JEE (Advanced) 2007 Paper-2

Physics

1. **In the experiment to determine the speed of sound using a resonance column,**

A prongs of the tuning fork are kept in a vertical plane

B prongs of the tuning fork are kept in a horizontal plane

C in one of the two resonances observed, the length of the resonating air columnis close to the wave length of sound in air

D in one of the two resonances observed, the length of the resonating air column is close to half of the wave length of sound in air

Answer: A

2. **A student performs an experiment to determine the Young's modulus of a wire, exactly 2 m long, by Searle's method. In a particular reading, the student measures the extension in the length of the wire to be 0.8 mm with an uncertainty of ± 0.05 mm at load of exactly 1.0 kg. The student also measures the diameter of the wire to be 0.4 mm with an uncertainty of ± 0.01 mm. Take g = 9.8 m/s^2 (exact). The Young's modulus obtained from the reading is**

A $(2.0 \pm 0.3) \times 10^{11} N/m^2$

B $(2.0 \pm 0.2) \times 10^{11} N/m^2$

C $(2.0 \pm 0.1) \times 10^{11} N/m^2$

D $(2.0 \pm 0.05) \times 10^{11} N/m^2$

Answer: A

3. **A particle moves in the X-Y plane underthe influence of a force such that its linear momentum is $\overrightarrow{p}(t) = A\left[\hat{i}\cos(kt) - \hat{j}\sin(kt)\right]$, where A and k are constants. The angle between the force and the momentum is**

A $0°$

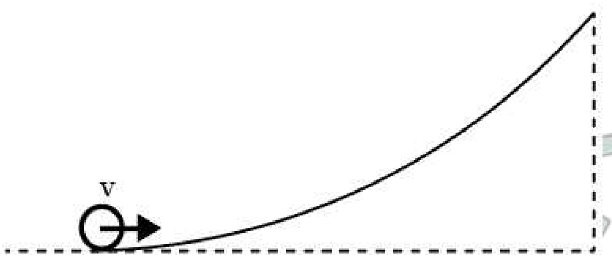
B $30°$

C $45°$

D $90°$

Answer: D

4. **A small object of uniform density rolls up a curved surface with an initial velocity v. It reaches up to a maximum height of $\frac{3v^2}{4g}$ with respect to the initial position. The object is**



A ring

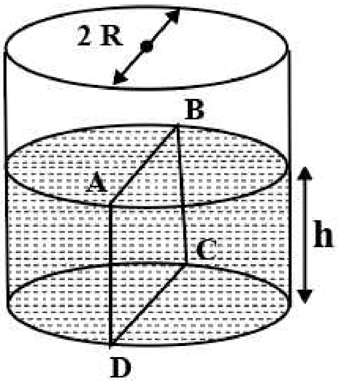
B solid sphere

C hollow sphere

D disc

Answer: D

5. **Water is filled up to a height h in a beaker of radius R as shown in the figure. The density of water is ρ, the surface tension of water is T and the atmospheric pressure is P_0. Consider a vertical section ABCD of the water column through a diameter of the beaker. The force on water on one side of this section by water on the other side of this section has magnitude.**



A $|\ 2P_0Rh + \pi R^2\rho gh - 2RT\ |$

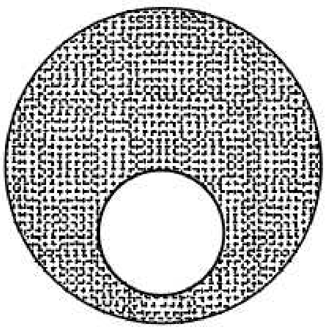
B $|\ 2P_0Rh + R\rho gh^2 - 2RT\ |$

C $|\ P_0\pi R^2 + R\rho gh^2 - 2RT\ |$

D $|\ P_0\pi R^2 + R\rho gh^2 + 2RT\ |$

Answer: B

6. **A spherical portion has been removed from a solid sphere having a charge distributed uniformly in its volume as showing the figure. The electric field inside the emptied space is**



A zero everywhere

B non-zero and uniform

C non-uniform

D zero only at its center

Answer: B

7. **Positive and negative point charges of equal magnitude are kept at $\left(0, 0, \frac{a}{2}\right)$ and $\left(0, 0, \frac{-a}{2}\right)$, respectively. The work done by the electric field when another positive point charge is moved from (-a, 0, 0) to (0, a, 0) is**

