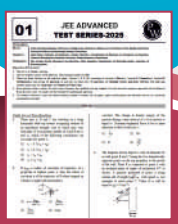
JEE Advanced 2025

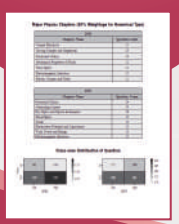
RANKERS TEST SERIES

As per Latest Pattern

10 TEST PAPERS



PAST YEAR ANALYSIS



ANSWER KEY WITH DETAILED EXPLANATIONS

- Mimics JEE Advanced Exam Format and difficulty, offering a realistic exam experience
- Excellent Quality of Questions
- Opening and closing Rank of Top IITs

Meticulously Curated and Verified by Expert PW Faculties for JEE Advanced-Level Accuracy and Authentic Exam Experience

JEE ADVANCED 2024 Paper Analysis

Paper 1

Section	Question Type	No. of Questions	Marks per Question	Negative marks per question	Total Marks (Section wise)
1	Single Correct MCQs	4	3	–1	12
2	More than One Correct MCQs	3	4	–2	12
3	Non Negative Integer Type Questions	6	4	0	24
4	Matrix Type Questions	4	3	–1	12
	Total Questions per subject	17			60

Paper 2

Section	Question Type	No. of Questions	Marks per Question	Negative marks per question	Total Marks (Section wise)
1	Single Correct MCQs	4	3	–1	12
2	More than One Correct MCQs	3	4	–2	12
3	Non Negative Integer Type Questions	6	4	0	24
4	(Numerical Value Based Questions)	4	3	–1	12
	Total Questions per subject	17			60

Total No. of Questions in Part 1 = 51 Questions
Total No. of Questions in Part 2 = 51 Questions
Each Subject Carries = 60 Marks
Total Marks = 180

PHYSICS

Physics Topics	Paper 1 Difficulty Level	Paper 2 Difficulty Level
Mechanics	Total 3 questions in paper 1 from Mechanics out which 1 question from fluid mechanics was difficult 1 question from Rotational mechanics was easy and 1 moderate level question from rotational mechanics	Total 3 questions in paper 2 were asked from Mechanics out which all of them where moderate level
Thermodynamics	Total 2 questions where asked from thermodynamics in paper 1 one question was easy and the other was moderate	No questions asked in paper 2
Electrodynamics	3 Moderate level Questions	Total 6 questions were asked out of which 1 Question from EMI was difficult and rest were moderate level. Rest were moderate
Optics	3 moderate level question from optics out which 2 were from Ray optics and 1 was from wave optics	3 moderate level question in paper 2 out which 2 were from wave optics and 1 was from ray optics
Modern Physics	1 moderate level question	1 easy level question from x rays
Oscillations & waves	Total 3 moderate level question out of which 2 question from waves and 1 question from shm	1 Question from SHM was difficult
Mathematical tools, Errors & measurement	1 question from mathematical tools were asked in paper 1	1 question from error was asked in paper. Level of question was easy

JEE (ADVANCED) 2024 AND 2023 STATISTICS

Category-wise shortlisted cadidates from JEE (Main) 2024 to appear in JEE (Advanced) 2024

Category	Required Candidates	Short listed candidates from JEE (Main) 2024	
		No. of candidate	Cut-off percentile
OPEN	96,187	97351	93.2362181
GEN-EWS	23,750	25029	81.3266412
OBC-NCL	64,125	67570	79.6757881
SC	35,625	37581	60.0923182
ST	17,812	18780	46.6975840
PwD (All)	12,501	3973	0.0018700
Total	2,50,000	2,50,284	

Category-wise shortlisted cadidates from JEE (Main) 2023 to appear in JEE (Advanced) 2023

Category	Required Candidates	Short listed candidates from JEE (Main) 2023	
		No of candidates*	Cut-off percentile
OPEN	96,187	98612	90.7788642
GEN-EWS	23,750	25057	75.6229025
OBC-NCL	64,125	67613	73.6114227
SC	35,625	37536	51.9776027
ST	17,812	18752	37.2348772
PwD (All)	12,501	2685	0.0013527
Total	2,50,000	2,50,075	

Summary of Candidates in JEE (Advanced) 2024

Category	PwD Status	Registered	Appeared in both Papers	Qualified	Alloted Seats
GEN	No	38701	37578	14083	6846
	Yes	857	798	236	136
OBC-NCL	No	68507	66213	9281	4665
	Yes	1139	1070	218	110
GEN-EWS	No	31363	30643	5423	1876
	Yes	340	324	85	50
SC	No	30730	29432	13794	2653
	Yes	227	207	41	21
ST	No	14651	13869	5073	1332
	Yes	69	66	14	6
Total		1,86,584	1,80,200	48,248	17,695

Summary of Number of Candidates of JEE (Advanced) 2023

Category	PwD Status	Registered	Appeared in both Papers	Qualified	Alloted Seats
GEN	No	40994	39176	13829	6517
	Yes	686	632	177	100
OBC-NCL	No	69913	66612	9028	4652
	Yes	772	732	181	95
GEN-EWS	No	31369	30348	5363	1999
	No	253	240	74	44
SC	No	30898	29058	10993	2604
	Yes	146	130	28	12
ST	No	14403	13396	4082	1307
	Yes	53	48	14	10
Total		1,89,487	1,80,372	43,769	17,340

Minimum Qualifying Marks for Inclusion in a Rank List-2024

Rank List	Minimum Marks in Each Subject	Minimum Aggregate Marks
Common Rank List (CRL)	10	109
OBC-NCL Rank List	9	98
GEN-EWS Rank List	9	98
SC Rank List	5	54
ST Rank List	5	54
Common-PwD Rank List (CRL-PwD)	5	54
OBC-NCL-PwD Rank List	5	54
GEN-EWS-PwD Rank List	5	54
SC-PWD Rank List	5	54
ST-PWD Rank List	5	54
Preparatory Course (PC) Rank List	2	27

Marks of First and Last Ranked Candidates in Each Category-202

Category	Rank	Mathematics	Physics	Chemistry	Total Marks
CRL	1	117	118	120	355
	25946	27	42	40	109
GEN-EWS	1	107	117	102	326
	5433	22	26	50	98
OBC-NCL	1	110	108	110	328
	9294	23	25	50	98
SC	1	107	101	95	303
	5682	16	14	24	54
ST	1	99	99	101	299
	1803	15	16	23	54

OPENING AND CLOSING RANK OF TOP NITs

Name of the NIT	Course	Gender-Neutral		Female-only (including Supernumerary)	
		Opening Rank	Closing Rank	Opening Rank	Closing Rank
Indian Institute of Technology Bhubaneswar	Civil Engineering (4 Years, Bachelor of Technology)	9106	14782	18286	23024
	Computer Science and Engineering (4 Years, Bachelor of Technology)	2372	3685	4130	7557
	Electrical Engineering (4 Years, Bachelor of Technology)	5017	7661	12140	14183
	Electronics and Communication Engineering (4 Years, Bachelor of Technology)	3464	5157	8187	10904
	Engineering Physics (4 Years, Bachelor of Technology)	9435	11307	17730	18825
	Mechanical Engineering (4 Years, Bachelor of Technology)	7135	10233	14537	19505
	Metallurgical and Materials Engineering (4 Years, Bachelor of Technology)	10181	14898	18582	21693
Indian Institute of Technology Bombay	Aerospace Engineering (4 Years, Bachelor of Technology)	585	2394	2494	6360
	BS in Mathematics (4 Years, Bachelor of Science)	631	1191	4101	4101
	Chemical Engineering (4 Years, Bachelor of Technology)	650	2545	4559	6650
	Chemistry (4 Years, Bachelor of Science)	5268	7430	9692	11262
	Civil Engineering (4 Years, Bachelor of Technology)	2244	4046	6334	8833
	Computer Science and Engineering (4 Years, Bachelor of Technology)	1	68	7	421
	Economics (4 Years, Bachelor of Science)	1421	2408	3674	4408
	Electrical Engineering (4 Years, Bachelor of Technology)	15	496	642	1339
	Electrical Engineering (5 Years, Bachelor and Master of Technology (Dual Degree))	496	973	1731	2424
	Energy Engineering (4 Years, Bachelor of Technology)	1687	2689	3767	5537
	Engineering Physics (4 Years, Bachelor of Technology)	92	1719	1680	3629
	Environmental Science and Engineering (4 Years, Bachelor of Technology)	3424	4718	8821	9292
	Industrial Engineering and Operations Research (4 Years, Bachelor of Technology)	1042	1726	3258	4762
	Mechanical Engineering (4 Years, Bachelor of Technology)	666	1685	1339	4444
	Metallurgical Engineering and Materials Science (4 Years, Bachelor of Technology)	2690	4193	6870	8491
Indian Institute of Technology Mandi	B.Tech in General Engineering (4 Years, Bachelor of Technology)	7173	10842	14742	18004
	B.Tech in Materials Science and Engineering (4 Years, Bachelor of Technology)	10553	14440	21003	23252
	B.Tech in Mathematics and Computing (4 Years, Bachelor of Technology)	2614	4089	7453	7886
	B.Tech in Microelectronics & VLSI (4 Years, Bachelor of Technology)	3980	6643	11035	12194
	Bio Engineering (4 Years, Bachelor of Technology)	11233	14239	20007	21077
	BS in Chemical Sciences (4 Years, Bachelor of Science)	12900	16430	21657	23698
	Civil Engineering (4 Years, Bachelor of Technology)	8925	12562	20298	22150

