EX NAVODAYAN FOUNDATION
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JEE-Main

4th Revision Minor Test

JEE-Mains Type Test paper

Test Date: 05 Jan, 2025 **M.M: 300**

TEST INSTRUCTIONS

1. The test is of **3 hours** duration. The test booklet consists of **75 questions**. The maximum marks are **300**.
2. There are three parts in the questions paper consisting of Physics, Chemistry and Mathematics having **25 questions in each part**.

Each Parts Contains –

- 20 multiple choice questions. Each question has four choices (a), (b), (c) and (d) out of which **ONLY ONE** is correct. All questions are carrying **+4 marks** for right answer and **-1 mark** for wrong answer. Partial marking will be allotted.
- 5 questions with answer as **numerical value** but attempted any **5** questions all questions are carrying **+4 marks** for right answer and **0 marks** for wrong answers.

Syllabus: Physics-Thermodynamics, Kinetic theory of gases, Electromagnetic induction and alternating currents, Gravitation, Properties of solids and liquids, Oscillations and waves | Chemistry-P-Block elements, d- and f-Block elements, Co-ordination compounds, Organic compounds containing halogens, Organic compounds containing oxygen, Organic compounds containing nitrogen, Biomolecules | Math-Matrices and determinants, Permutations and combinations, Binomial theorem and its simple applications, Co-ordinate geometry

Name of the Candidate (in Capital Letter): _____

Registration No. _____

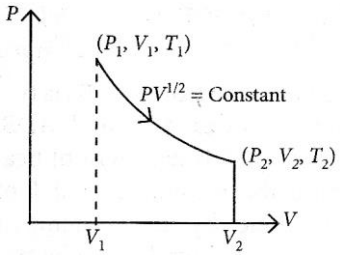
Invigilator Signature

Physics

(Single Correct Choice Type)

This Section contains **20 multiple choice questions.** Each question has four choices (a), (b), (c) and (d) out of which **ONLY ONE** is correct.

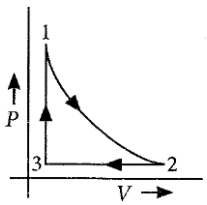
1. Thermodynamic process is shown below on a P-V diagram for one mole of an ideal gas. If $V_2 = 2V_1$ then the ratio of temperature T_2 / T_1 is

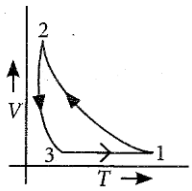


(a) $\frac{1}{2}$ (b) $\frac{1}{\sqrt{2}}$ (c) 2 (d) $\sqrt{2}$

2. Which of the following is an equivalent cyclic process corresponding to the thermodynamic cycl given in the figure? where, $1 \rightarrow 2$ is adiabatic.

(Graphs ate schematic and are not to scale)



(a)


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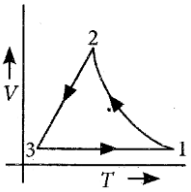

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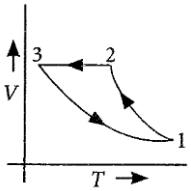

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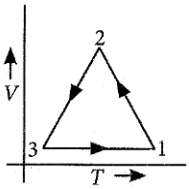
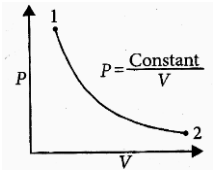


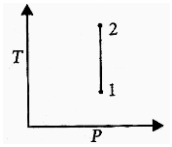
3. One mole of an ideal gas passes through a process where pressure and volume obey the relation $P = P_0\left[1 - \frac{1}{2}\left(\frac{V_0}{V}\right)^2\right]$. Here P_0 and V_0 are constants. Calculate the change in the temperature of the gas if its volume changes from V_0 to $2V_0$.

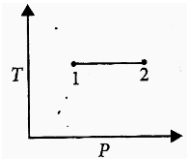
(a) $\frac{1}{4}\frac{P_0V_0}{R}$ (b) $\frac{5}{4}\frac{P_0V_0}{R}$ (c) $\frac{1}{2}\frac{P_0V_0}{R}$ (d) $\frac{3}{4}\frac{P_0V_0}{R}$

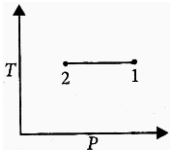
4. For the P-V diagram given for an ideal gas,

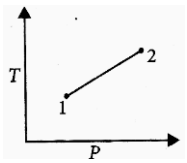


out of the following which one correctly represents the T-P diagram?

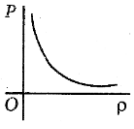
(a) 

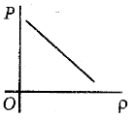
(b) 

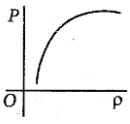
(c) 

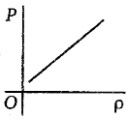
(d) 

5. Which of the following shows the correct relationship between the pressure 'P' and density ρ of an ideal gas at constant temperature?

(a) 

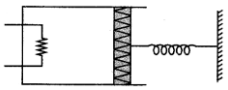
(b) 

(c) 

(d) 

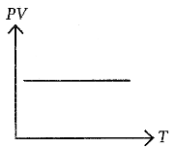
6. An ideal monoatomic gas is confined in a cylinder by a spring loaded piston of cross section $8.0\times10^{-3}m^2$. Initially the gas is at 300 K and occupies a volume of $2.4\times10^{-3}m^3$ and the spring is in its relaxed state as shown in figure. The gas is heated by a small heater until the piston moves out slowly by a small heater until the piston moves out slowly by 0.1 m. The force constant of the spring is 8000 N/m and the atmospheric pressure is $1.0\times10^5N/m^2$. The cylinder and the piston are thermally insulated. The piston and the spring are massless and there is no friction between the piston and the cylinder. The final temperature of the gas will be :

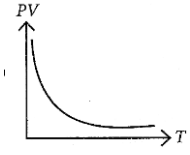
(Neglect the heat loss through the lead wires of the heater. The heat capacity of the heater coil is also negligible)

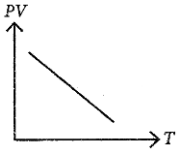


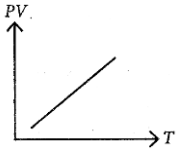
(a) 300 K (b) 800 K (c) 500 K (d) 1000 K

7. Which of the following graphs represent the behavior of an ideal gas? Symbols have their usual meaning.

(a) 

(b) 

(c) 

(d) 

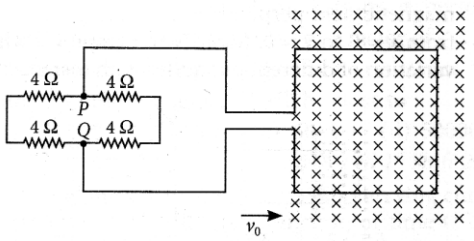
8. The volume V of an enclosure contains a mixture of three gases, 16g of oxygen, 28g of nitrogen and 44 g of carbon dioxide at absolute temperature T. Consider R as universal gas constant. The pressure of the mixture of gases is

(a) $\frac{4RT}{V}$ (b) $\frac{3RT}{V}$ (c) $\frac{88RT}{V}$ (d) $\frac{5}{2}\frac{RT}{V}$

9. A coil is placed perpendicular to a magnetic field of 5000 T. When the field is changed to 3000 T in 2 s, an induced emf of 22 V is produced in the coil. If the diameter of the coil is 0.02 m, then the number of turns in the coil is

(a) 140 (b) 7 (c) 35 (d) 70

10. A square loop of side 20 cm and resistance 1 Ω is moved towards right with a constant speed v_0. The right arm of the loop is in a uniform magnetic field of 5 T. The field is perpendicular to the plane of the loop and is going into it. The loop is connected to a network of resistors each of value 4 Ω. What should be the value of v_0 so that a steady current of 2 mA flows in the loop?

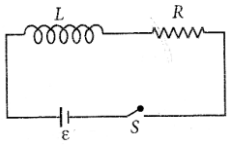


(a) 10^{-2} cm/s (b) 1 cm/s (c) 1 m/s (d) 10^2 m/s

11. In a coil, the current changes from –2A to 2A in 0.2 s and induces an emf of 0.1 V. The self inductance of the coil is

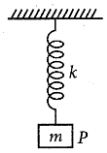
(a) 5 mH (b) 4 mH (c) 1 mH (d) 2.5 mH

12. As shown in the figure, a battery of emf ε is connected to an inductor L and resistance R in series. The switch is closed at t = 0. The total charge that flows from the battery, between t = 0 and $t = t_c$ (t_c is the time constant of the circuit) is



(a) $\frac{\varepsilon L}{R^2}\left(1-\frac{1}{e}\right)$ (b) $\frac{\varepsilon L}{R^2}$ (c) $\frac{\varepsilon R}{eL^2}$ (d) $\frac{\varepsilon L}{eR^2}$

13. In simple harmonic motion, the total mechanical energy of given system is E. If mass of oscillating particle P is doubled, the new energy of the system for same amplitude is



(a) 2E (b) E (c) $E\sqrt{2}$ (d) $E/\sqrt{2}$

14. If R is the radius of the earth and the acceleration due to gravity on the surface of earth is $g = \pi^2\, m/s^2$, then the length of the second's pendulum at a height h = 2R from the surface of earth will be

(a) $\frac{8}{9}m$ (b) $\frac{4}{9}m$ (c) $\frac{2}{9}m$ (d) $\frac{1}{9}m$

15. The measured value of the length of a simple pendulum is 20 cm with 2 mm accuracy. The time for 50 oscillations was measured to be 40 seconds with 1 second resolution. From these measurements, the accuracy in the measurement of acceleration due to gravity is N%. The value of N is

