $\dfrac{\sin(x+y)\sin(y+z)}{\sin x \sin z}$ is equal to

(a) 1 (b) 2 (c) 4 (d) none of these

62. If p_1, p_2, p_3 are respectively the perpendiculars from the vertices of a triangle to the opposite sides, then $\dfrac{\cos A}{p_1}+\dfrac{\cos B}{p_2}+\dfrac{\cos C}{p_3}$ is equal to

(a) $1/r$ (b) 1/R (c) $1/\Delta$ (d) none of these

63. In an equilateral ΔABC, $R : r : r_1 =$

(a) 2 : 2 : 3 (b) 2 : 1 : 3 (c) 2 : 1 : 4 (d) 3 : 1 : 4

64. If length of the sides AB and AC of a ΔABC are 3 cm and 6 cm respectively and if cosine of angle BAC is (1/8), then length of the angle bisector of angle BAC is

(a) 3 cm (b) 2.5 cm (c) 3.5 cm (d) none of these

65. If in a ΔABC, $\cos B \cos C + \sin A \sin B \sin C = 1$, then $a : b : c$ is equal to

(a) $1 : 1 : \sqrt{2}$ (b) $\sqrt{2} : 1 : 1$ (c) $1 : \sqrt{2} : 1$ (d) none of these

66. If A, B, C are the angles of a triangle, then value of $\cot \frac{A}{2} + \cot \frac{B}{2} + \cot \frac{C}{2}$ is

(a) $\frac{s}{R}$ (b) $\frac{R}{s}$ (c) $\frac{\Delta}{s^2}$ (d) $\frac{s^2}{\Delta}$

67. If a, b, c are the sides of a ΔABC and $3a = b + c$, then $\cot \frac{B}{2} \cot \frac{C}{2}$ is

(a) 1 (b) $\sqrt{3}$ (c) 2 (d) $\sqrt{2}$

68. If I is the incentre of ΔABC and AD is the angle bisector of angle BAC so that AI : ID = 2 : 1, then value of $\tan \frac{B}{2} \tan \frac{C}{2}$ is equal to

(a) $\frac{1}{3}$ (b) 3 (c) 2 (d) $\frac{1}{2}$

69. In a ΔABC if $a^2 \sin (B - C) + b^2 \sin (C - A) + c^2 \sin (A - B) = 0$, then triangle is

(a) right angled (b) obtuse angled (c) isosceles (d) none of these

70. Let $A_0 A_1 A_2 A_3 A_4 A_5$ be a regular hexagon inscribed in a circle of unit radius. Then the product of the lengths of the line segments $A_0 A_1$, $A_0 A_2$ and $A_0 A_4$ is

(a) $\frac{3}{4}$ (b) $3\sqrt{3}$ (c) 3 (d) $\frac{3\sqrt{3}}{2}$

71. The area of the circle and the area of a regular polygon of n sides and of perimeter equal to that of the circle are in the ratio of

(a) $\tan\left(\frac{\pi}{n}\right) : \frac{\pi}{n}$ (b) $\cot\left(\frac{\pi}{n}\right) : \frac{\pi}{n}$ (c) $\sin\left(\frac{\pi}{n}\right) : \frac{\pi}{n}$ (d) $\cos\left(\frac{\pi}{n}\right) : \frac{\pi}{n}$

72. The set of values of x for which $\frac{\tan 3x - \tan 2x}{1 + \tan 3x \tan 2x} = 1$ is

(a) ϕ (b) $\frac{\pi}{4}$

(c) $\left\{n\pi + \frac{\pi}{4}; n = 1, 2, 3...\right\}$ (d) $2n\pi + \frac{\pi}{4}$; $n = 1, 2, 3, ...$

73. If $\sin\left(\frac{\pi}{4}\cot\theta\right) = \cos\left(\frac{\pi}{4}\tan\theta\right)$, then θ is equal to

(a) $n\pi + \frac{\pi}{4}$ (b) $2n\pi \pm \frac{\pi}{4}$ (c) $n\pi - \frac{\pi}{4}$ (d) none of these

74. The expression $(1 + \tan x + \tan^2 x)(1 - \cot x + \cot^2 x)$ has positive value when x satisfies

(a) $0 \le x \le \frac{\pi}{2}$ (b) $0 \le x \le \pi$ (c) for all $x \in R$ (d) $x \ge 0$

75. General value of x satisfying the equation $\sqrt{3}\sin x + \cos x = \sqrt{3}$ is given by

(a) $n\pi \pm \frac{\pi}{6}$ (b) $n\pi + (-1)^n \frac{\pi}{4} + \frac{\pi}{3}$ (c) $n\pi \pm \frac{\pi}{3}$ (d) $n\pi + (-1)^n \frac{\pi}{3} - \frac{\pi}{6}$

76. The equation $k \sin x + \cos 2x = 2k - 7$ possesses a solution of

(a) $k > 6$ (b) $2 \le k \le 6$ (c) $k > 2$ (d) none of these

77. The number of all possible 5-tuples $(a_1, a_2, a_3, a_4, a_5)$ such that $a_1 + a_2 \sin x + a_3 \cos x + a_4 \sin 2x + a_5 \cos 2x = 0$ holds for all x is

(a) zero (b) 1 (c) 2 (d) infinite

78. The equation $\sin^4 x - 2\cos^2 x + a^2 = 0$ is solvable if

(a) $-\sqrt{3} \le a \le \sqrt{3}$ (b) $-\sqrt{2} \le a \le \sqrt{2}$ (c) $-1 \le a \le 1$ (d) none of these

