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Class 12 Physics Chapterwise PYQs

2026 – 2003 | All CBSE Board Papers

Chapter-wise previous year questions, sorted by marks and year

Chapter 5: Magnetism and Matter

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1-Mark Questions (43 questions · Section A · MCQ)

Q1. Two statements are given - one labelled as Assertion (A) and the other labelled as Reason (R). Select the correct answer from the options below: (A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A). (B) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A). (C) Assertion (A) is true, but Reason (R) is false. (D) Both Assertion (A) and Reason (R) are false. Assertion (A): All atoms have a net magnetic moment. Reason (R): A current loop does not always behave as a magnetic dipole.

(A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of (A).

(B) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of (A).

(C) Assertion (A) is true, but Reason (R) is false.

(D) Both Assertion (A) and Reason (R) are false.

[2026 • Set 55-1-1]

Q2. Which of the following materials has positive and small value of magnetic susceptibility?

(A) Cu

(B) Al

(C) Bi

(D) Ni

[2026 • Set 55-2-1]

Q3. Which of the following substances has relative magnetic permeability $\mu_r \gg 1$?

(A) Aluminium
(B) Copper
(C) Lead
(D) Nickel

[2026 • Set 55-2-2]

Q4. Assertion (A): When a ferromagnetic substance is heated to high temperature it becomes paramagnetic in nature. Reason (R): The disappearance of magnetisation of a ferromagnet is abrupt and not gradual.

(A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).
(B) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).
(C) Assertion (A) is true, but Reason (R) is false.
(D) Both Assertion (A) and Reason (R) are false.

[2026 • Set 55-4-1]

Q5. The magnetic field due to a small magnetic dipole of dipole moment 'M' at a distance 'r' from the centre along the axis of the dipole is given by

(A) $\frac{\mu_0}{4\pi} \cdot \frac{2M}{r^3}$
(B) $\frac{\mu_0}{4\pi} \cdot \frac{M}{r^3}$
(C) $\frac{\mu_0}{4\pi} \cdot \frac{M}{2r^3}$
(D) $\frac{\mu_0}{4\pi} \cdot \frac{2M}{r^2}$

[2025 • Set 55-2-1]

Q6. A diamagnetic substance is brought, one by one, near the north pole and the south pole of a bar magnet. It is

(A) repelled by north pole and attracted by south pole.
(B) attracted by north pole and repelled by south pole.
(C) attracted by north pole as well as by south pole.
(D) repelled by north pole as well as by south pole.

[2025 • Set 55-2-2]

Q7. A material is pushed out when placed in a uniform magnetic field. The material is

(A) non-magnetic

(B) diamagnetic
(C) paramagnetic
(D) ferromagnetic

[2025 • Set 55-2-3]

Q8. A bar magnet is initially at right angles to a uniform magnetic field. The magnet is rotated till the torque acting on it becomes one-half of its initial value. The angle through which the bar magnet is rotated is :

(A) 30°
(B) 45°
(C) 60°
(D) 75°

[2025 • Set 55-4-1]

Q9. Which one out of the following materials is not paramagnetic ?

(A) Aluminium
(B) Sodium Chloride
(C) Calcium
(D) Copper Chloride

[2025 • Set 55-4-1]

Q10. The materials having negative magnetic susceptibility are :

(A) diamagnetic
(B) paramagnetic
(C) ferromagnetic
(D) non-magnetic

[2025 • Set 55-4-2]

Q11. A piece of a diamagnetic material, free to move when placed in a uniform magnetic field:

(A) moves along the field
(B) moves opposite to the field
(C) moves perpendicular to the field
(D) does not move at all

[2025 • Set 55-6-1]

Q12. A current carrying circular loop of magnetic moment $\vec{M}$ is suspended in a vertical plane in an external magnetic field $\vec{B}$ such that its plane is normal to $\vec{B}$. The work done in rotating this loop by 45° about an axis perpendicular to $\vec{B}$ is closest to:

(A) $-0.3\,MB$
(B) $0.3\,MB$

(C) $-1.7\,MB$
(D) $1.7\,MB$

[2024 • Set 55-3-1]

