# SOLUTION OF IIT-JEE 2008 (PAPER - II)

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## MATHEMATICS

### Part I (Section - I)
### Straight Objective Type

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

1. Consider a branch of the hyperbola

$x^2 - 2y^2 - 2\sqrt{2}x - 4\sqrt{2}y - 6 = 0$

with vertex at the point A. Let B be one of the points of its latus rectum. If C is the focus of the hyperbola nearest to the point A, then the area of the triangle ABC is

(A) $1-\sqrt{\frac{2}{3}}$ (B) $\sqrt{\frac{3}{2}}-1$

(C) $1+\sqrt{\frac{2}{3}}$ (D) $\sqrt{\frac{3}{2}}+1$

**Ans. (D)**

2. A particle P starts from point $z_0 = 1+2i$, where $i=\sqrt{-1}$. It moves first horizontally away from origin by 5 units and then vertically away from origin by 3 units to reach a point $z_1$. From $z_1$ the particle moves $\sqrt{2}$ units in the direction of the vector $\hat{i}+\hat{j}$ and then it moves through an angle $\frac{\pi}{2}$ in anticlockwise direction on a circle with centre at origin, to reach a point $z_2$. The point $z_2$ is given by

(A) $6+7i$ (B) $-7+6i$

(C) $7+6i$ (D) $-6+7i$

**Ans. (D)**

3. Let the function $g:(-\infty,\infty)\to\left(-\frac{\pi}{2},\frac{\pi}{2}\right)$ be given by $g(u)=2\tan^{-1}(e^u)-\frac{\pi}{2}$. Then, g is

(A) Event and strictly increasing in $(0,\infty)$

(B) Odd and is strictly decreasing in $(-\infty,\infty)$

(C) Odd and is strictly increasing in $(-\infty,\infty)$

(D) neither even nor odd, but is strictly incresing in $(-\infty,\infty)$.

**Ans. (C)**

4. An experiment has 10 equally likely outcomes. Let A and B be two non-empty events of the experiment. If A consists of 4 outcomes, the number of outcomes that B must have so that A and B are independent, is

(A) 2,4 or 8 (B) 3,6 or 9

(C) 4 or 8 (D) 5 or 10

**Ans. (D)**

5. The area of the region between the curves $y=\sqrt{\frac{1+\sin x}{\cos x}}$ and $y=\sqrt{\frac{1-\sin x}{\cos x}}$ bounded by the lines $x=0$ and $x=\frac{\pi}{4}$ is

(A) $\int_0^{\sqrt{2}-1}\frac{t}{(1+t^2)\sqrt{1-t^2}}dt$

(B) $\int_0^{\sqrt{2}-1}\frac{4t}{(1+t^2)\sqrt{1-t^2}}dt$

(C) $\int_0^{\sqrt{2}+1} \frac{4t}{(1+t^2)\sqrt{1-t^2}}dt$

(D) $\int_0^{\sqrt{2}+1} \frac{t}{(1+t^2)\sqrt{1-t^2}}dt$

**Ans. (B)**

6. Consider three points $P=(-\sin(\beta-\alpha),-\cos\beta)$, $Q=(\cos(\beta-\alpha),\sin\beta)$ and $R=(\cos(\beta-\alpha+\theta),\sin(\beta-\theta))$, where $0<\alpha,\beta,\theta<\frac{\pi}{4}$. Then,

(A) P lies on the line segment RQ
(B) Q lies on the line segment PR
(C) R lies on the line segment QP
(D) P,Q,R are non-collinear

