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IIT JEE | MEDICAL | FOUNDATION

Sample Paper	12 Studying (JEE)

Duration: 2 Hrs **Maximum Marks: 200**

PAPER SCHEME:

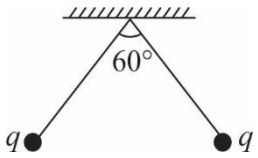
- This paper contains **50 Objective Type Questions** divided into three sections: **Section - I (Physics), Section - II (Chemistry) and Section - III (Mathematics)**.
- **Section - I** contains **15 Multiple Choice Questions**. Each question has 4 choices (A), (B), (C) and (D), out of which **ONLY ONE CHOICE is correct**.
- **Section - II** contains **15 Multiple Choice Questions**. Each question has 4 choices (A), (B), (C) and (D), out of which **ONLY ONE CHOICE is correct**.
- **Section - III** contains **20 Multiple Choice Questions**. Each question has 4 choices (A), (B), (C) and (D), out of which **ONLY ONE CHOICE is correct**.

MARKING SCHEME:

- For each question in Section-I, II and III, **4 marks** will be awarded for correct answer and **–1 negative marking** for incorrect answer.

SECTION - I [PHYSICS]

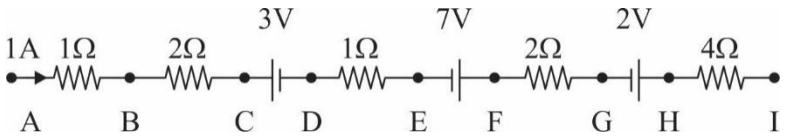
1. Two small spherical balls, each carrying charge $q = 10\mu C$ are suspended by two insulated threads of equal length 1 m each, from a point fixed in the celling. It is found that in equilibrium, threads are separated by an angle 60° between them as shown in figure, the tension in the thread is:



(A) 0.18 N **(B)** 18 N

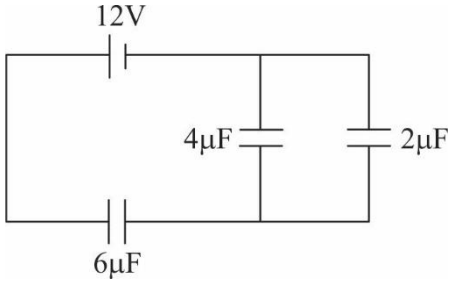
(C) 1.8 N **(D)** None of the above

2. Figure shows a part of the circuit. Which points have the same potential as that of point A?



(A) D **(B)** F **(C)** B **(D)** I

3. The charge deposited on $4\mu F$ capacitor in the given circuit is:



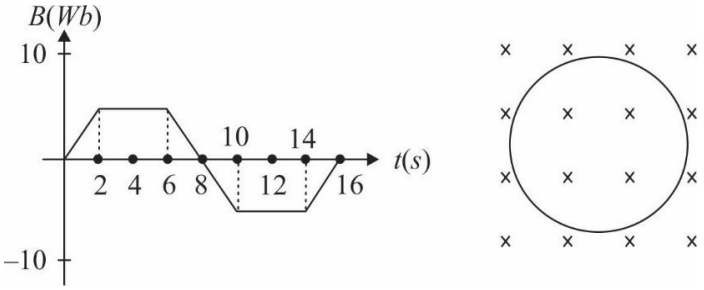
(A) $6\times10^{-6}C$ **(B)** $12\times10^{-6}C$ **(C)** $24\times10^{-6}C$ **(D)** $36\times10^{-6}C$

4. Two straight long conductors AOB and COD are perpendicular to each other and carry currents I_1 and I_2. The magnitude of the magnetic induction at a point P at a distance a from the point O in a direction perpendicular to the plane $ABCD$ is:

(A) $\frac{\mu_0}{2\pi a}(I_1 + I_2)$ **(B)** $\frac{\mu_0}{2\pi a}(I_1 - I_2)$

(C) $\frac{\mu_0}{2\pi a}(I_1^2 + I_2^2)^{1/2}$ **(D)** $\frac{\mu_0}{2\pi a}\frac{I_1 I_2}{I_1 + I_2}$

