JEE (Main)
Sample Question Paper

Subjects	Physics, Chemistry and Mathematics
Total Number of Questions	75
Maximum Marks	300
Time Allowed	3 Hours

Marking Scheme (As per JEE Main Pattern)

Each question carries **4 (four) marks**.

1 (one) mark will be deducted for each incorrect answer.

No marks will be deducted for unattempted questions.

Only one option is correct for each question.

Important Instructions

1. This Question Paper consists of **75 Multiple Choice Questions**.

2. The paper contains **25 questions each from Physics, Chemistry and Mathematics**.

3. All questions are compulsory.

4. Rough work should be done only in the space provided in the Question Paper.

5. Calculators, mobile phones, smart watches, or any electronic devices are strictly prohibited.

Name of the Candidate (Capital Letters)	
Roll Number	
Examination Centre Name	
Candidate's Signature	Date

Invigilator's Signature

PHYSICS

1. A point charge of $10\,\mu C$ is placed at the origin At what location on the X-axis should a point charge of $40\,\mu C$ be placed so that the net electric field is zero at $x = 2\,cm$ on the X-axis?

   A) $x = -4\,cm$
   B) $x = 4\,cm$
   C) $x = 8\,cm$
   D) $x = 6\,cm$

2. $E = E_0 \sin(\omega t - kx)$

   $B = B_0 \sin(\omega t - kx)$, then ratio of energy density of electric field to magnetic field is :

   A) 1:1
   B) 1:3
   C) 1:2
   D) 2:1

3. The height of the antenna is 98 m. The radius of Earth is 6400 km. The area up to which it will transmit signal is:

   A) 3642 km^2
   B) 3942 km^2
   C) 11200 km^2
   D) 22400 km^2

4. The following statements are given :
   (1) The average kinetic energy of a gas molecule decreases when the temperature is reduced
   (2) The average kinetic energy of a gas molecule increases with increase in pressure at constant temperature
   (3) The average kinetic energy of a gas molecule decreases with increases in volume
   (4) Pressure of a gas increases with increase in temperature at constant pressure
   (5) The volume of gas decreases with increase in temperature
   Choose the correct answer from the options given below :

   A) (1) and (4) only
   B) (1), (2) and (4) only
   C) (2) and (4) only
   D) (1), (2) and (5) only

5. The weight of a body on the surface of the earth is 100 N. The gravitational force on it when taken at a height, from the surface of earth, equal to one-fourth the radius of the earth is:

   A) 25 N
   B) 64 N
   C) 100 N
   D) 50 N

6. A drop of liquid of density ρ is floating half immersed in a liquid of density σ and surface tension 7.5×10^{-4} Ncm^{-1}. The radius of drop in cm will be : (Take : $g=10\ m/s^2$)

   A) $\dfrac{15}{\sqrt{2\rho-\sigma}}$
   B) $\dfrac{15}{\sqrt{\rho-\sigma}}$
   C) $\dfrac{3}{2\sqrt{\rho-\sigma}}$
   D) $\dfrac{3}{20\sqrt{2\rho-\sigma}}$

7. Match the list-I with list-II and choose the correct option.

List-I	List-II
(A). Microwave	(P). 1 nm - 400nm
(B). Ultraviolet	(Q). 1 nm - 1nm
(C). X-rays	(R). 2.5 µm - 750nm
(D). Infrared	(S). 1 µm - 1nm

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

8. A wire of length $1m$ moving with velocity $8m/s$ at right angles to a magnetic field of $2T$ The magnitude of induced emf, between the ends of wire will be _____

A) $20V$ B) $16V$

C) $8V$ D) $12V$

9. To radiate EM signal of wavelength λ with high efficiency, the antennas should have a minimum size equal to:

A) 2λ B) $\frac{\lambda}{4}$

C) $\frac{\lambda}{2}$ D) λ

10. Two isolated metallic solid spheres of radii R and $2R$ are charged such that both have same charge density σ. The spheres are then connected by a thin conducting wire. If the new charge density of the bigger sphere is σ' The ratio $\frac{\sigma'}{\sigma}$ is :

A) $\frac{5}{3}$ B) $\frac{9}{4}$

C) $\frac{5}{6}$ D) $\frac{4}{3}$

11. Variation of magnetic field through a coil of area 4 m^2 is shown in figure. What is the EMF induced in the coil (in mV)?

