NTPL

ALL INDIA TEST SERIES

CODE - A

TEST ID 001936

JEE (Advanced) - 2019

FULL TEST - 6 (Paper-II)

Time : 3 Hours ***Maximum Marks : 180***

Please read the instructions carefully. You are allotted 5 minutes specifically for this purpose.
You are not allowed to leave the Examination Hall before the end of the test.

INSTRUCTIONS

A. General :

1. This booklet is your Question Paper containing **54 questions**.
2. The Question Paper **CODE & TEST ID** is printed on the right hand top corner of this booklet. This should be entered on the OMR Sheet.
3. Fill the bubbles completely and properly using a **Blue/Black Ball Point Pen** only.
4. No additional sheets will be provided for rough work.
5. Blank papers, clipboards, log tables, slide rules, calculators, cellular phones, pagers, and electronic gadgets in any form are not allowed to be carried inside the examination hall.
6. The answer sheet, a machine-readable Optical mark recognition sheet (OMR Sheet), is provided separately.
7. DO NOT TAMPER WITH / MUTILATE THE OMR OR THE BOOKLET.
8. Do not break the seals of the question-paper booklet before being instructed to do so by the invigilator.

B. Question Paper Format :

9. The question paper consists of **3 parts (Part I: Physics, Part II: Chemistry & Part III: Maths)**. Each part has **3 sections**.
10. **Section I** contains **6 multiple choice questions.** Each question has 4 choices (A), (B), (C) and (D), for its answer, out of which ***ONE OR MORE*** is/are correct.
11. **Section II** contains **8 questions**. The answer to each question is a **numerical value.**
12. **Section III** contains **4 multiple choice questions.** Each question has two lists (List-1 : P, Q, R and S; List-2 : 1, 2, 3 and 4). The options for the correct match are provided as (A), (B), (C) and (D) out of which **ONLY ONE** is correct.

C. Marking Scheme :

13. For each question in **Section I,** you will be awarded **4 marks** if one the bubble(s) corresponding to the correct option(s) is(are) darkened, and **+1 marks** for darkening a bubble corresponding to each correct option, provided NO incorrect option is darkened. In all other cases, **minus one (-2) marks** will be awarded. **Zero marks** If none of the bubbles is darkened.
14. For each question in **Section II**, you will be awarded **3 marks** if you darken the bubble corresponding to the correct answer **ONLY**. In all other cases **zero (0) marks** will be awarded. **No negative marks** will be awarded for incorrect answer in this section.
15. For each question in **Section III**, you will be awarded **3 marks** if you darken the bubble(s) corresponding to the correct choice(s) for the answer, and **zero mark** if no bubble is darkened. In all other cases, **minus one (-1) mark** will be awarded.

Name of the Candidate (in Capitals) _____

Test Centre _____ Centre Code _____

Candidate's Signature _____ Invigilator's Signature _____

PART I : PHYSICS

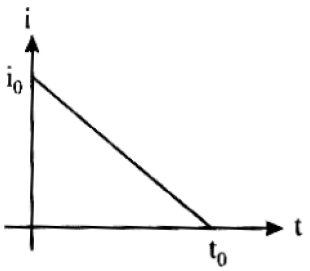
SECTION 1 (Maximum Marks : 24)

- This section contains **SIX** questions.
- Each question has **FOUR** options (a), (b), (c) and (d). **ONE OR MORE THAN ONE** of these four option(s) is(are) correct.
- For each question, darken the bubble(s) corresponding to the correct option(s) in the ORS.
- For each question, marks will be awarded in one of the following categories :

Full Marks	:	+4	If one the bubble(s) corresponding to the correct option(s) is(are) darkened.
Partial Marks	:	+1	For darkening a bubble corresponding to each correct option, provided NO incorrect option is darkened.
Zero Marks	:	0	If none of the bubbles is darkened.
Negative Marks	:	–2	In all other cases.

- For example, if (a), (c) and (d) are all the correct options for a question, darkening all these three will result in +4 marks; darkening only (a) and (d) will result in +2 marks; and darkening (a) and (b) will result in –2 marks, as a wrong option is also darkened.

