MAHARASHTRA BOARD · CLASS 12 · PHYSICS

Maharashtra Board Class 12 Physics Important Questions 2027

74 question patterns that repeated across past papers · the years show every time each was asked

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Rotational Dynamics

1. Derive maximum safe speed of a vehicle on a banked/horizontal road

Asked 3× · Board 2024, Board 2026 · 2/4 marks

Obtain an expression for the maximum speed of a vehicle along horizontal circular curved road.

2. Numerical: rotational power from torque and angular speed

Asked 2× · Board 2025, Board 2026 · 1/2 marks

A ceiling fan has moment of inertia of 2 kg m^2. It attains maximum frequency of 60 r.p.m. in 2 seconds. Calculate its power rating.

3. MCQ: moment of inertia of a standard body

Asked 2× · Board 2024, Board 2026 · 1 marks

The MI of ring of radius 'R' and mass 'M' about its central axis is _____ (a) 2 MR^2 (b) $MR^2/2$ (c) MR^2 (d) (3/2) MR^2

4. State and prove conservation of angular momentum

Asked 2× · Board 2023, Board 2025 · 2 marks

State and prove the law of conservation of angular momentum.

Mechanical Properties of Fluids

5. Define surface tension/energy and derive their relation

Asked 3× · Board 2023, Board 2024 · 3/4 marks

Define surface tension. Obtain the relation between surface tension and surface energy.

6. Numerical: excess pressure inside a liquid drop

Asked 2× · Board 2025, Board 2026 · 2/3 marks

Calculate the radius of water drop, so that the excess pressure inside it is 24 N/m^2. [Surface tension of water = 7.2×10^{-2} N/m]

7. Numerical/MCQ: droplets coalescing into a single drop

Asked 2× · Board 2022, Board 2026 · 1/2 marks

When a number of droplets coalesce to form a single drop, the total surface area of the drop _____. (a) decreases (b) becomes zero (c) remains same (d) increases

8. Coefficient of viscosity (define/derive via Newton's law)

Asked 2× · Board 2023, Board 2025 · 2 marks

Using Newton's law of viscosity for streamline flow, derive an expression for coefficient of viscosity.

9. Numerical: capillary rise versus tube radius

Asked 2× · Board 2022, Board 2025 · 1 marks

Two capillary tubes of radii 0.3 cm and 0.6 cm are dipped in the same liquid, the ratio of heights to which the liquid will rise in the tubes is _____. (a) 1 : 2 (b) 2 : 1 (c) 1 : 4 (d) 4 : 1

Kinetic Theory of Gases and Radiation

10. Derive expression for pressure exerted by a gas (kinetic theory)

Asked 3× · Board 2022, Board 2023, Board 2026 · 4 marks

Derive an expression for pressure exerted by a gas on the basis of kinetic theory of gases.

11. Numerical: ratio/comparison at two temperatures (Stefan's law)

Asked 2× · Board 2023, Board 2024 · 1/2 marks

The ratio of emissive power of a perfect black body at 927 deg C and 327 deg C is ____. (a) 2 : 1 (b) 4 : 1 (c) 8 : 1 (d) 16 : 1

Thermodynamics

12. Define types of thermodynamic equilibrium

Asked 4× · Board 2022, Board 2025, Board 2026 · 2/3 marks

For a thermodynamic system : Define : (a) Mechanical equilibrium (b) Chemical equilibrium

13. Derive work done in an isothermal process

Asked 3× · Board 2023, Board 2024, Board 2025 · 3/4 marks

Define isothermal process. Obtain an expression for work done during isothermal process. Draw P-V diagram.

14. Numerical: work done by a gas in isothermal expansion

Asked 2× · Board 2025, Board 2026 · 2/3 marks

0.5 mole of an ideal gas at 300 K, expands isothermally from an initial volume of 2 L to a final volume of 6 L. Calculate : (a) work done by the gas (b) heat supplied to the gas [Given : R = 8.31 J mol^{-1} K^{-1}]

15. Explain a cyclic process with a p-V diagram

Asked 2× · Board 2024, Board 2026 · 2 marks

Explain the cyclic process with the help of a neat p-V diagram.

16. Define a basic thermodynamic term (system/surroundings)

Asked 2× · Board 2024, Board 2025 · 1 marks

What do you mean by a thermodynamic system?

17. MCQ: conserved quantity in the first law of thermodynamics

Asked 2× · Board 2022, Board 2023 · 1 marks

The first law of thermodynamics is consistent with the law of conservation of _____. (a) momentum (b) energy (c) mass (d) velocity

Oscillations

18. Write/obtain the differential equation of SHM

Asked 3× · Board 2022, Board 2024 · 1/2 marks

Write the differential equation for linear S.H.M.

