



PHYSICS

NCERT - FULL MARKS PHYSICS(TAMIL)

MAGNETISM AND MATTER

Example

1. A magnetic needle has magnetic moment of $6 \cdot 7 \times 10^{-2} Am^2$ and moment of inertial of $7 \cdot 5 \times 10^{-6} kgm^2$. It perform 10 complete

oscillations in $6 \cdot 70s$. What is the magnitude of the magnetic field?



[Watch Video Solution](#)

2. A short bar magnet placed with its axis at 30° with an external field of 800 G experiences a torque of 0.016 Nm .

a. What is the magnetic moment of the magnet ?

b. What is the work done in moving it from its most stable to most unstable position ?

c. The bar magnet is replaced by a solenoid of cross - sectional area $2 \times 10^{-4} m^2$ and 1000 turns, but of the same magnetic moment . Determine the current flowing through the solenoid.



[Watch Video Solution](#)

3. (a) What happens if a bar magnet is cut into two pieces (i) transverse to its length (ii) along its length?

(b) What happens if an iron bar magnet is

melted? Does it retain its magnetism?

(c) A magnetised needle in a uniform magnetic field experiences a torque but no net force. However, an iron nail near a bar magnet experiences a force of attraction in addition to a torque, explain.

(d) Must every magnetic field configuration have a north pole and a south pole? What about the field due to a toroid?

(e) Can you think of magnetic field configuration with three poles?

(f) Two identical looking iron bars A and B are given, one of which is definitely known to be

magnetised. How would one ascertain whether or not both are magnetised? If only one is magnetised how does one ascertain which one? Use nothing else but the bars A and B.



[Watch Video Solution](#)

4. What is the magnitude of the equatorial and axial fields due to a bar magnet of length 5.0cm at a distance of 50cm from its midpoint? The magnetic moment of the bar magnet is 0.40Am^2 .

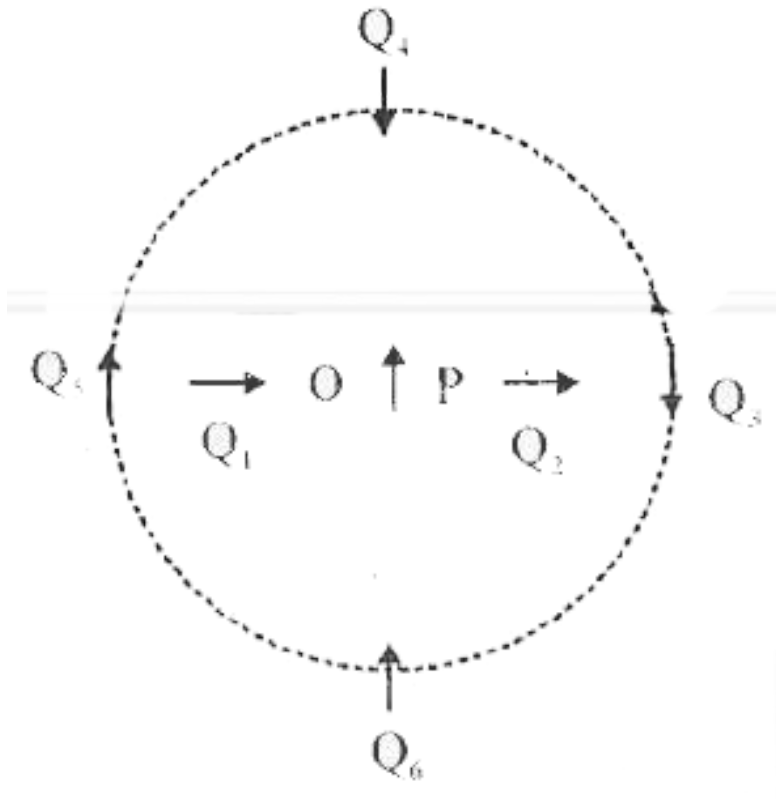


5. Figure shows a small magnetised needle P placed at a point O. the arrow the direction of its magnetic moment. The other arrows show different positions (and orientations of the magnetic moment) of another identical magnetised needle Q.

a. In which configuration the system is not in equilibrium ?

