SOLUTIONS TO IIT–JEE 2007 (PAPER–2)

PHYSICS

PART I

SECTION – I

Straight Objective Type

This section contains 9 multiple choice questions numbered 1 to 9. Each question has 4 choices (A), (B), (C) and (D), out of which ONLY ONE is correct.

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 column is close to the wavelength 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 wavelength of sound in air.

Sol : (A)

2. A student performs an experiment to determine the Young's modulus of a wire, exactly 2m 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 $\pm$ 0.05 mm at a load of exactly 1.0 kg. The student also measures the diameter of the wire to be 0.4 mm with an uncertainty of $\pm$ 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

Sol: $Y = \dfrac{FL}{Al} = \dfrac{4FL}{\pi d^2 l}$ Where L = length of the wire

l = elongation of the wire

d = diameter of the wire

$$\Rightarrow \quad \frac{\Delta Y}{Y} = 2\frac{\Delta d}{d} + \frac{\Delta l}{l}$$

$$= 2\left(\frac{0.01}{0.4}\right) + \frac{0.05}{0.8} = \frac{9}{40}$$

$$\Rightarrow \quad \Delta Y = \frac{9}{40} \times Y = \frac{9}{40} \times 2 \times 10^{11} = 0.2 \times 10^{11} \text{ N/m}^2$$

$\therefore$ (B)

3. A particle moves in the X-Y plane under the influence of a force such that its linear momentum is $\vec{p}(t) = A\left[\hat{i}\cos(kt) - \hat{j}\sin(kt)\right]$, where A and k are constants. The angle between the force and the momentum is
   (A) 0^0 (B) 30^0 (C) 45^0 (D) 90^0

Sol: $\vec{P}(t) = A\left[\hat{i}\cos(kt) - \hat{j}\sin(kt)\right]$

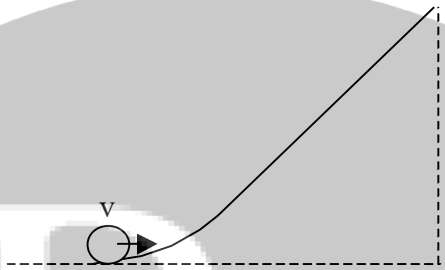
$\vec{F} = \frac{d\vec{p}}{dt} = Ak\left[-i\sin(kt) - \hat{j}\cos kt\right]$

Here, $\vec{P}.\vec{F} = 0$ therefore

The angle between $\vec{P}$ and $\vec{F}$ is 90^0

Hence (D) is correct.

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

Sol: From conservation of mechanical energy

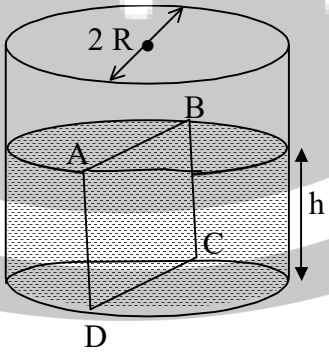
$$\frac{1}{2}mv^2 + \frac{1}{2}I\left(\frac{v^2}{R^2}\right) = mg\left(\frac{3}{4}\frac{v^2}{g}\right)$$

after solving $I = \frac{mR^2}{2}$

Which is for disc

Hence (D) is correct

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) $|2P_0\,Rh + \pi R^2\,\rho gh - 2RT|$ (B) $|2P_0\,Rh + R\rho gh^2 - 2RT|$

(C) $|P_0\pi R^2 + R\,\rho gh^2 - 2RT|$ (D) $|P_0\pi R^2 + R\,\rho gh^2 + 2RT|$

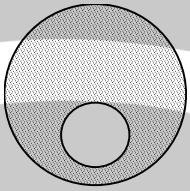
Sol : Net Force = Averge pressure x Area – T x 2R

$$\left(P_0 + \rho g \frac{h}{2}\right)(2Rh) - T2R$$

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

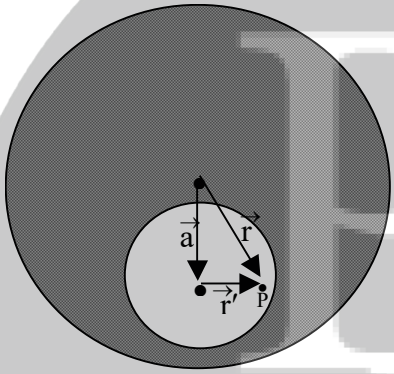
Hence (B) is correct

6. A spherical portion has been removed from a solid sphere having a charge distributed uniformly in its volume in 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

Sol:



a = distance between center of both sphere

By principle of superposition the net electric field at point P

$$\vec{E} = \frac{\rho\vec{r}}{3\in_0} - \frac{\rho\vec{r}'}{3\in_0}$$

$$\because \quad \vec{r} - \vec{r}' = \vec{a}$$

$$\therefore \quad \vec{E} = \frac{\rho\vec{a}}{3\in_0} = \text{uniform}$$

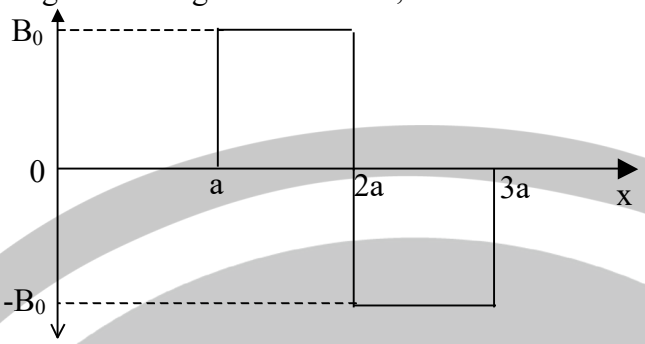
$\therefore$ (B)

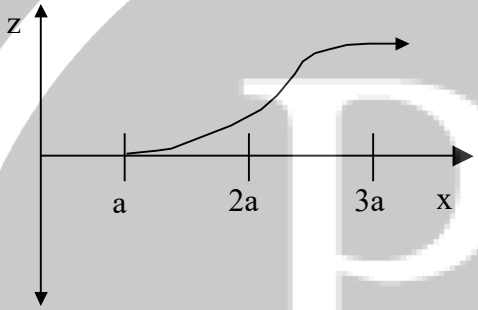
7. Positive and negative point charges of equal magnitude are kept at $\left(0,0,\frac{a}{2}\right)$ and $\left(0,0,\frac{-a}{2}\right)$, respectively. The work done by the electric field when another positive point charge is moved from (-a, 0, 0) to (0, a, 0) is