(a) 8 (b) 5 (c) 4 (d) 6

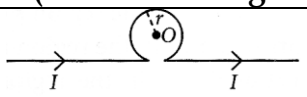
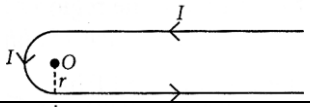
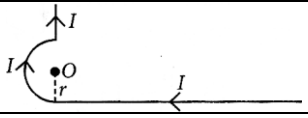
16. T is time period of simple pendulum on the earth's surface. Its time period becomes x T when taken to a height R (equal to earth's radius) above the earth's surface. Then, the value of x will be

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

17. In a co-axial straight cable, the central conductor and the outer conductor carry equal currents in opposite directions. The magnetic field is zero

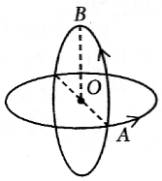
(a) inside the outer conductor (b) inside the inner conductor
(c) outside the cable (d) in between the two conductors

18. Match List I with List II.

	List-I (Current Configuration)		**List-II (Magnitude of magnetic field at point O)**
(A)		(I)	$B_0 = \frac{\mu_0 I}{4\pi r}[\pi + 2]$
(B)		(II)	$B_0 = \frac{\mu_0}{4}\frac{I}{r}$
(C)		(III)	$B_0 = \frac{\mu_0 I}{2\pi r}[\pi - 1]$
(D)		(IV)	$B_0 = \frac{\mu_0 I}{4\pi r}[\pi + 1]$

(a) (A)-(I), (B)-(III), (C)-(IV), (D)-(II) (b) (A)-(III), (B)-(IV), (C)-(I), (D)-(II)
(c) (A)-(II), (B)-(I), (C)-(IV), (D)-(III) (d) (A)-(III), (B)-(I), (C)-(IV), (D)-(II)

19. Two insulated circular loop A and B of radius 'a' carrying a current of 'I' in the anti clockwise direction as shown in the figure. The magnitude of the magnetic induction at the centre will be



(a) $\frac{\mu_0 I}{2a}$ (b) $\frac{2\mu_0 I}{a}$ (c) $\frac{\sqrt{2}\mu_0 I}{a}$ (d) $\frac{\mu_0 I}{\sqrt{2}a}$

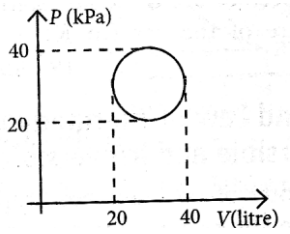
20. A long straight wire with a circular cross-section having radius R, is carrying a steady current I. The current I is uniformly distributed across this cross-section. Then the variation of magnetic field due to current I with distance r(r < R) from its centre will be

(a) $B \propto r^2$ (b) $B \propto r$ (c) $B \propto \frac{1}{r^2}$ (d) $B \propto \frac{1}{r}$

(Integer Type Questions)

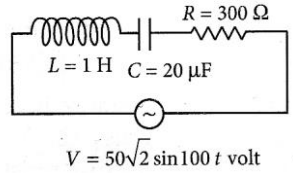
This Section contains **5 Questions.** The answer to each question is a single digit integer ranging from 0 to 9. The correct digit below the question number in the ORS is to be bubbled.

1. In the reported figure, heat energy absorbed by a system in going through a cyclic process is __ πJ.



2. One mole of a mono atomic gas is mixed with three moles of a diatomic gas. The molecular specific heat of mixture at constant volume is $\frac{\alpha^2}{4}$R J/mol K; then the value of α will be _____. (Assume that the given diatomic gas has no vibration mode).

3. An ac source is connected in given series LCR circuit. The rms potential difference across the capacitor of 20μF is _____ V.



4. A tuning fork resonates with a sonometer wire of length 1 m stretched with a tension of 6 N. When the tension in the wire is changed to 54 N, the same tuning fork produces 12 beats per second with it. The frequency of the tuning fork is _____ Hz.

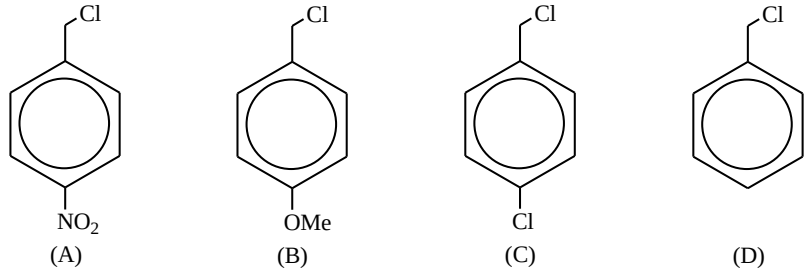
5. A square loop of edge length 2 m carrying current of 2 A is placed with its edges parallel to the x-y axis. A magnetic field is passing through the x-y plane and expressed as $\vec{B} = B_0(1+4x)\hat{k}$, where $B_0 = 5T$. The net magnetic force experienced by the loop is _____ N.

Chemistry

(Single Correct Choice Type)

This Section contains **20 multiple choice questions.** Each question has four choices (a), (b), (c) and (d) out of which **ONLY ONE** is correct.

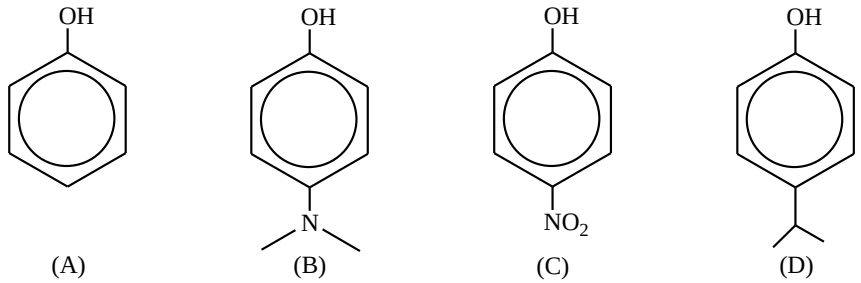
1. Decreasing order towards SN 1 reaction for the following compounds is:



(A) (B) (C) (D)

(a) A > C > D > B (b) B > D > C > A (c) A > B > C > D (d) D > B > C > A

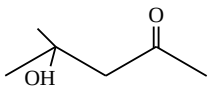
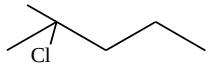
2. The correct order of pK_a values for the following compounds is:



(A) (B) (C) (D)

(a) C > A > D > B (b) B > A > D > C (c) B > D > A > C (d) A > B > C > D

3. Given below are two statements: One is labelled as Assertion A and the other is labelled as Reason R.

Assertion A:  can be easily reduced using Zn-Hg/HCl to 

Reason R: Zn − Hg/HCl is used to reduce carbonyl group to − CH_2 − group.

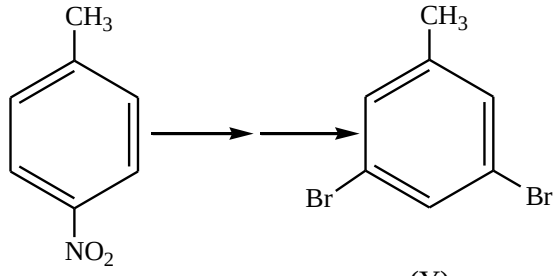
In the light of the above statements, choose the correct answer from the options given below:

(a) A is true but R is false

(b) Both A and R are true and R is the correct explanation of A

(c) A is false but R is true

(d) Both A and R are true but R is not the correct explanation of A

4. 

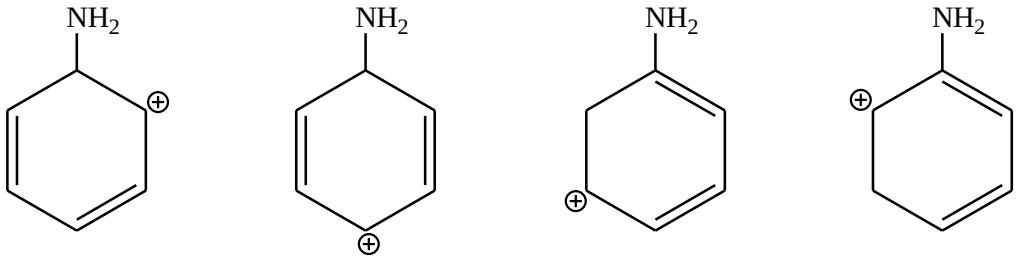
(X) (Y)

In the above conversion of compound (X) to product (Y), the sequence of reagents to be used will be:

(a) (i) Br_2(aq) (ii) $LiAlH_4$ (iii) H_3O^+ (b) (i) Br_2, Fe (ii) Fe, H^+ (iii) $LiAlH_4$

(c) (i) Fe, H^+ (ii) Br_2 (aq) (iii) HNO_2 (iv) H_3PO_2 (d) (i) Fe, H^+ (ii) Br_2 (aq) (iii) HNO_2 (iv) CuBr

5. The most stable carbocation for the following is:



(A) (B) (C) (D)

(a) A (b) C (c) D (d) B

6. The Cl − Co − Cl bond angle values in a fac- $[Co(NH_3)_3Cl_3]$ complex is/are:

(a) 90° (b) 90° & 120° (c) 180° (d) 90° & 180°

7. Match List I with List II:

	List-I (Complexes)		List-II (Hybridisation)
(A)	$[Ni(CO)_4]$	I.	sp^3
(B)	$[Cu(NH_3)_4]^{2+}$	II.	dsp^2
(C)	$[Fe(NH_3)_6]^{2+}$	III.	sp^3d^2
(D)	$[Fe(H_2O)_6]^{2+}$	IV.	d^2sp^3

