

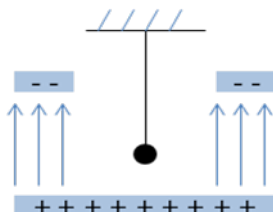
Physics Paper-I

SECTION I

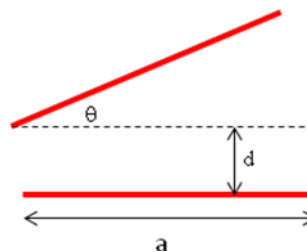
STRAIGHT OBJECTIVE TYPE

This section contains 6 multiple choice questions. Each question has four choices (a), (b), (c) and (d), out of which ONLY ONE is correct. 3 MARKS will be awarded for correct answer. 1 MARK will be deducted for wrong answer.

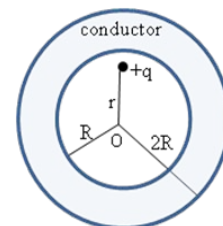
1. If a positively charged pendulum is oscillating in a uniform electric field as shown in figure. Its time period as compared to that when it was uncharged will
 (a) increase b) decrease c) not change d) will first increase then decrease



2. A capacitor has square plates each of side a , making an angle θ between them as shown in figure. For $\theta \ll 1$, the capacitance is given by (Let $C = \frac{\epsilon_0 a^2}{d} \left(1 - \frac{a\theta}{2d}\right)$)
 a) C b) $C/2$ c) $C/4$ d) $2C$



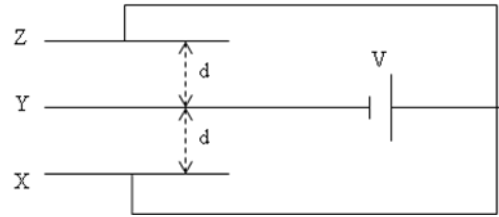
3. One mole of an ideal gas undergo a process in which the temperature changes with volume as $T = KV^2$. The work done by the gas as the temperature changes from T_0 to $4T_0$ is
 a) $3nRT_0$ b) $5nRT_0/2$ c) $3nRT_0/2$ d) zero
4. A point charge q is placed at a distance r from the centre O of an uncharged spherical shell of inner radius R and outer radius $2R$. The distance $r < R$. The electric potential at the centre of the shell will be
 a) $\frac{q}{4\pi\epsilon_0} \left(\frac{1}{r} - \frac{1}{2R} \right)$ b) $\frac{q}{4\pi\epsilon_0 r}$ c) $\frac{q}{4\pi\epsilon_0} \left(\frac{1}{r} + \frac{1}{2R} \right)$ d) $\frac{q}{4\pi\epsilon_0} \left(\frac{1}{r} - \frac{1}{R} \right)$



5. A hollow sphere of radius $2R$ is charged to V volts and another smaller sphere of radius R is charged to $V/2$ volts. Then the smaller sphere is placed inside the bigger sphere without changing the net charge on each sphere. The potential difference between two spheres will be
 a) $3V/2$ b) $V/4$ c) $V/2$ d) V

6. Consider the arrangement of three plates X, Y and Z each of area A and separation d. The energy stored when the plates are fully charged is

- a) $\frac{\epsilon_0 AV^2}{2d}$ b) $\frac{\epsilon_0 AV^2}{d}$ c) $\frac{2\epsilon_0 AV^2}{d}$ d) $\frac{3\epsilon_0 AV^2}{2d}$



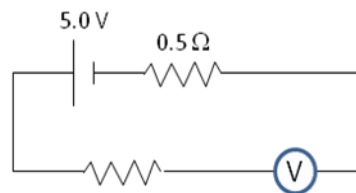
SPACE FOR ROUGH WORK

SECTION II

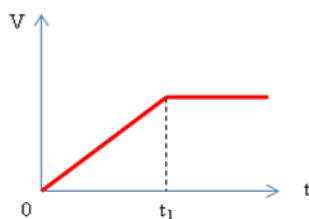
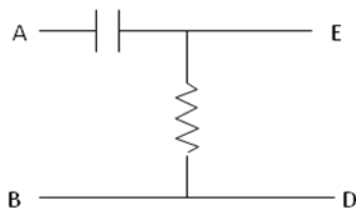
MULTIPLE CHOICE TYPE QUESTIONS

This section contains 4 multiple choice questions. Each question has 4 choices (A), (B), (C) and (D), out of which ONE OR MORE options may be correct. NO NEGATIVE marking.