1. Relation between current in conductor and time is shown in figure then correct options are



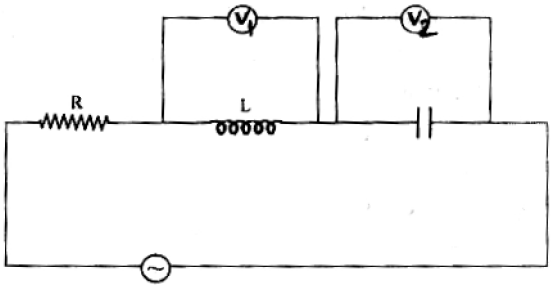
(a) Total charge flow through the conductor is $\frac{1}{2}i_0t_0$

(b) Expression of current in terms of time is $i_0\left(1-\frac{t}{t_0}\right)$

(c) If resistance of conductor is R then total heat dissipated across resistance R is $\frac{Rt_0i_0^2}{3}$

(d) If resistance of conductor is R then total heat dissipated across resistance R is $\frac{2Rt_0i_0^2}{3}$

2. In the circuit shown, resistance $R=100\Omega$, inductance $L=\frac{2}{\pi}H$ and capacitance $C=\frac{8}{\pi}\mu F$ are connected in series with an ac source of 200 volt and frequency *f*. If the readings of the hot wire voltmeters V_1 and V_2 are same then



(a) $f = 250\ \pi$ Hz (b) $f = 125$Hz

(c) current through R is 2 A (d) $V_1 = V_2 = 1000$ volt

3. The dimensions of energy per unit volume are the same as those of

(a) work (b) stress

(c) pressure (d) modulus of elasticity

4. Which of the following are not dependent on the intensity of the incident radiation in a photoelectric experiment

(a) Amount of photoelectric current

(b) Stopping potential to reduce the photoelectric current to zero

(c) Work function of the surface

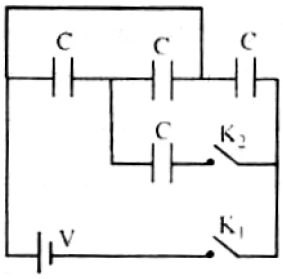
(d) Maximum kinetic energy of photoelectrons

5. A particle is projected vertically upwards in absence of air resistance with a velocity u from a point O. When it returns to the point of projection

(a) its average velocity is zero (b) its displacement is zero

(c) its average speed is u/2 (d) its average speed is u

6. How does the total energy stored in the capacitors in the circuit shown in the figure change when first switch K_1 is closed (process-1) and then switch K_2 is also closed (process-2). Assume that all capacitors were initially uncharged



(a) Increases in process-1

(b) Increases in process-2

(c) Decreases in process-2

(d) Magnitude of change in process-2 is less than that in process-1

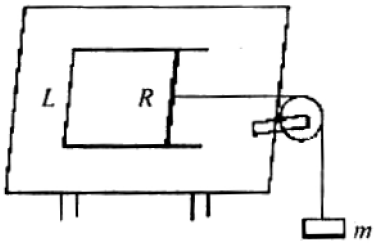
SECTION 2 (Maximum Marks : 24)

- This section contains **EIGHT (08)** questions. The answer to each question is a **NUMERICAL VALUE.**
- For each question, enter the correct numerical value (in decimal notation, truncated/rounded−off to the **second decimal place;** e.g. 6.25, 7.00, –0.33, –.30, 30.27, –127.30) using the mouse and the onscreen virtual numeric keypad in the place designated to enter the answer.
- Answer to each question will be evaluated according to the following marking scheme :

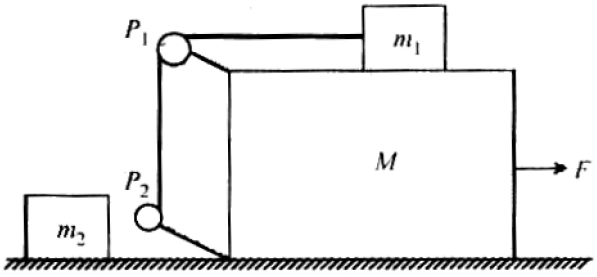
Full Marks : +3 If ONLY the correct numerical value is entered as answer.

Zero Marks : 0 In all other cases.

7. A pair of parallel horizontal conducting rails of negligible resistance shorted at one end is fixed on a table. The distance between the rails is L. A conducting massless rod of resistance R can slide on the rails frictionlessly. The rod is tied to a massless string which passes over a pulley fixed to the edge of the table. A mass m, tied to the other end of the siring hangs vertically. A constant magnetic field B exists perpendicular to the table. If the system is released from rest, calculate the acceleration (in ms^{-2}) of the mass at the instant when the velocity of the rod is half the terminal velocity.



8. In the figure masses m_1, m_2 and M are 20 kg, 5 kg and 50 kg respectively. The coefficient of friction between M and ground is zero. The coefficient of friction between m_1 and M and that between m_2 and ground is 0.3. The pulleys and the strings are massless. The string is perfectly horizontal between P_1 and m_1 and also between P_2 and m_2. The string is perfectly vertical between P_1 and P_2. An external horizontal force F is applied to the mass M. Take g = 10 m/s^2.