**Ans. (D)**

7. Let $I=\int \frac{e^x}{e^{4x}+e^{2x}+1}dx$,

$J=\int \frac{e^{-x}}{e^{-4x}+e^{-2x}+1}dx$,

Then, for an arbitrary constant C, the value of J-I equals

(A) $\frac{1}{2}\log\left(\frac{e^{4x}-e^{2x}+1}{e^{4x}+e^{2x}+1}\right)+C$

(B) $\frac{1}{2}\log\left(\frac{e^{2x}+e^{x}+1}{e^{2x}-e^{x}+1}\right)+C$

(C) $\frac{1}{2}\log\left(\frac{e^{2x}-e^{x}+1}{e^{2x}+e^{x}+1}\right)+C$

(D) $\frac{1}{2}\log\left(\frac{e^{4x}+e^{2x}+1}{e^{4x}-e^{2x}+1}\right)+C$

**Ans. (C)**

8. Let two non-collinear unit vectors $\hat{a}$ and $\hat{b}$ from an acute angle. A point P moves so that at any time t the position vector $\overrightarrow{OP}$ (where O is the origin) is given by $\hat{a}\cos t+\hat{b}\sin t$. When P is farthest from origin O, let M be the length of $\overrightarrow{OP}$ and $\hat{u}$ be the unit vector along $\overrightarrow{OP}$. Then.

(A) $\hat{u}=\frac{\hat{a}+\hat{b}}{|\hat{a}+\hat{b}|}$ and $M=(1+\hat{a}.\hat{b})^{1/2}$

(B) $\hat{u}=\frac{\hat{a}-\hat{b}}{|\hat{a}-\hat{b}|}$ and $M=(1+\hat{a}.\hat{b})^{1/2}$

(C) $\hat{u}=\frac{\hat{a}+\hat{b}}{|\hat{a}+\hat{b}|}$ and $M=(1+2\hat{a}.\hat{b})^{1/2}$

(D) $\hat{u}=\frac{\hat{a}-\hat{b}}{|\hat{a}-\hat{b}|}$ and $M=(1+2\hat{a}.\hat{b})^{1/2}$

**Ans. (A)**

9. Let $g(x)=\log f(x)$ where $f(x)$ is a twice differentiable positive function on $(0,\infty)$ such that $f(x+1)=xf(x)$. Then, for $N=1,2,3,.....,$

$$g''\left(N+\frac{1}{2}\right)-g''\left(\frac{1}{2}\right)=$$

(A) $-4\left\{1+\frac{1}{9}+\frac{1}{25}+....+\frac{1}{(2N-1)^2}\right\}$

(B) $4\left\{1+\frac{1}{9}+\frac{1}{25}+....+\frac{1}{(2N-1)^2}\right\}$

(C) $-4\left\{1+\frac{1}{9}+\frac{1}{25}+....+\frac{1}{(2N+1)^2}\right\}$

(D) $4\left\{1+\frac{1}{9}+\frac{1}{25}+....+\frac{1}{(2N+1)^2}\right\}$

**Ans. (A)**

## Section –II
## Reasoning Type

This section contains 4 reasoning type questions. Each question has 4 choices (A),(B),(C) and (D), out of which **only one** is correct.

10. Suppose four distinct positive numbers

$a_1, a_2, a_3, a_4$ are in G.P. Let $b_1 = a_1$,

$b_2 = b_1 + a_2,\ b_3 = b_2 + a_3,\ b_4 = b_3 + a_4,$

**STATEMENT - 1**

The numbers $b_1, b_2, b_3, b_4$ are neither in A.P. nor in G.P.

**and**

**STATEMENT - 2**

The numbers $b_1, b_2, b_3, b_4$ are in H.P.

**Ans. (C)**

11. Let a solution $y = y(x)$ of differential equation

$$x\sqrt{x^2-1}\,dy - y\sqrt{y^2-1}dx = 0$$

satisfy $y(2) = \frac{2}{\sqrt{3}}$.

**STATEMENT - 1**

$$y(x) = \sec\left(\sec^{-1}x - \frac{\pi}{6}\right)$$

**and**

**STATEMENT - 2**

$y(x)$ is given by

$$\frac{1}{y} = \frac{2\sqrt{3}}{x} - \sqrt{1-\frac{1}{x^2}}$$

**Ans. (C)**

12. Consider

$$L_1 : 2x + 3y + p - 3 = 0$$

$$L_2 : 2x + 3y + p + 3 = 0$$

where p is a real number, and

$$C : x^2 + y^2 + 6x - 10y + 30 = 0$$

**STATEMENT - 1**

If line $L_1$ is a chord of circle C, then line $L_2$ is not always a diameter of circle C.