(a) A-I, B-II, C-IV, D-III (b) A-II, B-I, C-III, D-IV

(c) A-II, B-I, C-IV, D-III (d) A-I, B-II, C-III, D-IV

8. Which of the following reaction is correct?

(a) $4LiNO_3 \xrightarrow{\Delta} 2Li_2O + 2N_2O_4 + O_2$ (b) $2LiNO_3 \xrightarrow{\Delta} 2NaNO_2 + O_2$

(c) $2LiNO_3 \longrightarrow 2Li + 2NO_2 + O_2$ (d) $4LiNO_3 \xrightarrow{\Delta} 2Li_2O + 4NO_2 + O_2$

9. Boric acid is solid, whereas BF_3 is gas at room temperature because of

(a) Strong Van der Waal's interaction in Boric acid

(b) Strong covalent bond in BF_3

(c) Strong ionic bond in Boric acid

(d) Strong hydrogen bond in Boric acid

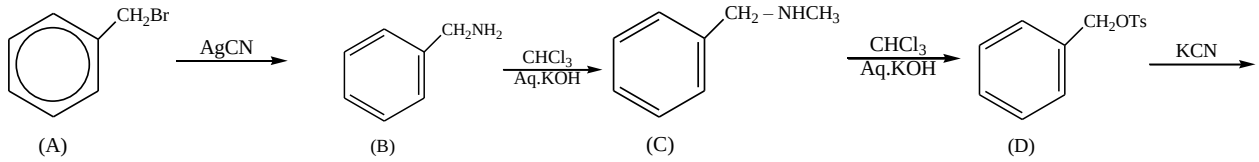
10. Formulae for Nessler's reagent is:

(a) HgI_2 (b) K_2HgI_4 (c) $KHgI_3$ (d) KHg_2I_2

11. $KMnO_4$ oxidises I^- in acidic and neutral/faintly alkaline solution, respectively, to

(a) IO_3^- & IO_3^- (b) I_2 & IO_3^- (c) I_2 & I_2 (d) IO_3^- & I_2

12. Benzyl isocyanide can be obtained by :

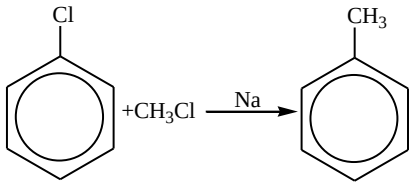
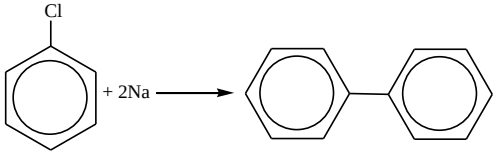
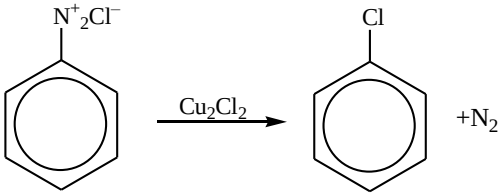


(A) (B) (C) (D)

Choose the correct answer from the options given below :

(a) A and D (b) Only B (c) B and C (d) A and B

13. Match List I with List II

	List-I		List-II
A.		I.	Fitting reaction
B.		II.	Wurtz Fitting reaction
C.		III.	Finkelstein reaction
D.	$C_2H_5Cl + NaI \rightarrow C_2H_5I + NaCl$	IV.	Sandmeyer reaction

Choose the correct answer from the options given below:

(a) A - II, B - I, C - IV, D – III

(b) A - IV, B - II, C - III, D – I

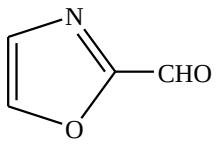
(c) A - III, B - II, C - IV, D – I

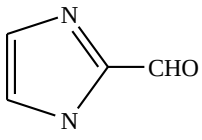
(d) A - II, B - I, C - III, D – IV

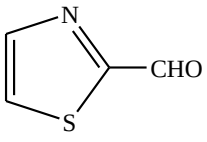
14. Which of the following compounds would give the following set of qualitative analysis?

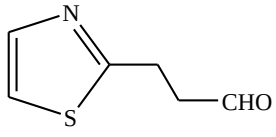
(i) Fehling's Test : Positive

(ii) Na fusion extract upon treatment with sodium nitroprusside gives a blood red colour but not prussian blue.

(a) 

(b) 

(c) 

(d) 

15. To inhibit the growth of tumours, identify the compounds used from the following :

A. EDTA

B. Coordination Compounds of Pt

C. D – Penicillamine

D. Cis - Platin

Choose the correct answer from the option given below:

(a) B and D Only (b) C and D Only (c) A and C Only (d) A and B Only

16. Which of the following is correct order of ligand field strength ?

(a) $CO < en < NH_3 < C_2O_4^{2-} < S^{2-}$ (b) $NH_3 < en < CO < S^{2-} < C_2O_4^{2-}$

(c) $S^{2-} < C_2O_4^{2-} < NH_3 < en < CO$ (d) $S^{2-} < NH_3 < en < CO < C_2O_4^{2}$

17. For OF_2 molecule consider the following :

A. Number of lone pairs on oxygen is 2. B. FOF angle is less than 104.5°.

C. Oxidation state of O is −2. D. Molecule is bent ' V ' shaped.

E. Molecular geometry is linear.

Correct options are:

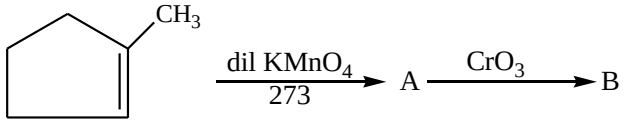
(a) A, C, D only (b) C, D, E only

(c) A, B, D only (d) B, E, A only

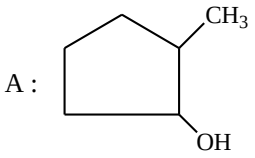
18. In the wet tests for identification of various cations by precipitation, which transition element cation doesn't belong to group IV in qualitative inorganic analysis ?

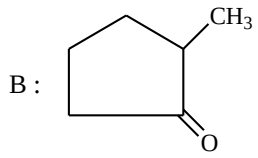
(a) Ni^{2+} (b) Zn^{2+} (c) Co^{2+} (d) Fe^{3+}

19. Identify product A and B:

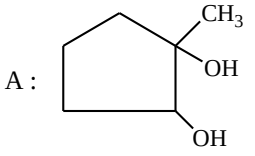


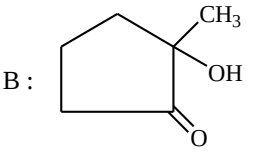
(a)





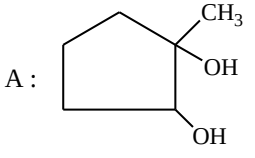
(b)

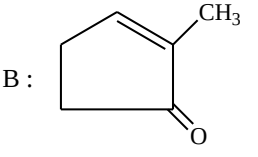




(c) $A: OHC-CH_2-CH_2-CH_2-\overset{\overset{O}{\|}}{C}-CH_3$ $B: HOOC-CH_2-CH_2-CH_2-\overset{\overset{O}{\|}}{C}-CH_3$

(d)





20. Glucose molecule reacts with X number of molecules of phenyl hydrazine to yield osazone. The value of X is

(a) Two (b) One (c) Four (d) Three

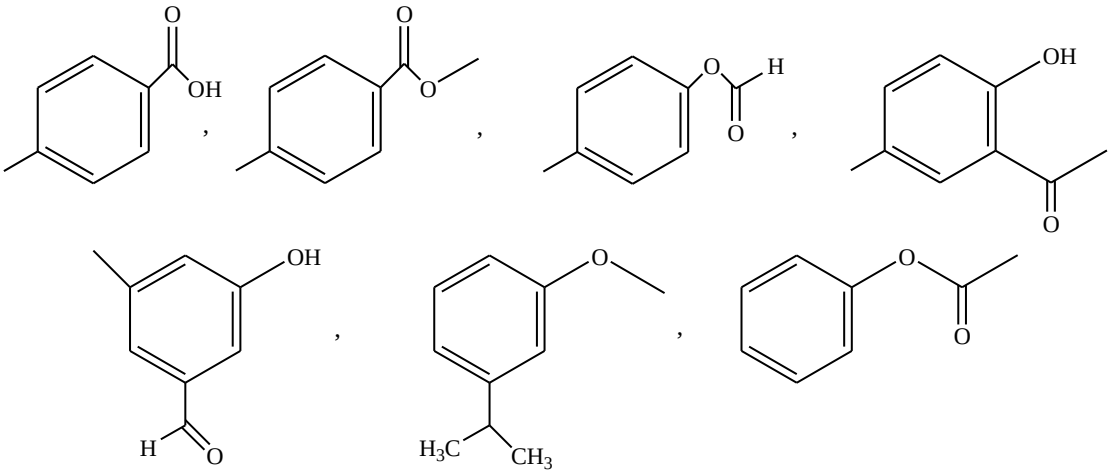
(Integer Type Questions)

This Section contains 5 **Questions.** The answer to each question is a single digit integer ranging from 0 to 9. The correct digit below the question number in the ORS is to be bubbled.