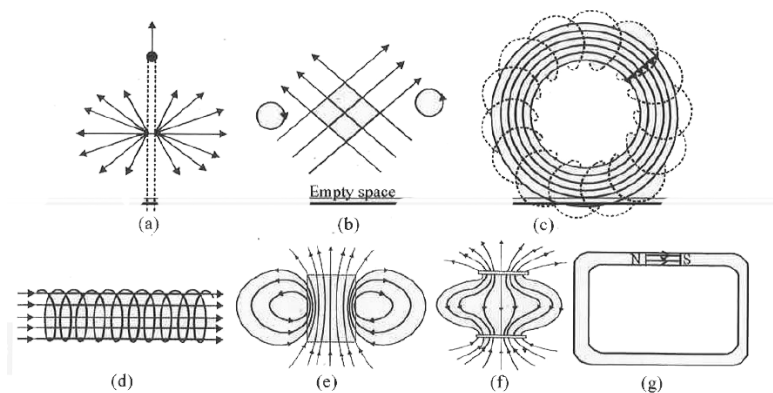
b. In which configuration is the system in (i) stable, and (ii) unstable equilibrium ?

c. Which configuration corresponds to the lowest potential energy among all the configuration shown ?



[Watch Video Solution](#)

6. Many of the diagrams given in figure show magnetic field lines (thick lines in the figure) wrongly. Point out what is wrong with them . Some of them may describe electrostatic field lines correctly. Point out which ones.



Watch Video Solution

7. a. Magnetic field lines show the direction (at every point) along which a small magnetised needle aligns (at the point) Do the magnetic field also represent the lines of force on a moving charged particle at every point ?

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

c. If magnetic monopoles existed, how would the Gauss ' law of magnetism be modified ?

d. Does a bar magnet exert a torque on itself due to its own field ? Does one element of a

current - carrying wire exert a force on another element of the same wire ?

e.Magnetic field arises due to charges in motion . Can a system have magnetic moments eventhough its charge is zero ?



[Watch Video Solution](#)

8. The earth's magnetic field at the equator is approximately $0.4G$, Estimate the earth's dipole moment.



[Watch Video Solution](#)

9. In the magnetic meridian of a certain place, the horizontal component of the earth's magnetic field is $0.26G$ and dip angle is 60° . What is the magnetic field of earth at this location?



Watch Video Solution

10. A solenoid a core of a material with relative permeability 400. The windings of the solenoid are insulated from the core and carry

a current of 2A. If the number of turns is 1000 per metre, calculate (a) H, (b) B and (c) the magnetising current I_m .



[Watch Video Solution](#)

11. A domain in ferromagnetic iron is in the form of a cube of side length $10^{-4}m$. Estimate the number of iron atoms in the domain and the maximum possible dipole moment and magnetisation of the domain. The molecular mass of iron is $55g/mole$, and its density is

7.9 g/cm^3 . Assume that each iron atom has a dipole moment of $9.27 \times 10^{-24} \text{ Am}^2$.



[Watch Video Solution](#)

Exercises

1. Answer the following questions regarding earth's magnetism.
 - a. A vector needs three quantities conventionally used to specify the earth's magnetic field.

b. The angle of dip at a location in southern India is about 18° . Would you expect a greater or smaller dip angle in Britain ?

c. If you made a map of magnetic field lines at Melbourne in Australia, would the lines seem to go into the ground or come out of the ground ?

d. In which direction would a compass free to move in the vertical plane point to, if located right on the geomagnetic north or south pole ?

e. the earth's field, it is claimed roughly approximates the field due to a dipole of

magnetic moment $8 \times 10^{22} \text{ JT}^{-1}$ located at its centre. Check the order of magnitude of this number in some way.

f. Geologists claim that besides the main magnetic N - S poles, there are several local poles on the earth's surface oriented in different directions. How is such a thing possible at all ?



Watch Video Solution

2. The angle of dip at a location in southern India is about 18° . Would you expect a greater or lesser dip angle in Britain?



[Watch Video Solution](#)

3. Answer the following questions regarding earth's magnetism.

a. A vector needs three quantities conventionally used to specify the earth's magnetic field.

b. The angle of dip at a location in southern India is about 18° . Would you expect a greater or smaller dip angle in Britain ?

c. If you made a map of magnetic field lines at Melbourne in Australia, would the lines seem to go into the ground or come out of the ground ?

d. In which direction would a compass free to move in the vertical plane point to, if located right on the geomagnetic north or south pole ?

e. the earth's field, it is claimed roughly approximates the field due to a dipole of

magnetic moment $8 \times 10^{22} \text{ JT}^{-1}$ located at its centre. Check the order of magnitude of this number in some way.

f. Geologists claim that besides the main magnetic N - S poles, there are several local poles on the earth's surface oriented in different directions. How is such a thing possible at all ?



