READY RECKONER

Last 10 Years' Weightage Analysis & Practice Test Papers

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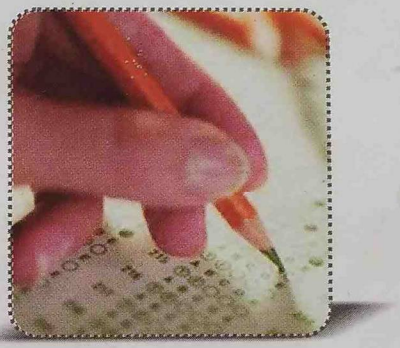
Distance Learning Programmes Division (DLPD)

History of JEE (Main)

Last 10 Years'
Weightage Analysis



Practice Test Papers
(With Solutions)

JEE

(Main)

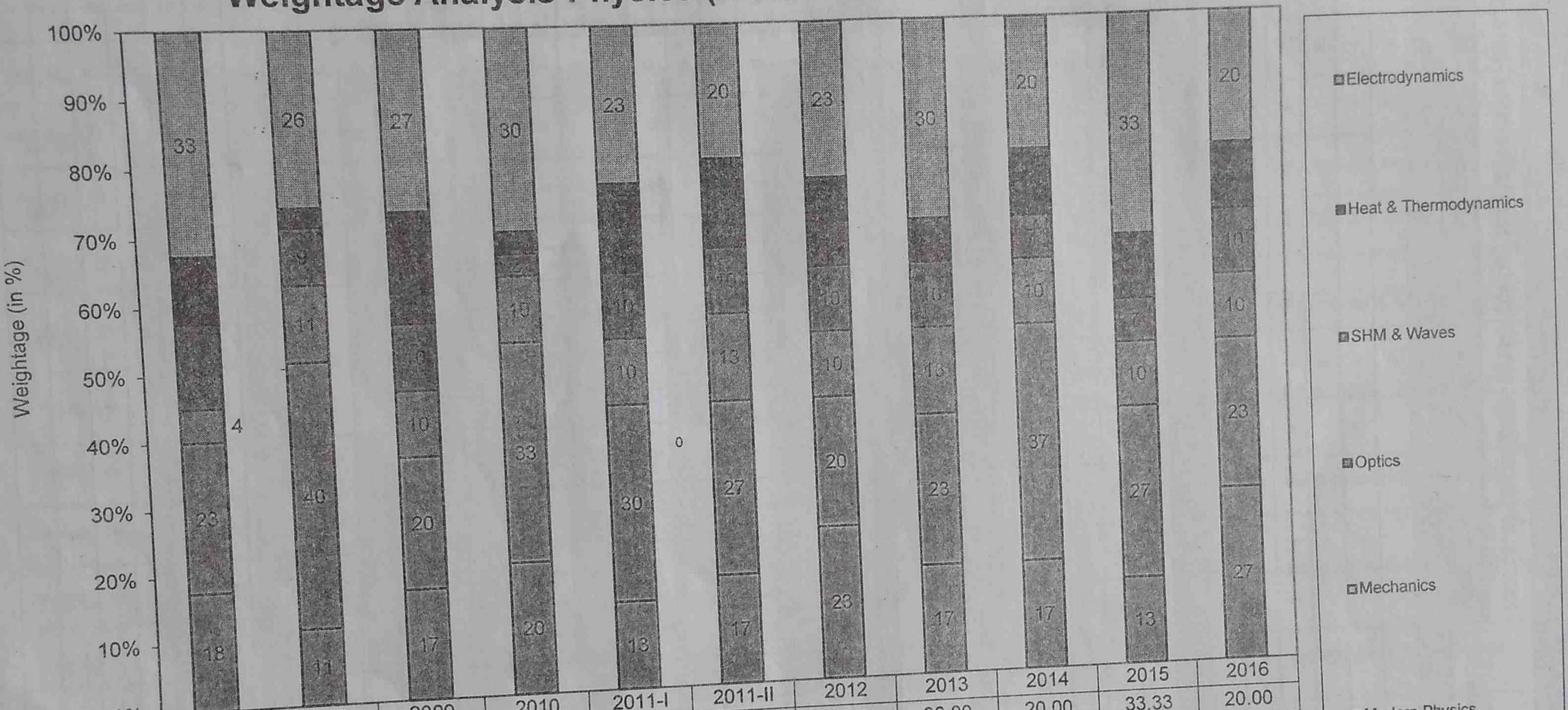
ENGLISH MEDIUM

Weightage Analysis for Physics JEE (Main) 2007 to 2016

Topic ↓ / No. of →	2007	2008	2009	2010	2011-I	2011-II	2012	2013	2014	2015	2016	Total No. of Question ↓
	40	35	30	30	30	30	30	30	30	30	30	
Electrodynamics	13	9	8	9	7	6	7	9	6	10	6	90
Electrostatics	3	1	4	3	2	1	2	2	1	2	1	22
Current Electricity	2	4	1	1	1	1	1	2	1	2	1	17
Capacitance	2	1	0	1	1	1	1	1	1	1	1	11
Electro Magnetic Field	5	2	2	1	1	2	2	1	2	3	2	23
Electro Magnetic Induction	0	1	1	2	2	1	1	3	1	2	0	14
Alternating Current	1	0	0	1	0	0	0	0	0	0	1	3
Heat & Thermodynamics	4	1	5	1	4	4	4	2	3	3	3	34
Calorimetry & Thermal Expansion	4	1	5	1	1	2	1	0	0	0	0	15
KTG & Thermodynamics	0	0	0	0	3	0	2	1	2	3	3	14
Heat Transfer	0	0	0	0	0	2	1	1	1	0		5
SHM & Waves	5	3	3	1	3	3	3	3	2	2	3	31
Simple Harmonic Motion	4	0	1	0	2	1	2	2	1	1	1	15
Wave on a String	0	1	0	1	0	0	1	1	0		1	5
Sound Waves	1	2	2	0	1	2	0	0	1	1	1	11
Optics	2	4	3	3	3	4	3	4	3	3	3	35
Geometrical Optics	1	1	2	3	2	2	2	2	2	1	2	20
Wave Optics	1	3	1	0	1	2	1	2	1	2	1	15
Mechanics	9	14	6	10	9	8	6	7	11	8	7	95
Unit & Dimension	0	1	0	0	0	0	0	1	0		0	2
Error in Measurement	0	2	1	1	1	1	1	0	2	1	2	12
Rectilinear Motion & Vectors	1	1	0	0	1	0	0	0	0		0	3
Projectile Motion	0	0	1	1	1	0	1	1	2		0	7
Relative Motion	0	0	0	0	0	0	0	0	0	1	0	1
Newton's Laws of Motion	1	0	0	1	0	1	0	0	0		0	3
Friction	0	0	0	0	0	1	0	0	1	1	0	3
Work, Power & Energy	2	1	0	1	0	1	1	0	1		2	9
Circular Motion	0	0	0	2	0	0	1	0	0		0	3
Centre of Mass	1	3	1	2	0	0	0	1	0	2	0	10
Rigid Body Dynamics	3	1	1	1	3	1	0	1	2	1	2	16
Gravitation	1	2	1	0	1	1	1	1	1	1	1	11
Fluid Mechanics & Properties of Matter	0	3	1	1	2	2	1	2	2	1	0	15

* MODERN

Weightage Analysis Physics (AIEEE 2007 To JEE(MAIN) 2016)



	2007	2008	2009	2010	2011-I	2011-II	2012	2013	2014	2015	2016
Electrodynamics	32.50	25.71	26.67	30.00	23.33	20.00	23.33	30.00	20.00	33.33	20.00
Heat & Thermodynamics	10.00	2.86	16.67	3.33	13.33	13.33	13.33	6.67	10.00	10.00	10.00
SHM & Waves	12.50	8.57	10.00	3.33	10.00	10.00	10.00	10.00	6.67	6.67	10.00
Optics	5.00	11.43	10.00	10.00	10.00	13.33	10.00	13.33	10.00	10.00	10.00
Mechanics	22.50	40.00	20.00	33.33	30.00	26.67	20.00	23.33	36.67	26.67	23.33
Modern Physics	17.50	11.43	16.67	20.00	13.33	16.67	23.33	16.67	16.67	13.33	26.67

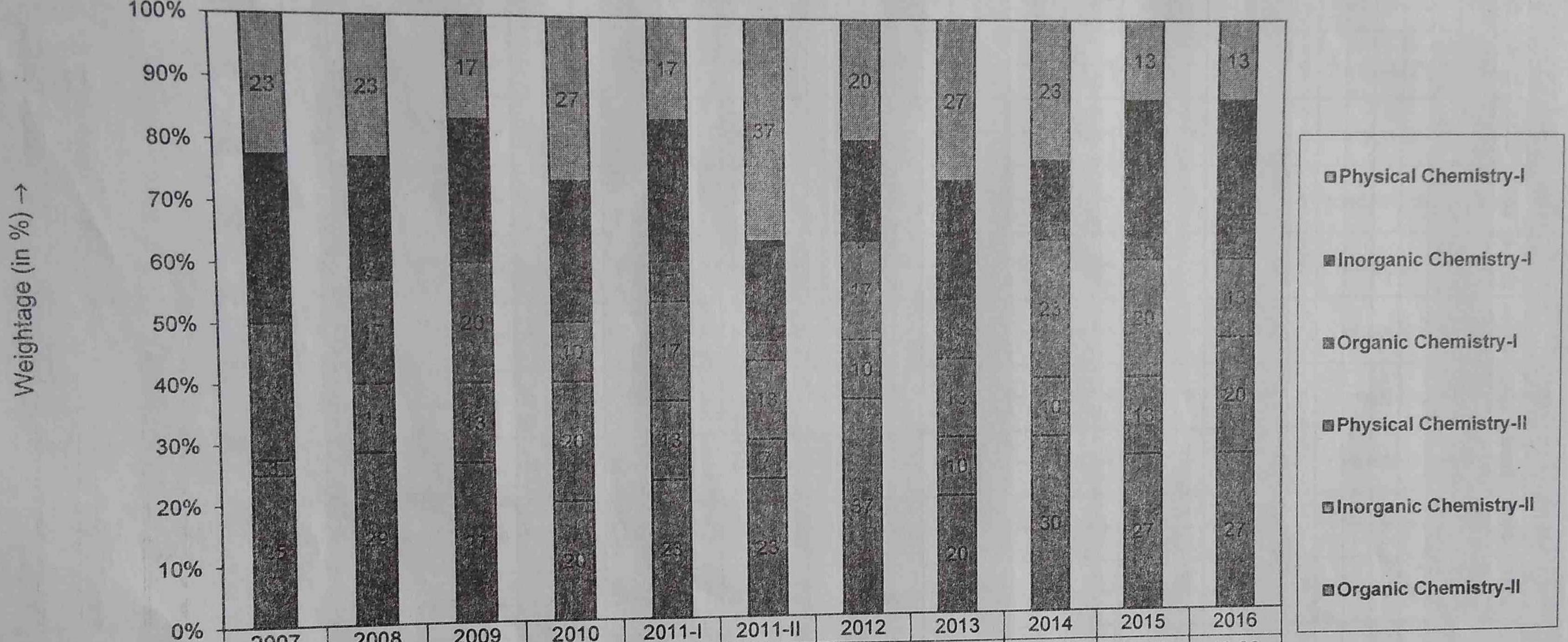
Note: The above data corresponds to Main Examination only.

Weightage Analysis

Weightage Analysis for Chemistry JEE (Main) 2007 to 2016

Topic ↓ / No. of Questions →	2007	2008	2009	2010	2011-I	2011-II	2012	2013	2014	2015	2016	Total No. of Question ↓
	40	35	30	30	30	30	30	30	30	30	30	
Physical Chemistry-I	9	8	5	8	5	11	6	8	7	4	4	
Stoichiometry (Mole-1, 2)	2	1	-	1	1	2	1	2	3	1	0	14
Atomic Structure	-	2	2	2	1	1	1	1	1	1	1	13
Gaseous State	1	-	-	1	1	2	1	2	1	0	1	10
Thermodynamics and Thermochemistry	3	1	2	1	1	3	1	2	1	1	1	17
Chemical Equilibrium	-	1	-	2	1	-	1	0	1	1	1	8
Ionic Equilibrium	3	3	1	1	-	3	1	1	0	0	0	13
Inorganic Chemistry-I	9	5	5	5	7	5	6	6	3	7	6	
Periodic Table & Periodicity in Properties	5	3	4	2	-	1	1	1	0	1	1	19
Chemical Bonding	4	2	1	3	3	2	2	4	2	2	2	27
p-block	-	-	-	-	3	1		1	1	3	1	10
s-block	-	-	-	-	1	1	1	0	0	1	1	5
Hydrogen & Its Compounds	-	-	-	-	-	-	1	0	0	0	1	2
Organic Chemistry-I	2	2	2	2	2	1	0	3	1	1	2	
General Organic Chemistry-I (GOC)	2	2	2	2				0	0	1	0	9
General Organic Chemistry- II	-	-	-	-	2	1		3	1	0	2	9
Physical Chemistry-II	9	6	6	3	5	4	5	4	7	6	4	
Chemical Kinetics	2	1	1	1	1	1	1	1	1	1	1	12
Electrochemistry	2	1	1	1	1	1	1	1	4	1	0	14
Solid State	-	1	1	1	1	1	1	1	1	1	0	9
Colligative Peroperties	3	2	2	-	2	1	1	0	1	1	1	14
Surface Chemistry	-	1	1	-	-	-	1	1	0	2	2	8
Nuclear Chemistry	2	-	-	-	-	-		0	0	0	0	2
Inorganic Chemistry-II	1	4	4	6	4	2	3	3	3	4	6	
Transition Elements and Coordination Chemistry	1	3	4	3	2	2	1	1	1	1	2	21
Metallurgy	-	1	-	-	-	-	1	0	0	1	1	4
d-block & f-bolck	-	-	-	-	2	-	1	2	2	1	2	10
Qualitative Analysis	-	-	-	3	-	-	-	0	0	1	1	5
Organic Chemistry-II	10	10	8	6	7	7	11	6	9	8	8	
Practical Organic Chemistry (POC)	-	-	-	-	2	-	1	1	1	3	2	10
Hydrocarbons	2	3	-	-	1	2	-	0	1	0	3	12
Alkyl halides (Oxidation & Reduction)	-	1	1	-	-	-	-	1	1	1	0	5
Alcohols And Ethers (Reaction Mechanics)	1	-	-	-	-	1	3	0	1	1	0	7
Aldehydes and Ketones	-	-	1	2	1	-	-	0	0	0	0	4
Aromatic Compound	3	2	1	1	1	2	2	0	1	1	0	14
Carboxylic Acid and their Derivatives	-	-	1	-	1	-	-	3	1	0	0	6
Amines	2	-	-	1	-	-	2	0	1	0	0	6
Carbohydrates, Amino Acids and Polymers	1	2	2	2	1	2	1	1	2	2	2	18
Stereo Chemistry	1	1	2	-	-	-	1	0	0	0	0	5
Environmental chemistry	-	1	-	-	-	-	1	0	0	0	1	3