1. The number of electrons involved in the reduction of permanganate to manganese dioxide in acidic medium is

2. A trisubstituted compound 'A', $C_{10}H_{12}O_2$ gives neutral $FeCl_3$ test positive. Treatment of compound 'A' with NaOH and CH_3Br gives $C_{11}H_{14}O_2$, with hydroiodic acid gives methyl iodide and with hot conc. NaOH gives a compound B, $C_{10}H_{12}O_2$. Compound 'A' also decolorises alkaline $KMnO_4$. The number of π bond/s present in the compound 'A' is

3. Number of compounds from the following which will not dissolve in cold $NaHCO_3$ and NaOH solutions but will dissolve in hot NaOH solution is



4. A short peptide on complete hydrolysis produces 3 moles of glycine (G), two moles of leucine (L) and two moles of valine (V) per mole of peptide. The number of peptide linkages in it are

5. The number of chiral carbon in one molecule of α-D-glucose is

Mathematics

(Single Correct Choice Type)

This Section contains **20 multiple choice questions.** Each question has four choices (a), (b), (c) and (d) out of which **ONLY ONE** is correct.

1. Let $\theta = \frac{\pi}{5}$ and $A = \begin{bmatrix} \cos\theta & \sin\theta \\ -\sin\theta & \cos\theta \end{bmatrix}$. If $B = A + A^4$, then $\det(B)$:

   (a) is zero (b) is one (c) lies in (2,3) (d) lies in (1,2)

2. If a, b, c are non – zero real number and if the system of equation $(a-1)x = y+z$, $(b-1)y = z+x$, $(c-1)z = x+y$, has a non- trivial solution , then $ab+bc+ca$ equals :

   (a) $a+b+c$ (b) abc (c) 1 (d) – 1

3. For the system of linear equations

   $2x - y + 3z = 5$

   $3x + 2y - z = 7$

   $4x + 5y + \alpha z = \beta$

   Which of the following is NOT correct?

   (a) The system has infinitely many solutions for $\alpha = -5$ and $\beta = 9$

   (b) The system has a unique solutions for $\alpha \neq -5$ and $\beta = 8$

   (c) The system has infinitely many solutions for $\alpha = -6$ and $\beta = 9$

   (d) The system is inconsistent for $\alpha = -5$ and $\beta = 8$

4. The value of $\sum_{r=0}^{20} {}^{50-r}C_6$ is equal to :

   (a) ${}^{51}C_7 - {}^{30}C_7$ (b) ${}^{51}C_7 + {}^{30}C_7$ (c) ${}^{50}C_7 - {}^{30}C_7$ (d) ${}^{50}C_6 - {}^{30}C_6$

5. If {p} denotes the fractional part of the number p, then $\left\{\frac{3^{200}}{8}\right\}$, is equal to :

   (a) $\frac{1}{8}$ (b) $\frac{3}{8}$ (c) $\frac{7}{8}$ (d) $\frac{5}{8}$

6. If $a_n = \sqrt{7+\sqrt{7+\sqrt{7+.....}}}$ having n radical sings then by methods of mathematical induction which is true

   (a) $a_n > 7 \forall n \geq 1$ (b) $a_n < 7 \forall n \geq 1$ (c) $a_n < 4 \forall n \geq 1$ (d) $a_n > 3 \forall n \geq 1$

7. $\sum_{\substack{i,j=0 \\ i \neq j}} {}^{n}C_i \, {}^{n}C_j$ is equal to

   (a) $2^{2n} - {}^{2n}C_n$ (b) $2^{2n-1} - {}^{2n-1}C_{n-1}$ (c) $2^{2n} - \frac{1}{2}^{2n} C_n$ (d) $2^{n-1} + {}^{2n-1}C_n$

8. The radius of a circle, having minimum area, which touches the curve $y = 4 - x^2$ and the lines, $y = |x|$ is

   (a) $2(\sqrt{2}-1)$ (b) $4(\sqrt{2}-1)$ (c) $4(\sqrt{2}+1)$ (d) $2(\sqrt{2}+1)$

9. The eccentricity of an ellipse whose centre is at the origin is $\frac{1}{2}$. If one of its directrices is $x=-4$, then the equation of the normal to it at $\left(1,\frac{3}{2}\right)$ is :

(a) $4x-2y=1$ (b) $4x+2y=7$ (c) $x+2y=4$ (d) $2y-x=2$

10. If $A=\begin{bmatrix}\cos\theta & i\sin\theta\\ i\sin\theta & \cos\theta\end{bmatrix}$, $\left(\theta=\frac{\pi}{24}\right)$ and $A^5=\begin{bmatrix}a & b\\ c & d\end{bmatrix}$, where $i=\sqrt{-1}$, then which one of the following is not true?

(a) $0\le a^2+b^2\le 1$ (b) $a^2-d^2=0$ (c) $a^2-b^2=\frac{1}{2}$ (d) $a^2-c^2=1$

11. Let k be an integer such that the triangle with vertices $(k,-3k),(5,k)$ and $(-k,2)$ has area 28 sq. units. Then the orthocentre of this triangle is the point :

(a) $\left(1,\frac{3}{4}\right)$ (b) $\left(1,-\frac{3}{4}\right)$ (c) $\left(2,\frac{1}{2}\right)$ (d) $\left(2,-\frac{1}{2}\right)$

12. If $\begin{vmatrix}x^2+x & x+1 & x-2\\ 2x^2+3x-1 & 3x & 3x-3\\ x^2+2x+3 & 2x-1 & 2x-1\end{vmatrix}=ax-12$, then 'a' is equal to :

(a) 12 (b) 24 (c) -12 (d) – 24

13. A man X has 7 friends, 4 of them are ladies and 3 are men. His wife Y also has 7 friends, 3 of them are ladies and 4 are mean Assume X and Y have no common friends. Then the total number of ways in which X and Y together can throw a party inviting 3 ladies and 3 men, so that 3 friends of each of X and Y are in this party, is :

(a) 468 (b) 469 (c) 484 (d) 485

14. Let A and B be any two 3×3 symmetric and skew symmetric matrices respectively. Then which of the following is NOT true?

(a) A^4-B^4 is a symmetric matrix (b) $AB-BA$ is a symmetric matrix

(c) B^5-A^5 is a skew-symmetric matrix (d) AB + BA is a skew – symmetric matrix

15. If x is so small that x^3 and higher powers of x may be neglected , then $\frac{(1+x)^{\frac{3}{2}}-\left(1+\frac{1}{2}x\right)^3}{(1-x)^{\frac{1}{2}}}$ may be approximated as

(a) $1-\frac{3}{8}x^2$ (b) $3x+\frac{3}{8}x^2$ (c) $-\frac{3}{8}x^2$ (d) $\frac{x}{2}-\frac{3}{8}x^2$

16. The number of symmetric matrices of order 3, with all the entries from the set {0 ,1,2,3, 4, 5, 6, ,7, 8, 9}, is :

(a) 6^{10} (b) 9^{10} (c) 10^9 (d) 10^6

17. If the vertices of a hyperbola be at (-2, 0) and (2, 0) and one of its foci be at (-3, 0) , then which one of the following points does not lie on this hyperbola?

(a) $(4,\sqrt{15})$ (b) $(-6,2\sqrt{10})$ (c) $(6,5\sqrt{2})$ (d) $(2\sqrt{6},5)$

18. The set $S=\{1,2,3,.....,12\}$ is to be partitioned into three sets A,B, C of equal size. Thus $A\cup B\cup C=S$, $A\cap B=B\cap C=A\cap C=\phi$. The number of ways to partition S is

(a) $\frac{12!}{(4!)^3}$ (b) $\frac{12!}{(4!)^4}$ (c) $\frac{12!}{3!(4!)^3}$ (d) $\frac{12!}{3!(4!)^4}$

19. Let $x=\left(8\sqrt{3}+13\right)^{13}$ and $y=(7\sqrt{2}+9)^9$. If [t] denotes the greatest integer $\le t$, then

(a) $[x]+[y]$ is even (b) [x] is odd but [y] is even

(c) [x] and [y] are both odd (d) [x] is even but [y] is odd

20. The number of $\theta\in(0,4\pi)$ for which the system of linear equations

$3(\sin 3\theta)x-y+z=2$

$3(\cos 2\theta)x+4y+3z=3$

$6x+7y+7z=9$

Has no solution is :

(a) 6 (b) 7 (c) 8 (d) 9

(Integer Type Questions)

This Section contains **5 Questions.** The answer to each question is a single digit integer ranging from 0 to 9. The correct digit below the question number in the ORS is to be bubbled.

1. The number of matrices of order 3×3, whose entries are either 0 or 1 and the sum of all the entries is a prime number , is .
2. If the system of linear equations $2x-3y=\gamma+5$, $\alpha x+5y=\beta+1$, where $\alpha,\beta,\gamma\in R$ has infinitely many solutions, then the value of $|9\alpha+3\beta+5\gamma|$ is equal to
3. Some couple participated in a mixed doubles badminton tournament. If the number of matches played, so that no couple played in a match , is 840, then the total numbers of persons who participated in the tournament, is ...
4. Let $\alpha>0$ be the smallest number such that the expansion of $\left(x^{\frac{2}{3}}+\frac{2}{x^3}\right)^{30}$ has a term $\beta x^{-\alpha},\beta\in N$. Then α is equal to.
5. Let $A(1,0), B(6,2)$ and $C\left(\frac{3}{2},6\right)$ be the vertices of a triangle ABC. If P is a Point inside the triangle ABC such that the triangles APC, APB and BPC have equal areas , then the length of the line segment PQ, where Q is the point $\left(-\frac{7}{6},-\frac{1}{3}\right)$, is _____.