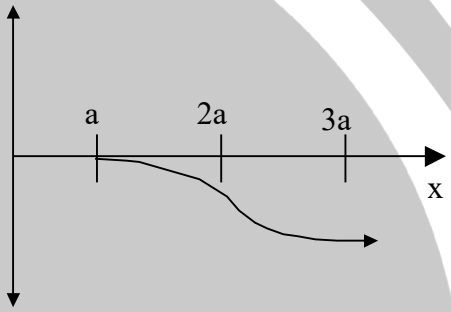
(A) positive
(B) negative
(C) zero
(D) depends on the path connecting the initial and final positions

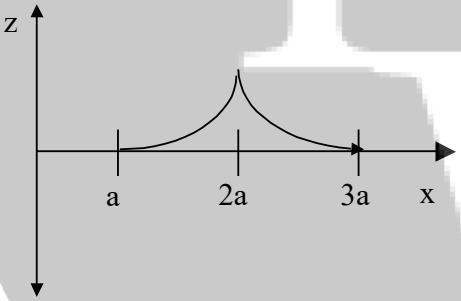
Sol : (C)

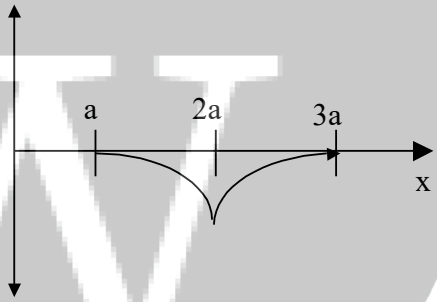
8. A magnetic field $\vec{B} = B_0\hat{j}$ exists in the region a < x < 2a and $\vec{B} = -B_0\hat{j}$, in the region 2a < x < 3a, where B_0 is a positive constant. A positive point charge moving with a velocity $\vec{v} = v_0\hat{i}$, where v_o is a positive constant, enters the magnetic field at x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



(A)


(B)


(C)


(D)


Sol : (A)

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

(A) $\lambda_0 = \dfrac{2mc\lambda^2}{h}$ (B) $\lambda_0 = \dfrac{2h}{mc}$

(C) $\lambda_0 = \dfrac{2m^2c^2\lambda^3}{h^2}$ (D) $\lambda_0 = \lambda$

Sol :

$$\lambda = \frac{h}{p} = \frac{h}{\sqrt{2mk}}$$

$$\Rightarrow \quad k = \frac{h^2}{2m\lambda^2} \qquad \text{-----(i)}$$

But, $\lambda_0 = \frac{hc}{k}$ ----- (ii)

From equation (i) and equation (ii)

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

Hence (A) is correct

SECTION – II
Assertion – Reason Type

This section contains 4 questions numbered 10 to 13. Each question contains STATEMENT –1 (Assertion) and STATEMENT-2 (Reason). Each question has 4 choices (A), (B), (C) and (D) out of which ONLY ONE is correct.

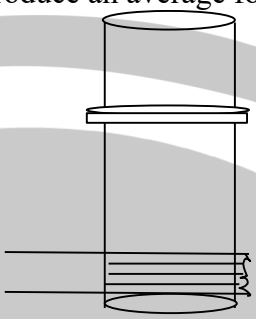
10. STATEMENT-1
If there is no external torque on a body about its center of mass, then the velocity of the center of mass remains constant.
because
STATEMENT-2
The linear momentum of an isolated system remains constant.
(A) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation 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

Sol :
Velocity of center of mass of a body is constant when no external force acts on the body. If there is no external torque, it does not mean that no external force acts on it
$\therefore$ (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 the table.
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

Sol :
Statement (I) refers to inertia and Statement (II) refers to Newton's third law
$\therefore$ (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 shown in 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

Sol :
According to the Lenz's law the ring and coil will repel each other. Hence an upward force will act on the ring to balance it
∴ (A)

13. STATEMENT-1
The total translational kinetic energy of all the molecules of a given mass of an ideal gas is 1.5 times the product of tis pressure and its volume.
because
STATEMENT-2
The molecules of a gas collide with each other and the velocities of the molecules change due to the collision.
(A) Statement-1 is True, Statement-2 is True; Statement-2 is 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

Sol :
Total translational kinetic energy = $\frac{3}{2}nRT = \frac{3}{2}PV$
In an ideal gas all molecules moving randomly in all direction collide and their velocity changes after collision.
∴ (B)

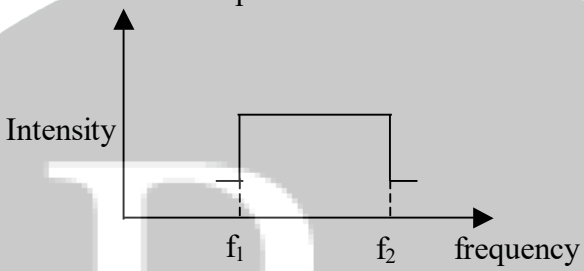
SECTION – III
Linked Comprehension Type

This section contains 2 paragraphs $P_{14\text{-}16}$ and $P_{17\text{-}19}$. Based upon each paragraph, 3 multiple choice questions have to be answered. Each question has 4 choices (A), (B), (C) and (D), out of which ONLY ONE is correct.

$P_{14\text{-}16}$: Paragraph for Question Nos. 14 to 16

Two trains A and B are moving with speeds 20 m/s and 30 m/s respectively in the same direction on the same straight track, with B ahead of A. The engines are at the front ends. The engine of train A blows a long whistle.

Assume that the sound of the whistle is composed of components varying in frequency from f_1 = 800 Hz to f_2 = 1120 Hz, as shown in the figure. The spread in the frequency (highest frequency – lowest frequency) is thus 320 Hz. The speed of sound in still air is 340 m/s

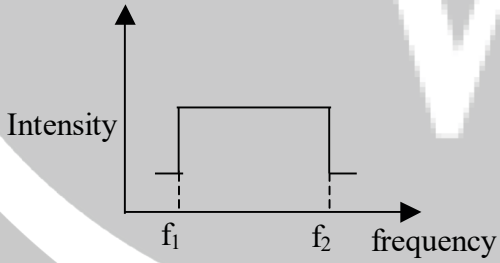


14. The speed of sound of the whistle is
(A) 340 m/s for passengers in A and 310 m/s for passengers in B
(B) 360 m/s for passengers in A and 310 m/s for passengers in B
(C) 310 m/s for passengers in A nd 360 m/s for passengers in B
(D) 340 m/s for passengers in both the trains

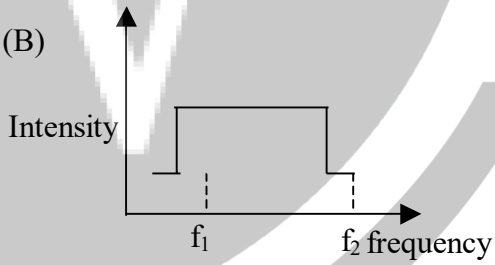
Sol : (A)