CONTENTS

01

PAPER - 01

RANKERS TEST SERIES
JEE ADVANCED (2025)

DURATION : 180 Minutes | **M.MARKS : 198**

General Instructions:

1. Immediately fill in the particulars on this page of the test booklet.
2. The test is of **3 hours** duration.
3. The test booklet consists of 54 questions. The maximum marks are **198**.

SECTION 1 (Maximum Marks: 18)

- This section contains **SIX (06)** questions.
- Each question has **FOUR** options. **ONLY ONE** of these four options is the correct answer.
- For each question, choose the option corresponding to the correct answer.
- Answer to each question will be evaluated according to the following marking scheme:

  Full Marks : +3 If ONLY the correct option is chosen;
  Zero Marks : 0 If none of the options is chosen (i.e. the question is unanswered);
  Negative Marks : -1 In all other cases.

SECTION 2 (Maximum Marks: 24)

- This section contains **SIX (06)** questions.
- Each question has **FOUR** options. **ONE OR MORE THAN ONE** of these four option(s) is(are) correct answer(s).
- For each question, choose the option(s) corresponding to (all) the correct answer(s).
- Answer to each question will be evaluated according to the following marking scheme:

  Full Marks : +4 ONLY if (all) the correct option(s) is(are) chosen;
  Partial Marks : +3 If all the four options are correct but **ONLY** three options are chosen;
  Partial Marks : +2 If three or more options are correct but **ONLY** two options are chosen, both of which are correct;
  Partial Marks : +1 If two or more options are correct but **ONLY** one option is chosen and it is a correct option;
  Zero Marks : 0 If none of the options is chosen (i.e. the question is unanswered);
  Negative Marks : –2 In all other cases.

SECTION 3 (Maximum Marks: 24)

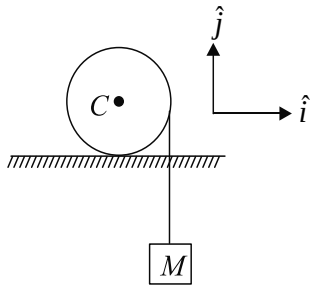
- This section contains **SIX (06)** questions. The answer to each question is a **NUMERICAL VALUE.**
- For each question, enter the correct numerical value of the answer using the mouse and the on-screen virtual numeric keypad in the place designated to enter the answer. If the numerical value has more than two decimal places, truncate/round-off the value to **TWO** decimal places.
- Answer to each question will be evaluated according to the following marking scheme:

  Full Marks : +4 If ONLY the correct numerical value is entered;
  Zero Marks : 0 In all other cases.

SECTION-1

***Single Correct Type Question* (1–6)**

1. A disc of mass M and radius r has massless string wrapped over it with one end fixed on disc and other end connected to block of same mass M. Initially system is held at rest. Now system is released from rest. Immediately after system is released (assume there is no slipping at any contact surface).



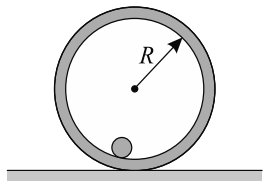
(A) Acceleration of block in ground frame is $\frac{2}{5}g\hat{i} - \frac{2}{5}g\,\hat{j}$

(B) Acceleration of block in the frame of centre of disc is $-\frac{2}{5}g\hat{i} - \frac{2}{5}g\,\hat{j}$

(C) Acceleration of block in ground frame is $-\frac{2}{5}g\,\hat{j}$

(D) None of these

2. A thin-walled tube of mass m and radius R has a rod of mass m and very small cross section soldered on its inner surface. The side-view of the arrangement is as shown in the following figure.

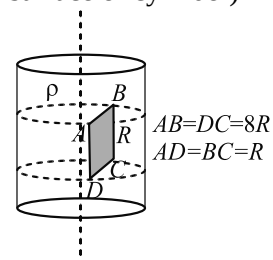


The entire arrangement is placed on a rough horizontal surface. The system is given a small angular displacement from its equilibrium position, as a result, the system performs oscillations. The time period of resulting oscillations if the tube rolls without slipping is:

(A) $2\pi\sqrt{\frac{4R}{g}}$ (B) $2\pi\sqrt{\frac{2R}{g}}$

(C) $2\pi\sqrt{\frac{R}{g}}$ (D) None of these

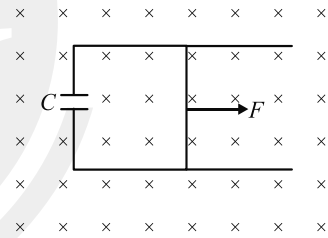
3. A non conducting solid cylinder of infinite length having uniform charge density ρ and radius of cylinder is $5R$. Find the flux passing through the surface $ABCD$ as shown in figure. (all the points lies on the surface of cylinder)



(A) $\frac{12\rho R^3}{\epsilon_0}$ (B) $\frac{6\rho R^3}{\epsilon_0}$

(C) $\frac{\rho R^3}{\epsilon_0}$ (D) $\frac{3\rho R^3}{\epsilon_0}$

4. A wire of mass m and length l can freely slide on a pair of parallel, smooth, horizontal rails placed in a vertical magnetic field B (figure). The rails are connected by a capacitor of capacitance C. The electric resistance of the rails and the wire is zero. If a constant force F acts on the wire as shown in the figure. Find the acceleration of the wire.



(A) $a = \left[\frac{F}{m + B^2Cl^2}\right]$ (B) $a = \left[\frac{F}{m + BCl^2}\right]$

(C) $a = \left[\frac{F}{m + B^2Cl}\right]$ (D) $a = \left[\frac{F}{m - B^2Cl^2}\right]$

5. The electric field of two plane electromagnetic plane waves in the vacuum are given by $\vec{E}_1 = E_0\,\hat{j}\cos(\omega t - kx)$ & $\vec{E}_2 = E_0\,\hat{k}\cos(\omega t - ky)$. At $t = 0$, a particle of charge q is at origin with a velocity $\vec{v} = 0.8c\,\hat{j}$ (c is the speed of light in vacuum). The instantaneous force experienced by the particle is:

(A) $E_0q\left(0.8\hat{i} - \hat{j} + 0.4\hat{k}\right)$

(B) $E_0q\left(0.4\hat{i} - 3\hat{j} + 0.8\hat{k}\right)$

(C) $E_0q\left(-0.8\hat{i} + \hat{j} + \hat{k}\right)$

(D) $E_0q\left(0.8\hat{i} + \hat{j} + 0.2\hat{k}\right)$

6. In a hydrogen atom sample spectrum, when electrons de-excite from same higher energy level $n >> 1$ to lower energy levels then first few low frequencies of light that is emitted (e. g. $n = n$ to $n - 1$, n to $n - 2$, n to $n - 3$ etc.) are very nearly:

(A) in *AP* (Arithmetic progression)

(B) in *GP* (Geometric progression)

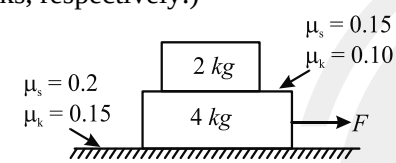
(C) in *HP* (Harmonic progression)

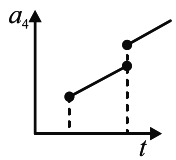
(D) None of these

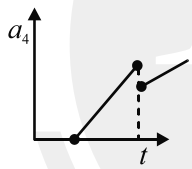
SECTION-2

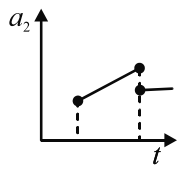
***One or More than One Correct Type* (7–12)**

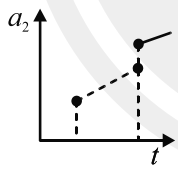
7. Two blocks of masses 2 *kg* and 4 *kg* are placed over each other as shown in the adjoining figure. The coefficient of kinetic and static friction are as shown in the figure. A variable force $F = 4t$ starts acting on the 4 *kg* block as shown. Choose the correct option from the following. (a_4 and a_2 represents the accelerations of 4 *kg* and 2 *kg* blocks, respectively.)