7. Air is enclosed in a vessel at 10 atm pressure. A tap in the vessel is opened suddenly and closed in a short time. The air in the vessel attains a pressure of 1 atm. Given, γ for air = 1.4. Then,
- Adiabatic process most closely resembles this process
 - Isothermal process most closely resembles this process
 - Adiabatic process at the beginning and isothermal process later most closely resembles this process
 - The fraction of air that has escaped is 0.807
8. Two fixed charges $-2Q$ and Q are located at coordinates $(-3a, 0)$ and $(+3a, 0)$ respectively in x-y plane. Then
- All the points in x-y plane where the potential is zero lies on a circle
 - All the points in x-y plane where the potential is zero lies on a straight line
 - There is only one point in x-y plane where electric field is zero
 - There is only one point in x-y plane where potential is zero
9. An ideal voltmeter V is connected to a 2.0Ω resistor and a battery with emf 5.0 V and internal resistance 0.5Ω as shown in figure. Then
- The current in the 2Ω resistor is zero
 - The terminal voltage of the battery is 5.0 V
 - The reading of the voltmeter is 5.0 V
 - The potential difference across this battery in an open circuit (when no current is drawn) is 5.0 V .



10. A time varying voltage V is applied to the given circuit such that voltage V_c across the capacitor is as shown in the figure.
- If V is applied across terminals C and D then $V = a$ positive constant, for time $t = 0$ to $t = t_1$
 - If V is applied across terminals C and D then $V = \text{zero}$, for time beyond $t = t_1$
 - If V is applied across terminals A and B then $V = a$ positive constant, for time $t = 0$ to $t = t_1$
 - If V is applied across terminals A and B then $V = \text{zero}$, for beyond $t = t_1$



SECTION III

ASSERTION-REASON TYPE

This question contains 4 reasoning type questions. Each question has 4 choices (a), (b), (c) and (d), out of which ONLY ONE is correct. 3 MARKS will be awarded for correct answer. 1 MARK will be deducted for wrong answer. NO MARKS WILL BE GIVEN OR DEDUCTED IF A QUESTION IS NOT ANSWERED.

- (a) STATEMENT-1 is True, STATEMENT-2 is true; STATEMENT-2 is a correct explanation for STATEMENT 1
 - (b) STATEMENT-1 is True, STATEMENT-2 is true; STATEMENT-2 is NOT a correct explanation for STATEMENT-1
 - (c) STATEMENT-1 is True, STATEMENT-2 is False
 - (d) STATEMENT-1 is False, STATEMENT-2 is true
-

11. **STATEMENT 1:** We can define the thermodynamic parameters P, V and T uniquely in a quasi-static process.
STATEMENT 2: The system is very nearly in thermal equilibrium at any instant in a quasi-static process.
12. **STATEMENT 1:** The entropy of the system remains constant in an adiabatic reversible cycle.
STATEMENT 2: Entropy is a conserved quantity.
13. **STATEMENT 1:** If there is no systematic motion in the system, then first law of thermodynamics is given by $\Delta U = \Delta Q - \Delta W$, where ΔU = increase in internal energy of the system, ΔQ = heat given to the system, ΔW = work done by the process.
STATEMENT 2: First law of thermodynamics follows conservation of energy.
14. **STATEMENT 1:** Charge on an electron is 3.2×10^{-19} C lesser than that of a proton.
STATEMENT 2: Charge on an electron = -1.6×10^{-19} C and charge on an proton is $+1.6 \times 10^{-19}$ C
-

SPACE FOR ROUGH WORK

Paragraph for Questions numbers 18 to 20

A charged capacitor C_1 is discharged through a resistance R by putting switch S in position 1 of circuit shown in figure. When discharge current reduces to I_0 the switch is suddenly shifted to position 2.

Answer the following question based on this paragraph.

