Sample Papers

JEE Advanced

PAPER - 2

Maximum Marks: 180

Physics : Simple Harmonic Motion, Waves & Sound, Modern Physics, Semi-Conductor Devices & Communication Systems.

Chemistry: Chemical Kinetics, States of matter, Environmental Chemistry, Hydrogen & Compounds, Alcohol Phenol & Ethers, Carbonyl Compounds, Carboxylic Acid, Nitrogen Compounds, Biomolecules & Polymers

Mathematics: Circles, Parabola, Ellipse, Hyperbola, Areas, Differential Equation, Probability, Linear Programming

Important Instruction:

Please read the instructions carefully. INSTRUCTIONS

A. General:

1. This booklet is your Question Paper.

2. Blank papers, clipboards, log tables, slide rules, calculators, cameras, cellular phones, pagers and electronic gadgets are NOT allowed inside the examination hall.

3. Using a black ball point pen to darken the bubbles .

B. Question Paper Format :

4. The question paper consists of three parts (Physics, Chemistry and Mathematics). Each part consists of three sections.

5. Section 1 contains 10 multiple choice questions. Each question has four choices (A), (B), (C) and (D) out of which ONE is correct

6. Section 2 contains 3 paragraphs each describing theory, experiment and data etc. Six questions relate to three paragraphs with two questions on each paragraph. Each question pertaining to a particular passage should have only one correct answer among the four given choices (A), (B), (C) and (D).

7. Section 3 contains 4 multiple choice questions. Each question has two lists (list-1 : P, Q, R and S; List-2 : 1, 2, 3 and 4). The options for the correct match are provided as (A), (B), (C) and (D) out of which ONLY ONE is correct.

C. Marking Scheme

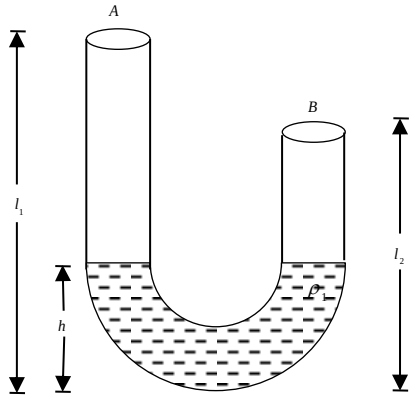
8. For each question in Section 1, 2 and 3 you will be awarded 3 marks if you darken the bubble corresponding to the correct answer and zero mark if no bubble is darkened. In all other cases, minus one (– 1) mark will be awarded.

PART – A (PHYSICS)

SECTION – I

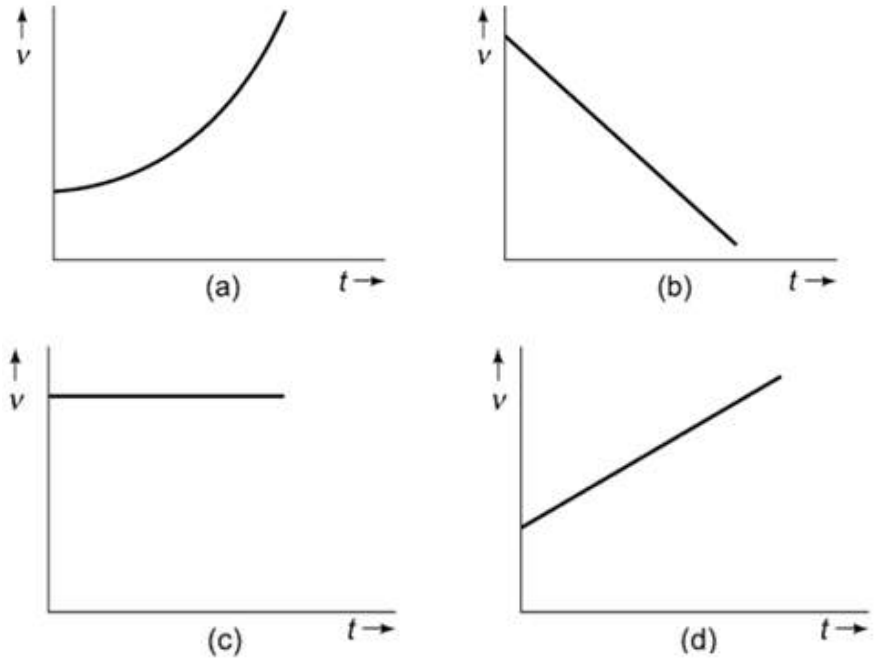
MULTIPLE CHOICE QUESTION (ONLY ONE ANSWER IS CORRECT)

1. A tube U – shaped has a uniform cross – section with arm length l_1 and $l_2 (l_1 > l_2)$. Tube has a liquid of density ρ_1 filled to a height h. Another liquid of density $\rho_2 = \frac{\rho_1}{2}$ is poured in arm A. Both liquids are immiscible. The length of the second liquid that should be poured in A so that first overtone of A is in unison with fundamental tone of B is



(a) $\frac{3}{2}(l_1 - 3l_2 - 2h)$ (b) $\frac{3}{2}(l_1 - 3l_2 + 2h)$ (c) $\frac{2}{3}(l_1 + 3l_2 + 2h)$ (d) $\frac{2}{3}(l_1 - 3l_2 + 2h)$

2. Starting from rest, an observer moves with a constant acceleration a towards a stationary source emitting a sound of frequency v_0. Which of the graphs shown in Fig. correctly represents the variation of the apparent frequency v of sound as heard by the observer with time t?