5. Magnetic flux in a circular coil of resistance 10Ω changes with time as shown in the figure.

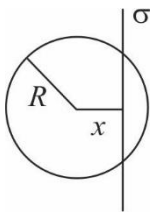


Now, match the following columns and select the correct option from the codes given below:

	Column I		**Column II**
I	At 1*s* induced current is	**(P)**	Clockwise
II	At 5*s* induced current is	**(Q)**	Anit-clockwise
III	At 9*s* induced current is	**(R)**	Zero
IV	At 15*s* induced current is	**(S)**	2*A*

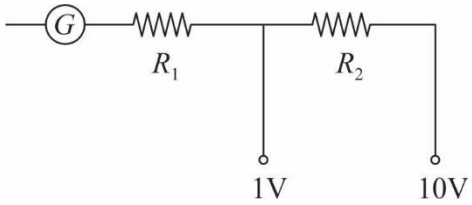
	I	**II**	**III**	**IV**
(A)	Q	R	P	Q
(B)	P	Q	R	S
(C)	Q	R	P	S
(D)	Q	R	S	P

6. An infinite, uniformly charged sheet with surface charge density σ cuts through a spherical Gaussian surface of radius *R* at a distance *x* from its centre, as shown in the figure. The electric flux ϕ through the Gaussian surface is:



(A) $\dfrac{\pi R^2\sigma}{\varepsilon_0}$ **(B)** $\dfrac{2\pi(R^2-x^2)\sigma}{\varepsilon_0}$ **(C)** $\dfrac{\pi(R-x)^2\sigma}{\varepsilon_0}$ **(D)** $\dfrac{\pi(R^2-x^2)\sigma}{\varepsilon_0}$

7. The resistance of a galvanometer is 50Ω and it shows full scale deflection for a current of 1 *mA*. To convert it into a voltmeter to measure 1 *V* and as well as 10 *V* (refer circuit diagram) the resistance R_1 and R_2 respectively are:



(A) 950 Ω and 9150 Ω **(B)** 900 Ω and 9950 Ω
(C) 900 Ω and 9900 Ω **(D)** 950 Ω and 9000 Ω

8. A small bar magnet placed with its axis at 30° with an external field of 0.06 *T* experiences a torque of 0.018 *Nm*. The minimum work required to rotate it from its stable to unstable equilibrium position is:

(A) $7.2\times10^{-2}J$ **(B)** $6.4\times10^{-2}J$

(C) $9.2\times10^{-3}J$ **(D)** $11.7\times10^{-3}J$

9. Two coaxial solenoids are made by winding thin insulated wire over a pipe of cross-sectional area $A=10cm^2$ and length = 20 cm. If one of the solenoids has 300 turns and the other 400 turns, their mutual inductance is: $(\mu_0=4\pi\times10^{-7}TmA^{-1})$

(A) $2.4\pi\times10^{-5}H$

(B) $4.8\pi\times10^{-4}H$

(C) $4.8\pi\times10^{-5}H$

(D) $2.4\pi\times10^{-4}H$

10. An electric field is expressed as $\vec{E}=2\hat{i}+3\hat{j}$. Find the potential difference (V_A-V_B) between two points *A* and *B* whose position vectors are given by $\overrightarrow{r_A}=\hat{i}+2\hat{j}$ and $\overrightarrow{r_B}=2\hat{i}+\hat{j}+3\hat{k}$.

(A) $-1V$ **(B)** $1V$ **(C)** $2V$ **(D)** $3V$

11. Which of the following statements is correct?

(i) A charged particle can be accelerated by a magnetic field.

(ii) A charged particle cannot be accelerated by a magnetic field.

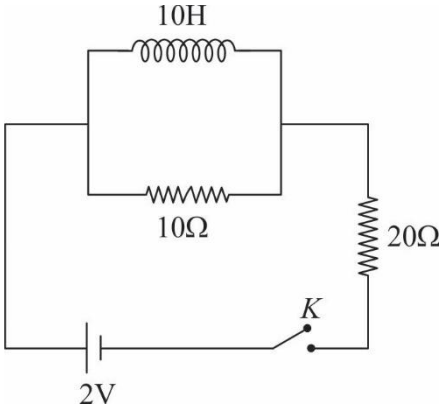
(iii) The speed of a charged particle can be increased by a magnetic field.