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

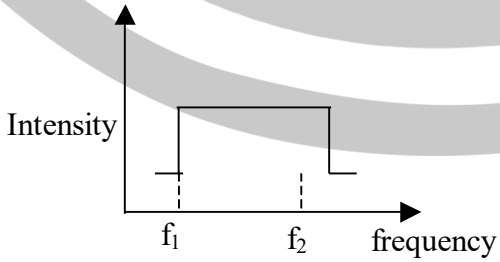
(A)



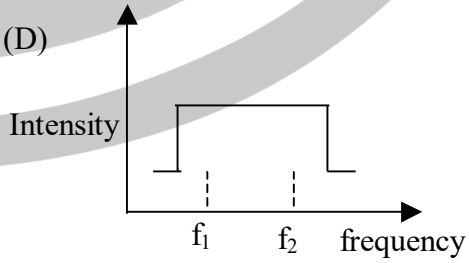
(B)



(C)



(D)



Sol :

∴ (A)

16. The spread of frequency as observed by the passengers in train B is
(A) 310 Hz (B) 330 Hz (C) 350 Hz (D) 290 Hz

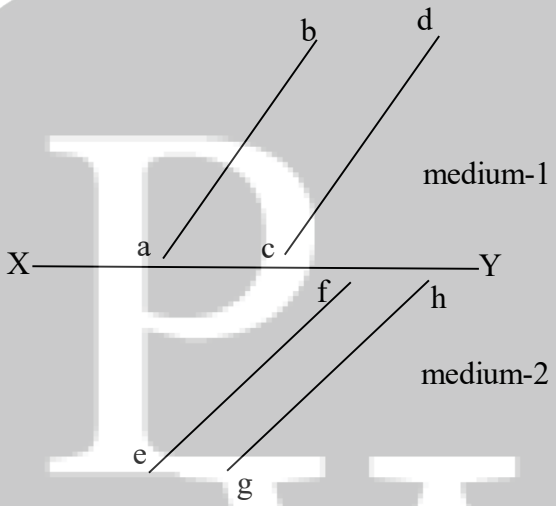
Sol : $f' = \left(\frac{v - v_B}{v - v_A}\right) f_0 = \left(\frac{340 - 30}{340 - 20}\right) \times f_0 = \frac{31}{32} f_0$

$(f')_{min} = \frac{31}{32} \times 800 = 775 \text{ Hz}$

$(f')_{max} = \frac{31}{32} \times 1120 = 1085 \text{ Hz}$

Spread of frequency = $(f')_{max} - (f')_{mim} = 310 \text{ Hz}$

P17-19: Paragraph for Question Nos. 17 to 19



The figure shows a surface XY separating two transparent media, medium-1 and medium-2 The lines ab and cd represent wavefronts of a light wave traveling in medium-1 and incident of XY. The lines ef and gh represent wavefronts of the light wave in medium-2 after refraction.

17. Light travels as
(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

Sol : The direction of beam is perpendicular to the wavefront. Since the wavefront are planar and parallel the beam will be parallel in both the medium.
$\therefore$ (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 $(\phi_f - \phi_e)$

Sol : All the points on a wavefront are at the same phase

$\therefore \quad \phi_d = \phi_c$

and $\phi_f = \phi_e$

$\Rightarrow \quad (\phi_d - \phi_f) = (\phi_c - \phi_e)$

$\therefore$ (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

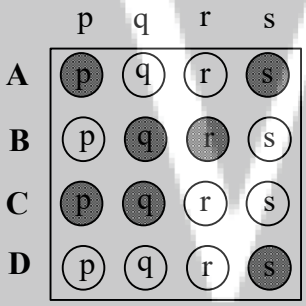
Sol : Direction of wave is perpendicular to the wavefront. From the figure it is clear that the beam bends towards normal after passing from medium-I to the medium-II. Therefore the medium 2 is denser than medium - I

$\therefore$ (B)

SECTION – IV
Matrix-Match Type

This section contains 3 questions. Each question contains statements given in two columns which have to be matched. Statements (A, B, C, D) in Column I have to be matched with statements (p, q, r, s) in Column II. The answers to these questions have to be appropriately bubbled as illustrated in the following example.

If the correct matches are A-p, A-s, B-q, B-r, C-p, C-q and D-s, then the correctly bubbled 4 x 4 matrix should be as follows:

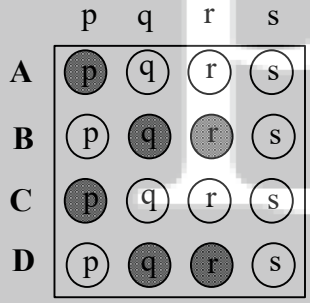


20. Column I describes some situations in which a small object moves. Column II describes some characteristics of these motions. Match the situations in Column I with the characteristics in Column II and indicate your answer by darkening appropriate bubles in the 4 x 4 matrix given in the ORS.

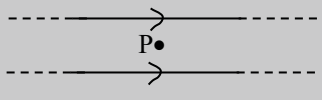
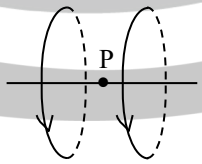
Column I	Column II
(A) The object moves on the x-axis under a conservative force in such a way that its "speed" and "position" satisfy $v = c_1\sqrt{c_2 - x^2}$, where c_1 and c_2 are positive constants.	(p) The object executes a simple harmonic motion.

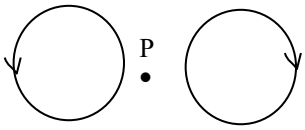
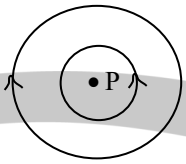
(B) The object moves on the x-axis in such a way that its velocity and its displacement from the origin satisfy v = -kx, where k is a positive constant.	(q) The object does not change its direction.
(C) The object is attached to one end of a mass-less spring of a given spring constant. The other end of the spring is attached to the ceiling 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 $2\sqrt{GM_e/R_e}$, where, M_e is the mass of the earth and Re is the radius of the earth. Neglect forces from objects other than the earth.	(s) The object can change its direction only once.

Sol :



21. Two wires each carrying a steady current I and 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 is Column II and indicate your answer by darkening appropriate bubbles in the 4 x 4 matrix given in the ORS.

Column I		Column II
(A) Point P is situated midway between the wires.		(p) The magnetic fields (B) at P due to the currents in the wires are in the same direction.
(B) Point P is situated at the mid-point of the line joining the centers of the circular wires, which have same radii		(q) The magnetic fields (B) at P due to the currents in the wires are in opposite directions.

(C) Point P is situated at the mid-point of the line joint the centers of the circular wires, which have same radii.		(r) There is no magnetic field at P.
(D) Point P is situated at the common center of the wires.		(s) The wires repel each other.