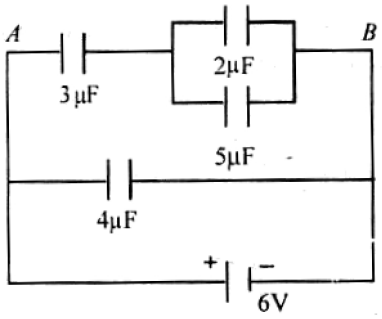


Let the magnitude of the force of friction between m_1 and M be f_1 and that between m_2 and ground be f_2. For a particular F it is found that $f_1 = 2f_2$. Find $\frac{2}{5}(f_1 - f_2)$ in newton.

9. A column of air and a tuning fork produce 4 beats per second when sounded together. The tuning fork gives the lower note. The temperature of air is 15°C. When the temperature falls to 10°C, the two produce 3 beats per second. If the frequency (in Hz) of the fork be n then find the value of $\left(\frac{n}{10} - 4\right)$.

10. An electric heater is used in a room of total wall area 137 m^2 to maintain a temperature of + 20°C inside it, when the outside temperature is –10°C. The walls have three different layers materials. The innermost layer is of wood of thickness 2.5 cm, the middle layer is of cement of thickness 1.0 cm and the outermost layer is of brick of thickness 25.0 cm. Find the power (in kilowatt) of the electric-heater. Assume that there is no heat loss through the floor and the ceiling. The thermal conductivities of wood, cement and brick are 0.125, 1.5 and 1.0 watt/m/°C respectively.

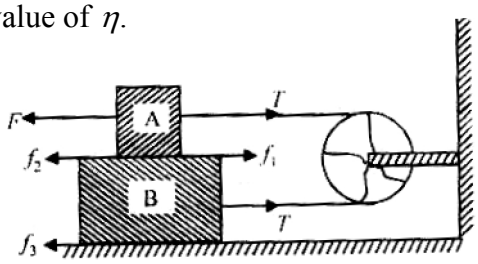
11. A circuit is shown in figure.



Find the charge (in μC) on the condenser having a capacity of $5\mu F$.

12. Two coils are wound on the same iron rod so that the flux generated by one also passes through the other. The primary has 100 loops and secondary has 200 loops. When a current of 2 A flows through the primary, the flux in it is 25 × 10^{-4} Wb. If the value of mutual inductance (in henry) between the coils is (0.025 K), find the value of K.

13. A block A of mass m_1(= 10 kg) rests on a block B of mass m_2 (=20 kg). B rests on fixed surface. The coefficient of friction between any two surfaces is μ (=0.3). A and B are connected by a mass less string passing around a frictionless pulley fixed to the wall as shown in fig. The force(F) by which A is dragged so as to keep both A and B moving with uniform speed is related to a constant η as $F = 10(\eta + 6)$, find the value of η.



14. A point particle of mass 0.1 kg is executing S.H.M. of amplitude of 0.1 m. When the particle passes through the mean position, its kinetic energy is 8 × 10^{-3} joule. Obtain the magnitude (in rad/s) of angular frequency.

SECTION 3 (Maximum Marks : 12)

- This section contains **FOUR (04)** questions.
- Each question has **TWO (02)** matching lists : **LIST-I** and **LIST-II**.
- **FOUR** options are given representing matching of elements from **LIST-I** and **LIST-II. ONLY ONE** of these four options corresponds to a correct matching.
- For each question, choose the option corresponding to the correct matching.
- For each question, marks will be evaluated according to the following marking scheme :

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

15.

LIST-I	**LIST-II**
P. Beats	**1.** Frequency changes
Q. Doppler's effect	**2.** Amplitude changes
R. Stationary wave	**3.** Superposition of waves
S. Progressive wave	**4.** Transmission of energy

(a) **P → 2, 3; Q → 1, 4; R → 3; S → 4**
(b) **P → 3; Q → 1; R → 2; S → 4**
(c) **P → 2; Q → 4; R → 4; S → 3**
(d) **P → 1; Q → 2, 3; R → 3; S → 4**

16.

LIST-I	**LIST-II**
P. Current	**1.** Potential difference
Q. Drift velocity of electron	**2.** Length of the wire
R. Power	**3.** Thickness of the wire
S. Resistance	**4.** Scalar

(a) **P → 2, 3, 4; Q → 1, 2; R → 4; S → 2, 3, 4**
(b) **P → 1, 2; Q → 3; R → 1, 2, 3, 4; S → 2, 3, 4**
(c) **P → 1, 2, 3, 4; Q → 1, 2, 3; R → 1, 2, 3, 4; S → 2, 3, 4**
(d) **P → 4; Q → 1, 2, 3; R → 1, 2, 3, 4; S → 2, 3**

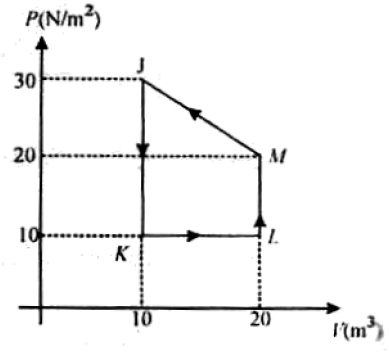
17.