18. Current through the circuit as a function of time t is given by

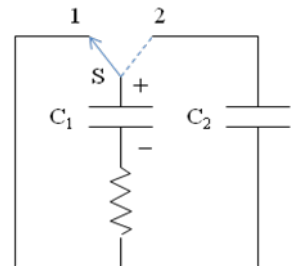
a) $I = I_0 e^{-\frac{t}{R(C_1+C_2)}}$ b) $I = I_0 e^{-\frac{(C_1+C_2)t}{R(C_1C_2)}}$ c) $I = I_0 \left(1 - e^{-\frac{t}{R(C_1+C_2)}} \right)$ d) $I = I_0 \left(1 - e^{-\frac{(C_1+C_2)t}{R(C_1C_2)}} \right)$

19. The energy stored in the two capacitors in steady state is

a) $\frac{I_0^2 R^2 C_1}{2(C_1 + C_2)}$ b) $\frac{I_0^2 R^2 C_2}{2(C_1 + C_2)}$ c) $\frac{I_0^2 R^2 C_1 C_2}{2(C_1 + C_2)^2}$ d) $\frac{I_0^2 R^2 C_1 C_2}{(C_1 + C_2)^2}$

20. Heat generated across resistance R is

a) $\frac{I_0^2 R^2 C_1}{2(C_1 + C_2)}$ b) $\frac{I_0^2 R^2 C_2}{2(C_1 + C_2)}$ c) $\frac{I_0^2 R^2 C_1 C_2}{2(C_1 + C_2)^2}$ d) $\frac{I_0^2 R^2 C_1 C_2}{(C_1 + C_2)^2}$



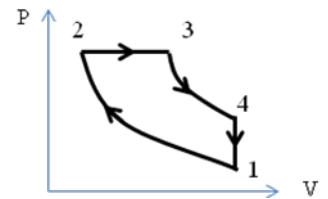
SPACE FOR ROUGH WORK

Paragraph for Questions numbers 21 to 23

The diatomic gas is used as working substance in an engine working on the cycle as shown in figure. Processes 1-2, 2-3, 3-4, 4-1 are isothermal, isobaric, adiabatic and isochoric respectively. The ratio of maximum to minimum volume of gas during the cycle is 5 and that of maximum to minimum absolute temperature is 2 assuming gas to be an ideal gas. Assume minimum temperature = T_0 . Use $\ln 5 = 1.61$ and $(0.4)^{0.4} = 0.693$

Answer the following questions based on this paragraph.

21. Net work done by the gas during the cycle is
a) $0.925 nRT_0$ b) $0.825 nRT_0$ c) $0.725 nRT_0$ d) $0.625 nRT_0$
22. Total heat supplied to the gas during heating process is
a) nRT_0 b) $1.5 nRT_0$ c) $2.5 nRT_0$ d) $3.5 nRT_0$
23. The efficiency of the engine is
a) 30.41% b) 36.42% c) 26.42% d) 22.42%



SPACE FOR ROUGH WORK

Chemistry Paper-I

SECTION I

STRAIGHT OBJECTIVE TYPE

This section contains 6 multiple choice questions. Each question has four choices (a), (b), (c) and (d), out of which ONLY ONE is correct. 3 MARKS will be awarded for correct answer. 1 MARK will be deducted for wrong answer.

1. A compound with the empirical formula $\text{Fe}(\text{H}_2\text{O})_4(\text{CN})_2$ has a magnetic moment corresponding to 8/3 unpaired electrons per iron. What is the correct possible formula for the above complex.

- (a) $[\text{Fe}(\text{CN})_2(\text{H}_2\text{O})_4]$ (b) $[\text{Fe}(\text{H}_2\text{O})_6]_2[\text{Fe}(\text{CN})_6]$ (c) $[\text{Fe}(\text{H}_2\text{O})_6][\text{Fe}(\text{CN})_4(\text{H}_2\text{O})_2]$ (d) $[\text{Fe}(\text{H}_2\text{O})_6][\text{Fe}(\text{CN})_6]$

2. Which of the following is not correctly matched

- (a) $[\text{Fe}(\text{en})_3]^{3+}$: sp^3d^2 and paramagnetic
 (b) $[\text{FeCl}_2(\text{PPh}_3)_2]$: sp^2 and paramagnetic
 (c) $[\text{Fe}(\text{CN})_6]^{3-}$: d^2sp^3 and paramagnetic
 (d) $[\text{Fe}(\text{CO})_2(\text{NO})_2]$: sp^3 and diamagnetic

3. $\text{MCl}_2 + \text{K}_2\text{CrO}_4 \rightarrow$ Yellow precipitate

What can be MCl_2 respectively

(A) If it give green flame in Bunsen flame

(B) If it is soluble in hot water

- (a) PbCl_2 , BaCl_2 (b) AgCl , SrCl_2 (c) AgCl , BaCl_2 (d) BaCl_2 , PbCl_2

4. Consider the following statement .roasting is carried to :

(A) convert sulphide to oxide and sulphate

(B) remove water of hydration

(C) melt the ore

(D) remove arsenic and sulphide impurities .