(A) 

(B) 

(C) 

(D) 

8. A standing wave generated by two opposite travelling waves each of amplitude 3 cm, is set up on a tight string of length 240 cm, clamped at both its ends. Difference in position along the string in between two consecutive points oscillating with amplitudes of $3\sqrt{2}$ cm is equal to 20 cm. Choose the correct options from the statements given below.

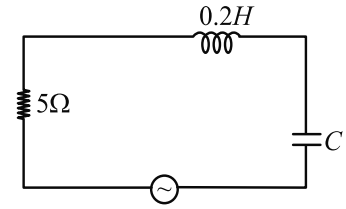
(A) The overtone in which the string is vibrating will be 5^{th}

(B) The overtone in which the string is vibrating will be 4^{th}

(C) The wavelength of the travelling waves is 20 cm

(D) The wavelength of the travelling waves is 80 cm

9. An alternating voltage $v = 6\sin 20t + 8\cos 20t$ is applied to a series resonant circuit as shown. The correct statement(s) is/are :



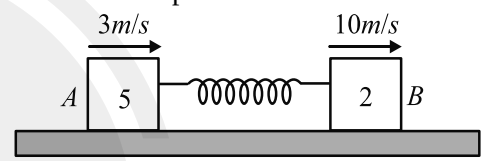
(A) The capacitance *C* is12.5*mF*

(B) The rms current in the circuit is 2*A*

(C) The power dissipated in the circuit is 10 *W*

(D) The quality factor of the circuit is 0.8

10. Two blocks *A*(5 *kg*) and *B*(2 *kg*) attached to the ends of a spring constant 1120 *N*/*m* are placed on a smooth horizontal plane with the spring undeformed. Simultaneously velocities of 3 *m*/*s* and 10 *m*/*s* along the line of the spring in the same direction are imparted to *A* and *B* then



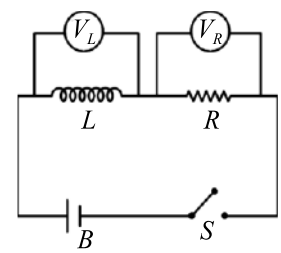
(A) The maximum extension of the spring is 0.25 *m*

(B) The first maximum compression occurs after start at $\frac{3\pi}{56}s$

(C) The maximum extension of the spring is 0.50 *m*

(D) Time period of oscillation is $\frac{\pi}{14}s$

11. An inductance *L*, resistance *R*, battery *B* and switch *S* are connected in series. Voltmeters V_L and V_R are connected across *L* and *R* respectively. When switch is closed



(A) The initial reading in V_L will be greater than V_R

(B) The initial reading in V_L will be lesser than V_R

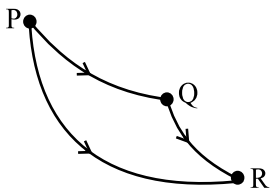
(C) The initial readings in V_L and V_R will be the same

(D) The reading in V_L will be decreasing as time increases

SECTION-1

***Single Correct Type Question* (19–24)**

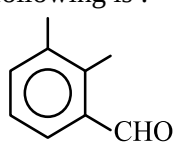
19. The three thermodynamic states P, Q and R of a system are connected by the path shown in the figure given below. The entropy change in the processes P → Q, Q → R and P → R along the paths indicated are ΔS_{PQ}, ΔS_{QR} and ΔS_{PR} respectively. If the process P → Q is adiabatic and irreversible, while P → R is adiabatic and reversible, then the correct relation is :

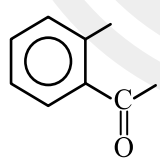


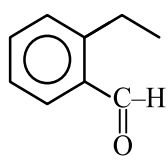
(A) $\Delta S_{QR} > 0$ (B) $\Delta S_{PR} > 0$

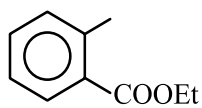
(C) $\Delta S_{QR} < 0$ (D) $\Delta S_{PQ} < 0$

20. An organic compound on reaction with 2,4 – Dinitrophenyl hydrazine (2,4 –DNP) gives a yellow ppt. It also gives silver mirror with ammoniacal $AgNO_3$. It gives an alcohol and sodium salt of carboxylic acid on reaction with concentrated NaOH. It yields Benzene–1,2–dicarboxylic acid on heating with alkaline $KMnO_4$. The structure of the compound among the following is :

(A) 

(B) 

(C) 

(D) 

21. Decomposition of $2H_2O_2 \rightarrow 2H_2O + O_2$ follows a first order reaction. In fifty minutes the concentration of H_2O_2 decreases from 0.5 to 0.125 M in one such decomposition.

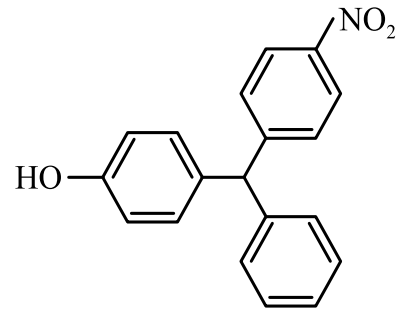
When the concentration of H_2O_2 reaches 0.05 M, the rate of formation of O_2 will be:

(A) 6.93×10^{-4} mol min^{-1}

(B) 6.93×10^{-5} mol min^{-1}

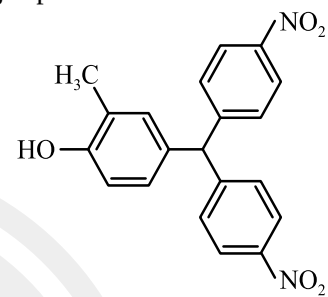
(C) 0.693 mol min^{-1}

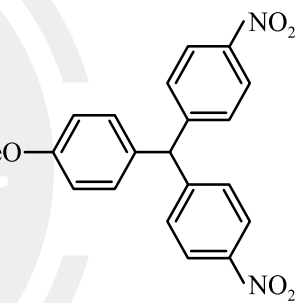
(D) 6.93×10^{-2} mol min^{-1}

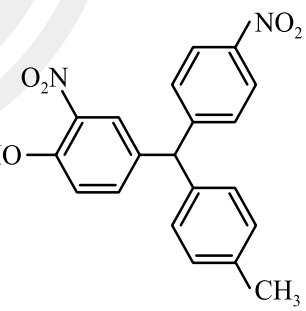
22. 

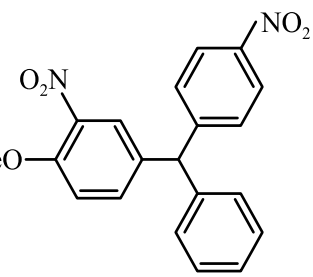
$\xrightarrow[\text{(ii) } H_2SO_4, HNO_3]{\text{(i) } CH_3I, K_2CO_3}$

Major product of the above reaction is:

(A) 

(B) 

(C) 

(D) 

23. In the cell $Zn \mid Zn^{2+}(C_1) \parallel Cu^{2+}(C_2) \mid Cu$, $E_{cell} - E^{\circ}_{Cell} = 0.0591V$. The ratio C_1/C_2 at 298 K will be:

(A) 2 (B) 100

(C) 10^{-2} (D) 1

24. Which one of the following statement(s) is **NOT TRUE** for the hydrolysis of XeF_4?

(A) It is a redox reaction.

(B) One of the product(s) has central atom in +6 oxidation state.

(C) Some of product(s) is/are in zero oxidation state.

(D) In one of the products central atom is in +2 oxidation state.

SECTION-2

***One or More than One Correct Type* (25–30)**

25. Werner, when passed excess of ammonia through cobalt(III) chloride solution, followed by crystallisation observed 4 different coloured compounds yellow, purple, green, violet. Considering that separate aqueous solution of each compound show reasonable electrical conductance then which of the following statement(s) is/are true?

(A) All four coloured compounds are ionisation isomers.

