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. The refractive index of the material of a glass prism is 3. The angle of minimum deviation is equal to the angle of the prism. What is the angle of the prism?

A) 50°
B) 60°
C) 58°
D) 48°

2. Which one of the following is the correct dimensional formula for the capacitance in F? M, L, T, and C stand for unit of mass, length, time, and charge.

A) $[CM^{-1}L^{-2}T^{2}]$
B) $[C^{2}M^{-1}L^{-2}T^{-2}]$
C) $[C^{2}M^{-1}L^{2}T^{-2}]$
D) $[C^{-2}M^{-1}L^{2}T^{-4}]$

3. The position vector of a moving body at any instant of time is given as r = ($5t^2\hat{i}$ - $5t\hat{j}$) m. The magnitude and direction of velocity at $t = 2\,\text{s}$ are:

A) $5\sqrt{17}\,\text{m/s}$, making an angle of $\tan^{-1}\left(\frac{5}{4}\right)$ with the $-\hat{y}$ axis
B) $5\sqrt{15}\,\text{m/s}$, making an angle of $\tan^{-1}\left(\frac{5}{4}\right)$ with the $-\hat{y}$ axis
C) $5\sqrt{15}\,\text{m/s}$, making an angle of $\tan^{-1}\left(\frac{5}{3}\right)$ with the $\hat{x}$ axis
D) $5\sqrt{17}\,\text{m/s}$, making an angle of $\tan^{-1}\left(\frac{5}{4}\right)$ with the $+\hat{x}$ axis

4. An electron is made to enters symmetrically between two parallel and equally but oppositely charged metal plates, each of 10 cm length. The electron emerges out of the field region with a horizontal component of velocity 10^6 m/s. If the magnitude of the electric field between the plates is 9.1 V/cm, then the vertical component of velocity of electron is (mass of electron = 9.1×10^{-31} kg and charge of electron = 1.6×10^{-19} C):

A) 1×10^6 m/s
B) 0
C) 16×10^6 m/s
D) 16×10^4 m/s

5. The expression given below shows the variation of velocity v with time t:

$$v = \frac{At^2 + Bt}{C + t}$$

The dimension of A, B, and C is:

A) $[ML^2T^{-3}]$
B) $[MLT^{-3}]$
C) $[ML^2T^{-2}]$
D) $[MLT^{-2}]$

6. A radioactive nucleus n_2 has 3 times the decay constant as compared to the decay constant of another radioactive nucleus n_1. If the initial number of both nuclei are the same, what is the ratio of the number of nuclei of n_2 to the number of nuclei of n_1, after one half-life of n_1?

A) $\frac{1}{4}$
B) $\frac{1}{8}$
C) 4
D) 8

7. The radii of two planets 'A' and 'B' are 'R' and '4R' and their densities are ρ and $\frac{\rho}{3}$ respectively. The ratio of acceleration due to gravity at their surfaces (i.e. $g_A : g_B$) will be:

A) 1:16
B) 3:16
C) 3:4
D) 4:3

8. Two projectiles are fired with the same initial speed from the same point on the ground at angles of $(45^\circ - \alpha)$ and $(45^\circ + \alpha)$, respectively, with the horizontal direction. The ratio of their maximum heights attained is:

A) $\frac{1-\tan\alpha}{1+\tan\alpha}$
B) $\frac{1-\sin 2\alpha}{1+\sin 2\alpha}$
C) $\frac{1+\sin 2\alpha}{1-\sin 2\alpha}$
D) $\frac{1+\sin\alpha}{1-\sin\alpha}$

9. A block of mass m is moving with velocity v on a smooth horizontal surface. If a constant force F is applied to the block, what is the work done by this force after 5 seconds?

A) Fv
B) $F \cdot 5v$
C) $\frac{1}{2}mv^2$
D) $F \cdot 5$

10. Consider the following statements:

A. Surface tension arises due to extra energy of the molecules at the interior as compared to the molecules at the surface of a liquid.