Of these statement which of the following are correct?

- (a) A, B and C (b) B, C and D (c) A, B and D (d) A, B, C and D

5. COLUMN I

COLUMN ii

(A) Horn silver

(P) AgNO_3

(B) Lunar caustic

(Q) $\text{ZnSO}_4 \cdot 7\text{H}_2\text{O}$

(C) blue vitriol

(R) AgCl

(D) White vitriol

(S) $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$

- (a) A-P; B-R ; C-S ; D-Q (b) A-R; B-P ; C-S ; D-Q (c) A-P; B-Q ; C-S; D-R (d) A-R ; B-Q ; C-P; D-S

6. Lanthanoid contraction is cause due to:

(a) the appreciable shielding on outer electron by 4f electrons from the outer charge

(b) the same effective nuclear charge from Ce to Lu

(c) the imperfect shielding on outer electron by 4f electrons from the nuclear charge

(d) the appreciable shielding on the outer electrons by 5d electrons from the nuclear charge

SECTION II**MULTIPLE CHOICE TYPE QUESTIONS**

This section contains 4 multiple choice questions. Each question has 4 choices (A), (B), (C) and (D), out of which ONLY ONE is correct. NO NEGATIVE marking.

7. Which of the following is/are correct?

- (a) A solution of HgCl_2 and SnCl_2 can exist together and remain unreacted.
- (b) PbCl_2 is insoluble in cold water but soluble in hot water
- (c) The blue ppt. formed by the action of $\text{K}_4[\text{Fe}(\text{CN})_6]$ on Fe^{3+} and by that of $\text{K}_3[\text{Fe}(\text{CN})_6]$ on Fe^{2+} have the same composition
- (d) Br_2 vapour turns the starch iodide paper blue, more quickly by the NO_2 gas.

8. When CO_2 is passed through aqueous :

- (a) Na_2CrO_4 solution, its yellow colour change to orange
- (b) K_2MnO_4 solution, it disproportionate to KMnO_4 and MnO_2
- (c) $\text{Na}_2\text{Cr}_2\text{O}_7$ solution, its orange colour changes to green
- (d) KMnO_4 solution, its pink colour changes to green

9. Which is the correct order ?

- (a) $[\text{Cr}(\text{NH}_3)_5(\text{NO}_2)]_3[\text{Co}(\text{NO}_2)_6]_2 > \text{Mg}[\text{Cr}(\text{NH}_3)(\text{NO}_2)_5] > \text{K}[\text{Co}(\text{NH}_3)_2(\text{NO}_2)_4]$, molar conductivity order
- (b) $\text{C} > \text{N} > \text{O} > \text{S}$, σ donation tendency
- (c) $[\text{Fe}(\text{en})_3]^{3+} > [\text{Fe}(\text{CN})_6]^{3+} > [\text{Fe}(\text{EDTA})]^-$, order of stability
- (d) $\text{V}(\text{CO})_6 > [\text{V}(\text{CO})_6]^-$, order of V-C bond length

10. Which of the following element(s) is/are extracted by electrolytic reduction from the aqueous solution of their salts?

- (a) Cu
 - (b) Al
 - (c) Mg
 - (d) Ag
-

SPACE FOR ROUGH WORK

SECTION III**ASSERTION-REASON TYPE**

This question contains 4 reasoning type questions. Each question has 4 choices (a), (b), (c) and (d), out of which ONLY ONE is correct. 3 MARKS will be awarded for correct answer. 1 MARK will be deducted for wrong answer. NO MARKS WILL BE GIVEN OR DEDUCTED IF A QUESTION IS NOT ANSWERED.