(iv) The speed of a charged particle can not be changed by a magnetic field.

(A) (i) and (iv) only **(B)** (i) and (iii) only

(C) (ii) and (iii) only **(D)** (ii) and (iv) only

12. Two resistors of 10Ω and 20Ω and an ideal inductor of $10H$ are connected to a $2V$ battery as shown in figure. Key *K* is closed inserted at time *t* = 0. The initial (*t* = 0) and final $(t\to\infty)$ currents through the battery are respectively:

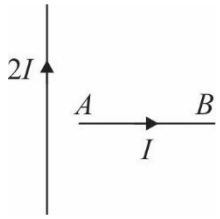


(A) $\frac{1}{15}A,\frac{1}{10}A$ **(B)** $\frac{1}{10}A,\frac{1}{15}A$ **(C)** $\frac{2}{15}A,\frac{1}{10}A$ **(D)** $\frac{1}{15}A,\frac{2}{25}A$

13. Let $\rho(r) = \frac{Q}{\pi R^4} r$ be the charge density distribution for a solid sphere of radius R and total charge Q. For a point P inside the sphere at distance r_1 from the centre of the sphere, the magnitude of electric field is:

(A) Zero **(B)** $\frac{Q}{4\pi\varepsilon_0 r_1^2}$ **(C)** $\frac{Qr_1^2}{4\pi\varepsilon_0 R^4}$ **(D)** $\frac{Qr_1^2}{3\pi\varepsilon_0 R^4}$

14. The length of conductor *AB* carrying current *I* is l. Find the magnetic force on it due to a long wire carrying current 2*I* as shown in the figure. The midpoint of wire *AB* is at a distance of l from the long wire.



(A) $\frac{\mu_0 I^2}{\pi}$ **(B)** $\frac{\mu_0 I^2}{\pi} l\text{n}2$ **(C)** $\frac{\mu_0 I^2}{\pi} l\text{n}3$ **(D)** $\frac{\mu_0 I^2}{2\pi} l\text{n}3$

15. The magnetic moment produced in a substance of 1 *gm* is 6×10^{-7} ampere-metre^2. If its density is $5gm/cm^3$, then the intensity of magnetization in *A/m* will be:

(A) 8.3×10^6 **(B)** 3.0 **(C)** 1.2×10^{-7} **(D)** 3×10^{-6}

SECTION - II [CHEMISTRY]

16. The vapour pressure of ethanol and methanol at a particular temperature are 42 and 88 mm Hg respectively. An ideal solution is formed at the same temperature by mixing 46 gm of ethanol with 16 gm of methanol. What is the mole fraction of methanol vapour?

(A) 0.467 **(B)** 0.613 **(C)** 0.511 **(D)** 0.821

17. Plot of $\frac{1}{X_A}$ v/s $\frac{1}{Y_A}$ (X_A is mole fraction of A in liquid state and Y_A mole fraction in vapour state) is linear whose slope and intercept respectively are:

(A) $\frac{P_B^\circ}{P_A^\circ}, \frac{P_B^\circ - P_A^\circ}{P_B^\circ}$ **(B)** $P_A^\circ - P_B^\circ, \frac{P_A^\circ - P_B^\circ}{P_B^\circ}$

(C) $\frac{P_A^\circ}{P_B^\circ}, \frac{P_B^\circ - P_A^\circ}{P_B^\circ}$ **(D)** $\frac{P_B^\circ}{P_A^\circ}, \frac{P_A^\circ - P_B^\circ}{P_B^\circ}$

18. Conductance of 0.1 M KCl(conductivity $= X\ ohm^{-1}\ cm^{-1}$) filled in a conductivity cell is $Y\ ohm^{-1}$. If the conductance of 0.1 M NaOH filled in the same cell is $Z\ ohm^{-1}$, the molar conductance of NaOH (in $ohm^{-1}\ cm^2\ mol^{-1}$) will be:

(A) $10^3 \frac{XZ}{Y}$ **(B)** $10^4 \frac{XZ}{Y}$

(C) $10\frac{XZ}{Y}$ **(D)** $0.1\frac{XZ}{Y}$

19. 48250 C of electricity was required to deposit all the copper present in 0.5 L of $CuSO_4$ solution using inert electrodes. The Molarity of the solution was (assuming constant volume):