**and**

**STATEMENT - 2**

If line $L_1$ is a diameter of circle C, $L_2$ is not a chord of circle C.

**Ans. (C)**

13. Let a,b,c,p,q be real numbers, Suppose $\alpha, \beta$ are the roots of the equation $x^2 + 2px + q$ and $\alpha, \frac{1}{\beta}$ are the roots of the equation $ax^2 + 2bx + c = 0$, where $\beta^2 \notin \{-1, 0, 1\}$.

**STATEMENT - 1**

$$\left(p^2 - q\right)\left(b^2 - ac\right) \geq 0$$

**and**

**STATEMENT - 2**

$$b \neq pa \text{ or } c \neq qa$$

**Ans. (B)**

**section - III (Linked comprehension Type)**

This section contains 2 paragraphs. 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.

**Paragraph for Question Nos. 14 to 16**

Consider the lines

$$L_1 : \frac{x+1}{3} = \frac{y+2}{1} = \frac{z+1}{2}$$

$$L_2 : \frac{x-2}{1} = \frac{y+2}{2} = \frac{z-3}{3}$$

14. The unit vector perpendicular to both $L_1$ and $L_2$ is

(A) $\frac{-\hat{i} + 7\hat{j} + 7\hat{k}}{\sqrt{99}}$ (B) $\frac{-\hat{i} - 7\hat{j} + 5\hat{k}}{5\sqrt{3}}$

(C) $\frac{-\hat{i} + 7\hat{j} + 5\hat{k}}{5\sqrt{3}}$ (D) $\frac{7\hat{i} - 7\hat{j} - \hat{k}}{\sqrt{99}}$

**Ans. (B)**

15. The shortest distance between $L_1$ and $L_2$ is

(A) 0 (B) $\frac{17}{\sqrt{3}}$

(C) $\frac{41}{5\sqrt{3}}$ (D) $\frac{17}{5\sqrt{3}}$

**Ans. (D)**

16. The distance of the point (1,1,1) from the plane passing through the point (-1,-2,-1) and whose normal is perpendicular to both the lines $L_1$ and

$L_2$ is

(A) $\frac{2}{\sqrt{75}}$ (B) $\frac{7}{\sqrt{75}}$

(C) $\frac{13}{\sqrt{75}}$ (D) $\frac{23}{\sqrt{75}}$

**Ans. (C)**

**Paragraph for Question Nos. 17 to 19**

Consider the fucntion $f:(-\infty,\infty)\to(-\infty,\infty)$ defined by

$$f(x)=\frac{x^2-ax+1}{x^2+ax+1},\ 0<a<2.$$

17. Which of the following is true ?

(A) $(2+a)^2 f''(1)+(2-a)^2 f''(-1)=0$

(B) $(2-a)^2 f''(1)-(2+a)^2 f''(-1)=0$

(C) $f'(1)f'(-1)=(2-a)^2$

(D) $f'(1)f'(-1)=-(2+a)^2$

**Ans. (A)**

18. Which of the following is true ?

(A) $f(x)$ is decreasing on $(-1,1)$ and has a local minimum at $x=1$

(B) $f(x)$ is increasing on $(-1,1)$ and has a local maximum at $x=1$

(C) $f(x)$ is increasing on $(-1,1)$ but has neither a local maximum nor a local minimum at $x=1$

(D) $f(x)$ is decreasing on $(-1,1)$ but has neither a local maximum nor a local minimum at $x=1$

**Ans. (A)**

19. Let

$$g(x)=\int_0^{e^x}\frac{f'(t)}{1+t^2}\,dt$$

Which of the following is true ?