Watch Video Solution

4. Answer the following questions regarding earth's magnetism.

a. A vector needs three quantities conventionally used to specify the earth's magnetic field.

b. The angle of dip at a location in southern India is about 18° . Would you expect a greater or smaller dip angle in Britain ?

c. If you made a map of magnetic field lines at Melbourne in Australia, would the lines seem to go into the ground or come out of the ground ?

d. In which direction would a compass free to move in the vertical plane point to, if located right on the geomagnetic north or south pole?

e. The earth's field, it is claimed, roughly approximates the field due to a dipole of magnetic moment $8 \times 10^{22} \text{ JT}^{-1}$ located at its centre. Check the order of magnitude of this number in some way.

f. Geologists claim that besides the main magnetic N - S poles, there are several local poles on the earth's surface oriented in

different directions. How is such a thing possible at all ?



[Watch Video Solution](#)

5. The earth's field, it is claimed, roughly approximates the field due to a dipole of magnetic moment $8 \times 10^{22} \text{ JT}^{-1}$ located at its centre. Check the order of magnitude of this number in some way.



[Watch Video Solution](#)

6. Answer the following questions regarding earth's magnetism.

a. A vector needs three quantities conventionally used to specify the earth's magnetic field.

b. The angle of dip at a location in southern India is about 18° . Would you expect a greater or smaller dip angle in Britain ?

c. If you made a map of magnetic field lines at Melbourne in Australia, would the lines seem to go into the ground or come out of the ground ?

d. In which direction would a compass free to move in the vertical plane point to, if located right on the geomagnetic north or south pole?

e. The earth's field, it is claimed, roughly approximates the field due to a dipole of magnetic moment $8 \times 10^{22} \text{ JT}^{-1}$ located at its centre. Check the order of magnitude of this number in some way.

f. Geologists claim that besides the main magnetic N - S poles, there are several local poles on the earth's surface oriented in

different directions. How is such a thing possible at all ?



Watch Video Solution

7. Answer the following questions .

a. The earth's magnetic field varies from point to point in space. Does it also change with time ? If so , on what time scale does it change appreciably ?

b. The earth's core is known to contain iron. Yet geologists do not regard this as a source

of the earth's magnetism why ?

c. The charged currents in the outer conducting regions of the earth's core are thought to be responsible for earth's magnetism . What might be the ' battery ' (i.e., the source of energy) to sustain these currents ?

d. The earth may have even reversed the direction of its field several times during its history of 4 to 5 billion years. How can geologists know about the earth's field in such distant past ?

e. The earth's field departs from its dipole

substantially at large distances (greater than about 30,000 km) what agencies may be responsible for this distortion ?

f. Interstellar space has an extremely weak magnetic field of the order of 10^{-12} T, Can such a weak field be of any significant consequence ? Explain.

[Note : Exercise 2 is meant mainly to arouse your curiosity . Answers to some question above are tentative or unknown . Brief answers wherever possible are given at the end . For details , you should consult a good text on geomagnetism.]



Watch Video Solution

8. Answer the following questions .

a. The earth's magnetic field varies from point to point in space. Does it also change with time ? If so , on what time scale does it change appreciably ?

b. The earth's core is known to contain iron. Yet geologists do not regard this as a source of the earth's magnetism why ?

c. The charged currents in the outer conducting regions of the earth's core are

thought to be responsible for earth's magnetism . What might be the ' battery ' (i.e., the source of energy) to sustain these currents ?

d. The earth may have even reversed the direction of its field several times during its history of 4 to 5 billion years. How can geologists know about the earth's field in such distant past ?

e. The earth's field departs from its dipole substantially at large distances (greater than about 30,000 km) what agencies may be responsible for this distortion ?

f. Interstellar space has an extremely weak magnetic field of the order of 10^{-12} T, Can such a weak field be of any significant consequence ? Explain.

[Note : Exercise 2 is meant mainly to arouse your curiosity . Answers to some question above are tentative or unknown . Brief answers wherever possible are given at the end . For details , you should consult a good text on geomagnetism.]



Watch Video Solution

9. Answer the following questions .

a. The earth's magnetic field varies from point to point in space. Does it also change with time ? If so , on what time scale does it change appreciably ?

b. The earth's core is known to contain iron. Yet geologists do not regard this as a source of the earth's magnetism why ?

c. The charged currents in the outer conducting regions of the earth's core are thought to be responsible for earth's magnetism . What might be the ' battery ' (i.e., the source of energy) to sustain these

currents ?

d. The earth may have even reversed the direction of its field several times during its history of 4 to 5 billion years. How can geologists know about the earth's field in such distant past ?

e. The earth's field departs from its dipole substantially at large distances (greater than about 30,000 km) what agencies may be responsible for this distortion ?

f. Interstellar space has an extremely weak magnetic field of the order of 10^{-12} T, Can such a weak field be of any significant

consequence ? Explain.