A positive

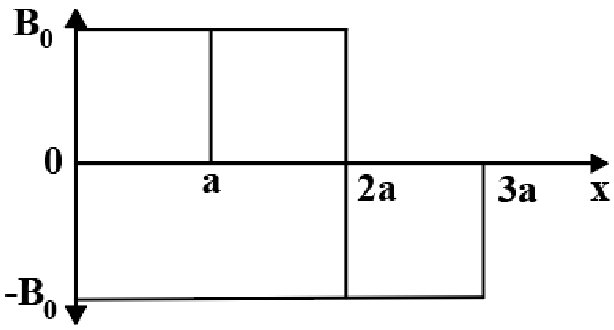
B negative

C zero

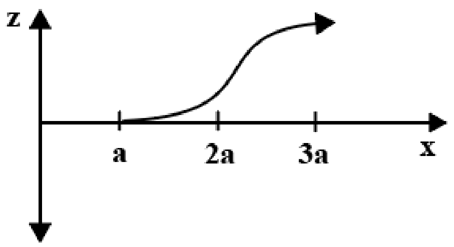
D depends on the path connecting the initial and final positions

Answer: C

8. **A magnetic field $\overrightarrow{B} = B_0\hat{j}$ exists in the region a < x < 2a and $\overrightarrow{B} = -B_0\hat{j}$, in the region 2a < x < 3a, where B_0 is a positive constant. A positive point charge moving with a velocity $\overrightarrow{v} = v_0\hat{i}$, where v_0 is a positive constant, enters the magnetic field at x = a. The trajectory of the charge in this region can be like,**



A



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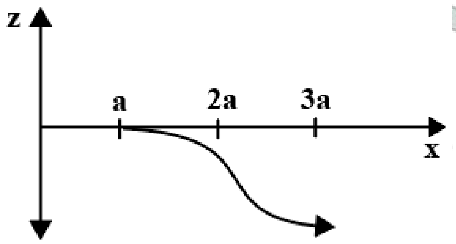

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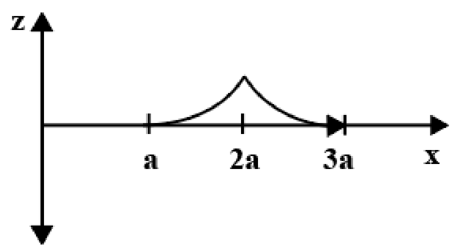
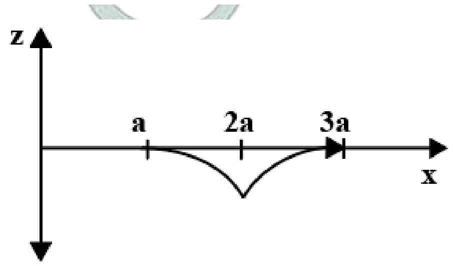


D



Answer: A

9. **Electrons with de-Broglie wave length λ fall on the target in an X-ray tube. The cut-off wavelength of the emitted X-rays is**

A $\lambda_0 = \frac{2mc\lambda^2}{h}$

B $\lambda_0 = \frac{2h}{mc}$

C $\lambda_0 = \frac{2m^2c^2\lambda^3}{h^2}$

D $\lambda_0 = \lambda$

Answer: A

10. **STATEMENT-1**
If there is no external torque on a body aboutits center of mass, then the velocity of the center of mass remains constant.
because
STATEMENT-2
The linear momentum of an isolated system remains constant.

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

Answer: D

11. **STATEMENT-1**
A cloth covers a table. Some dishes are kept on it. The cloth can be pulled out without dislodging the dishes from thetable.
because
STATEMENT-2
For every action there is an equal and opposite reaction.

A Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1

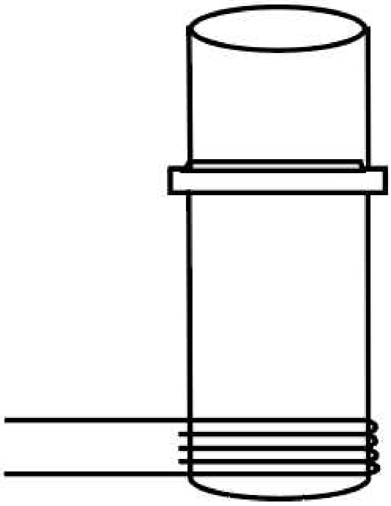
B Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1

C Statement-1 is True, Statement-2 is False

D Statement-1 is False, Statement-2 is True

Answer: B

12. **STATEMENT-1**
A vertical iron rod has a coil of wire wound over it at the bottom end. An alternating current flows in the coil. The rod goes through a conducting ring as showing the figure. The ring can float at a certain height above the coil.
because
STATEMENT-2
In the above situation, a current is induced in the ring which interacts with the horizontal component of the magnetic field to produce an average force in the upward direction.