Date- 05-01-2025 **Answer – key**

4th Revision Minor JEE-Main Test (Main Type)

Physics
1. d
2. b
3. b
4. c
5. d
6. b
7. d
8. d
9. d
10. b
11. a
12. d
13. b
14. d
15. d
16. d
17. c
18. d
19. d
20. b

Integer
1. 100
2. 3
3. 50
4. 6
5. 160

Chemistry
1. b
2. c
3. b
4. c
5. b
6. a
7. a
8. d
9. d
10. b
11. b
12. d
13. a
14. d
15. a
16. c
17. c
18. d
19. b
20. d

Integer
1. 3
2. 4
3. 3
4. 6
5. 5

Maths
1. d
2. b
3. a
4. a
5. a
6. d
7. a
8. b
9. a
10. c
11. c
12. b
13. d
14. c
15. c
16. d
17. c
18. a
19. a
20. b

Integer
1. 282
2. 58
3. 16
4. 2
5. 5

4th Revision Minor JEE-Main Test (Main Type)

PHYSICS

1. (d)

From P-V diagram, $PV^{\frac{1}{2}} = \text{constant}$

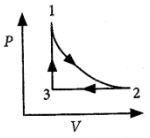
From ideal gas equation, $PV = nRT$

For, $n = 1$; $P \propto \frac{T}{V}$; $\frac{TV^{\frac{1}{2}}}{V} = \text{constant}$ or $T \propto V^{\frac{1}{2}}$

or $\frac{T_2}{T_1} = \left(\frac{V_2}{V_1}\right)^{\frac{1}{2}}$ or $\frac{T_2}{T_1} = \sqrt{\frac{2V_1}{V_1}} = \sqrt{2}$ (Given $V_2 = 2V_1$)

2. (b)

In process 2 to 3,
Pressure is constant – Isobaric
In process 3 to 1,
Volume is constant – Isochoric
Also it is given that, process 1 → 2 is adiabatic.
So, only option (b) gives correct explanation.



3. (b)

For one mole of ideal gas

$PV = RT$ ...(i)

Differentiating equation (i) w.r.t. V

or $P + V\frac{dP}{dV} = R\frac{dT}{dV}$

or $P_0\left[1 - \frac{1}{2}\left(\frac{V_0}{V}\right)^2\right] + V\left(-\frac{P_0}{2}V_0^2\frac{(-2)}{V^3}\right) = R\frac{dT}{dV}$

Total change in temperature by changing volume from V_0 to $2V_0$

$$\int_{T_1}^{T_2} dT = \frac{1}{R}\int_{V_0}^{2V_0}\left(P_0 + \frac{1}{2}P_0\frac{V_0^2}{V^2}\right)dV = \frac{1}{R}\left(P_0V - \frac{1}{2}\frac{P_0V_0^2}{V}\right)\Bigg|_{V_0}^{2V_0}$$

$$R(T_2 - T_1) = P_0(2V_0 - V_0) - \frac{1}{2}P_0V_0^2\left(\frac{1}{2V_0} - \frac{1}{V_0}\right)$$

$$\Delta T = \frac{5}{4R}P_0V_0$$

4. (c)

Here, PV = constant, so given process is **isothermal *i.e.*,** temperature is constant. Pressure at point 1 **is higher than** that at point 2. So, correct option is (c).

5. (d)

Ideal gas equation, $PV = nRT$

As temperature is constant

$PV = \text{constant} \Rightarrow P\frac{m}{\rho} = \text{constant}$, $P \propto \rho$ (for given m)

So, the graph will be a straight line having positive slope.

6. (b)

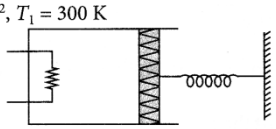
$A = 8 \times 10^{-3}\ \text{m}^2$, $T_1 = 300\ \text{K}$

$V_1 = 2.4 \times 10^{-3}\ \text{m}^3$

$\Delta x = 0.1\ \text{m}$,

$k = 8000\ \text{N/m}$

$P = 1 \times 10^5\ \text{N/m}^2$



Pressure, $P = \frac{F}{A} = \frac{kx}{A}$

$V_2 = V_1 + A\Delta x = 2.4 \times 10^{-3} + (8 \times 10^{-3} \times 0.1)$

$V_2 = 3.2 \times 10^{-3}\ \text{m}^3$ ...(i)

$P_2 = P_1 + \frac{k\Delta x}{A} = 10^5 + \frac{8000 \times 0.1}{8 \times 10^{-3}} = 2 \times 10^5\ \text{N/m}^2$ ...(ii)

From ideal gas equation, $\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$

$\Rightarrow \frac{10^5 \times 2.4 \times 10^{-3}}{300} = \frac{2 \times 10^5 \times 3.2 \times 10^{-3}}{T_2}$

$\Rightarrow T_2 = 800\ \text{K}$

7. (d)

For ideal gas, the relation between pressure (P), volume (V), number of moles (n), absolute temperature (T) is $PV = nRT$. So, the graph for $PV \propto T$ is a straight line with positive slope.

8. (d)

Number of moles of O_2, $n_1 = \frac{16}{32} = 0.5$ mole

Number of moles of N_2, $n_2 = \frac{28}{28} = 1$ mole

Number of moles of CO_2, $n_3 = \frac{44}{44} = 1$ mole

Total number of moles, $n = n_1 + n_2 + n_3$

$\therefore$ Now $n = 0.5 + 1 + 1 = \frac{5}{2}$ moles

Now, $PV = nRT$, $P = \frac{(nRT)}{V} = \left(\frac{5}{2}\right)\left(\frac{RT}{V}\right)$

9. (d)

As, induced emf, $\varepsilon = \frac{-d\phi}{dt}$

Flux, $\phi = NBA$

Thus, $\varepsilon = -NA\frac{dB}{dt}$ or $\varepsilon = -NA\frac{(B_2 - B_1)}{t}$

$\therefore \quad 22 = \frac{N \times \pi \times (0.01)^2 \times 2000}{2} \Rightarrow N = \frac{22 \times 2 \times 7}{22 \times 10^{-4} \times 2 \times 10^3}$

$\Rightarrow N = 70$

10. (b)

Resistance between P and $Q = 4\ \Omega + 1\ \Omega = 5\ \Omega$

Current, $I = 2$ mA; Emf, $\varepsilon = 5 \times 2 \times 10^{-3} = 10 \times 10^{-3}$ V

Also, induced emf, $\varepsilon = Blv_0$; $10 \times 10^{-3} = 5 \times 20 \times 10^{-2}\ v_0$

$\therefore \quad v_0 = \frac{1}{100}\ \text{m/s} = 1\ \text{cm/s}$

11. (a)

Given : $dt = 0.2$ s, $e = 0.1$ V

Change in current in a coil, $di = 2 - (-2) = 4$ A

$$e = L\frac{di}{dt} \Rightarrow 0.1 = L \times \frac{4}{0.2} \; ; L = 5 \text{ mH}$$

12. (d)

In case of charging, $i = i_0(1 - e^{-t/\tau})$

where $\tau = L/R = t_c$. So, charge $q = \int_0^{t_c} i\,dt = \int_0^{t_c} i_0(1 - e^{-t/t_c})\,dt$

$$= \frac{\varepsilon}{R}\int_0^{t_c}(1 - e^{-t/t_c})\,dt \; = \frac{\varepsilon}{R}\left[t + t_c e^{-t/t_c}\right]_0^{t_c}$$

$$= \frac{\varepsilon}{R}\left[(t_c + t_c e^{-t_c/t_c}) - (0 + t_c e^{-0})\right]$$

$$= \frac{\varepsilon}{R}[(t_c + t_c e^{-1}) - t_c] = \frac{\varepsilon}{R} t_c e^{-1} = \frac{\varepsilon}{Re} \times \frac{L}{R}; \; q = \frac{\varepsilon L}{eR^2}$$

13. (b)

Total mechanical energy of spring mass system is given by,

$$\text{T.E.} = \frac{1}{2} kA^2$$

It is independent of mass, so T.E. will remain same.

14. (d)

$R_e = R$, $g = \pi^2$, $h = 2R$, $l = 1$ m

Let the length of second's pendulum be l',

$$g' = \frac{gR^2}{(h+R)^2} = \frac{gR^2}{(3R)^2} = \frac{g}{9}$$

$$T \propto \sqrt{\frac{l}{g}}$$

So, as T is same as 2 s

$$\sqrt{\frac{l}{g}} = \sqrt{\frac{l'}{g'}} \Rightarrow \sqrt{\frac{l}{g}} = \sqrt{\frac{l' \times 9}{g}} \Rightarrow l' = \frac{l}{9} \; ; \; l' = \frac{1}{9} \text{ m}$$

15. (d)

$$\text{As } T = 2\pi\sqrt{\frac{L}{g}} \quad \therefore T^2 = \frac{4\pi^2 L}{g} \Rightarrow g = \frac{4\pi^2 L}{T^2}$$

Thus, the percentage error in 'g' is

$$\frac{\Delta g}{g} \times 100 = \frac{\Delta L}{L} \times 100 + \frac{2\Delta T}{T} \times 100$$

Here, $\left(\frac{\Delta g}{g} \times 100\right) = \left(\frac{0.2}{20} + \frac{2 \times 1}{40}\right) \times 100 = 1 + 5 = 6\%$

So, $N = 6$

16. (d)

Time period on earth's surface = T, height, $h = R$

Let the new period be T'.

$$g' = g\left(\frac{R}{R+h}\right)^2 = g\left(\frac{R}{R+R}\right)^2 = \frac{g}{4}$$

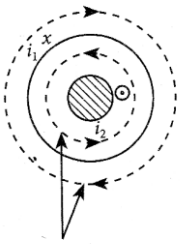
As, time period, $T \propto \frac{1}{\sqrt{g}}$

$$\frac{T'}{T} = \sqrt{\frac{g}{g'}} = \sqrt{\frac{g}{g} \times 4} = 2$$

$T' = 2T$

So, $x = 2$

17. (c)



Amperian loop

Given that, the central conductor and the outer conductor carry equal currents in opposite direction, thus, $i_1 = i_2$.