Weightage Analysis Chemistry (AIEEE 2007 To JEE(MAIN) 2016)



	2007	2008	2009	2010	2011-I	2011-II	2012	2013	2014	2015	2016
Physical Chemistry-I	22.50	22.86	16.67	26.67	16.67	36.67	20.00	26.67	23.33	13.33	13.33
Inorganic Chemistry-I	22.50	14.29	16.67	16.67	23.33	16.67	16.67	20.00	10.00	23.33	20.00
Organic Chemistry-I	5.00	5.71	6.67	6.67	6.67	3.33	0.00	10.00	3.33	3.33	6.67
Physical Chemistry-II	22.50	17.14	20.00	10.00	16.67	13.33	16.67	13.33	23.33	20.00	13.33
Inorganic Chemistry-II	2.50	11.43	13.33	20.00	13.33	6.67	10.00	10.00	10.00	13.33	20.00
Organic Chemistry-II	25.00	28.57	26.67	20.00	23.33	23.33	36.67	20.00	30.00	26.67	26.67

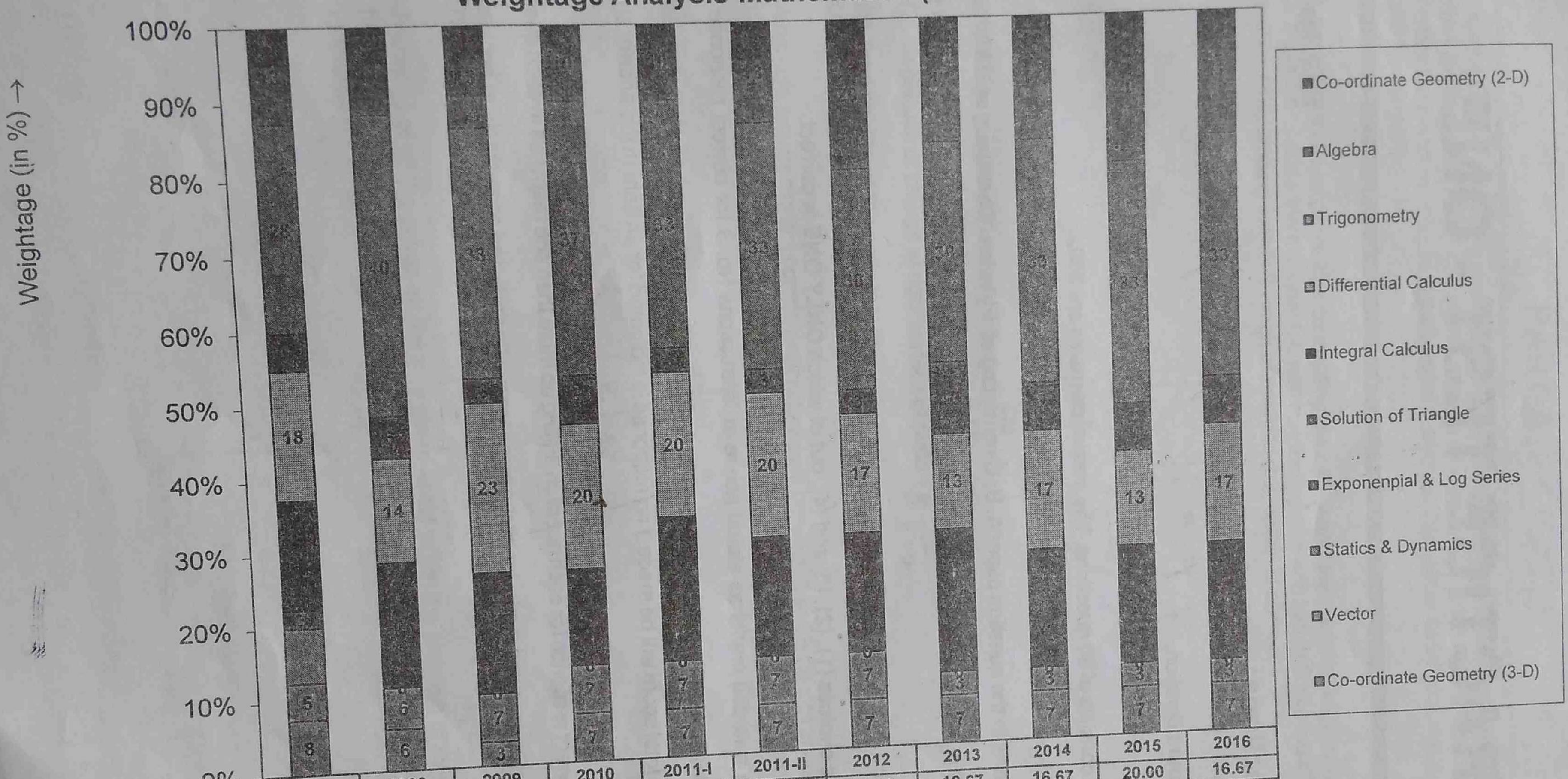
Note: The above data corresponds to Main examination only.

Weightage Analysis

Weightage Analysis for Mathematics JEE (Main) 2007 to 2016

Topic ↓ / No. of Questions →	2007	2008	2009	2010	2011-I	2011-II	2012	2013	2014	2015	2016	Total No. of Question
	40	35	30	30	30	30	30	30	30	30	30	
Co-ordinate Geometry (2-D)	5	4	4	3	3	4	6	5	5	6	5	50
Straight line	2	1	1	1	1	2	2	2	2	1	1	16
Circle	1	1	2	1	1	1	1	1	1	2	2	14
Parabola	1	1	-	1	-	-	1	1	1	2	1	9
Ellipse	-	1	1	-	1	-	2	1	1	1		8
Hyperbola	1	-	-	-	-	1	-	0	0		1	3
Algebra	11	14	10	11	10	10	9	9	10	10	10	114
Complex number	1	1	1	2	2	-	1	1	1	1	1	12
Binomial Theorem	2	1	1	1	1	-	1	1	1	1	1	11
Sequence & Series	1	1	1	1	1	1	2	1	2	1	2	14
Permution & Combination	1	2	1	1	1	1	1	1	0	2	1	12
Quadratic equation	1	1	1	-	-	2	-	1	2	1	1	10
Matries & Determinants	3	3	2	3	2	3	2	2	2	2	2	26
Probability	2	2	2	2	2	1	1	1	1	1	1	16
Mathematical induction	-	1	-	-	-	1		0	0	0		2
Mathematical Reasoning	-	2	1	1	1	1	1	1	1	1	1	11
Trigonometry	2	2	1	2	1	1	1	3	2	2	2	19
Trigo. Ratio & identities	-	-	1	2	1	-	1	1	0	0	1	7
Trigonometric equation	-	-	-	-	-	1	-	1	1	0	1	4
Inverse Trigonometric function	1	1	-	-	-	-	-	1	0	1		4
Height & distance	1	1	-	-	-	-	-	0	1	1		4
Differential Calculus	7	5	7	6	6	6	5	4	5	4	5	60
Sets & Relation	-	1	1	1	1	1	1	1	1	1		9
Functions	1	1	2	-	1	1	-	0	1	0	1	8
Limit of function	-	-	-	1	1	1	-	1	1	1		6
Continuity & Derivability	2	1	1	-	1	2	1	0	0	1	1	10
Differentiation (MOD)	-	-	1	1	1	-	-	1	0	0	1	5
Application of Derivatives (AOD)	4	2	2	3	1	1	3	1	2	1	2	22
Integral Calculus	6	6	5	4	6	5	5	6	5	5	5	58
Indefinite integration	1	1	-	-	-	-	1	1	2	1	1	8
Definite integration	2	1	1	1	2	1	1	2	0	2	1	14
Area under curve	1	1	1	1	1	1	1	1	1	0	1	10
Differential equation	1	2	1	1	2	2	1	1	1	1	1	14
Statistics	1	1	2	1	1	1	1	1	1	1	1	12
Solution of Triangle	0	0	0	0	0	0	0	0	0	0	0	0
Exponenpial & Log Series	1	0	0	0	0	0	0	0	0	0	0	1
Statics & Dynamics	3	0	0	0	0	0	0	0	0	0	0	3
Vector	2	2	2	2	2	2	2	1	1	1	1	18
Co-ordinate Geometry (3-D)	3	2	1	2	2	2	2	2	2	2	2	22

Weightage Analysis Mathematics (AIEEE 2007 To JEE(MAIN) 2016)



	2007	2008	2009	2010	2011-I	2011-II	2012	2013	2014	2015	2016
Co-ordinate Geometry (2-D)	12.50	11.43	13.33	10.00	10.00	13.33	20.00	16.67	16.67	20.00	16.67
Algebra	27.50	40.00	33.33	36.67	33.33	33.33	30.00	30.00	33.33	33.33	33.33
Trigonometry	5.00	5.71	3.33	6.67	3.33	3.33	3.33	10.00	6.67	6.67	6.67
Differential Calculus	17.50	14.29	23.33	20.00	20.00	20.00	16.67	13.33	16.67	13.33	16.67
Integral Calculus	15.00	17.14	16.67	13.33	20.00	16.67	16.67	20.00	16.67	16.67	16.67
Solution of Triangle	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Exponenpial & Log Series	2.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Statics & Dynamics	7.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Vector	5.00	5.71	6.67	6.67	6.67	6.67	6.67	3.33	3.33	3.33	3.33
Co-ordinate Geometry (3-D)	7.50	5.71	3.33	6.67	6.67	6.67	6.67	6.67	6.67	6.67	6.67

Note : The above data corresponds to Main Examination only.

PRACTICE TEST - ONE

Time : 3 Hours **Max. Marks 360**

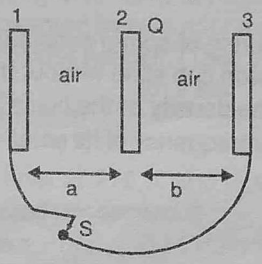
Important Instructions:

1. The test is of **3 hours** duration.
2. The Test Booklet consists of **90** questions. The maximum marks are **360.**
3. There are three parts in the question paper A, B, C consisting of **Physics, Chemistry and Mathematics** having 30 questions in each part of equal weightage. Each question is allotted **4 (four)** marks for each correct response.
4. Each question has choices (1), (2), (3) and (4), out of which **ONLY ONE** is correct.
5. Candidates will be awarded marks as stated above in Instructions No. 3 for correct response of each question. **¼ (one fourth)** marks will be deducted for indicating incorrect response of each question. No deduction from the total score will be made if no response is indicated for an item in the answer sheet.
6. 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 as per instructions 5 above.