B. As the temperature of liquid rises, the coefficient of viscosity increases.

C. As the temperature of gas increases, the coefficient of viscosity increases.

D. The onset of turbulence is determined by Reynolds number.

E. In a steady flow, two streamlines never intersect.

Choose the correct answer from the options given below:

A) A, B, C Only

B) A, D, E Only

C) B, C, D Only

D) C, D, E Only

11. Consider I_1 and I_2 are the currents flowing simultaneously in two nearby coils 1 and 2, respectively. If L_1 = self-inductance of coil 1, M_{12} = mutual inductance of coil 1 with respect to coil 2, then the value of induced emf in coil 1 will be:

A) $e_1 = -L_1\frac{dI_1}{dt} + M_{12}\frac{dI_2}{dt}$

B) $e_1 = -L_1\frac{dI_1}{dt} + M_{12}\frac{dI_1}{dt}$

C) $e_1 = -L_1\frac{dI_1}{dt} - M_{12}\frac{dI_2}{dt}$

D) $e_1 = -L_1\frac{dI_1}{dt} + M_{12}\frac{dI_1}{dt}$

12. A ball having kinetic energy KE, is projected at an angle of 60° from the horizontal. What will be the kinetic energy of the ball at the highest point of its flight?

A) $\frac{KE}{8}$

B) $\frac{KE}{4}$

C) $\frac{KE}{16}$

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

13. A point charge causes an electric flux of $-2 \times 10^4\,\mathrm{Nm^2C^{-1}}$ to pass through a spherical Gaussian surface of 8.0 cm radius, centered on the charge. The value of the point charge is:

A) $17.7 \times 10^{-7}\,\mathrm{C}$

B) $15.7 \times 10^{-7}\,\mathrm{C}$

C) $17.7 \times 10^{-6}\,\mathrm{C}$

D) $15.7 \times 10^{-6}\,\mathrm{C}$

14. A photograph of a landscape is captured by a drone camera at a height of 18 km. The size of the camera film is 2 cm $\times$ 2 cm and the area of the landscape photographed is 400 km^2. The focal length of the lens in the drone camera is:

A) $0.9\,\mathrm{cm}$

B) $2.8\,\mathrm{cm}$

C) $2.5\,\mathrm{cm}$

D) $1.8\,\mathrm{cm}$

15. A solid sphere of mass m and radius r is allowed to roll without slipping from the highest point of an inclined plane of length L and makes an angle of 30° with the horizontal. The speed of the particle at the bottom of the plane is v_1. If the angle of inclination is increased to 45° while keeping L constant, the new speed of the sphere at the bottom of the plane is v_2. The ratio of $v_1^2 : v_2^2$ is:

A) $1 : \sqrt{2}$

B) $1 : 3$

C) $1 : 2$

D) $1 : \sqrt{3}$

16. Arrange the following in the ascending order of wavelength (λ):

(A) Microwaves (λ_1)

(B) Ultraviolet rays (λ_2)

(C) Infrared rays (λ_3)

(D) X-rays (λ_4)

Choose the most appropriate answer from the options given below:

A) $\lambda_4 < \lambda_3 < \lambda_1 < \lambda_2$

B) $\lambda_3 < \lambda_4 < \lambda_1 < \lambda_2$

C) $\lambda_4 < \lambda_2 < \lambda_3 < \lambda_1$

D) $\lambda_3 < \lambda_4 < \lambda_2 < \lambda_1$

17. A body of mass m connected to a massless and unstretchable string goes in a vertical circle of radius R under gravity g. The other end of the string is fixed at the center of the circle. If velocity at the top of the circular path is $v = \sqrt{ngR}$, where $n \geq 1$, then the ratio of kinetic energy of the body at bottom to that at top of the circle is:

A) $\frac{n^2+4}{n^2}$

B) $\frac{n}{n+4}$

C) $\frac{n+4}{n}$

D) $\frac{n^2}{n^2+4}$

18. A ball of mass 100 g is projected with velocity 20 m/s at 60° with horizontal. The decrease in kinetic energy of the ball during the motion from point of projection to highest point is:

A) Zero

B) 15 J

C) 20 J

D) 5 J

19. In photoelectric effect, the stopping potential V_0 vs frequency u curve is plotted. h is the Planck's constant and ϕ_0 is the work function of metal.