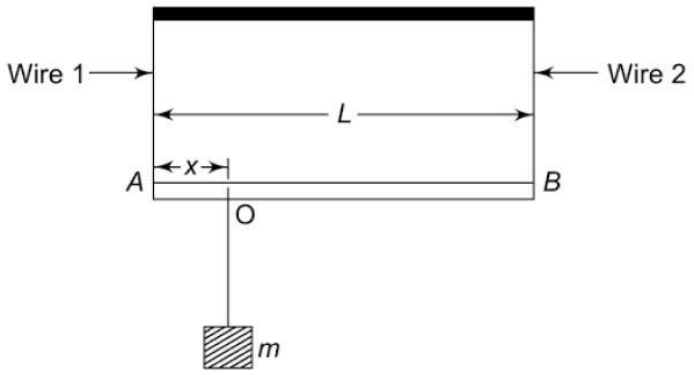
3. A uniform cylinder of length L and mass M having cross-sectional area A is suspended with its vertical length, from a fixed point by a massless spring, such that it is half submerged in a liquid of density d at equilibrium position. When the cylinder is given a small downward push and released, it starts oscillating vertically with a small amplitude. If the force constant of the spring is K, the frequency of oscillation of the cylinder is :

(a) $\frac{1}{2}\left(\frac{K-Adg}{M}\right)^{1/2}$ (b) $\frac{1}{2\pi}\left(\frac{K+dgL}{M}\right)^{1/2}$ (c) $\frac{1}{2\pi}\left(\frac{K+Adg}{M}\right)^{1/2}$ (d) $\frac{1}{2\pi}\left(\frac{K-Adg}{Adg}\right)^{1/2}$

4. A particle of charge equal to that of an electron, $-e$, and mass 208 times of the mass of the electron (called a mu-meson) moves in a circular orbit around a nucleus of charge $+3e$. (Take the mass of the nucleus to be infinite). Assume that the Bohr model of the atom is applicable to this system. If the value of n for which the radius of the orbit is approximately the same as that of the first Bohr orbit for the hydrogen atom, then the value of $\frac{n}{4}$ rounded off to nearest integer is

(a) 2 (b) 4 (c) 6 (d) 8

5. A rod AB of length L is hung from two identical wires 1 and 2. A block of mass m is hung at point O of the rod as shown in fig. The value of x so that a tuning fork excites the fundamental mode in wire 1 and the second harmonic in wire 2 is



(a) $\frac{L}{5}$ (b) $\frac{L}{4}$ (c) $\frac{L}{3}$ (d) $\frac{2L}{3}$

6. Three charges q, q and – 2q are fixed on the vertices of an equilateral triangular plate of edge length a. This plate is in equilibrium between two very large plates having surface charge density σ_1 and σ_2 respectively. Find time period of small angular oscillation about an axis passing through its centroid and perpendicular to plane. Moment of inertia of the system about this axis is I.

(a) $2\pi\sqrt{\frac{\varepsilon_0 I}{qa|\sigma_1-\sigma_2|}}$ (b) $2\pi\sqrt{\frac{\varepsilon_0 I}{2qa|\sigma_1-\sigma_2|}}$

(c) $2\pi\sqrt{\frac{2\varepsilon_0 I}{\sqrt{3}qa|\sigma_1-\sigma_2|}}$ (d) $2\pi\sqrt{\frac{2\varepsilon_0 I}{qa|\sigma_1-\sigma_2|}}$

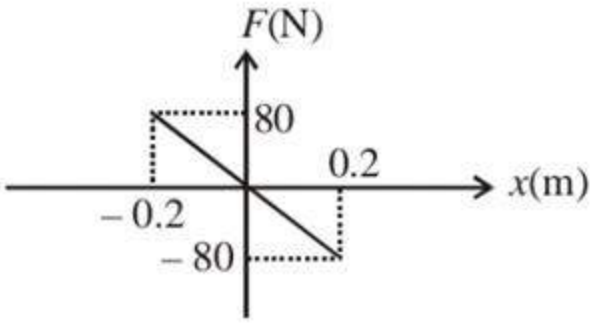
7. Three sound waves of equal amplitudes have frequencies (v – 1), (v) and (v + 1). They superpose to give beats. The number of beats produced per second will be

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

8. A radioactive isotope is being produced at a constant rate A. The isotope has a half life T. Initially, there are no nuclei and after a time, t>>T, the number of nuclei becomes a constant. The value of this constant is:

(a) AT (b) $\frac{A}{T}\ln(2)$ (c) $AT\ln(2)$ (d) $\frac{AT}{\ln(2)}$

9. A body of mass 0.01 kg executes simple harmonic motion (SHM) about x = 0 under the influence of a force show below



The time period of the SHM is approximately

(a) 1.05s (b) 0.52 s (c) 0.25 (d) 0.03 s

10. Let A_n be the area enclosed by nth orbit in a hydrogen atom. The graph of $\ln\left\{\frac{A_n}{A_1}\right\}$ against ln(n)

(a) will not pass through origin (b) will be a straight line with slope 4

(c) will be a rectangular hyperbola (d) will be a parabola

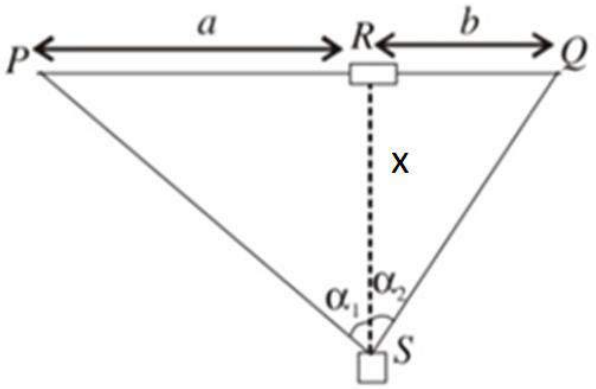
SECTION – II

PARAGRAPH QUESTIONS (ONLY ONE CORRECT ANSWER)

Paragraph - 1

A wire of negligible mass and length ℓ is stretched between two fixed points P and Q. The wire suffers from a tension T when a mass m is attached to the wire. Distance of this mass from fix point P is a and from Q is b. The attachment of mass to the stretched wire sets it into oscillations of small amplitude. Since the amplitude is small, the transverse movement of R is small so the change in length of the wire can be ignored. Thus tension in the wire can be taken as practically same as T itself. The time period of linear vibratory motion of the mass can be given by T = 2π/ω, where ω is a constant of SHM.

Now answer the following questions.



11. Force exerted while trying to bring back the mass attached to the wire from the pulled distance x is given by

(a) $\frac{1}{2}\frac{1}{(a+b)a}$ xT (b) $2\frac{(a+b)}{ab}$ xT (c) $\frac{(a+b)}{ab}$ xT (d) $\frac{ab}{(a+b)a}$ xT

12. Angular frequency of SHM of mass m is

(a) $\sqrt{\frac{1}{2}\frac{ab}{(a+b)a}\frac{T}{m}}$ (b) $\sqrt{\frac{2(a+b)}{ab}\frac{T}{m}}$ (c) $\sqrt{\frac{ab}{(a+b)a}\frac{T}{m}}$ (d) $\sqrt{\frac{(a+b)}{ab}\frac{T}{m}}$

Paragraph - II

A uniform string of length ℓ is fixed at both ends such that tension T is produced in it. The string is excited to vibrate with maximum displacement amplitude a_0.

13. The maximum kinetic energy of the string for its fundamental tone is

(a) $\frac{a_0^2\pi^2T}{4\ell}$ (b) $\frac{a_0^2\pi^2T}{\ell}$ (c) $\frac{a_0^2\pi^2T}{2\ell}$ (d) $\frac{a_0^2\pi^2T}{3\ell}$

14. The maximum kinetic energy of the string for its first overtone is

(a) $\frac{a_0^2\pi^2T}{4\ell}$ (b) $\frac{a_0^2\pi^2T}{\ell}$ (c) $\frac{a_0^2\pi^2T}{2\ell}$ (d) $\frac{a_0^2\pi^2T}{3\ell}$

Paragraph - III

Nuclei of a radioactive element are being produced at a constant rate α. The element has a decay constant λ. At time t = 0, there are N_0 nuclei of the element.

15. The number N of nuclei at time t is

(a) $\frac{1}{\lambda}(\alpha - \lambda N_0)e^{-\lambda t}$ (b) $\frac{1}{\lambda}(\alpha + \lambda N_0)e^{-\lambda t}$

(c) $\frac{1}{\lambda}[\alpha + (\alpha - \lambda N_0)e^{-\lambda t}]$ (d) $\frac{1}{\lambda}[\alpha - (\alpha - \lambda N_0)e^{-\lambda t}]$

16. If $\alpha = 2N_0\lambda$, the number N of nuclei as $t \to \infty$ is

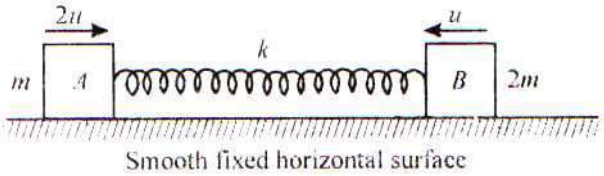
(a) $\frac{N_0}{4}$ (b) $\frac{N_0}{2}$ (c) $2N_0$ (d) $4N_0$

SECTION – III

MATRIX MATCH QUESTION

17.