PART-A (PHYSICS)

1. A solid sphere of mass 2 kg and density 10^5 kg/m^3 hanging from a string is lowered into a vessel of uniform cross-section area 10 m^2 containing a liquid of density 0.5 x 10^5 kg/m^3, until it is fully immersed. The increase in pressure of liquid at the base of the vessel is (Assume liquid does not spills out of the vessel and take g = 10 m/s^2)
(1) 2 N/m^2 (2) 1N/m^2 (3) 4 N/m^2 (4) 1/2 N/m^2

2. A system of three large parallel conducting plates 1, 2 and 3 are shown in figure, charge on middle plate is Q. Plate 1 and plate 3 are connected with conducting wire and switch S and initially plate 1 and plate 3 are neutral. After closing switch S which of the following option is **correct** -

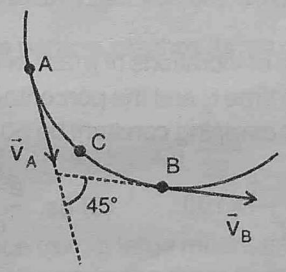


(1) Charge at right surface of plate 2 is $\frac{Qa}{a+b}$

(2) Magnitude of charge at right surface of plate 1 is $\frac{Qb}{a+b}$

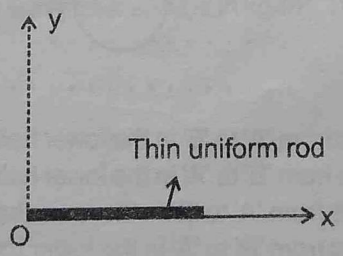
(3) Total charge of the system is Q
(4) All the above options are correct

3. A particle moves along a constant curvature path between A and B (length of curve wire AB is 100m) with a constant speed of 72 km/hr. The acceleration of particle at mid point 'C' of curve AB is :



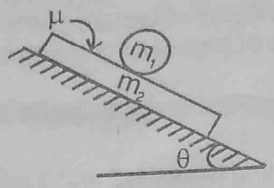
(1) Zero (2) 3.14 m/s^2 (3) 50.84 m/s^2 (4) 50.84 km/hr^2

4. The locus of all the points on the x - y plane about which the moment of inertia of the uniform rod (axes perpendicular to xy-plane) shown in figure, is same as that about axis perpendicular to rod and passing through point 'O' is :



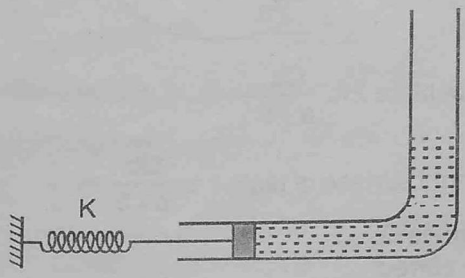
(1) circle (2) parabola (3) straight line (4) ellipse

5. A uniform solid sphere of mass m_1 is placed on the plank of mass m_2 and the coefficient of friction between the plank and sphere is μ. If the inclined plane is frictionless then frictional force on m_1 is (Assume that the plank and uniform solid sphere are released on the inclined plane from rest)



(1) parallel to the incline plane upwards.
(2) parallel to the incline plane downwards.
(3) Zero
(4) $0 < f < \mu m_1 g\cos\theta$

6. A massless piston connected to a spring of spring constant k fits smoothly inside an L shaped fixed glass tube as shown in the figure. The piston can slide without friction and without leakage of water. The cross sectional area of the tube is s and the density of the liquid is ρ. If the system is slightly disturbed from its equilibrium position then the angular frequency of its small oscillations is: (m is the total mass of liquid and the liquid is ideal)

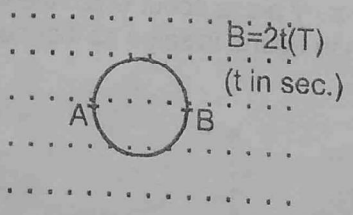


(1) $\sqrt{\frac{2\rho sg}{m}} + \sqrt{\frac{k}{m}}$ (2) $\sqrt{\frac{\rho sg}{m}} + \sqrt{\frac{k}{m}}$ (3) $\sqrt{\frac{k+2\rho sg}{m}}$ (4) $\sqrt{\frac{k+\rho sg}{m}}$

7. In a damped oscillator the amplitude of vibrations of mass m = 150 grams falls by 1/e times of its initial value in time t_0 due to viscous forces. The time t_0 and the percentage loss in mechanical energy during the above time interval t_0 respectively are (Let damping constant be 50 grams/s)

(1) 6s, $\frac{e^2-1}{e^2}\times 100$ (2) 3s, $\frac{e^2-1}{e^2}\times 100$ (3) 6s, $\frac{e-1}{e}\times 100$ (4) 3s, $\frac{e-1}{e}\times 100$

8. A circular coil is placed in a uniform but time varrying magnetic field as shown in figure. Then which of the following is correct statement :



(1) A variable current flows from 'A' to 'B' in the lower half of ring
(2) A variable current flows from 'B' to 'A' in the lower half of ring
(3) A constant current flows from 'A' to 'B' in the lower half of ring
(4) A constant current flows from 'B' to 'A' in the lower half of ring

9. The distance moved by the screw of a screw gauge is 2 mm in four rotations and there are 50 divisions on its cap. When nothing is put between its jaws, 30th division of circular scale coincides with reference line, with zero of circular scale lying above the reference line. When a plate is placed between the jaws, main scale reads 2 division and circular scale reads 20 division. Thickness of plate is :
(1) 1.5 mm (2) 1.2 mm (3) 1.4 mm (4) 1.6 mm

10. Two stars at a distance 20 light years are viewed through a telescope having a lens of 20 cm diameter. Then the minimum separation of these stars for which they appears distinguishable is (λ = 6000 Å)) :
(1) 7.32×10^{-5} light years (2) 3.66×10^{-5} light years
(3) 14.64×10^{-5} light years (4) None of these

11. A car is moving towards an approaching bike. Bike is moving with velocity 30 m/s. Frequency of horn sounded by car is 100 Hz, while it is observed by bike rider as 120 Hz. The actual duration of horn is 6 sec. Find the time interval for which the bike rider hears it. (Take velocity of sound in air as 330 m/s)
(1) 5 sec (2) 6 sec (3) 7 sec
(4) Cannot be calculate with given information

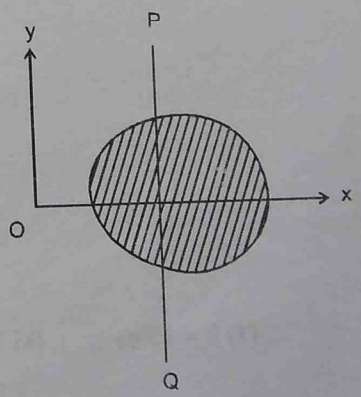
12. A carnot refrigeration cycle absorbs heat at 270 K and rejects heat at 300 K. If the cycle is absorbing 1260 KJ/min at 270 K, then work required per second is :
(1) 2.33 KJ/sec. (2) 4.66 KJ/sec. (3) 1 KJ/sec. (4) 4 KJ/sec.

13. The radius of the orbit of an electron in a Hydrogen-like atom is 3 a_0, where a_0 is the Bohr radius. Its orbital angular momentum is $\frac{3h}{2\pi}$. It is given that h is Planck's constant and R is Rydberg constant. The possible wavelength, when the atom de-excites is :
(1) $\frac{4}{5R}$ (2) $\frac{4}{9R}$ (3) $\frac{1}{2R}$ (4) $\frac{9}{32R}$

14. A particle leaves the origin at t = 0 with an initial velocity $\vec{v} = 3v_0\hat{i}$. It experiences a constant acceleration $\vec{a} = -2a_1\hat{i} - 5a_2\hat{j}$. The time at which the particle reaches its maximum x coordinate is (a_1, a_2 & v_0 are positive number)
(1) $\frac{3V_0}{10a_2}$ (2) $\frac{3V_0}{9a_1 - 5a_2}$ (3) $\frac{3V_0}{2a_1}$ (4) $\frac{3V_0}{2a_1 + 5a_2}$

15. A man beats drum at a certain distance from a large mountain. He slowly increases the rate of beating and finds that the echo is not heard distinctly, when the drum beating is at the rate of 40 per minute. He moves by 80 meter towards the mountain and finds that the echo is again not heard distinctly, when the rate of beating of the drum is 1 per second. What is the initial distance of the man from the mountain ?
(1) 120 m (2) 240 m (3) 270 m (4) 340 m

16. Line PQ is parallel to y-axis and moment of inertia of a rigid body about PQ line is given by $I = 2x^2 - 12x + 27$, where x is in meter and I is in kg-m^2. The minimum value of I is :



(1) 27 kg m^2

(2) 11 kg m^2

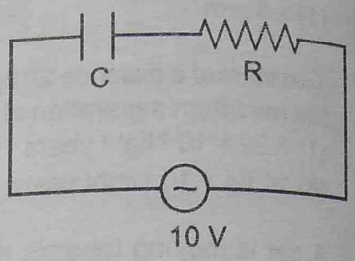
(3) 17 kg m^2

(4) 9 kg m^2

17. A ring of mass m and radius R is rolling without sliding on a flat fixed horizontal surface, with a constant angular velocity. The angle between the velocity and acceleration vectors of a point P on the rim of the ring at the same horizontal level as the centre of the ring may be -

(1) zero (2) 90° (3) 135° (4) $\tan^{-1}1/2$

18. In a series RC circuit shown in figure applied voltage is 10 V and voltage across capacitor is found to be 8 V. Then voltage across R and phase difference between current and applied voltage respectively will be



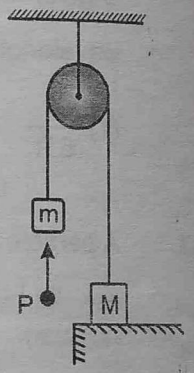
(1) 6V, $\tan^{-1}\left(\frac{4}{3}\right)$ (2) 3V, $\tan^{-1}\left(\frac{3}{4}\right)$

(3) 6V, $\tan^{-1}\left(\frac{5}{3}\right)$ (4) 2V, $\tan^{-1}(1)$

19. The electric field of a plane electromagnetic wave in vacuum is $E_y = 0.5\cos\left[2\pi\times10^8\left\{t-\frac{x}{c}\right\}\right]$ V/m;

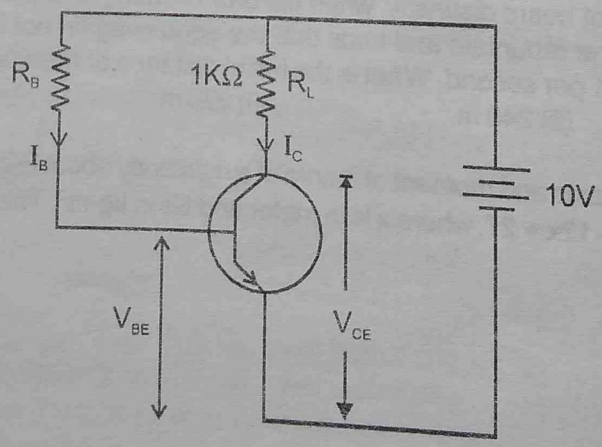
$E_z = E_x = 0$. Then select correct alternative.
(1) Direction of propagation of wave is along +ve x-axis
(2) Plane of polarization is x-y plane
(3) Amplitude of magnetic field is 1.66×10^{-9} T
(4) All of above

20. A light inelastic thread passes over a small frictionless pulley. Two blocks of masses m = 1 kg and M = 3 kg are attached with the thread and heavy block rests on a surface. A particle P of mass 1 kg moving upward with a velocity 10 m/s collides with the lighter block elastically at t = 0. ($g = 10\ m/s^2$). Choose the **incorrect** option.



(1) Velocity with which heavy block is jerked into motion is 2.5 m/s
(2) Maximum height ascended by heavy block after it is jerked into motion is 0.625 m
(3) Impulse of tension in jerk is 7.5 Ns
(4) Time after which block again strikes the surface is 2.5 s

21. In the circuit shown in figure, the current gain $\beta = 100$ for a npn transistor. The bias resistance R_B so that $V_{CE} = 5V$ is ($V_{BE} << 10$ V)

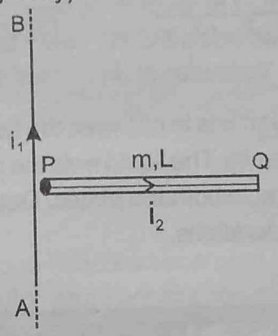


(1) $2\times10^3\Omega$ (2) $10^5\Omega$ (3) $2\times10^5\Omega$ (4) $5\times10^5\Omega$

22. A point mass M is placed at a distance 'd' from infinite sheet. The magnitude of gravitational flux through the sheet is :
(1) $2GM\pi$ (2) $4GM\pi$ (3) $3GM\pi$ (4) $GM\pi$

23. The activity of radioactive sample is measured as 9750 counts per minute at t = 0, and 975 counts per minute at t = 5 minutes. The decay constant approximately is :
(1) 0.230 per minute (2) 0.461 per minute (3) 0.691 per minute (4) 0.922 per minute

24. A metallic uniform rod PQ is hinged at point P and it can rotate about point P in vertical plane and an infinite long wire AB having current i_1 is placed as shown in the figure. If the mass of rod is m and length L, then the current i_2 in rod PQ such that it remains in equilibrium as shown is (separation between P and current carrying wire AB is very small) (consider gravity)

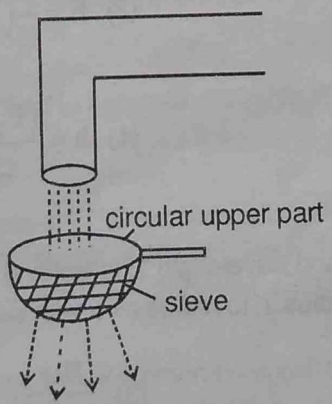


(1) $\frac{2mg\pi}{\mu_0 i_1}$ (2) $\frac{mg\pi}{2\mu_0 i_1}$ (3) $\frac{mg\pi}{4\mu_0 i_1}$ (4) $\frac{mg\pi}{\mu_0 i_1}$

25. Maximum deviation occurs in a prism of refracting angle A_1 and having critical angle of its material as A_2, when the angle of incidence is -

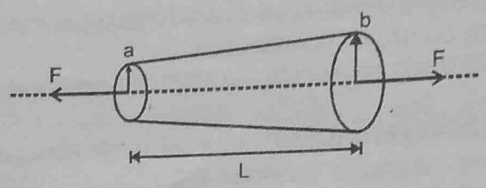
(1) $\sin^{-1}\left[\frac{\sin(A_1 - A_2)}{\sin A_1}\right]$ (2) $\sin^{-1}\left[\frac{\sin A_2}{\sin A_1}\right]$ (3) $\sin^{-1}\left(\frac{\sin A_1}{\sin A_2}\right)$ (4) $\sin^{-1}\left[\frac{\sin(A_1 - A_2)}{\sin A_2}\right]$

26. Water, having positive ions of charge '+e' dissolved in it with concentration c (Number of ions/volume), falls from a tube of cross sectional area 'a' with a speed 'v' in a sieve such that water is not retained in the sieve. The value of $\int \vec{B}.\vec{d\ell}$ integrated over the upper circular part of the sieve will be : [$\vec{B}$ indicates the magnetic field produced by Na^+ ions and $\vec{d\ell}$ is along the tangent on the periphery of circular part of the sieve].