(A) 0.50 M **(B)** 2.50 M **(C)** 0.25 M **(D)** 1.00 M

20. For producing the effective collisions, the colliding molecules must posses:

(A) A certain minimum amount of energy

(B) Energy equal to or greater than threshold energy

(C) Proper orientation

(D) Threshold energy as well as proper orientation of collision

21. The rate of a reaction doubles when its temperature changes from 300 K to 310K. Activation energy of such a reaction will be: ($R = 8.314\ JK^{-1}mol^{-1}$ and log 2 = 0.301)

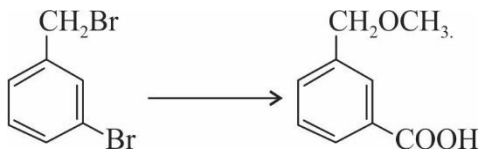
(A) $53.6\ kJ\,mol^{-1}$

(B) $48.6\ kJ\,mol^{-1}$

(C) $58.5\ kJ\,mol^{-1}$

(D) $60.5\ kJ\,mol^{-1}$

22. Which of the following combination of reagents in given sequence can brought transformation?



(A) $CH_3O^-Na^+, Mg/ether, CO_2, H_2O/H^+$

(B) $CH_3O^-Na^+, KCN/DMSO, H_2O/H^+$

(C) Mg/ether, CO_2, H_2O/H^+, $CH_3O^-Na^+$

(D) NaOH, Mg/ether, CO_2, H_2O/H^+, CH_3I

23. For the reactions $4A + B \rightarrow 2C + 2D$

The incorrect statement is:

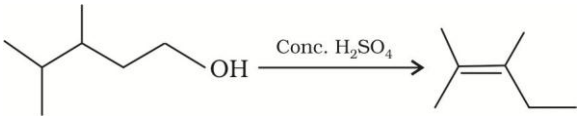
(A) The rate of disappearance of B is one fourth the rate of disappearance of A

(B) The rate of appearance of C is half the rate of disappearance of B

(C) The rate of appearance of D is half the rate of disappearance of A

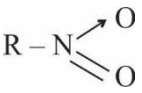
(D) The rates of appearance of C and D are equal

24. How many number of rearrangements takes place in the following conversion:



(A) 0 **(B)** 3 **(C)** 2 **(D)** 1

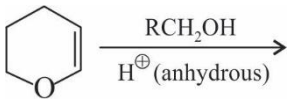
25. Which of the following pairs is/are correctly matched?

	Reaction	**Product**
I.	RX + AgCN	RNC
II.	RX + KCN	RCN
III.	$RX + KNO_2$	
IV.	$RX + AgNO_2$	R–O–N = O

(A) Only I **(B)** I and II

(C) III and IV **(D)** I,II, III and IV

26. The major product of the following reaction is:



(A) A hemiacetal

(B) An acetal

(C) An ether

(D) An ester

27. Which of the following reactions will yield 2-propanol?

I. $CH_2 = CH - CH_3 + H_2O \xrightarrow{H^+}$

II. $CH_3 - CHO \xrightarrow[(ii)\ H_2O]{(i)\ CH_3MgI}$

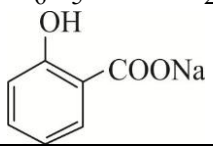
III. $CH_2O \xrightarrow[(ii)\ H_2O]{(i)\ C_2H_5MgI}$

IV. $CH_2 = CH - CH_3 \xrightarrow{2\%\ KOH, KMnO_4}$

(A) I and II **(B)** II and III

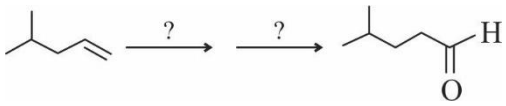
(C) I and III **(D)** II and IV

28. Match List I (Reaction) with List II (Name) and select the correct answer using the codes given below the lists:

	List I		List II
I.	$R-CO-CH_3 \xrightarrow{Zn-Hg/HCl} R-CH_2-CH_3$	**(P)**	Friedel-Craft's reaction
II.	$2C_6H_5CHO \xrightarrow{NaOH} C_6H_5COONa + C_6H_5CH_2OH$	**(Q)**	Kolbe's reaction
III.	$C_6H_6 + CH_3COCl \xrightarrow[AlCl_3]{Anhyd.} C_6H_5COCH_3$	**(R)**	Clemmensen's reduction
IV.	$C_6H_5OH + CO_2 + NaOH \rightarrow$ 	**(S)**	Cannizzaro's reaction

