CHAPTER-5

Magnetism and Matter

One mark questions:

1. How the name 'magnet' is derived?   (K)
2. Does magnetic mono pole exist? (K)
3. Is source of magnetic field analogue to the source of electric field? (U)
4. What is a magnetic dipole? (K)
5. Define magnetic dipole moment of a bar magnet.   (U)
6. Is magnetic dipole moment a vector or a scalar quantity?   (K)
7. What is the direction of dipole moment of a bar magnet?   (U)
8. What happens to the magnetic dipole moment of a bar magnet if it is cut into two pieces along its length? (K)
9. What happens when a bar magnet is suspended freely?   (K)
10. Is magnetic field a vector or a scalar quantity?   (K)
11. What are the magnetic field lines?   (U)
12. Is magnetic field lines form continuous closed loops. (K)
13. What happens when a magnetic needle is kept in a uniform magnetic field?   (K)
14. Write the expression for torque acting on a compass needle kept in a uniform magnetic field. (K)
15. Write the expression for torque acting on a compass needle in a uniform magnetic field in vector form. (U)
16. Mention the expression for the potential energy of a magnetic dipole in a uniform magnetic field. (K)
17. Write the expression for time period of oscillation of small magnetic needle in a uniform magnetic field. (K)
18. How does the time period of oscillation of small magnetic needle in a uniform magnetic field depends on its magnetic dipole moment? (U)
19. How does the time period of oscillations of small magnetic needle in a uniform magnetic field depends on the strength of the external magnetic field? (U)
20. How does the time period of oscillations of small magnetic needle in a uniform magnetic field depends on its moment of inertia? (U)
21. What happens to the time period of oscillation of a small magnetic needle if the strength of uniform magnetic field in which it is kept increases by four times? (A)
22. Does the time period of oscillations of small magnetic needle in a uniform magnetic field depend on temperature? (K)
23. Which parameter in magnetism is analogous to the permittivity in electrostatics of a dipole? (U)
24. State Gauss's law in magnetism.   (K)
25. Define magnetic meridian. (U)
26. Define geographic meridian.   (U)
27. Define magnetic declination. (U)
28. Define inclination or magnetic dip.   (U)

QUESTION BANK

29. What is the value of dip at the equator?   (K)
30. What is the value of magnetic dip at the poles?   (K)
31. If the value of horizontal component of the earth BH is equal to vertical component BV, then what is the value of dip at that place?   (U)
32. How does the value of magnetic inclination/dip vary from equator to the poles? (K)
33. How does the value of magnetic declination vary with the latitudes? (K)
34. How does the value of horizontal component of earth's magnetic field vary from equator to poles? (K)
35. Write the relation connecting the angle of dip, horizontal and vertical components of magnetic field of the earth at a place. (K)
36. Define magnetization of a magnetic material.   (U)
37. Mention the S.I unit of magnetization of a magnetic material.   (K)
38. Is magnetization of a magnetic material a scalar or a vector?   (K)
39. Is magnetic flux through a scalar or vector quantity?   (K)
40. How does the magnetization of a magnetic material vary with the magnetic intensity? (U)
41. Define magnetic susceptibility of a magnetic material. (U)
42. Mention the significance of magnetic susceptibility of a magnetic material. (K)
43. Define relative permeability of a material. (U)
44. How the relative permeability is related to its magnetic susceptibility? (U)
45. Give the relation between magnetic flux density B, magnetization of the material M and magnetic intensity H. (K)
46. Susceptibility of ferromagnetic substance is 3000. What is its relative permeability? (A)
47. What happens when diamagnetic material is placed in varying magnetic field? (U)
48. How does magnetic susceptibility of diamagnetic material depend on temperature? (U)
49. What does negative susceptibility signify in diamagnetic material? (U)
50. What is the net orbital magnetic moment of an atom of a diamagnetic material?   (U)
51. Which type of magnetic material has relative permeability greater than one?   (K)
52. For which material susceptibility low and negative?   (K)
53. What is Meissner effect?   (K)
54. What are paramagnetic materials? (K)
55. Give an example for paramagnetic material.   (K)
56. Mention any one property of paramagnetic material. (K)
57. Sketch neat diagram to represent the distribution of magnetic field lines through paramagnetic material when placed in a uniform magnetic field. (S)
58. How does magnetic susceptibility of paramagnetic material depend on temperature? (U)
59. For which material susceptibility is low and positive? (K)
60. State Curie's law in magnetism.   (K)
61. What is Curie temperature?   (K)
62. What happens to the property of a ferromagnetic substance when it is heated? (U)
63. How does the ferromagnetism change with temperature? (U)
64. Susceptibility of iron is more than that of aluminum. What is the inference of this statement?   (U)
65. Can susceptibility be positive and negative for the same material?   (K)