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

Answer: A

13. **STATEMENT-1**
The total translational kinetic energy of all the molecules of a given massof an ideal gas is 1.5 times the product of its pressure and its volume.
because
STATEMENT-2
The molecules of a gas collide with each other and the velocities of the molecules change dueto thecollision.

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

Answer: B

14. **The speed of sound of the whistle is**

A 340 m/s for passengers in A and 310 m/s for passengers in B

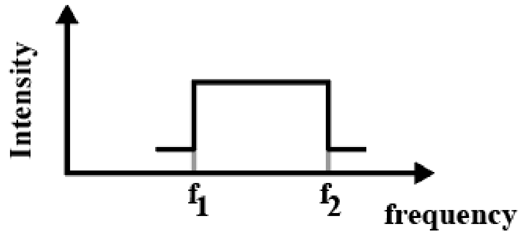
B 360 m/s for passengers in A and 310 m/s for passengers in B

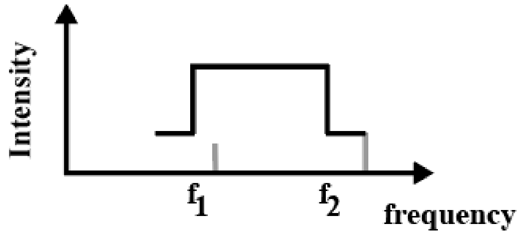
C 310 m/s for passengers in A and 360 m/s for passengers in B

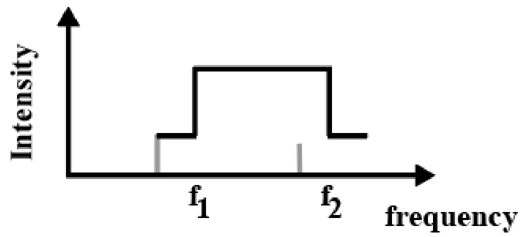
D 340 m/s for passengersin both the trains

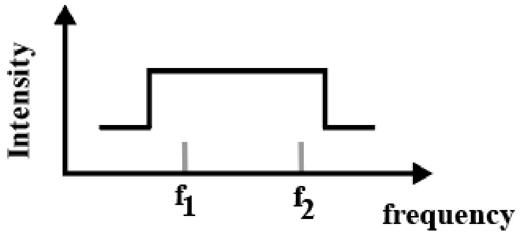
Answer: B

15. **The distribution of the sound intensity of the whistle as observed by the passengers in train A is best represented by**

A 

B 

C 

D 

Answer: A

16. **The spread of frequency as observed by the passengersin train B is**

A 310 Hz

B 330 Hz

C 350 Hz

D 290 Hz

Answer: A

17. **Light travels as a**

A parallel beam in each medium

B convergent beam in each medium

C divergent beam in each medium

D divergent beam in one medium and convergent beam in the other medium

Answer: A

18. **The phases of the light wave at c, d, e and f are ϕ_C, ϕ_d, ϕ_e and ϕ_f respectively. It is given that $\phi_c \neq \phi_f$.**

A ϕ_c cannot be equal to ϕ_d

B ϕ_d can be equal to ϕ_e

C $(\phi_d - \phi_f)$ is equal to $(\phi_c - \phi_e)$

D $(\phi_d - \phi_c)$ is not equal to $(\phi_f - \phi_e)$

Answer: C

19. **Speed of light is**

A the same in medium-1 and medium-2

B larger in medium-1 than in medium-2

C larger in medium-2 than in medium-1

D different at b and d

Answer: B

20. **Column I describes some situations in which a small object moves. Column II describes some characteristics of these motions. Match the situations in Column I with the characteristics in Column II and indicate your answer by darkening appropriate bubbles in the 4×4 matrix given in the ORS.**