Two blocks A and B of mass m and $2m$ connected by a light spring of spring constant k lie at rest on a fixed smooth horizontal plane are given velocities initially of magnitudes $2u$ and u as shown in figure. In the subsequent motion, the only horizontal force acting on blocks is due to spring. Match the conditions in column I with the instants of time they occur as given in column II.



Column I	Column II
(A) The length of spring is least at time	(p) $\frac{\pi}{2}\sqrt{\frac{2m}{3k}}$
(B) The length of spring is maximum at time	(q) $\pi\sqrt{\frac{2m}{3k}}$
	(r) $\pi\sqrt{\frac{3m}{2k}}$
(C) The acceleration of both blocks is zero simultaneously at time	(s) zero
(D) velocity of center of mass at time t=0 is	

Choose the correct option

(a) A-p; B-r; C-q; D-s (b) A-p; B-q; C-r; D-s (c) A-q; B-p; C-s; D-q (d) A-p; B-s; C-q; D-s

18.

A tuning fork is placed near a vibrating stretched wire. If frequency of tuning fork is greater than frequency of stretched wire, then a boy standing near the two hears a beat frequency f.

Column I		**Column II**	
(A)	If tuning fork is loaded with wax	(p)	Beat frequency must increase
(B)	If prongs of tuning fork are filed	(q)	Beat frequency must decrease
(C)	If tension in stretched wire is increased	(r)	Beat frequency may increase

(D)	If tension in stretched wire is decreased	(s)	Beat frequency may decrease

(a) **A –p, B –s, C –rs, D -p**
(b) **A –q, B –p, C –rs, D -p**
(c) **A –rs, B –p, C –rs, D -p**
(d) **A –p, B –q, C –rs, D -p**

19.

In the following chain reaction,

$A \rightarrow B \rightarrow C$, A and B are radioactive while C is stable. Initially we have only A and B type of nuclei. There is no nucleus of type C. As the time progresses, match the two columns

Column I		**Column II**	
(A)	Number of nuclei of (A +B)	(p)	Will increase continuously
(B)	Number of nuclei of (B)	(q)	Will decrease continuously
(C)	Number of nuclei of (C +B)	(r)	Will first increase and then decrease
(D)	Number of nuclei of (A +C)	(s)	Data insufficient

(a) A-s; B-q; C-q; D-s
(b) A-p; B-q; C-r; D-s

(c) A-q; B-s; C-p; D-s
(d) A-p; B-q,r; C-p; D-q,r

20.

In the photoelectric effect experiment, if v is frequency of radiation and I is intensity in terms of number of photons incident per second per unit area, then match the following

Column I		**Column II**	
(a)	If v increased keeping I and work function constant	(p)	Stopping potential increases
(b)	If I is increased keeping v and work function constant	(q)	Saturation current increases
(c)	If I is decreased keeping v and work function constant	(r)	Maximum kinetic energy of photoelectron increases
(d)	Work function is decreased keeping v and I constant	(s)	Stopping potential remains same

(a) A-p,r; B-q,s; C-s; D-p,r
(b) A-p,q; B-q,r; C-r; D-s

(c) A-q; B-p,r; C-s; D-q,s
(d) A-p,q; B-s; C

PART – B (CHEMISTRY)

SECTION – I

MULTIPLE CHOICE QUESTION (ONLY ONE ANSWER IS CORRECT)

21. For the elementary reaction, M → N, the rate of disappearance of M increases by a factor of 8 upon doubling the concentration of M. The order of the reaction with respect to M is

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

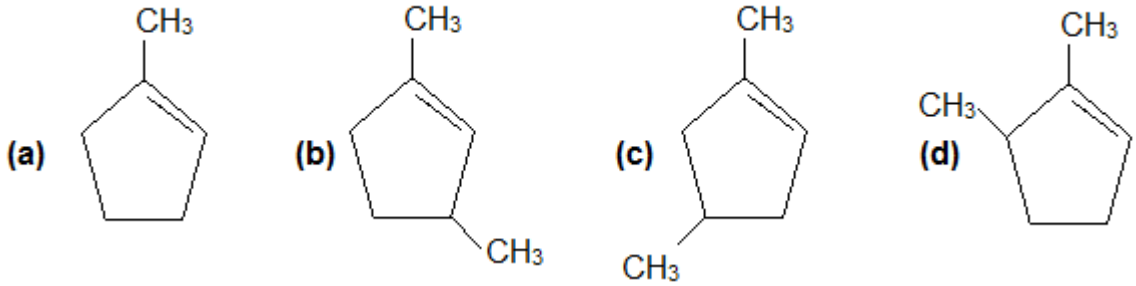
22. The specific rate constant of a first order reaction depends on the

(a) concentration of the reactant (b) concentration of the product (c) time (d) temperature