A) 8   B) 16

C) 4   D) 2

12. A planet has double the mass of the earth. Its average density is equal to that of the earth. An object weighing W on earth will weigh on that planet:

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

C) $(2)^{-\frac{1}{3}}$ D) 2

13. Assume that the earth is a solid sphere of uniform density and a tunnel is dug along its diameter throughout the earth It is found that when a particle is released in this tunnel, it executes a simple harmonic motion The mass of the particle is $100\,g$ The time period of the motion of the particle will be (approximately)(Take $g = 10\,ms^{-2}$, radius of earth $= 6400\,km$)

A) 1 hour 24 minutes   B) 1 hour 40 minutes

C) 12 hours   D) 24 hours

14. Two forces of magnitude A and $\frac{A}{2}$ act perpendicular to each other. The magnitude of the resultant force is equal to:

A) $\frac{A}{2}$ B) $\frac{\sqrt{5}A}{2}$

C) $\frac{3A}{2}$ D) $\frac{5A}{2}$

15. An object moves x distance with speed v_1 and next x distance with speed v_2. The average velocity v is related to v_1 and v_2 as

A) $v = \frac{(v_1+v_2)}{2}$ B) $\frac{1}{v} = \frac{1}{v_1} + \frac{1}{v_2}$

C) $v = \frac{(2v_1v_2)}{(v_1+v_2)}$ D) $v = \frac{(v_1-v_2)}{2}$

16. Statement —I: Electromagnets are made of soft iron.
Statement —II: Soft iron has lower permeability and high retentivity.
Choose the correct option related to statements.

A) Statement — I is true but Statement — II is false   B) Statement — I is false but Statement — II is true

C) Statement — I is false and Statement — II is also false   D) Statement —I is true and Statement —II is also true

17. The length of a seconds pendulum at a height $h=2R$ from earth surface will be :

(Given : R= Radius of earth and acceleration due to gravity at the surface of earth $g=\pi^2 ms^{-2}$)

A) $\frac{2}{9}m$ **B)** $\frac{4}{9}m$

C) $\frac{8}{9}m$ **D)** $\frac{1}{9}m$

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

A) $\frac{1}{4}$ **B)** 4

C) $\frac{1}{2}$ **D)** 2

19. What is the center of gravity of a semi-circular disc of radius (R)?

A) $\frac{2R}{\Pi}$ **B)** $\frac{4R}{3\Pi}$

C) $\frac{R}{2}$ **D)** $\frac{3R}{8}$

20. A passenger sitting in a train A moving at 90 km/h observes another train B moving in the opposite direction for 8 s. If the velocity of train B is 54 km/h, then the length of train B is:

A) 100 m **B)** 320 m

C) 200 m **D)** 400 m

21. The temperature of the body drops from 60°C to 40°C in 7 min. The surrounding temperature is 10°C. The temperature of the body drops from 40°C to T°C in 7 min. Find the value of T

A) 16 **B)** 20

C) 28 **D)** 30

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

Assertion (A):- fan spins even after switch is off

Reason (R):- Fan in rotation has rotational inertia.

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

A) A is correct and R is correct explanation of A **B)** A is correct and R is incorrect explanation of A

C) A is correct and R is correct but R is not correct explanation of **D)** Both (A) and (R) are incorrect

23. Given below are two statements, one is labelled as Assertion A and the other is labelled as Reason R.

Assertion (A): Range of a horizontal projectile is maximum when angle of projection is $\theta = 45°$.

Reason (R): Range is maximum when $sin(2\theta) = 1$.

