

JEE Main

Sample Question Paper - 2024

Country: IN | Duration: 3 hours | Max Marks: 300 | Language: English

Negative Marking: Yes (-1) | Total Questions: 75 | QuizVerse AI Tutor

General Instructions:

1. This paper contains 75 questions across 3 section(s): Physics, Chemistry, Mathematics.
2. Duration: 3 hours. Maximum marks: 300.
3. Negative marking: Yes (-1).
4. Read each question carefully before answering.

Section 1: Physics (25 Questions)

Q1. A wire of resistance 11 ohm is bent into a circle. Effective resistance between diametrically opposite points is:

- (A) 7 ohm
- (B) 3 ohm
- (C) 4 ohm
- (D) 2 ohm

Q2. A body of mass 4 kg is moving in a circle of radius 8 m at 19 m/s. The centripetal force is:

- (A) 124 N
- (B) 65 N
- (C) 176 N
- (D) 146 N

Q3. An ideal gas at 292 K is heated at constant pressure to 489 K. The ratio of final to initial volume is:

- (A) 2.1
- (B) 2.3
- (C) 2.1
- (D) 2.7

Q4. An ideal gas at 295 K is heated at constant pressure to 678 K. The ratio of final to initial volume is:

- (A) 1.5
- (B) 1.5
- (C) 2.3
- (D) 2.4

Q5. A car of mass 1565 kg moving at 25 m/s brakes to rest in 7 s. The braking force is:

- (A) 15156 N
- (B) 6477 N
- (C) 17916 N
- (D) 6209 N

Q6. The escape velocity from a planet of mass 3×10^{24} kg and radius 6004 km is:

- (A) 14.0 km/s
- (B) 9.6 km/s
- (C) 12.6 km/s
- (D) 9.1 km/s

Q7. The current through a 26 ohm resistor connected to a 15 V battery is:

- (A) 2.36 A
- (B) 0.50 A
- (C) 1.89 A
- (D) 2.83 A

Q8. The work function of a metal is 3.3 eV. The threshold frequency is:

- (A) 6.65×10^{14} Hz
- (B) 7.25×10^{14} Hz
- (C) 9.88×10^{14} Hz
- (D) 10.83×10^{14} Hz

Q9. A force of 64 N acts on a 17 kg body initially at rest. The velocity after 4 s is:

- (A) 49 m/s
- (B) 37 m/s
- (C) 7 m/s
- (D) 26 m/s

Q10. A projectile is launched at 45 degrees with initial velocity 22 m/s. The time of flight is approximately:

- (A) 3.9 s
- (B) 4.6 s
- (C) 2.9 s
- (D) 3.3 s

Q11. A ball is dropped from height 90 m. Its velocity just before hitting the ground is:

- (A) 32.6 m/s
- (B) 28.3 m/s
- (C) 35.8 m/s
- (D) 35.0 m/s

Q12. Two capacitors 9 μ F and 8 μ F are connected in series. The equivalent capacitance is:

- (A) 4.24 μ F
- (B) 2.11 μ F
- (C) 2.76 μ F
- (D) 3.56 μ F

Q13. The binding energy per nucleon of Fe-56 is approximately:

- (A) 8.8 MeV
- (B) 6.5 MeV
- (C) 9.2 MeV
- (D) 7.6 MeV

Q14. The current through a 11 ohm resistor connected to a 12 V battery is:

- (A) 2.81 A
- (B) 2.50 A
- (C) 2.22 A
- (D) 2.51 A

Q15. A block of mass 6 kg slides down a frictionless incline of angle 37 degrees. The acceleration is:

- (A) 6.8 m/s²
- (B) 6.6 m/s²
- (C) 4.1 m/s²
- (D) 5.2 m/s²

Q16. A convex lens of focal length 16 cm forms a real image of an object placed 22 cm away. The image distance is:

- (A) 45 cm
- (B) 51 cm
- (C) 25 cm
- (D) 15 cm

Q17. The binding energy per nucleon of Fe-56 is approximately:

- (A) 7.6 MeV
- (B) 6.5 MeV
- (C) 9.2 MeV
- (D) 8.8 MeV

Q18. A solenoid of 145 turns and length 0.1 m carries current 4 A. The magnetic field inside is:

- (A) 9.69 mT
- (B) 17.15 mT
- (C) 1.19 mT
- (D) 16.56 mT

Q19. The binding energy per nucleon of Fe-56 is approximately:

- (A) 7.6 MeV
- (B) 8.8 MeV
- (C) 9.2 MeV
- (D) 6.5 MeV

Q20. Light passes from glass (n=1.6) to air. The critical angle is:

- (A) 42 degrees
- (B) 42 degrees
- (C) 48 degrees
- (D) 46 degrees

Q21. A projectile is launched at 45 degrees with initial velocity 36 m/s. The time of flight is approximately:

- (A) 2.5 s
- (B) 2.4 s
- (C) 1.6 s
- (D) 4.3 s

Q22. A spring with $k = 494 \text{ N/m}$ is compressed by 0.17 m . The stored PE is:

- (A) 18.25 J
- (B) 22.76 J
- (C) 16.40 J
- (D) 20.63 J

Q23. A car of mass 1593 kg moving at 44 m/s brakes to rest in 9 s . The braking force is:

- (A) 3916 N
- (B) 16867 N
- (C) 4174 N
- (D) 15289 N

Q24. Two masses 8 kg and 7 kg are connected by a string over a frictionless pulley. The acceleration of the system is:

- (A) 4.13 m/s^2
- (B) 1.73 m/s^2
- (C) 2.54 m/s^2
- (D) 1.16 m/s^2

Q25. Two masses 7 kg and 11 kg are connected by a string over a frictionless pulley. The acceleration of the system is:

- (A) 5.61 m/s^2
- (B) 3.18 m/s^2
- (C) 2.57 m/s^2
- (D) 3.15 m/s^2

Section 2: Chemistry (25 Questions)

Q26. For an endothermic reaction, increasing temperature:

- (A) Decreases rate
- (B) Decreases equilibrium constant
- (C) No effect
- (D) Increases equilibrium constant

Q27. The osmotic pressure of a solution is given by:

- (A) $\pi = mRT$
- (B) $\pi = iMRT$
- (C) $\pi = PV$
- (D) $\pi = nRT/V$

Q28. The crystal field splitting energy in octahedral complex is:

- (A) $10Dq_{tet}$
- (B) Δ_{oct}
- (C) Δ_{sq}
- (D) Δ_{tet}

Q29. Grignard reagents react with dry CO₂ to give:

- (A) Esters
- (B) Carboxylic acids
- (C) Alcohols
- (D) Ketones

Q30. The hybridization of Ni in [Ni(CN)₄]²⁻ is:

- (A) dsp²
- (B) d²sp³
- (C) sp³d
- (D) sp³

Q31. The major product of SN₁ reaction of tert-butyl chloride with ethanol is:

- (A) tert-Butanol
- (B) Isobutane
- (C) tert-Butyl ethyl ether
- (D) 2-Methylpropene

Q32. Gibbs free energy change for a spontaneous process is:

- (A) Zero
- (B) Negative
- (C) Undefined
- (D) Positive

Q33. The rate of reaction doubles when temperature increases by:

- (A) 50 K
- (B) 10 K
- (C) 5 K
- (D) 20 K

Q34. The product of dehydration of ethanol at 443 K is:

- (A) Diethyl ether
- (B) Acetic acid
- (C) Acetaldehyde
- (D) Ethylene (C₂H₄)

Q35. VSEPR theory predicts the shape of SF₆ as:

- (A) Tetrahedral
- (B) Octahedral
- (C) Trigonal bipyramidal
- (D) Square planar

Q36. Which element has the highest electronegativity?