23. For a monoatomic gas kinetic energy = E. The relation with R.M.S velocity is

(a) $\mu = \left(\frac{2E}{m}\right)^{1/2}$ (b) $\mu = \left(\frac{3E}{2m}\right)^{1/2}$ (c) $\mu = \left(\frac{E}{2m}\right)^{1/2}$ (d) $\mu = \left(\frac{E}{3m}\right)^{1/2}$

24. Which compound would give 5-keto-2-methyl hexanal upon ozonolysis?



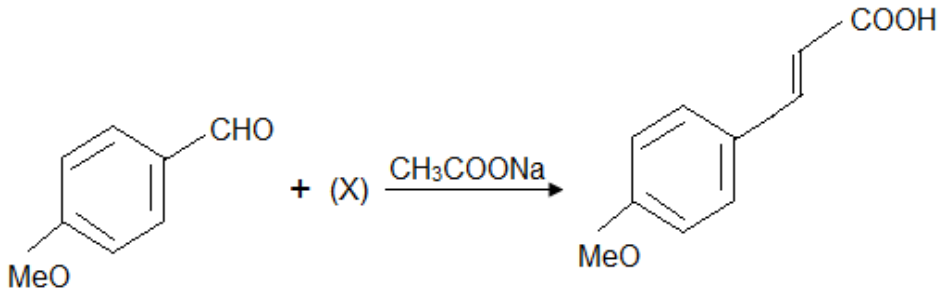
25. The compound that will not give Iodoform on treatment with alkali Iodine is

(a) Acetone (b) Ethanol (c) Diethyl ketone (d) Isopropyl alcohol

26. The most suitable reagent for the conversion of R – CH_2 – OH → R – CHO is

(a) $KMnO_4$ (b) $K_2Cr_2O_7$ (c) CrO_3 (d) PCC

27.



What is X?

(a) CH_3COOH (b) $BrCH_2COOH$ (c) $(CH_3CO)_2O$ (d) HOC – COOH

28. The carboxyl functional group (–COOH) is present in

(a) picric acid (b) Barbituric acid (c) Ascorbic acid (d) Aspirin

29. Acetamide is treated separately with the following reagents. Which one of these would give methyl amine?

(a) PCl_5 (b) NaOH + Br_2 (c) Sodalime (d) Hot Conc. H_2SO_4

30. p-Chloraniline and anilinium hydrochloride can be distinguished by

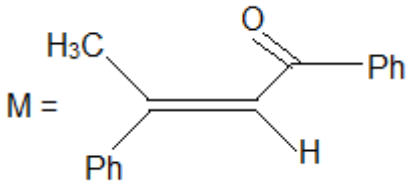
(a) Sandmeyer reaction (b) $NaHCO_3$ (c) AgCl (d) Carbylamine test

SECTION – II

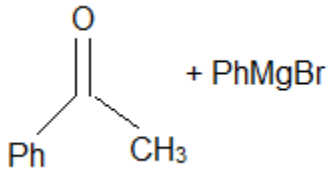
PARAGRAPH QUESTIONS (ONLY ONE CORRECT ANSWER)

Paragraph – 1

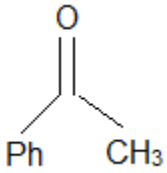
I. A tertiary alcohol 'H' upon acid catalyzed dehydration gives a product I. Ozonolysis of I leads to compounds J and K. Compound J upon reaction with KOH gives benzyl alcohol and a compound L, whereas K on reaction with KOH gives only M>

M = 

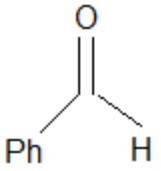
31. Compound 'H' is formed by the reaction of

(a) 

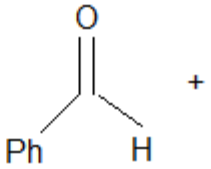
+ PhMgBr

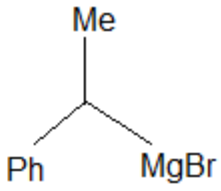
(b) 

+ $PhCH_2MgBr$

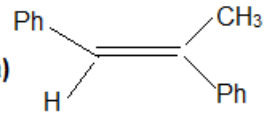
(c) 

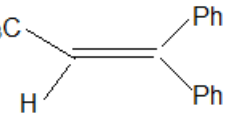
+ $PhCH_2MgBr$

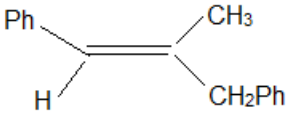
(d) 

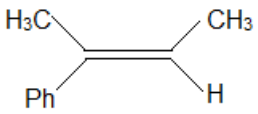
+ 

32. The structure of compound I is

(a) 

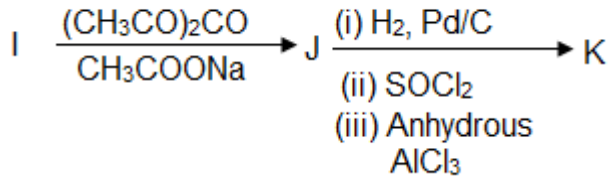
(b) 

(c) 

(d) 

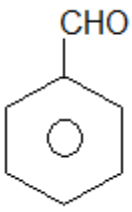
Paragraph – 2

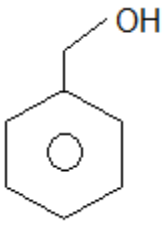
II. In the following reaction sequence, the compound J is an intermediate.