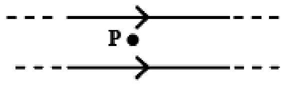
Coloumn - I	Coloumn - II
(A) The object moves on the x - axis under a coservative force in such a way that its " speed" and "position" satisfy $v = c_1\sqrt{C_2 - X^2}$ where c and c are positive constants.	(p) The object executes a simple harmonic motion.
(B) The object moves on the x - axis in such a way that its velocity and its displacements from the orgin satisfy v = -kx, where k is a positive constant.	(q) The object does not change its direction.
(C) The object is attached to one end of a mass-less spring of a given spring constant. The other end of the spring is attached to the ceilling of an elevator. Initially everything is at rest. The elevator starts going upwards with a constant acceleration a. The motion of the object is observed from the elevator during the period it maintains this acceleration.	(r) The kinetic energy of the object keeps on decreasing.
(D) The object is projected from the earth's surface vertically upwards with a speed $2\sqrt{GM_e IR_e}$, where , M_e is the mass of the earth and R_e is the mass of the radius of the earth. Neglate forces from objects other than the earth.	(s) The object can change its direction only once.

Answer:e

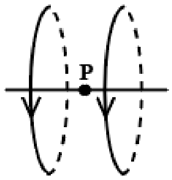
21. Two wires each carrying a steady current J are shown in four configurations in Column I. Some of the resulting effects are described in Column II. Match the statements in Column I with the statements in Column II and indicate your answer by darkening appropriate bubbles in the 4×4 matrix given in the ORS.

Coloumn - I

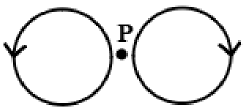
(A) Point P is situated midway between the wires.



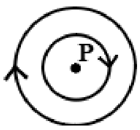
(B) Point P is situated at the mid- point of the line joining the centers of the circular wires, which have same radii.



(C) Point P is situated at the mid - point of the centers of the circular wires, which have same radii.



(D) Point P is situated at the common centers of the wires.



Coloumn - II

(p) The magnistic fields (B) at P due to the currents in the wires are in the same direction.

(q) The magnistic fields (B) at P due to the currents in the wires are in opposite directions.

(r) There is no magnetic fieled at P.

(s) The wires repel each other.

Answer:e

22. Column I gives some devices and Column II gives some processes on which the functioning of these devices depend. Match the devices in Column I with the processes in Column II and indicate your answer by darkening appropriate bubbles in the 4×4 matrix given in the ORS.

Column I		Column II	
(A)	Bimetallic strip	(p)	Radiation from a hot body
(B)	Steam engine	(q)	Energy conversion
(C)	Incandescent lamp	(r)	Melting
(D)	Electric fuse	(s)	Thermal expension of solid

Answer:e

Chemistry

23. Consider a titration of potassium dichromate solution with acidified Mohr's salt solution using diphenylamine as indicator. The number of moles of Mohr's salt required per mole of dichromate is

A 3

B 4

C 5

D 6

Answer: D

24. Among the following metal carbonyls, the C-O bond order is lowest in

A $[Mn(CO)_6]^+$

B $[Fe(CO)_5]$

C $[Cr(CO)_6]$

D $[V(CO)_6]^-$

Answer: D

25. **A solution of a metal ion when treated with KI gives a red precipitate which dissolves in excess KI to give a colourless solution. Moreover, the solution of metal ion on treatment with a solution of cobalt(II) thiocyanate gives rise to a deep blue crystalline precipitate. The metal ion is**

A Pb^{2+}

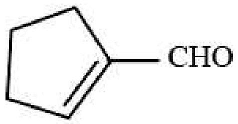
B Hg^{2+}

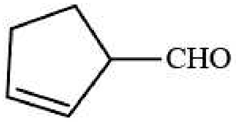
C Cu^{2+}

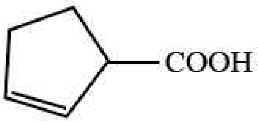
D Co^{2+}

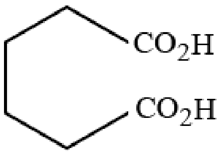
Answer: B

26. **Cyclohexene on ozonolysis followed by reaction with zinc dust and water gives compound E. Compound E on further treatment with aqueous KOH yields compound F. Compound F is**