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

A) (A) and (R) both are true and (R) is correct explanation of (A) **B)** (A) and (R) both are true but (R) is not correct explanation of (A)

C) (A) is true and (R) is false **D)** Both (A) and (R) are false

24. Match List I with List II

LIST I	LIST II
A Isothermal Process	I Work done by the gas decreases internal energy
B Adiabatic Process	II No change in internal energy
C Isochoric Process	III The heat absorbed goes partly to increase internal energy and partly to do work
D Isobaric Process	IV No work is done on or by the gas

Choose the correct answer from the options given below:

A) A-I, B-II, C-IV, D-III
B) A-II, B-I, C-IV, D-III
C) A-I, B-II, C-III, D-IV
D) A-II, B-I, C-III, D-IV

25. 100 balls each of mass m moving with speed v simultaneously strike a wall normally and reflected back with same speed, in time ts The total force exerted by the balls on the wall is

A) $\frac{100mv}{t}$
B) $200mvt$
C) $\frac{200mv}{t}$
D) $\frac{mv}{100t}$

JEE MAIN PHYSICS ANSWER KEY

1. (D)	**2. (A)**	**3. (B)**	**4. (A)**	**5. (B)**
6. (A)	**7. (A)**	**8. (B)**	**9. (B)**	**10. (C)**
11. (A)	**12. (B)**	**13. (A)**	**14. (B)**	**15. (C)**
16. (B)	**17. (D)**	**18. (D)**	**19. (B)**	**20. (B)**
21. (C)	**22. (A)**	**23. (A)**	**24. (B)**	**25. (C)**

CHEMISTRY

1. Anomalous behaviour of oxygen is due to its

   A) Large size and high electronegativity
   B) Small size and low electronegativity
   C) Small size and high electronegativity
   D) Large size and low electronegativity

2. The energy of an electron in the first Bohr orbit of hydrogen atom is $-2.18 \times 10^{-18} J$. Its energy in the third Bohr orbit is ____.

   A) One third of this value
   B) $\frac{1}{9}$ th of this value
   C) Three times of this value
   D) $\frac{1}{27}$ of this value

3. The element having the highest first ionization enthalpy is

   A) Si
   B) Al
   C) N
   D) C

4. $2IO_3^- + xI^- + 12H^+ \longrightarrow 6I_2 + 6H_2O$ What is the value of x?

   A) 2
   B) 10
   C) 6
   D) 12

5. The density of the alkali metals is in the order:

   A) K<Na<Rb<Cs
   B) Na<K<Cs<Rb
   C) K<Cs<Na<Rb
   D) NavRb<K<Cs

6. The correct order of spin only magnetic moments for the following complex ions is

   A) $[Fe(CN)_6]^{3-} < [CoF6]^{3-} < [MnBr_4]^{2-} < [Mn(CN)_6]^{3-}$
   B) $[Fe(CN)_6]^{3-} < [Mn(CN)_6]^{3-} < CoF_6]^{3-} < [MnBr_4]^{2-}$
   C) $[COF_6]^{3-} < [MnBr_4]^{2-} < [Fe(CN)_6]^{3-} < [Mn(CN)_6]^{3-}$
   D) $[MnBr_4]^{2-} < [CoF_6]^{3-} < [Fe(CN)_6]^{3-} < [Mn(CN)_6]^{3-}$

7. We have three aqueous solutions of NaCl labelled as 'A', 'B' and 'C' with concentration 0.1 M, 0.01M & 0.001 M, respectively. The value of vant' Haft factor (i) for these solutions will be in the order.