Q13. Which of the following is a diamagnetic substance?
(A) Gadolinium
(B) Sodium
(C) Copper chloride
(D) Sodium chloride

[2024 • Set 55-3-3]

Q14. The magnetic susceptibility for a diamagnetic material is
(A) small and negative
(B) small and positive
(C) large and negative
(D) large and positive

[2024 • Set 55-4-1]

Q15. Which of the following pairs is that of paramagnetic materials?
(A) Copper and Aluminium
(B) Sodium and Calcium
(C) Lead and Iron
(D) Nickel and Cobalt

[2024 • Set 55-5-1]

Q16. An iron needle is kept near a strong bar magnet. It will experience:
(A) a force of attraction and no torque.
(B) a force of attraction and a torque.
(C) a torque and no force.
(D) neither a force nor a torque.

[2024 • Set 55-5-2]

Q17. Which of the following material has its magnetic susceptibility χ in the range $0 < \chi < \epsilon$, where ϵ is positive and small?
(A) Aluminium
(B) Water
(C) Gadolinium
(D) Bismuth

[2024 • Set 55-5-3]

Q18. Assertion (A): When a bar of copper is placed in an external magnetic field, the field lines get concentrated inside the bar. Reason (R): Copper is a paramagnetic substance.

(A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).

(B) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).

(C) Assertion (A) is true, but Reason (R) is false.

(D) Assertion (A) is false and Reason (R) is also false.

[2023 • Set 55-1-1]

Q19. A diamagnetic substance is brought near the north or south pole of a bar magnet. It will be:

(A) repelled by both the poles.

(B) attracted by both the poles.

(C) repelled by the north pole and attracted by the south pole.

(D) attracted by the north pole and repelled by the south pole.

[2023 • Set 55-1-1]

Q20. Assertion (A): Diamagnetic substances exhibit magnetism. Reason (R): Diamagnetic materials do not have permanent magnetic dipole moment.

(A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).

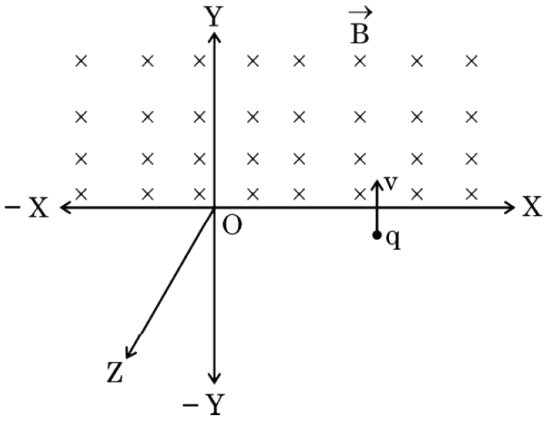
(B) Both Assertion (A) and Reason (R) are true and Reason (R) is NOT the correct explanation of Assertion (A).

(C) Assertion (A) is true and Reason (R) is false.

(D) Assertion (A) is false and Reason (R) is also false.

[2023 • Set 55-2-1]

Q21. The magnetic field lines near a substance are as shown in the figure. The substance is:



(A) Copper

(B) Iron

(C) Sodium
(D) Aluminium

[2023 • Set 55-4-1]

Q22. Which one of the following has negative value of susceptibility?
(A) Nickel
(B) Aluminium
(C) Lead
(D) Iron

[2023 • Set 55-4-2]

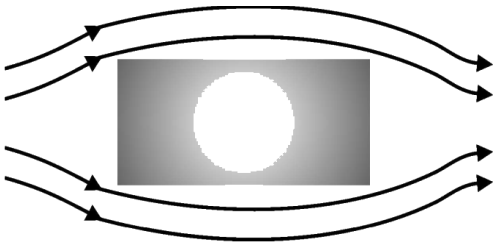
Q23. Which one of the following has relative magnetic permeability between 0 and 1?
(A) Aluminium
(B) Alnico
(C) Water
(D) Sodium

[2023 • Set 55-4-3]

Q24. Which of the following has its permeability less than that of free space?
(A) Copper
(B) Aluminium
(C) Copper chloride
(D) Nickel

[2023 • Set 55-5-1]

Q25. Which of the following cannot modify an external magnetic field as shown in the figure?