Sol :

	p	q	r	s
A	p	q	r	s
B	p	q	r	s
C	p	q	r	s
D	p	q	r	s

22. Column I give 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 x 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 expansion of solids

Sol :

	p	q	r	s
A	p	q	r	s
B	p	q	r	s
C	p	q	r	s
D	p	q	r	s

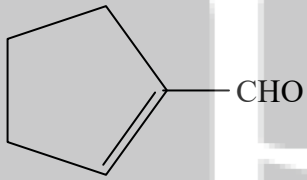
CHEMISTRY
PART II
SECTION - I
Straight Objective Type

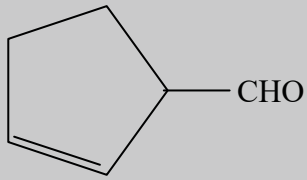
This section contains 9 multiple choice questions numbered 1 to 9. Each question has 4 choices (A), (B), (C) and (D), out of which ONLY ONE is correct.

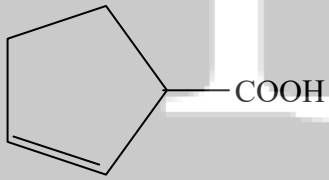
1. Among the following metal carbonyls, the C–O bond order is lowest in
(A) $[Mn(CO)_6]^+$ (B) $[Fe(CO)_5]$ (C) $[Cr(CO)_6]$ (D) $[V(CO)_6]^-$

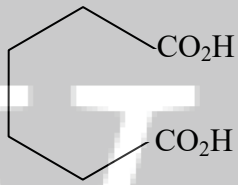
Sol. An anionic carbonyl complex can delocalise more electron density to antibonding pi orbital of CO and hence lowers the bond order.
$\therefore$(D)

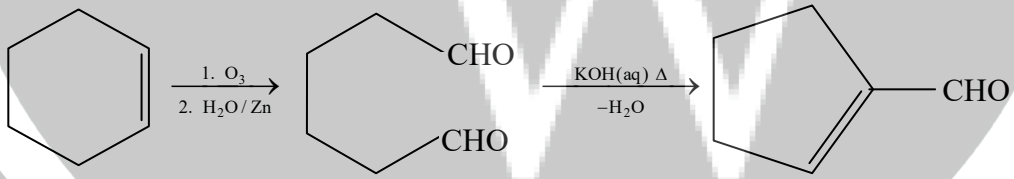
2. Cyclohexene on ozonolysis followed by reaction with zinc dust and water gives compound **E**. Compound **E** on further treatment with aqueous KOH yields compound **F**. Compound **F** is

(A) 

(B) 

(C) 

(D) 

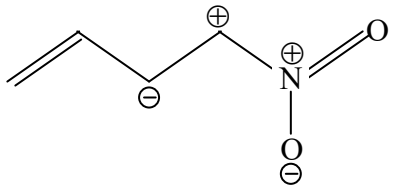
Sol. 

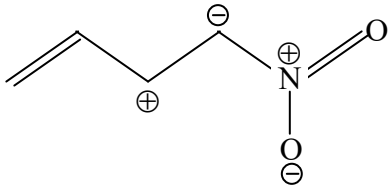
$\therefore$(A)

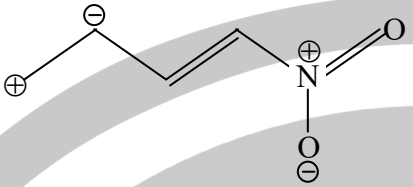
3. Consider a titration of potassium dichromate solution with acidified Mohr's salt solution using diphenylamine as indicator. The number of moles of Mohr's salt required per mole of dichromate is
(A) 3 (B) 4 (C) 5 (D) 6

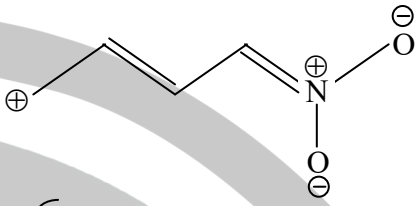
Sol. $6Fe^{2+} + Cr_2O_7^{2-} + 14H^+ \rightarrow 6Fe^{3+} + 2Cr^{3+} + 7H_2O$
Mohr's salt $(FeSO_4.(NH_4)_2SO_4.6\ H_2O)$ & dichromate reacts in 6:1 molar ratio.
$\therefore$(D)

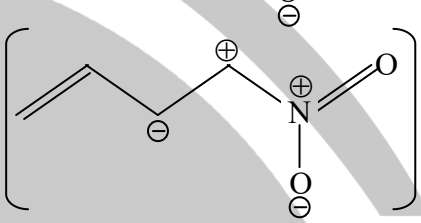
4. Among the following, the least stable resonance structure is

(A) 

(B) 

(C) 

(D) 

Sol. Due to similar charges on adjacent atom the structure 

is least stable

$\therefore$ (A)

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

(A) Pb^{2+} (B) Hg^{2+} (C) Cu^{2+} (D) Co^{2+}

Sol. $Hg^{2+} + 2KI \rightarrow HgI_2\downarrow + 2K^+$
(red ppt)

$HgI_2 + 2KI \rightarrow K_2HgI_4$

$Hg^{2+} + Co^{2+} + 4SCN^- \rightarrow CoHg(SCN)_4\downarrow$
(deep blue crystalline)

$\therefore$ (B)

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

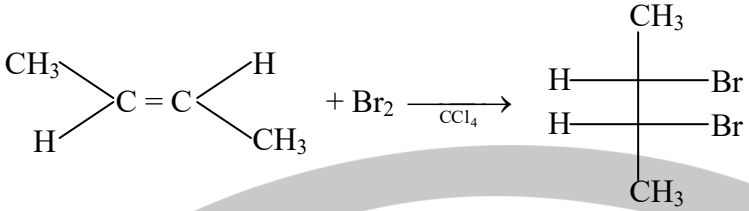
(A) $\Delta G = 0, \Delta S = +ve$ (B) $\Delta G = 0, \Delta S = -ve$
(C) $\Delta G = +ve, \Delta S = 0$ (D) $\Delta G = -ve, \Delta S = +ve$

Sol. Since, liquid is passing in to gaseous phase so entropy will increase and at 373 K the phase transformation remains at equilibrium. So $\Delta G = 0$.

$\therefore$ (A)

7. The number of stereoisomers obtained by bromination of trans–2–butene is
(A) 1 (B) 2 (C) 3 (D) 4

Sol. Anti addition of Br_2 on trans alkene provide meso compound



$\therefore$ (A)

8. Consider a reaction aG + bH $\rightarrow$ Products. When concentration of both the reactants G and H is doubled, the rate increase 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

Sol.

