SHIKSHA CLASSES, BHANDARA

TEST-4

CHEMISTRY , PHYSICS, MATHEMATICS

Time : - 3 Hours **Max. Marks:- 300** **Date : .....**

INSTRUCTIONS :

1. The test is of 3 hours duration.
2. The Test Booklet consists of 90 questions. The maximum marks are **300.**
3. There are three parts in the question paper A, B, C consisting of Chemistry, Physics and Mathematics having **30questions** in each part of equal weightage. **20 questions** will be **MCQs** and **10 questions** (**ATTEMPT ANY FIVE QUESTIONS OUT OF 10**)will have answer to be filled as **numerical value**.
   Marking Scheme for MCQs
   Correct Answer Four mark (+4), Incorrect Answer Minus one mark (–1), Unanswered No mark (0)
   Marking Scheme for questions for which answer is a **Numerical value**
   Correct Answer Four mark (+4), Incorrect Answer No mark (0), Unanswered No mark (0)
4. There is only one correct response for each question. Filling up more than one response in each question will be treated as wrong response and marks for wrong response will be deducted accordingly.

SYLLABUS

CHEMISTRY: ORGANIC CHEMISTRY - BASIC PRINCIPLES & TECHNIQUES, HYDROCARBONS, ENVIRONMENTAL CHEMISTRY

PHYSICS : OSCILLATIONS AND WAVES

MATHEMATICS : CONICS, MATHEMATICAL REASONING, STATISTICS.

You are never too old to set another goal or to dream a new dream.

There is no substitute for hard work.

Name : .....

Address : .....

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Phone/Mobile No. .....

Roll No. .....

PART A – CHEMISTRY

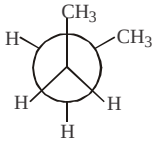
SECTION - 1 (Q.1 - Q.20)

Each question has FOUR options (1), (2), (3) and (4). ONLY ONE of these four options is correct.

Q.1 The IUPAC nomenclature of $(CH_3)_3C–CH = C(CH_3)_2$ is :

(1) 2,4,4–Trimethylpent-3-ene
(2) 2,4,4–Trimethylpent-2-ene
(3) 2,2,4–Trimethylpent-3-ene
(4) 2,2,4–Trimethylpent-2-ene

Q.2 Which one is most stable conformers of n-butane?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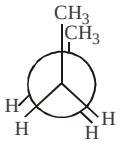
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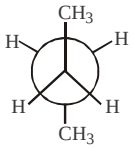
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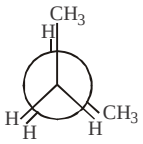
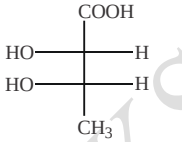
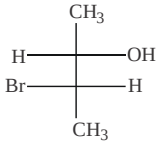

(4)

Q.3 Acetylene reacts with a 42% H_2SO_4 solution containing 1% $HgSO_4$ to give :

(1) $C_2H_5HSO_4$ (2) $CH_2 = CH_2$
(3) CH_3CHO (4) HCHO

Q.4 Which of the following is erythro form and optically active ?


(1)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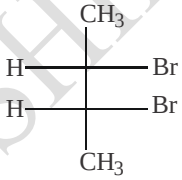
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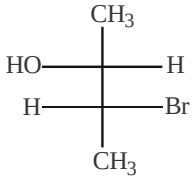

(4)

Q.5 1-Alkyne and 2-alkyne can be distinguished by

(1) Tollen's reagent
(2) Baeyer's regent
(3) Br_2 / CCl_4
(4) Hydrogenation over Ni

Q.6 **Assertion :** Ozone is destroyed by CFCs in the upper stratosphere

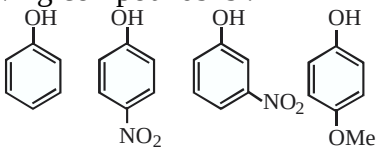
Reason : Ozone holes increase the amount of UV radiation reaching the earth.

(1) Assertion and reason are correct, but the reason is not the explanation for the assertion.
(2) Assertion is false, but the reason is correct.
(3) Assertion and reason are incorrect, Assertion and reason are both correct.
(4) And the reason is the correct explanation for the assertion.