Column I (Nuclides)	**Column II (Activity)**
P. Na^{24}	**1.** α-particle emission
Q. C^{11}	**2.** $_{-1}e^{0}$ emission
R. U^{238}	**3.** β-particle emission
S. H^{3}	**4.** $_{+1}e^{0}$ emission

(a) **P → 2, 3; Q → 4; R → 1; S → 2, 3** (b) **P → 1; Q → 4; R → 1; S → 2, 3**

(c) **P → 2, 3; Q → 2; R → 1; S → 2, 3** (d) **P → 2, 3; Q → 1; R → 4; S → 2, 3**

18. An ideal gas undergoes a cyclic process as shown in P-V graph. Match each process given in column-I with the corresponding results given in column II.



Column I	**Column II**
P. Process *J-K*	**1.** $\Delta W > 0$
Q. Process *K-L*	**2.** $\Delta W < 0$
R. Process *L-M*	**3.** $\Delta Q > 0$
S. Process *M-J*	**4.** $\Delta Q < 0$

(a) **P → 1; Q → 1, 3; R → 2; S → 2, 4** (b) **P → 2, 4; Q → 1, 3; R → 3; S → 2**

(c) **P → 3; Q → 2, 3; R → 1; S → 2, 4** (d) **P → 4; Q → 1, 3; R → 3; S → 2, 4**

PART II : CHEMISTRY

SECTION 1 (Maximum Marks : 24)

- This section contains **SIX** questions.
- Each question has **FOUR** options (a), (b), (c) and (d). **ONE OR MORE THAN ONE** of these four option(s) is(are) correct.
- For each question, darken the bubble(s) corresponding to the correct option(s) in the ORS.
- For each question, marks will be awarded in one of the following categories :

Full Marks	:	+4	If one the bubble(s) corresponding to the correct option(s) is(are) darkened.
Partial Marks	:	+1	For darkening a bubble corresponding to each correct option, provided NO incorrect option is darkened.
Zero Marks	:	0	If none of the bubbles is darkened.
Negative Marks	:	–2	In all other cases.

- For example, if (a), (c) and (d) are all the correct options for a question, darkening all these three will result in +4 marks; darkening only (a) and (d) will result in +2 marks; and darkening (a) and (b) will result in –2 marks, as a wrong option is also darkened.

19. Choose the correct statement

(a) The nodal surface of 2s-orbital exists at a distance 1.058 Å from the nucleus.

(b) in the plots of radial probability versus distances from the nucleus, the number of peaks equal to $n - \ell$

(c) The opposite lobes of p-orbital and d-orbital have the same sign

(d) Orbitals of a particular type will have different angular wave function, depending upon the value of n.

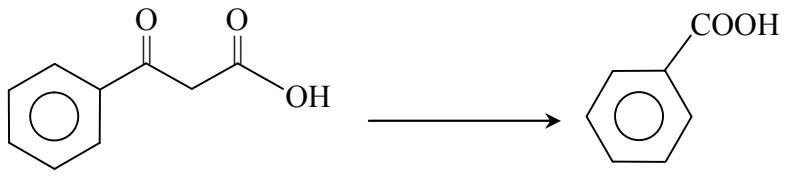
20. In a reaction between A and B, the initial rate of reaction was measured for different initial concentrations of A and B as given below : [Given log 1.5 = 0.17609, log 2 = 0.30101]

A/M	0.20	0.20	0.40
B/M	0.30	0.10	0.05
R_0/M s^{-1}	5.07×10^{-5}	5.07×10^{-5}	7.6×10^{-5}

(a) The order of reaction with respect to A is 0.5 (b) The order of reaction with respect to B is 0.5

(c) The order of reaction with respect to B is 0 (d) The order of reaction with respect to A is 1.5

21. The following conversion reaction can be carried out by using reaction sequence/s.



(a) $\xrightarrow{Zn/Hg/HCl,\ \Delta}\xrightarrow{Br_2/h\nu}\xrightarrow{KCN}\xrightarrow{H_3O^+,\ \Delta}$ (b) $\xrightarrow{NaBH_4}\xrightarrow{Al_2O_3,\ \Delta}\xrightarrow{O_3/H_2O(oxidative)}$