(A) V_0 vs u is linear.

(B) The slope of V_0 vs u curve is $\frac{\phi_0}{h}$.

(C) h constant is related to the slope of V_0 vs u line.

(D) The value of electric charge of electron is not required to determine h using the V_0 vs u curve.

(E) The work function can be estimated without knowing the value of h.

Choose the correct answer from the options given below:

A) (C) and (D) only

B) (D) and (E) only

C) (A), (B) and (C) only

D) (A), (C) and (E) only

20. The number of spectral lines emitted by atomic hydrogen that is in the 4th energy level is:

A) 6

B) 3

C) 4

D) 1

21. Given below are two statements: Statement I : In a vernier callipers, one vernier scale division is always smaller than one main scale division. Statement II : The vernier constant is given by one main scale division multiplied by the number of vernier scale divisions. In light of the above statements, choose the correct answer from the options given below.

A) Both Statement I and Statement II are false.

B) Statement I is true but Statement II is false.

C) Both Statement I and Statement II are true.

D) Statement I is false but Statement II is true.

22. Consider a long thin conducting wire carrying a uniform current I. A particle having mass M and charge q is released at a distance a from the wire with a speed v_0 along the direction of current in the wire. The particle gets attracted to the wire due to magnetic force. The particle turns round when it is at distance x from the wire. The value of x is:

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

B) $a\left(1-\frac{mv_0}{q\mu_0 I}\right)$

C) $ae\left(-4\frac{mv_0}{q\mu_0 I}\right)$

D) $a\left[1-\frac{mv_0}{2q\mu_0 I}\right]$

23. In a resistive circuit, the power dissipated by a resistor R when a current I flows through it is given by $P = I^2R$. What happens to the power when the current is doubled?

A) It quadruples

B) It doubles

C) It remains the same

D) It is halved

24. A plane electromagnetic wave of frequency 20 MHz travels in free space along the +x direction. At a particular point in space and time, the electric field vector of the wave is $E_y = 9.3\,\mathrm{V/m}$. Then, the magnetic field vector of the wave at that point is:

A) $B_z = 9.3 \times 10^{-8}\,\mathrm{T}$

B) $B_z = 1.55 \times 10^{-8}\,\mathrm{T}$

C) $B_z = 6.2 \times 10^{-8}\,\mathrm{T}$

D) $B_z = 3.1 \times 10^{-8}\,\mathrm{T}$

25. In the photoelectric effect, an electromagnetic wave is incident on a metal surface and electrons are ejected from the surface. If the work function of the metal is 2.14 eV and the stopping potential is 2V, what is the wavelength of the electromagnetic wave? Given $hc = 1242\,\mathrm{eV \cdot nm}$ where h is the Planck constant and c is the speed of light in vacuum.

A) 400 nm

B) 600 nm

C) 200 nm

D) 300 nm

JEE MAIN PHYSICS ANSWER KEY

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

CHEMISTRY

1. The alkaline earth metal sulphate(s) which are readily soluble in water is/are:

(a) $BeSO_4$

(b) $MgSO_4$

(c) $CaSO_4$

(d) $SrSO_4$

(e) $BaSO_4$

Choose the correct answer from the options given below:

A) Only a and b

B) Only a, b, c

C) Only d and e

D) Only a and e

2. Formation of photochemical smog involves the following reaction in which A, B, and C are respectively:

$NO_2 \xrightarrow{hu} A + B$

$B + O_2 \rightarrow C$

$A + C \rightarrow NO_2 + O_2$

Choose the correct answer from the options given below:

A) NO, O, and O_3

B) N_2O and NO

C) N, O_2, and O_3

D) O, NO, and NO_3

3. In the wet tests for identification of various cations by precipitation, which transition element cation doesn't belong to group IV in qualitative inorganic analysis?