A 

B 

C 

D 

Answer: A

27. **The numberof stereoisomers obtained by bromination of trans-2-butene is**

A 1

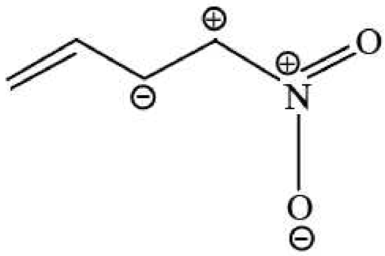
B 2

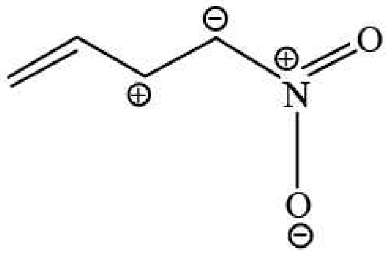
C 3

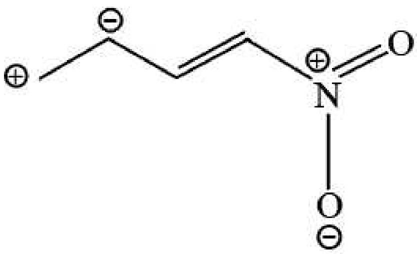
D 4

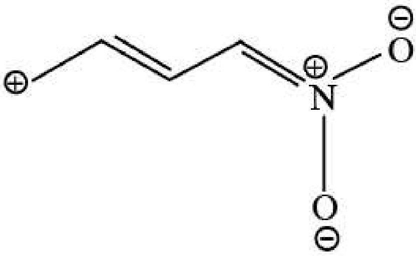
Answer: A

28. **Among the following, the least stable resonance structure is**

A 

B 

C 

D 

Answer: A

29. **A positron is emitted from** $^{23}_{11}Na$. **The ratio of the atomic mass and atomic number of the resulting nuclide is**

A $\frac{22}{10}$

B $\frac{22}{11}$

C $\frac{23}{10}$

D $\frac{23}{12}$

Answer: C

30. **For the process** $H_2O(l)$ **(1 bar, 373 K)** $\rightarrow H_2O(g)$**(1 bar, 373 K), the correct set of thermodynamic parameters is**

A $\triangle G = 0, \triangle S = +ve$

B $\triangle G = 0, \triangle S = -ve$

C $\triangle G = +ve, \triangle S = 0$

D $\triangle G = -ve, \triangle S = +ve$

Answer: A

31. **Consider a reaction $aG + bH \rightarrow$ Products. When concentration of both the reactants G and is doubled, the rate increases by eight times. However, when concentration of G is doubled keeping the concentration of H fixed, the rate is doubled. The overall order of the reaction is**

A 0

B 1

C 2

D 3

Answer: D

32. **STATEMENT-1: Alkali metals dissolve in liquid ammoniato give blue solutions.**
because
STATEMENT-2: Alkali metals in liquid ammonia give solvated species of the type $[M(NH_3)_n]^+$ (M = alkali metals).

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

Answer: B

33. **STATEMENT-1: Glucose gives a reddish-brown precipitate with Fehling's solution.**
because
STATEMENT-2: Reaction of glucose with Fehling's solution gives CuO and gluconic acid.

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

Answer: C

34. **STATEMENT-1: Molecules that are not superimposable on their mirror images are chiral.**
because
STATEMENT-2: All chiral molecules have chiral centres.

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

Answer: C

35. **STATEMENT-1: Band gap in germanium is small.**
because
STATEMENT-2: The energy spread of each germanium atomic energy level is infinitesimally small.

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

Answer: B

36. **Among the following, identify the correct statement.**

A Chloride ion is oxidised by O_2

B Fe^{2+} is oxidised by iodine

C Iodide ion is oxidised by chlorine

D Mn^{2+} is oxidised by chlorine

Answer: C

37. **While Fe^{3+} is stable, Mn^{3+} is not stable in acid solution because**

A O_2 oxidises Mn^{2+} to Mn^{3+}

B O_2 oxidises both Mn^{2+} to Mn^{3+} and Fe^{2+} to Fe^{3+}

C Fe^{3+} oxidises H_2O to O_2

D Mn^{3+} oxidises H_2O to O_2

Answer: D

38. **Sodium fusion extract, obtained from aniline, on treatment with iron(II) sulphate and H_2SO_4 in presence of air gives a Prussian blue precipitate. The blue colour is due to the formation of**