[Note : Exercise 2 is meant mainly to arouse your curiosity . Answers to some question above are tentative or unknown . Brief answers wherever possible are given at the end . For details , you should consult a good text on geomagnetism.]



[Watch Video Solution](#)

10. Answer the following questions .

a. The earth's magnetic field varies from point

is space. Does it also change with time ? It so ,
on what time scale does it change appreciably
?

b. The earth's core is known to contain iron.
Yet geologists do not regard this as a source
of the earth's magnetism why ?

c. The charged currents in the outer
conducting regions of the earth's core are
thought to be responsible for earth's
magnetism . What might be the ' battery ' (i.e.,
the source of energy) to sustain these
currents ?

d. The earth may have even reversed the

direction of its field several times during its history of 4 to 5 billion years. How can geologists know about the earth's field in such distant past ?

e. The earth's field departs from its dipole substantially at large distances (greater than about 30,000 km) what agencies may be responsible for this distortion ?

f. Interstellar space has an extremely weak magnetic field of the order of 10^{-12} T, Can such a weak field be of any significant consequence ? Explain.

[Note : Exercise 2 is meant mainly to arouse

your curiosity . Answers to some question above are tentative or unknown . Brief answers wherever possible are given at the end . For details , you should consult a good text on geomagnetism.]



[Watch Video Solution](#)

11. The earth's field departs from its dipole shape substantially at large distance (greater than about 3000 km). The responsible factor for this distortion is



12. Answer the following questions .

a. The earth's magnetic field varies from point to point in space. Does it also change with time ? If so , on what time scale does it change appreciably ?

b. The earth's core is known to contain iron. Yet geologists do not regard this as a source of the earth's magnetism why ?

c. The charged currents in the outer conducting regions of the earth's core are

thought to be responsible for earth's magnetism . What might be the ' battery ' (i.e., the source of energy) to sustain these currents ?

d. The earth may have even reversed the direction of its field several times during its history of 4 to 5 billion years. How can geologists know about the earth's field in such distant past ?

e. The earth's field departs from its dipole substantially at large distances (greater than about 30,000 km) what agencies may be responsible for this distortion ?

f. Interstellar space has an extremely weak magnetic field of the order of 10^{-12} T, Can such a weak field be of any significant consequence ? Explain.

[Note : Exercise 2 is meant mainly to arouse your curiosity . Answers to some question above are tentative or unknown . Brief answers wherever possible are given at the end . For details , you should consult a good text on geomagnetism.]



Watch Video Solution

13. A short bar magnet placed with its axis at 30° with a uniform external magnetic field of $0.25T$ experiences a torque of magnitude equal to $4.5 \times 10^{-2}J$. What is the magnitude of magnetic moment of the magnet?



Watch Video Solution

14. A short bar magnet of moment $0.32JT^{-1}$ is placed in a uniform external magnetic field of $0.15T$, if the bar is free to rotate in the

plane of the field, which orientations would correspond to its, (i) stable and (ii) unstable equilibrium? What is the potential energy of the magnet in each case?



[Watch Video Solution](#)

15. A closely wound solenoid of 800 turns and area of cross section $2 \cdot 5 \times 10^{-4} m^2$ carries a current of $3 \cdot 0 A$. Explain the sense in which the solenoid acts like a bar magnet. What is its associated magnetic moment?



[Watch Video Solution](#)

16. If the solenoid in the above question is free to turn about the vertical direction, and a uniform horizontal magnetic field of $0.25T$ is applied, what is the magnitude of the torque on the solenoid when its axis makes an angle of 30° with the direction of the applied field?



[Watch Video Solution](#)

17. A bar magnet of magnetic moment $1.5JT^{-1}$ lies aligned with the direction of a uniform magnetic field of $0.22T$.

(a) What is the amount of work done to turn the magnet so as to align its magnetic moment

(i) normal to the field direction, (ii) opposite to the field direction?

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



Watch Video Solution

18. A closely wound solenoid of 2000 turns and area of cross section $1.6 \times 10^{-4} \text{m}^2$, carrying a current of 4amp . is suspended through its centre allowing it to turn in a horizontal plane:

(a) What is the magnetic moment associated with the solenoid?

(b) What are the force and torque on the solenoid if a uniform horizontal magnetic field of $7.5 \times 10^{-2} \text{T}$ is set up at an angle of 30° with the axis of the solenoid?



Watch Video Solution

19. A circular coil of 16 turns and radius 10cm carrying a current of 0.75A rests with its plane normal to an external field of magnitude $5.0 \times 10^{-2}T$. The coil is free to turn about an axis in its plane perpendicular to the field direction. When the coil is turned slightly and released, it oscillates about its stable equilibrium with a frequency of $2.0s^{-1}$. What is the moment of inertia of the coil about its axis of rotation?