	I	II	III	IV
(A)	P	Q	R	S
(B)	Q	P	R	S
(C)	R	S	P	Q
(D)	S	R	P	Q

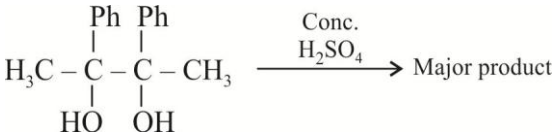
29. The suitable reaction steps to carryout the following transformation.

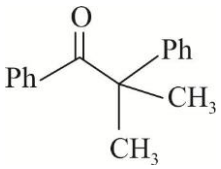


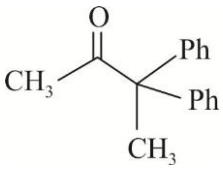
(A) $\xrightarrow[(ii)\ H_2O_2,NaOH]{(i)\ BH_3,THF} \xrightarrow[CH_2Cl_2]{PCC}$ **(B)** $\xrightarrow[(ii)\ H_2O_2,NaOH]{(i)\ BH_3,THF} \xrightarrow{CrO_3/H_2SO_4}$

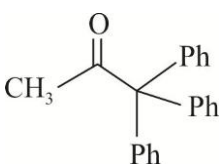
(C) $\xrightarrow{H_2O/H_2SO_4} \xrightarrow[CH_2Cl_2]{PCC}$ **(D)** $\xrightarrow[KMnO_4]{Cold.\ Alkaline} \xrightarrow[H_2O]{K_2Cr_2O_7,H_2SO_4}$

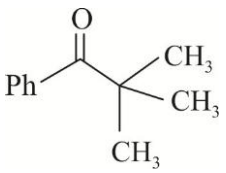
30. Major product of the following reaction is:



(A) 

(B) 

(C) 

(D) 

SECTION - III [MATHEMATICS]

31. Let $f(x) = \sqrt{1-|x-2|}$. The domain of $f(x)$ is:

(A) $[1,\ 3]$ **(B)** $(-\infty, 3]$ **(C)** $[0, 4]$ **(D)** $(-\infty, \infty)$

32. If $f(x) = \dfrac{2x+3}{x-1}$, then its inverse $f^{-1}(x)$ is:

(A) $\dfrac{x+3}{x-2}$ **(B)** $\dfrac{x+1}{2}$ **(C)** $\dfrac{x+3}{2x-1}$ **(D)** $\dfrac{x+1}{x-2}$

33. Suppose $f : \mathbb{R} \to \mathbb{R}$ is defined by $f(x) = \begin{cases} x^2, & x \geq 0 \\ -2x, & x < 0 \end{cases}$.

Which of the following is true?

(A) One-one and onto **(B)** Neither one-one nor onto

(C) Onto but not one-one **(D)** One-one but not onto

34. Let $f(x) = |x-1| + |x+2|$.

The minimum value of $f(x)$ is:

(A) 0 **(B)** 1 **(C)** 2 **(D)** 3

35. If $f(x) = x^2 - 6x + 9$ and $g(x) = \sqrt{x}$, then the domain of the composite function $g(f(x))$ is:

(A) $[-3, \infty)$ **(B)** $[-\infty, 3) \cup [3, \infty)$

(C) All real numbers **(D)** $[3, \infty)$

36. If $y = \sin^{-1}\left(\dfrac{2x}{1+x^2}\right)$, then $\dfrac{dy}{dx}$ equals:

(A) $\dfrac{2}{1+x^2} \cdot \dfrac{1}{\sqrt{\left(\dfrac{1-x^2}{1+x^2}\right)^2}}$ **(B)** $\dfrac{2}{1+x^2}$