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19. Distinguish between free and forced vibrations
Asked 2× · Board 2023, Board 2026 · 2 marks

Distinguish between free and forced vibrations.

20. Derive acceleration, velocity and displacement in SHM
Asked 2× · Board 2023, Board 2026 · 3/4 marks

State differential equation of linear S.H.M. hence obtain an expression for acceleration, velocity and displacement of a particle performing S.H.M.

21. Numerical: force constant in SHM from restoring force and displacement
Asked 2× · Board 2024, Board 2025 · 1/2 marks

A body of mass 0.8 kg performs linear S.H.M. It experiences a restoring force of 0.4N, when its displacement from mean position is 4 cm. Determine Force constant and Period of S.H.M.

22. Second's pendulum (definition and length)
Asked 2× · Board 2022, Board 2026 · 1/4 marks

Define second's pendulum.

23. Numerical: velocity of a particle in SHM at a given displacement
Asked 2× · Board 2023, Board 2024 · 1 marks

The velocity of bob of a second's pendulum when it is 6 cm from its mean position and amplitude of 10 cm, is _____. (a) 8 pi cm/s (b) 6 pi cm/s (c) 4 pi cm/s (d) 2 pi cm/s

Superposition of Waves

24. Explain/distinguish harmonics and overtones
Asked 3× · Board 2022, Board 2025, Board 2026 · 2 marks

Distinguish between harmonics and overtones. [Any Two points]

25. Numerical: beats from two tuning forks
Asked 3× · Board 2023, Board 2024, Board 2025 · 2/3 marks

Two tuning forks having frequencies 160 Hz and 170 Hz are sounded together to produce sound waves. The velocity of sound in air is 326.4 m/s. Calculate the difference between wavelengths of these waves.

Wave Optics

26. State conditions for a steady interference pattern
Asked 2× · Board 2025, Board 2026 · 3/4 marks

What is interference of light? State any four conditions for obtaining well defined and steady interference pattern.

27. Numerical: resolving power / angular resolution of a telescope
Asked 2× · Board 2024, Board 2026 · 2 marks

A star is emitting light at the wavelength of 4000 Angstrom. Determine the limit of angular resolution of a telescope having an objective of diameter of 400 cm.

28. Derive expression for fringe width in Young's double-slit experiment
Asked 2× · Board 2024, Board 2026 · 4 marks

Using analytical method, obtain an expression for the fringe width of two interfering waves.

29. Derive Brewster's angle / state Brewster's law
Asked 2× · Board 2024, Board 2025 · 3/4 marks

What is Brewster's law? Derive the formula for Brewster's angle.

30. MCQ: property of light constant on changing medium

Asked 2× · Board 2022, Board 2023 · 1 marks

The property of light which remains unchanged when it travels from one medium to another is _____. (a) velocity (b) wavelength (c) amplitude (d) frequency

31. Reflection of light using Huygens' principle

Asked 2× · Board 2022, Board 2023 · 3 marks

Derive laws of reflection of light using Huygens' principle.

Electrostatics

32. Electric field of a uniformly charged spherical shell

Asked 2× · Board 2025, Board 2026 · 1/3 marks

State the formula for electric field intensity due to uniformly charged spherical shell.

33. Numerical/formula: equivalent capacitance of capacitors in series

Asked 2× · Board 2024, Board 2026 · 1 marks

When n number of capacitors having each of capacity 'C' are connected in series, their equivalent capacity is (a) 1/C (b) nC (c) C/n (d) 1/(nC)

34. Numerical: torque and work done to rotate an electric dipole

Asked 2× · Board 2023, Board 2026 · 2/3 marks

An electric dipole consists of two unlike charges of magnitude 2 x 10^{-6} C each and separated by 4 cm. The dipole is placed in an external electric field of 10^{5} N/C. Calculate the work done by an external agent to turn the dipole through 180 deg.

35. Define polar and non-polar molecules/dielectrics

Asked 2× · Board 2022, Board 2026 · 2 marks

What are polar molecules and non polar molecules?

36. Numerical: capacitance of a parallel plate capacitor

Asked 2× · Board 2022, Board 2026 · 3 marks

A parallel plate capacitor filled with air has an area 6 cm^2 and the plate separation is 2 mm. Calculate its capacity.

Current Electricity

37. Determine internal resistance of a cell using a potentiometer

Asked 2× · Board 2023, Board 2025 · 1/3 marks

Which of the following equations gives correct expression for the internal resistance of a cell by using potentiometer? (a) r = R(V/E - 1) (b) r = R(1 - E/V) (c) r = R(1 - V/E) (d) r = R(E/V - 1)

38. Compare potentiometer and voltmeter

Asked 2× · Board 2022, Board 2025 · 2 marks

State the advantages of a potentiometer over a voltmeter.