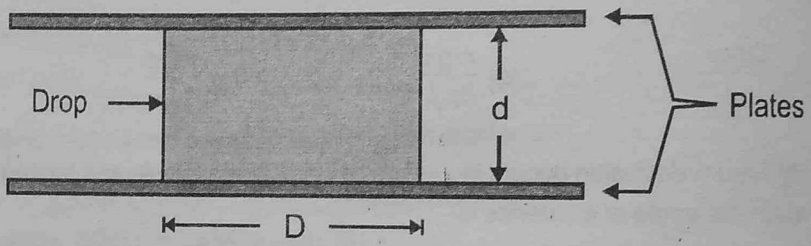
(1) $\mu_0 avce$ (2) $2\mu_0 avce$ (3) $\mu_0 ace/v$ (4) $\mu_{0/} avce$

27. A slightly conical wire of length L and radii a and b is stretched by two forces each of magnitude F, applied parallel to its length in opposite directions and normal to end faces. If Y denotes the Young's modulus, then the extension produced is :



(1) $\frac{FL}{\pi(a^2+b^2)Y}$ (2) $\frac{FL}{\pi(a^2-b^2)Y}$ (3) $\frac{FL}{\pi abY}$ (4) None of these

28. A drop of liquid of surface tension σ is in between the two smooth parallel glass plates held at a distance d apart from each other in zero gravity. The liquid wets the plate so that the drop is a cylinder of diameter D with its curved surface at right angles to both the plates. Determine the force acting on each of the plates from drops under the following considerations.



(1) $\frac{\sigma\pi D}{2}$ (2) $\frac{\sigma^2\pi D}{2}$ (3) zero (4) None of these

29. Ultraviolet light of wavelength λ_1 and $\lambda_2(\lambda_2 > \lambda_1)$ when allowed to fall on hydrogen atoms in their ground state is found to liberate electrons with kinetic energies E_1 and E_2 respectively. The value of planck's constant can be found from the relation.

(1) $h = \frac{1}{c}(\lambda_2-\lambda_1)(E_1-E_2)$ (2) $h = \frac{1}{c}(\lambda_1+\lambda_2)(E_1+E_2)$

(3) $h = \frac{(E_1-E_2)\lambda_1\lambda_2}{c(\lambda_2-\lambda_1)}$ (4) $h = \frac{(E_1+E_2)\lambda_1\lambda_2}{c(\lambda_1+\lambda_2)}$

30. A point source of light of power 'P' and wavelength 'λ' is emitting light in all directions. The number of photons present in a spherical region of radius 'r' to radius r + x with centre at the source is

(1) $\frac{P\lambda}{4\pi r^2 hc}$ (2) $\frac{P\lambda x}{hc^2}$ (3) $\frac{P\lambda x}{4\pi r^2 hc}$ (4) $\frac{3P\lambda x}{4\pi r^2 hc}$

PART-B (CHEMISTRY)

31. $\underset{(I)}{[(H_2O)_4Co(O_2)_2Co(H_2O)_4](SO_4)_2} \xrightarrow{[X]\text{ reagent}} \underset{(II)}{[(H_2O)_4Co(O_2)_2Co(H_2O)_4](SO_4)}$

In both the complex Co has $t_{2g}^6 e_g^0$ configuration. Which option is incorrect ?

(1) Complex (I) is Paramagnetic
(2) Complex (II) is Diamagnetic
(3) (X) is oxidising agent
(4) (X) is reducing agent

32. An azeotropic solution of two liquids has boiling point lower than that of either of the liquids when it
(1) Shows a negative deviation from Raoult's law
(2) Shows no deviation from Raoult's law
(3) Shows positive deviation from Raoult's law
(4) Is saturated

33. In which of the following cases does entropy increase?
(1) $C_2H_4(g) + H_2(g) \longrightarrow C_2H_6(g)$
(2) $N_2O_4(g) \longrightarrow N_2O_4(s)$
(3) Graphite $\longrightarrow$ diamond
(4) Combustion of glucose (s)

34. In qualitative analysis, the metals of Group I can be separated from other ions by precipitating them as chloride salts. A solution initially contains Ag^+ and Pb^{2+} at a concentration of 0.10 M. Aqueous HCl is added to this solution until the Cl^- concentration is 0.10 M. What will the concentrations of Ag^+ and Pb^{2+} be at equilibrium ? (K_{SP} for AgCl = 1.8×10^{-10}, K_{SP} for $PbCl_2$ = 1.7×10^{-5}.)
(1) $[Ag^+] = 1.8 \times 10^{-7}$ M ; $[Pb^{2+}] = 1.7 \times 10^{-6}$ M
(2) $[Ag^+] = 1.8 \times 10^{-11}$ M ; $[Pb^{2+}] = 8.5 \times 10^{-5}$ M
(3) $[Ag^+] = 1.8 \times 10^{-9}$ M ; $[Pb^{2+}] = 1.7 \times 10^{-3}$ M
(4) $[Ag^+] = 1.8 \times 10^{-11}$ M ; $[Pb^{2+}] = 8.5 \times 10^{-4}$ M

35. Consider the following statements and pick out the wrong one.
(1) The solubility, thermal stability and the basic character of the hydroxides of alkaline earth metals increases from $Mg(OH)_2$ to $Ba(OH)_2$.
(2) The dehydration of hydrated chlorides, bromides and iodides of Ca, Sr and Ba can be achieved on heating.
(3) The chlorides of both beryllium and aluminium are soluble in organic solvents and are strong Lewis acids.
(1) (1) and (2) only
(2) (1) and (3) only
(3) (1), (2) and (3)
(4) None

36. In the reaction $[CoCl_2(NH_3)_4]^+ + Cl^- \longrightarrow [CoCl_3(NH_3)_3] + NH_3$, the product complex obtained has no isomer of it. Hence the initial complex must be
(1) cis isomer
(2) trans isomer
(3) both
(4) mixture of both

37. The number of OH units directly linked to boron atoms in $Na_2B_4O_7 \cdot 10H_2O$ is :
(1) 2
(2) 3
(3) 4
(4) 10

38. One mole of an ideal monoatomic gas at 27°C expands adiabatically against a constant external pressure of 1 atm from a volume of 10 dm^3 to a volume of 20 dm^3. Then (Take 1 atm = 1.013×10^5 Pa)
(1) W = –1013 J
(2) ΔU = –1013 J
(3) ΔH = –1688 J
(4) All of the above

39. The number of carbon atoms per unit cell of diamond unit cell is :
(1) 8
(2) 6
(3) 1
(4) 4

40. On heating $K_4[Fe(CN)_6]$ with conc. H_2SO_4 following gas is obtained :
(1) SO_2
(2) CO_2
(3) CO
(4) NO_2

41. Which of the following is correct :
(1) $B(OCH_3)_3$ is much stronger lewis acid than BBr_3
(2) $B(OH)_3$ (aq) behaves as a triprotic acid
(3) The decrease in the B–F bond length in BF_3 is due to delocalised $p_\pi - p_\pi$ bonding between vacant '2p' orbital of B and filled '2p' orbital of F.
(4) $BF_3 > BCl_3 > BBr_3$ lewis acid strength

42. Select the correct statements :
(p) Liquation process is used for purification of impure tin and zinc metals as the impurities present have lesser melting point than the metal itself.
(q) Fractional crystallization method produces metal of very high purity.
(r) Bessemerisation of cast iron involves oxidative refining.
(s) Cupellation involves removal of Ag impurity from Pb metal.
(1) q, r, s (2) p, q, r (3) p, q, s (4) None of these

43. Select the incorrect statement among following :
(1) For an electron with n = 3 with only one radial node, the orbital angular momentum of the electron will be $\sqrt{2}\frac{h}{2\pi}$.
(2) If the de-Broglie wavelength of an electron moving in a circular orbit is λ, then the minimum radius of orbit will be $\frac{\lambda}{\pi}$.
(3) de-Broglie wave length of electron in the 1st orbit of He^+ ion is equal to that in 2nd orbit of Be^{3+}ion.
(4) In case of $d_{x^2-y^2}$ orbital, probability of finding the electrons is maximum along x and y axis.

44. $CaC_2 + N_2 \xrightarrow{1100°C}$ A (ionic compound) + B (element)
(1) anion of A is isoelctronic with CO_2 (2) on hydrolysis of A, NH_4OH is formed
(3) shape of anion of A is linear (4) All of these

45. Which of the following statements is/are correct :
(1) The bleaching action of chlorine is due to oxidation and therefore it is permanent, while the bleaching action of sulphur dioxide is due to reduction therefore it is temporary.
(2) Both HI and HCl can be prepared by heating an ionic iodide/Chloride with conc. H_2SO_4.
(3) The oxidising power of halogens follow the order : $Cl_2 > F_2 > Br_2 > I_2$.
(4) On reaction of XeF_2 with water, no redox change takes place.

46. The substances, P, Q and R have coagulation values 3, 0.6, 0.08 for a metal sol respectively. Their flocculating powers are in the ratio :
(1) 0.0267 : 5 : 1 (2) 1 : 5 : 37.5 (3) 0.08 : 0.6 : 3 (4) 1 : 0.2 : 0.0267

47. The rates of effusion of two gases A and B under the same condition of temperature and pressure are in the ratio $\gamma_A : \gamma_B = 2 : 1$. What would be the ratio of the rms speeds of molecules of A and B at temperature T_A and T_B respectively if $T_A : T_B = 2 : 1$?
(1) $2\sqrt{2} : 1$ (2) 2 : 1 (3) 4 : 1 (4) $\sqrt{3} : 1$

48. The following electrochemical cell is taken.
$Cu \mid Cu^{2+}(aq) \parallel Ag^+(aq) \mid Ag$, and has emf $E_1 > 0$. By which of the following actions, E_1 increases?
(1) Adding NH_3 to the cathodic chamber. (2) Adding HCl to the cathodic chamber.
(3) Adding $AgNO_3$ to the anodic chamber. (4) Adding NH_3 to the anodic chamber.

49. What volume of 3 molar HNO_3 is needed to oxidise 8 g of Fe^{2+} to Fe^{3+}, HNO_3 gets converted to NO :
(1) 8 mL (2) 16 mL (3) 32 mL (4) 64 mL

50. For a reaction A + 2B ⟶ C + D, the following data were obtained :

Expt.	Initial Concentration (mol L^{-1})		Initial rate of formation of D (mol L^{-1} min^{-1})
	(A)	(B)	
1.	0.1	0.1	6.0×10^{-3}
2.	0.3	0.2	7.2×10^{-2}
3.	0.3	0.4	2.88×10^{-1}
4.	0.4	0.1	2.4×10^{-2}

The correct rate law expression will be
(1) Rate = k [A] [B] (2) Rate = k [A] $[B]^2$ (3) Rate = k $[A]^2$ $[B]^2$ (4) Rate = k $[A]^2$ [B]

51. An organic compound A upon reacting with NH_3 gives B. On heating, B gives C. C in presence of KOH reacts with Br_2 to give $CH_3CH_2NH_2$. Compound A is :
(1) CH_3COOH (2) $CH_3CH_2CH_2COOH$ (3) $CH_3-\underset{\displaystyle CH_3}{\underset{|}{CH}}-COOH$ (4) CH_3CH_2COOH

52.
$$\begin{array}{l} CH_2-O-COC_{15}H_{31} \\ | \\ CH-O-COC_{15}H_{31} \\ | \\ CH_2-O-COC_{15}H_{31} \end{array} + 3NaOH \longrightarrow A + \underset{\text{(Soap)}}{\text{Salt of fatty acid}}$$

Product (A) of the reaction is :
(1) Ethylene glycol (2) Glycerol
(3) Glyceryltrinitrate (explosive) (4) Cumene hydrogen peroxide

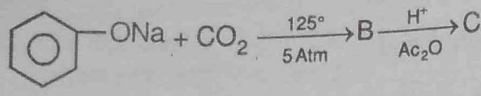
53. What is the major organic product of the following sequence of reaction ?

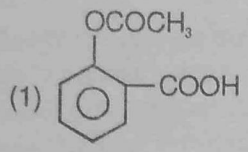
$$(CH_3)_2CHCH_2-OH \xrightarrow{PBr_3} \xrightarrow[\text{Ether}]{Mg} \xrightarrow{\text{O}\atop\diagup\diagdown\atop CH_2-CH_2} \xrightarrow{H_3O^+}$$

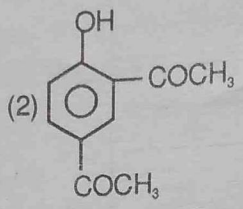
(1) $(CH_3)_2CH-\underset{\displaystyle OH}{\underset{|}{CH}}CH_2CH_3$ (2) $(CH_3)_2CHCH_2\underset{\displaystyle OH}{\underset{|}{CH}}-CH_3$
(3) $(CH_3)_2CHCH_2CH_2-OH$ (4) $(CH_3)_2CHCH_2CH_2CH_2OH$

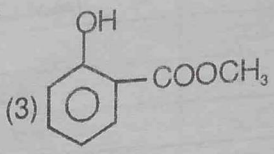
54. The most suitable reagent for the conversion of $R-CH_2-OH \rightarrow R-CHO$ is :
(1) $KMnO_4$ (2) $K_2Cr_2O_7$
(3) CrO_3 (4) PCC (Pyridinium Chlorochromate)

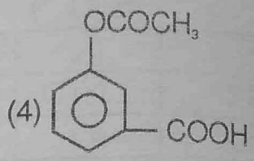
55. Sodium phenoxide when heated with CO_2 under pressure at 125°C yields a product which on acetylation produces C.