(A) $g'(x)$ is positive on $(-\infty,0)$ and negative on $(0,\infty)$

(B) $g'(x)$ is negative on $(-\infty,0)$ and positive on $(0,\infty)$

(C) $g'(x)$ changes sign on both $(-\infty,0)$ and $(0,\infty)$

(D) $g'(x)$ does not change sign on $(-\infty,\infty)$

**Ans. (B)**

**Section IV**

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

If the correct matches are A-q, A-r, B-p, B-s, C-r, C-s and D-q, then the correctly bubbled matrix will look like the following :

20. Match the Statements / Expressions in **Column I** with the statements / Expressions in Column II

| **Column I** | **Column II** |
|---|---|
| (A) The minimum value of $\frac{x^2+2x+4}{x+2}$ is | (p) 0 |
| (B) Let A and B be $3\times3$ matrices of real numbers, where A i symmetric, B is skew-symmetric, and $(A+B)(A-B)=(A-B)(A+B)$. If $(AB)^t=(-1)^k AB$ where $(AB)^t$ is the transpose of the matrix AB, then the possibel values of k are | (q) 1 |
| (C) Let $a=\log_3\log_3 2$. An integer k satisfying $1<2^{(-k+3^{-a})}<2$, must be less than | (r) 2 |
| (D) If $\sin\theta=\cos\phi$, then the possible values of $\frac{1}{\pi}\left(\theta\pm\phi-\frac{\pi}{2}\right)$ are | (s) 3 |

**Ans. (A) - r (B) - q,s (C) - s,r (D) p,r**

21. Consider all possible permutation of the letters of the word ENDEANOEL.

Match the Statements / Expressions in **Column I** with the statements / Expressions in Column II

| **Column I** | **Column II** |
|---|---|
| (A) The number of permutations containing the word ENDEA is | (p) $5!$ |
| (B) The number of permutations in which the letter E occurs in the first and the last positions is | (q) $2\times5!$ |
| (C) The number of permutation in which none of the letters D,L,N occurs in the last five positions is | (r) $7\times5!$ |
| (D) The number of permutations in which the letters A,E,O occur only in odd positions is | (s) $21\times5!$ |

**Ans.** **(A) - p (B) - s (C) - q (D) q**

22. Consider the lines given by

$$L_1 : x+3y-5=0$$
$$L_2 : 3x-ky-1=0$$
$$L_2 : 5x+2y-12=0$$

| **Column I** | **Column II** |
|---|---|
| (A) $L_1, L_2, L_3$ are concurrent, if | (p) |
| (B) One of $L_1, L_2, L_3$ is parallel to at least one of the other | (q) |
| (C) $L_1, L_2, L_3$ form a triangle , if | (r) |
| (D) $L_1, L_2, L_3$ do not form a triangle, if | (s) |

**Ans.** **(A) - s (B) - p,q (C) - r (D) p,q,s**

## ----- PHYSICS-----

**Paper II**

**Section - I**

**Straight objective Type**

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

23. A light beam is traveling from Region I to Region IV (Refer Figure). The refractive index in Regions I, II, III and IV are $n_0, \frac{n_0}{2}, \frac{n_0}{6}$ and $\frac{n_0}{8}$, respectively. The angle of incidence $\theta$ for which the beam just misses entering Region IV is

**Ans.** **(B)**

24. A vibrating string of certain length $l$ under a tension $T$ resonates with a mode corresponding to the first overtone (third harmonic) of an air column of length 75 cm inside a tube closed at one end. The string also generates 4 beats per second when excited along with a tuning fork of frequency $n$. Now when the tension of the string is slightly increased the number of beats reduces to 2 per second. Assuming the velocity of sound in air to be 340 m/s, the frequency $n$ of the tuning fork in $Hz$ is

**Ans.** **(A)**

25. A parallel plate capacitor $C$ with plates of unit area and separation $d$ is filled with a liquid of dielectric constant $K=2$. The level of liquid is $\frac{d}{3}$ initially. Suppose the liquid level decreases at a constant speed $V$, the time constant as a function of time $t$ is