Using Amperes circuital law,

$\oint \vec{B}.d\vec{l} = \mu_o I_{\text{enclosed}}$

For any point, outside the cable, $i_{\text{enclosed}} = i_1 - i_2 = 0$

i.e., $\oint \vec{B}.d\vec{l} = 0$

Therefore, magnetic field is zero only outside the cable since i_{enclosed} is zero only outside the cable. In other cases, like inside the outer conductor, inside the inner conductor and between the two conductor, magnetic field will be constant as the applying current is the one that passes through the inner conductor only.

18. (d)

(A)–(III)

B_1(due to circular coil)

$$B_1 = \frac{\mu_0}{4\pi} \cdot \frac{2I}{r} = \frac{\mu_0 I}{2r} \otimes$$

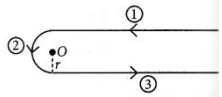
Now magnetic field due to straight wire

$$B_2 = \frac{\mu_0}{4\pi} \frac{2I}{r} = \frac{\mu_0 I}{2\pi r} \odot$$

$$B_{\text{net}} = B_1 - B_2 = \frac{\mu_0 I}{2r} - \frac{\mu_0 I}{2\pi r} = \frac{\mu_0 I}{2r}\left[1 - \frac{1}{\pi}\right]$$

$$B_{\text{net}} = \frac{\mu_0 I}{2r}\left(\frac{\pi - 1}{\pi}\right) \otimes$$

(B)–(I)



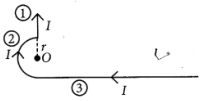
$$B_1 = \frac{\mu_0}{4\pi} \cdot \frac{I}{r} \odot$$

$$B_2 = \frac{\mu_0}{4\pi} \cdot \frac{\pi I}{r} = \frac{\mu_0 I}{4r} \odot; \; B_3 = \frac{\mu_0}{4\pi} \frac{I}{r} \odot$$

$$B_{\text{net}} = B_1 + B_2 + B_3 = \frac{\mu_0}{4} \frac{I}{r}\left[\frac{1}{\pi} + 1 + \frac{1}{\pi}\right] = \frac{\mu_0 I}{4r}\left[\frac{2}{\pi} + 1\right]$$

$$B_{\text{net}} = \frac{\mu_0 I}{4r}\left(\frac{2 + \pi}{\pi}\right)$$

(C)–(IV)

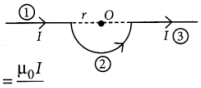


$$B_1 = 0, B_2 = \frac{\mu_0}{4\pi} \cdot \frac{\pi I}{r} = \frac{\mu_0 I}{4r} \otimes$$

$$B_3 = \frac{\mu_0}{4\pi} \frac{I}{r} \otimes$$

$$B_{\text{net}} = B_2 + B_3 + B_1 = \frac{\mu_0 I}{4r}\left[1 + \frac{1}{\pi}\right] = \frac{\mu_0 I(\pi + 1)}{4\pi r} \otimes$$

(D)–(II)



$B_1 = B_3 = 0$

$$B_{\text{net}} = B_2 = \frac{\mu_0}{4\pi} \cdot \frac{\pi I}{r} \Rightarrow B_{\text{net}} = \frac{\mu_0 I}{4r}$$

(A)–(III), (B)–(I), (C)–(IV), (D)–(II).

19. (d)

Magnetic field induction due to loop A at the centre O is

$$B_A = \frac{\mu_0 I}{2a}$$

Magnetic field induction due to loop B at the centre O is

$$B_B = \frac{\mu_0 I}{2a}$$

$\because$ B_A and B_B are perpendicular to each other, therefore, the resultant magnetic field induction at centre O is,

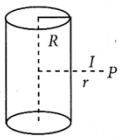
$$B = \sqrt{B_A^2 + B_B^2} = \sqrt{\left(\frac{\mu_0 I}{2a}\right)^2 + \left(\frac{\mu_0 I}{2a}\right)^2} = \sqrt{2}\,\frac{\mu_0 I}{2a}$$

$$\Rightarrow B = \frac{\mu_0 I}{\sqrt{2}\,a}$$

20. (b)

Let the current density per unit area is $J = \frac{I}{\pi R^2}$

Current on area πr^2 is $\frac{I}{\pi R^2} \cdot \pi r^2 = \frac{Ir^2}{R^2}$



According to Ampere's law,

$$B \times 2\pi r = \mu_0 \frac{Ir^2}{R^2} \; ; \; B = \frac{\mu_0 Ir}{2\pi R^2} \Rightarrow B \propto r$$

Integer Type

1. (100)

In the given cyclic process, $dU = 0$

So, $dQ = dW$; $dW = \pi a^2 = \pi \times \frac{(40-20)}{2} \times 10^{-3} \times \frac{20}{2} \times 10^3$

$$dW = dQ = \pi \times \frac{20 \times 20}{4} = \frac{400\pi}{4}\,\text{J} = 100\,\pi\,\text{J}$$

100. (17258) : Temperature, $T = 27°C = 300$ K, $n = 1$

Work done in isothermal process, $W = nRT \ln \frac{V_2}{V_1}$

$$W = 1 \times 8.3 \times 300 \ln \frac{4}{2}$$

$W = 8.3 \times 300 \times 0.6931 = 1725.8$ J $= 17258 \times 10^{-1}$ J

2. (3)

Degree of freedom of mixed gas, $f = \frac{n_1 f_1 + n_2 f_2}{n_1 + n_2}$

$$f = \frac{1 \times 3 + 3 \times 5}{1+3} \; ; \; f = \frac{9}{2}$$

Now, $C_V = \frac{f}{2}R$, $C_V = \frac{9}{4}R = \frac{(3)^2}{4}R \Rightarrow \alpha = 3$

3. (50)

In the given series LCR circuit,

Resistance, $R = 300\ \Omega$

Inductance, $L = 1$H

Capacitance, $C = 20\ \mu\text{F} = 20 \times 10^{-6}$ F

RMS value of voltage, $E_{rms} = 50$V

Frequency of source, $f = \frac{50}{\pi}$ Hz $\quad (\because \omega = 2\pi f = 100$ Hz)

Now, inductive reactance, $X_L = \omega L = 2\pi f L$

$$\therefore \quad X_L = 2\pi \times \frac{50}{\pi} \times 1 = 100\ \Omega$$

Capacitive reactance,

$$X_C = \frac{1}{\omega C} = \frac{1}{2\pi f C} = \frac{1}{100 \times 20 \times 10^{-6}} = 500\ \Omega$$

The expression for effective impedance in the LCR circuit is,

$$Z = \sqrt{R^2 + (X_C - X_L)^2}$$

Substituting the values in above expression,

$$Z = \sqrt{(300)^2 + (500-100)^2} = 500\ \Omega$$

Thus, *rms* current in the circuit is

$$I_{rms} = \frac{E_{rms}}{Z} \Rightarrow I_{rms} = \frac{50\text{V}}{500\ \Omega} = 0.1\text{ A}$$

The *rms* potential difference across the capacitor

$= I_{rms} \times X_C = 0.1 \times 500 = 50$V

4. (6)

$l = 1$ m, $T = 6$ N, $T' = 54$ N, $b = 12$

Let the frequency be f.

$$f = \frac{1}{2l}\sqrt{\frac{T}{\mu}}$$

so, $\quad f_1 = \frac{1}{2 \times 1}\sqrt{\frac{6}{\mu}} \Rightarrow f_2 = \frac{1}{2 \times 1}\sqrt{\frac{54}{\mu}}$

$$\frac{f_2}{f_1} = 3 \Rightarrow f_2 = 3 f_1$$

And, $f_2 - f_1 = 12 \Rightarrow 3f_1 - f_1 = 12$

$f_1 = 6$ Hz

5. (160)

$B = B_0(1 + 4x)\,\hat{k}$

$B_0 = 5$T

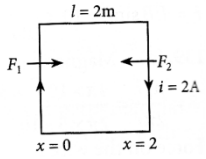
$B(x = 0) = B_0 = 5$T

$B'(x = 2) = 9B_0 = 45$T

$F_1 = ilB = 2 \times 2 \times 5 = 20$ N

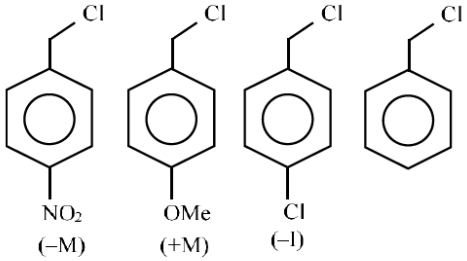
$F_2 = ilB' = 2 \times 2 \times 45 = 180$ N