(B) In all the four compounds hybridisation of central atom is same.

(C) All four compounds have same number of unpaired electrons.

(D) Addition of excess $AgNO_3$ to the equimolar solution of separate four compounds, two solutions will produce same amount of AgCl as precipitate.

26. Which of the following statement(s) about cyclooctatetraene is/are true?

(A) The compound rapidly decolorizes Br_2/CCl_4 solution (test for unsaturated hydrocarbon).

(B) The compound readily adds hydrogen.

(C) The compound is nonplanar.

(D) The compound is comparable to benzene in stability.

27. Which of the following fact(s)s is/are not true?

(A) If $E°\ (M^{n+}/M)$ is negative. then H^+ will be reduced to H_2 by the metal M.

(B) If $E°\ (M^{n+}/M)$ is positive, then M^{+n} will be reduced to M by H_2.

(C) In a cell M^{n+}/M electrode is attached to hydrogen-half cell. To produce spontaneous cell reaction, metal M always acts as negative electrode.

(D) Compounds of active metals (Zn, Na, Mg) are reducible by H_2 whereas those of noble metals (Cu, Ag, Au) are not reducible.

28. Identify the correct statement(s).

(A) Changing the catalyst always change the final product obtained in a reaction.

(B) Catalyst cannot change equilibrium constant of a reaction.

(C) Lacto bacilli enzyme is responsible for curd formation from milk.

(D) A promotor when taken without catalyst will always increase rate of reaction

29. For the following reactions:

I. $(NH_4)_2SO_4 + NaOH \xrightarrow[\text{yield}]{40\%} Na_2SO_4 + H_2O + NH_3$

II. $NH_3 + HCl \xrightarrow[\text{yield}]{80\%} NH_4Cl$

Choose correct option(s). [Assuming all other reactants required are in sufficient amount]

(A) Produced mass of NH_4Cl is 2.71 g if 4 g of NaOH is taken.

(B) 39.6 g $(NH_4)_2SO_4$ is required to produce 10.27 g NH_4Cl.

(C) 25 g of NaOH is required to produce 10.7 g NH_4Cl.

(D) Produced moles of NH_4Cl (in II reaction) are 1.6 times the produced moles of Na_2SO_4 (in I reaction) if 4 g of NaOH is taken.

30. The radial distribution function [P(r)] is used to determine the most probable radius, which is used to find the electron in a given orbital $\frac{dP(r)}{dr}$ for 1s-orbital of hydrogen like atom having atomic number Z, is $\frac{dP}{dr} = \frac{4Z^3}{a_0^3}\left(2r - \frac{2Zr^2}{a_0}\right)e^{-2Zr/a_0}$.

Then which of the following statement(s) is/are correct?

(A) At the point of maximum value of radial distribution function; one antinode is present

(B) Most probable radius of Li^{2+} is $\frac{a_0}{3}$ pm

(C) Most probable radius of He^+ is $\frac{a_0}{2}$ pm

(D) Most probable radius of hydrogen atom is a_0 pm

SECTION-3

Numerical Type (Double Decimal) (31–36)

31. 500 ml 0.02 M $AgNO_3$(aq) solution and 500 ml 0.02 M HCN (aq) solution are mixed together. If concentration of Ag^+ at equilibrium is $y\times10^{-z}$ M then calculate the value of y + z. (in scientific notation) Auto protolysis constant of water = 10^{-14}
Given : K_{sp} (AgCN) = 4×10^{-16}Hydrolysis constant of NaCN = 10^{-4}

32. How many of the following has underlined atom in sp^2 hybridisation?
$\underline{Si}O_2$, $\underline{N}(SiH_3)_3$, $\underline{B}F_3$, $\underline{Al}Cl_3.6H_2O$, $H_3\underline{O}^{\oplus}$, $B_3\underline{N}_3H_6$, $\underline{S}O_2$, $\underline{N}O_2$

33. 2-Methylpentane on monochlorination produces 'x' isomers. Product mixture on fractional distillation gives 'y' fractions. The value of (x – y) is _____.

34. In an aqueous solution mole fraction of solute is 0.2 and its density is d_1(g/ml). It is diluted such that mole fraction of solute becomes 0.1 and density becomes d_2 (g/ml) If density of new solution is 20% less than initial solution then molarity of new solution is almost half of the original solution. If molar mass of the solute is 'X' g/mol, then closest integer value of $\left[\frac{X}{13}\right]$ is ____.

35. The rate of a reaction doubles when its temperature changes from 300 K to 310 K. Activation energy of such a reaction will be ____. (in kJ mol^{-1}): (R = 8.314 JK^{-1} mol^{-1} and log2 0.301)

36. How many species are coloured, paramagnetic and act as oxidiser among the given species?
CsO_2, PbO_2, NO_2, KO_3, NO, F_2, $Mn^{+3}{}_{(Aq.)}$, O_3, XeF_2

MATHS

SECTION-1

***Single Correct Type Question* (37–42)**

37. A plane passing through (1, 1, 1) cuts positive direction of co-ordinate axes at *A*, *B* and *C*, the volume (V) of tetrahedron *OABC* satisfies

(A) $V \le \frac{9}{2}$ (B) $V \ge \frac{9}{2}$

(C) $V = \frac{7}{2}$ (D) $V < \frac{7}{2}$

38. Let *M* denote the matrix $\begin{pmatrix} 0 & i \\ i & 0 \end{pmatrix}$, where $i^2 = -1$, and let *I* denote the identity matrix $\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$. Then $I + M + M^2 + M^3 + M^4 + \ldots..+M^{2010}$ is equal to:

(A) $\begin{pmatrix} 0 & 0 \\ 0 & 0 \end{pmatrix}$ (B) $\begin{pmatrix} 0 & i \\ i & 0 \end{pmatrix}$

(C) $\begin{pmatrix} 1 & i \\ i & 1 \end{pmatrix}$ (D) $\begin{pmatrix} -1 & 0 \\ 0 & -1 \end{pmatrix}$

39. Suppose $g(x)$ satisfies

$g(x) = x + \int_0^1 \left(xy^2 + yx^2\right) g\left(y\right) dy$, then $g(x)$ is

(A) $x + \frac{61}{119}x + \frac{80}{119}x^2$ (B) $x + \frac{7}{11}x^2$

(C) $\frac{180}{61}x + \frac{80}{119}x^2$ (D) None of these

40. Let $T = \int_0^{\ln 2} \frac{2e^{3x} + e^{2x} - 1}{e^{3x} + e^{2x} - e^x + 1} dx$, then e^T equals:

(A) $\frac{7}{4}$ (B) $\frac{7}{2}$

(C) $\frac{11}{2}$ (D) $\frac{11}{4}$

41. Nitin has twelve blocks, two each of red (*R*), blue (*B*), yellow (*Y*), green (*G*), orange (*O*), and purple (*P*). Call an arrangement of blocks Even if there is an even number of blocks between each pair of blocks of the same color. For example, the arrangement

R B B Y G G Y R O P P O

is even, lina arranges her blocks in a row in random order. The probability that her arrangement is Even is $\frac{m}{n}$, where *m* and *n* are relatively prime positive integers. The value *m* + *n* is

(A) 245 (B) 247

(C) 147 (D) 360

42. Suppose $\vec{a}, \vec{b}, \vec{c}$ are three non-zero vectors such that $\vec{a} + 4\vec{b} + 2\vec{c} = 0$ and $|\vec{a} - \vec{b}| = |\vec{b} - \vec{c}| = |\vec{c} - \vec{a}|$, then:

(A) $\vec{a} \cdot \vec{b} = 0$ (B) $\vec{b} \cdot \vec{c} = 0$

(C) $\vec{a} \cdot \vec{c} = 0$ (D) $\vec{a}.(\vec{b} + \vec{c}) = -6$

SECTION-2

***One or More than One Correct Type* (43–48)**

43. If the roots Z_1, Z_2, Z_3 of the equation $Z^3 - Z^2 + mZ - 1 = 0$ lie on $|Z| = 1$ and $\left|(Z_1+3)(Z_2+3)(Z_3+3)\right| = \lambda$ then λ is divisible by

(A) 3 (B) 5
(C) 10 (D) 4

44. Let the equation of the plane containing line $x - y - z - 4 = 0 = x + y + 2z = 4$ and parallel to the line of intersection of the planes $2x + 3y + z = 1$ and $x + 3y + 2z = 2$ be $x + Ay + Bz + C = 0$. Then the value of $|A+B+C|$ is less then

(A) 13 (B) 12
(C) 5 (D) 17

45. Identify the correct statement(s).

(A) Number of zero's standing at the end of 125! is 30
(B) A telegraph has 10 arms and each arm is capable of 9 distinct positions excluding the position of rest. The number of signals that $10^{10} - 1$
(C) Number of numbers greater than 4 lacs which can be formed by using only the digits 0, 2, 2, 4, 4 and 5 is 90
(D) In a table tennis tournament, each player plays with every other player. If the number of games played is 5050 then the number of players in the tournament is 100

46. In triangle *ABC*, co-ordinates of *A* are $(-1,3)$ and equations of medians and altitude through point *B* are $2x + y = 8$ and $2x + 3y = 8$ respectively, then:

(A) coordinates of *B* are (4,0)
(B) coordinates of *B* are (3, 9)
(C) coordinates of *C* are (3, 9)
(D) coordinates of centroid are (2, 4)

47. Which of the following is/are subset(s) of set of values of '*t*' for which the equation $\left(3\log_8^2 t - 4\log_8 t + 2\right)\tan x = 3\tan 3x$ for $(x \in R - \{n\pi\},\ n \in I)$, has a solution?