(A) Nickel
(B) Silicon
(C) Sodium Chloride
(D) Copper

[2023 • Set 55-5-3]

Q26. Two statements are given - one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer to this question from the codes (A), (B), (C) and (D) as given below: (A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct

explanation of Assertion (A). (B) Both Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation of Assertion (A). (C) Assertion (A) is true but Reason (R) is false. (D) Assertion (A) is false and Reason (R) is also false. Assertion (A): In most of the northern hemisphere, the north pole of the dip needle tilts upwards. Reason (R): This gives the direction of magnetic field of the Earth at that place.

[2021]

Q27. The magnetic field and angle of dip at a place on the earth are $0{\cdot}3\,\text{G}$ and 30°, respectively. The value of vertical component of the earth's magnetic field at the place is _____.

[2020 • Set 55-1-1]

Q28. The magnetic field lines are _____ by a diamagnetic substance.

[2020 • Set 55-1-2]

Q29. The material which is not suitable for making a permanent magnet is

(A) Steel
(B) Ticonal
(C) Lead
(D) Alnico

[2020 • Set 55-2-2]

Q30. Define 'magnetic declination' at a place on earth.

[2020 • Set 55-4-1]

Q31. Define 'angle of dip' at a place on earth.

[2020 • Set 55-4-2]

Q32. The magnetic susceptibility of magnesium at $300\,\text{K}$ is 1.2×10^{-5}. At what temperature will its magnetic susceptibility become 1.44×10^{-5}?

OR

The magnetic susceptibility χ of a given material is -0.5. Identify the magnetic material.

[2019 • Set 55-2-1]

Q33. Write one important property of a paramagnetic material.

OR

Do the diamagnetic substances have resultant magnetic moment in an atom in the absence of external magnetic field?

[2019 • Set 55-5-1]

Q34. At a place, the horizontal component of earth's magnetic field is B and angle of dip is 60°.

What is the value of horizontal component of the earth's magnetic field at equator?

[2017]

Q35. In what way is the behaviour of a diamagnetic material different from that of a paramagnetic, when kept in an external magnetic field?

[2016]

Q36. What are permanent magnets? Give one example.

[2013]

Q37. The horizontal component of the earth's magnetic field at a place is B and angle of dip is $60°$. What is the value of vertical component of earth's magnetic field at equator?

[2012]

Q38. A magnetic needle, free to rotate in a vertical plane, orients itself vertically at a certain place on the Earth. What are the values of (i) horizontal component of Earth's magnetic field and (ii) angle of dip at this place?

[2012]

Q39. Where on the surface of Earth is the angle of dip $90°$?

[2011]

Q40. The permeability of a magnetic material is 0.9983. Name the type of magnetic materials it represents.

[2011 • Set 55-1-1]

Q41. Why should the material used for making permanent magnets have high coercivity?

[2007]

Q42. The vertical component of Earth's magnetic field at a place is $\sqrt{3}$ times the horizontal component. What is the value of angle of dip at this place?

[2006]

Q43. How does the (i) pole strength and (ii) magnetic moment of each part of a bar magnet change if it is cut into two equal pieces transverse to its length?

[2003]

2-Mark Questions (18 questions · Section B · VSA)

Q1. A small magnetised needle P is placed at the origin of x-y plane with its magnetic moment pointing along the y-axis. Another identical magnetised needle Q is placed in two positions, one by one. Case 1: at $(a, 0)$ with its magnetic moment pointing along x-axis. Case 2: at $(0, a)$ with its magnetic moment pointing along y-axis.

(a) In which case is the potential energy of P and Q minimum?

(b) In which case is P and Q not in equilibrium? Justify your answers.

[2023 • Set 55-4-1]

Q2. Answer the following giving reasons:

(a) Do the magnetic field lines also represent the 'lines of force' on a moving charged particle at every point?