(c) $\xrightarrow{Heat}\xrightarrow{I_2/NaOH,\ \Delta}\xrightarrow{H^+}$ (d) $KMnO_4/OH^{\ominus}/heat$

22. The enthalpy of neutralization of 1M solution of HCl with 1M NaOH is –57.3 kJ/mol. The enthalpy of solution of a weak base XOH (1M) with same HCl solution is –54.6 kJ/mole. If molar conductivity of 1M solution of XOH is 200×10^{-4} $Sm^2\ mol^{-1}$ and molar conductivity of XOH at infinite dilution is 0.20 $Sm^2\ mol^{-1}$ then select correct statement(s) [Assume all statements at 298 K]

(a) $\Delta H_{ionization}$ of XOH is 3.0 kJ/mole

(b) pH of 1M XOH solution is 12

(c) pK_a of X^+ is 1

(d) At equivalent point resultant solution of HCl and XOH is acidic

23. 80.0 gm. salt of weak base and strong acid XY is dissolved in water and formed 2 litre of aqueous solution. The pH of the resultant solution was found to be 5 at 298K. If XY forms CsCl type crystal having r_{X^+} (radius of X^+) = 1.6Å and r_{Y^-} (radius of Y^-) = 1.864 Å then select correct statement(s) (Given K_b (XOH) = 4×10^{-5}, $N_A = 6 \times 10^{23}$)

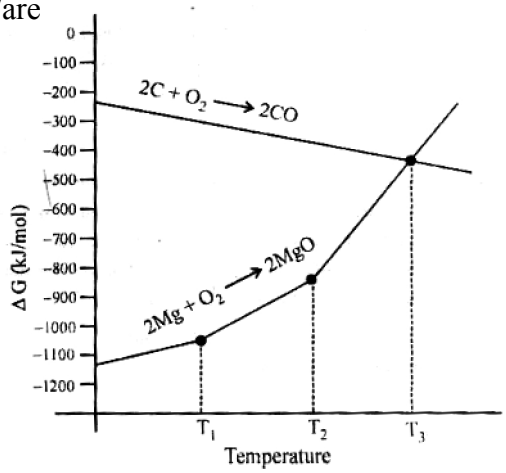
(a) Molar mass of salt is 100 g/mol

(b) % Degree of dissociation of salt is 0.25

(c) Edge length of AB is 4Å

(d) Density of solid salt XY is 2.6 in gm/cc

24. Correct statements about the plot is/are



(a) T_1 and T_2 are melting point and boiling point of Mg respectively

(b) T_1 and T_2 are melting point and boiling point of MgO respectively

(c) Reduction of MgO by coke is possible above T_3

(d) Mg can be extracted from gaseous products by rapid cooling

SECTION 2 (Maximum Marks : 24)

- This section contains **EIGHT (08)** questions. The answer to each question is a **NUMERICAL VALUE.**
- For each question, enter the correct numerical value (in decimal notation, truncated/rounded−off to the **second decimal place;** e.g. 6.25, 7.00, –0.33, –.30, 30.27, –127.30) using the mouse and the onscreen virtual numeric keypad in the place designated to enter the answer.
- Answer to each question will be evaluated according to the following marking scheme :

Full Marks	:	+3	If ONLY the correct numerical value is entered as answer.
Zero Marks	:	0	In all other cases.

25. An element X (Atomic mass = 25) exists as X_4 is benzene. 51g of saturated solution of X in benzene was added to 50.0 g of pure benzene. The resulting solution showed a depression of freezing point of 0.55 K. Calculate the solubility of X per 100 g of benzene. (K_f for benzene = 5.5 K kg mol^{-1})

26. K_p for the process

$$CuSO_4.5H_2O(s) \rightleftharpoons CuSO_4.3H_2O_{(s)} + 2H_2O_{(g)}$$

is 1.40×10^{-6} atm^2 at certain temperature. If aqueous tension at that temperature is 30 torr, then at what relative humidity of air will $CuSO_4.5H_2O$ efforsce?

27. The composition of a sample of Wustite is $Fe_{0.93}O_{1.00}$. If percentage of the iron is present in the form of Fe (III) is expressed as $90/x$ then what will be the value of x?

28. A monobasic acid is dissociated in 0.1 M solution. When 200ml of the acid solution is neutralized by 0.1 *M* NaOH, heat evolved is 244 cal. If the heat of neutralization of a strong acid with a strong base is –13.7 kcal then calculate the amount of the molar heat of dissociation (kcal) of the acid.

29. What will be the total number of cyclic structure as well as stereoisomers possible for a compound with the molecular formula C_5H_{10}?

30. A compound contains 28 percent of nitrogen and 72 percent of metal by weight. 3 atoms of metal combine with 2 atoms of N. If the atomic weight of metal is expressed as 20+A. Then find the value of A.