(A) (2, 8) (B) (8, 128)
(C) (128, ∞) (D) $\left(0, \frac{1}{8}\right)$

48. The number of ways in which five different books to be distributed among 3 persons so that each person gets at least one book, is equal to the number of ways in which:

(A) 5 persons are allotted 3 different residential flats so that each person is allotted at most one flat and no two persons are allotted the same flat
(B) number of parallelograms (some of which may be overlapping) formed by one set of 6 parallel lines and other set of 5 parallel lines that goes in other direction
(C) 5 different toys are to be distributed among 3 children, so that each child gets at least one toy
(D) 3 mathematics professors are assigned five different lectures to be delivered, so that each professor gets at least one lecture.

SECTION-3

***Numerical Type* (*Double Decimal*) (49–54)**

49. Let $P = \tan(27x) - \tan x$ and $Q = \frac{\sin x}{\cos 3x} + \frac{\sin 3x}{\cos 9x} + \frac{\sin 9x}{\cos 27x}$.
If $P = \lambda Q$, then find the value of λ.

50. Let the triangle *PQR* has vertices $P\left(\frac{-1}{2}, -1\right)$, $Q(5,6)$ and $R(4,3)$. If A is a point inside the triangle *PQR* such that Area of ΔAPQ = Area of ΔAQR = Area of ΔARP and intercepts made by line $\frac{6x}{55} + \frac{6y}{14} + 1 = 0$ on *x* and *y* axes are *a* and *b* respectively, then distance between point *A* and *B* (*a*, *b*) is

51. The graph of a certain function *f* contains the point (0, 2) and has the property that for each number '*p*' the line tangent to $y = f(x)$ at $(p, f(p))$ intersect the *x*-axis at $p + 2$. Find $f(-2)$.

52. Find $\lim\limits_{x \to \alpha^+}\left[\frac{\min(\sin x, \{x\})}{x-1}\right]$ where α is root of equation $\sin x + 1 = x$ (here [.] represent greatest integer and {.} represent fractional part function)

53. Locus of intersection point of lines $x - \lambda = 2$ and $\lambda + \lambda y = 4$ (where 'λ' is parameter) is a curve which intersect the circle $x^2 + y^2 - 4x + 2y - 20 = 0$ at four points *A*, *B*, *C* and *D*. If '*O*' is centre of curve and $OA^2 + OB^2 + OC^2 + OD^2 = 200k$, then value of *k* is

54. Let a three-dimension vector $\vec{V}$ satisfy the condition, $2\vec{V} + \vec{V} \times (\hat{i} + 2\hat{j}) = 2\hat{i} + \hat{k}$.
If $3|\vec{V}| = \sqrt{m}$, $m \in N$. Then find the value of *m*.

Test Booklet Code

01

PAPER - 01

RANKERS TEST SERIES
JEE ADVANCED (2025)

ANSWER KEY

1.	**(A)**	**19.**	**(C)**	**37.**	**(B)**
2.	**(A)**	**20.**	**(C)**	**38.**	**(B)**
3.	**(A)**	**21.**	**(A)**	**39.**	**(A)**
4.	**(A)**	**22.**	**(D)**	**40.**	**(D)**
5.	**(D)**	**23.**	**(C)**	**41.**	**(B)**
6.	**(A)**	**24.**	**(D)**	**42.**	**(C)**
7.	**(AC)**	**25.**	**(BCD)**	**43.**	**(BCD)**
8.	**(AD)**	**26.**	**(ABC)**	**44.**	**(ABD)**
9.	**(ACD)**	**27.**	**(CD)**	**45.**	**(BC)**
10.	**(ABD)**	**28.**	**(BC)**	**46.**	**(ACD)**
11.	**(AD)**	**29.**	**(BCD)**	**47.**	**(ACD)**
12.	**(AD)**	**30.**	**(ABCD)**	**48.**	**(BCD)**
13.	**(6.00)**	**31.**	**(6.00)**	**49.**	**(2.00)**
14.	**(1.04)**	**32.**	**(5.00)**	**50.**	**(13.00)**
15.	**(74.83)**	**33.**	**(3.00)**	**51.**	**(5.40–5.50)**
16.	**(1.00)**	**34.**	**(6.00)**	**52.**	**(0.00)**
17.	**(0.67)**	**35.**	**(53.60)**	**53.**	**(0.50)**
18.	**(3.00)**	**36.**	**(4.00)**	**54.**	**(6.00)**

HINTS AND SOLUTIONS

PHYSICS

1. (A)

$a = \alpha R$ ($\because$ no slipping)

For block, $ma = mg - T$ ... (i)

For disc, $TR - fR = I\alpha$

$$T - f = \frac{mR^2}{2} \times \frac{a}{R} \times \frac{1}{R}$$

$$T - f = \frac{ma}{2} \quad \text{.... (ii)}$$

And $f = ma$ ... (iii)

Put (i) and (iii) in (ii) ; $a = \frac{2}{5}g$

For block, acceleration $\rightarrow -\frac{2}{5}g\,\hat{j}$

For disc, acceleration $\rightarrow \frac{2}{5}g\,\hat{i}$

$$a_{Bg} = \frac{2}{5}g\hat{i} - \frac{2}{5}g\hat{j}$$

$$a_{BD} = -\frac{2}{5}g\hat{j}$$

From (i), $T = mg - ma$

$$T = mg - \frac{2mg}{5} \; ; T = \frac{3mg}{5}$$

2. (A)

Here, we use energy method to compute time period of oscillation, as the tube is rolling without slipping, work done by friction force is zero and total energy of the system remains constant. Let us consider the instant when the body is at an angular displacement θ from the equilibrium position. Let us assume at this instant, velocity of centre of mass of tube is v and it is rotating with angular velocity ω. For rolling without slipping, $v = R\omega$.

At this instant, total energy of the system is

$$E = \frac{2m \times v^2}{2} + \frac{\left(mR^2 + mR^2\right)\omega^2}{2} + mgR(1 - \cos\theta)$$

(for gravitational potential energy the plane, level is taken as reference)

on simplifying and differentiating w.r.t. time and putting $\frac{dE}{dt} = 0$

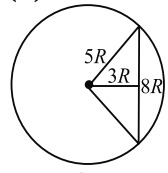
we get $\therefore \frac{d\omega}{dt} = -\frac{g\sin\theta}{4R}$

$\therefore \frac{d\omega}{dt} = \frac{-g\theta}{4R}$ {As θ is very small $\sin\theta \approx \theta$}

$\therefore \omega' = \sqrt{\frac{g}{4R}}$

$$T = 2\pi\sqrt{\frac{4R}{g}}$$

3. (A)



(Top view)

Using Gauss Law,

$$\phi = \frac{q_{in}}{\epsilon_0} = \frac{\rho\left(\frac{1}{2}8R.3R\right)R}{\epsilon_0} = \frac{12\rho R^3}{\epsilon_0}$$

($\therefore$ electric field is radial)

4. (A)

