

# JEE Mains Mock Test – Paper 2

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## Physics (25 Questions)

### Section A – MCQs (20 Questions)

**Q1.** The time constant of an RC circuit is:

- (A)  $R/C$
- (B)  $RC$
- (C)  $1/RC$
- (D) None

**Q2.** A wire of resistance  $R$  is stretched to double its length. Its new resistance is:

- (A)  $R/2$
- (B)  $2R$
- (C)  $4R$
- (D)  $R$

**Q3.** The energy stored in a capacitor is given by:

- (A)  $\frac{1}{2}CV^2$
- (B)  $CV$
- (C)  $\frac{1}{2}QV$
- (D) Both A and C

**Q4.** A coil has 100 turns and area  $0.1 \text{ m}^2$ . It is rotated at  $50 \text{ rad/s}$  in a uniform field of  $0.1 \text{ T}$ . Maximum emf induced is:

- (A)  $50 \text{ V}$
- (B)  $100 \text{ V}$
- (C)  $200 \text{ V}$
- (D)  $500 \text{ V}$

**Q5.** Two equal charges are placed at distance  $d$ . At midpoint between them, the electric field is:

- (A) Zero
- (B)  $q/4\pi\epsilon_0 d^2$
- (C)  $2q/4\pi\epsilon_0 d^2$
- (D) None

**Q6.** The drift velocity is inversely proportional to:

- (A) Current
- (B) Area of cross section

- (C) Number density of electrons
- (D) Both B and C

**Q7.** A solenoid of length 50 cm has 1000 turns. Its self-inductance ( $\mu_0 = 4\pi \times 10^{-7} \text{ H/m}$ , area =  $10^{-3} \text{ m}^2$ ) is approximately:

- (A) 0.05 H
- (B) 0.1 H
- (C) 0.25 H
- (D) 0.5 H

**Q8.** Potential at a point due to a point charge varies as:

- (A)  $1/r$
- (B)  $1/r^2$
- (C)  $r$
- (D)  $r^2$

**Q9.** Kirchhoff's current law is based on:

- (A) Conservation of energy
- (B) Conservation of momentum
- (C) Conservation of charge
- (D) Ohm's law

**Q10.** The unit of capacitance is:

- (A) Henry
- (B) Farad
- (C) Tesla
- (D) Weber

**Q11.** A  $10 \Omega$  resistor and  $5 \Omega$  resistor are connected in parallel. Their equivalent resistance is:

- (A)  $15 \Omega$
- (B)  $5 \Omega$
- (C)  $10/3 \Omega$
- (D)  $2 \Omega$

**Q12.** The phase difference between current and voltage in a pure capacitor is:

- (A)  $0^\circ$
- (B)  $90^\circ$
- (C)  $-90^\circ$
- (D)  $180^\circ$

**Q13.** The electrostatic potential inside a charged spherical shell is:

- (A) Zero everywhere
- (B) Constant

- (C) Inversely proportional to  $r$
- (D) Directly proportional to  $r^2$

**Q14.** The charge on a conductor resides:

- (A) Inside
- (B) On the surface
- (C) Uniformly in the body
- (D) At the center

**Q15.** The magnetic field inside a long solenoid is:

- (A) Zero
- (B) Uniform
- (C) Non-uniform
- (D) Decreasing

**Q16.** The unit of resistance is:

- (A) Volt
- (B) Ohm
- (C) Coulomb
- (D) Watt

**Q17.** A  $10\ \mu\text{F}$  capacitor is connected to  $200\ \text{V}$ . The charge on capacitor is:

- (A)  $2000\ \mu\text{C}$
- (B)  $1000\ \mu\text{C}$
- (C)  $2\ \mu\text{C}$
- (D)  $20\ \mu\text{C}$

**Q18.** Electric flux through a closed surface depends on:

- (A) Total charge inside
- (B) Surface area only
- (C) Shape of surface
- (D) Volume of surface

**Q19.** Which device works on electromagnetic induction?

- (A) Transformer
- (B) Battery
- (C) Diode
- (D) Transistor

**Q20.** In a conductor, current is due to:

- (A) Positive charges only
- (B) Negative charges only
- (C) Both
- (D) None

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**Section B – NAT (5 Questions)**

**Q21.** A capacitor  $10\ \mu\text{F}$  is charged to  $100\ \text{V}$ . Find energy stored (J).

**Answer:** \_\_\_\_\_

**Q22.** A coil of inductance  $1\ \text{H}$  carries current  $2\ \text{A}$ . Find energy stored (J).

**Answer:** \_\_\_\_\_

**Q23.** A  $10\ \Omega$  resistor is connected across  $20\ \text{V}$ . Find current (A).

**Answer:** \_\_\_\_\_

**Q24.** A charge of  $2\ \mu\text{C}$  is placed in field  $500\ \text{N/C}$ . Force = ? N

**Answer:** \_\_\_\_\_

**Q25.** A conductor of area  $1\ \text{mm}^2$  carries  $2\ \text{A}$ . If  $n = 8.5 \times 10^{28}$ , find drift velocity (approx, m/s).