- (e) STATEMENT-1 is True, STATEMENT-2 is true; STATEMENT-2 is a correct explanation for STATEMENT 1
 - (f) STATEMENT-1 is True, STATEMENT-2 is true; STATEMENT-2 is NOT a correct explanation for STATEMENT-1
 - (g) STATEMENT-1 is True, STATEMENT-2 is False
 - (h) STATEMENT-1 is False, STATEMENT-2 is true
-

11. Statement 1: In hoops process of aluminium purification, the fused material remains in three different layers . These layers remain intact even in electrolytic reduction.

Statement 2: All three layers have different densities.

12. Statement 1: In the brown ring test for nitrates , though we start with FeSO_4 , we end up with $[\text{Fe}(\text{H}_2\text{O})_5(\text{NO})]\text{SO}_4$

Statement 2: NO transfers its odd electron to iron(2) to form iron(1) and itself changes to NO^+

13. Statement 1: Transition metal ion forming octahedral complexes undergo d^2sp^3 or sp^3d^2 hybridisation .

Statement 2 : Strong field ligand force the unpaired electron of central metal ion to pair up and weak field ligand cannot do this.

14. Statement 1: Metals which are not reduced by carbon or form carbides are reduced by sodium

Statement 2: Sodium is a stronger reducing agent than carbon.

SPACE FOR ROUGH WORK

SECTION IV

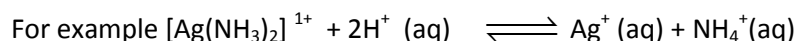
LINKED COMPREHENSION TYPE

This section contains 2 paragraphs. Based upon each paragraph, 3 multiple choice questions have to be answered. Each question has four choices (a), (b), (c) and (d), out of which ONLY ONE is correct. 4 MARKS will be awarded for correct answer. 1 MARK will be deducted for wrong answer. NO MARKS WILL BE GIVEN OR DEDUCTED IF A QUESTION IS NOT ANSWERED.

Paragraph for Questions numbers 15 to 17

Coordination sphere in complexes is normally more stable due to its high formation constant.

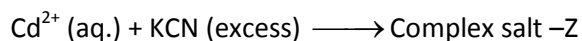
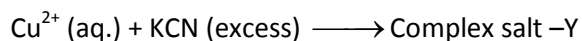
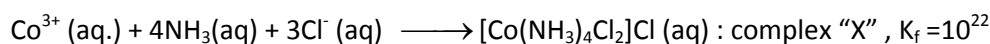
But in presence of some reagent it will decompose into metal and ligands .



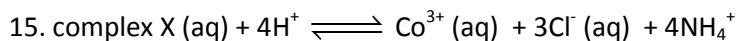
Complex formation reaction and structure of complexes are determined by colligative property measurements and electrical conductance measurements.

For example osmotic pressure = total conc. $\times R \times T$

For a particular experiment

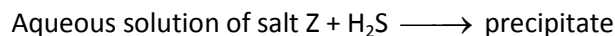


Given : K_{sp} of $\text{CuS} = K_{sp}$ of CdS , K_b of $\text{NH}_3 = 2 \times 10^{-5}$



Which of the following is correct?

- (a) Equilibrium constant for above reaction is 10^8
- (b) Mole of AgCl formed by adding excess of AgNO_3 in acidic solution of complex X is one.
- (c) three geometrical isomer is possible for complex X
- (d) Complex X and $[\text{Co}(\text{NH}_3)_5\text{Cl}]\text{Cl}_2$ can be distinguished by using cryoscopic measurement and electrical conductance measurement



Therefore correct statement is :

- (a) formation constant of salt Y is greater than formation constant of salt Z
 - (b) Osmotic pressure of 200ml aq solution of 0.1 M of complex Z is greater than that of 300ml aq. Solution of 0.1 M complex of Y
 - (c) % p character in hybrid orbitals of Y and Z are different .
 - (d) Electrical conductance of equimolar solutions of Y and Z corresponds to same charge number.
17. If 200ml of 0.2M CuSO_4 is mixed with 300ml of 0.2M $\text{K}_4[\text{Fe}(\text{CN})_6]$. Assuming formation of complex occurs upto 100% extent . calculate boiling point of final solution .(assuming molarity is same as molality and solution are ideal, K_b for water = $0.5 \text{K kg mole}^{-1}$, boiling point of pure water = 373k)
- (a) 373.16k
 - (b) 373.64k
 - (c) 373.50k
 - (d) 373.32k

Paragraph for Questions numbers 18 to 20

Strong planar complexes are formed by d^8 ions with strong field ligands. The crystal field splitting Δ_0 is larger for second and third row transition elements and for more highly charged species. All the complexes having $4d^8$ and $5d^8$ configuration are mostly square planar including those of weak field ligands such as halide ions. Square planar complexes can show geometrical isomerism but they do not show optical isomerism due to presence of plane of symmetry .