Let any instant the velocity of wire is v, the induced emf,

$e = Bv\ell$

and charge on capacitor

$q = Ce = CBv\ell$

and current in the wire

$$i = \frac{dq}{dt} = \frac{d}{dt}(CBv\ell)$$

$$= CB\left(\frac{dv}{dt}\right)\ell$$

As $\frac{dv}{dt}$ is the acceleration a,

$\therefore i = CBa\ell$

The resisting force on wire exerted by magnetic field

$F_{res} = Bi\ell = B(CBa\ell)\ell = B^2Ca\ell^2$

Now by Newton's second law

$F - F_{rest} = ma$

or $F - B^2Ca\ell^2 = ma$

$$\therefore a = \left[\frac{F}{m + B^2C\ell^2}\right]$$

5. (D)

$E_0q(0.8\hat{i} + j + 0.2k)$

Given: $\vec{E}_1 = E_0\hat{j}\cos(\omega t - kx)$

i.e., Travelling in +ve x-direction

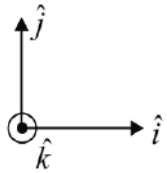
$\vec{E} \times \vec{B}$ should be in x-direction

$\therefore$ $\vec{B}$ is in K

$$\therefore \vec{B}_1 = \frac{E_0}{C}\cos(\omega t - kx)\hat{k} \quad \left(B_0 = \frac{E_0}{C}\right)$$

$\vec{E}_2 = E_0\hat{k}\cos(\omega t - ky)$

$\vec{B}_2 = \frac{E_0}{C}\hat{i}\cos(\omega t - ky)$



$\therefore$ Travelling in +ve axis

$\vec{E} \times \vec{B}$ should be y-axis

$\therefore$ Net force $\vec{F} = q\vec{E} + q(\vec{v} \times \vec{B})$

$q\left(\vec{E}_{-1} + \vec{E}_{-2}\right)$

$+q\left(0.8cj \times \left(\vec{B}_{-1} + \vec{B}_{-2}\right)\right)$

If $t = 0$ and $x = y = 0$

$\vec{E}_{-1} = E_0\hat{j}$ $\quad$ $\vec{E}_{-2} = E_0\hat{k}$

$\vec{B}_{-1} = \frac{E_0}{c}\hat{k}$ $\quad$ $\vec{B}_{-2} = \frac{E_0}{c}\hat{i}$

$$\therefore \vec{F}_{net} = qE_0\left(\hat{j} + \hat{k}\right)$$

$$+q \times 0.8c \times \frac{E_0}{C}\hat{j} \times \left(\hat{k} + \hat{i}\right)$$

$= qE_0\left(\hat{j} + \hat{k}\right) + 0.8qE_0\left(\hat{i} - \hat{k}\right)$

$= qE_0\left(0.8\hat{i} + \hat{j} + 0.2\hat{k}\right)$

6. (A)

$$v = \frac{C}{\lambda} = RC\left[\frac{1}{(n-m)^2} - \frac{1}{n^2}\right]$$

$$= \frac{RC}{n^2}\left[\left(1 - \frac{m}{n}\right)^{-2} - 1\right] = \left(\frac{2RC}{n^3}\right)m$$

For m = 1, 2, 3

v is in $A.P.$

7. (AC)

Initially the $4kg$ block experience increasing friction as it tries to prevent relative motion between the $2kg$ and $4kg$ and the force increases with time then there is a discontinuity in the graph of Avast because the values of frictional force decrease from limiting to kinetic friction. The friction causes increasing acceleration on 2 kg block but after it starts relative motion the kinetic friction it constant causing constant acceleration.

8. (AD)

$2A\sin kx = 3\sqrt{2}$

$2 \times 3\sin kx = 3\sqrt{2}$

$$\sin kx = \frac{1}{\sqrt{2}}$$

$$\frac{2\pi}{\lambda}x = \frac{\pi}{4}; \frac{3\pi}{4}$$

Distance between consecutive points

$$= \frac{3\lambda}{8} - \frac{\lambda}{8} = \frac{\lambda}{4}$$

$\frac{\lambda}{4} = 20$ cm $\Rightarrow \lambda = 80$ cm

So, $(n+1)\frac{\lambda}{2} = 240$

$\Rightarrow (n+1)\frac{80}{2} = 240$

Or $n + 1 = 6$ $n = 5$

So, string is vibrating in fifth overtone.

9. (ACD)

$$\omega = \frac{1}{\sqrt{LC}}$$

$$\Rightarrow C = \frac{1}{\omega^2 L} = \frac{1}{400 \times 0.2}F = 12.5\text{mF}$$

$$I_{rms} = \frac{\varepsilon_{rms}}{R} = \frac{10/\sqrt{2}}{5} = \sqrt{2}\text{ A}$$

$P = I_{rms}^2 R = 2 \times 5 = 10$ W

Quality factor $= \frac{\omega L}{R} = \frac{20 \times 0.2}{5} = 0.8$

10. (ABD)

By momentum conservation,

$5 \times 3 + 10 \times 2 = 7v$

$v = 5m/s$

By energy conservation,

$$\frac{1}{2} \cdot 5.3^2 + \frac{1}{2} \times 2 \times (10)^2 = \frac{1}{2} \times 7 \times 5^2 + \frac{1}{2}Kx^2$$

Which gives $x = 0.25m$

Time period of oscillation,

$$T = 2\pi\sqrt{\frac{\mu}{K}}$$

Here, $\mu = \left(\frac{m_1m_2}{m_1 + m_2}\right) = \frac{10}{7} \Rightarrow T = \frac{\pi}{14}$

First compression occurs $= \frac{3\pi}{4} = \frac{3\pi}{56}s$

(Going from natural length to maximum elongation will take $\frac{T}{4}$, then from maximum elongation to natural length will take $\frac{T}{4}$, going from natural length to maximum compression $= \frac{T}{4}$).

11. (AD)

At $t = O^+$, $V_L = \varepsilon$; $V_R = 0$

As time increases V_L decreases and finally $V_L = 0$;

$V_R = \varepsilon$ at ∞.

$\therefore$ A and D.

12. (AD)

Since $\rho \propto \frac{1}{r} \Rightarrow \rho = \frac{a}{r}$

And $M = \int\left(\frac{a}{r}\right)4\pi r^2 dr = 2\pi aR^2$

$$\therefore \quad a = \frac{M}{2\pi R^2}$$

Now $V_C = -Ga\int_0^R 4\pi dr = -Ga4\pi R$

$$= -\frac{GM}{2\pi R^2} \times 4\pi R = -\frac{2GM}{R}$$

And $E(r) = \frac{a\int\frac{a}{r}4\pi r^2 dr}{r^2} = 2\pi aG$

Now, self-energy is equal to gravitational field energy.

$$U_{0 \to R} = -\frac{1}{2} \times \left(\frac{1}{4\pi G}\right)(2\pi aG)^2 \frac{4}{3}\pi R^3$$

$$= -\frac{GM^2}{6R}$$

and $U_{R \to \infty} = -\frac{GM^2}{2R}$

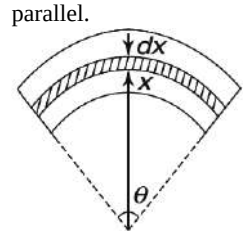
$$\therefore \quad U = \frac{-2}{3}\frac{GM^2}{R}$$

13. (6.00)

Consider a strip of width dx as shown in figure. Resistance of the strip

$$dR = \frac{x\theta}{\sigma t dx} = \frac{\pi}{6\sigma t}\frac{x}{dx}$$

All such small resistances will be in parallel.



$$\therefore \frac{1}{R}=\frac{1}{dR_1}+\frac{1}{dR_2}+\frac{1}{dR_3}+\ldots$$

$$\Rightarrow \frac{1}{R}=\int\frac{1}{dR}=\frac{6\sigma t}{\pi}\int_r^{2r}\frac{dx}{x}$$

$$\Rightarrow \frac{1}{R}=\frac{6\sigma t}{\pi}\left[\ln x\right]_r^{2r}=\frac{6\ln 2}{\pi}\sigma t$$

$$\therefore R=\frac{\pi}{6\cdot\ln 2\sigma t}$$

14. (1.04)

Let k be the force constant and l be the length of the cord at the moment of sliding $\cos\theta=\frac{l_0}{l}$