Q.7 The compound that is NOT a common component of photochemical smog is :

(1) O_3 (2) $CH_2 = CHCHO$
(3) CF_2Cl_2 (4) $H_3C-\overset{\overset{O}{\|}}{C}-OONO_2$

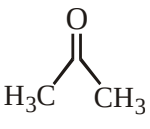
Q.8 The increasing order of the pKa values of the following compounds is :


A B C D

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

Q.9 The major product of the following addition reaction is : $H_3C - CH = CH_2 \xrightarrow{Cl_2/H_2O}$

(1) $CH_3-\underset{Cl}{\underset{|}{CH}}-\underset{OH}{\underset{|}{CH_2}}$ (2) $H_3C-\underset{OH}{\underset{|}{CH}}-\underset{Cl}{\underset{|}{CH_2}}$

(3) H_3C-  (4) 

SPACE FOR ROUGH WORK

Q.10 The correct set of species responsible for the photochemical smog is :

(1) NO, NO_2, O_3 and hydrocarbons

(2) N_2,O_2, O_3 and hydrocarbons

(3) N_2, NO_2 and hydrocarbons

(4) CO_2, NO_2, SO_2 and hydrocarbons

Q.11 $\left[CH_3–CH_2–\underset{\oplus N(CH_3)_3}{\underset{|}{CH}}–CH_3\right]\overset{\ominus}{O}H \xrightarrow{\text{pyrolysis}}$

major alkene will be :

(1) Trans-2-butene (2) Cis-2-butene

(3) 1-Butene (4) isobutylene

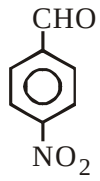
Q.12 Which among the given acids has lowest pK_a value

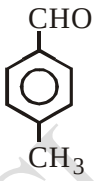
(1) Chloroacetic acid (2) Bromoacetic acid

(3) Nitroacetic acid (4) Cyanoacetic acid

Q.13 Arrange the following in correct order of rate of NAR -

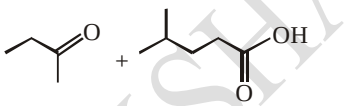
(I) $H-\overset{\overset{O}{\|}}{C}-H$ (II) $CH_3-\overset{\overset{O}{\|}}{C}-H$

(III) 

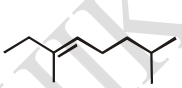
(IV) 

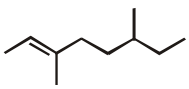
(1) I > II > III > IV (2) I > III > II > IV

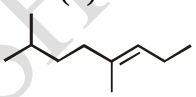
(3) IV > III > II > I (4) III > I > II > IV

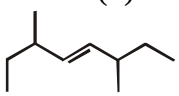
Q.14 Alkene (x) $\xrightarrow[\Delta]{KMnO_4/H^+}$ 

x is :

(1) 

(2) 

(3) 

(4) 

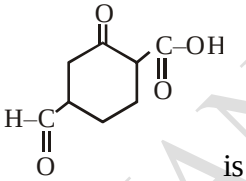
Q.15 The number of optical isomers for the given compound :

$CH_3-\underset{\underset{OH}{|}}{CH}-\underset{\underset{Cl}{|}}{CH}-CH_3-COOH$

(1) 2 (2) 3

(3) 4 (4) 5

Q.16 IUPAC name of



is –

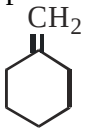
(1) 6-Oxo-4- formyl cyclohexane carboxylic acid

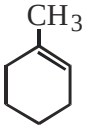
(2) 4-Formyl-2-Oxo cyclohexane carboxylic acid

(3) 4-Formyl-2-Oxo cyclohexanoic acid

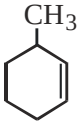
(4) 1-Carboxy -4-fromyl-2-Oxo cyclohexane

Q.17 In the reaction with HCl, an alkene reacts in accordance with the Markovnikov's rule, to give a product 1–chloro–1–methylcyclohexane. The possible alkene is :

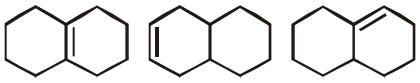
(1) 

(2) 

(3) (1) and (2)

(4) 

Q.18 Given



I **II** **III**

The enthalpy of hydrogenation of these compounds will be in the order

(1) II > III > I (2) II > I > III

(3) III > II > I (4) I > II > III

SPACE FOR ROUGH WORK

Q.19 Least reactive towards nucleophilic addition is :

(1) $CH_2 = O$ (2) $CCl_3 - \underset{\underset{O}{\|}}{C} - H$

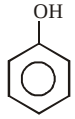
(3) $CH_3 - \underset{\underset{O}{\|}}{C} - C_2H_5$ (4) $CH_3 - \underset{\underset{O}{\|}}{C} - H$

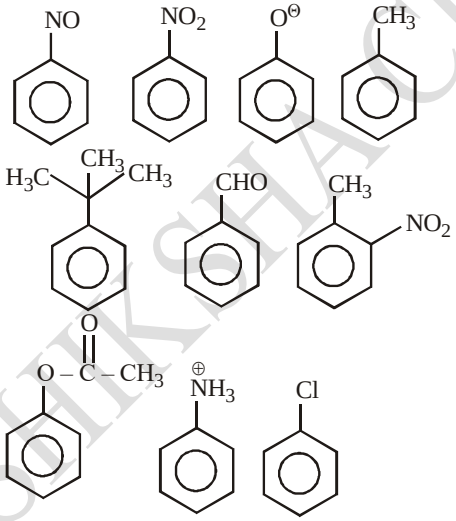
Q.20 A mixture of camphor and benzoic acid can be separated by –