18. among the following ion which do not form the square planar complexes ?

- (a) Ni(+II) and Rh(+I) with strong field ligands
- (b) Rh(+I) and Ag(+II) with weak field ligand
- (c) Pd(+II) , Pt(+II) and Au(+III) with strong and weak field ligands
- (d) Ni(+II) with strong and weak field ligand.

19. Among the following compound witch has the square planar geometry ?

- (a) $[\text{RhCl}(\text{CO})(\text{PPh}_3)_2]$
- (b) $\text{K}_3[\text{Cu}(\text{CN})_4]$
- (c) $\text{K}_2[\text{Zn}(\text{CN})_4]$
- (d) $[\text{Ni}(\text{CO})_4]$

20. Select the correct statement :

- (a) Both $[\text{NiCl}_2(\text{PPh}_3)_2]$ and its analogous Pd(II) show geometrical isomerism.
- (b) $[\text{CoBrCl}(\text{en})_2]$ will not show geometrical isomerism but is a chiral compound
- (c) $[\text{Cis-Pt}(\text{NH}_3)_2\text{Cl}_2]$ will show geometrical as well as optical isomerism.
- (d) A complex of palladium (II) with two chloride ions and two thiocyanate ions will show linkage as well as geometrical isomerism.

SPACE FOR ROUGH WORK

Paragraph for Questions numbers 21 to 23

In metal carbonyls, there is synergic bonding interaction between metal and carbon monoxide. This leads to increase in strength of metal ligand bond and decrease in bond order of CO in carbonyl complexes as compared to bond order in carbon monoxide .

Simple carbonyls are invariably spin-paired complexes except for vanadium.

21. The increase in bond length of CO as compared to carbon monoxide is due to:

- (a) The donation of lone pair of electron on the carbon into the vacant orbital of metal atom.
- (b) due to the donation of pair of electron from a filled d-orbital of metal into the vacant antibonding orbital of carbon monoxide .
- (c) Both (a) and (b)
- (d) None

22. Which of the following statement is false for Nickle carbonyl $[\text{Ni}(\text{CO})_4]$?

- (a) It is colourless compound
- (b) The Ni-C-O group is linear
- (c) The four carbonyl group is at the four corners of a regular tetrahedron.
- (d) The metal carbonyl bond length does not alter (for σ bond) does not alter.

23. which among the following metal carbonyls are inner orbital complexes with diamagnetic property.

- (I) $\text{Ni}(\text{CO})_4$ (II) $\text{Fe}(\text{CO})_5$ (III) $\text{V}(\text{CO})_6$ (IV) $\text{Cr}(\text{CO})_6$
- (a) I and II only (b) II ,III and IV only (c) II and IV only (d) I , II and IV only

SPACE FOR ROUGH WORK

Mathematics Paper-I

SECTION I

STRAIGHT OBJECTIVE TYPE

This section contains 6 multiple choice questions. Each question has four choices (a), (b), (c) and (d), out of which ONLY ONE is correct. 3 MARKS will be awarded for correct answer. 1 MARK will be deducted for wrong answer.