31. Find out the number of waves made by a Bohr electron in one complete revolution in its 3rd orbit.

32. A spherical balloon of 24 cm diameter is to be filled up with hydrogen at N.T.P. from a cylinder containing the gas at 20 atmospheres at 27°C. If the cylinder can hold 2.82 litres of water, calculate the number of balloons that can be filled up.

SECTION 3 (Maximum Marks : 12)

- This section contains **FOUR (04)** questions.
- Each question has **TWO (02)** matching lists : **LIST-I** and **LIST-II**.
- **FOUR** options are given representing matching of elements from **LIST-I** and **LIST-II. ONLY ONE** of these four options corresponds to a correct matching.
- For each question, choose the option corresponding to the correct matching.
- For each question, marks will be evaluated according to the following marking scheme :

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

33.

Column I	**Column II**
P. Orthosilicate	**1.** Oxygen atoms shared <2
Q. Pyrosilicale	**2.** Oxygen atoms shared ≥ 2
R. Single chain silicate	**3.** Net charge = –2
S. Ring silicate	**4.** Net charge = –6

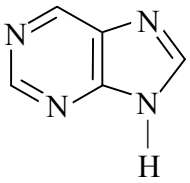
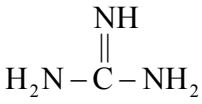
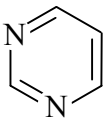
(a) **P → 1; Q → 1, 4; R → 2, 3; S → 2, 3**

(b) **P → 4; Q → 3; R → 1, 4; S → 2**

(c) **P → 5; Q → 3; R → 1, 2; S → 4**

(d) **P → 4; Q → 2, 3; R → 1; S → 3**

34.

Column I	Column II
P. 	**1.** One type of N
	2. Two types of N
Q. 	
R. 	**3.** Aromatic
S. $C_6H_5N^+ \equiv NCl^-$	**4.** Non-aromatic

(a) **P → 3; Q → 3, 4; R → 1; S → 3**

(b) **P → 2, 3; Q → 1, 4; R → 1, 3; S → 1, 3**

(c) **P → 2, 3; Q → 4; R → 1, 2; S → 3**

(d) **P → 2; Q → 4; R → 1; S → 1, 3**

35. Match the gradation of properties listed in column II with the substances listed in column I.

Column I	Column II
P. $Be(OH)_2 < Mg(OH)_2 < Ca(OH)_2 < Ba(OH)_2$	**1.** Solubility
Q. $Al_2O_3 < MgO < Na_2O < K_2O$	**2.** Acidic character
R. $NH_3 < PH_3 < AsH_3 < SbH_3$	**3.** Bond moment
S. $PH_3 < AsH_3 < SbH_3 < NH_3$	**4.** Basic character

(a) **P → 1; Q → 3, 4; R → 1; S → 2**

(b) **P → 1, 4; Q → 4; R → 2; S → 3**

(c) **P → 1, 4; Q → 1, 4; R → 2; S → 3**

(d) **P → 4; Q → 1, 4; R → 2; S → 1**

36. Match the geometry and magnetic behaviour described in List II with the complex ions in List I.

List I	**List II**
P. $MnCl_4^{2-}$	**1.** Square planar
Q. $NiCl_4^{2-}$	**2.** Tetrahedral
R. $CuCl_4^{2-}$	**3.** Diamagnetic
S. $Ni(CN)_4^{2-}$	**4.** Paramagnetic

(a) **P → 2, 4; Q → 2, 4; R → 1, 4; S → 1, 3**

(b) **P → 4; Q → 3; R → 1, 4; S → 2**

(c) **P → 4; Q → 2, 4; R → 1, 2; S → 3**

(d) **P → 4; Q → 2, 3; R → 1; S → 1, 3**

PART III : MATHS

SECTION 1 (Maximum Marks : 24)

- This section contains **SIX** questions.
- Each question has **FOUR** options (a), (b), (c) and (d). **ONE OR MORE THAN ONE** of these four option(s) is(are) correct.
- For each question, darken the bubble(s) corresponding to the correct option(s) in the ORS.
- For each question, marks will be awarded in one of the following categories :

Full Marks	:	+4	If one the bubble(s) corresponding to the correct option(s) is(are) darkened.
Partial Marks	:	+1	For darkening a bubble corresponding to each correct option, provided NO incorrect option is darkened.
Zero Marks	:	0	If none of the bubbles is darkened.
Negative Marks	:	–2	In all other cases.

- For example, if (a), (c) and (d) are all the correct options for a question, darkening all these three will result in +4 marks; darkening only (a) and (d) will result in +2 marks; and darkening (a) and (b) will result in –2 marks, as a wrong option is also darkened.