**Ans.** **(A)**

26. A bob of mass M is suspended by a massless string of length L. The horizontal velocity V at position A is just sufficient to make it reach the point B. The angle $\theta$ at which the speed of the bob is half of that at A, satisfies

**Ans.** **(D)**

27. A glass tube of uniform internal radius (r) has a valve seperating the two identical ends. Initially, the valve is in a tightly closed position. End 1 has a hemispherical soap bubble of radius r. End 2 has sub-hemispherical soap bubble as shown in figure. Just after opening the valve.

**Ans.** **(B)**

28. A block (B) is attached to two unstretched springs S1 and S2 with spring constants k and 4k, respectively (see figure I). The other ends are attached to identical supports M1 and M2 not attached to the walls. The springs and supports have negligible mass. There is no friction anywhere. The block B is displaced towards wall

1 by a small distance $x$ (figure II) and released. The block returns and moves a maximum distance $y$ towards wall 2. Displacements $x$ and $y$ are measured with respect to the equilibrium position of the block B. The ratio $\frac{y}{x}$ is

**Ans.** **(C)**

29. A transverse sinusoidal wave moves along a string in the positive $x-$direction at a speed of 10 cm/s. The wavelength of the wave is 0.5 m and its amplitude is 10 cm. At point P when its displacement is 5 cm is

**Ans.** **(A)**

30. Consider a system of three charges $\frac{q}{3}, \frac{q}{3}$ and $-\frac{2q}{3}$ placed at points A, B and C, respectively, as shown in the figure. Take O to be the centre of the circle of radius $R$ and angle $CAB = 60°$.

**Ans.** **(C)**

31. A radioactive sample $S1$ having an activity of $5\mu Ci$ has twice the number of nuclei as another sample $S2$ which has an activity of $10\mu Ci$. The half lives of $S1$ and $S2$ can be

**Ans.** **(A)**

**Section - II**

**Reasoning Type**

This section contains 4 reasoning type questions. Each question has 4 choices (A), (B), (C) and (D), out of which **ONLY ONE** is correct.

32. **STATEMENT - 1**

It is easier to pull a heavy object than to push it on a level ground.

and

**Statement - 2**

The magnitude of frictional force depends on the nature of the two surfaces in contact.

**Ans.** **(B)**

33. **STATEMENT - 1**

For practical purposes, the earth is used as a reference at zero potential in electrical circuits.

and

**Statement - 2**

The electrical potential of a sphere of radius $R$ with charge $Q$ uniformly distributed on the surface is given by $\frac{Q}{4\pi\varepsilon_0 R}$.

**Ans.**

34. **STATEMENT - 1**

The sensitivity of a moving coil galvanometer is increased by placing a suitable magnetic material as a core inside the coil.

and

**Statement - 2**

Soft iron has a high magnetic permeability and cannot be easily magnetized or demagnetized.

**Ans.** **(C)**

35. **STATEMENT - 1**

For an observer looking out through the window of a fast moving train, the nearby objects appear to move in the opposite direction to the train, while the distant objects appear to be stationary.

and

**Statement - 2**

If the observer and the object are moving at velocities $\vec{V}_2 - \vec{V}_1$.

**Ans.** **(B)**

**Section - III**

**Linked Comprehension Type**

This section contains 2 paragraphs. 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.

**Paragraph for Question Nos.36 to 38**

A uniform thin cylindrical disk of mass M and radius R is attached to two identical massless spring constant k which are fixed to the wall as shown in the figure. The springs are attached to the axle of the disk symmetrically on either side at a distance d from its centre. The axle is massless and both the springs and the axle are in a horizontal plane. The unstretched length of each spring is L. The disk is initially at its equilibrium position with its centre of mass (CM) at a distance L from the wall. The disk rolls without slipping with velocity $\vec{V}_0 = V_0\,\hat{i}$. The coefficient

of friction is $\mu$.

