

JEE Main

Sample Question Paper - 2023

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 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) 146 N
- (C) 176 N
- (D) 65 N

Q2. A Carnot engine operates between 781 K and 324 K. Its efficiency is:

- (A) 60%
- (B) 51%
- (C) 28%
- (D) 54%

Q3. The de Broglie wavelength of an electron accelerated through 50 V is approximately:

- (A) 1.07 Angstrom
- (B) 2.55 Angstrom
- (C) 1.17 Angstrom
- (D) 1.32 Angstrom

Q4. A block of mass 8 kg slides down a frictionless incline of angle 45 degrees. The acceleration is:

- (A) 3.1 m/s²
- (B) 3.8 m/s²
- (C) 4.3 m/s²
- (D) 5.1 m/s²

Q5. The current through a 11 ohm resistor connected to a 12 V battery is:

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

Q6. The current through a 26 ohm resistor connected to a 15 V battery is:

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

Q7. 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) 17916 N
- (C) 6477 N
- (D) 6209 N

Q8. Two capacitors 9 uF and 9 uF are connected in series. The equivalent capacitance is:

- (A) 4.96 uF
- (B) 3.34 uF
- (C) 1.37 uF
- (D) 4.38 uF

Q9. An electron moves with velocity 1×10^6 m/s perpendicular to a magnetic field of 0.2 T. The radius of its path is:

- (A) 1.26 cm
- (B) 3.91 cm
- (C) 1.26 cm
- (D) 1.43 cm

Q10. The focal length of a concave mirror is 12 cm. An object at 46 cm forms image at:

- (A) 32 cm, real inverted
- (B) 26 cm, real inverted
- (C) 49 cm, real inverted
- (D) 35 cm, real inverted

Q11. The escape velocity from a planet of mass 3×10^{24} kg and radius 6004 km is:

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

Q12. A Carnot engine operates between 765 K and 266 K. Its efficiency is:

- (A) 56%
- (B) 25%
- (C) 52%
- (D) 35%

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

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

Q14. A wire of resistance 19 ohm is bent into a circle. Effective resistance between diametrically opposite points is:

- (A) 8 ohm
- (B) 8 ohm
- (C) 6 ohm
- (D) 2 ohm

Q15. An ideal gas at 295 K is heated at constant pressure to 678 K. The ratio of final to initial volume is:

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

Q16. A solenoid of 145 turns and length 0.1 m carries current 4 A. The magnetic field inside is:

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

Q17. A car of mass 1593 kg moving at 44 m/s brakes to rest in 9 s. The braking force is:

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

Q18. The focal length of a concave mirror is 17 cm. An object at 30 cm forms image at:

- (A) 32 cm, real inverted
- (B) 17 cm, real inverted
- (C) 23 cm, real inverted
- (D) 43 cm, real inverted

Q19. A projectile is launched at 45 degrees with initial velocity 22 m/s. The time of flight is approximately:

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

Q20. The electric field at 3 m from a point charge of 6 uC is:

- (A) 672 N/C
- (B) 1784 N/C
- (C) 7047 N/C
- (D) 8811 N/C

Q21. Two masses 7 kg and 11 kg are connected by a string over a frictionless pulley. The acceleration of the system is:

- (A) 3.15 m/s²
- (B) 5.61 m/s²
- (C) 2.57 m/s²
- (D) 3.18 m/s²

Q22. A radioactive substance has half-life 14 days. The fraction remaining after 54 days is:

- (A) 1/4
- (B) 1/16
- (C) 1/8
- (D) 1/4

Q23. 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

Q24. A convex lens of focal length 18 cm forms a real image of an object placed 46 cm away. The image distance is:

- (A) 19 cm
- (B) 35 cm
- (C) 25 cm
- (D) 34 cm

Q25. A spring with $k = 494 \text{ N/m}$ is compressed by 0.17 m. The stored PE is:

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

Section 2: Chemistry (25 Questions)

Q26. 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

Q27. For an endothermic reaction, increasing temperature:

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

Q28. The van't Hoff factor for NaCl is approximately:

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

Q29. Which of the following has the highest lattice energy?

- (A) NaBr
- (B) NaI
- (C) NaF
- (D) NaCl

Q30. Gibbs free energy change for a spontaneous process is:

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

Q31. The hybridization of Ni in $[\text{Ni}(\text{CN})_4]^{2-}$ is:

- (A) sp^3
- (B) d^2sp^3
- (C) dsp^2
- (D) sp^3d

Q32. The order of ionic radius: Na^+ vs Mg^{2+} vs Al^{3+} is:

- (A) $\text{Mg}^{2+} > \text{Na}^+ > \text{Al}^{3+}$
- (B) $\text{Na}^+ > \text{Mg}^{2+} > \text{Al}^{3+}$
- (C) $\text{Al}^{3+} > \text{Mg}^{2+} > \text{Na}^+$
- (D) All equal

Q33. For a first-order reaction with $k = 0.074 \text{ s}^{-1}$, the half-life is:

- (A) 15.0 s
- (B) 20.0 s
- (C) 10.0 s
- (D) 13.9 s

Q34. Lanthanide contraction is caused by:

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

Q35. The rate of reaction doubles when temperature increases by:

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

Q36. The colour of KMnO_4 is due to:

- (A) d-d transition
- (B) f-f transition
- (C) Charge transfer transition
- (D) s-p transition

Q37. Hess's law states that:

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

Q38. Markovnikov's rule applies to the addition of HBr to:

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

Q39. According to Raoult's law, the vapour pressure of a solvent in solution is:

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

Q40. The reagent for converting aldehyde to carboxylic acid is:

- (A) Zn-Hg / HCl
- (B) LiAlH_4
- (C) KMnO_4 / $\text{K}_2\text{Cr}_2\text{O}_7$
- (D) NaBH_4

Q41. The lightest noble gas is:

- (A) Helium
- (B) Argon
- (C) Krypton
- (D) Neon

Q42. Colligative properties depend on:

- (A) Number of solute particles
- (B) Nature of solute
- (C) Molar mass of solute
- (D) Nature of solvent

Q43. The IUPAC name of $\text{CH}_3\text{CH}(\text{OH})\text{CH}_3$ is:

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

Q44. Williamson's synthesis is used to prepare:

- (A) Amines
- (B) Esters
- (C) Ethers
- (D) Alcohols

Q45. The pH of a 0.01 M HCl solution is:

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

Q46. The ore of aluminium is:

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

Q47. d-block elements show variable oxidation states because:

- (A) Filled d orbitals
- (B) Large atomic size
- (C) Close energy of (n-1)d and ns orbitals
- (D) Low ionization energy

Q48. Which metal is extracted by thermite process?

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

Q49. The coordination number in BCC is:

- (A) 6
- (B) 4
- (C) 8
- (D) 12

Q50. Grignard reagents react with dry CO₂ to give:

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

Section 3: Mathematics (25 Questions)

Q51. Integral of $(x^3 + 1) dx$ from 0 to 1 equals:

- (A) 33
- (B) 8
- (C) 23
- (D) 99

Q52. The distance between parallel lines $5x + 2y = 6$ and $2x + 4y = 18$ is:

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

Q53. If $z = 5 + 4i$, then $|z| =$

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

Q54. The rank of the matrix $[[1,2,3],[4,5,6],[8,9,10]]$ is:

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

Q55. The derivative of $x^3 \sin(x)$ at $x = \pi$ is:

- (A) -18.89
- (B) -6.35
- (C) -10.50
- (D) 15.80

Q56. The distance between parallel lines $4x + 3y = 2$ and $3x + 2y = 16$ is:

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

Q57. The sum of first 22 terms of AP with $a = 1$, $d = 1$ is:

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

Q58. The number of ways to arrange 5 distinct objects in a circle is:

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

Q59. The area under $y = x^2$ from $x = 0$ to $x = 4$ is:

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

Q60. Integral of $(x^1 + 2) dx$ from 0 to 5 equals:

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

Q61. The mean of a binomial distribution with $n = 41$ and $p = 0.6$ is:

- (A) 25.0
- (B) 3.9
- (C) 25.1
- (D) 15.7

Q62. The eccentricity of the ellipse $x^2/4 + y^2/6 = 1$ is:

- (A) 0.69
- (B) 0.55
- (C) 0.38
- (D) 0.59

Q63. The mean of a binomial distribution with $n = 43$ and $p = 0.5$ is:

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

Q64. Integral of $(x^4 + 8) dx$ from 0 to 2 equals:

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

Q65. The probability of getting exactly 2 heads in 7 tosses of a fair coin is:

- (A) $37/128$
- (B) $7/64$
- (C) $23/64$
- (D) $29/128$

Q66. The equation of tangent to $y = x^4$ at $x = 3$ is:

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

Q67. The equation of tangent to $y = x^3$ at $x = 2$ is:

- (A) $y = 11x - 16$
- (B) $y = 2x - 2$
- (C) $y = 9x - 12$
- (D) $y = 3x - 9$

Q68. The probability of getting exactly 4 heads in 5 tosses of a fair coin is:

- (A) $20/256$
- (B) $14/32$
- (C) $43/32$
- (D) $36/64$

Q69. The sum of first 22 terms of AP with $a = 3$, $d = 4$ is:

- (A) 3114
- (B) 2828
- (C) 3166
- (D) 2203

Q70. $\lim_{x \rightarrow 0} \sin(2x)/x =$

- (A) 6
- (B) 5
- (C) 1
- (D) 5

Q71. The value of integral $\sin^6(x) dx$ from 0 to $\pi/2$ is:

- (A) $2\pi/16$
- (B) $8\pi/8$
- (C) $5\pi/8$
- (D) $6\pi/32$

Q72. The area under $y = x^3$ from $x = 0$ to $x = 2$ is:

- (A) 27.6
- (B) 73.8
- (C) 170.4
- (D) 76.4

Q73. The eccentricity of the ellipse $x^2/19 + y^2/2 = 1$ is:

- (A) 0.70
- (B) 0.58
- (C) 0.34
- (D) 0.84

Q74. If $\det(A) = 7$ and A is 3×3 , then $\det(2A) =$

- (A) 31
- (B) 51
- (C) 58
- (D) 81

Q75. The rank of the matrix $[[1,2,3],[4,5,6],[8,10,11]]$ is:

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

Answer Key

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

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