   A) $i_A < i_B < i_C$
   B) $i_A < i_C < i_B$
   C) $i_A = i_B = i_C$
   D) $i_A > i_B > i_C$

8. Which of the following acts as a strong reducing agent? (Atomic number : Ce = 58, Eu = 63, Gd = 64, Lu = 71)

   A) Lu^{3+}
   B) Gd^{3+}
   C) Eu^{2+}
   D) Ce^{4+}

9. In chromyl chloride, the number of d-electrons present on chromium is same as in (Given at no. of Ti : 22, V : 23, Cr : 24, Mn : 25, Fe : 26)

   A) Mn (VII)
   B) Fe (III)
   C) V (IV)
   D) Ti (III)

10. Choose the correct option having all the elements with d^{10} electronic configuration from the following:

    A) $^{27}Co, {}^{28}Ni, {}^{26}Fe, {}^{24}Cr$
    B) $^{29}Cu, {}^{30}Zn, {}^{48}Cd, {}^{47}Ag$
    C) $^{46}Pd, {}^{28}Ni, {}^{26}Fe, {}^{24}Cr$
    D) $^{28}Ni, {}^{24}Cr, {}^{26}Fe, {}^{29}Cu$

11. The coordination geometry around the manganese in decacarbonyldimanganese(0) is

    A) Octahedral
    B) Trigonal bipyramidal
    C) Square pyramidal
    D) Square planar

12. Given below are two statements:
    Statement (I): Aqueous solution of ammonium carbonate is basic.
    Statement (II): Acidic/basic nature of salt solution of a salt of weak acid and weak base depends on K_a and K_b value of acid and the base forming it.
    In the light of the above statements, choose the most appropriate answer from the options given below:

    A) Both Statement I and Statement II are correct
    B) Statement I is correct but Statement II is incorrect
    C) Both Statement I and Statement II are incorrect
    D) Statement I is incorrect but Statement II is correct

13. The compound that is white in color is

    A) ammonium sulphide
    B) lead sulphate
    C) lead iodide
    D) ammonium arsinomolybdate

14. Given below are two statements:
    Statement (I): The 4f and 5f-series of elements are placed separately in the Periodic table to preserve the principle of classification.
    Statement (II): s-block elements can be found in pure form in nature.
    In the light of the above statements, choose the most appropriate answer from the options given below:

    A) Statement I is false but Statement II is true
    B) Both Statement I and Statement II are true
    C) Statement I is true but Statement II is false
    D) Both Statement I and Statement II are false

15. The Lassaigne's extract is boiled with dil HNO_3 before testing for halogens because

    A) AgCN is soluble in HNO_3
    B) Silver halides are soluble in HNO_3
    C) Ag_2S is soluble in HNO_3
    D) Na_2S and NaCN are decomposed by HNO_3

16. The correct sequence of electron gain enthalpy of the elements listed below is
    A. Ar
    B. Br
    C. F
    D. S
    Choose the most appropriate from the options given below:

    A) C > B > D > A
    B) A > D > B > C
    C) A > B > D > C
    D) D > C > B > A

17. The group of chemicals used as pesticide is

    A) Dieldrin, Sodium arsinite, Tetrachloroethene
    B) Sodium chlorate, DDT, PAN
    C) DDT, Aldrin
    D) Aldrin, Sodium chlorate, Sodium arsinite

18. Given below are two statements:
    Statement (I) : Oxygen being the first member of group 16 exhibits only –2 oxidation state.
    Statement (II) : Down the group 16 stability of +4 oxidation state decreases and +6 oxidation state increases.
    In the light of the above statements, choose the most appropriate answer from the options given below:

    A) Statement I is correct but Statement II is incorrect
    B) Both Statement I and Statement II are correct
    C) Both Statement I and Statement II are incorrect
    D) Statement I is incorrect but Statement II is correct

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

Assertion (A): B_eCl_2 and $MgCl_2$ produce characteristic flame.

Reason (R): The excitation energy is high in B_eCl_2 and $MgCl_2$

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

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

B) (A) is false but (R) is true

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

D) (A) is true but (R) is false.