(1) Chemical method
(2) Sublimation
(3) Fractional distillation
(4) Extraction with a solvent

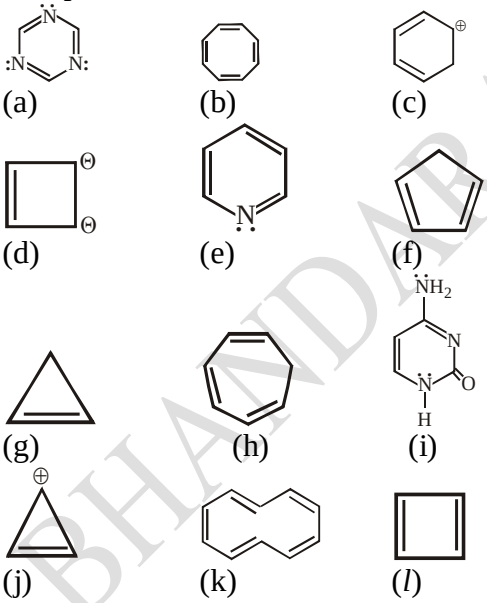
SECTION - 2 (Q.21 - Q.30)

This section contains TEN (10) questions. ATTEMPT ANY FIVE (05) QUESTIONS. The answer to each question is NUMERICAL VALUE. If the numerical value has more than two decimal places truncate/round-off the value upto TWO decimal places.

Q.21 Number of compounds which are more reactive than  towards electrophilic substitution reaction.



Q.22 Compounds :



(a) (b) (c)

(d) (e) (f)

(g) (h) (i)

(j) (k) (*l*)

(i) No. of compounds which are aromatic = P

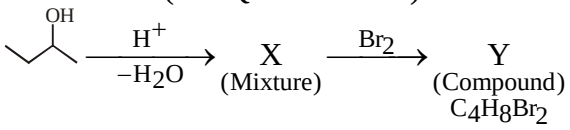
(ii) No. of compounds which are antiaromatic = Q

(iii) No. of compounds which are non-aromatic =R

(iv) No. of compounds which are readily undergo dimerization at room temperature = S

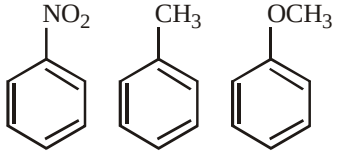
(v) No. of compounds unstable at room temperature = T

Sum of (P + Q + R + S + T)/2 = ?

Q.23 

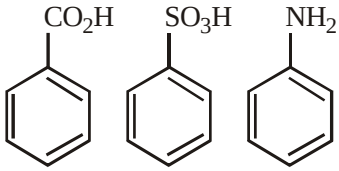
(including stereoisomer). Sum of (X + Y) will be –

Q.24 Among given compounds how many are ortho-para (o/p) director?



(a) (b) (c)

SPACE FOR ROUGH WORK



(d) (e) (f)

Q.25 A compound containing C, H and O with molecular weight 122 on acetylation gives the derivative whose molecular weight is 290. The no. of –OH groups present in the original molecule is

Q.26 How many position isomers of dibromonaphthalene is possible if each ring of naphthalene has one halogen?

Q.27 $CH_3 - \underset{\underset{CH_3}{|}}{CH} - CH_2 - Ph \xrightarrow[\text{monochlorination}]{Cl_2/h\nu}$ Products

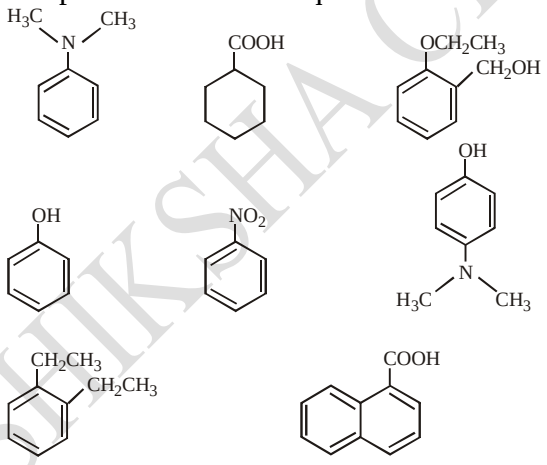
How many total number of possible products are formed

Q.28 The number of optically active isomers of the following compound is

$OHC - CHBr - CHOH - CHBr - CH_2OH$

Q.29 The number of structural isomers possible for methyl anthracene is

Q.30 Amongst the following, the total number of compounds soluble in aqueous NaOH is.

