PHYSICS

BOOKS - HC VERMA PHYSICS (HINGLISH)

MAGNETIC PROPERTIES OF MATTER

Examples

1. A bar magnet made of steel has a magnetic moment of $2.5Am^2$ and amass of $6.6 \times 10^{-5}kg$. If the density of steel is $7.9 \times 10^3 kgm^{-3}$, find the intensity of magnetization of the magnet.

Watch Video Solution

2. Find the magnetic intensity H at the centre of a long solenoid having n turns per unit length and carrying a current i (a) when no material is kept in it and (b) when a long copper rod is inserted in the solenoid.

Watch Video Solution

3. Find the per cent increase in the magnetic field B when the space within a current- carrying toroid is

filled with aluminiu. The susceptibility of aluminium is 2.1×10^{-5}.

A. 0.021

B. 0.000021

C. 0.00021

D. 2.1

Answer: C

Watch Video Solution

Worked Out Examples

1. A tightly-wound, long solenoid having 50 turns cm^{-1}, carris a current of $4.00A$. Find the magnetic intensity H and the magnetic field B at the centre of the solenoid. What will be the values of these quantities if an iron core is inserted in the solenoid and the magnetization I in the core is $4.00 \times 10^6 Am^{-1}$?

Watch Video Solution

2. A long, cylindrical iron core of cross-sectional area $5.00cm^2$ is inserted into a long solenoid having 2000 tunres m^{-1} and carrying a current $2.00A$. The

magnetic field inside the core is found to be $1.57T$. Neglecting the end effects, find the magnetization I of the core and the pole strength developed.

Watch Video Solution

3. An ideal solenoid having 40 turns cm^{-1} has an aluminium core and carries a current of $2.0A$. Calculate the magnetization $Ideveloped \in thec$ or e and $themag \neq ticfield$B $atthecentre. Thesusceptibility$chio$falu$ min ium= 2.3 xx 10^(-5)`.

Watch Video Solution

4. Find (a) the magnetization I, (b) the magnetic intensity H and © the magnetic field B at the centre of a bar magnet having pole strength 3.6 A m , $mag \neq tic \leq n > h$12cm

and $cross - \sec tionalare$0.90 cm^2`.

Watch Video Solution

5. The maxiumu value of the permeability of $\mu mn\eta l$ (77% Ni, 16% Fe, 5% Cu, 2% Cr) is $0.128TmA^{-1}$. Find the maxiumu relative permeability and susceptibiliyt.

Watch Video Solution

6. A toroid has a mean radius R equal to $\frac{20}{\pi}$ cm, and a total of 400 turns of wire carrying a current of $2.0A$. An aluminium ring at temperature $280K$ inside the toroid provides the core. (a) If the magnetization I is $4.8 \times 10^{-2} Am^{-1}$, find the susceptibility of aluminium at $280K$. (b) If the temperature of the aluminium ring is raised to $320K$, what will be the magnetization?

Watch Video Solution

Short Answer

1. When a dielectric is placed in an electric field, it gets polarized. The electric field in a polarized material is less than the applied field. When a paramagnetic substance is kept in a magnetic field, the field in the substance is more than the applied field. Explain the reason of this opposite behaviour.

Watch Video Solution

2. The property of diamagnetism is said to be present in all materials. Then, why are some materials paramagnetic or ferromagnetic?

Watch Video Solution

3. Do permeability and relative permeability have the same dimensions?

Watch Video Solution

4. A rod when suspended in a magnetic field stays in east-west direction. Can we be sure that the field is in the east-west direction? Can it be in the north-south direction?

Watch Video Solution

5. Why cannot we make permanent magnets from paramagnetic materials?

Watch Video Solution

6. Can we have magnetic hysterisis in paramagnetic or diamagnetic substances?

Watch Video Solution

7. When a ferromagnetic material goes through a hysteresis loop, its theremal energy is increased. Where does this energy come from?

Watch Video Solution

8. What are the advantagges of using soft iron as a core, instead of steel, in the coils of galvanometers?

Watch Video Solution

9. To keep valuable instruments away from the earth's magnetic field, they are enclosed in iron boxes. Explain.

Watch Video Solution

Objective 1

1. A paramagnetic material is placed in a magnetic field. Consider the following statements : (A) If the magnetic field is increased, the magnetization is increased. (B) If the temperature is increased, the increased the magnetization is increased.

A. Both A and B are ture

B. A is true but B is false

C. B is true but A is false

D. Both A and B are false.

Answer: B

Watch Video Solution

2. A paramagnetic material is kept in a magnetic field. The field is increased till the magnetization becomes constant. If the temperature is now decreased, the magnetization.