QUESTION BANK

66. What is magnetic hysteresis? (K)
67. What is hysteresis loss?   (K)
68. What is retentivity? (K)
69. What is coercivity?   (K)
70. What is coercive field?   (K)
71. What does the area under hysteresis curve represent?   **OR**   what is the significance of hysteresis loop? (U)
72. What are permanent magnets?   (K)
73. Why steel is preferred over soft iron for making permanent magnets?   (U)
74. Mention a material which is used for making permanent magnets. (K)
75. Why should the material used for making permanent magnets have high coercivity? (U)
76. Why electromagnets are made of soft iron?   (U)

Two mark questions:

1. Write any two properties of a bar magnet. (K)
2. Mention any two properties of magnetic field lines. (K)
3. Can two magnetic field lines intersect each other? Justify your answer. (U)
4. Explain a method to plot the magnetic field lines of a bar magnet.   (U)
5. When is the potential energy of a dipole in magnetic field (i) minimum (ii) maximum?   (K)
6. When is the torque acting on a magnetic needle/bar magnet/magnetic dipole in a uniform magnetic field (a) maximum and (b) minimum?   (K)
7. Write the expression for potential energy of a magnetic dipole in a uniform magnetic field and explain the terms. (K)
8. Write the expression for the time period of oscillation of small magnetic needle in a uniform magnetic field and explain the terms. (K)
9. State and explain Gauss's law in magnetism. (U)
10. Mention the two differences between Gauss law in magnetism and Gauss law in electrostatics. (U)
11. Write the latitude and longitude locations of earth's magnetic poles. (K)
12. Define magnetic declination and dip at a place. (U)
13. At what place on the earth the dip is (i) maximum and (ii) minimum? (K)
14. Define magnetization of a magnetic material. Mention its S.I unit   (U)
15. Define magnetic intensity. Give its S.I unit.   (U)
16. What is diamagnetism? Give an example of a diamagnetic material.   (K)
17. Mention any two properties of diamagnetic materials. (K)
18. Explain why diamagnetic materials are repelled by magnets?   (U)
19. Which are the two important properties required for a material to behave as superconductor? (U)
20. What is paramagnetism? Give an example of a paramagnetic material. (K)
21. Mention any two properties of paramagnetic materials.   (K)
22. Explain why paramagnetic substances are weakly magnetized in the direction of the magnetic field? (U)
23. State and explain Curie's law in magnetism. (K)
24. Draw the behavior of magnetic field lines near a (i) diamagnetic (ii) paramagnetic substance. (S)

25. What is ferromagnetism? Give an example of a ferro magnetic material. (K)
26. Mention any two properties of ferromagnetic materials. (K)
27. Why ferromagnetic substances magnetized easily and strongly? (U)
28. How does susceptibility of ferromagnetic vary with temperature? Explain. (U)
29. What is soft ferromagnetic material? Give an example. (K)
30. What is hard ferromagnetic material? Give an example. (K)
31. Draw the variation of magnetic field (B) with magnetic intensity (H) when ferromagnetic substance is subjected to a cycle of magnetization.   (S)
32. What are the salient features of a hysteresis curve? (U)
33. What is hysteresis curve? Mention the significance of hysteresis curve. (K)
34. Mention any two applications of hysteresis curve. (K)
35. What is a permanent magnet? Name the material used for making permanent magnet.   (K)
36. Paramagnetic and diamagnetic substances cannot be used for permanent magnets. Why? (U)
37. Which type materials are required for the manufacture of electromagnets? Give an example. (K)
38. Which material is used to make electromagnets and why? (U)
39. Steel is preferred for making permanent magnets whereas soft iron is preferred for making electromagnets. Why? (U)
40. What type of material is required for making permanent magnets? Give an example. (K)
41. The area of hysteresis curve of materials used in transformer cores and telephone diaphragms should be narrow. Why?   (U)
42. Give any two uses of permanent magnets.   (K)
43. Mention any two methods to destroy magnetism of a magnet.   (K)