Magnetic Fields due to Electric Current

39. Numerical: resistance to convert a galvanometer into ammeter/voltmeter

Asked 4× · Board 2024, Board 2025, Board 2026 · 2/3 marks

A galvanometer has a resistance of 40 ohm and a current of 4 mA is needed for full scale deflection. What is the resistance and how is it to be connected to convert the galvanometer (a) into an ammeter of 0.4 A range and (b) into a voltmeter of 5 V range?

40. State the resistance of an ideal voltmeter/ammeter

Asked 3× · Board 2023, Board 2024 · 1 marks

What is the resistance of an ideal voltmeter?

41. Derive magnetic field at the centre of a circular arc (Biot-Savart)

Asked 2× · Board 2025, Board 2026 · 2/3 marks

Derive an expression for the magnetic field produced by a current in a circular arc of a wire using Biot-Savart law.

42. MCQ: cyclotron - particles it can accelerate

Asked 2× · Board 2024, Board 2026 · 1 marks

Cyclotron can not accelerate _____ (a) protons (b) alpha-particles (c) neutrons (d) deuterons

43. Derive magnetic induction of a toroid

Asked 2× · Board 2023, Board 2026 · 2/4 marks

Obtain an expression for magnetic induction of a toroid of N no. of turns about an axis passing through its centre and perpendicular to plane. [Second part:] A Carnot refrigerator operates between 150 K and 200 K, calculate its coefficient of performance.

44. Numerical: current in parallel wires from force per unit length

Asked 2× · Board 2023, Board 2026 · 3 marks

Calculate the current flowing through two long parallel wires carrying equal currents and separated by a distance of 1.35 cm experiencing a force per unit length of 4.76×10^{-2} N/m.

45. Numerical: magnetic field at the centre of a circular coil/loop

Asked 2× · Board 2024, Board 2025 · 2/3 marks

State the formula for magnetic induction produced by a current in a circular arc of a wire. Hence find the magnetic induction at the centre of a current carrying circular loop.

Magnetic Materials

46. Define magnetization, magnetic intensity, susceptibility and permeability

Asked 5× · Board 2022, Board 2023, Board 2024, Board 2025, Board 2026 · 1/2/3 marks

Define magnetization. State its S.I. unit and dimensions. What is the relation between permeability and magnetic susceptibility?

47. Derive period of a bar magnet vibrating in a magnetic field

Asked 2× · Board 2025, Board 2026 · 3 marks

Obtain an expression for period of a bar magnet vibrating in a uniform magnetic field and performing angular S.H.M.

48. Orbital magnetic moment of a revolving electron

Asked 2× · Board 2023, Board 2026 · 1/3 marks

Obtain an expression for orbital magnetic moment of an electron revolving around the nucleus of an atom.

49. Distinguish types of magnetic materials / Curie temperature

Asked 2× · Board 2024, Board 2025 · 2/3 marks

Distinguish between diamagnetic and paramagnetic substances.

50. Numerical: bar magnet oscillation (period-based magnetometer)

Asked 2× · Board 2023, Board 2024 · 2 marks

A bar magnet of moment of inertia of 500 g cm^2 oscillates with a time period of 3.142 seconds in a horizontal plane. What is its magnetic moment if the horizontal component of earth's magnetic field is 4 x 10^{-5} T ?

Electromagnetic Induction

51. Define self and mutual inductance

Asked 3× · Board 2025, Board 2026 · 1/4 marks

Define : (i) Self inductance (ii) Mutual inductance. [Second part:] A conducting loop of area 1 m^2 is placed normal to a uniform magnetic field of 3 Wb/m^2. If the magnetic field is uniformly reduced to 1 Wb/m^2 in 0.5 second, calculate the induced e.m.f. produced in the coil.

52. Motional emf of a rotating conducting bar

Asked 3× · Board 2025, Board 2026 · 1/3/4 marks

A conducting rod of length l, rotates about one of its ends in a uniform magnetic field B, with a constant angular velocity omega. If the plane of rotation is perpendicular to B, the e.m.f. induced between the ends of rod is _____. (a) (1/2) B omega l^2 (b) B omega l^2 (c) 2 B omega l^2 (d) B omega l

53. Construction and working of a transformer

Asked 3× · Board 2024, Board 2026 · 2/4 marks

With the help of neat diagram explain construction of a transformer. [Second part:] Calculate energy required to build up current of 1A in an inductor of inductance 20 mH.

54. Eddy currents (definition and applications)

Asked 2× · Board 2024, Board 2026 · 1/2 marks

What are Eddy currents? State its two applications.

55. Numerical: mutual inductance from induced emf and rate of change of current

Asked 2× · Board 2022, Board 2026 · 3 marks

An emf of 90 mV is induced in the winding of a coil, when current in a nearby coil is increasing at the rate of 4.5 A/s. What is the mutual inductance of the two coils?