36. The net external force acting on the disk when its centre of mass is at displacement $x$ with respect to its equilibrium position is

**Ans.** **(D)**

37. The centre of mass of the disk undergoes simple harmonic motion with angular frequency $\omega$ equal to

**Ans.** **(D)**

38. The maximum value of $V_0$ for which the disk will roll without slipping is

**Ans.** **(C)**

**Paragraph for Question Nos.39 to 41**

The nuclear charge $(Ze)$ is non-uniformly distributed within a nucleus of radius $R$. The charge density $\rho(r)$ [charge per unit volume] is dependent only on the radial distance $r$ from the centre of the nucleus as shown in figure. The electric field is only along the radial direction.

39. The electric field at $r = R$ is

**Ans.** **(A)**

40. For $a = 0$, the value of $d$ (maximum value of $\rho$ as shown in the figure) is

**Ans.** **(B)**

41. The electric field within the nucleus is generally observed to be linearly dependent on $r$. This implies

**Ans.** **(C)**

**Section - IV**

**Matrix Match Type**

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

If the correct matches are A-q, A-r, B-p, B-s, C-r, C-s and D-q, then the correctly bubbled matrix will look like the following :

42. **An optical component and an object S placed along its optic axis are given in Column I. The distance between the object and the component can be varied**. The properties of images are given in Column II. Match all the properties of images from Column II with the appropriate components given in Column I. Indicate your answer by darkening the appropriate bubbles of the $4 \times 4$ matrix given in the ORS.

**Ans.** **(A) - p, q, r, s**
**(B) - q**
**(C) - p, q, r, s**
**(D) - p, q, r, s**

43. **Column I contains a list of processes involving expansion of an ideal gas.** Match this with Column II describing the thermodynamic change during this process. Indicate your answer by darkening the appropriate bubbles of the $4 \times 4$ matrix given in the ORS.

**Ans.** **(A) - q**
**(B) - p, r**
**(C) - p, s**
**(D) - q, s**

44. **Column I gives a list of possible set of parameters measured in some experiments.** The variations of the parameters in the form of graphs are shown in Column II. Match the set of parameters given in Column I with the graphs given in Column II. Indicate your answer by darkening the appropriate bubbles of the $4 \times 4$ matrix given in the ORS.

**Ans.** **(A) - p**
**(B) - q, s**
**(C) - s**
**(D) - q**

## ----- CHEMISTRY -----

**Paper II**

**Section - I**

**Straight objective Type**

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

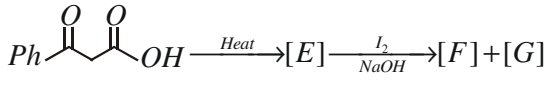
45. Cellulose upon acetylation with excess acetic anhydride / $H_2SO_4$ (catalytic) gives cellulose triacetate whose structure is

**Ans.** **(A)**

46. The correct stability order for the following species is

**Ans.** **(D)**

47. In the following reaction sequence, the correct structure of E, F and G are



(* implies $^{13}C$ labelled carbon)

**Ans.** **(C)**

48. Among the following, the surfactant that will form micelles in aqueous solution at the lowest molar concentration at ambient conditions is

**Ans.** **(A)**

49. Electrolysis of dilute aqueous NaCl solution was carried out by passing 10 milli ampere current. The time required to liberate 0.01 mol of $H_2$ gas at the cathode is $(1 Faraday = 96500 C\, mol^{-1})$

**Ans.** **(B)**

50. Solubility product constant $(K_{sp})$ of salts of types $MX$, $MX_2$ and $M_3X$ at temperature 'T' are $4.0\times10^{-8}$, $3.2\times10^{14}$ and $2.7\times10^{-15}$, respectively. Solubilities $(mol\, dm^{-3})$ of the salts at temperature 'T' are in the order

**Ans.** **(D)**

51. Among the following, the coloured compound is

**Ans.** **(C)**

52. The IUPAC name of $[Ni(NH_3)_4][NiCl_4]$ is

**Ans.** **(C)**

53. Both $[Ni(CO)_4]$ and $[Ni(CN)_4]^{-2}$ are diamagnetic. The hybridisations of nickel in these complexes, respectively, are

**Ans.** **(B)**

**Section - II**

**Reasoning Type**

This section contains 4 reasoning type questions. Each question has 4 choices (A), (B), (C) and (D), out of which **ONLY ONE** is correct.