Net force, $F_2 - F_1 = 180 - 20 = 160$ N



CHEMISTRY

1. b

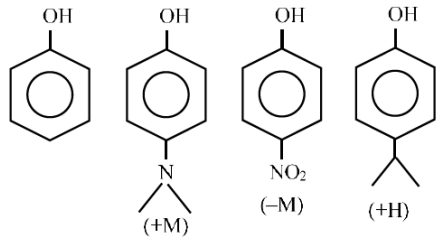


b > d > c > a

2. c

Acidic strength $\propto$ (–M, –H, – I)

$$\propto \frac{1}{(+M,+H,+I)}$$

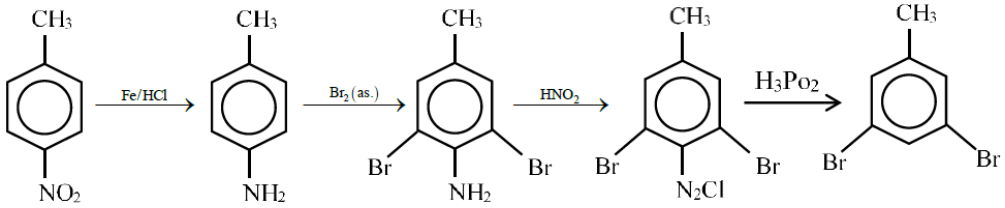


PKa $\propto \frac{1}{\text{Acidic}}$ strength

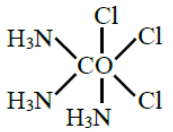
A order of acidic strength: c > a > d > b

Order of PKa : c < a < d < b

3. b
4. c



5. b
6. a



(90°)

7. a

Complex	Hyloridisation
(A) $Ni(CO)_4$	sp^3
(B) $[Cu(NH_3)_4]^{+2}$	dsp^2
(C) $[Fe(NH_3)_6]^{+2}$	d^2sp^3
(D) $[Fe(H_2O)_6]^{+2}$	sp^3d^2

8. d

$4\ LiNO_3 \xrightarrow{\Delta} 2\ Li_2O + 4\ NO_2 + O_2$

9. d

Due to strong hydrogen bonding present in boric acid, boric acid present in solid form.

10. b

Nessler's reagent

$K_2HgI_4 + KOH$

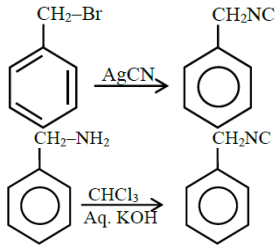
11. b

$2\ KMnO_4 + 10I^- + 16H^+ \rightarrow 2Mn^{+2} + 8H_2O + 5I_2$

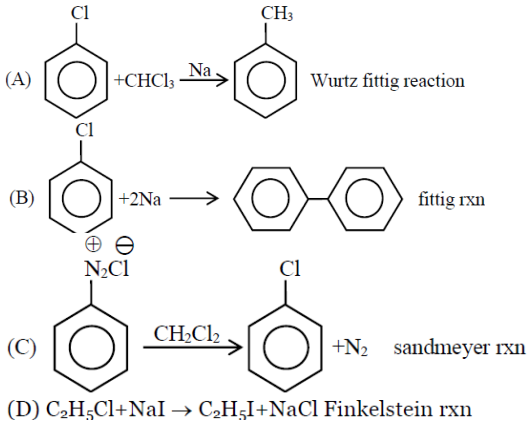
neutral/faintly alkaline sol^n.

$2\ MnO_4^- + I^- + H_2O \rightarrow 2\ MnO_2 + 2OH^- + IO_3^-$

12. d



13. a



(D) $C_2H_5Cl + NaI \rightarrow C_2H_5I + NaCl$ Finkelstein rxn

14. d

fehling test gives positive result for aliphatic aldehyde While sodium nitroprasside gives blood red

color with S and N.

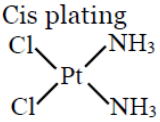
So Na+N+C+S → NaSCN (Sodium thiocyanate)

$SCN^- + Fe^{3+} \rightarrow [Fe(SCN)]^{2+}$ Ferric thiocyanate (Blood red color)

Confims presence of N and S

15. a

Cis plating



is used as Anticancer agent

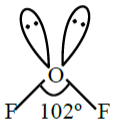
16. c

order of ligand strength

$S^{2-} < C_2O_4^{2-} < NH_3 < en < CO$

17. c

OF_2



2 l.pe⁻ in 'O'
bond angle 102°
bent/V shape

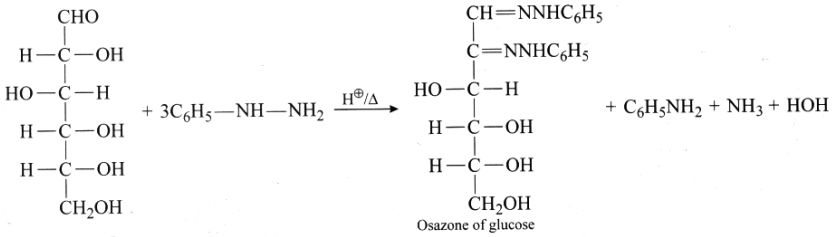
18. d

Zn^{+2}, CO^{+2}, Ni^{+2}, IVth group
Fe^{+3} = IIIrd group

19. b

Integer Type

1. d

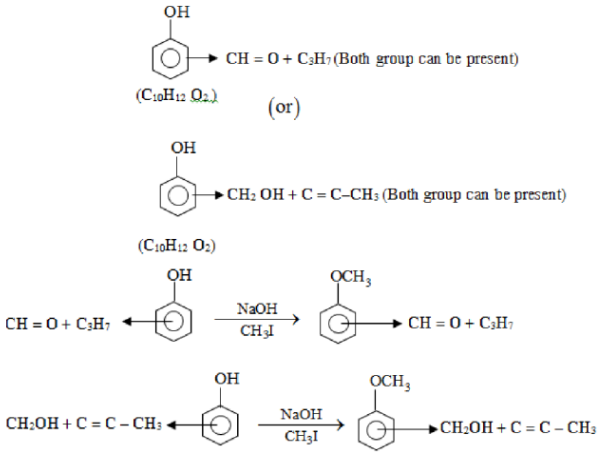


Osazone of glucose

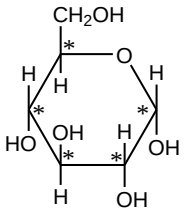
2. 3

$4H^+ + MnO_4^- + 3e^- \rightarrow MnO_2 + 2H_2O$

3. 4



4. 3
5. 6
6. 5



Sol^{n}

① $A = \begin{bmatrix} \cos\theta & \sin\theta \\ -\sin\theta & \cos\theta \end{bmatrix}$

$A^2 = \begin{bmatrix} \cos 2\theta & \sin 2\theta \\ -\sin 2\theta & \cos 2\theta \end{bmatrix}$

$B = A + A^4 = \begin{bmatrix} \cos\theta & \sin\theta \\ -\sin\theta & \cos\theta \end{bmatrix} + \begin{bmatrix} \cos 4\theta & \sin 4\theta \\ -\sin 4\theta & \cos 4\theta \end{bmatrix}$

$|B| = 2 + 2\cos 3\theta \qquad \theta = \pi/5$

$|B| = \frac{5-\sqrt{5}}{2} \in (1,2)$

$= \frac{5-2.23}{2}$

② $(a-1)x - y - z = 0$

$-x + (b-1)y - z = 0$

$-x - y + (c-1)z = 0$

Non trivial Sol^{n}

$$\begin{vmatrix} a-1 & -1 & -1 \\ -1 & b-1 & -1 \\ -1 & -1 & c-1 \end{vmatrix} = 0$$

$\Rightarrow ab + bc + ca = abc$

③ $\Delta_0 = \begin{vmatrix} 2 & -1 & 3 \\ 3 & 2 & -1 \\ 4 & 5 & \alpha \end{vmatrix} = 7(\alpha+5) = 0$

$\Delta_1 = \begin{vmatrix} -1 & 3 & -5 \\ 2 & -1 & -7 \\ 5 & \alpha & -\beta \end{vmatrix} = 0$

$\Delta_2 = \begin{vmatrix} 2 & 3 & -5 \\ 3 & -1 & -7 \\ 4 & \alpha & -\beta \end{vmatrix} = 0$

$\Delta_3 = \begin{vmatrix} 2 & -1 & -5 \\ 3 & 2 & -7 \\ 4 & 5 & -\beta \end{vmatrix} = 0$

infinite Sol^{n} $\Delta = 0$ $\Delta_1 = \Delta_2 = \Delta_3 = 0$

$\alpha = -5 \quad \beta = 9$

④ $\sum_{r=0}^{20} {}^{50-r}C_6$

$= {}^{50}C_6 + {}^{49}C_6 + {}^{48}C_6 + \cdots + {}^{30}C_6$

$= \text{Coeff. of } x^6 \text{ in } \left[(1+x)^{50} + (1+x)^{49} + \cdots + (1+x)^{30}\right]$

$= \text{Coeff. of } x^6 \text{ in } (1+x)^{50}\left[1 + \left(\frac{1}{1+x}\right) + \cdots + \left(\frac{1}{1+x}\right)^{20}\right]$

$= \text{Coeff. of } x^6 \text{ in } (1+x)^{50}\left(\frac{1 - \left(\frac{1}{1+x}\right)^{21}}{1 - \frac{1}{1+x}}\right)$

$= \text{Coeff. of } x^6 \text{ in } (1+x)^{51} \cdot x^{-1}\left(1 - \left(\frac{1}{1+x}\right)^{21}\right)$

$= \text{Coeff. of } x^6 \text{ in } \left[(1+x)^{51} \cdot x^{-1} - (1+x)^{30} x^{-1}\right]$