20. The complex with highest magnitude of crystal field splitting energy ($\Delta 0$) is

A) $[Ti(OH)_2)_6]^{3+}$

B) $[C_r(OH)_2)_6]^{3+}$

C) $[m_n(OH)_2)_6]^{3+}$

D) $[F_e(OH)_2)_6]^{3+}$

21. NaCl reacts with conc. H_2SO_4 and $K_2Cr_2O_7$ to give reddish fumes (B), which react with NaOH to give yellow solution (C). (B) and (C) respectively are:

A) CrO_2Cl_2, Na_2CrO_4

B) Na_2CrO_4, CrO_2Cl_2

C) $CrO_2Cl_2, KHSO_4$

D) $CrO_2Cl_2, Na_2Cr_2O_7$

22. Given below are two statements:

Statement (I): A solution of $[Ni(H_2O)_6]^{2+}$ is green in color.

Statement (II): A solution of $[Ni(CN)_4]^{2-}$ is colorless.

In the light of the above statements, choose the most appropriate answer from the options given below.

A) Both Statement I and Statement II are incorrect

B) Both Statement I and Statement II are correct

C) Statement I is incorrect but Statement II is correct

D) Statement I is correct but Statement II is incorrect

23. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).

Assertion (A): PH_3 has lower boiling point than NH_3.

Reason (R): In liquid state NH_3 molecules are associated through vander waal's forces, but PH_3 molecules are associated through hydrogen bonding.

In the light of the above statements.

Choose the most appropriate answer from the options given below:

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

B) (A) is not correct but (R) is correct

C) Both (A) and (R) are correct but (R) is the correct explanation of (A)

D) (A) is correct but (R) is not correct

24. Which of the following statements is not correct about rusting of iron?

A) Coating of iron surface by tin prevents rusting, even if the tin coating is peeling off.

B) When pH lies above 9 or 10, rusting of iron does not take place.

C) Dissolved acidic oxides SO_2, NO_2

D) Rusting of iron is envisaged as setting up of electrochemical cell on the surface of iron object.

25. Given below are two statements:

Statement I: Boron is extremely hard indicating its high lattice energy

Statement II: Boron has highest melting and boiling point compared to its other group members.

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

A) Both Statement I and Statement II is correct

B) Both Statement I and Statement II is incorrect

C) Statement I is correct but Statement II is incorrect

D) Statement I is incorrect but Statement II is correct

JEE MAIN CHEMISTRY ANSWER KEY

1. (C)	2. (B)	3. (C)	4. (B)	5. (A)
6. (B)	7. (A)	8. (C)	9. (A)	10. (B)
11. (A)	12. (A)	13. (B)	14. (C)	15. (D)
16. (B)	17. (C)	18. (C)	19. (D)	20. (B)
21. (A)	22. (B)	23. (D)	24. (A)	25. (A)

MATHEMATICS

1. Let Ω be the sample space and $A \subseteq \Omega$ be an event .
   Given below are two statements :
   (S1): If $P(A) = 0$, then $A = \emptyset$
   (S2): If $P(A) = 1$, then $A = \Omega$
   Then
   A) both (S1) and (S2) are true
   B) only $(S1)$ is true
   C) only (S2) is true
   D) both (S1) and (S2) are false

2. A wire of length $20m$ is to be cut into two pieces A piece of length l_1 is bent to make a square of area A_1 and the other piece of length l_2 is made into a circle of area A_2 If $2A_1 + 3A_2$ is minimum then $(\pi l_1) : l_2$ is equal to:
   A) $6 : 1$
   B) $3 : 1$
   C) $4 : 1$
   D) $1 : 6$

3. The minimum number of elements that must be added to the relation $R = \{(a,b),(b,c)\}$ on the set $\{a,b,c\}$ so that it becomes symmetric and transitive is :
   A) 3
   B) 7
   C) 4
   D) 5

4. If an unbiased die, marked with $-2,-1,0,1,2,3$ on its faces, is thrown five times, then the probability that the product of the outcomes is positive, is:
   A) $\frac{440}{2592}$
   B) $\frac{881}{2592}$
   C) $\frac{27}{288}$
   D) $\frac{521}{2592}$

5. Let $f(x) = \int \frac{2x}{(x^2+1)(x^2+3)} dx$ If $f(3) = \frac{1}{2}(\log_e 5 - \log_e 6)$, then $f(4)$ is equal to
   A) $\log_e 17 - \log_e 18$
   B) $\log_e 19 - \log_e 20$
   C) $\frac{1}{2}(\log_e 19 - \log_e 17)$
   D) $\frac{1}{2}(\log_e 17 - \log_e 19)$