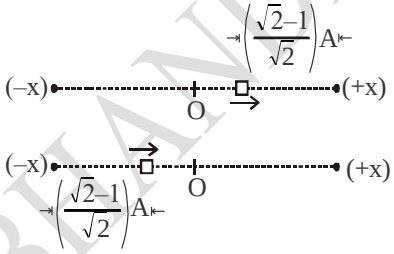


PART B – PHYSICS

SECTION - 1 (Q.31 - Q.50)

Each question has FOUR options (1), (2), (3) and (4). ONLY ONE of these four options is correct.

Q.31 Two bodies performing SHM have same amplitude and frequency. Their phases at a certain instant are as shown in the figure. The phase difference between them is



(1) π (2) $2\pi/3$

(3) $\pi/2$ (4) $3\pi/4$

Q.32 While measuring the speed of sound by performing a resonance column experiment, a student gets the first resonance condition at a column length of 18 cm during winter. Repeating the same experiment during summer, she measures the column length to be x cm for the second resonance. Then :-

(1) $x > 54$ (2) $54 > x > 36$

(3) $36 > x > 18$ (4) $18 > x$

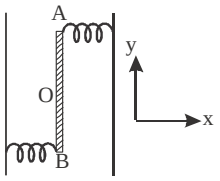
Q.33 A simple pendulum of length 1m is oscillating with an angular frequency 10 rad/s. The support of the pendulum starts oscillating up and down with a small angular frequency of 1 rad/s and an amplitude of 10^{-2} m. The relative change in the angular frequency of the pendulum is best given by :

(1) 10^{-3} rad/s (2) 10^{-1} rad/s

(3) 1 rad/s (4) 10^{-5} rad/s

Q.34 Two light identical springs of spring constant k are attached horizontally at the two ends of a uniform horizontal rod AB of length ℓ and mass m. The rod is pivoted at its centre 'O' and can rotate freely in horizontal plane. The other ends of the two springs are fixed to rigid supports as shown in figure.

SPACE FOR ROUGH WORK



The rod is gently pushed through a small angle and released. The frequency of resulting oscillation is:

(1) $\frac{1}{2\pi}\sqrt{\frac{6k}{m}}$ (2) $\frac{1}{2\pi}\sqrt{\frac{2k}{m}}$

(3) $\frac{1}{2\pi}\sqrt{\frac{k}{m}}$ (4) $\frac{1}{2\pi}\sqrt{\frac{3k}{m}}$

Q.35 A stationary source emits sound waves of frequency 500 Hz. Two observers moving along a line passing through the source detect sound to be of frequencies 480 Hz and 530 Hz. Their respective speeds are, in ms^{-1}.
(Given speed of sound = 300 m/s)
(1) 16, 14 (2) 12, 18
(3) 12, 16 (4) 8, 18

Q.36 A source of sound S is moving with a velocity of 50 m/s towards a stationary observer. The observer measures the frequency of the source as 1000 Hz. What will be the apparent frequency of the source when it is moving away from the observer after crossing him ? (Take velocity of sound in air is 350 m/s)
(1) 857 Hz (2) 807 Hz
(3) 750 Hz (4) 1143 Hz

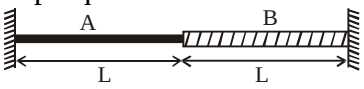
Q.37 A simple pendulum oscillating in air has period T. The bob of the pendulum is completely immersed in a non-viscous liquid. The density of the liquid is
$(1/16)^{th}$ of the material of the bob. If the bob is inside liquid all the time, its period of oscillation in this liquid is :

(1) $4T\sqrt{\frac{1}{15}}$ (2) $2T\sqrt{\frac{1}{10}}$

(3) $2T\sqrt{\frac{1}{14}}$ (4) $2T\sqrt{\frac{1}{12}}$

Q.38 A travelling harmonic wave is represented by the equation $y(x, t) = 10^{-3} \sin(50t + 2x)$, where x and y are in meter and t is in seconds. Which of the following is a correct statement about the wave?
The wave is propagating along the
(1) negative x-axis with speed $25 ms^{-1}$.
(2) The wave is propagating along the positive x-axis with speed 25 ms^{-1}.
(3) The wave is propagating along the positive x-axis with speed 100 ms^{-1}.
(4) The wave is propagating along the negative x-axis with speed 100 ms^{-1}.

Q.39 A wire of length 2L, is made by joining two wires A and B of same length but different radii r and 2r and made of the same material. It is vibrating at a frequency such that the joint of the two wires forms a node. If the number of antinodes in wire A is p and that in B is q then the ratio p : q is :



(1) 4 : 9 (2) 3 : 5
(3) 1 : 4 (4) 1 : 2

Q.40 A particle executing SHM of amplitude 4 cm and T = 4s. The time taken by it to move from +2 cm to $+2\sqrt{3}$ cm is :-
(1) 1s (2) 1/3 s
(3) 2/3 s (4) $\sqrt{\frac{3}{2}}$s