37. Let $a=\sin^{-1}(\sin 3)+\sin^{-1}(\sin 4)+\sin^{-1}(\sin 5)$, $f(x)=e^{x^2+|x|}$, domain of $f(x)$ be $[\alpha,\infty)$ & range of $f(x)$ be $[b,\infty)$ and $g(x)=\left(4\cos^4 x-2\cos 2x-\frac{1}{4}\cos 4x-x^7\right)^{1/7}$, domain & range of $g(x)$ is set of real numbers. Which of the following are correct?

(a) $a=-2$ (b) $a+b=-1$

(c) $f(g(g(b)))=e^2$ (d) Both $f(x)$, $g(x)$ are non invertible fns

38. If a point P is taken on $xy = 2$ and then a normal is drawn from P on the ellipse $\frac{x^2}{6}+\frac{y^2}{3}=1$ which is perpendicular to $x+y=8$, then P is

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

39. If $f(x)=\big||x-1|+|x-3|-|2x-1|\big|+\big||x-1|+|x-3|+|2x-1|\big|$, then

(a) $f(x)$ is non-differentiable at $x = 1$ (b) $f(x)$ is non-differentiable at $x=\frac{3}{2}$

(c) minimum value of $f(x)$ is 2 (d) none of these

40. In a ΔABC, if $a^2 - b^2 - c^2 + (x-2)bc = 0$, then x can be equal to

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

41. If a tangent on ellipse at $A(1, 1)$ intersect its directrix at B (7, –6) and S be the focus of ellipse and $C(\alpha, \beta)$ is the circum centre of ΔSAB, then

(a) $\alpha + \beta = 1$ (b) $\alpha - \beta = 7$ (c) $SC^2 = 20.5$ (d) $SC^2 = 21.25$

42. If a, b, c are sides of an acute angled triangle satisfying $a^2 + b^2 + c^2 = 6$ then $(ab + bc + ca)$ can be equal to

(a) 3 (b) 4 (c) 5 (d) 7

SECTION 2 (Maximum Marks : 24)

- This section contains **EIGHT (08)** questions. The answer to each question is a **NUMERICAL VALUE.**
- For each question, enter the correct numerical value (in decimal notation, truncated/rounded−off to the **second decimal place;** e.g. 6.25, 7.00, –0.33, –.30, 30.27, –127.30) using the mouse and the onscreen virtual numeric keypad in the place designated to enter the answer.
- Answer to each question will be evaluated according to the following marking scheme :

Full Marks : +3 If ONLY the correct numerical value is entered as answer.
Zero Marks : 0 In all other cases.

43. If $y = 2$ is directrix and (0, 1) be the vertex of parabola $x^2 + \lambda y + \mu = 0$ then; $(\lambda - \mu) = ?$

44. If z_1, z_2, z_3 are three complex numbers, such that $|z_1| = |z_2| = |z_3| = 1$ & $z_1^2 + z_2^2 + z_3^2 = 0$ then $|z_1^3 + z_2^3 + z_3^3|$ is equal to_____. (not equal to 1)

45. If $[\vec{a}\ \vec{b}\ \vec{c}] = 2$ and $(\vec{a}.\vec{b}) = 2$, $(\vec{c}.\vec{a}) = 5$, then $\vec{a}$ is equal to $x\vec{b} + y\vec{c} + z(\vec{b} \times \vec{c})$ (where $\vec{b}$ & $\vec{c}$ are two non-coplanar orthogonal unit vectors) then $(x + y - z) = ?$

46. If $\cos^{-1}(2 - x^2) + \sin^{-1}(2 - x^2) + \tan^{-1} x \geq \frac{2\pi}{3}$ have no solution if $x < \alpha$ or $x > \beta$ (for $\alpha < \beta$), then $\left\{\frac{1}{\max(\alpha)} + (\min(\beta))^2\right\} = ...$

47. If $f(x)=\dfrac{3x^2+1}{\sqrt{x^4+x^2}}\ \forall 0<x\le\sqrt{2}$, then $f(x)$ has minimum value M at $x = m$. Then, $\left(m_2+\dfrac{1}{M^2}\right)$ is equal to

48. If $x=\displaystyle\int_0^{\infty}\dfrac{dt}{(1+t^2)(1+t^{2017})}$, then $\dfrac{3x}{\pi}$ is equal to

49. If $\log_{(3x+4)}(4x^2+x+1)+\log_{(2x+1)}(6x^2+11x+4)=4$ then x is _____.

50. The no. of natural numbers which are smaller than 2.10^8 and which can be written by means of digits 1 and 2 is

SECTION 3 (Maximum Marks : 12)