$l_0 \sec\theta = l$

When it start slipping $T\cos\theta + N = mg$

and $\mu N = T\sin\theta$

Where T = tension of the cord

$$k(lo\sec\theta - l_0)\cos\theta + N = mg$$

$$\mu N = Kl_0(\sec\theta - 1)\sin\theta$$

$$T = K\Delta l = k(l_0\sec\theta - l_0)$$

Eliminating N

$$K=\frac{\mu mg}{l_0(\sec\theta-1)(\mu\cos\theta+\sin\theta)}$$

By the work energy theorem

$$W_{mg}+W_{fr}+W_{\text{spring}}=0$$

$$0+w_{fr}+0-\frac{1}{2}k(\Delta l)^2=0$$

$$w_{fr}=\frac{1}{2}k(\Delta l)^2$$

$$w_{fr}=\frac{\mu mg(l_0\sec\theta-l_0)^2}{2l_0(\sec\theta-1)(\mu\cos\theta+\sin\theta)}$$

$$w_{fr}=\frac{\mu mg\,l_0(1-\cos\theta)}{2\cos\theta(\mu\cos\theta+\sin\theta)}$$

$$w_{fr}\frac{0.2\times 2\times 10\times 0.5(1-\cos 60^\circ)}{2\cos 60^\circ(0.2\cos 60^\circ+\sin 60^\circ)}$$

$w_{fr} = 1.036\ J$

15. (74.83)

$$W=P_1(V_2-V_1)-P_2(V_2-V_1)$$

$$=P_1V_2-P_1V_1-P_2V_2+P_2V_1$$

$$P_2=\frac{nRT_2}{V_2}, P_1=\frac{nRT_1}{V_1}$$

$$\Rightarrow P_2V_2=P_1V_1=nR\sqrt{T_1T_2}$$

$$P_1V_2=nRT_1,\ P_2V_1=nRT_2$$

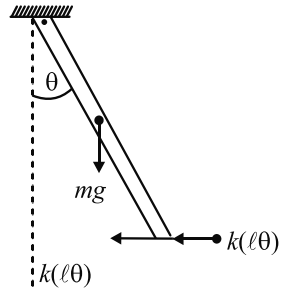
$$\Rightarrow W=nR\left(\sqrt{T_1}-\sqrt{T_2}\right)^2$$

$$=1\times 8.314(20-17)^2=74.83\text{J}$$

16. (1.00)

If the rod is rotated slightly by θ, the right spring will get compressed by $l\theta$ and left string will get elongated by $l\theta$.

Restoring torque about hinge A is:



$$\tau=-\left[mg\frac{l}{2}\sin\theta+2kl\theta(l\cos\theta)\right]$$

$\because \theta$ is very small

$\Rightarrow \sin\theta = \theta, \cos\theta = 1$

$$\therefore \tau=-\left[mg\frac{l}{2}+2kl^2\right]\theta$$

$$\Rightarrow \frac{ml^2}{3}\alpha=-\left[mg\frac{l}{2}+2kl^2\right]\theta$$

$$\Rightarrow \alpha=-\left(\frac{3g}{2l}+\frac{6k}{m}\right)\theta$$

$$=-\left[\frac{30}{2}+\frac{6(12.5)}{3}\right]\theta$$

$$\Rightarrow \alpha=-(40)\theta\Rightarrow\omega^2=40$$

$$\Rightarrow T=\frac{2\pi}{\omega}=\frac{2\pi}{\sqrt{40}}=\frac{2\sqrt{10}}{2\sqrt{10}}=1s$$

17. (0.67)

Two sphere of equal size will share charge till both of them acquire same potential. Let charge on inner sphere be q.

A charge $-q$ is induced on the inner surface of the shell.

Potential of the inner sphere = potential of distant sphere

$$=K\frac{q}{R}+K\frac{-q}{2R}=K\frac{Q-q}{R}$$

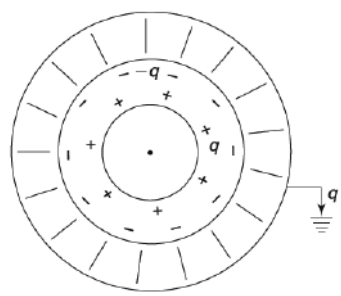
$$\Rightarrow q=2Q-2q$$

$$\Rightarrow q=\frac{2Q}{3}$$

$\therefore$ charge induced on the inner surface of the shell $=-q=\frac{-2Q}{3}$

$\therefore$ charge that flows tod earth

$$=+q=\frac{2Q}{3}$$



18. (3.00)

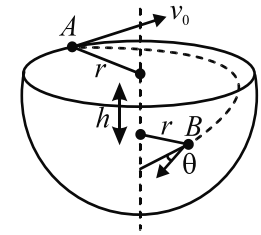
Angular momentum of the particle is conserved about the vertical centre line

$$mv_0r_0=mvr\cos\theta$$

where conservation of mechanical energy gives,

$$\frac{1}{2}mv_0^2+mgh=\frac{1}{2}mv^2\ ;\ r^2=r_0^2-h^2\ ;$$

$$\cos\theta=\frac{1}{\sqrt{1+\frac{2gh}{v_0^2}}\sqrt{1-\frac{h^2}{r_0^2}}}$$



CHEMISTRY

19. (C)

P → Q – Adiabatic irreversible ⇒ $\Delta S_{PQ} > 0$.

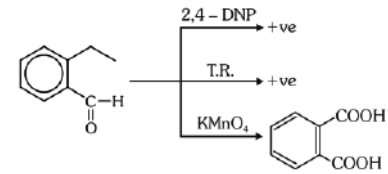
P → R – Adiabatic reversible ⇒ $\Delta S_{PR} = 0$.

Since entropy is state function hence

$\Delta S_{PQ} + \Delta S_{QR} = \Delta S_{PR}$

$\Rightarrow \Delta S_{QR} < 0$.

20. (C)



21. (A)

In fifty minutes, the concentration of H_2O_2 decreases from 0.5 to 0.125 M.

It means two half lives must have passed.

$\Rightarrow 2t_{1/2} = 50$ minutes

$t_{1/2} = 25$ minutes

$$\therefore k=\left(\frac{0.693}{25}\right)\text{min}^{-1}$$

Also, $\frac{-d[H_2O_2]}{dt}=k[H_2O_2]$

$$=\frac{0.693}{25}\times(0.05)mol\,\text{min}^{-1}$$

As per reaction

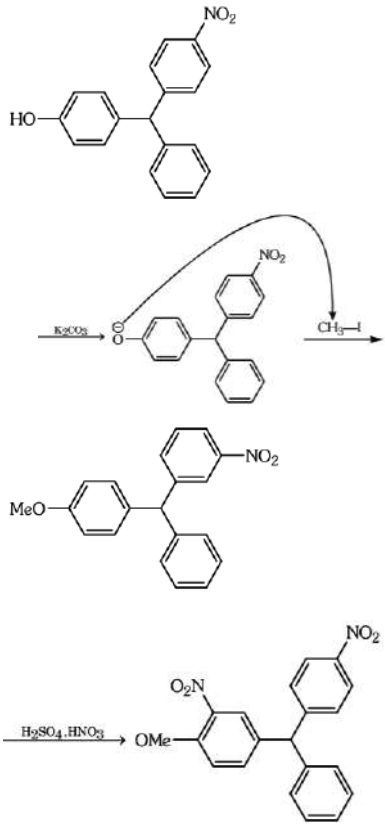
$2H_2O_2 \longrightarrow 2H_2O + O_2$

$$\frac{d[O_2]}{dt}=-\frac{1}{2}\left(\frac{d[H_2O_2]}{dt}\right)$$

$$=\frac{1}{2}\times\frac{0.693}{25}\times 0.05mol\,\text{min}^{-1}$$

$= 6.93 \times 10^{-4}$ mol min^{-1}

22. (D)



23. (C)

$Zn + Cu^{2+} \longrightarrow Zn^{2+} + Cu,$

$$E_{cell} - E^{\circ}_{cell} = -\frac{0.0591}{2}\log\frac{\left[Zn^{2+}\right]}{\left[Cu^{2+}\right]}$$

i.e. $0.0591 = -\frac{0.0591}{2}\log\frac{C_1}{C_2}$

Or,

$\log\frac{C_1}{C_2} = -2$ or, $\frac{C_1}{C_2} =$ Antilog $\bar{2} = 10^{-2}$

24. (D)

Complete hydrolysis of XeF_4 is redox.

$6XeF_6 + 12H_2O \rightarrow 4Xe + 2XeO_3 + 24HF + 3O_2$

25. (BCD)

$CoCl_3(aq) + NH_3(aq) \longrightarrow$

$CoCl_3.6NH_3 + CoCl_3.5NH_3 + CoCl_3.4NH_3$

$[Co(NH_3)_6]^{3+}$ $3Cl^-$ –yellow – d^2sp^3(diamagnetic).

$[Co(NH_3)_5Cl]^{2+}$ $2Cl^-$ –purple – d^2sp^3(diamagnetic).