Q.41 The pressure wave $P = 0.01 \sin[1000t - 3x] Nm^{-2}$ corresponds to the sound produced by a vibrating blade on a day when atmospheric temperature is 0°C. On some other day, when temperature is T, the speed of sound produced by the same blade and at the same frequency is found to be 336 m/s. Approximate value of T is
(1) 15°C (2) 12°C
(3) 4°C (4) 11°C

SPACE FOR ROUGH WORK

Q.42 A light pointer fixed to one prong of a tuning fork touches a vertical plate. The fork is set vibrating and the plate is allowed to fall freely. If eight oscillations are counted when the plate falls through 10 cm, the frequency of the tuning fork is :-

(1) 360 Hz (2) 280 Hz

(3) 560 Hz (4) 56 Hz

Q.43 A particle is executing a simple harmonic motion. Its maximum acceleration is α and maximum velocity is β. Then its frequency of vibration will be

(1) $\alpha / 2\pi\beta$ (2) α^2 / β^2

(3) β / α (4) α / β^2

Q.44 Regarding speed of sound in gas match the following

(a)	Temperature of gas is made 4 times and pressure 2 times	(P)	Speed becomes $2\sqrt{2}$ times
(b)	Only pressure is made 4 times without change in temperature	(Q)	Speed become 2 times
(c)	Only temperature is changed to 4 times	(R)	Speed remains unchanged
(d)	Molecular mass of the gas is made 4 times	(S)	Speed becomes half

(1) a–Q, b–R, c–Q, d–S (2) a–Q, b–S, c–Q, d–S

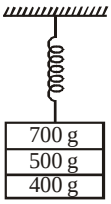
(3) a–S, b–R, c–Q, d–S(4) a–Q, b–R, c–Q, d–Q

Q.45 A transverse wave is described by the equation $y = y_0 \sin 2\pi\left(ft - \frac{x}{\lambda}\right)$. The maximum particle velocity is equal to four times wave velocity if

(1) $\lambda = \frac{\pi y_0}{4}$ (2) $\lambda = \frac{\pi y_0}{2}$

(3) $\lambda = \pi y_0$ (4) $\lambda = 2\pi y_0$

Q.46 Three masses 700 g, 500 g and 400 g are suspended at the end of a spring as shown and are in equilibrium. When the 700 g mass is removed, the system oscillates with a period of 3 seconds when the 500 g mass is also removed, it will oscillate with a period of :



(1) 1s (2) 2 s

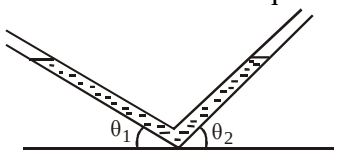
(3) 3 s (4) $\sqrt{\frac{12}{5}}$s

Q.47 A wire of density ρ is stretched between the clamps at a distance L apart, while being subjected to an extension ℓ (<<L), Y is the Young's modulus of the wire. The lowest resonant frequency of transverse vibration of the wire is approximately given by –

(1) $f = \frac{1}{2L}\sqrt{\frac{YL}{\ell\rho}}$ (2) $f = \frac{1}{2L}\sqrt{\frac{Y\rho L}{\ell^2}}$

(3) $f = \frac{1}{2L}\sqrt{\frac{Y\ell}{L\rho}}$ (4) $f = \frac{1}{2L}\sqrt{\frac{L\rho}{Y\ell}}$

Q.48 A nonviscous liquid of mass m and density ρ is filled in a tube with A as the area of cross-section, as shown in the figure. If the liquid is slightly depressed in one of the arms, the liquid column oscillates with a frequency:



(1) $\frac{1}{2\pi}\sqrt{\frac{\rho g A \sin\left(\frac{\theta_1+\theta_2}{2}\right)}{m}}$

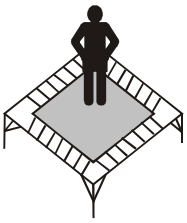
(2) $\frac{1}{2\pi}\sqrt{\frac{\rho g A (\sin\theta_1 - \sin\theta_2)}{m}}$

(3) $\frac{1}{2\pi}\sqrt{\frac{\rho g A (\sin\theta_1 + \sin\theta_2)}{m}}$

(4) $\frac{1}{2\pi}\sqrt{\frac{\rho g A \sin\left(\frac{\theta_1-\theta_2}{2}\right)}{m}}$

SPACE FOR ROUGH WORK

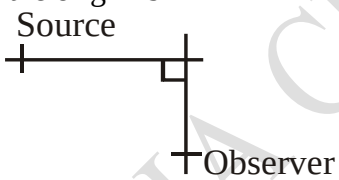
Q.49 The trampoline is modelled as having an effective vertical undamped linear spring with stiffness k = 160 N/m. The person is modelled as a rigid mass m = 40 kg, g = 10 m/s^2. If she repeatedly jumps so that her feet clear the trampoline by a height h = 3.75m, what is the period of this motion.