6. Let the plane P pass through the intersection of the planes $2x + 3y - z = 2$ and $x + 2y + 3z = 6$, and be perpendicular to the plane $2x + y - z + 1 = 0$ If d is the distance of P from the point (-7,1,1), then d^2 is equal to :
   A) $\frac{25}{83}$
   B) $\frac{250}{83}$
   C) $\frac{15}{53}$
   D) $\frac{250}{82}$

7. Consider the lines L_1 and L_2 given by $L_1 : \frac{x-1}{2} = \frac{y-3}{1} = \frac{z-2}{2}$ $L_2 : \frac{x-2}{1} = \frac{y-2}{2} = \frac{z-3}{3}$ A line L_3 having direction ratios $1,-1,-2$, intersects L_1 and L_2 at the points P and Q respectively Then the length of line segment PQ is
   A) $3\sqrt{2}$
   B) 4
   C) $2\sqrt{6}$
   D) $4\sqrt{3}$

8. The value of $\lim\limits_{n \to \infty} \dfrac{1+2-3+4+5-6+\ldots+(3n-2)+(3n-1)-3n}{\sqrt{2n^4+4n+3}-\sqrt{n^4+5n+4}}$ is :
   A) $3(\sqrt{2}+1)$
   B) $\frac{3}{2}(\sqrt{2}+1)$
   C) $\frac{\sqrt{2}+1}{2}$
   D) $\frac{3}{2\sqrt{2}}$

9. The shortest distance between the lines $x + 1 = 2y = -12z$ and $x = y + 2 = 6z - 6$ is

A) $\frac{3}{2}$

B) 3

C) 2

D) $\frac{5}{2}$

10. The minimum value of the function $f(x) = \int\limits_{0}^{2} e^{|x-t|} dt$ is :

A) 2

B) $2(e - 1)$

C) $2e - 1$

D) $e(e - 1)$

11. Two dice are thrown independently Let A be the event that the number appeared on the 1st die is less than the number appeared on the 2nd die, B be the event that the number appeared on the 1st die is even and that on the second die is odd, and C be the event that the number appeared on the 1st die is odd and that on the 2nd is even Then :

A) A and B are mutually exclusive

B) the number of favourable cases of the events A , B and C are 15, 6 and 6 respectively

C) B and C are independent

D) the number of favourable cases of $(A \cup B) \cap C$ is the event 6

12. If A and B are two non-zero $n \times n$ matrics such that $A^2 + B = A^2 B$, then

A) $A^2 = I$ or $B = I$

B) $A^2 B = BA^2$

C) $AB = I$

D) $A^2 B = I$

13. The value of $\sum\limits_{r=0}^{22} {}^{22}C_r\, {}^{23}C_r$ is

A) ${}^{45}C_{24}$

B) ${}^{45}C_{23}$

C) ${}^{44}C_{23}$

D) ${}^{44}C_{22}$

14. Let N denote the number that turns up when a fair die is rolled If the probability that the system of equations $x + y + z = 1$ $2x + Ny + 2z = 2$ $3x + 3y + Nz = 3$ has unique solution is $\frac{k}{6}$, then the sum of value of k and all possible values of N is

A) 18

B) 19

C) 20

D) 21

15. The shortest distance between the lines $\frac{x-5}{1} = \frac{y-2}{2} = \frac{z-4}{-3}$ and $\frac{x+3}{1} = \frac{y+5}{4} = \frac{z-1}{-5}$ is

A) $7\sqrt{3}$

B) $6\sqrt{3}$

C) $4\sqrt{3}$

D) $5\sqrt{3}$

16. The distance of the point $(7, -3, -4)$ from the plane passing through the points $(2, -3, 1), (-1, 1, -2)$ and $(3, -4, 2)$ is :

A) $5\sqrt{2}$

B) $4\sqrt{2}$

C) 4

D) 5

17. The area enclosed by the closed curve C given by the differential equation $\frac{dy}{dx} + \frac{x+a}{y-2} = 0, y(1) = 0$ is 4π. Let P and Q be the points of intersection of the curve C and the y-axis If normals at P and Q on the curve C intersect x-axis at points R and S respectively, then the length of the line segment RS is

A) $\frac{4\sqrt{3}}{3}$

B) $\frac{2\sqrt{3}}{3}$

C) 2

D) $2\sqrt{3}$

18.