A $Fe_4[Fe(CN)_6]_3$

B $Fe_3[Fe(CN)_6]_2$

C $Fe_4[Fe(CN)_6]_2$

D $Fe_3[Fe(CN)_6]_3$

Answer: A

39. **Which one of the following reagents is used in the above reaction?**

A $aq.NaOH + CH_3Cl$

B $aq.NaOH + CH_2Cl_2$

C $aq.NaOH + CHCl_3$

D $aq.NaOH + CCl_4$

Answer: C

40. **The electrophile in this reaction is**

A : $CHCl$

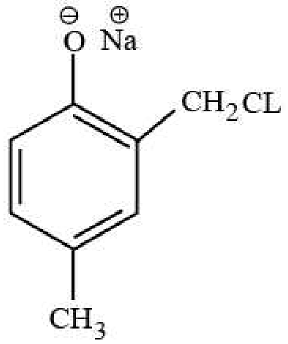
B $^{+}CHCl_2$

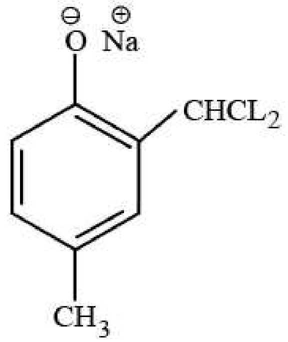
C : CCl_2

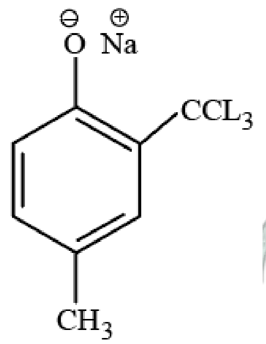
D $.CCl_3$

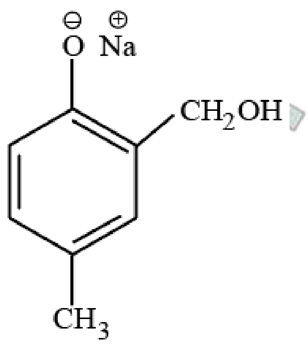
Answer: C

41. **The structure of the intermediate I is**

A 

B 

C 

D 

Answer: B

42. Match the reactions in Column I with nature of the reactions/type of the products in Column II. Indicate your answer by darkening the appropriate bubbles of the 4×4 matrix given in the ORS.

Coloumn - I	Coloumn - II
(A) $O_2^- \rightarrow O_2 + O_2^{2-}$	(p) redox reaction
(B) $CrO_4^{2-} + H^+ \rightarrow$	(q) one of the production has trigonal planner structure
(C) $MnO_4^- + NO_2^- + H^+ \rightarrow$	(r) dimeric bridge tetrahedral metal ion
(D) $NO_3^- + H_2SO_4 + Fe^{2+} \rightarrow$	(s) disproportionation

Answer: e

43. Match the compounds/ions in Column I with their properties/reactions in Column II. Indicate your answer by darkening the appropriate bubbles of the 4×4 matrix given in the ORS.

Coloumn - I	Coloumn - II
(A) C_6H_5CHO	(p) gives precipitate with 2, 4- dinitrophylhydrazine
(B) $CH_3C = CH$	(q) gives precipitate with $AgNO_3$
(C) CN^-	(r) is a nucleophile
(D) I^-	(s) is involved in cyanohydrin formation

Answer: e

44. Match the crystal system/unit cells mentioned in Column I with their characteristic features mentioned in Column II. Indicate your answer by darkening the appropriate bubbles of the 4×4 matrix given in the ORS.

Coloumn - I	Coloumn - II
(A) simple cubic and face-centered cubic	(p) have these cell parameters a = b = c and $\alpha = \beta = \gamma$
(B) cubic and rhombohedral	(q) are two crystal systems
(C) cubic and tetragonal	(r) have only two crystallographic angles of 90^o
(D) hexagonal and monoclinic	(s) belong to same crystal system

Answer: e

Mathematics

45. Let O(0, 0), P(3, 4), Q(6, 0) be the vertices of the triangle OPQ. The point R inside the triangle OPQ is such that the triangles OPR, PQR, OQR are of equal area. The coordinates of R are

A $\left(\frac{4}{3}, 3\right)$

B $\left(3, \frac{2}{3}\right)$

C $\left(3, \frac{4}{3}\right)$

D $\left(\frac{4}{3}, \frac{2}{3}\right)$

Answer: C

46. **If** $|z| = 1$ **and** $z \neq \pm 1$**, then all the values of** $\frac{z}{1-z^2}$ **lie on**