Exp. No.	[G] mole litre $^{-1}$	[H] mole litre $^{-1}$	rate mole litre $^{-1}$ time^{-1}
1	a	b	r
2	2a	2b	8r
3	2a	b	2r

Applying $r' = k[G]^x [H]^y$
$x = 1, y = 2$
$\therefore$ overall order is 3.
$\therefore$ (D)

9. A positron is emitted from $^{23}_{11}Na$. The ratio of the atomic mass and atomic number of the resulting nuclide is
(A) 22/10 (B) 22/11
(C) 23/10 (D) 23/12

Sol. $^{23}_{11}Na \longrightarrow {}^{23}_{10}X + {}^{0}_{1}\beta$
$\therefore$ (C)

SECTION – II
Assertion – Reason Type

This section contains 4 question numbered 10 to 13. Each question contains STATEMENT–1(Assertion) and STATEMENT–2 (Reason). Each question has 4 choices (A), (B), (C) and (D) out of which ONLY ONE is correct.

10. 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

Sol. (C)

11. STATEMENT–1 : Band gap is 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.

Sol. (B)

12. STATEMENT–1 : Alkali metals deissolve in liquid ammonia to 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.

Sol. (B)

13. STATEMENT–1 : Molecules that are not superimposable on their mirror images are chiral.
because
STATEMENT–2 : All chiral molecules have chiral centers.
(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.

Sol. (C)

SECTION – III
Linked Comprehension Type

This section contains 2 paragraphs $C_{14–16}$ and $C_{17–19}$. Based upon each paragraph, 3 multiple choice questions have to be answered. Each question has 4 choices (A), (B), (C) and (D), out of which ONLY ONE is correct.

$C_{14–16}$: Paragraph for Question Nos. 14 to 16

Redox reactions play a pivotal role in chemistry and biology. The values of standard redox potential (E^o) of two half–cell reactions decide which way the reaction is expected to proceed. A simple example is a Daniel cell in which zinc goes into solution and copper gets deposited. Given below are a set of half–cell reactions (acidic medium) along with their E^o (V with respect to normal hydrogen electrode) values. Using this data obtain the correct explanations to Questions 14–16.

$I_2 + 2e^- \rightarrow 2I^-$	$E^o = 0.54$
$CI_2 + 2e^- \rightarrow 2CI^-$	$E^o = 1.36$
$Mn^{3+} + e^- \rightarrow Mn^{2+}$	$E^o = 1.50$
$Fe^{3+} + e^- \rightarrow Fe^{2+}$	$E^o = 0.77$
$O_2 + 4H^+ + 4e^- \rightarrow 2H_2O$	$E^o = 1.23$

14. 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

Sol. $2I^- + Cl_2 \rightarrow I_2 + 2Cl^-$

$E^o = E^o_{I^-/I_2} + E^o_{Cl_2/Cl^-}$

$= -0.54 + 1.36$

$E^o = 0.82$ V

E^o is positive hence iodide ion is oxidized by chlorine.

$\therefore$ (C)

15. 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

Sol. $4\,Mn^{3+} + 2H_2O \longrightarrow 4Mn^{2+} + O_2 + 4H^+$

$E^o = E^o_{Mn^{3+}/Mn^{2+}} + E^o_{H_2O/O_2} = 1.50 + (-1.23) = 0.27V$

Reaction is feasible.

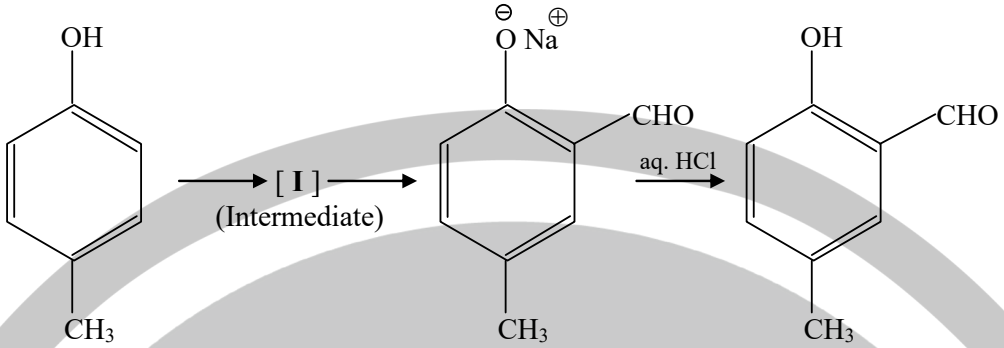
$\therefore$ (D)

16. 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) $Fe_3[Fe(CN)_6]_3$

Sol. (A)

$C_{17–19}$: Paragraph for Question Nos. 17 to 19

Riemer–Tiemann reaction introduces an aldehyde group, on to the aromatic ring of phenol, *ortho* to the hydroxy1 group. This reaction involves electrophilic aromatic substitution. This is a general method for the synthesis of substituted salicylaldehydes as depicted below.



(I) (II) (III)

17. 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.$NaOH + CCl_4$

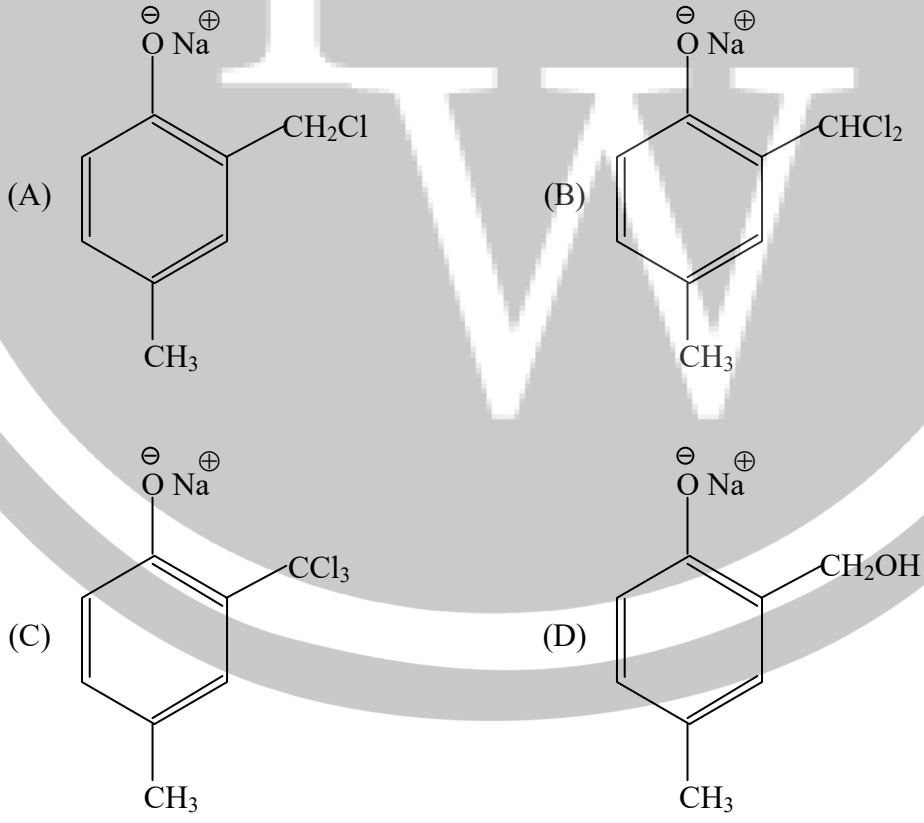
Sol. (C)