1. The curve for which the x-intercept of the tangent drawn at any point P on the curve is three times the x-coordinate of the point P, is
 a) $xy = c$ b) $xy^2 = c$ c) $xy^3 = c$ d) none of these

2. Equation of mirror image of parabola $y^2 = 4x$ in the line $x - y + 2 = 0$ is
 a) $4(y - 2) = (x - 2)^2$ b) $4(y + 2) = (x + 2)^2$ c) $4(y - 2) = (x + 2)^2$ d) $(y - 2) = (x - 2)^2$

3. The locus of midpoints of the chord of the circle $x^2 - 2x + y^2 - 2y + 1 = 0$ which are of unit length is
 a) $(x - 1)^2 + (y - 1)^2 = \frac{3}{4}$ b) $(x - 1)^2 + (y - 1)^2 = 2$ c) $(x - 1)^2 + (y - 1)^2 = 4$ d) none

4. The binomial expansion having term independent of x is
 a) $\left(x^3 - \frac{1}{x^2}\right)^{25}$ b) $(x^{1/3} - 2x^{1/5})^{23}$ c) $(x^{1/5} - 2x^{2/5})^{25}$ d) none of these

5. If $x_{n+1} = \sqrt{\frac{1+x_n}{2}}$ and $|x_0| < 1, n \geq 0$ then $\lim_{n \rightarrow \infty} \left(\frac{\sqrt{1-x_0^2}}{x_1 x_2 x_3 \dots x_n} \right) =$
 a) -1 b) 1 c) $\cos^{-1}(x_0 + 1)$ d) $\cos^{-1}x_0$

6. If the domain of $f(x)$ is $x \in R - (-1, 1)$ then the domain of function $f\left([\sin x] \cos\left(\frac{\pi}{x-1}\right)\right)$, where $[.]$ denotes greatest integer function is
 a) $x \in R$ b) $x \in R - (-1, 1)$ c) $x \in \phi$ d) $x \in (-1, 1)$

SPACE FOR ROUGH WORK

SECTION II**MULTIPLE CHOICE TYPE QUESTIONS**

This section contains 4 multiple choice questions. Each question has 4 choices (A), (B), (C) and (D), out of which ONE OR MORE options may be correct. NO NEGATIVE marking.

7. If $\lim_{x \rightarrow 0} (1 + ax + bx^2)^{2/x} = e^3$ then
a) $a = 3, b = 0$ b) $a = 3/2, b = 1$ c) $a = 3/2, b = 4$ d) $a = 2, b = 3$
8. A man has 10 friends among whom two are married to each other. Then the number of different ways in which he can invite 5 people to a dinner party if married couple refused to attend separately is
a) $10 C_5 - 2$ b) $10 C_5 - 2 \times 8 C_4$ c) $2 \times 8 C_3$ d) 112
9. The coefficient of the middle term in the expansion of $(1 + x)^{2n}$ is
a) $\frac{1 \cdot 3 \cdot 5 \cdot \dots \cdot (2n-1) \cdot 2^n}{n!}$ b) $2n C_n$ c) $\frac{(n+1) \cdot (n+2) \cdot \dots \cdot (2n-1) \cdot 2n}{n!}$ d) $\frac{2^n \cdot n!}{(2n)!}$
10. The angle between the two curves $y = [|\sin x| + |\cos x|]$ and $x^2 + y^2 = 5$, where $[x]$ denotes the greatest integer function is
a) $\pi/2$ b) the curves are orthogonal c) $\tan^{-1} 2$ d) $\cos^{-1} (2/\sqrt{5})$
-

SPACE FOR ROUGH WORK

SECTION III**ASSERTION-REASON TYPE**

This question contains 4 reasoning type questions. Each question has 4 choices (a), (b), (c) and (d), out of which ONLY ONE is correct. 3 MARKS will be awarded for correct answer. 1 MARK will be deducted for wrong answer. NO MARKS WILL BE GIVEN OR DEDUCTED IF A QUESTION IS NOT ANSWERED.

- (i) STATEMENT-1 is True, STATEMENT-2 is true; STATEMENT-2 is a correct explanation for STATEMENT 1
- (j) STATEMENT-1 is True, STATEMENT-2 is true; STATEMENT-2 is NOT a correct explanation for STATEMENT-1
- (k) STATEMENT-1 is True, STATEMENT-2 is False
- (l) STATEMENT-1 is False, STATEMENT-2 is true

11. **Statement 1:** The eccentricity of the ellipse is $\sqrt{\frac{\sqrt{5}-1}{2}}$ when the normal at one end of latus-rectum of an ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ passes through one extremity of the minor axis.

Statement 2: The eccentricity of an ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ is $e = \sqrt{1 - \frac{b^2}{a^2}}$.

12. **Statement 1:** $f(x) = \left[\frac{x}{\pi} \right] + \frac{1}{2}$ is an odd function, where x is not an integral multiple of π .