**54.** **Statement - 1 :**

The geometrical isomers of the complex $[M(NH_3)_4Cl_2]$ are optically inactive.

**and** **Statement - 2 :**

Both geometrical isomers of the complex $[M(NH_3)_4Cl_2]$ possess axis of symmetry.

**Ans.** **(B)** The molecule should not posses alternate axis of symmetry to be optically active.

**55.** **Statement - 1:**

There is a natural asymmetry between converting work to heat and converting heat to work.

**and** **Statement - 2** :

No process is possible in which the sole result is the absorption of heat from a reservoir and its complete conversion into work.

**Ans.** **(B)**

**56.** **Statement - 1**

Aniline on reaction with $NaNO_2 / HCl$ at 0°C followed by coupling with $\beta-$ naphthol gives a dark blue coloured precipitate.

**and** **Statement - 2** :

The colour of the compound formed in the reaction of anilines with $NaNO_2 / HCl$ at 0°C followed by coupling with $\beta-$ naphthol is due to the extended conjugation.

**Ans.** **(D)**

**57.** **Statement - 1** :

$[Fe(H_2O)_5NO]SO_4$ is paramagnetic.

**and** **Statement - 2** :

The $Fe$ in $[Fe(H_2O)_5NO]SO_4$ has three unpaired electrons.

**Ans.** **(C)**

**Section III**

**Linked Comprehension Type**

**Paragraph for Question Nos. 58 to 60**

A tertiary alcohol H upon acid catalysed dehydration gives a product I. Ozonolysis of I leads to compounds J and K. .....

58. Coumpound H is formed by the reaction of

**Ans.** **(B)**

59. The structure of compound I is

**Ans.** **(A)**

60. The structures of compounds J, K and L, respectively, are

**Ans.** **(D)**

**Paragraph for Question Nos. 61 to 63**

In hexagonal systems of crystals, a frequently encountered arrangement of atoms is described as a hexagonal prism.

61. The number of atoms in this HCP unit cell is

**Ans. (B)**

62. The volume of this HCP unit is

**Ans. (A)**

63. The empty space in the HCP unit cell is

**Ans. (D)**

**Section IV**

**Matrix Match Type**

64. Match the compounds in Column I with their characteristic test(s)/reaction(s) given in Column (II).

| **Column I** | **Column II** |
|---|---|
| (A) $H_2N-\overset{\oplus}{N}H_3\,\overset{\ominus}{Cl}$ | (p) Sodium fusion extract of the compoun |

**Ans. (A) - (s); (r),**
**(B) - (p); (q),**
**(C) - (p); (q); (r)**
**(D) - (p); (s)**

65. Match the entries in Column I with the corerectly

| **Column I** | **Column II** |
|---|---|
| (A) Orbital angular momentum of the electron in a hydrogen-like atomic orbital | (p) Principal quantum number |
| (B) $CaCO_3 \rightarrow CaO$ | (q) calcination |

**Ans. (A) - (q) ,**
**(B) - (s),**
**(C) - (p); (q); (r),**
**(D) - (p); (q); (r)**

66. Match the conversions in

| **Column I** | **Column II** |
|---|---|
| (A) $PbS \rightarrow PbO$ | (p) roasting |
| (B) $CaCO_3 \rightarrow CaO$ | (q) calcination |

**Ans. (A) - (p) (B) - (q),**
**(C) - (p) ;(r) (D) - (p);(s)**