A) Fe^{3+}

B) Zn^{2+}

C) Co^{2+}

D) Ni^{2+}

4. Number of cyclic tripeptides formed with 2 amino acids A and B is:

A) 3

B) 4

C) 2

D) 5

5. The magnetic behavior of Li_2O, Na_2O_2 and KO_2, respectively, are

A) Paramagnetic, paramagnetic and diamagnetic

B) Diamagnetic, diamagnetic and paramagnetic

C) Paramagnetic, diamagnetic and paramagnetic

D) Diamagnetic, paramagnetic and diamagnetic

6. The set of correct statements is :

(i) Manganese exhibits +7 oxidation state in its oxide.

(ii) Ruthenium and Osmium exhibit +8 oxidation in their oxides.

(iii) Sc shows +4 oxidation state which is oxidizing in nature.

(iv) Cr shows oxidising nature in +6 oxidation state.

A) (ii) and (iii)

B) (i), (ii) and (iv)

C) (ii), (iii) and (iv)

D) (i) and (iii)

7. "A" obtained by Ostwald's method involving air oxidation ofNH_3, upon further air oxidation produces "B". "B" on hydration forms an oxoacid of Nitrogen along with evolution of "A". The oxoacid also produces "A" and gives positive brown ring test.

A) NO, NO_2

B) N_2O_3, NO_2

C) NO_2, N_2O_4

D) NO_2, N_2O_5

8. "A" obtained by Ostwald's method involving air oxidation of NH_3, upon further air oxidation produces "B". "B" on hydration forms an oxoacid of Nitrogen along with evolution of "A". The oxoacid also produces "A" and gives positive brown ring test.

A) NO, NO_2 **B)** N_2O_3, NO_2

C) NO_2, N_2O_4 **D)** NO_2, N_2O_5

9. The pair of compounds from the following pairs having both the compounds with net non-zero dipole moment is

A) Cis-dichloroethene; trans-dichloroethene **B)** $CH_2Cl_2; CHCl_3$

C) 1,4-dichlorobenzene;1,3,5-trichlorobenzene **D)** Benzene; p-Anisidine

10. The alkaline earth metal sulphate(s) which are readily soluble in water is/are:

(a) $BeSO_4$

(b) $MgSO_4$

(c) $CaSO_4$

(d) $SrSO_4$

(e) $BaSO_4$

Choose the correct answer from the options given below:

A) Only a and b **B)** Only a, b, c

C) Only d and e **D)** Only a and e

11. Suitable reaction condition for preparation of Methyl phenyl ether is

A) PhO- Na+ , MeBr **B)** PhO- Na+ , MeOH

C) Ph - Br, MeO- Na+ **D)** Benzene, MeBr

12. The concentration of dissolved Oxygen in water for growth of fish should be more than *X* ppm and Biochemical Oxygen Demand in clean water should be less than *Y* ppm. X and Y in ppm are, respectively.

A) X Y
4 8

B) X Y
6 5

C) X Y
4 15

D) X Y
6 12

13. Which of the following salt solutions would coagulate the colloid solution formed when $FeCl_3$ is added to NaOH solution, at the fastest rate?

A) 10 mL of 0.1 mol dm^{-3} $Ca3(PO_4)_2$ **B)** 10 mL of 0.2 mol dm^{-3} $AlCl_3$

C) 10 mL of 0.1 mol dm^{-3} Na_2SO_4 **D)** 10 mL of 0.15 mol dm^{-3} $CaCl_2$

14. Match List I and List II

List II	**List II**
A. van't Hoff factor, i	I. Cryoscopic constant
B. k_f	II. Isotonic solutions
C. Solution with same with same osmotic pressure	III. Normal molar mass /Abnormal molar mass
D. Azeotropes	IV. Solutions with same composition of vapour above it

Choose the correct answer from the options given below :

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

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

15. Which of the given compounds can enhance the efficiency of hydrogen storage tank?

A) Li/P_4 **B)** $NaNi_5$

C) SiH_4 **D)** Di-isobutylaluminium hydride

16. Which of the following compound is used as the antacid?

A) Ranitidine **B)** Meprobamate

C) Terfenadine **D)** Brompheniramine

17. To inhibit the growth of tumours, identify the compounds used from the following:
(A) EDTA
(B) Coordination Compounds of Pt
(C) D – Penicillamine
(D) Cis – Platin
Choose the correct answer from the options given below:

A) B and D Only **B)** C and D Only

C) A and B Only **D)** A and C Only

18. According to MO theory the bond orders for O_2^{2-}, CO and NO^+ respectively, are

A) 1, 2 and 3 **B)** 1,3 and 2

C) 2,3 and 3 **D)** 1, 3 and 3

19. Given below are two statements:
Statement I: In redox titration, the indicators used are sensitive to change in pH of the solution.
Statement II: In acid-base titration, the indicators used are sensitive to change in oxidation potential.
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)** Both Statement I and Statement II are incorrect

C) Statement I is correct but Statement II is incorrect **D)** Statement I is incorrect but Statement II is correct

20. Given below are two statements: One is labelled as Assertion A and the other is labelled as Reason R
Assertion A : Sodium is about 30 times as abundant as potassium in the oceans.
Reason R : Potassium is bigger in size than sodium.
In the light of the above statements, choose the correct answer from the options given below

A) Both A and R are true and R is the correct explanation of A **B)** Both A and R are true and R is NOT the correct explanation of A

C) A is true but R is false **D)** A is false but R is true

21. Compound that will give positive Lassaigne's test for both nitrogen and halogen is

A) $CH_3NH_2.HCl$ **B)** NH_2OH .HCl

C) NH_4Cl **D)** N_2H_4 . HCl

22. Match List I and List II

List II	**List II**
A. Osmosis	I. Solvent molecules pass through semi permeable membrane towards solvent side.
B. Reverse osmosis	II. Movement of charged colloidal particles under the influence of applied electric potential towards oppositely charged electrodes.
C. Electro osmosis	III. Solvent molecules pass through semi permeable membrane towards solution side.
D. Electrophoresis	IV. Dispersion medium moves in an electric field.

Choose the correct answer from the options given below :

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

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

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

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

23. Which of the given compounds can enhance the efficiency of hydrogen storage tank?

A) Li/P_4

B) $NaNi_5$

C) SiH_4

D) Di-isobutylaluminium hydride

24. Correct statement about smog is

A) NO_2 is present in classical smog

B) Classical smog also has high concentration of oxidizing agents

C) Photochemical smog has high concentration of oxidizing agents

D) Both NO_2 and SO_2 are present in classical smog

25. Correct order of spin only magnetic moment of the following complex ions is:
(Given At.no. Fe: 26, Co:27)

A) $[FeF_6]^{3-} > [Co(C_2O_4)_3]^{3-} > [CoF_6]^{3-}$

B) $[FeF_6]^{3-} > [CoF_6]^{3-} > [Co(C_2O_4)_3]^{3-}$

C) $[Co(C_2O_4)_3]^{3-} > [CoF_6]^{3}- > [FeF_6]^{3-}$

D) $[CoF_6]^{3-} > [FeF_6]^{3-} > [Co(C_2O_4)_3]^{3-}$

JEE MAIN CHEMISTRY ANSWER KEY

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

MATHEMATICS

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1. If the solution curve f(x, y) = 0 of the differential equation $(1+\log_e x)\frac{dx}{dy} - x\log_e x = e^y$, $x > 0$, passes through the points (1,0) and (α, 2) then α^a is equal to

A) e^{e^2} **B)** $e^{\sqrt{2}e^2}$

C) $e^{2e^{\sqrt{2}}}$ **D)** e^{2e^2}

2. Let $P = \begin{bmatrix} \frac{\sqrt{3}}{2} & \frac{1}{2} \\ -\frac{1}{2} & \frac{\sqrt{3}}{2} \end{bmatrix}$ $A = \begin{bmatrix} 1 & 1 \\ 0 & 1 \end{bmatrix}$ and $Q = PAP^T$. If $P^TQ^{2007}P = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$, then 2a+b-3c-4d equal to

A) 2004 **B)** 2005

C) 2006 **D)** 2007

3. Let f be a continuous function satisfying $\int_0^{t^2}(f(x)+x^2)dx = \frac{4}{3}t^3, \forall t > 0$. Then $f(\frac{\pi^2}{4})$ is equal to