(1) $\left(\sqrt{3}+\frac{2\pi}{3}\right)$ s (2) $\left(\sqrt{3}+\frac{5\pi}{6}\right)$ s

(3) $\left(\frac{\sqrt{3}}{2}+\frac{\pi}{2}\right)$ s (4) $\left(\frac{\sqrt{3}}{2}+\frac{2\pi}{3}\right)$ s

Q.50 A source and an observer are situated on two perpendicular tracks as shown in the figure. The observer is at rest and source is moving with a speed 50 m/s. The source emits sound waves of frequency 90 Hz which travel in the medium with velocity 200m/s. The frequency of sound heard by observer when the source crosses the origin is –



(1) 84 Hz (2) 88 Gz

(3) 92 Hz (4) 96 Hz

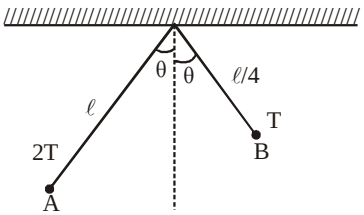
SECTION - 2 (Q.51 - Q.60)

This section contains TEN (10) questions. ATTEMPT ANY FIVE (05) QUESTIONS. The answer to each question is NUMERICAL VALUE. If the numerical value has more than two decimal places truncate/round-off the value upto TWO decimal places.

Q.51 The fundamental frequency of a sonometer wire increases by 6 Hz if its tension is increased by 44% keeping the length constant. Find the magnitude of change in the fundamental frequency (in Hz) of the sonometer wire when the length of the wire is increased by 20% keeping the original tension in the wire.

Q.52 Two metallic strings A and B of different materials are connected in series forming a joint. The strings have similar cross-sectional area. The length of A is ℓ_A = 0.3m and that B is ℓ_B = 0.5m. One end of the combined string is tied with a support rigidly and the other end is loaded with a block of mass 0.9 kg passing over a frictionless pulley. Transverse waves are set up in the combined string using an external source of variable frequency, the lowest frequency for which standing waves are observed such that the joint is a node is X Hz. Find the value of (X/100). (The linear densities of A and B are 10g/m and 2.5 g/m respectively).

Q.53 Two simple pendulums A and B having length ℓ and ℓ/4 respectively are released from the position as shown in figure. Calculate the time after the release at which two strings become parallel for the first time. Angle θ is very small. If the answer will be $\frac{\pi}{\alpha}\sqrt{\frac{\ell}{g}}$ then find the value of α.

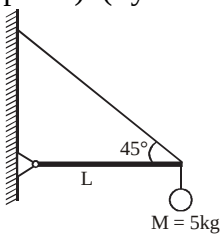


Q.54 A closed organ pipe of length 83.2 cm. and 6cm. diameter is vibrated. The velocity of sound is 340 m/s. What is number of overtones in this tube having frequency below 1000Hz.

SPACE FOR ROUGH WORK

Q.55 A narrow organ pipe of length 28cm closed at one end is found to be at resonance when a tuning fork of frequency 850 Hz is sounded near the open end. If velocity of sound in air is 340 m/s, then the end correction of the pipe is X cm. Find the value of X.

Q.56 A sphere of mass M = 5kg is supported by a uniform thin string that passes over a light horizontal rod of length L=1m as shown in figure. The fundamental frequency of standing wave in the portion of the string above the rod is 50Hz the angle θ is 45º. The mass of the string above the rod is x(gram). The value of x is: (Take g = 10 m/s^2 and mass of the thin uniform string is very-very small in comparison to mass of sphere). (System is in equilibrium)



Q.57 Three waveforms travelling along a straight line have the forms :

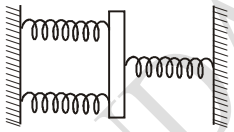
$2A\sin\left(kx-\omega t+\frac{\pi}{3}\right)$, $\sqrt{3}A\sin\left(kx-\omega t-\frac{\pi}{3}\right)$,

$2\sqrt{3}A\cos\left(kx-\omega t+\frac{\pi}{3}\right)$. If the amplitude of the resulting waveform is $\sqrt{\frac{95}{x}}A$ unit then x is

Q.58 A particle is executing SHM on a straight line. A and B are two points at which its velocity is zero. It passes through a certain point P(AP<PB) at successive intervals of 0.5 and 1.5 sec with a speed of $3\sqrt{2}$ m/s. Determine the maximum speed (in m/s).

Q.59 Two identical organ pipes are producing fundamental note of frequency 200 Hz at 15°C. When the temperature of one pipe is raised to 27°C, find the number of beats produced.

Q.60 The three springs are identical. The bar of mass m performs SHM on horizontal plane such that its kinetic energy T varies at n cycles/s. Then the spring constant of each spring is $\frac{m\pi^2n^2}{A}$. Find the value of A.



PART C – MATHEMATICS

SECTION - 1 (Q.61 - Q.80)

Each question has FOUR options (1), (2), (3) and (4). ONLY ONE of these four options is correct.