**Answer:** \_\_\_\_\_

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**Chemistry (25 Questions)****Section A – MCQs (20 Questions)**

**Q26.** The rate constant has unit  $\text{s}^{-1}$  for:

- (A) Zero order
- (B) First order
- (C) Second order
- (D) Third order

**Q27.** The plot of  $\ln k$  vs  $1/T$  is:

- (A) Straight line
- (B) Curve
- (C) Hyperbola
- (D) None

**Q28.** Raoult's law is applicable to:

- (A) Ideal solution
- (B) Non-ideal solution
- (C) Strong electrolytes
- (D) Colloids

**Q29.** Equivalent conductance increases with:

- (A) Dilution
- (B) Concentration
- (C) Pressure
- (D) Temperature

**Q30.** In Nernst equation, R stands for:

- (A) Resistance
- (B) Universal gas constant
- (C) Rate constant
- (D) None

**Q31.** The unit of rate constant for zero-order is:

- (A)  $\text{mol L}^{-1} \text{s}^{-1}$
- (B)  $\text{mol L}^{-1}$
- (C)  $\text{mol L}^{-1} \text{min}$
- (D)  $\text{mol L}^{-1} \text{s}$

**Q32.** The osmotic pressure of 0.1 M urea at 300 K is ( $R = 0.0821 \text{ L atm mol}^{-1} \text{K}^{-1}$ ):

- (A) 2.46 atm
- (B) 0.246 atm
- (C) 24.6 atm
- (D) 0.0246 atm

**Q33.** Electrochemical equivalent depends on:

- (A) Atomic mass
- (B) Charge
- (C) Both
- (D) None

**Q34.** The rate of a reaction doubles when T is raised from 300 K to 310 K. The activation energy is approximately:

- (A) 52 kJ/mol
- (B) 5.2 kJ/mol
- (C) 520 kJ/mol
- (D) 2.6 kJ/mol

**Q35.** Molality is independent of:

- (A) Solvent mass
- (B) Temperature
- (C) Solute mass
- (D) None

**Q36.** Faraday's constant is approximately:

- (A) 96500 C
- (B)  $9.65 \times 10^4 \text{ C}$
- (C) Both A and B
- (D) None

**Q37.** The colligative property is:

- (A) Osmotic pressure
- (B) Vapour pressure lowering
- (C) Elevation of boiling point
- (D) All

**Q38.** Rate law is determined by:

- (A) Mechanism
- (B) Experiment
- (C) Both
- (D) None

**Q39.** Conductivity of strong electrolyte at infinite dilution is given by:

- (A) Kohlrausch law
- (B) Raoult's law
- (C) Arrhenius law
- (D) Faraday's law

**Q40.** Which of the following is not a colligative property?

- (A) Surface tension
- (B) Osmotic pressure
- (C) Depression in freezing point
- (D) Elevation in boiling point

**Q41.** The electrochemical cell which converts chemical energy to electrical is:

- (A) Galvanic
- (B) Electrolytic
- (C) Both
- (D) None

**Q42.** Henry's law is related to:

- (A) Solubility of gases
- (B) Vapour pressure
- (C) Boiling point
- (D) Osmotic pressure

**Q43.** The rate law for  $2A \rightarrow B$  is  $\text{rate} = k[A]^2$ . Order = ?

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

**Q44.** A solution shows positive deviation from Raoult's law if:

- (A)  $\Delta H_{\text{mix}} > 0$

- (B)  $\Delta H_{\text{mix}} < 0$   
(C)  $\Delta H_{\text{mix}} = 0$   
(D) None

**Q45.** The unit of cell potential is:

- (A) Volt  
(B) Ampere  
(C) Joule  
(D) Coulomb
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**Section B – NAT (5 Questions)**

**Q46.** Half-life of a first-order reaction is 100 s. Find rate constant ( $\text{s}^{-1}$ ).

**Answer:** \_\_\_\_\_

**Q47.** Molality of 10 g NaOH ( $M = 40$ ) in 100 g  $\text{H}_2\text{O}$ .

**Answer:** \_\_\_\_\_

**Q48.** For reaction  $\text{Zn} + \text{Cu}^{2+} \rightarrow \text{Zn}^{2+} + \text{Cu}$ ,  $E^\circ_{\text{cell}} = 1.1 \text{ V}$ . Find  $\Delta G^\circ$  ( $F = 96500$ ).