79. The general solution of the equation $(\sqrt{3} - 1)\sin\theta + (\sqrt{3} + 1)\cos\theta = 2$ is

(a) $n\pi + (-1)^n \frac{\pi}{4} - \frac{\pi}{12}$ (b) $2n\pi \pm \frac{\pi}{4} - \frac{\pi}{12}$ (c) $n\pi + (-1)^n \frac{\pi}{4} + \frac{\pi}{12}$ (d) $2n\pi \pm \frac{\pi}{4} + \frac{\pi}{12}$

80. The maximum value of $\cos \alpha_1 . \cos \alpha_2 . \cos \alpha_3 ..... \cos \alpha_n$ under the restriction $0 \le \alpha_1, \alpha_2, ..., \alpha_n \le \frac{\pi}{2}$ and $\cot \alpha_1 . \cot \alpha_2 ..... \cos \alpha_n = 1$ is

(a) $\frac{1}{2^{n/2}}$ (b) $\frac{1}{2^n}$ (c) $\frac{-1}{2^n}$ (d) 1

81. The graph of the function $\cos x \cos (x + 2) - \cos^2(x + 1)$ is

(a) a straight line passing through $(0, -\sin^2 1)$ with slope 2

(b) a straight line passing through (0, 0)

(c) a parabola with vertex $(1, -\sin^2 1)$

(d) a straight line passing through the point $\left(\frac{\pi}{2}, -\sin^2 1\right)$ and parallel to the x-axis.

82. If $\frac{\pi}{2} < \alpha < \pi, \pi < \beta < \frac{3\pi}{2}$; $\sin \alpha = \frac{15}{17}$ and $\tan \beta = \frac{12}{5}$, the value of $\sin (\beta - \alpha)$ is

(a) $-\frac{21}{221}$ (b) $\frac{21}{221}$ (c) $-\frac{171}{221}$ (d) $\frac{171}{221}$

83. If $\tan (\pi \cos x) = \cot (\pi \sin x)$, then $\cos \left(x - \frac{\pi}{4}\right)$ is

(a) $\frac{1}{\sqrt{2}}$ (b) $\frac{1}{2\sqrt{2}}$ (c) 0 (d) none of these

84. If $\frac{\sin(\alpha + \beta)}{\cos(\alpha - \beta)} = \frac{1 - m}{1 + m}$, then $\tan \left(\frac{\pi}{4} - \alpha\right) \tan \left(\frac{\pi}{4} - \beta\right)$ is equal to

(a) m (b) $1 + m$ (c) $2m$ (d) $2 + m$

85. The value of $\cos \frac{2\pi}{7} + \cos \frac{4\pi}{7} + \cos \frac{6\pi}{7}$ is

(a) 1 (b) –1 (c) 1/2 (d) –1/2

86. If $90° < \alpha < 180°$ and $0 < \beta < 90°$ and $\sin\alpha = \frac{4}{5}$ and $\cos\beta = \frac{5}{13}$, then value of $\tan\left(\frac{\alpha-\beta}{2}\right)$ is

(a) $-\frac{4}{7}$ (b) $-\frac{1}{8}$ (c) $\frac{1}{8}$ (d) $\frac{4}{7}$

87. If $\sin 2\alpha > 0$ and $\tan(\alpha+\beta) = 4$, $\tan(\alpha-\beta) = 3$, then 2α will lie in the interval

(a) $\left(0, \frac{\pi}{2}\right)$ (b) $\left(\frac{\pi}{2}, \pi\right)$ (c) $\left(\pi, \frac{3\pi}{2}\right)$ (d) $\left(\frac{3\pi}{2}, 2\pi\right)$

88. Maximum value of $\sin^8\theta + \cos^{18}\theta$ is

(a) 1 (b) $\frac{3}{4}$ (c) $\frac{3}{2}$ (d) none of these

89. The number of integral values of k for which the equation $7\cos x + 5\sin x = 2k + 1$ has a solution is

(a) 4 (b) 8 (c) 10 (d) 12

90. The value of the expression $\frac{1-4\sin 10°\sin 70°}{2\sin 10°}$ is

(a) 1/2 (b) 1 (c) 2 (d) none of these

TEST-13

ANSWERS

Physics

1.	(a)	2.	(c)	3.	(b)	4.	(b)	5.	(b)
6.	(b)	7.	(c)	8.	(d)	9.	(c)	10.	(d)
11.	(a)	12.	(c)	13.	(a)	14.	(b)	15.	(a)
16.	(d)	17.	(d)	18.	(a)	19.	(a)	20.	(a)
21.	(d)	22.	(c)	23.	(a)	24.	(a)	25.	(a)
26.	(b)	27.	(b)	28.	(b)	29.	(a)	30.	(a)

Chemistry

31.	(d)	32.	(a)	33.	(b)	34.	(b)	35.	(d)
36.	(d)	37.	(c)	38.	(b)	39.	(d)	40.	(a)
41.	(c)	42.	(b)	43.	(b)	44.	(a)	45.	(b)
46.	(a)	47.	(b)	48.	(d)	49.	(d)	50.	(d)
51.	(a)	52.	(d)	53.	(a)	54.	(a)	55.	(d)
56.	(a)	57.	(c)	58.	(d)	59.	(c)	60.	(c)

Mathematics

61.	(c)	62.	(b)	63.	(b)	64.	(a)	65.	(b)
66.	(d)	67.	(c)	68.	(a)	69.	(c)	70.	(c)
71.	(a)	72.	(a)	73.	(a)	74.	(c)	75.	(d)
76.	(b)	77.	(b)	78.	(b)	79.	(d)	80.	(a)
81.	(d)	82.	(d)	83.	(b)	84.	(a)	85.	(c)
86.	(d)	87.	(b)	88.	(a)	89.	(b)	90.	(b)