Q.61 In an ellipse, with centre at the origin, if the difference of the lengths of major axis and minor axis is 10 and one of the foci is at $(0, 5\sqrt{3})$, then the length of its latusrectum is:

(1) 10 (2) 8
(3) 5 (4) 6

Q.62 If the normal to the ellipse $3x^2 + 4y^2 = 12$ at a point P on it is parallel to the line, $2x + y = 4$ and the tangent to the ellipse at P passes through Q (4, 4) then PQ is equal to :

(1) $\frac{\sqrt{221}}{2}$ (2) $\frac{\sqrt{157}}{2}$
(3) $\frac{\sqrt{61}}{2}$ (4) $\frac{5\sqrt{5}}{2}$

Q.63 If $5x + 9 = 0$ is the directrix of the hyperbola $16x^2 - 9y^2 = 144$, then its corresponding focus is :

(1) (–5/3, 0) (2) (5, 0)
(3) (–5, 0) (4) (5/3, 0)

Q.64 If the data $x_1, x_2, ..., x_{10}$ is such that the mean of first four of these is 11, the mean of the remaining six is 16 and the sum of squares of all of these is 2,000; then the standard deviation of this data is :

(1) 4 (2) 2
(3) $\sqrt{2}$ (4) $2\sqrt{2}$

SPACE FOR ROUGH WORK

Q.65 If the line $y = mx + 7\sqrt{3}$ is normal to the hyperbola $\frac{x^2}{24} - \frac{y^2}{18} = 1$, then a value of m is

(1) $\frac{\sqrt{5}}{2}$ (2) $\frac{3}{\sqrt{5}}$

(3) $\frac{2}{\sqrt{5}}$ (4) $\frac{\sqrt{15}}{2}$

Q.66 If both the mean and the standard deviation of 50 observations x_1, x_2....,x_{50} are equal to 16, then the mean of $(x_1 - 4)^2$, $(x_2 - 4)^2$,... $(x_{50} - 4)^2$ is :

(1) 525 (2) 380

(3) 480 (4) 400

Q.67 The contrapositive of the statement "If you are born in India, then you are a citizen of India", is :

(1) If you are born in India, then you are not a citizen of India.

(2) If you are not a citizen of India, then you are not born in India.

(3) If you are a citizen of India, then you are born in India.

(4) If you are not born in India, then you are not a citizen of India.

Q.68 The equation of a common tangent to the curves, $y^2 = 16x$ and $xy = -4$ is :

(1) $x + y + 4 = 0$ (2) $x - 2y + 16 = 0$

(3) $2x - y + 2 = 0$ (4) $x - y + 4 = 0$

Q.69 Which one of the following statements is not a tautology ?

(1) $(p \wedge q) \rightarrow p$ (2) $(p \wedge q) \rightarrow (\sim p) \vee q$

(3) $p \rightarrow (p \vee q)$ (4) $(p \vee q) \rightarrow (p \vee (\sim q))$

Q.70 An ellipse, with foci at (0, 2) and (0, –2) and minor axis of length 4, passes through which of the following points ?

(1) $(1, 2\sqrt{2})$ (2) $(2, \sqrt{2})$

(3) $(2, 2\sqrt{2})$ (4) $(\sqrt{2}, 2)$

Q.71 A student scores the following marks in five tests : 45,54,41,57,43. His score is not known for the sixth test. If the mean score is 48 in the six tests, then the standard deviation of the marks in six tests is

(1) $10/\sqrt{3}$ (2) $100/\sqrt{3}$

(3) 100 / 3 (4) 10 / 3

Q.72 From the focus of the parabola $y^2 = 8x$ as centre, a circle is described so that a common chord of the curves is equidistant from the vertex and focus of the parabola. The equation of the circle is -

(1) $(x - 2)^2 + y^2 = 3$ (2) $(x - 2)^2 + y^2 = 9$

(3) $(x + 2)^2 + y^2 = 9$ (4) $x^2 + y^2 - 4x = 0$

Q.73 The equation to the locus of the middle point of the portion of the tangent to the ellipse $\frac{x^2}{16} + \frac{y^2}{9} = 1$ included between the co-ordinate axes is the curve-

(1) $9x^2 + 16y^2 = 4x^2y^2$ (2) $16x^2 + 9y^2 = 4x^2y^2$

(3) $3x^2 + 4y^2 = 4x^2y^2$ (4) $9x^2 + 16y^2 = x^2y^2$

Q.74 If S*(p, q) is the dual of the compound statement S(p, q) then S * (~p, ~q) is equivalent to-

(1) S(~p, ~q) (2) ~S(p, q)

(3) ~S*(p, q) (4) None of these

Q.75 Let an incident ray $L_1 = 0$ gets reflected at point A(–2, 3) on hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ & passes through focus S (2, 0), then -