$[Co(NH_3)_4Cl_2]^+$ Cl^- – green and $[Co(NH_3)_4Cl_2]^+$ Cl^- – violet are geometrical isomers.

* Geometrical isomers will produce same amount of AgCl.

26. (ABC)

Non planar compound (stability is not due to resonance)

27. (CD)

Noble metals are also reducible by H_2 at high temperature.

28. (BC)

Equilibrium constant is dependent on temperature only promotor increases the efficiency of the catalyst.

29. (BCD)

B. $(NH_4)_2SO_4 + 2\,NaOH$

$\xrightarrow{40\%}$

39.6 gm

$Na_2SO_4 + 2H_2O + 2NH_3$

0.24 mol

$\frac{39.6}{132} = 0.3$ mole

$NH_3 + HCl \xrightarrow{80\%} NH_4Cl$

0.24 mole

0.24×0.8

0.192 mol

Mass of

$NH_4Cl = 0.192 \times 53.5 = 10.272$ gm

C. $n_{NaOH} = \frac{25}{40} = 0.625$ mole

$\left(n_{NH_3}\right)_{produced} = 0.625 \times 0.4 = 0.25$

mole n_{NH_4Cl}

$\Rightarrow$ moles = 0.25 × 0.8 = 0.2

mass of NH_4Cl = 0.2 × 53.5 = 10.7 gm

D. $n_{NaOH} = \frac{4}{40} = 0.1$ mole

$\left(n_{Na_2SO_4}\right)_{produced} = \frac{0.1 \times 0.4}{2} = 0.02$

mole $\left(n_{NH_3}\right)_{produced} = 0.04$ mole

$\left(n_{NH_4Cl}\right)_{produced} = 0.04 \times 0.8 = 0.032$

mole

$\left(n_{NH_4Cl}\right)_{produced} = 1.6 \times 0.02$

$= 1.6 \times \left(n_{Na_2SO_4}\right)_{produced}$

30. (ABCD)

At the point of maximum value of RDF

$\frac{dP}{dr} = 0$

$\left(2r - \frac{2Zr^2}{a_0}\right) = 0;\ r = \frac{a_0}{Z}$

Where $Z = 3$ for Li^{2+} and $Z = 2$ for the He^+;

$Z = 1$ for hydrogen

31. (6.00)

$K_h = \frac{K_w}{K_a} \Rightarrow K_a = \frac{10^{-14}}{10^{-4}} = 10^{-10}$

$Ag^+(aq) + CN^-(aq) \rightleftharpoons$

$AgCN(s)K' = \frac{1}{K_{sp}} = \frac{10^{16}}{4}$

$HCN(aq) \rightleftharpoons H^+(aq) + CN^-(aq)K_a = 10^{-10}$;

$Ag^+(aq) + HCN(aq) \rightleftharpoons$

0.01 − x, 0.01 − x

$AgCN(s) + H^+(aq) : K$

0 ≃0.01, 0 ≃0.01

$K = 10^{-10} \times \frac{10^{16}}{4} = \frac{10^6}{4}$

$K = \frac{10^6}{4} = \frac{0.01}{x^2} \Rightarrow x^2 = \frac{0.01 \times 4}{10^6}$

$\Rightarrow$ x = 2 × 10^{-4}; y + z = 2 + 4 = 6

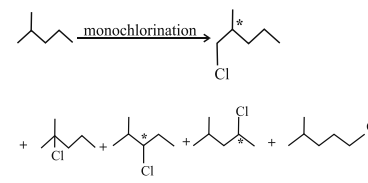
32. (5.00)

$N(SiH_3)_3$, BF_3, $B_3N_3H_6$, SO_2, NO_2 → sp^2

SiO_2, $H_3O^{\oplus}$ → sp^3

$AlCl_3.6H_2O$ → sp^3d^2.

33. (3.00)



Hence x = 8

y = 5, (x–y) = 3

34. (6.00)

Molarity of 1st solution

$= \frac{\frac{0.2 \times M}{0.2M + 18 \times 0.8} \times 1000}{d_1}$

Molarity of 2nd solution

$= \frac{\frac{0.1M}{0.1M + 0.9 \times 18} \times 1000}{d_2}$

$\Rightarrow d_2 = 0.8d_1$

$\frac{1}{2} \times \frac{0.2 \times 1000}{0.2M + 18 \times 0.8} \times d_1 = \frac{0.1 \times 0.8d_1}{0.1M + 0.9 \times 18}$

$\Rightarrow \frac{5}{0.2M + 18 \times 0.8} = \frac{4}{0.1M + 0.9 \times 18}$

M = 78

35. (53.60)

As per Arrhenius equation:

$\ln\frac{k_2}{k_1} = -\frac{E_a}{R}\left(\frac{1}{T_2} - \frac{1}{T_1}\right)$

$2.303\log 2 = -\frac{E_a}{8.314}\left(\frac{1}{310} - \frac{1}{300}\right)$

$\Rightarrow E_a = 53.6$ kJ / mole

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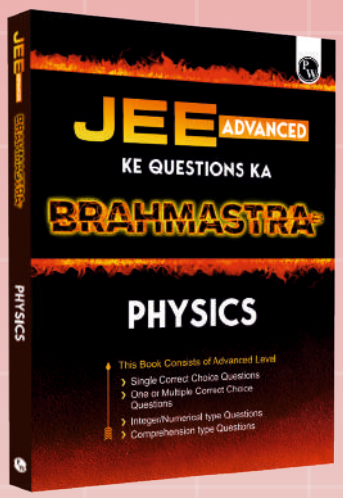

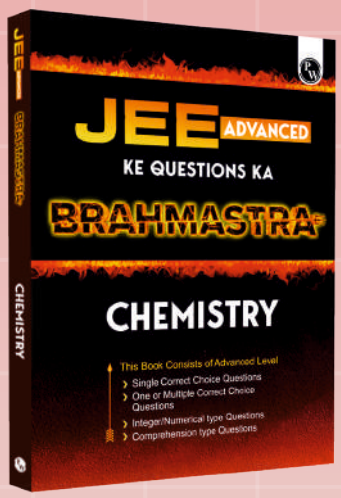

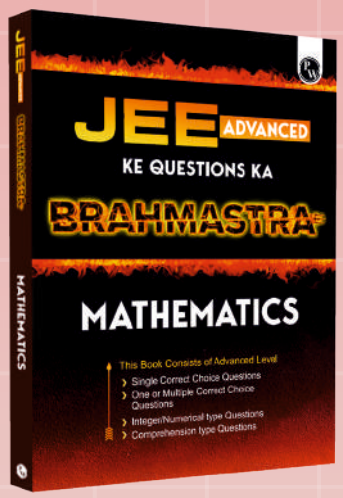

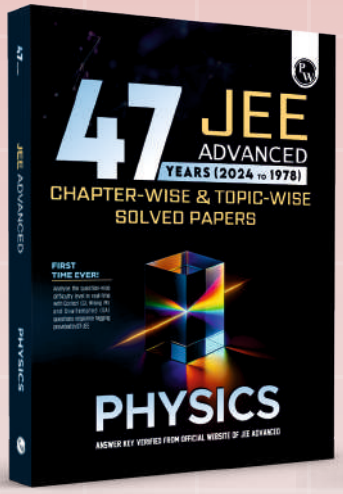

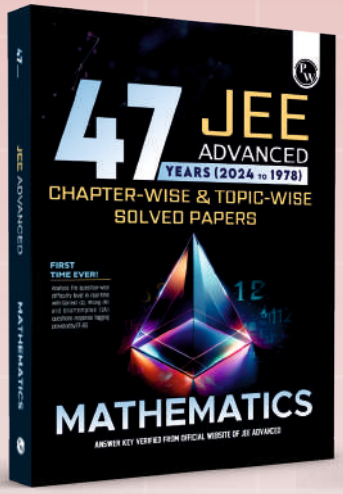

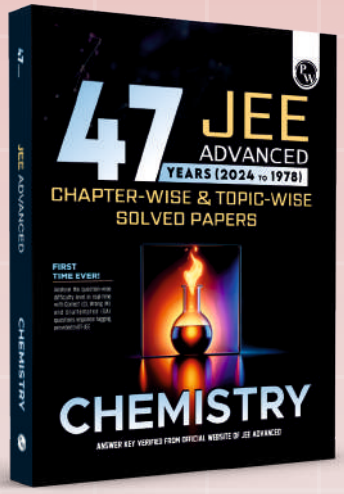

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