(C) $\dfrac{1-x^2}{1+x^2}$ **(D)** $\dfrac{2}{1+x^2} \cdot \dfrac{1}{\sqrt{1-\left(\dfrac{2x}{1+x^2}\right)^2}}$

37. The derivative of $y = \sin^{-1}(x) + \cos^{-1}(x)$ is:

(A) $\dfrac{1}{\sqrt{1-x^2}}$ **(B)** -1 **(C)** 0 **(D)** 1

38. $\lim_{x\to\infty} x\cos\left(\frac{\pi}{4x}\right)\sin\left(\frac{\pi}{4x}\right) =$

(A) $\frac{\pi}{2}$ **(B)** $\frac{\pi}{4}$ **(C)** 1 **(D)** None of these

39. Find the minimum value of $f(x) = x + \frac{1}{x}$, where $x > 0$.

(A) 0 **(B)** 1 **(C)** 2 **(D)** –1

40. Let $f(x) = x^3 - 3x^2 + 4$. Find the points where $f(x)$ attains its local maxima and minima.

(A) Max at $x = 2$, min at $x = 0$ **(B)** No maxima or minima exist

(C) Max at $x = 1$, min at $x = 2$ **(D)** Max at $x = 0$, min at $x = 2$

41. Evaluate the integral:

$$I = \int \frac{x^2}{(x^3+1)^2} dx$$

(A) $-\frac{1}{3(x^3+1)} + C$ **(B)** $\frac{1}{3(x^3+1)} + C$

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

42. Find the equation of the normal to the curve $y = \sqrt{x}$ at the point where $x = 4$.

(A) $y = 4x + 18$ **(B)** $y + 4x = 18$

(C) $4y = x + 18$ **(D)** $4y + x = 18$

43. If $y = \frac{1+x^2+x^4}{1+x+x^2}$ and $\frac{dy}{dx} = ax + b$, then values of *a* and *b* are:

(A) $a = 2, b = 1$ **(B)** $a = -2, b = 1$

(C) $a = 2, b = -1$ **(D)** $a = -2, b = -1$

44. Function $f(x) = x^2(x-2)^2$ is:

(A) Increasing in $(0,1) \cup (2,\infty)$ **(B)** Decreasing in $(0,1) \cup (2,\infty)$

(C) Decreasing function **(D)** Increasing function

45. If $f(x) = \begin{cases} 1-|x|, & |x| \le 1 \\ |x|-1, & |x| > 1 \end{cases}$, and $g(x) = f(x-1) + f(x+1)$ then value of $\int_{-3}^{5} g(x)dx$ is:

(A) 22 **(B)** 23 **(C)** 24 **(D)** 25

46. If $\int \frac{dx}{(x+2)(x^2+1)} = a\ell n(1+x^2) + b\tan^{-1}x + \frac{1}{5}\ell n|x+2| + C$ then:

(A) $a = -\frac{1}{10}, b = -\frac{2}{5}$ **(B)** $a = \frac{1}{10}, b = -\frac{2}{5}$

(C) $a = -\frac{1}{10}, b = \frac{2}{5}$ **(D)** $a = \frac{1}{10}, b = \frac{2}{5}$

47. The order and degree of the differential equation $\left(1+3\frac{dy}{dx}\right)^{\frac{2}{3}} = 4\frac{d^3y}{dx^3}$ are:

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

48. The area of the region(s) enclosed by the curves $y = x^2$ and $y = \sqrt{|x|}$ is:

(A) 1/3 **(B)** 2/3 **(C)** 1/6 **(D)** 1

49. Solution of differential equation $(1+y^2)dx + \left(x - e^{\tan^{-1}y}\right)dy = 0$ is:

(A) $ye^{\tan^{-1}x} = \tan^{-1}x + c$ **(B)** $xe^{\tan^{-1}y} = \frac{1}{2}e^{2\tan^{-1}y} + c$

(C) $2x = e^{\tan^{-1}y} + c$ **(D)** $y = xe^{-\tan^{-1}x} + c$

50. The value of $x > 1$ satisfying the equation $\int_1^x t\ln t\,dt = \frac{1}{4}$, is:

(A) $\sqrt{e}$ **(B)** e **(C)** e^2 **(D)** $e-1$

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