(a) equation of incident ray is $x + 2 = 0$

(b) equation of reflected ray is $3x + 4y = 6$

(c) eccentricity, $e = 2$

(d) length of latus rectum = 6

Correct statements are –

(1) a, b, c (2) a, c, d

(3) a, b, c, d (4) b, c, d

Q.76 The triangle PQR of area 'A' is inscribed in the parabola $y^2 = 4ax$ such that the vertex P lies at the vertex of the parabola and the base QR is a focal chord. The modulus of the difference of the ordinates of the points Q and R is -

(1) A / 2a (2) A / a

(3) 2A / a (4) 4A / a

SPACE FOR ROUGH WORK

Q.77 The variance of series
a, a + d, a + 2d, ..., a + 2nd is :

(1) $\frac{n(n+1)}{2}d^2$ (2) $\frac{n(n+1)}{3}d^2$

(3) $\frac{n(n+1)}{6}d^2$ (4) $\frac{n(n+1)}{12}d^2$

Q.78 Let P (asecθ, btanθ) and Q (asecϕ, btanϕ), where $\theta+\phi=\frac{\pi}{2}$, be two points on the hyperbola $\frac{x^2}{a^2}-\frac{y^2}{b^2}=1$. If (h, k) is the point of intersection of the normals at P & Q, then k is equal to -

(1) $\frac{a^2+b^2}{a}$ (2) $-\left(\frac{a^2+b^2}{a}\right)$

(3) $\frac{a^2+b^2}{b}$ (4) $-\left(\frac{a^2+b^2}{b}\right)$

Q.79 Which of the following statement is a tautology-
(1) $(\sim p \vee \sim q) \vee (p \vee \sim q)$ (2)$(\sim p \vee \sim q) \wedge (p \vee \sim q)$
(3) $\sim p \wedge (\sim p \vee \sim q)$
(4) $\sim q \wedge (\sim p \vee \sim q)$

Q.80 If mean and standard deviation of 5 observations x_1, x_2, x_3, x_4, x_5 are 10 and 3, respectively, then the variance of 6 observations x_1, x_2, ..., x_5 and –50 is equal to :
(1) 582.5 (2) 507.5
(3) 586.5 (4) 509.5

SECTION - 2 (Q.81 - Q.90)

This section contains TEN (10) questions. ATTEMPT ANY FIVE (05) QUESTIONS. The answer to each question is NUMERICAL VALUE. If the numerical value has more than two decimal places truncate/round-off the value upto TWO decimal places.

Q.81 If F_1 & F_2 are the feet of the perpendiculars from the foci S_1 & S_2 of an ellipse $\frac{x^2}{5}+\frac{y^2}{3}=1$ on the tangent at any point P on the ellipse, then $(S_1F_1)\,.\,(S_2F_2)$ is equal to

Q.82 Mean deviation from the mean for the observation –1, 0, 4 is-

Q.83 The mean of five observations is 5 and their variance is 9.20. If three of the given five observations are 1, 3 and 8, then a ratio of other two observations is (A : 9). Find the value of A.

Q.84 The length of the chord of the parabola $x^2 = 4y$ having equation $x-\sqrt{2}y+4\sqrt{2}=0$ is $(6\sqrt{A})$. Find the value of A.

Q.85 If a hyperbola has length of its conjugate axis equal to 5 and the distance between its foci is 13, then the eccentricity of the hyperbola is $\frac{13}{2\times A}$. Find the value of A.

Q.86 AB is a chord of the parabola $y^2 = 4ax$ with vertex A. BC is drawn perpendicular to AB meeting the axis at C. The projection of BC on the axis of the parabola is Xa. Find the value of X.

Q.87 If the equation of the curve on reflection of the ellipse $\frac{(x-4)^2}{16}+\frac{(y-3)^2}{9}=1$ about the line $x - y - 2 = 0$ is
$16x^2 + 9y^2 + k_1x - 36y + k_2 = 0$, then find the value of $(|\,2k_1 + k_2\,|) / 4$

Q.88 Abscissa of two points P and Q on parabola $y^2 = 8x$ are roots of equation $x^2 – 17x + 11 = 0$. Tangents at P and Q meet at point T. Find distance of T from the focus of parabola.

Q.89 If the variance of the following frequency distribution :

Class :	10–20	20–30	30–40
Frequency :	2	x	2

is 50, then x is equal to ____

SPACE FOR ROUGH WORK

Q.90 Number of correct statements-

(i) The proposition $p \rightarrow \sim (p \wedge \sim q)$ is equivalent to $(\sim p) \vee q$.

(ii) The statement $(p \rightarrow (q \rightarrow p)) \rightarrow (p \rightarrow (p \vee q))$ is a tautology.

(iii) Consider the statement : "For an integer n, if $n^3 - 1$ is even, then n is odd." The contrapositive statement of this statement is : For an integer n, if n is even, then $n^3 - 1$ is odd.

SPACE FOR ROUGH WORK