Three mark questions:
1. Give any three properties of a bar magnet.   (K)
2. Mention any three properties of magnetic field lines. (K)
3. Sketch the magnetic field lines of (a) a bar magnet (b) a current carrying finite solenoid (c) an electric dipole. (S)
4. Arrive at the expression for magnetic potential energy of a dipole in a magnetic field. (U)
5. State and prove Gauss law in magnetism. (U)
6. What is 'dynamo effect' of earth? Explain. (U)
7. Name the elements of earth's magnetic field. (K)
8. Define the terms: (1) Declination, (2) Inclination or Dip and (3) Horizontal component of earth's magnetic field at a given place. (U)
9. Define the terms: (1) magnetization of a magnetic material, (2) magnetic intensity and (3) magnetic susceptibility. (U)
10. Define magnetic permeability and magnetic susceptibility. Write a relation between them. (U)
11. Obtain the relation between relative magnetic permeability magnetic susceptibility. (U)
12. Mention any three properties of diamagnetic material.   (K)
13. Explain the cause for the diamagnetic behavior of materials. (U)
14. Mention any three properties of paramagnetic material. (K)
15. Mention any three properties of ferromagnetic material. (K)

16. Mention any three differences between diamagnetic and paramagnetic materials. (U)
17. Mention any three differences between diamagnetic and ferromagnetic materials.   (U)
18. Mention any three differences between ferromagnetic and paramagnetic materials.   (U)
19. Explain magnetic hysteresis by drawing hysteresis loop. (S)
20. Write the applications of electromagnets. (K)
21. Mention the different methods to magnetize a given material.   (K)
22. Give the characteristics of magnetic materials used for making permanent magnets. (K)
23. The core of electromagnets is made of ferromagnetic material having high permeability and low retentivity. Explain why?   (U)

Five mark questions:

1. Which are the commonly known ideas regarding magnetism in nature till now?   (K)
2. Show that a current carrying solenoid is equivalent to a bar magnet. (U)
                    (Or)
3. Derive the expression for magnetic field at a point along the axis of a current carrying solenoid and hence show that a solenoid is equivalent to a bar magnet. (U)
4. Derive the expression for time period of oscillation of a dipole in a uniform magnetic field. [OR] Obtain an expression for time period of oscillation of small magnetic needle in a uniform magnetic field. (U)
5. Compare the electrostatic analogy of an electric dipole with a magnetic dipole in magnetism. (U)
6. Obtain the relation between magnetic susceptibility, magnetic permeability of a substance with permeability of free space. (U)

Numerical problems

1. Find the vertical component and the total magnetic field at a place where the horizontal component is 0.38×10^{-4}T and the angle of dip is 170. (A)   [0.12×10^{-4}T, 0.4×10^{-4}T]
2. A circular coil of radius 5×10^{-2}m and 20 turns carrying a current of 2A is placed perpendicular to a magnetic field of strength 2×10^{-3}T. The coil is free to turn about an axis in its plane perpendicular to the field direction. When the coil is slightly turned and released, it oscillates about its stable equilibrium with a frequency of $1.5s^{-1}$. Calculate the moment of inertia of the coil about its axis of rotation. (A)   [2.22×10^{-5}Kgm2]
3. A short bar magnet placed with its axis at 450 with a uniform external magnetic field of 3T experiences a torque of magnitude equal to 4.5×10^{-2}J. Find the magnitude of the magnetic moment of the magnet. (A)

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