Statement 2: $[-x] \leq -1 - [x]$

13. **Statement 1:** $f(x) = \frac{1}{x - [x]}$ is discontinuous for integral value of x .

Statement 2: For integral value of x , $f(x)$ is undefined.

14. **Statement 1:** If $f(x) = \begin{cases} \frac{(e^{kx} - 1) \sin kx}{4x^2}; & x \neq 0 \\ 1; & x = 0 \end{cases}$

is continuous at $x = 0$ then $k = \pm 2$.

Statement 2: For continuous function $\lim_{x \rightarrow 0} f(x) = f(0)$

SPACE FOR ROUGH WORK

SECTION IV**LINKED COMPREHENSION TYPE**

This section contains 2 paragraphs. Based upon each paragraph, 3 multiple choice questions have to be answered. Each question has four choices (a), (b), (c) and (d), out of which ONLY ONE is correct. 4 MARKS will be awarded for correct answer. 1 MARK will be deducted for wrong answer. NO MARKS WILL BE GIVEN OR DEDUCTED IF A QUESTION IS NOT ANSWERED.

Paragraph for Questions numbers 15 to 17

The tangents at P and P' on the parabola $y^2 = 4ax$ meet in T. S is the focus, O is the vertex and SP, ST and SP' are equal to α , β and γ respectively. The tangent at the point P(x_1, y_1) to the parabola $y^2 = 4ax$ meets the parabola $y^2 = 4a(x + b)$ at Q and R. Answer the following questions based on this paragraph.

15. The normal chord at a point P on the parabola $y^2 = 4ax$ subtends a right angle at vertex O. Then the length of the chord is
a) $2\sqrt{3a}$ b) $\sqrt{3a}$ c) $4\sqrt{3a}$ d) $6\sqrt{3a}$
16. Then the roots of the equation $\alpha x^2 + \beta x + \gamma = 0$ are
a) Real and different b) real and equal c) complex d) irrational
17. The chord of contact of tangents from point P to the parabola $y^2 = 4ax$ touches the parabola $x^2 = 4by$, then locus of P is a/an
a) circle b) parabola c) ellipse d) hyperbola

Paragraph for Questions numbers 18 to 20

Let $f(x)$ be a polynomial function satisfying $f(x + 1) = f(x) + 2x$, given that $f(0) = 0$. Answer the following questions based on this paragraph.

18. The value of $f(x)$ cannot be less than
a) $\frac{1}{2}$ b) 0 c) $-\frac{1}{4}$ d) 1
19. Consider $h(x) = f(x) + f(-x)$, $x \in (-a, a)$, however small may be a . Pick the wrong statement.
a) The minimum value of $h(x)$ will be constant
b) The equation $h(x) = 0$ will always have at least one root in $(-a, a)$
c) $h(x) = 0$ has no solution in $(-a, a)$
d) $h(2)h(3) = 144$
20. Number of integral values of x at which $\sin^{-1}(f(x))$ is defined
a) 0 b) 1 c) 2 d) 3
-

SPACE FOR ROUGH WORK

Paragraph for Questions numbers 21 to 23

The infinite series may be used to find the number of ways of distributing identical objects into distinct boxes. For example, the number of ways in which 5 identical balls can be distributed in 3 different boxes must be equal to the coefficient of x^5 in the infinite product $(x^0 + x^1 + x^2 + \dots)(x^0 + x^1 + x^2 + \dots)(x^0 + x^1 + x^2 + \dots)$. For any ways in which x^5 is obtained is one of the ways in which 5 identical balls can be distributed in 3 distinct boxes. While finding the number of ways the conditions $|x| < 1$ may be insignificant. Answer the following questions based on this paragraph.

21. The coefficient of x^n in the expansion of $(1 - x)^{-3}$ must be

- a) $\frac{n(n+1)}{2}$ b) $\frac{n(n-1)}{2}$ c) $\frac{(n+1)(n+2)}{2}$ d) none of these

22. The number of ways of distributing 10 identical objects in three distinct boxes must be

- a) 36 b) 48 c) 66 d) 1000

23. The number of ways in which we can get a total of 10 while throwing 3 dice must be

- a) 27 b) 36 c) 66 d) 18

SPACE FOR ROUGH WORK