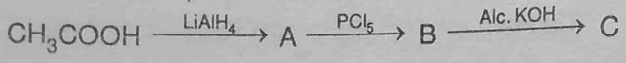
(1) 

(2) 

(3) 

(4) 

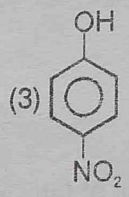
56. In the reaction product C is :

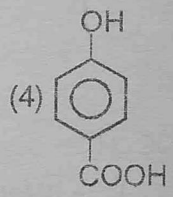


(1) Acetaldehyde (2) Acetylene (3) Ethylene (4) Acetyl chloride

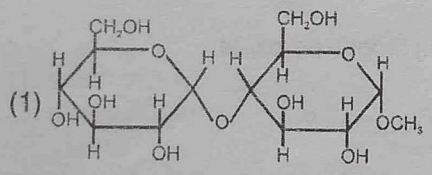
57. Which is most acidic among the followings ?

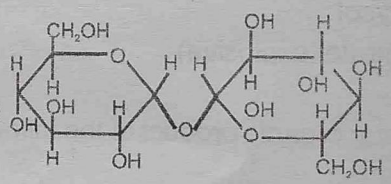
(1) NH_2–OH (2) Ph–OH

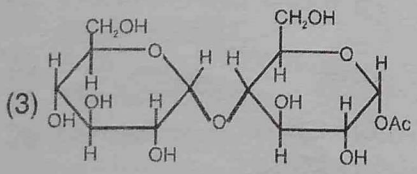
(3) 

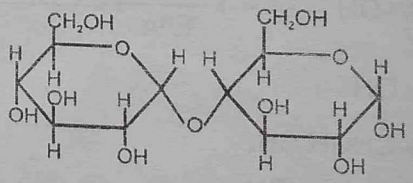
(4) 

58. The phenomenon of mutarotation is shown by :

(1) 

(2) 

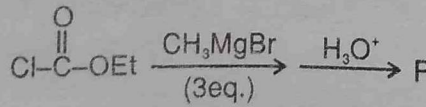
(3) 

(4) 

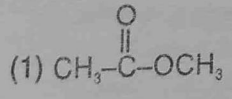
59. A carbonyl compound (Q) is formed by the reductive ozonolysis of olefin (P). Q in the basic medium produced 3- Hydroxybutanal.

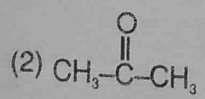
The olefin (P) is :

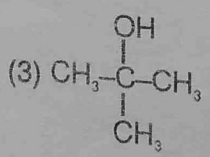
(1) CH_2=CH–CH_2–CH_3 (2) CH_2=CH_2 (3) CH_3–CH=CH–CH_3 (4) $(CH_3)_2$C=CH_2

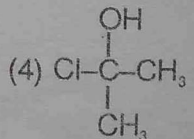
60. 

Product is :

(1) 

(2) 

(3) 

(4) 

PART - C (MATHEMATICS)

61. If m is the slope of the straight line through the point (1, 2), whose distance from the point (13, 1) has the greatest value, then $\frac{2}{3}$m is equal to

(1) 2 (2) 4 (3) 8 (4) 12

62. The distance from the point P(4, 1) to the line $4x - y = 0$, measured along a line making an angle of 135° with the positive x-axis, is

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

63. The equation to the circle which touches the axis of y at the origin and passes through (3, 4) is

(1) $2(x^2 + y^2) - 3x = 0$ (2) $3(x^2 + y^2) - 25x = 0$ (3) $4(x^2 + y^2) - 25y = 0$ (4) $4(x^2 + y^2) - 25x - 10 = 0$

64. **Statement-1 :** If PSQ is the focal chord of the parabola $y^2 = 8x$ such that SP = 6, then SQ is 3.
Statement-2 : The latus rectum of a parabola is the harmonic mean of the segment of any focal chord of the parabola

(1) Statement-1 is true, statement-2 is true ; statement-2 is correct explanation for statement-1.
(2) Statement-1 is true, statement-2 is true ; statement-2 is not a correct explanation for statement-1.
(3) Statement-1 is true, statement-2 is false.
(4) Statement-1 is false, statement-2 is true.

65. The lines $x - y + 1 = 0$ and $x + y - 3 = 0$ are tangents to an ellipse with major axis 8 and minor axis 4. The locus of centre of ellipse is

(1) $x^2 + y^2 + 2x + 4y - 4 = 0$ (2) $x^2 + y^2 + 2x - 4y - 4 = 0$
(3) $x^2 + y^2 - 2x - 4y - 15 = 0$ (4) $x^2 + y^2 - 2x - 4y - 7 = 0$

66. If one root of equation $ix^2 - 2(i + 1)x + (2 - i) = 0$ is $2 - i$, then other root will be -

(1) $-i$ (2) $2 + i$ (3) i (4) $2 - i$

67. Value of $3^{\frac{1}{4}} \times 9^{\frac{1}{8}} \times 27^{\frac{1}{16}}$ ..... is

(1) 9 (2) 27 (3) 3 (4) None of these

68. If origin and non-real roots of $2z^2 + 2z + \lambda = 0$ form three vertices of an equilateral triangle in argand plane then λ is -

(1) 1 (2) 2/3 (3) –1 (4) 3/2

69. Number of prime numbers satisfying the inequation $\frac{1}{10} < 10^x < 1000$ are/is

(1) 1 (2) 2 (3) 3 (4) 4

70. A man observes a tower AB of height h from a point P on the ground. He moves a distance 'd' towards the foot of the tower and finds that the angle of elevation is doubled. He further moves a distance $\frac{3d}{4}$ in the same direction and finds that the angle of elevation is three times that of at the point P, then

(1) $30h^2 = 35d^2$ (2) $35h^2 = 36d^2$ (3) $36h^2 = 35d^2$ (4) $36h^3 = 35d^3$

71. The sum of the series $\sin\theta \sec 3\theta + \sin 3\theta \sec 3^2\theta + \sin 3^2\theta \sec 3^3\theta$ ..... upto n terms is

(1) $\frac{1}{2}\{\tan 3^n\theta - \tan 3^{n-1}\theta\}$ (2) $(\tan 3^n\theta - \tan\theta)$

(3) $\frac{1}{2}(\tan 3^n\theta - \tan\theta)$ (4) None of these

72. The inverse of the proposition $(p \wedge \sim q) \Rightarrow r$ is -

(1) $\sim r \Rightarrow \sim p \vee p$ (2) $\sim p \vee q \Rightarrow \sim r$ (3) $r \Rightarrow p \wedge \sim q$ (4) None of these

73. There are 3 vowels A, E,O and 6 consonants P, Q, R, S, T, B. Number of ways in which these all letters can be arranged in a line, if between any two vowels there are exactly two consonants, is k 6! , then value of k is less than

(1) 18 (2) 24 (3) 12 (4) 6

74. In a triangle ABC, the median to the side BC is of length $\frac{1}{\sqrt{11-6\sqrt{3}}}$ and it divides the angle A into of 30° and 45°. Then the length of side BC is equal to -

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

75. For a regular polygon, let r and R be the radii of the inscribed and the circumscribed circles. A **false** statement among the following is

(1) There is a regular polygon with $\frac{r}{R}=\frac{1}{\sqrt{2}}$. (2) There is a regular polygon with $\frac{r}{R}=\frac{2}{3}$.

(3) There is a regular polygon with $\frac{r}{R}=\frac{\sqrt{3}}{2}$. (4) There is a regular polygon with $\frac{r}{R}=\frac{1}{2}$.

76. If $\lim\limits_{x\to 0}\frac{ae^x-b\cos x+ce^{-x}}{x\sin x}=2$ then

(1) $a+b+c=0$ (2) $a-b+c=4$ (3) $a+b+c=4$ (4) $a+b-c=0$

77. If $5f(x)+3f\left(\frac{1}{x}\right)=x+2$ and $y=xf(x)$ then $\frac{dy}{dx}$ at $x=1$ is–

(1) 1 (2) –1 (3) $\frac{7}{8}$ (4) $-\frac{7}{8}$

78. solution set of the equation $\sin^{-1}x+\sin^{-1}(1-x)=\cos^{-1}x$ is -

(1) {0, 1} (2) $\left[0,\frac{1}{2}\right]$ (3) $\left\{0,\frac{1}{2}\right\}$ (4) [0, 1]

79. Let a relation R in the set of natural numbers be defined as $(x, y) \Leftrightarrow x^2-4xy+3y^2=0$ $x, y \in N$. The relation R is -

(1) symmetric (2) Reflexive (3) transitive (4) an equivalence relation

80. If $f(x)=\begin{cases}\frac{\sin[x^2]\pi}{x^2-3x-18}+ax^3+b & 0\le x\le 1\\ 2\cos\pi x+\tan^{-1}x, & 1<x\le 2\end{cases}$ is differentiable funciton in [0, 2], then possible value of a is -

(1) $\frac{\pi}{4}-\frac{13}{6}$ (2) $\frac{1}{6}$ (3) $-\frac{1}{6}$ (4) None of these

81. A survey shows that 63% of the Indian like apples whereas 76% like oranges. If x% of the Indian like both apples & oranges then

(1) minimum value of x is 39
(2) maximum value of x is 63
(3) one possible value of x is 51
(4) all of these

82. $\int \frac{\log(x+1)-\log x}{x(x+1)}\,dx =$

(1) $-\frac{1}{2}\log^2(x+1)-\frac{1}{2}\log^2 x+\log(x+1)\log x+c$

(2) $-\frac{1}{2}\log\left(1+\frac{1}{x}\right)+c$

(3) $-\log^2(x+1)-\log^2 x+\log x\log(x+1)+c$

(4) None of these

83. If $\beta > \alpha$, then $\int_{\alpha}^{\beta} \frac{1}{\sqrt{(x-\alpha)(\beta-x)}}\,dx =$

(1) $\sin^{-1}\left(\frac{\alpha}{\beta}\right)$ (2) $\sin^{-1}\left(\frac{\beta}{\alpha}\right)$ (3) $\pi/2$ (4) π

84. The area bounded by the curves $y = xe^x$, $y = xe^{-x}$ and $x = 1$ is -

(1) $\frac{1}{e}$ (2) $\frac{2}{e}$ (3) $1-\frac{1}{e}$ (4) $1-\frac{2}{e}$

85. Solution of $\frac{dy}{dx}=\frac{ax+h}{by+k}$ represents a parabola if -

(1) $a=-2, b=0$ (2) $a=2, b=2$ (3) $a=-2, b=2$ (4) $a=0, b=0$

86. **Statement – 1 :** Let $A(\vec{a})$, $B(\vec{b})$ and $C(\vec{c})$ be three points such that $\vec{a}=2\hat{i}+\hat{j}+\hat{k}$, $\vec{b}=3\hat{i}-\hat{j}+3\hat{k}$ and $\vec{c}=-\hat{i}+7\hat{j}-5\hat{k}$, then OABC is a tetrahedron.

Statement – 2 : Let $A(\vec{a})$, $B(\vec{b})$ and $C(\vec{c})$ be three points such that $\vec{a}$, $\vec{b}$ and $\vec{c}$ are non-coplanar. then OABC is a tetrahedron, where O is the origin.

(1) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.
(2) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1
(3) Statement-1 is True, Statement-2 is False
(4) Statement-1 is False, Statement-2 is True

87. If $\vec{a}, \vec{b}, \vec{c}$ are three non-coplanar non-zero vectors and $\vec{r}$ is any vector in space, then $(\vec{a}\times\vec{b})\times(\vec{r}\times\vec{c}) + (\vec{b}\times\vec{c})\times(\vec{r}\times\vec{a}) + (\vec{c}\times\vec{a})\times(\vec{r}\times\vec{b})$ is equal to

(1) $2[\vec{a}\ \vec{b}\ \vec{c}]\,\vec{r}$ (2) $3[\vec{a}\ \vec{b}\ \vec{c}]\,\vec{r}$ (3) $[\vec{a}\ \vec{b}\ \vec{c}]\,\vec{r}$ (4) none of these

88. If a real valued function f(x) satisfies $2f(xy) = (f(x))^y + (f(y))^x \quad \forall\ x, y \in R$, $f(1) = a$ where $a \neq 1$ then $(a-1)\sum_{i=1}^{n} f(i)$ is equal to -

(1) a^n (2) a^{n+1} (3) $a^{n-1} + a$ (4) $a^{n+1} - a$

89. A coin is tossed n times. The probability of getting at least one head is greater than that of getting at least two tails by $\frac{5}{32}$. Then n is

(1) 15 (2) 5 (3) 10 (4) none of these

90. Let $f(x) = \tan x$, $g(f(x)) = f\left(x - \frac{\pi}{4}\right)$, where f(x) and g(x) are real valued functions. For all possible value of x, f(g(x)) is equal to

(1) $\tan\left(\frac{x-1}{x+1}\right)$ (2) $\tan(x-1) - \tan(x+1)$

(3) $\frac{f(x)+1}{f(x)-1}$ (4) $\frac{x-\pi/4}{x+\pi/4}$

Answers

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

PRACTICE TEST - TWO

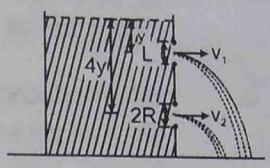
Time : 3 Hours **Max. Marks 360**

Important Instructions:

1. The test is of **3 hours** duration.
2. The Test Booklet consists of **90** questions. The maximum marks are **360.**
3. There are three parts in the question paper A, B, C consisting of **Physics, Chemistry and Mathematics** having 30 questions in each part of equal weightage. Each question is allotted **4 (four)** marks for each correct response.
4. Each question has choices (1), (2), (3) and (4), out of which **ONLY ONE** is correct.
5. Candidates will be awarded marks as stated above in Instructions No. 3 for correct response of each question. ¼ **(one fourth)** marks will be deducted for indicating incorrect response of each question. No deduction from the total score will be made if no response is indicated for an item in the answer sheet.
6. 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 as per instructions 5 above.