**Answer:** \_\_\_\_\_

**Q49.** Calculate vapour pressure of water at 300 K when 18 g glucose is dissolved in 180 g water ( $P^\circ = 23.1 \text{ mmHg}$ ).

**Answer:** \_\_\_\_\_

**Q50.** Osmotic pressure of 0.5 M solution at 300 K ( $R = 0.0821$ ).

**Answer:** \_\_\_\_\_

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**Mathematics (25 Questions)**

**Section A – MCQs (20 Questions)**

**Q51.** If  $\det(A) = 2$ , then  $\det(A^2) =$

- (A) 2  
(B) 4  
(C) 8  
(D) 16

**Q52.** If  $A$  is identity matrix, then  $A^{-1} =$

- (A)  $I$   
(B)  $0$   
(C)  $-I$   
(D) None

**Q53.** For  $f(x) = |x|$ ,  $f(-x) =$

- (A)  $f(x)$
- (B)  $-f(x)$
- (C)  $f(x)^2$
- (D) None

**Q54.** Range of  $\cos^{-1}(x)$  is:

- (A)  $[0, \pi]$
- (B)  $[-\pi/2, \pi/2]$
- (C)  $[0, 2\pi]$
- (D) None

**Q55.** If  $n(A) = 3$ , number of subsets =

- (A) 3
- (B) 6
- (C) 8
- (D) 9

**Q56.** Determinant of  $\begin{bmatrix} 1 & 2 \\ 2 & 4 \end{bmatrix}$  is:

- (A) 0
- (B) 2
- (C) 4
- (D) -2

**Q57.** Number of one-one functions from  $\{1,2,3\}$  to  $\{a,b,c,d\}$  is:

- (A) 24
- (B) 12
- (C) 36
- (D) 64

**Q58.** Relation  $R = \{(a,a), (b,b)\}$  on set  $\{a,b\}$  is:

- (A) Reflexive
- (B) Symmetric
- (C) Both
- (D) None

**Q59.** If  $f(x) = \sin x$ , then  $f(-x) =$

- (A)  $-f(x)$
- (B)  $f(x)$
- (C) Both
- (D) None

**Q60.** The determinant of a diagonal matrix is:

- (A) Product of diagonal elements



- (B) Sum of diagonal elements
- (C) Zero
- (D) None

**Q61.** Number of binary operations on set with 3 elements is:

- (A) 9
- (B) 27
- (C) 729
- (D) 19683

**Q62.** If  $\det(A) = 5$ , then  $\det(2A)$  for  $2 \times 2$  matrix =

- (A) 10
- (B) 20
- (C) 25
- (D) 100

**Q63.** If  $f(x) = x^3$ , then  $f$  is:

- (A) Odd
- (B) Even
- (C) Neither
- (D) Both

**Q64.** Adjoint of unit matrix is:

- (A) I
- (B) 0
- (C)  $-I$
- (D) None

**Q65.** The sum of diagonal elements of a matrix is called:

- (A) Rank
- (B) Trace
- (C) Determinant
- (D) Dimension

**Q66.** If  $n(A) = 2$ , number of relations on  $A$  =

- (A) 4
- (B) 16
- (C) 64
- (D) 256

**Q67.** If  $f(x) = \cos x$ , then  $f$  is:

- (A) Even
- (B) Odd

- (C) Both
- (D) Neither

**Q68.** The determinant of  $\begin{bmatrix} 0 & 1 \\ -1 & 0 \end{bmatrix}$  is:

- (A) 1
- (B) -1
- (C) 0
- (D) 2

**Q69.** Rank of identity matrix of order 3 is:

- (A) 1
- (B) 2
- (C) 3
- (D) None

**Q70.** Every function is:

- (A) A relation
- (B) Not a relation
- (C) Independent of relation
- (D) None

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**Section B – NAT (5 Questions)**

**Q71.** Solve  $\det\left(\begin{bmatrix} x & 2 \\ 3 & 4 \end{bmatrix}\right) = 2$ .

**Answer:** \_\_\_\_\_

**Q72.** If  $f(x) = x^2 - 2x + 1$ , find  $f(3)$ .

**Answer:** \_\_\_\_\_

**Q73.** If matrix  $A = \begin{bmatrix} 2 & 0 \\ 0 & 2 \end{bmatrix}$ , find  $\det(A^3)$ .

**Answer:** \_\_\_\_\_

**Q74.** Find number of reflexive relations on a set of 3 elements.

**Answer:** \_\_\_\_\_

**Q75.** Evaluate  $\det\left(\begin{bmatrix} 2 & 1 & 0 \\ 0 & 3 & 4 \\ 5 & 0 & 1 \end{bmatrix}\right)$ .

**Answer:** \_\_\_\_\_