Let $A = \begin{pmatrix} 1 & 0 & 0 \\ 0 & 4 & -1 \\ 0 & 12 & -3 \end{pmatrix}$ Then the sum of the diagonal elements of the matrix $(A + I)^{11}$ is equal to :

A) 2050

B) 4094

C) 6144

D) 4097

19. Let α be a root of the equation $(a - c)x^2 + (b - a)x + (c - b) = 0$ where a, b, c are distinct real numbers such that the matrix $\begin{bmatrix} \alpha^2 & \alpha & 1 \\ 1 & 1 & 1 \\ a & b & c \end{bmatrix}$ is singular Then, the value of $\frac{(a-c)^2}{(b-a)(c-b)} + \frac{(b-a)^2}{(a-c)(c-b)} + \frac{(c-b)^2}{(a-c)(b-a)}$ is

A) 6

B) 3

C) 9

D) 12

20. In a binomial distribution $B(n, p)$, the sum and the product of the mean and the variance are 5 and 6 respectively, then $6(n + p - q)$ is equal to

A) 50

B) 53

C) 52

D) 51

21. The sum $\sum_{n=1}^{\infty} \frac{2n^2 + 3n + 4}{(2n)!}$ is equal to:

A) $\frac{11e}{2} + \frac{7}{2e} - 4$

B) $\frac{11e}{2} + \frac{7}{2e}$

C) $\frac{13e}{4} + \frac{5}{4e} - 4$

D) $\frac{13e}{4} + \frac{5}{4e}$

22. Let $f(x) = 2x^n + \lambda$, where $\lambda \in \mathbb{R}$ and $n \in \mathbb{N}$. Given that $f(4) = 133$ and $f(5) = 255$, What is the sum of all the positive integer divisors of $f(3) - f(2)$?

A) 59

B) 60

C) 61

D) 58

23. Let z be a complex number such that $\left| \frac{z - 2i}{z + i} \right| = 2z \neq -i$ Then z lies on the circle of radius 2 and centre

A) $(2, 0)$

B) $(0, 2)$

C) $(0, 0)$

D) $(0, -2)$

24. A vector $\vec{v}$ in the first octant is inclined to the x-axis at $60'$, to the y-axis at 45 and to the z-axis at an acute angle If a plane passing through the points $(\sqrt{2}, -1, 1)$ and (a, b, c), is normal to $\vec{v}$, then

A) $\sqrt{2}a - b + c = 1$

B) $a + \sqrt{2}b + c = 1$

C) $\sqrt{2}a + b + c = 1$

D) $a + b + \sqrt{2}c = 1$

25. The compound statement $(-(P \wedge Q)) \vee ((-P) \wedge Q) \Rightarrow ((-P) \wedge (-Q))$ is equivalent to

A) $((\sim P) \vee Q) \wedge ((\sim Q) \vee P)$

B) $(\sim Q) \vee P$

C) $((-P) \vee Q) \wedge (-Q)$

D) $(-P) \vee Q$

JEE MAIN MATHEMATICS ANSWER KEY

1. (A)	2. (A)	3. (B)	4. (D)	5. (D)
6. (B)	7. (C)	8. (B)	9. (C)	10. (B)
11. (D)	12. (B)	13. (B)	14. (C)	15. (B)
16. (A)	17. (A)	18. (D)	19. (B)	20. (C)
21. (C)	22. (B)	23. (D)	24. (B)	25. (A)