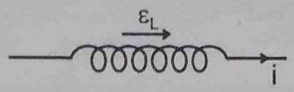
PART-A (PHYSICS)

1. A large open tank has two holes in the wall. One is a square hole of side L at a depth y from the top and the other is a circular hole of radius R at a depth 4y from the top. When the tank is completely filled with water, the quantities of water flowing out per second from both holes are the same. Then radius R, is equal to :



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

2. At a given instant the current and self induced emf in an inductor are directed as shown in figure. If the induced emf is 17 volt and rate of change of current is 25 kA/s the correct statement is :



(1) Current is increasing and inductance of coil is 3.4 μH
(2) Current is decreasing and inductance of coil is 680 μH
(3) Current is decreasing and inductance of coil is 3.4 μH
(4) Current is increasing and inductance of will is 6.8 μH

3. **Statement-1 :** If the centre of mass of object is hinged, then net external force on the object will be zero.

Statement-2 : $\vec{F}_{ext} = M\vec{a}_{cm}$, where symbols have usual meanings.

(1) Statement-1 is True, Statement-2 is True; Statement-2 **is** a correct explanation for Statement-1
(2) Statement-1 is True, Statement-2 is True; Statement-2 **is NOT** a correct explanation for Statement-1
(3) Statement-1 is True, Statement-2 is False
(4) Statement-1 is False, Statement-2 is True.

4. The surface tension and bulk modulus of elasticity of water are S and B respectively. Then the ratio $\frac{B}{S}$ is dimensionally equivalent to the dimension of

(1) Length (2) Wave number (3) $(\text{area})^{-1}$ (4) Force

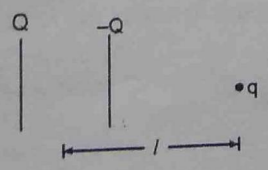
5. A stone projected from the ground level falls on the ground after 4 second. Then the height of the stone 1 second after the projection (Take $g = 10\ m/s^2$)
(Take $g = 10\ m/s^2$)

(1) 5 m (2) 10 m (3) 15 m (4) 20 m

6. A force of 6.4N stretches a vertical spring by 0.1m. The mass that must be suspended from the spring so that it oscillates with a time period of $\pi/4$ second.

(1) $\frac{\pi}{4}$ kg (2) $\frac{4}{\pi}$ kg (3) 1 kg (4) 10 kg

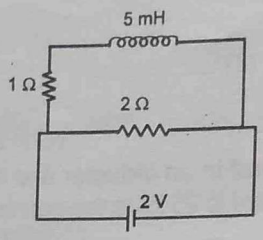
7. The plates of small size of a parallel plate capacitor are charged as shown . The force on the charged particle of 'q' at a distance 'l' from the capacitor is : (Assume that the distance between the plates is $d << l$)



(1) zero (2) $\frac{Qqd}{2\pi\epsilon_0 \ell^3}$ (3) $\frac{Qqd}{\pi\epsilon_0 \ell^3}$ (4) $\frac{Qqd}{4\pi\epsilon_0 \ell^3}$

8. Amplitude of a travelling wave on a string is 1mm. If linear mass density of string is 10^{-4} kg m^{-1}, tension in the string is 1N and frequency of vibration is 10Hz, then average power needed to maintain such waves in string is : ($\pi^2 = 10$)
(1) 3×10^{-5} W (2) 2×10^{-5} W (3) 4×10^{-5} W (4) 10^{-5} W

9. When induced emf in inductor coil is 50% of its maximum value then stored energy in inductor coil in the given circuit will be : -



(1) 2.5 mJ (2) 5mJ (3) 15 mJ (4) 20 mJ

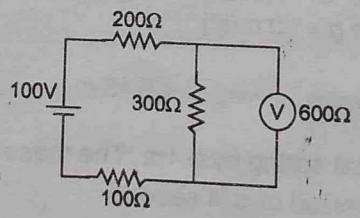
10. If a prism having refractive index $\sqrt{2}$ has angle of minimum deviation equal to the angle of refraction of the prism, then the angle of refraction of the prism is:
(1) 30° (2) 45° (3) 60° (4) 90°

11. A satellite is in a circular orbit around the earth has kinetic energy E_k. Minimum amount of energy that is added so that it escapes the earth's gravitational field is:
(1) E_k (2) $E_k/2$ (3) $E_k/4$ (4) $2E_k$

12. An oscillator is producing FM waves of frequency 2 kHz with a variation of 10 kHz. What is the modulating index
(1) 0.20 (2) 5.0 (3) 0.67 (4) 1.5

13. The path difference between two interfering waves at a point on the screen is $\lambda/6$. The ratio of intensity at this point and that at the central bright fringe will be : (Assume that intensity due to each slit in same)
(1) 0.853 (2) 8.53 (3) 0.75 (4) 7.5

14. The reading of voltmeter is

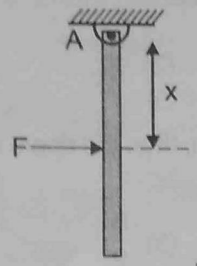


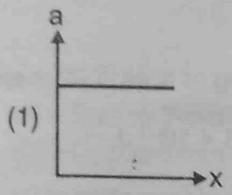
(1) 50V (2) 60 V (3) 40V (4) 80 V

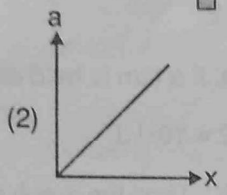
15. A thermodynamic process of one mole ideal monoatomic gas is shown in figure. The efficiency of cyclic process ABCA will be :

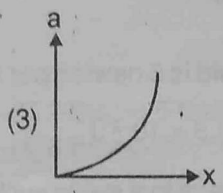
(1) 25% (2) 12.5% (3) 50% (4) $\frac{100}{13}$ %

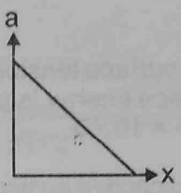
16. A uniform rod of mass m and length L is hinged at one of its end A and a force F is applied at a distance x from A. The acceleration of centre of mass 'a' at the instant shown varies with x as :



(1) 

(2) 

(3) 

(4) 

17. For a particle in S.H.M., if the amplitude of displacement is 'a' and the amplitude of velocity is 'v' the amplitude of acceleration is

(1) va (2) $\frac{v^2}{a}$ (3) $\frac{v^2}{2a}$ (4) $\frac{v}{a}$

18. Thermal coefficient of volume expansion at constant pressure for an ideal gas sample of n moles having pressure P_0, volume V_0 and temperature T_0 is

(1) $\frac{R}{P_0V_0}$ (2) $\frac{P_0V_0}{R}$ (3) $\frac{1}{T_0}$ (4) $\frac{1}{nT_0}$

19. **Statement–1:** If potential difference between two points is non zero in an electric circuit, electric current between those two points may be zero.
Statement–2: Current always flows from high potential to low potential
(1) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.
(2) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1
(3) Statement-1 is True, Statement-2 is False
(4) Statement-1 is False, Statement-2 is True

20. A conducting wire of length L fixed at both ends is vibrating in its fundamental mode with angular frequency ω and maximum amplitude A. There exists a uniform and constant magnetic field of induction B perpendicular to the plane of oscillations of the wire. The maximum emf induced in the wire is:

(1) $\frac{BA\omega L}{\pi}$ (2) $\frac{2BA\omega L}{\pi}$ (3) $\frac{BA\omega L}{2\pi}$ (4) $\frac{BA\omega L\pi}{2}$

21. The distance of n^{th} bright fringe to the $(n+1)^{th}$ dark fringe in Young's experiment is equal to:

(1) $\frac{n\lambda D}{d}$ (2) $\frac{n\lambda D}{2d}$ (3) $\frac{\lambda D}{2d}$ (4) $\frac{\lambda D}{d}$

22. If ε_0 and μ_0 are the electric permittivity and magnetic permeability in free space, ε and μ are the corresponding quantities in a medium, then index of refraction of the medium is

(1) $\sqrt{\frac{\varepsilon_0\mu}{\varepsilon\mu_0}}$ (2) $\sqrt{\frac{\varepsilon}{\varepsilon_0}}$ (3) $\sqrt{\frac{\varepsilon_0\mu_0}{\varepsilon\mu}}$ (4) $\sqrt{\frac{\varepsilon\mu}{\varepsilon_0\mu_0}}$

23. When a metallic surface is illuminated with monochromatic light of wavelength λ, the stopping potential is $5V_0$. When the same surface is illuminated with light of wavelength 3λ, the stopping potential is V_0. Then the work function of the metallic surface is :

(1) $\frac{hc}{6\lambda}$ (2) $\frac{hc}{5\lambda}$ (3) $\frac{hc}{4\lambda}$ (4) $\frac{2hc}{4\lambda}$

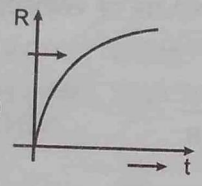
24. If the frequency of input alternating potential is n, then the ripple frequency of output potential of full wave rectifier will be-

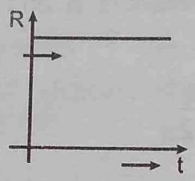
(1) 2n (2) n (3) $\frac{n}{2}$ (4) $\frac{n}{4}$

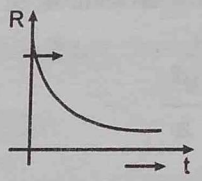
25. The surface tension of a liquid is 5 newton per metre. If a film is held on a ring of area 0.02 metres^2, its surface energy is about :

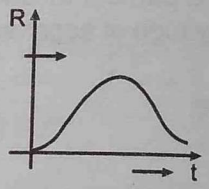
(1) 5×10^{-2} J (2) 2.5×10^{-2} J (3) 2×10^{-1} J (4) 3×10^{-1} J

26. A radioactive nucleus 'X' decays to a stable nucleus 'Y'. Then the graph of rate of formation of 'Y' against time 't' will be :

(1) 

(2) 

(3) 

(4) 

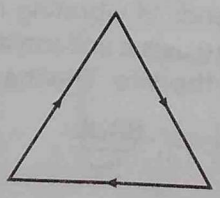
27. A prism of refractive index μ_g deviates the incident ray towards its base. If it is immersed in a transparent liquid of refractive index μ_l such that $\mu_l > \mu_g$ then prism would

(1) deviate the ray towards its base (2) deviate the ray away from its base
(3) bot deviate the ray at all (4) nothing can be said

28. Three charges + 4q, -q and +4q are kept on a straight line at position (0, 0, 0), (a, 0, 0) and (2a, 0, 0) respectively. Considering that they are free to move along the x-axis only

(1) all the charges are in stable equilibrium
(2) all the charges are in unstable equilibrium
(3) only the middle charge is in stable equilibrium
(4) only middle charge is in unstable equilibrium

29 A current I flows along a triangular loop having sides of equal length a'. The strength of magnetic field at the centre of the loop is :



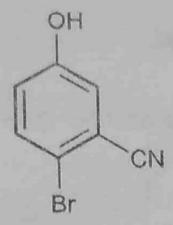
(1) $\frac{3\mu_0 I}{2\pi a}$ (2) $\frac{9\mu_0 I}{2\pi a}$ (3) $\frac{3\sqrt{3}\mu_0 I}{2\pi a}$ (4) $\frac{3\mu_0 I}{4\pi a}$

30 An electron (of charge –e) revolves around a long wire with uniform charge density λ in a circular path of radius r. Its kinetic energy is given by

(1) $\frac{\lambda e}{2\pi \epsilon_0 r}$ (2) $\frac{\lambda e}{4\pi \epsilon_0 r}$ (3) $\frac{\lambda e}{2\pi \epsilon_0}$ (4) $\frac{\lambda e}{4\pi \epsilon_0}$

PART-B (CHEMISTRY)

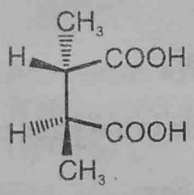
31. The IUPAC name of the following compound is :



(1) 4-Bromo-3-cyanophenol
(2) 2-Bromo-5-hydroxybenzonitrile
(3) 2-Cyano-4-hydroxybromobenzene
(4) 6-Bromo-3-hydroxybenzonitrile

32. The IUPAC name for the complex $[Co(NO_2)(NH_3)_5]Cl_2$ is :
(1) nitrito-N-pentaamminecobalt(III) chloride
(2) nitrito-N-pentaamminecobalt(II) chloride
(3) pentaamminenitrito-N-cobalt(II) chloride
(4) pentaamminenitrito-N-cobalt(III) chloride

33. KO_2 (potassium super oxide) is used in space and submarines because it :
(1) absorbs CO_2 and increases O_2 contents
(2) eliminates moisture and increases CO contents
(3) absorbs CO_2 only
(4) produces ozone

34. 

The correct statement about above molecule is :
(1) molecule is optically inactive.
(2) has plane of symmetry.
(3) has centre of symmetry.
(4) has C_2 axis of symmetry.