A. will increase

B. decrease

C. remain constant

D. may increase or decrease

Answer:

Watch Video Solution

3. A ferromagnetic material is placed in an external magnetic field. The magnetic domains

A. increase in size

B. decrease in size

C. may increase or decrease in size

D. have no relation with the field.

Answer: C

Watch Video Solution

4. A long, straight wire carries a current i. The magnetizing field intensity H is measured at a point P close to the wire. A long, cylindrical iron rod is brought close to the wire so that the point P is at the centre of the rod. The value of H at P will

A. increase many times

B. decrease many times

C. remain almost constant

D. become zero

Answer: C

Watch Video Solution

5. The magnetic susceptibility is negative for

A. paramagnetic materials only

B. diamagnetic materials only

C. ferromagnetic materials only

D. paramagnetic and ferromagnetic materials.

Answer: B

Watch Video Solution

6. The desirable properties for making permanent magnets are

A. high retentivity and high coercive force

B. high retentivity and low coercive force

C. low retentivity and high coercive force

D. low retentivity and low coercive force.

Answer: A

 Watch Video Solution

7. Electromagnets are made of soft iron because soft iron has

A. high retentivity and high coercive force

B. high retentivity and low coercive force

C. high retentivity and high coercive force

D. low retentivity and low coercive force.

Answer: D

Watch Video Solution

Objective 2

1. Pick the correct option

A. All electrons have magnetic moment

B. All protons have magnetic moment

C. All nuclei have magnetic moment.

D. All atoms have magnetic moment.

Answer: A::B

Watch Video Solution

2. The permanent magnetic moment of the atoms of a material is not zero. The material

A. must be paramagnetic

B. must be diamagnetic

C. must be ferromagnetic

D. may be paramagnetic

Answer: D

Watch Video Solution

3. The permanent magnetic moment of the atoms of a material is zero. The material

A. must be paramagnetic

B. must be diamagnetic

C. must be ferromagnetic

D. may be paramagnetic

Answer: B

Watch Video Solution

4. Which of the following pairs has quantities of the same dimensions?

A. Magnetic field B and magnetizing field intensity H

B. Magnetic field B and intensity of magnetization I

C. Magnetizing field intensity H and intensity of magnetization I

D. Longitudinal strain and magnetic susceptibility

Answer: C::D

Watch Video Solution

5. When a ferromagnetic material goes through a hysteresis loop, the magnetic susceptibility

A. has a fixed value

B. may be zero

C. may be infinity

D. may be negative

Answer: B::C::D

Watch Video Solution

6. Mark out the correct options.

A. Diamagnetism occurs in all materials

B. Diamagnetism results from the partial alignment of permanent magnetic moment.

C. The magnetizing field intensity H is always zero in free space.

D. The magnetic field of induced magnetic moment is opposite to the applied fied.

Answer: A::D

Watch Video Solution

Exercises

1. The magnetic intensity H at the centre of a long solenoid carrying a current of $2.0A$, is found to be

$1500 Am^{-1}$. Find the number of turns per centimetre of the solenoid.

Watch Video Solution

2. A rod is inserted as the core in the current-carrying solenoid of the previous problem. (a) What is the magnetic intensity H at the centre? (b) If the magnetization I of the core is found to be $0.12 Am^{-1}$, find the susceptibility of the material of the rod. (c) Is the material paramagnetic, diamagnetic or ferromagnetic?

Watch Video Solution

3. The magnetic field inside a long solenoid having 50 turns cm^{-1} is increased from $2.5 \times 10^{-3}T$ to $2.5T$ when an iron core of cross-sectional area $4cm^2$ is inserted into it. Find $(a)thecurrent \in theso \leq noid, (b)themag \neq tization$ I` of the core and (c) the pole strength developed in the core.

Watch Video Solution

4. A bar magnet of length $1cm$ and cross-sectonal area $1.0cm^2$ produces a magnetic field of $1.5 \times 10^{-4}T$ at a point in end-on position at a

distance 15cm away from the centre. (a) Find the magnetic moment M of the magnet. (b) Find the magnetization I of the magnet. (c) Find the magnetic field B at the centre of the magnet.

Watch Video Solution

5. The susceptibility of annealed iron at saturation is 5500. Find the permeability of annealed iron at saturation.

Watch Video Solution

6. The magnetic field B and the magnetic intensity H in a material are found to be $1.6T$ and $1000Am^{-1}$ respectively. Calculate the relative permeability μ, and the susceptibiliyt χ of the material.

Watch Video Solution

7. The susceptibility of magnesium at $300K$ is 1.2×10^{-5}. At what temperature will the susceptibility increase to 1.8×10^{-5}?

A. $200K$

B. $250K$

C. $400K$

D. $150K$

Answer: A

Watch Video Solution

8. Assume that each iron atom has a permaanent magnetic moment equal to 2 Bohr magnetons $\left(1Bohrmag \neq \ \rightarrow nequals9.27 \times 10^{-24} Am^2\right)$. The density of atoms in iron is $8.52 \times 10^{28} a \rightarrow msm^{-3}$. (a) Find the maximum magnetization I in a long cylinder of iron. (b) Find the maximum magnetic field B on the axis inside the cylinder.

Watch Video Solution

9. The coercive force for a certain prmanent magnet is $4.0 \times 10^4 Am^{-1}$. This magnet is placed inside a long solenoid of 40 turns/cm and a current is passed in the solenoid to demagnetize it completely. Find the current.

Watch Video Solution