- (A) Fluorine
- (B) Chlorine
- (C) Nitrogen
- (D) Oxygen

Q37. Hess's law states that:

- (A) Volume is constant
- (B) Entropy always increases
- (C) Rate depends on concentration
- (D) Enthalpy change is path independent

Q38. The pH of a 0.01 M HCl solution is:

- (A) 3
- (B) 4
- (C) 1
- (D) 2

Q39. The pH of a 0.01 M HCl solution is:

- (A) 1
- (B) 4
- (C) 3
- (D) 2

Q40. Kolbe's electrolysis of sodium acetate gives:

- (A) Ethane
- (B) Propane
- (C) Butane
- (D) Methane

Q41. Markovnikov's rule applies to the addition of HBr to:

- (A) Propene
- (B) Methane
- (C) Ethene
- (D) Benzene

Q42. Lanthanide contraction is caused by:

- (A) Electron capture
- (B) Nuclear fusion
- (C) Poor shielding by 4f electrons
- (D) High ionization energy

Q43. According to Raoult's law, the vapour pressure of a solvent in solution is:

- (A) $p = p_0 / x_{\text{solvent}}$
- (B) $p = RT/V$
- (C) $p = p_0 * x_{\text{solvent}}$
- (D) $p = p_0 * x_{\text{solute}}$

Q44. The IUPAC name of $\text{CH}_3\text{CH}(\text{OH})\text{CH}_3$ is:

- (A) Propan-2-ol
- (B) Isopropyl ether
- (C) 2-Methylethanol
- (D) Propan-1-ol

Q45. The magnetic moment of Fe²⁺ (d⁶) in weak field is:

- (A) 4.9 BM (4 unpaired)
- (B) 2.83 BM
- (C) 5.9 BM
- (D) 0 BM

Q46. Which reagent is used for Baeyer-Villiger oxidation?

- (A) mCPBA / peracid
- (B) KMnO₄
- (C) NaBH₄
- (D) LiAlH₄

Q47. The van't Hoff factor for NaCl is approximately:

- (A) 3
- (B) 2
- (C) 0.5
- (D) 1

Q48. For an ideal gas, C_p - C_v equals:

- (A) R/2
- (B) R (8.314 J/mol K)
- (C) 0
- (D) 2R

Q49. The ore of aluminium is:

- (A) Chalcopyrite
- (B) Galena
- (C) Haematite
- (D) Bauxite

Q50. Which metal is extracted by thermite process?

- (A) Aluminium
- (B) Chromium
- (C) Iron
- (D) Sodium

Section 3: Mathematics (25 Questions)

Q51. The number of ways to arrange 5 distinct objects in a circle is:

- (A) 297
- (B) 2295
- (C) 410
- (D) 833

Q52. The number of ways to arrange 3 distinct objects in a circle is:

- (A) 2236
- (B) 1188
- (C) 4624
- (D) 621

Q53. The derivative of $x^2 \sin(x)$ at $x = \pi$ is:

- (A) 11.37
- (B) 5.37
- (C) -10.70
- (D) 16.30

Q54. If $z = 1 + 5i$, then $|z| =$

- (A) 9.94
- (B) 2.76
- (C) 5.04
- (D) 9.54

Q55. The area under $y = x^4$ from $x = 0$ to $x = 5$ is:

- (A) 132.3
- (B) 135.5
- (C) 24.4
- (D) 15.9

Q56. The rank of the matrix $\begin{bmatrix} 1, 2, 3 \\ 4, 5, 6 \\ 8, 10, 11 \end{bmatrix}$ is:

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

Q57. The number of ways to arrange 7 distinct objects in a circle is:

- (A) 570
- (B) 1166
- (C) 3909
- (D) 4480

Q58. The mean of a binomial distribution with $n = 43$ and $p = 0.5$ is:

- (A) 39.2
- (B) 26.4
- (C) 37.9
- (D) 20.5

Q59. The probability of getting exactly 2 heads in 7 tosses of a fair coin is:

- (A) $\frac{23}{64}$
- (B) $\frac{29}{128}$
- (C) $\frac{7}{64}$
- (D) $\frac{37}{128}$

Q60. The area under $y = x^2$ from $x = 0$ to $x = 2$ is:

- (A) 113.7
- (B) 73.2
- (C) 77.9
- (D) 73.1

Q61. The distance between parallel lines $5x + 2y = 6$ and $2x + 4y = 18$ is:

- (A) 2.76
- (B) 4.16
- (C) 2.11
- (D) 0.57

Q62. If $\det(A) = 8$ and A is 3×3 , then $\det(2A) =$

- (A) 98
- (B) 52
- (C) 77
- (D) 44

Q63. The sum of first 22 terms of AP with $a = 1$, $d = 1$ is:

- (A) 4744
- (B) 4913
- (C) 218
- (D) 1919

Q64. The distance between parallel lines $4x + 3y = 10$ and $2x + 4y = 12$ is:

- (A) 4.15
- (B) 4.25
- (C) 4.75
- (D) 3.08

Q65. Integral of $(x^1 + 2)$ dx from 0 to 5 equals:

- (A) 50
- (B) 43
- (C) 100
- (D) 28

Q66. The area under $y = x^2$ from $x = 0$ to $x = 4$ is:

- (A) 46.0
- (B) 164.8
- (C) 155.7
- (D) 73.5

Q67. Integral of $(x^4 + 8)$ dx from 0 to 2 equals:

- (A) 18
- (B) 97
- (C) 59
- (D) 48

Q68. The probability of getting exactly 3 heads in 5 tosses of a fair coin is:

- (A) $6/128$
- (B) $23/32$
- (C) $7/64$
- (D) $48/256$

Q69. The distance between parallel lines $4x + 3y = 2$ and $3x + 2y = 16$ is:

- (A) 2.95
- (B) 4.33
- (C) 3.17
- (D) 4.36

Q70. The rank of the matrix $[[1,2,3],[4,5,6],[8,9,10]]$ is:

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

Q71. If $\det(A) = 10$ and A is 3×3 , then $\det(2A) =$

- (A) 36
- (B) 89
- (C) 58
- (D) 36

Q72. If $z = 5 + 4i$, then $|z| =$

- (A) 4.13
- (B) 1.85
- (C) 9.55
- (D) 1.87

Q73. The equation of tangent to $y = x^4$ at $x = 3$ is:

- (A) $y = 10x - 6$
- (B) $y = 2x - 14$
- (C) $y = 8x - 5$
- (D) $y = 5x - 19$

Q74. Integral of $(x^1 + 6) dx$ from 0 to 5 equals:

- (A) 75
- (B) 65
- (C) 63
- (D) 81

Q75. $\lim_{x \rightarrow 0} \sin(4x)/x =$

- (A) 4
- (B) 1
- (C) 6
- (D) 1

Answer Key

Q1: (D)	Q2: (D)	Q3: (D)	Q4: (A)	Q5: (C)
Q6: (B)	Q7: (A)	Q8: (C)	Q9: (D)	Q10: (B)
Q11: (D)	Q12: (A)	Q13: (A)	Q14: (A)	Q15: (D)
Q16: (D)	Q17: (D)	Q18: (B)	Q19: (B)	Q20: (A)
Q21: (B)	Q22: (C)	Q23: (C)	Q24: (B)	Q25: (B)
Q26: (D)	Q27: (B)	Q28: (B)	Q29: (B)	Q30: (A)
Q31: (C)	Q32: (B)	Q33: (B)	Q34: (D)	Q35: (B)
Q36: (A)	Q37: (D)	Q38: (A)	Q39: (C)	Q40: (A)
Q41: (A)	Q42: (C)	Q43: (C)	Q44: (A)	Q45: (A)
Q46: (A)	Q47: (B)	Q48: (B)	Q49: (D)	Q50: (B)
Q51: (B)	Q52: (D)	Q53: (A)	Q54: (D)	Q55: (D)
Q56: (B)	Q57: (B)	Q58: (C)	Q59: (A)	Q60: (B)
Q61: (A)	Q62: (B)	Q63: (B)	Q64: (B)	Q65: (D)
Q66: (B)	Q67: (B)	Q68: (C)	Q69: (D)	Q70: (B)
Q71: (A)	Q72: (A)	Q73: (B)	Q74: (B)	Q75: (C)

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