- This section contains **FOUR (04)** questions.
- Each question has **TWO (02)** matching lists : **LIST-I** and **LIST-II**.
- **FOUR** options are given representing matching of elements from **LIST-I** and **LIST-II. ONLY ONE** of these four options corresponds to a correct matching.
- For each question, choose the option corresponding to the correct matching.
- For each question, marks will be evaluated according to the following marking scheme :

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

51. $x^2+y^2-14x-10y+24=0,$ makes an :

Column I	**Column II**
P. intercept on x-axis	**1.** 0
Q. intercept on y-axis	**2.** 2
R. intercept on $y=x$	**3.** $8\sqrt{3}$
S. intercept on $7x+y-4=0$	**4.** 10

(a) **P → 4; Q → 2; R → 3; S → 1**

(b) **P → 4; Q → 3; R → 2; S → 1**

(c) **P → 1; Q → 2; R → 3; S → 4**

(d) **P → 4; Q → 2; R → 1; S → 3**

52. Match the columns :

Column I	Column II
P. A circular plate is expanded by heat from radius 6 cm to 6.06 cm. Approximate increase in the area is	**1.** 5
Q. If an edge of a cube increases by 2%, then percentage increase in the volume is	**2.** 0.72π
R. If the rate of decrease of $\frac{x^2}{2}-2x+5$ is thrice the rate of decrease of x, then x is equal to (rate of decrease in non-zero)	**3.** 6
S. The rate of increase in the area of an equilateral triangle of side 30 cm, when each side increases at the rate of 0.1 cm/s is	**4.** $\frac{3\sqrt{3}}{2}$

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

53. A vertical pole of height h stands at the centre O of a circle and subtends an angle α at a point A outside the circle. The circle subtends an angle 2θ at A. AT and AT' are tangents from A to the circle, then :

Column I	Column II
P. radius of the circle	**1.** $h\cot\alpha$
Q. length of the tangent AT or AT'	**2.** $h\sin\theta\cot\alpha$
R. distance of A from the centre	**3.** $h\cos\theta\cot\alpha$
S. distance of A from the top of the pole	**4.** $h\operatorname{cosec}\alpha$

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

54. Match the columns :

Column I (*A*, *B*, *C* are matrices)	**Column II**
P. If $\lvert A\rvert = 2,$ then $\lvert 2A^{-1}\rvert =$ (where A is of order 3)	**1.** 1
Q. If $\lvert A\rvert = \frac{1}{8},$ then $\lvert adj.(adj.(2A))\rvert =$ (where A is of order 3)	**2.** 4
R. If $(A+B)^2 = A^2 + B^2,$ and $\lvert A\rvert = 2,$ then $\lvert B\rvert =$ (where A and B are of odd order)	**3.** 24
S. $\lvert A_{2\times 2}\rvert = 2,$ $\lvert B_{2\times 2}\rvert = 3$ and $\lvert C_{2\times 2}\rvert = 4,$ then $\lvert ABC\rvert$ is equal to :	**4.** 0

(a) **P → 2; Q → 1; R → 4; S → 3**

(b) **P → 1; Q → 2; R → 4; S → 3**

(c) **P → 4; Q → 3; R → 1; S → 2**

(d) **P → 2; Q → 1; R → 3; S → 4**

ANSWER KEY

PHYSICS

1. **(a), (b), (c)**	2. **(b), (c), (d)**	3. **(b), (c), (d)**	4. **(b), (c), (d)**
5. **(a), (b), (c)**	6. **(a), (b), (d)**	7. **(4)**	8. **(6)**
9. **(7)**	10. **(9)**	11. **(9)**	12. **(1)**
13. **(9)**	14. **(4)**	15. **(a)**	16. **(c)**
17. **(a)**	18. **(d)**		

CHEMISTRY

19. **(c), (d)**	20. **(a), (c)**	21. **(b), (c), (d)**	22. **(a), (d)**
23. **(a), (c)**	24. **(a), (c), (d)**	25. **(2)**	26. **(3)**
27. **(6)**	28. **(2)**	29. **(7)**	30. **(4)**
31. **(3)**	32. **(7)**	33. **(a)**	34. **(b)**
35. **(c)**	36. **(a)**		

MATHS

37. **(a), (b), (c)**	38. **(b), (c)**	39. **(a), (b), (c)**	40. **(a), (b), (c)**
41. **(a), (b), (d)**	42. **(b), (c)**	43. **(8)**	44. **(3)**
45. **(5)**	46. **(4)**	47. **(1.13)**	48. **(0.75)**
49. **(0.75)**	50. **(766)**	51. **(a)**	52. **(c)**
53. **(b)**	54. **(a)**		