35. Degree of hydrolysis of 0.25 M CH_3COONa is 10% what will be the degree of hydrolysis if concentration of CH_3COONa is made 0.01 M
(1) 10%
(2) 1%
(3) 50%
(4) 75%

36. Which of the following options with respect to increasing bond order is correct ?
(1) $NO < C_2 < O_2^- < B_2$
(2) $C_2 < NO < B_2 < O_2^-$
(3) $B_2 < O_2^- < NO < C_2$
(4) $B_2 < O_2^- < C_2 < NO$

37. According to Bohr's model, if the kinetic energy of an electron in 2nd orbit of He^+ is x, then what should be the ionisation energy of the electron revolving in 3rd orbit of M^{5+} ion
(1) x
(2) 4x
(3) $\frac{x}{4}$
(4) 2x

38. Osmotic pressure at 300 K when 1g glucose (P_1), 1 g urea (P_2) and 1 g sucrose (P_3) are dissolved in 500 ml of water are follows the order.
(1) $P_1 > P_2 > P_3$
(2) $P_2 > P_1 > P_3$
(3) $P_3 > P_1 > P_2$
(4) $P_2 > P_3 > P_1$

39. $Ph-C\equiv N \xrightarrow[(2)H_2O]{(1)DIBAL-H} P \xrightarrow[\Delta]{KOH} Q + R$

Correct statement for the above products is :

(1) P is Ph–COOH

(2) If Q is salicylic acid then R is para-hydroxybenzoic acid.

(3) If Q is benzoic acid then R is benzyl alcohol.

(4) P is $Ph-CH_2-NH_2$

40. Match the following columns :

	Column-I		Column-II
(A)	Nylon-6	(p)	Addition copolymer
(B)	Buna-S	(q)	Addition homopolymer
(C)	Polythene	(r)	Condensation homopolymer
(D)	Teflon	(s)	Condensation copolymer

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

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

(3) (A) - r ; (B) - p ; (C) - q ; (D) - q

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

41. Which of the following is a planar molecule ?

(1) XeO_2F_2 (2) $XeOF_3$ (3) XeF_4 (4) XeF_6

42. In a face centred cubic arrangement of metallic atoms, what is the relative ratio of the sizes of tetrahedral and octahedral voids?

(1) 0.543 (2) 0.732 (3) 0.414 (4) 0.637

43. Extra pure N_2 can be obtained by heating

(1) NH_3 with calcium hypochlorite

(2) $NH_4Cl + NaNO_3$

(3) $(NH_4)_2Cr_2O_7$

(4) $Ba(N_3)_2$

44. The uncertainty in position and velocity of the particle are 0.1 nm and 5.27×10^{-27} ms^{-1} respectively then the mass of the particle is : ($h = 6.625 \times 10^{-34}$Js)

(1) 200 g (2) 300 g (3) 100 g (4) 1000 g

45. A complex $[CrCl_3(Py)_3]$ (atomic number of Cr = 24) has chromium in +3 oxidation state (i.e. $3d^3$ electron configuration). According to crystal field theory, the correct distribution of 3d electrons in the chromium present in the complex is :

(1) $3d^1_{xy}, 3d^1_{yz}, 3d^1_{zx}$

(2) $3d^1_{(x^2-y^2)}, 3d^1_{z^2}, 3d_{xy}$

(3) $3d^1_{xy}, 3d^1_{yz}, 3d^1_{zy}$

(4) $3d^1_{xy}, 3d^1_{yz}, 3d^1_{(x^2-y^2)}$

46. $[Fe(NO_2)_3Cl_3]$ and $[Fe(ONO)_3Cl_3]$ shows :

(1) linkage isomerism

(2) geometrical isomerism

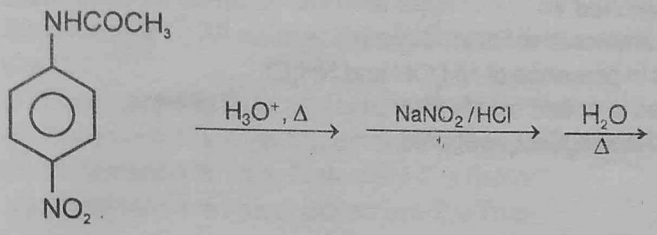
(3) optical isomerism

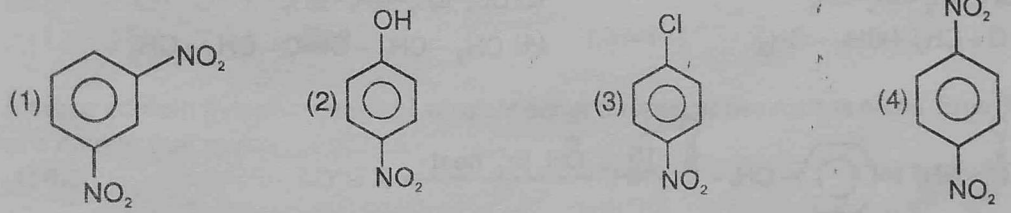
(4) none of the above

47. Temperature at which r.m.s. speed of O_2 is equal to that of neon at 300 K is :
(1) 280 K (2) 480 K (3) 680 K (4) 180 K

48. The reaction of propene with HOCl in acidic medium proceeds via the addition of :
(1) H^+ in the first step
(2) Cl^+ in the first step
(3) OH^- in the first step
(4) Cl^+ and OH^- in a single step

49. The product of the following reaction is :





50. An aqueous solution containing 21.6 mg at solute in 100 ml of solution had an osmotic pressure of 3.70 mm of Hg at 25°C. The molecular wt of solute in g/mol is
(1) 1085 (2) 9035 (3) 1355 (4) 700

51. The oxidation state of sulphur in the anions SO_3^{2-}, $S_2O_4^{-2}$ and $S_2O_6^{2-}$ follows the order :
(1) $S_2O_6^{2-} < SO_4^{2-} < SO_3^{2-}$
(2) $S_2O_4^{2-} < SO_3^{2-} < S_2O_6^{2-}$
(3) $SO_3^{2-} < S_2O_4^{2-} < S_2O_6^{2-}$
(4) $S_2O_4^{2-} < S_2O_6^{2-} < SO_3^{2-}$

52. How many moles of $KMnO_4$ are needed to oxidised a mixture of 1 mole of each $FeSO_4$ & FeC_2O_4 in acidic medium :
(1) $\frac{4}{5}$ (2) $\frac{5}{4}$ (3) $\frac{3}{4}$ (4) $\frac{5}{3}$

53. When MnO_2 is fused with KOH, a coloured compound is formed. The product and its colour is :
(1) K_2MnO_4, green (2) Mn_2O_3, brown (3) Mn_2O_4, black (4) $KMnO_4$, purple

54. You are given the following cell at 298 K, $Zn \left| \begin{matrix} Zn^{++}(aq.) \\ 0.01\ M \end{matrix} \right| \left| \begin{matrix} HCl(aq.) \\ 1.0\ lit \end{matrix} \right| \left| \begin{matrix} H_2(g) \\ 1.0\ atm \end{matrix} \right| Pt$

with $E_{cell} = 0.701$ and $E^0_{Zn^{2+}/Zn} = -0.76$ V. Which of the following amounts of NaOH (equivalent weight = 40) will just make the pH of cathodic compartment to be equal to 7.0 :
(1) 0.4 g (2) 4 g (3) 10 g (4) 2 g

55. Which one of the following statements is correct in relation to ionization enthalpy ?
(1) Electron-electron repulsion forces in the outer orbitals of the elements does not affect the ionization enthalpy.
(2) Removal of electron from orbitals bearing higher 'n' value is easier than from orbitals having lower 'n' value.
(3) The ionization enthalpies of iso-electronic species in general are same because their size and electron configuration are same.
(4) End of valence electrons is indicated by a small jump in ionization enthalpy.

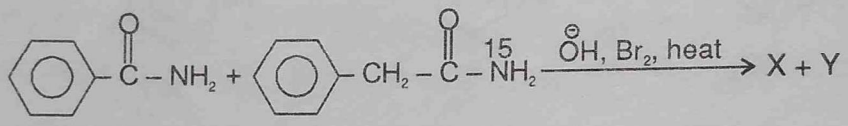
56. Which of the following is not correctly matched ?
(1) Ni^{2+} – Red precipitate with DMG and ammonia solution.
(2) Zn^{2+} – White precipitate with H_2S gas in presence of NH_4OH and NH_4Cl.
(3) Al^{3+} – Infusible green mass is obtained in cobalt nitrate test.
(4) Pb^{2+} – Yellow precipitate with both KI and K_2CrO_4 reagents.

57. What is the final product of reaction ?

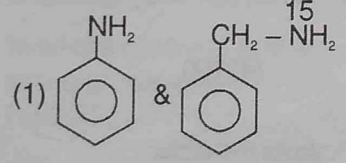
$$CH_3-CH_2-C\equiv CH \xrightarrow{Na} X \xrightarrow{CH_3-I} \text{Product}$$

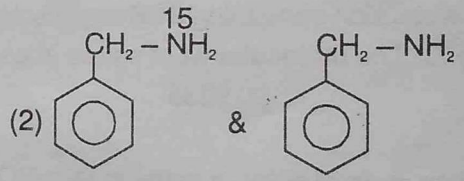
(1) $CH_2=CH-CH_2-CH_2-CH_3$
(2) $CH_3-CH_2-C\equiv C-CH_3$
(3) $CH\equiv C-CH_2-CH_2-CH_3$
(4) $CH_3-CH_2-C\equiv C-CH_2-CH_3$

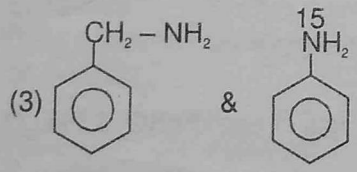
58.

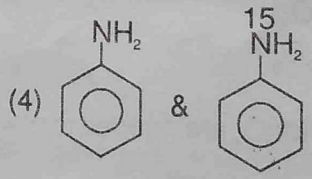


Product X &Y can be :

(1) 

(2) 

(3) 

(4) 

59. A mixture of N_2 & H_2 of 1 : 3 molar ratio at 50 atm & 923 K is allowed to react till equilibrium is obtained. The NH_3 present at equilibrium is 25 % by wt. then calculate K_p for $\frac{1}{2}N_2 + \frac{3}{2}H_2 \rightleftharpoons NH_3$.
(1) 9.26×10^{-5} (2) 9.62×10^{-3} (3) 2.43×10^{-4} (4) 4.52×10^{-3}

60. Sucrose on hydrolysis yields a mixture, which is:
(1) optically inactive (2) dextrorotatory (3) laevorotatory (4) racemic

PART - C (MATHEMATICS)

61. If the graph of the function $y = f(x)$ has a unique tangent at the point (a, 0) through which the graph passes then $\lim_{x\to a} \frac{\log_e(1+6(f(x))}{3f(x)}$ is

(1) 1 (2) 2 (3) 3 (4) –2

62. **Statement-1 :** The differential equation $y^3\,dy + (x + y^2)\,dx = 0$ becomes homogeneous if we put $y^2 = t$
Statement-2 : All differential equation of first order and first degree becomes homogeneous if we put $y = tx$

(1) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.
(2) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1
(3) Statement-1 is True, Statement-2 is False
(4) Statement-1 is False, Statement-2 is True

63. Vector $(-bc, b^2 + bc, c^2 + bc)$, $(a^2 + ac, -ac, c^2 + ac)$ and $(a^2 + ab, b^2 + ab, -ab)$ are coplanar where a,b,c are non-zero then ab + bc + ca is

(1) 1 (2) 2 (3) – 1 (4) 0

64. A purse contain five coins each of which is either a rupee or two rupees coins. Find the expected value of a coin in that purse

(1) 6.5 (2) 17.5 (3) 7.5 (4) 8.5

65. Let function $f : X \to Y$, defined as $f(x) = x^2 - 4x + 5$ is invertible and its inverse is $f^{-1}(x)$, then

(1) $X = [2, \infty)$, $Y = [1, \infty)$, $f^{-1}(x) = 2 + \sqrt{x-1}$ (2) $X = (-\infty, 2)$, $Y = (1, \infty)$, $f^{-1}(x) = 2 - \sqrt{x-1}$

(3) $X = (-\infty, \infty)$, $Y = [1, \infty)$, $f^{-1}(x) = 2 - \sqrt{x^2+1}$ (4) none of these

66. Solution of the differential equation $x^2y\,\frac{d^2y}{dx^2} + \left(\frac{xdy}{dx} - y\right)^2 = 0$ is

(1) $y = \sqrt{x(c_2x^2 + 2c_1)}$ (2) $y = \sqrt{x(c_1 - 2c_2x^2)}$ (3) $y = \sqrt{x(c_2x - 2c_1)}$ (4) $y^2 = \sqrt{x(c_2x + 2c_1)}$

67. $\int_{-\pi/4}^{\pi/4} \frac{\sec^2 x}{1+3^x}dx =$

(1) 2 (2) 1 (3) 0 (4) 4

68. The locus of the point $(\sqrt{3h+2}, \sqrt{3k})$. If (h, k) lies on x + y = 1 is

(1) a pair of straight lines (2) a circle
(3) a parabola (4) an ellipse

69. Let $f : R \to R$ be a function such that $f\left(\frac{x+y}{3}\right) = \frac{f(x)+f(y)}{3}$, $f(0) = 0$ and $f'(0) = 3$ then f(x) is :

(1) 3x (2) 3x + 1 (3) $4x^2$ (4) $4x^2 + 1$

70. **Statement - 1 :** The area of a circle is A_1 and the area of regular pentagon inscribed in the circle is A_2. Then $A_1/A_2 = \frac{\pi}{5}\sec\frac{\pi}{10}$

Statement - 2 : Area of pentagon is $\frac{5r^2}{2}\cos 18°$. If radius of circles is r.