$= {}^{51}C_7 - {}^{30}C_7$

⑤ $\frac{3^{200}}{8} = \frac{(3^2)^{100}}{8} = \text{Re}\,\frac{1}{8}$

$\left\{\frac{3^{200}}{8}\right\} = \frac{1}{8}$

⑥ $a_n = \sqrt{7 + a_n}$

$a_n^2 - a_n - 7 = 0$

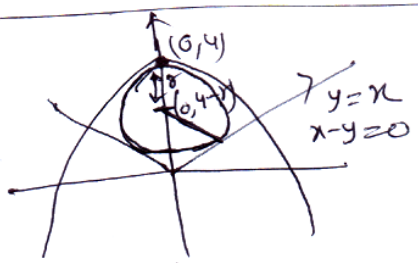
$a_n = \frac{1 \pm \sqrt{29}}{2} > 3$

(7) $\sum_{\substack{i,j=0 \\ i\neq j}} {}^nC_i \, {}^nC_j$

$= \sum_{i=0}^{n} {}^nC_i \sum_{j=0}^{n} {}^nC_j - \sum_{i=0}^{n} \sum_{j=0}^{n} ({}^nC_i)^2$

$= 2^{2n} - {}^{2n}C_n$

(8)



Centre $= (0, 4-r)$

$\frac{|0-(4-r)|}{\sqrt{2}} = r$

$r-4 = -\sqrt{2}r$

$(1+\sqrt{2})r = 4$

$r = \frac{4}{\sqrt{2}+1} = 4(\sqrt{2}-1)$

$|r-4| = \sqrt{2}r$

$r = 4+\sqrt{2}r$

$r(1-\sqrt{2}) = 4$

$r = \frac{4}{1-\sqrt{2}}$ ✗

(9) $e = \frac{1}{2}$ $\quad \frac{a}{e} = 4$ $\quad a = 2$

$b^2 = a^2(1-e^2) \Rightarrow b^2 = 3$

$b = \sqrt{3}$

eq^n of an ellipse $\boxed{\frac{x^2}{4} + \frac{y^2}{3} = 1}$

eq^n of Normal at (x_1, y_1)

$\frac{a^2x}{x_1} - \frac{b^2y}{y_1} = a^2 - b^2$

eq^n of Normal at $(1, 3/2)$

$\frac{4x}{1} - \frac{3y}{3/2} = 4-3$

$\boxed{4x - 2y = 1}$

(10) $A^2 = \begin{pmatrix} \cos 2\theta & \sin 2\theta \\ i\sin 2\theta & \cos 2\theta \end{pmatrix}$

$A^5 = \begin{pmatrix} \cos 5\theta & i\sin 5\theta \\ i\sin 5\theta & \cos 5\theta \end{pmatrix} = \begin{pmatrix} a & b \\ c & d \end{pmatrix}$

(1) $a^2+b^2 = \cos^2 5\theta - \sin^2 5\theta = \cos 10\theta = \cos 720^\circ$

(2) $a^2-d^2 = \cos^2 5\theta - \cos^2 5\theta = 0$

(3) $a^2-b^2 = \cos^2 5\theta + \sin^2 5\theta = 1$

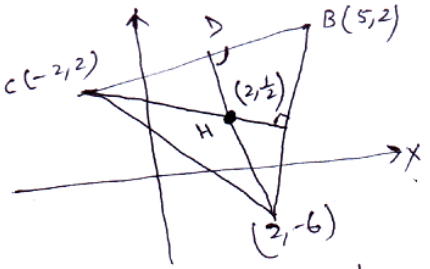
(4) $a^2-c^2 = \cos^2 5\theta + \sin^2 5\theta = 1$

(11) $\frac{1}{2}\begin{vmatrix} k & -3k & 1 \\ 5 & k & 1 \\ -k & 2 & 1 \end{vmatrix} = \pm 28$

$5k^2 + 13k + 10 = \pm 56$

Solving we get

$k = 2 \quad k \in I$



(12) $\begin{vmatrix} x^2+x & x+1 & x-2 \\ x^2+3x-1 & 3x & 3x-3 \\ x^2+2x+3 & 2x-1 & 2x-1 \end{vmatrix} = \alpha x - 12$

Put $x = 1$

$\begin{vmatrix} 2 & 2 & -1 \\ 4 & 3 & 0 \\ 6 & 1 & 1 \end{vmatrix} = \alpha - 12$

$12 = \alpha - 12$

$\Rightarrow \boxed{\alpha = 24}$

(13)

Man		wife		No of ways
Men 3	L 4	Men 4	L 3	3L & 3M.
3	0	0	3	${}^3C_3 \times {}^4C_0 \times {}^4C_0 \times {}^3C_3 = 1$
0	3	3	0	${}^3C_0 \times {}^4C_3 \times {}^4C_3 \times {}^3C_0 = 16$
1	2	2	1	${}^3C_1 \times {}^4C_2 \times {}^4C_2 \times {}^3C_1 = 324$
2	1	1	2	${}^3C_2 \times {}^4C_1 \times {}^4C_1 \times {}^3C_2 = 144$

(14) $A^T = A \quad B^T = -B$

(1) $C = A^4 - B^4$

$C^T = (A^4 - B^4)^T = (A^4)^T - (B^4)^T$

$= A^4 - B^4 = C$

(2) $C = AB - BA$

$C^T = (AB - BA)^T = B^T A^T - A^T B^T$

$= -BA + AB$

$= C$

(3) $C = B^5 - A^5$

$C^T = -B^5 - A^5$

(4) $C = AB + BA$

$C^T = (AB + BA)^T$

$\boxed{C^T = -C}$

(15) $\dfrac{\left(1 + \frac{3}{2}x + \frac{3}{2}\cdot\frac{1}{2}\frac{1}{2!}x^2 + \cdots\right)\left(1 + 3\cdot\frac{1}{2}x + \frac{3\cdot 2}{2!}\frac{1}{4}x^2 + \cdots\right)}{(1-x)^{\frac{1}{2}}}$

$= -\frac{3}{8}x^2(1-x)^{-1/2}$

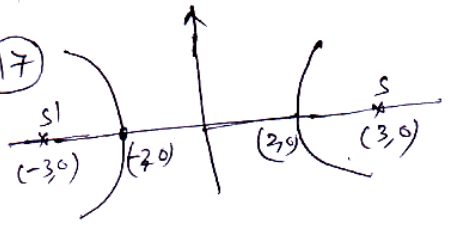
$= -\frac{3}{8}x^2\left(1 + \frac{1}{2}x + \frac{1}{2}\cdot\frac{3}{2}\cdot\frac{1}{2!}x^2 + \cdots\right)$

$= -3/8x^2$

(16) $A = \begin{bmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{bmatrix}$

No. of Symmetric Matrix $= 10^3 \times 10^3 = 10^6$

(17)



$ae = 3 \quad a = 2$

$b^2 = a^2(e^2 - 1)$

$b^2 = 9 - 4 \quad \boxed{b^2 = 5}$

eq^n of hyperbola $\boxed{\frac{x^2}{4} - \frac{y^2}{5} = 1}$

$(6, 5\sqrt{2})$ does not lie.

No. of ways

(18) ${}^{12}C_4 \times {}^8C_4 \times {}^4C_4$

$= \dfrac{12!}{(4!)^3}$

(19) $x = (8\sqrt{3} + 13)^{13}$

$I + f = (8\sqrt{3} + 13)^{13}$

$f = (8\sqrt{3} - 13)^{13}$

$I + f - f =$ even integer

$f - f = 0 \Rightarrow I =$ even integer

$[x] =$ even integer

Similarly $[y] =$ even integer

$[x] + [y] =$ even integer

(20)

$D = 0$

$$\begin{vmatrix} 3\sin 3\theta & -1 & 1 \\ 3\cos 2\theta & 4 & 3 \\ 6 & 7 & 7 \end{vmatrix} = 0$$

$$\boxed{\sin 3\theta + 2\cos 2\theta - 2 = 0}$$

No of sol^{n} is 7 in $(0, 4\pi)$

Integer

(1) $\sum a_{ij} = 2, 3, 5, 7$

Top Matrix

$= {}^{9}C_2 + {}^{9}C_3 + {}^{9}C_5 + {}^{9}C_7$

$= 282$

(2) $\frac{\alpha}{2} = \frac{5}{-3} = \frac{\beta+1}{\gamma+5}$

$\alpha = -\frac{10}{3}$ $\quad 3\beta + 5\gamma = -28$

$9\alpha = -30$ $\quad 3\beta + 5\gamma = -28$

$|9\alpha + 3\beta + 5\gamma| = 58$

(3) ${}^{n}C_2 \times {}^{n-2}C_2 \times 2 = 840$

$\boxed{n = 8}$

No of Person $= 8 \times 2 = 16$

(4)

$T_{r+1} = {}^{30}C_r \, 2^{r} \, x^{\frac{60-11r}{3}}$

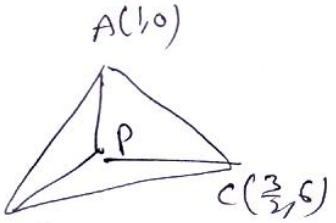
$\frac{60-11r}{3} < 0 \Rightarrow 11r > 60$

$r > \frac{60}{11} \Rightarrow r \geq 6$

$T_7 = {}^{30}C_6 \, 2^6 \, x^{-2}$

$\boxed{\alpha = 2}$

(5)



P is the Centroid

$P = \left(\frac{17}{6}, \frac{8}{3}\right)$

$\boxed{PQ = 5}$