A a line not passing through the origin

B $|z| = \sqrt{2}$

C the x-axis

D the y-axis

Answer: D

47. **Let** E^c **denote the complement of an event E. Let E, F, G be pairwise independent events with** $P(G) > 0$ **and** $P(E \cap F \cap G) = 0$**. Then** $P(E^c \cap F^c \mid G)$ **equals**

A $P(E^c) + P(F^c)$

B $P(E^c) - P(F^c)$

C $P(E^c) - P(F)$

D $P(E) - P(F^c)$

Answer: C

48. $\frac{d^2x}{dy^2}$ **equals**

A $\left(\frac{d^2y}{dx^2}\right)^{-1}$

B $-\left(\frac{d^2y}{dx^2}\right)^{-1}\left(\frac{dy}{dx}\right)^{-3}$

C $\left(\frac{d^2y}{dx^2}\right)\left(\frac{dy}{dx}\right)^{-2}$

D $-\left(\frac{d^2y}{dx^2}\right)\left(\frac{dy}{dx}\right)^{-3}$

Answer: D

49. **The differential equation** $\frac{dy}{dx} = \frac{\sqrt{1-y^2}}{y}$ **determines a family of circles with**

A variable radii and a fixed centre at (0, 1)

B variable radii and a fixed centre at (0, -1)

C fixed radius 1 and variable centres along the x-axis

D fixed radius 1 and variable centres along the y-axis

Answer: C

50. **Let $\vec{a}, \vec{b}, \vec{c}$ be unit vectors such that $\vec{a}+\vec{b}+\vec{c}=\vec{0}$. Which one of the following is correct?**

A $\vec{a}\times\vec{b}=\vec{b}\times\vec{c}=\vec{c}\times\vec{a}=\vec{0}$

B $\vec{a}\times\vec{b}=\vec{b}\times\vec{c}=\vec{c}\times\vec{a}\neq\vec{0}$

C $\vec{a}\times\vec{b}=\vec{b}\times\vec{c}=\vec{a}\times\vec{c}\neq\vec{0}$

D $\vec{a}\times\vec{b}, \vec{b}\times\vec{c}, \vec{c}\times\vec{a}$ are mutually perpendicular

Answer: B

51. **Let ABCD be a quadrilateral with area 18, with side AB parallel to the side CD and AB =2CD. Let AD be perpendicular to AB and CD. If a circle is drawn inside the quadrilateral ABCD touchingall the sides, then its radius is**

A 3

B 2

C $\frac{3}{2}$

D 1

Answer: B

52. **Lat $f(x)=\frac{x}{(1+x^n)^{\frac{1}{n}}}$ for $n\geq 2$ and $g(x)=\underbrace{(f\circ f\circ ...\circ f)(x)}_{f occurs n times}$. Then $\int x^{n-2}g(x)dx$ equals**

A $\frac{1}{n(n-1)}(1+nx^n)^{1-\frac{1}{n}}+K$

B $\frac{1}{n-1}(1+nx^n)^{1-\frac{1}{n}}+K$

C $\frac{1}{n(n+1)}(1+nx^n)^{1+\frac{1}{n}}+K$

D $\frac{1}{n+1}(1+nx^n)^{1+\frac{1}{n}}+K$

Answer: A

53. **The letters of the word COCHIN are permuted and all the permutations are arranged in an alphabetical order as in an English dictionary. The number of words that appear before the word COCHIN is**

A 360

B 192

C 96

D 48

Answer: C

54. **Consider the planes $3x - 6y - 2z = 15$ and $2x + y - 2z = 5$.**
STATEMENT-1: The parametric equations of the line of intersection of the given planes are $$x = 3 + 14t, y = 1 + 2t, z = 15t.
because
STATEMENT-2: The vector $14\hat{i} + 2\hat{j} + 15\hat{k}$ is parallel to the line ofintersection of given planes.

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

Answer: D

55. **STATEMENT-1: The curve $y = \frac{-x^2}{2} + x + 1$ is symmetric with respect to the line x = 1.**
because
STATEMENT-2: A parabola is symmetric aboutits axis.

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

Answer: A

56. **Let $f(x) = 2 + \cos x$ for all real x.**
STATEMENT-1: For each real t, there exists a point c in $[t, t + \pi]$ such that $f'(c) = 0$.
because
STATEMENT-2: $f(t) = f(t + 2\pi)$ for each real t.