(1) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.
(2) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1
(3) Statement-1 is True, Statement-2 is False
(4) Statement-1 is False, Statement-2 is True

71. Number of distinct normals that can be drawn from $\left(\frac{11}{4}, \frac{1}{4}\right)$ to the parabola $y^2 = 4x$ is

(1) 1 (2) 2 (3) 3 (4) 4

72. Values of n for which the length of subnormal of the curve $xy^n = a^{n+1}$ is constant

(1) 3 (2) -2 (3) -3 (4) $\frac{1}{2}$

73. $\sum_{r=1}^{n} \frac{1}{(r+1)(r+2)} {}^{n+3}C_r =$

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

(3) $\frac{2^{n+5}-2}{(n+4)(n+5)} - \frac{2}{n+4} - 1$ (4) None of these

74. There are n points in a plane of which p points are collinear. How many lines can be formed from these points.

(1) ${}^nC_2 - {}^pC_2 + 1$ (2) ${}^nC_2 - {}^pC_2$ (3) ${}^nC_2$ (4) ${}^nC_2 - 1$

75. The probability of a man hitting a target is $\frac{2}{3}$. He tries 5 times. The probability that the target will be hit at least 3 times, is

(1) ${}^5C_3\left(\frac{2}{3}\right)^3\left(\frac{1}{3}\right)^2$ (2) ${}^5C_4\left(\frac{2}{3}\right)^4\left(\frac{2}{3}\right)^1$ (3) ${}^5C_5\left(\frac{2}{3}\right)^5\left(\frac{1}{3}\right)^0$ (4) none of these

76. The mean deviation from the median of the following data

Wages per week (in Rs)	10-20	20-30	30-40	40-50	50-60	60-70	70-80
No. of workers	4	6	10	20	10	6	4

(1) 20 (2) 12 (3) 11.33 (4) 45

77. Let p, q and r be the statements :
p : X is a square
q : X is a rectangle
r : $p \rightarrow q$
Contrapositive of r is
(1) If X is not a rectangle, then X is not a square
(2) X is neither a rectangle nor a square
(3) X is a rectangle but not a square
(4) X is a rectangle as well as a square

78. The number of elements in the set $\{(a, b) : 2a^2 + 3b^2 = 35, a, b \in Z\}$, where Z is the set of all integers, is
(1) 2 (2) 4 (3) 8 (4) 12

79. The value of $\lim_{x\to 0} \frac{(1+x)^{1/x} - e + \frac{ex}{2}}{11x^2}$ is equal to--

(1) $\frac{5}{24}e$ (2) 0 (3) $\frac{11}{24}e$ (4) $\frac{e}{24}$

80. If $f(x) = x^n$ then

$f(1) + \frac{f'(1)}{1!} + \frac{f''(1)}{2!} + ... + \frac{f^n(1)}{n!}$ is equal to

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

81. **Statement-1 :** Number of solutions of the equation $\cos(x - 1) = \frac{|x-1|}{10}$ are 6.

Statement-2 : Number of solutions of the equation $f(x) = g(x)$ is equal to number of points of intersection of graphs $y = f(x)$ & $y = g(x)$.

(1) Statement -1 is True, Statement -2 is True ; Statement -2 is a correct explanation for Statement -1
(2) Statement-1 is True, Statement-2 is True ; Statement-2 **is NOT** a correct explanation for Statement-1
(3) Statement -1 is True, Statement -2 is False
(4) Statement -1 is False, Statement -2 is True

82. The area of the figure bounded by the straight line $x = 0$, $x = 2$ and the curves $y = 2^x$, $y = 2x - x^2$ is

(1) $\left(\frac{4}{\ell n\, 2} - \frac{8}{3}\right)$ sq. units (2) $\left(\frac{4}{\ell n\, 2} + \frac{8}{3}\right)$ sq. units

(3) $\left(\frac{8}{\ell n\, 3} - \frac{4}{3}\right)$ sq. units (4) $\left(\frac{3}{\ell n\, 2} - \frac{4}{3}\right)$ sq. units

83. Let P denotes the set of all values of λ for which the system of equation

$$\lambda x_1 + x_2 + x_3 = 1$$
$$x_1 + \lambda x_2 + x_3 = 1$$
$$x_1 + x_2 + \lambda x_3 = 1$$

is in consistent, then

(1) $\sum_{\lambda \in p} |\lambda| = 1$ (2) λ is An even prime number

(3) $\sum_{x\to\lambda} \frac{|x+2|}{x^2-4}$ is not exist (4) Cube roots of λ are 1, ω, ω^2

84. The line of intersection of the planes $\vec{r}.(\hat{i}-3\hat{j}+\hat{k}) = 1$ and $\vec{r}.(2\hat{i}+5\hat{j}-3\hat{k}) = 2$ is parallel to vector

(1) $-4\hat{i}+5\hat{j}+11\hat{k}$ (2) $4\hat{i}+5\hat{j}+11\hat{k}$ (3) $4\hat{i}-5\hat{j}+11\hat{k}$ (4) $4\hat{i}-5\hat{j}-11\hat{k}$

85. General solution of $\sin x + \sin 5x = \sin 2x + \sin 4x$ is

(1) $\frac{n\pi}{3}$; $n \in I$ (2) $2n\pi, \frac{2n\pi}{3}$; $n \in I$ (3) $2n\pi$; $n \in I$ (4) none of these

86. $\int \frac{dx}{x(x^{2010}+1)}$ is equal to

(1) $\frac{1}{2009} \ln|1 + x^{2010}| + c$ (2) $\frac{1}{2010}\ln|1+x^{-2010}|+c$

(3) $\ln|1 + x^{2010}| + x + c$ (4) $-\frac{1}{2010}\ln|1+x^{-2010}|+c$

87. If $\tan\theta_1 \tan\theta_2 = -2$ then the chord joining two points θ_1 & θ_2 on the ellipse $x^2 + 2y^2 = 2$ will subtend a right angle at

(1) focus (2) center
(3) ends of major axis (4) ends of minor axis

88. A car is moving at a constant speed at an angle θ east of north. Observations of the car are made from a fixed point. It is due north at some instant. Ten minutes earlier its bearing was α west of north, whereas ten minutes afterwards its bearing is β east of north. Find the value of $\tan\theta$.

(1) $\frac{1}{\cot\beta - \cos\alpha}$ (2) $\frac{2}{\cos\beta - \cot\alpha}$

(3) $\frac{2}{\cot\beta - \cot\alpha}$ (4) $\frac{2}{\tan\beta - \tan\beta}$

89. Values of α if $(\alpha, 2\alpha)$ lies in side the ΔABC if A(0, 2), B(2, 0) and C(4, 4)

(1) $\alpha \in \left(\frac{1}{3}, \frac{2}{3}\right)$ (2) $\alpha \in \left(\frac{2}{3}, 1\right)$ (3) $\alpha \in \left(\frac{2}{3}, \frac{4}{3}\right)$ (4) $\alpha \in \left(\frac{1}{3}, 1\right)$

90. The sum $1 + 4 + 13 + 40 + 121 + \ldots\ldots$ is equal to

(1) $\frac{1}{4}[3^n - 2n - 3]$ (2) $\frac{1}{4}[3^{n+1} - 2n - 3]$

(3) $\frac{1}{4}[3^n - 2n - 2]$ (4) $\frac{1}{4}[3^{n+1} - 4n - 3]$

Answers

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

PRACTICE TEST - THREE

Time : 3 Hours **Max. Marks 360**

Important Instructions:

1. The test is of **3 hours** duration.

2. The Test Booklet consists of **90** questions. The maximum marks are **360.**

3. There are three parts in the question paper A, B, C consisting of **Physics, Chemistry and Mathematics** having 30 questions in each part of equal weightage. Each question is allotted **4 (four)** marks for each correct response.

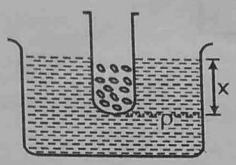
4. Each question has choices (1), (2), (3) and (4), out of which **ONLY ONE** is correct.

5. Candidates will be awarded marks as stated above in Instructions No. 3 for correct response of each question. ¼ **(one fourth)** marks will be deducted for indicating incorrect response of each question. No deduction from the total score will be made if no response is indicated for an item in the answer sheet.

6. 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 as per instructions 5 above.

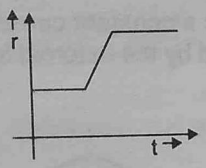
PART-A (PHYSICS)

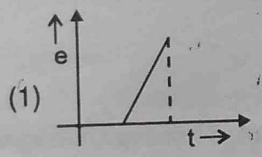
1. A test tube of length ℓ and area of cross-section A has some iron fillings of mass M as shown in figure. The test tube floats normally in a liquid of density ρ with length x dipped in the liquid. A disturbing force makes the tube oscillate in the liquid. The time period of oscillation is given by -

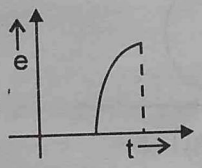


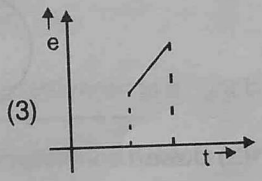
(1) $2\pi\sqrt{\frac{M\rho}{Ag}}$ (2) $2\pi\sqrt{\frac{x}{g}}$ (3) $2\pi\sqrt{\frac{\ell}{g}}$ (4) $2\pi\sqrt{\frac{M}{g}}$

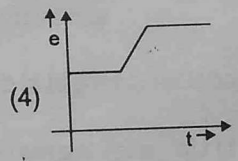
2. Radius of a circular ring is changing with time and the coil is placed in uniform constant magnetic field perpendicular to its plane. The variation of 'r' with time 't' is shown in the figure. Then induced e.m.f. ε with time willbe best represented by.:



(1) 

(2) 

(3) 

(4) 

3. Two blocks of mass m and 2m are fixed to the ends of a spring. The spring is initially compressed & then the system is released in air (neglecting the air resistance). After time t
(1) the momentum of the system will be zero
(2) the momentum of the system will be 3 m g t
(3) the momentum of the system will be m g t
(4) the momentum of the system will depend on the value of spring constant.

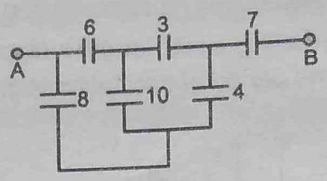
4 E , M , L , G denotes energy , mass , angular momentum (which is momentum x distance) and gravitational constant respectively . $EL^2/(M^5 G^2)$ has the dimensions of :
(1) length (2) mass (3) angle (4) time

5. The position vector $\vec{r}$ w. r. t. to the origin of a particle varies with time t as $\vec{r} = at\hat{i} + (bt - ct^2)\hat{j}$ where x – axis is horizontal axis and y – axis is vertical axis. The acceleration due to gravity in that place is.
(1) 2a (2) 2b (3) 2c (4) c

6. A particle performs SHM with a time period T and amplitude a. The magnitude of average velocity of the particle over the time interval during which it travels a distance $\frac{a}{2}$ from the extreme position is

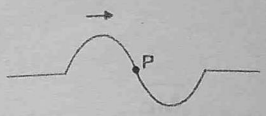
(1) $\frac{a}{T}$ (2) $\frac{2a}{T}$ (3) $\frac{3a}{T}$ (4) $\frac{a}{2T}$

7. In the circuit diagram shown all the capacitors are in m F. The equivalent capacitance between points A & B is (in m F)



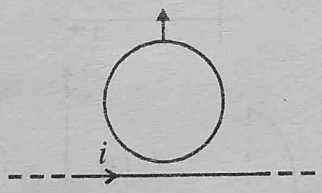
(1) 14/5 (2) 7/5 (3) 3/7 (4) none of these

8. A pulse on a string is shown in the figure. P is particle of the string. Then state which of the following is incorrect.



(1) If P is stationary point, then pulse consists of two waves travelling in opposite direction
(2) If P is moving upwards, then pulse is travelling in positive direction
(3) If P is moving downwards, then pulse is travelling in negative direction
(4) none of these

9. The straight infinite long wire carries a constant current i to the right. The conducting circular loop in the same plane is being pulled upward by the external force. What is the direction of the magnetic force on the loop ?



(1) Up (2) Down (3) Left (4) There is no magnetic force

10. The magnifying power of a telescope can be increased
(1) by increasing focal lengths of both lenses (2) by fitting eyepiece of high power
(3) by fitting eyepiece of low power (4) by increasing the distance of object

11. Energy needed for moving a mass of 2kg from the centre of the earth to its surface will be (in joule) (R is radius of earth in m, g is in m/sec^2)

(1) gR (2) $\frac{3}{2}$gR (3) $\frac{gR}{2}$ (4) 2gR

12. Forward resistance of PN diode is 100 Ω then slope of forward characteristic curve of PN diode is:
(1) 100 Ω (2) 0.01 ohm^{-1} (3) 0 (4) 10 ohm^{-1}

13. Two light waves are given by, $E_1 = 2 \sin (100 \pi t - k x + 30°)$ and $E_2 = 3 \cos (200 \pi t - k' x + 60°)$ The ratio of intensity of first wave to that of second wave is :

(1) $\frac{2}{3}$ (2) $\frac{4}{9}$ (3) $\frac{1}{9}$ (4) $\frac{1}{3}$

14. Current flowing through a conducting wire is given by $I = (1 + 2t)$. Where t is in seconds and current I is in amperes. The charge (in coulombs) flown through the resistor in the interval from $t = 0$ to $t = 1$ second is -
(1) 3 (2) 2 (3) 1 (4) 0