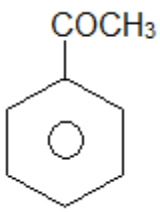


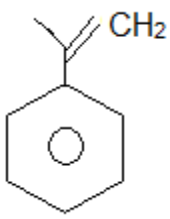
J($C_9H_8O_2$) gives effervescence on treatment with $NaHCO_3$ and a positive Bayer's test.

33. The compound I is

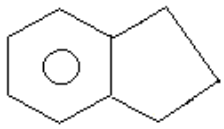
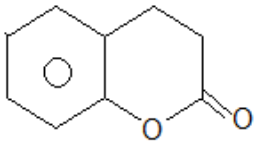
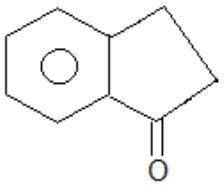
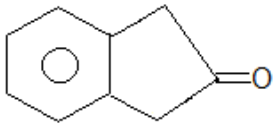
(a) 

(b) 

(c) 

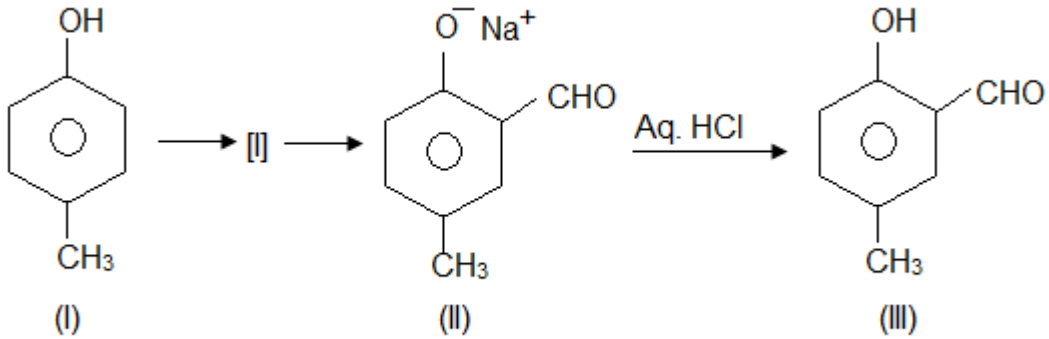
(d) 

34. The compound K is

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

Paragraph – 3

III. Riemer Tiemann reaction introduces an aldehyde group, on to the aromatic ring of phenol, ortho to the hydroxyl group. This reaction involves electrophilic aromatic substitution. This is a general method for the synthesis of substituted salicylaldehydes as depicted below



(I) (II) (III)

35. Which one of the following reagents is used in the above reaction?

(a) aq. NaOH + CH_3Cl (b) aq. NaOH + CH_2Cl_2

(c) aq. NaOH + $CHCl_3$ (d) aq. NaOH + CCl_4

36. The electrophile in this reaction is

(a) : CHCl (b) + $CHCl_2$ (c) : CCl_2 (d) · CCl_3

SECTION – III

MATRIX MATCH QUESTION

37.

List – 1		List – 2	
P.	Aniline	1.	Sulpha drug
Q.	TNT	2.	Solvent in Friedel Craft
R.	Sulphanilamide	3.	Explosive
S.	Nitrobenzene	4.	Used in Azo dyes

	P	Q	R	S
(a)	1	2	3	4
(b)	4	3	2	1
(c)	2	3	4	1
(d)	4	3	1	2

38.

List – 1		List – 2	
P.	CH_3CONH_2 and PCl_5	1.	Acid strengthening
Q.	– NO_2 group	2.	Optically active
R.	Lactic acid	3.	Hydrogen is liberated
S.	CH_3COOH and Na	4.	Acetonitrile

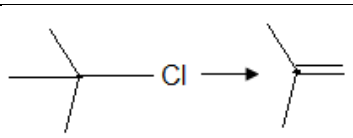
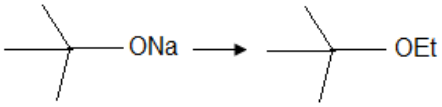
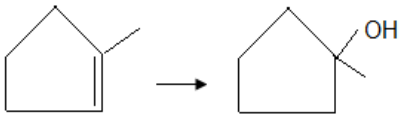
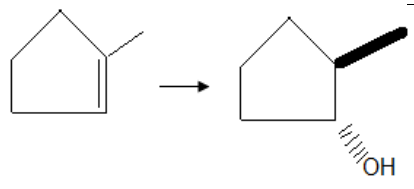
	P	Q	R	S
(a)	1	2	3	4
(b)	4	1	2	3
(c)	4	1	3	2
(d)	3	1	2	4

39.