A) $-\pi^2(1+\frac{\pi^2}{16})$ **B)** $\pi^2(1-\frac{\pi^2}{16})$

C) $-\pi(1+\frac{\pi^3}{16})$ **D)** $\pi(1-\frac{\pi^3}{16})$

4. The straight lines l_1 and l_2 pass through the origin and trisect the line segment of the line L: 9x + 5y = 45 between the axes. If m_1 and m_2 are the slopes of the lines l_1 and l_2, then the point of intersection of the line $y = (m_1 + m_2)x$ with L lies on

A) y-2x=5 **B)** 6x-y=15

C) y-x=5 **D)** 6x+y=10

5. If the set $\left(Re\left(\frac{z-\bar{z}+z\bar{z}}{2-3z+5\bar{z}}\right) : z \in C, Re(z) = 3\right)$ is equal to the interval (α,β), then 24(β-α) is equal to

A) 27 **B)** 30

C) 36 **D)** 42

6. Among the two statements
(S1) : $(p \Rightarrow q) \wedge (q \wedge (\sim q))$ is a contradiction and
(S2) : $(p \wedge q) \vee ((\sim p) \wedge q) \vee (p \wedge (\sim q)) \vee ((\sim p) \wedge (\sim q))$ is a tautology

A) both are true **B)** both are false

C) only (S1) is true **D)** only (S2) is true

7. Two integers x and y are chosen with replacement from the set $\{0, 1, 2, 3, \ldots, 10\}$. Then the probability that $|x - y| > 5$ is:

A) $\frac{30}{121}$ **B)** $\frac{62}{121}$

C) $\frac{60}{121}$ **D)** $\frac{31}{121}$

8. The range of $f(x) = 4\sin^{-1}(\frac{x^2}{x^2+1})$ is

A) $[0, \pi]$ **B)** $[0, \pi)$

C) $[0, 2\pi]$ **D)** $[0, 2\pi)$

9. If the tangent at a point P on the parabola $y^2 = 3x$ is parallel to the line $x + 2y = 1$ and the tangents at the points Q and R on the ellipse $\frac{x^2}{4} + \frac{y^2}{1} = 1$ are perpendicular to the line $x-y=2$, then the area of the triangle PQR is :

A) $\frac{3}{2}\sqrt{5}$ **B)** $5\sqrt{3}$

C) $3\sqrt{5}$ **D)** $\frac{9}{\sqrt{5}}$

10. For, α, β, γ, δ ∈ ℕ, if $\int \left(\left(\frac{x}{e}\right)^{2x} + \left(\frac{e}{x}\right)^{2x}\right) log_e\, x dx = \frac{1}{\alpha}\left(\frac{x}{e}\right)^{\beta x} - \frac{1}{\gamma}\left(\frac{e}{x}\right)^{\delta x} + c$, Where $e = \sum_{n=10}^{\infty} \frac{1}{n!}$ and C is constant of integration, then α + 2β + 3γ - 4δ is equal to

A) -8 **B)** -4

C) 1 **D)** 4

11. Let the centre of a circle C be (α, β) and its radius r < 8. Let 3x + 4y = 24 and 3x – 4y = 32 be two tangents and 4x + 3y =1 be a normal to C. Then (α – β + r) is equal to

A) 5 **B)** 6

C) 7 **D)** 9

12. The letters of the word OUGHT are written in all possible ways and these words are arranged as in a dictionary, in a series. Then the serial number of the word TOUGH is

A) 79 **B)** 86

C) 84 **D)** 89

13. Let S = {1, 2, 3, 4, 5}
if f : S → P(S), where P(S) is power set of S. Then number of one-one functions f can be made is

A) $(32)^5$ **B)** $\frac{32!}{27!}$

C) ${}^{32}C_{27}$ **D)** ${}^{32}P_{27}$

14. Two dice A and B are rolled, Let the numbers obtained on A and B be α and β respectively. If the variance of α - β is $\frac{p}{q}$, where p and q are coprime, then the sum of the positive divisors of p is equal to