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

Answer: B

57. **Lines $L_1 : y - x = 0$ and $L_2 : 2x + y = 0$ intersect the line $L_3 : y + 2 = 0$ at P and Q, respectively. The bisector of the acute angle between L_1 and L_2 intersects L_3 at R.**
STATEMENT-1: The ratio PR : RQ equals $2\sqrt{2} : \sqrt{5}$.
because
STATEMENT-2: In any triangle, bisector of an angle divides the triangle into two similar triangles.

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

Answer: C

58. **Which one of the folowing statements is correct?**

A $G_1 > G_2 > G_3 > ....$

B $G_1 < G_2 < G_3 < ....$

C $G_1 = G_2 = G_3 = ...$

D $G_1 < G_3 < G_5 < ....$ and $G_2 > G_4 > G_6 > ....$

Answer: C

59. **Which one of the following statements is correct?**

A $A_1 > A_2 > A_3 > ...$

B $A_1 < A_2 < A_3 < ...$

C $A_1 > A_3 > A_5 > ...$ and $A_2 < A_4 < A_6 < ...$

D $A_1 < A_3 < A_5 < ...$ and $A_2 > A_4 > A_6 > ...$

Answer: A

60. **Which one of the following statements is correct?**

A $H_1 > H_2 > H_3 > ...$

B $H_1 < H_2 < H_3 < ...$

C $H_1 > H_3 > H_5 > ...$ and $H_2 < H_4 < H_6 < ...$

D $H_1 < H_3 < H_5 > ...$ and $H_2 > H_4 > H_6 > ...$

Answer: B

Instructions [61 - 63]

If a continuous function f defined on the real line R, assumespositive and negative values in R then the equation f(x)=0 has a root in R. For example, if it is known that a continuous function f on R is positive at some point and its minimum value is negative then the equation f(x) = 0 has a root in R.
Consider $f(x) = ke^x - x$ for all real x where kis a real constant.

61. **The line y = x meets $y = ke^x$ for $k \leq 0$ at**

A no point

B one point

C two points

D more than two points

Answer: B

62. **The positive value of k for which $ke^x - x = 0$ has only one root is**

A $\frac{1}{e}$

B 1

C e

D $\log_e 2$

Answer: A

63. For $k > O$, the set of all values of k for which $ke^x - x = 0$ has two distinct roots is

A $(0, \frac{1}{e})$

B $(\frac{1}{e}, 1)$

C $(\frac{1}{e}, \infty)$

D $(0, 1)$

Answer: A

64. Let $f(x) = \frac{x^2-6x+5}{x^2-5x+6}$.
Match the expressions/statements in Column I with expressions/statements in Column II and indicate your answer by darkening the appropriate bubbles in the 4×4 matrix given in the ORS.

Coloumn - I	Coloumn - II
(A) If $-1 < x < 1$, then f(x) satisfies	(p) $0 < f(x) < 1$
(B) If $1 < x < 2$, then f(x) satisfies	(q) $f(x) < 0$
(C) If $3 < x < 5$, then f(x) satisfies	(r) $f(x) > 0$
(D) If $x > 2$, then f(x) satisfies	(s) $f(x) < 1$

Answer:e

65. Let (x, y) be such that $\sin^{-1}(ax) + \cos^{-1}(y) + \cos^{-1}(bxy) = \frac{\pi}{2}$.
Match the statements in Column I with statements in Column II and indicate your answer by darkening the appropriate bubbles in the 4×4 matrix given in the ORS.

Coloumn - I	Coloumn - II
(A) If a = 1 and b = 0, then (x,y)	(p) lies on the circle $x^2 + y^2 = 1$
(B) If a = 1 and b = 1, then (x,y)	(q) lies on $(x^2 - 1)(y^2 - 1) = 0$
(C) If a = 1 and b = 2, then (x,y)	(r) lies on $y = x$
(D) If a = 2 and b = 2, then (x,y)	(s) lies on $(4x^2 - 1)(y^2 - 1) = 0$

Answer:e

66. **Match the statements in Column I with the properties in Column II and indicate your answer by darkening the appropriate bubbles in the 4×4 matrix given in the ORS.**

Column I	Column II
(A) Two intersecting circle	(p) have a comman tangent
(B) Two mutually external circle	(q) have a comman normal
(C) Two circles, one strictly inside the other	(r) do not have a comman tangent
(D) Two branches of a hyperbola	(s) do not have a comman normal

Answer:e