List – 1		List – 2	
P.	$\varphi NO_2 \xrightarrow{Zn/NH_4Cl}$	1.	$\phi - N = N - \phi$
Q.	$\varphi NO_2 \xrightarrow{Zn/Alc.NaOH}$	2.	$\varphi - NH_2$
R.	$\varphi NO_2 \xrightarrow{LAH}$	3.	$\varphi NHOH$
S.	$\varphi NO_2 \xrightarrow{Na_3AsO_3/NaOH}$	4.	$\Phi - \overset{\overset{O}{\uparrow}}{N} = N - \Phi$

	P	Q	R	S
(a)	1	2	3	4
(b)	2	3	1	4
(c)	3	1	2	4
(d)	2	4	3	1

40.

List – 1		List – 2	
P.		1.	(i) $Hg(OAc)_2$ (ii) NaOEt
Q.		2.	NaOEt
R.		3.	EtBr
S.		4.	(i) BH_3 (ii) H_2O_2/NaOH

	P	Q	R	S
(a)	2	3	1	4
(b)	3	2	1	4
(c)	2	3	4	1
(d)	3	2	4	1

PART – C (MATHEMATICS)

SECTION – I
MULTIPLE CHOICE QUESTION (ONLY ONE ANSWER IS CORRECT)

41. The numbers *a,b* are chosen from the set {1,2,3,4,---,10} such that $a \le b$ with replacement. The probability that *a* divides *b* is

(a) $\frac{5}{11}$ (b) $\frac{29}{55}$ (c) $\frac{27}{55}$ (d) None

42. The area of the loop of the curve $y^2 = x^4(x+2)$ is [in square units]

(a) $\frac{32\sqrt{2}}{105}$ (b) $\frac{64\sqrt{2}}{105}$ (c) $\frac{128\sqrt{2}}{105}$ (d) $\frac{256\sqrt{2}}{105}$

43. Area of the region in which point $p(x,y)$, $\{x > 0\}$ lies; such that $y \le \sqrt{16 - x^2}$ and $\left|\tan^{-1}\left(\frac{y}{x}\right)\right| \le \frac{\pi}{3}$ is

(a) $\left(\frac{16}{3}\pi\right)$ (b) $\left(\frac{8\pi}{3} + 8\sqrt{3}\right)$ (c) $\left(4\sqrt{3} - \pi\right)$ (d) $\left(\sqrt{3} - \pi\right)$

44. The equation of chord of the circle $x^2 + y^2 - 6x - 4y - 12 = 0$ which passes through the origin such that origin divides it in the ratio 3 : 2 is

(a) y + x = 0, 7y + 17x = 0 (b) y + 3x = 0, 7y + 3x = 0
(c) 4x + y = 0, 9y + 8x = 0 (d) y + 3x = 7, y + 3x = 0

45. In a test student either guesses or copies or knows the answer to a multiple choice questions with four choices in which exactly one choice is correct. The probability that he makes a guess is $\frac{1}{3}$; The probability that he copies the answer is $\frac{1}{6}$.The Probability that his answer is correct given that he copied it is $\frac{1}{8}$.Find the probability that he knew the answer to the question given that he correctly answered it is

(a) $\frac{29}{35}$ (b) $\frac{24}{29}$ (c) $\frac{1}{7}$ (d) $\frac{1}{9}$

46. A hyperbola has centre C and one focus at P(6, 8). If its two directrices are 3x + 4y + 10 = 0 and 3x + 4y – 10 = 0 then CP =

(a) 14 (b) 8 (c) 10 (d)6

47. Area bounded by the curves $y = e^x$, $y = \log_e x$ and the lines $x = 0$, $y = 0$, $y = 1$ is

(a) $e^2 + 2 sq.units$ (b) $e + 1 sq.unit$ (c) $e + 2 sq.units$ (d) $e - 1\ sq.unit$

48. Let A, B, C be any three events in a sample space of a random experiment. Let the events $E_1 =$ exactly one of A, B occurs $E_2 =$ exactly one of B, C occurs, $E_3 =$ exactly one of C, A occurs, $E_4 =$ all of A, B, C occurs, $E_5 =$ atleast one of A, B, C occurs. $P(E_1) = P(E_2) = P(E_3) = 1/3$, $P(E_4) = \frac{1}{9}$ then $P(E_5) =$

(a) $\frac{1}{9}$ (b) $\frac{7}{9}$ (c) $\frac{5}{18}$ (d) $\frac{11}{18}$

49. Let L = 0 be a common normal to the circle $x^2 + y^2 - 2\alpha x - 36 = 0$ and the curve $S : (1+x)^y + e^{xy} = y$ drawn at a point x = 0 on S, then the radius of the circle is

(a) 10 (b) 5 (c) 8 (d) 12

50. A tangent to the parabola $x^2 = 4ay$ meets the hyperbola $x^2 - y^2 = a^2$ at two points P and Q, then midpoint of P and Q lies on the curve

(a) $y^3 = x(y-a)$ (b) $y^3 = x^2(y-a)$ (c) $y^2 = x^2(y-a)$ (d) $y^2 = x^3(a-y)$

SECTION – II

PARAGRAPH QUESTIONS (ONLY ONE CORRECT ANSWER)

Paragraph - 1

Three fair coins are tossed simultaneously. Let E be the event of getting three heads or three tails, F be the event of at least two heads & G be the event of atmost two heads then.