A) 31 **B)** 36

C) 48 **D)** 72

15. Let α,β be the roots of the quadratic equation $x^2+\sqrt{6}x+3=0$. Then $\frac{\alpha^2 3+\beta^2 3+\alpha^1 4+\beta^1 4}{\alpha^1 5+\beta^1 5+\alpha 160+\beta^{10}}$ is equal to

A) 9 **B)** 12

C) 81 **D)** 729

16. If α > β > 0 are the roots of the equation ax2 + bx + 1 = 0, and $\lim\limits_{x\to\frac{1}{\alpha}} \left(\frac{1-cos(x^2+bx+a)}{2(1-ax)^2}\right)^{1/2} = \frac{1}{k}\left(\frac{1}{\beta} - \frac{1}{\alpha}\right)$, then k is equal to

A) α **B)** β

C) 2α **D)** 2β

17. Let $y = y(x)$ be the solution of the differential equation $x\, log_e x \frac{dy}{dx} + y = x^2 log_e x, (x > 1)$. If $y(2) = 2$, then $y(e)$ is equal to

A) $\frac{2+e^2}{2}$ **B)** $\frac{1+e^2}{2}$

C) $\frac{1+e^2}{4}$ **D)** $\frac{4+e^2}{4}$

18. If the system of equations
$2x + y - z = 5$
$2x - 5y + \lambda z = \mu$
$x + 2y - 5z = 7$
has infinitely many solutions, then $(\lambda + \mu)^2 + (\lambda - \mu)^2$ is equal to
A) 904 **B)** 912
C) 916 **D)** 920

19. Let N be the foot of perpendicular from the point P (1, –2, 3) on the line passing through the points (4, 5, 8) and (1, –7, 5). Then the distance of N from the plane $2x – 2y + z + 5 = 0$ is
A) 6 **B)** 7
C) 8 **D)** 9

20. If the tangents at the points P and Q on the circle $x^2 + y^2 – 2x + y = 5$ meet at the point R $(\frac{9}{4}, 2)$then the area of the triangle PQR is
A) $\frac{13}{8}$ **B)** $\frac{13}{4}$
C) $\frac{5}{8}$ **D)** $\frac{5}{4}$

21. Let $y = f(x)$ be the solution of the differential equation $y(x+1)dx - x^2dy = 0$, $y(1) = e$. Then $lim_{x\to 0^-} f(x)$ is equal to
A) 1/e **B)** 0
C) 1/e2 **D)** e2

22. If f : R $\to$ R be a continuous function satisfying $\int_0^{\frac{\pi}{2}} f(sin2x)sinxdx + \alpha \int_0^{\frac{\pi}{4}} f(cos2x)cosxdx = 0$, then the value of α is
A) -√3 **B)** √3
C) -√2 **D)** √2

23. Let for a triangle ABC,
$\vec{AB} = -2\hat{i} + \hat{j} + 3\hat{k}$
$\vec{CB} = \alpha\hat{i} + \beta\hat{j} + \gamma\hat{k}$
$\vec{CA} = 4\hat{i} + 3\hat{j} + \delta\hat{k}$
If $\delta > 0$ and the area of the triangle ABC is $5\sqrt{6}$, then $\vec{CB}.\vec{CA}$ is equal to
A) 60 **B)** 54
C) 120 **D)** 108

24. Let$|\vec{a}| = 2, |\vec{b}| = 3$ and the angle between the vectors $\vec{a}$ and $\vec{b}$ be $\frac{\pi}{4}$. Then $|(\vec{a} + 2\vec{b}) \times (2\vec{a} - 3\vec{b})|^2$ is equal to
A) 441 **B)** 882
C) 482 **D)** 841

25. Let $S = w_1, w_2, \ldots\ldots$ be the sample space associated to a random experiment. Let $P(w_n) = \frac{P(w_{n-1})}{2}, n \geq 2$. Let $A=(2k + 3l : k, l \in \mathbb{N})$ and $B = w_n : n \in A$. Then $P(B)$ is equal to
A) $\frac{3}{64}$ **B)** $\frac{1}{16}$
C) $\frac{1}{32}$ **D)** $\frac{3}{32}$

JEE MAIN MATHEMATICS ANSWER KEY

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