18. The electrophile in this reaction is

(A) **:**CHCl (B) $^{+}CHCl_2$ (C) **:**CCl_2 (D) $\cdot CCl_3$

Sol. (C)

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

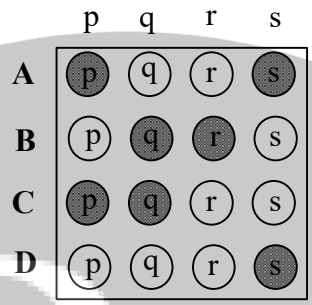


Sol. (B)

SECTION – IV
Matrix–Match Type

This section contains 3 questions. Each question contains statements given in two columns which have to be matched. Statements (A, B, C, D) in **Column I** have to be matched with statements (p, q, r, s) in **Column II**. The answers to theses questions have to be appropriately bubbled as illustrated in the following example.

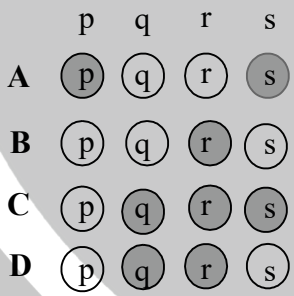
If the correct matches are A–p, A–s, B–q, B–r, C–p, C–q and D–s, then the correctly bubbled 4 x 4 matrix should be as follows:



20. 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 x 4 matrix given in the ORS.

Column I	Column II
(A) C_6H_5CHO	(p) gives precipitate with 2, 4–dinitrophenylhydrazine
(B) $CH_3C{\equiv}CH$	(q) gives precipitate with $AgNO_3$
(C) CN^-	(r) is a nucleophile
(D) I^-	(s) is involved in cyanohydrin formation

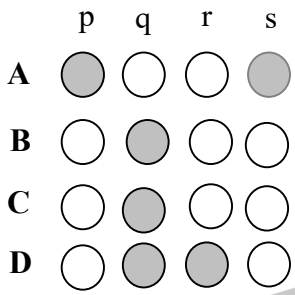
Sol.



21. 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 x 4 matrix given in the ORS.

Column I	Column II
(A) simple cubic and face–centred 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°
(D) hexagonal and monoclinic	(s) belong to same crystal system

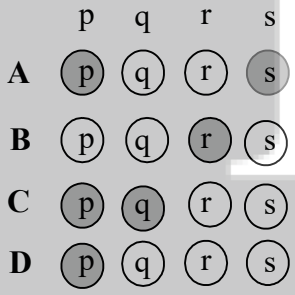
Sol.



22. 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.

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

Sol.



MATHEMATICS
PART III
SECTION – I
Straight Objective Type

This section contains 9 multiple choice questions numbered 1 to 9. Each question has 4 choices (A), (B), (C) and (D), out of which only one is correct.

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

Sol. (D)

$$\frac{dx}{dy}=\left(\frac{dy}{dx}\right)^{-1}$$

$$\frac{d^2x}{dy^2}=\frac{d}{dy}\left(\frac{dx}{dy}\right)=\frac{d}{dy}\left(\frac{1}{\left(\frac{dy}{dx}\right)}\right)=\frac{-1}{\left(\frac{dy}{dx}\right)^2}\frac{d}{dy}\left(\frac{dy}{dx}\right)$$

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

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

2. 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

Sol. (D)

$$z=\cos\theta+i\sin\theta=e^{i\theta}$$

$$\frac{z}{1-z^2}=\frac{e^{i\theta}}{1-e^{2i\theta}}=\frac{1}{e^{-i\theta}-e^{i\theta}}=\frac{1}{(\cos\theta-i\sin\theta)-(\cos\theta+i\sin\theta)}=\frac{i}{2\sin\theta}.$$

3. 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?

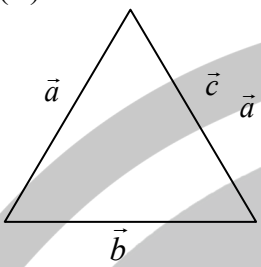
(A) $\vec{a} \times \vec{b} = \vec{b} \times \vec{c} = \vec{c} \times \vec{a} = \vec{0}$

(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

Sol. (B)



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

4. 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 the equal area. The coordinates of R are

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

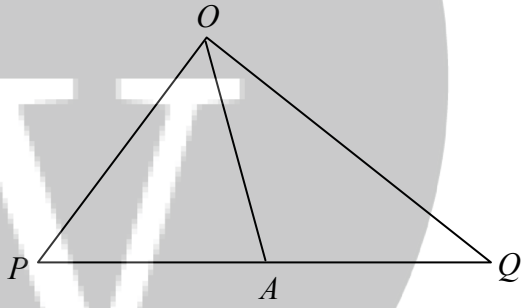
(C) $\left(3, \frac{4}{3}\right)$ (D) $\left(\frac{4}{3}, \frac{2}{3}\right)$

Sol. (C)

Median OA divides Δ into equal triangles

$\therefore$ R is intersection of medians

i.e., R is centroid.



5. Let $f(x) = \frac{x}{(1+x^n)^{1/n}}$ for $n \geq 2$ and $g(x) = \underbrace{(f \text{ o } f \text{ o } \ldots\ldots \text{o } f)}_{\text{f occurs n times}}(x)$. Then $\int x^{n-2} g(x)\,dx$ equals

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

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

Sol. (A)

$$f(x) = \frac{x}{(1+x^n)^{1/n}}$$

$$fof(x) = \frac{x}{(1+2x^n)^{1/n}}$$

$$\text{fofof}(x) = \frac{x}{\left(1+3x^n\right)^{1/n}}$$

$$\underbrace{\text{fofof.....of}(x)}_{n \text{ times}} = \frac{x}{\left(1+nx^n\right)^{1/n}}$$

$$\therefore \quad I = \int x^{n-2}\frac{x}{\left(1+nx^n\right)^{1/n}}dx$$

$$I = \int \frac{x^{n-1}dx}{\left(1+nx^n\right)^{1/n}}$$

Put $y = 1 + nx^n$

$$\frac{dy}{n^2} = x^{n-1}dx$$

$$I = \frac{1}{n(n-1)}y^{1-\frac{1}{n}}$$

6. 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) $P(E) - P(F^c)$

Sol. (C)

$$P\left(E^c \cap F^c / G\right) = \frac{P\left((E \cup F)^c \cap G\right)}{P(G)}$$

$$= \frac{P(G) - P(E \cap G) - P(F \cap G)}{P(G)}$$

$$= \frac{P(G) - P(E).P(G) - P(G)P(F)}{P(G)}$$

$$= 1 - P(E) - P(F)$$

$$= P\left(E^c\right) - P(F).$$

7. Letters of the word COCHIN are permutated 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

Sol. (C)