(b) If magnetic monopoles existed, how would the Gauss's law of magnetism be modified?

[2023 • Set 55-4-2]

Q3. **(i)** The angle of dip at a location in southern India is about $18°$. Would you expect a greater or smaller dip angle in Britain? Justify your answer.

(ii) "The declination in India is small, it being $0°41'$ E at Delhi and $0°58'$ W at Mumbai." What is the significance of this statement?

[2021]

Q4. The magnetic moment of a circular coil carrying current I, having N turns, each of radius r, is M. Find the magnetic moment of the same coil if it is unwound and rewound into a coil having $2N$ turns for the same current.

[2021]

Q5. Two identical bars, one of paramagnetic material and other of diamagnetic material are kept in a uniform external magnetic field parallel to it. Draw diagrammatically the modifications in the magnetic field pattern in each case.

[2020 • Set 55-3-1]

Q6. Write two properties of a material suitable for making (a) a permanent magnet, and (b) an electromagnet.

[2017]

Q7. Out of the two magnetic materials, 'A' has relative permeability slightly greater than unity while 'B' has less than unity. Identify the nature of the materials 'A' and 'B'. Will their susceptibilities be positive or negative ?

[2014]

Q8. Show diagrammatically the behaviour of magnetic field lines in the presence of (i) paramagnetic and (ii) diamagnetic substances. How does one explain this distinguishing feature ?

[2014]

Q9. The susceptibility of a magnetic material is -2.6×10^{-5}. Identify the type of magnetic material and state its two properties.

[2012]

Q10. A short bar magnet of magnetic moment $0.9\,\text{J/T}$ is placed with its axis at 30° to a uniform magnetic field. It experiences a torque of $0.063\,\text{J}$.

(i) Calculate the magnitude of the magnetic field.

(ii) In which orientation will the bar magnet be in stable equilibrium in the magnetic field?

[2012]

Q11. A magnetic needle free to rotate in a vertical plane parallel to the magnetic meridian has its north tip down at 60° with the horizontal. The horizontal component of the earth's magnetic field at the place is known to be 0.4 G. Determine the magnitude of the earth's magnetic field at the place.

[2011 • Set 55-1-1]

Q12. Explain the following:

(i) Why do magnetic lines of force form continuous closed loops?

(ii) Why are the field lines repelled (expelled) when a diamagnetic material is placed in an external uniform magnetic field?

[2011 • Set 55-2-1]

Q13. **(i)** Name the three elements of the Earth's magnetic field.

(ii) Where on the surface of the Earth is the vertical component of the Earth's magnetic field zero?

[2011 • Set 55-2-1]

Q14. **(i)** Write two characteristics of a material used for making permanent magnets.

(ii) Why is core of an electromagnet made of ferromagnetic materials?

[2010]

Q15. Draw magnetic field lines when a (i) diamagnetic, (ii) paramagnetic substance is placed in an external magnetic field. Which magnetic property distinguishes this behaviour of the field lines due to the two substances?

[2010]

Q16. Define magnetic susceptibility of a material. Name two elements, one having positive susceptibility and the other having negative susceptibility. What does negative susceptibility

signify?

[2008]

Q17. Define the terms 'Magnetic Dip' and 'Magnetic Declination' with the help of relevant diagrams.

[2005]

Q18. Explain with the help of diagram the terms (i) magnetic declination and (ii) angle of dip at a given place.

[2004]

3-Mark Questions (15 questions · Section C · SA)

Q1. The magnetic moment (5 J/T) of a bar magnet points along a uniform magnetic field 0.4 T.

(a) Calculate (i) the potential energy of the bar magnet, and (ii) the work done in turning the magnet by $180°$.

(b) In which case is the potential energy of the magnet minimum?

[2025 • Set 55-5-3]

Q2. (a) A bar magnet of magnetic moment $2.5\,\text{JT}^{-1}$ lies aligned with the direction of a uniform magnetic field of $0.32\,\text{T}$. Find the amount of work done to turn the magnet so as to align its magnetic moment (i) normal to the field direction, and (ii) opposite to the field direction.