51. Probability that at least one head occur is

(a) 5/8 (b) 3/8 (c) $\frac{7}{8}$ (d) none

52. P(G) =

(a) $\frac{3}{4}$ (b) $\frac{7}{8}$ (c) $\frac{1}{3}$ (d) $\frac{1}{2}$

Paragraph 2

Starting at *(0,0)* ,an object moves in *x-y* plane via a sequence of steps, each of length 1 unit. Each step is left, right, up or down ,all the four being equally likely. The probability that object reaches *(2,2)* in

53. Exactly 4 steps is

(a) $\frac{5}{128}$ (b) $\frac{3}{128}$ (c) $\frac{1}{128}$ (d) $\frac{1}{256}$

54. Exactly 6 steps is

(a) $\frac{6}{4^4}$ (b) $\frac{1}{4^6}$ (c) $\frac{6}{4^6}$ (d) $\frac{15}{4^4}$

Paragraph 3

$Let\ A\left(\frac{1}{2},0\right), B\left(\frac{3}{2},0\right), C\left(\frac{5}{2},0\right)$ be the given points and P be a point satisfying

max $(PA+PB,\ PB+PC) < 2$.

55. P lies inside

(a) A circle and an ellipse (b) A circle and a hyperbola

(c) A parabola and an ellipse (d) None of these

56. The area of the region of the point P is

(a) $\sqrt{2}\left(\frac{\pi}{3} - \frac{\sqrt{3}}{4}\right)$ (b) $\sqrt{3}\left(\frac{\pi}{3} - \frac{\sqrt{3}}{4}\right)$ (c) $2\left(\frac{\pi}{3} - \frac{\sqrt{3}}{4}\right)$ (d) None of these

SECTION – III
MATRIX MATCH QUESTION

57. We are given M urns, numbered 1 to M and n balls (n<M) and P(A) denote the probability that each of the urns numbered 1 to n, will contain exactly one ball.

	Column I		**Column II**
(a)	If the balls are different and any number of balls can go to any urn then P(A)=___	(p)	$\frac{1}{{}^{M}C_{n}}$
(b)	If the balls are identical and any number of balls can go to any urn then P(A)=___	(q)	$\frac{1}{{}^{(M+n-1)}C_{M-1}}$
(c)	If the balls are identical but at most one ball can be put in any box, then P(A)=___	(r)	$\frac{n!}{{}^{M}C_{n}}$
(d)	If the balls are different and at most one ball can be put in any box, then P(A)=___	(s)	$\frac{n!}{M^{n}}$

58. 'n' whole numbers are randomly chosen and multiplied, then probability that

	Column I		**Column II**
(a)	the last digit is 1, 3, 7 or 9	(p)	$\frac{8^{n}-4^{n}}{10^{n}}$
(b)	the last digit 2, 4, 6, 8	(q)	$\frac{5^{n}-4^{n}}{10^{n}}$
(c)	the last digit is 5	(r)	$\frac{4^{n}}{10^{n}}$
(d)	the last digit is zero	(s)	$\frac{10^{n}-8^{n}-5^{n}+4^{n}}{10^{n}}$

59.

	Column I		**Column II**
(a)	If $\frac{a_1}{a_2}=\frac{b_1}{b_2}$ then $(a_1x+b_1y+c_1)(a_2x+b_2y+c_2)+k=0$, $(k\neq 0)$ represents	(p)	a parabola
(b)	If $\frac{a_1}{a_2}\neq\frac{b_1}{b_2}$ then $(a_1x+b_1y+c_1)(a_2x+b_2y+c_2)+k=0$, $(k\neq 0)$ represents	(q)	a pair of lines
(c)	Locus of a point moving such that its distances from the point (–13, 7) and the line 17x + 29y + 18 = 0 are always equal	(r)	a straight line
(d)	Locus of a point moving such that the ratio of its distances from the point (3, 11) and the line 14x – 5y + 13 = 0 is always 2	(s)	a hyperbola

60. Consider the ellipse $(3x-6)^2+(3y-9)^2=\frac{4}{169}(5x+12y+6)^2$.
Column I contains the distances associated with this ellipse and Column II gives their value.
Match the expressions/statements in column I with those in column II.

Column – I		Column – II	
(a)	The length of major axis	(p)	$\frac{72}{5}$
(b)	The length of minor axis	(q)	$\frac{16}{\sqrt{5}}$
(c)	The length of latus rectum	(r)	$\frac{16}{3}$
(d)	The distance between the directrices	(s)	$\frac{48}{5}$