CC	HINO	→ 4!	
CH	CINO	→ 4!	
CI	CHNO	→ 4!	$4 \times 4! = 96$
CN	CHIO	→ 4!	
CO	CHIN	→ it self	

8. 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

Sol. (C)

$$\int \frac{y}{\sqrt{1-y^2}}dy = \int dx$$

$$-\sqrt{1-y^2} = (x+c)$$

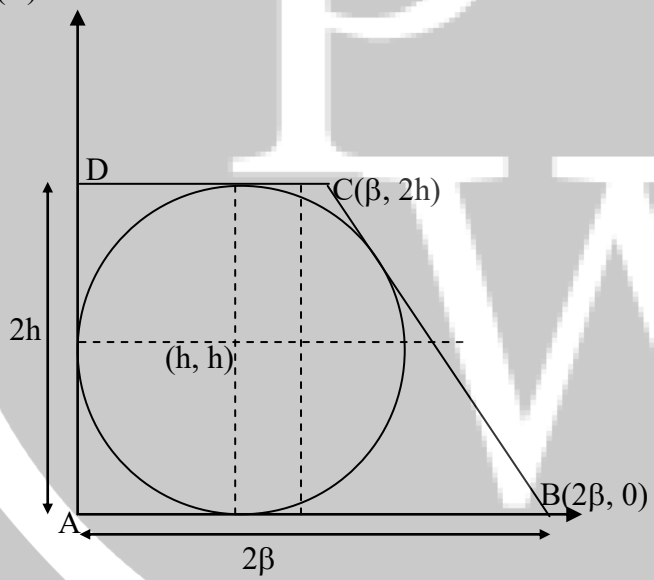
$$x^2 + y^2 + 2cx + c^2 - 1 = 0$$

Centre (–c, 0) and radius (r) = 1.

9. 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 touching all the side, the its radius is

(A) 3 (B) 2 (C) $\frac{3}{2}$ (D) 1

Sol. (B)



Equation of straight line BC

$$\beta y + 2hx - 2h\beta = 0$$

$$\frac{1}{2}(2h)(\beta + 2\beta) = 18$$

$$h\beta = 6$$

$$\beta y + 2hx = 24$$

For the line to be tangent to the circle perpendicular distance from centre must be equal to radius of the circle.

$$\frac{\beta h + 2\beta h - 24}{\sqrt{\beta^2 + 4h^2}} = h$$

$(3\beta h - 24)^2 = (\beta^2 + 4h^2)h^2$

$h = 2$

SECTION – II
Assertion – Reason Type

This section contains 4 questions numbered 10 to 13. Each question contains STATEMENT-1 (Assertion) and STATEMENT-2 (Reason). Each question has 4 choices (A), (B), (C) and (D) out of which ONLY ONE is correct.

10. 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

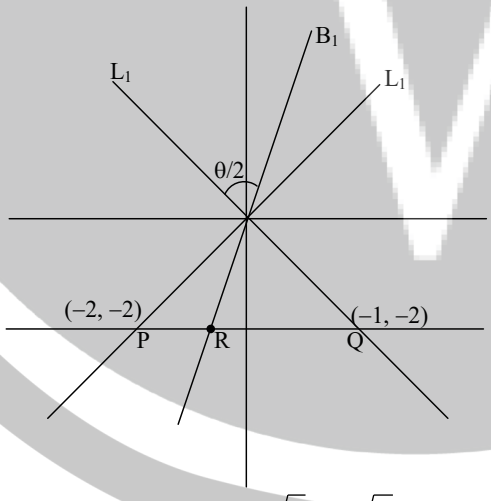
(C) Statement-1 is True, Statement-2 is False

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

Sol. (C)

Equation of angle bisectors

$$\frac{y - x}{\sqrt{2}} = \pm\frac{2x + y}{\sqrt{5}} \text{ (taking positive sign)}$$



Acute angle bisector is $y = \frac{\sqrt{5} + 2\sqrt{2}}{\sqrt{5} - \sqrt{2}}x$ (as)

$$\tan\frac{\theta}{2}=\left|\frac{\frac{\sqrt{5}+2\sqrt{2}}{\sqrt{5}-\sqrt{2}}+2}{1-2\frac{\sqrt{5}+2\sqrt{2}}{\sqrt{5}-\sqrt{2}}}\right|<1$$

Now R is $\left\{(-2)\frac{\sqrt{5}-\sqrt{2}}{\sqrt{5}+2\sqrt{2}},-2\right\}$

PR = $\frac{6\sqrt{2}}{2\sqrt{2}+\sqrt{5}}$

RQ = $\frac{3\sqrt{5}}{\sqrt{5}+2\sqrt{2}}$

PR : RQ = $2\sqrt{2}:\sqrt{5}$

Statement 2 is false

11. 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 about its 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

Sol. (A)

$2\left(y-\frac{3}{2}\right)=-(x-1)^2 \Rightarrow$ parabola with axis x = 1.

12. Let f(x) = 2 + cosx for all real x.

Statement – 1 : For each real t, there exists a point c in [t, t + π] such that f ′(c) = 0

Because

Statement – 2 : f(t) = f(t + 2π) 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

Sol. (B)

13. 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 of intersection 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

Sol. (D)
Let l, m, n be direction ratio of line of intersection
$3l - 6m - 2n = 0$ and $2l + m - 2n = 0$
$l = 7m$, $n = \frac{15}{2}m$
And solving we get line of intersection
$$\frac{x-3}{14} = \frac{y+1}{2} = \frac{z-0}{15}$$

SECTION – III
Linked Comprehension Type

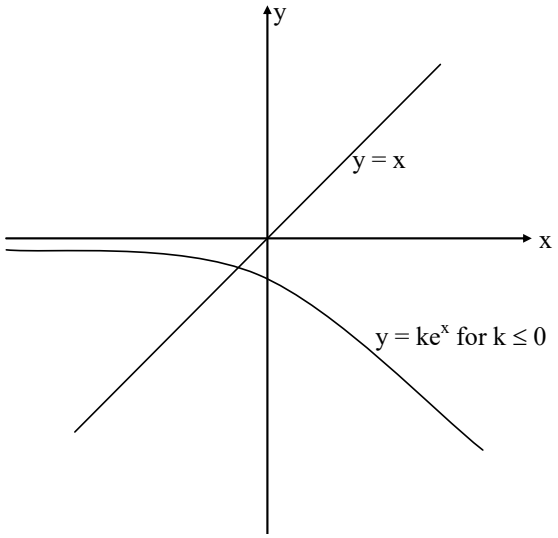
This section contains 2 paragraphs $M_{14\text{-}16}$ and $M_{17\text{-}19}$. Based upon each paragraph, 3 multiple choice questions have to be answered. Each question has 4 choices (A), (B), (C) and (D), out of which ONLY ONE is correct.