(b) What is the torque on the magnet in above cases (i) and (ii)?

[2024 • Set 55-1-2]

Q3. What are ferromagnetic materials? Explain ferromagnetism with the help of suitable diagrams, using the concept of magnetic domain.

[2024 • Set 55-4-1]

Q4. State Gauss's law for magnetism. Explain its significance.

[2019 • Set 55-1-1]

Q5. Write the four important properties of the magnetic field lines due to a bar magnet.

[2019 • Set 55-1-1]

Q6. Write three points of differences between para-, dia- and ferro-magnetic materials, giving one example for each.

[2019 • Set 55-1-1]

Q7. (a) Show that the time period (T) of oscillations of a freely suspended magnetic dipole of magnetic moment (m) in a uniform magnetic field (B) is given by $T = 2\pi\sqrt{\frac{I}{mB}}$, where I is a moment of inertia of the magnetic dipole.

(b) Identify the following magnetic materials: (i) A material having susceptibility $(\chi_m) = -0.00015$. (ii) A material having susceptibility $(\chi_m) = 10^{-5}$.

[2019 • Set 55-3-1]

Q8. Answer the following:

(a) Magnetic field lines can be entirely confined within the core of a toroid, but not within a straight solenoid. Why?

(b) Does a bar magnet exert a torque on itself due to its own field? Justify your answer.

(c) When an electron revolves around a nucleus, obtain the expression for the magnetic moment associated with it.

[2019 • Set 55-3-2]

Q9. Define the dipole moment of a magnetic dipole. Write its S.I. unit. Obtain the expression for the torque acting on a magnetic dipole placed in an external uniform magnetic field.

[2019 • Set 55-3-3]

Q10. A bar magnet of magnetic moment 6 J/T is aligned at $60°$ with a uniform external magnetic field of 0.44 T. Calculate (a) the work done in turning the magnet to align its magnetic moment (i) normal to the magnetic field, (ii) opposite to the magnetic field, and (b) the torque on the magnet in the final orientation in case (ii).

[2018]

Q11. (a) An iron ring of relative permeability μ_r has windings of insulated copper wire of n turns per metre. When the current in the windings is I, find the expression for the magnetic field in the ring.

(b) The susceptibility of a magnetic material is 0.9853. Identify the type of magnetic material. Draw the modification of the field pattern on keeping a piece of this material in a uniform magnetic field.

[2018]

Q12. (i) Mention two properties of soft iron due to which it is preferred for making an electromagnet.

(ii) State Gauss's law in magnetism. How is it different from Gauss's law in electrostatics and why?

OR

Derive an expression for the axial magnetic field of a finite solenoid of length $2l$ and radius r carrying current I. Under what condition does the field become equivalent to that produced by a bar magnet?

[2016]

Q13. In what way is Gauss's law in magnetism different from that used in electrostatics? Explain briefly. The Earth's magnetic field at the Equator is approximately 0.4 G. Estimate the Earth's magnetic dipole moment. Given: Radius of the Earth = 6400 km.

[2015]

Q14. What are permanent magnets? What is an efficient way of preparing a permanent magnet? Write two characteristic properties of materials which are required to select them for permanent magnets.

[2008]

Q15. Distinguish between diamagnetic and ferromagnetic materials in respect of their (i) intensity of magnetisation, (ii) behaviour in a non-uniform magnetic field and (iii) susceptibility.

[2003]

5-Mark Questions (2 questions · Section E · Long Answer)

Q1. Define the terms: 'magnetic field strength', 'magnetic flux density' and 'permeability' of a magnetic material. Write their SI units.

[2010]

Q2. Distinguish the magnetic properties of dia-, para- and ferro-magnetic substances in terms of (i) susceptibility, (ii) magnetic permeability and (iii) coercivity. Give one example of each of these materials. Draw the field lines due to an external magnetic field near a (i) diamagnetic, (ii) paramagnetic substance.

[2007]