AC Circuits

56. Numerical: quantities from an AC emf/voltage equation across a resistor

Asked 4× · Board 2023, Board 2024, Board 2025, Board 2026 · 2/3 marks

An alternating voltage source given by e = 140 sin(314.2 t) is connected across a pure resistor of 50 ohm. Determine : (i) Frequency of the source. (ii) RMS value of emf.

57. Derive expression for impedance of a series LCR circuit

Asked 3× · Board 2024, Board 2025 · 3/4 marks

Using phasor diagram for a series LCR circuit, obtain an expression for impedance. Define admittance.

58. Power factor value in an AC circuit
Asked 2× · Board 2024, Board 2026 · 1 marks

In a purely inductive and capacitive circuit, power factor is, _____ (a) one (b) zero (c) infinity (d) 10

59. Average power dissipated in a series LCR circuit
Asked 2× · Board 2024, Board 2025 · 2/4 marks

Obtain an expression for average power dissipated in a series LCR circuit.

60. Define inductive reactance, capacitive reactance and impedance
Asked 2× · Board 2022, Board 2026 · 3 marks

Define the terms : (a) Inductive reactance (b) Capacitive reactance (c) Impedance

61. Average value of alternating current over a full cycle
Asked 2× · Board 2022, Board 2023 · 1 marks

What is the average value of alternating current over a complete cycle?

Dual Nature of Radiation and Matter

62. Describe experimental set-up of photoelectric effect
Asked 3× · Board 2023, Board 2024 · 3/4 marks

What is photoelectric effect? Describe with neat circuit diagram an experimental setup of photoelectric effect.

63. MCQ: compare de Broglie wavelength of particles with same kinetic energy
Asked 2× · Board 2024, Board 2025 · 1 marks

An electron, a proton, an alpha-particle and a hydrogen atom are moving with the same kinetic energy. The associated de-Broglie wavelength will be longest for - (a) proton (b) electron (c) hydrogen atom (d) alpha-particle

64. Relation between stopping potential and maximum kinetic energy of photoelectron
Asked 2× · Board 2023, Board 2024 · 1 marks

In a photoelectric experiment, the stopping potential is 1.5V. What is the maximum kinetic energy of a photoelectron?

Structure of Atoms and Nuclei

65. Numerical: shortest and longest wavelengths in a hydrogen spectral series
Asked 3× · Board 2022, Board 2025, Board 2026 · 3 marks

Calculate the shortest wavelength of Paschen series and the longest wavelength of Balmer series for hydrogen atom.

66. State postulates of Bohr's atomic model
Asked 3× · Board 2022, Board 2023, Board 2026 · 1/2/3 marks

State any two postulates of Bohr's theory of hydrogen atom.

67. Numerical: number of revolutions of an electron in a Bohr orbit
Asked 2× · Board 2024, Board 2025 · 2/3 marks

An electron in hydrogen atom stays in its second orbit for 10^{-8} s. How many revolutions will it make around the nucleus in that time? [Given : e = 1.6 x 10^{-19} C, m = 9.1 x 10^{-31} kg]

68. Derive the radius of the nth Bohr orbit
Asked 2× · Board 2022, Board 2026 · 2 marks

Derive an expression for radius of nth Bohr orbit.

69. Numerical: angular momentum of an electron in a Bohr orbit

Asked 2× · Board 2022, Board 2024 · 2 marks

Calculate the change in angular momentum of electron when it jumps from third orbit to first orbit in hydrogen atom.

Semiconductor Devices

70. Identify logic gate / its Boolean expression

Asked 4× · Board 2022, Board 2023, Board 2025, Board 2026 · 1 marks

The Boolean equation for NOR gate is (a) Y = A.B (b) Y = (A + B) bar (c) Y = A bar (d) Y = A + B

71. Full wave rectifier (circuit and working)

Asked 2× · Board 2025, Board 2026 · 2/3 marks

With a neat circuit diagram, explain the working of a full wave rectifier. Draw input-output waveforms.

72. Define logic gate

Asked 2× · Board 2024, Board 2025 · 1/4 marks

Define logic gate and explain why NOT gate is called an inverter. [Second part:] The transistor is in the common emitter configuration. Its DC current gain is 50. If collector current is 3mA, calculate the base current.

73. Explain working of a half wave rectifier

Asked 2× · Board 2022, Board 2026 · 3/4 marks

With the help of a neat circuit diagram, explain the working of a half wave rectifier. Draw input and output waveforms.

74. MCQ: condition under which an LED emits light

Asked 2× · Board 2023, Board 2024 · 1 marks

An LED emits light when its ____ (a) junction is reverse biased. (b) depletion region widens. (c) holes and electrons recombine. (d) junction becomes hot.

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