$M_{14\text{-}16}$: Paragraph of Question Nos. 14 to 16

If a continuous function f defined on the real line R, assumes positive and negative values of 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 k is a real constant.

14. The line $y = x$ meets $y = ke^x$ for $k \le 0$ at
(A) no point (B) one point
(C) two points (D) more than two points

Sol. (B)
$y = x$, $y = ke^x$ for $k \le 0$



15. 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) $\log_e 2$

Sol. (A)

For only one root and $k > 0$

$ke^x - x = 0 \Rightarrow ke^x = x$ (1)

also $y = x$ be a tangent to the curve $y = ke^x$ at some point

$\frac{d}{dx}(ke^x) = 1$

$ke^x = 1$ (2)

from (1) and (2)

$\therefore \quad x = 1$

$k = \frac{1}{e}$

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

(A) $\left(0, \frac{1}{e}\right)$ (B) $\left(\frac{1}{e}, 1\right)$ (C) $\left(\frac{1}{e}, \infty\right)$ (D) (0, 1)

Sol. (A)

For $k > 0$ and for two distinct roots

$k < \frac{1}{e}$

$\therefore$ on combining $0 < k < \frac{1}{e}$.

M_{17-19}: Paragraph of Question Nos. 17 to 19

Let A_1, G_1, H_1 denote the arithmetic, geometric and harmonic means, respetively, of two distinct positive numbers. For $n \geq 2$, let A_{n-1} and H_{n-1} have arithmetic, geometric and harmonic means as A_n, G_n, H_n respectively.

17. Which one of the following statement is correct?
(A) $G_1 > G_2 > G_3 > \ldots\ldots$
(B) $G_1 < G_2 < G_3 < \ldots\ldots$
(C) $G_1 = G_2 = G_3 = \ldots\ldots$
(D) $G_1 < G_3 < G_5 < \ldots\ldots$ and $G_2 > G_4 > G_6 > \ldots..$

Sol. (C)
Since A_1, G_1, H_1 are in G.P.

$$G_1 = \sqrt{A_1 H_1}$$

For $n \geq 2$

$$G_2 = \sqrt{A_1 H_1} = G_1$$

$$G_3 = \sqrt{A_2 H_2} = G_2$$

18. Which one of the following statement is correct?
(A) $A_1 > A_2 > A_3 > \ldots.$
(B) $A_1 < A_2 < A_3 < \ldots.$
(C) $A_1 > A_3 > A_5 > \ldots.$ and $A_2 < A_4 < A_6 < \ldots.$
(D) $A_1 < A_3 < A_5 < \ldots.$ and $A_2 > A_4 > A_6 > \ldots.$

Sol. (A)

$$A_1 = \frac{a+b}{2} \qquad A_2 = \frac{A_1 + H_1}{2}$$

$$A_1 - A_2 = A_1 - \frac{A_1 + H_1}{2} = \frac{A_1 - H_1}{2} > 0$$

$A_1 > A_2$

19. Which one of the following statement is correct?
(A) $H_1 > H_2 > H_3 > \ldots.$
(B) $H_1 < H_2 < H_3 < \ldots.$
(C) $H_1 > H_3 > H_5 > \ldots.$ and $H_2 < H_4 < H_6 < \ldots.$
(D) $H_1 < H_3 < H_5 < \ldots.$ and $H_2 > H_4 > H_6 > \ldots.$

Sol. (B)

$$H_1 = \frac{G_1^2}{A_1}$$

$$H_2 = \frac{G_2^2}{A_2} = \frac{G_1^2}{A_2}$$

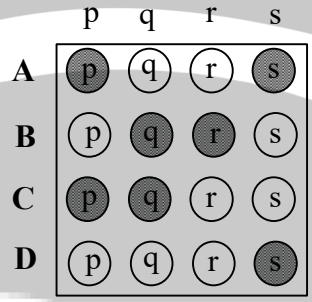
$$H_3 = \frac{G_3^2}{A_3} = \frac{G_1^2}{A_2} \qquad \text{Since } A_1 > A_2 > A_3$$

$\Rightarrow \quad H_1 < H_2 < H_3.$

SECTION – IV
Matrix-Match Type

This section contains 3 questions. Each question contains statements given in two columns which have to be matched. Statement (A, B, C, D) in Column I have to be matched with statements (p, q, r, s) in Column II. The answers to these questions have to be appropriately bubbled as illustrated in the following example.

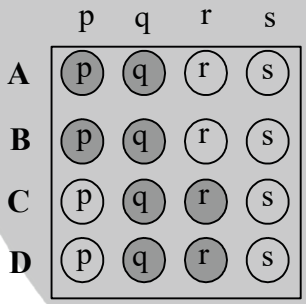
If the correct matches are A-p, A-s, B-q, B-r, C-p, C-q and D-s, then the correctly bubbled 4 × 4 matrix should be as follows :



20. Match the statement is Column 1 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 circles	(p) have a common tangent
(B) Two mutually external circle	(q) have a common normal
(C) Two circles, one strictly inside the order	(r) do not have a common tangent
(D) Two branches of a hyperbola	(s) do not have a common normal

Sol.



21. Let (x, y) be such that

$$\sin^{-1}(ax) + \cos^{-1}(y) + \cos^{-1}(bxy) = \frac{\pi}{2}$$

Match the statement is Column 1 with statement 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) 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 $(4x^2 - 1)(y^2 - 1) = 0$

Sol.

	p	q	r	s
A	p	q	r	s
B	p	q	r	s
C	p	q	r	s
D	p	q	r	s

(A) $a = 1, b = 0$

$\sin^{-1}x + \cos^{-1}y = 0$

by solving we get $x^2 + y^2 = 1$.

(B) $a = 1, b = 1$

$\sin^{-1}x + \cos^{-1}y + \cos^{-1}(xy) = \frac{\pi}{2}$

by solving we get $(y^2 - 1)(x^2 - 1) = 0$

(C) $a = 1, b = 2$

$\sin^{-1}x + \cos^{-1}y + \cos^{-1}(2xy) = \frac{\pi}{2}$

by solving we get $(x^2 + y^2) = 1$

(D) $a = 2, b = 2$

$\sin^{-1}2x + \cos^{-1}y + \cos^{-1}(xy) = \frac{\pi}{2}$

by solving we get $(y^2 - 1)(4x^2 - 1) = 0$

22. Let $f(x) = \frac{x^2 - 6x + 5}{x^2 - 5x + 6}$

Match the expressions/statement is Column 1 with expressions/statement 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) 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 $x > 5$, then f(x) satisfies	(s) $f(x) < 1$

Sol.

	p	q	r	s
A	p	q	r	s
B	p	q	r	s
C	p	q	r	s
D	p	q	r	s