Watch Video Solution

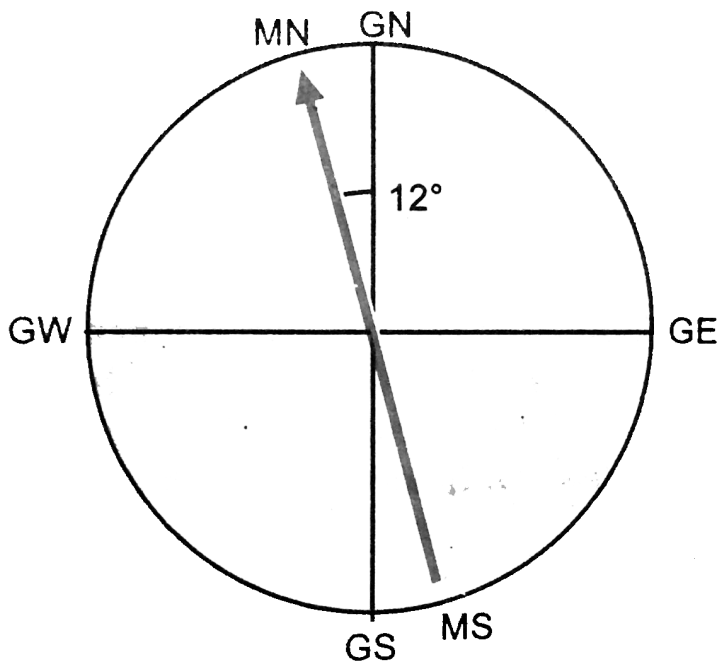
20. A magnetic needle free to rotate in a vertical plane parallel to the magnetic meridian has its north tip pointing down at 22° with the horizontal . The horizontal component of the earth's magnetic field at the place is known to be 0.35 G . Determine the magnitude of the earth's magnetic field at the place.



[Watch Video Solution](#)

21. At a certain location in Africa, compass points 12° west of geographic north, figure. The north tip of magnetic needle of a dip circle placed in the plane of magnetic meridian points 60° above the horizontal. The horizontal component of earth's field is measured to be 0.16gauss . Specify the direction and magnitude of the earth's field at

the location.



[Watch Video Solution](#)

22. A short bar magnet has a magnetic moment of $0.48JT^{-1}$. Give the direction and

magnitude of the magnetic field produced by the magnet at a distance of 10cm from the centre of the magnet on (i) the axis (ii) the equatorial line (normal bisector) of the magnet.



[Watch Video Solution](#)

23. A short bar magnet placed in a horizontal plane has its axis aligned along the magnetic north south direction. Null points are found on the axis of the magnet at 14cm from the

centre of the magnet. The earth's magnetic field at the plane is $0.36G$ and the angle of dip is zero. What is the total magnetic field on the normal bisector of the magnet at the same distance as the null points (i.e. 14 cm) from the centre of the magnet? (At null points, field due to a magnet is equal and opposite to the horizontal component of earth's magnetic field).



Watch Video Solution

24. If the bar magnet in the above problem is turned around by 180° , where will the new null points be located?



Watch Video Solution

25. A short bar magnet of magnetic moment $5 \cdot 25 \times 10^{-2} \text{ JT}^{-1}$ is placed with its axis perpendicular to earth's field direction. At what distance from the centre of the magnet, is the resultant field inclined at 45° with

earth's field on (i) its normal bisector, (ii) its axis? Magnitude of earth's field at the place $0.42G$. Ignore the length of the magnet in comparison to the distances involved.



[Watch Video Solution](#)

Additional Exercises

1. Answer the following questions .

a. Why does a paramagnetic sample display greater magnetisation (for the same

magnetising field) when cooled ?

b. Why is diamagnetism , in contrast , almost independent of temperature ?

c. If a toroid uses bismuth for its core, will the the field in the core be (slightly) greater or (slightly) less than when the core is empty ?

d. Is the permeability of a ferromagnetic material independent of the magnetic field ? If not, is it more for lower or higher fields ?

e. Magnetic field lines are always nearly normal to the surface of ferromagnet at every point .

(This fact is analogous to the static electric field lines being normal to the surface of

conductor at every point). Why ?

f. Would the maximum possible magnetisation of paramagnetic sample be of the same order of magnitude as the magnetisation of ferromagnet ?



[Watch Video Solution](#)

2. Answer the following questions .

a. Why does a paramagnetic sample display greater magnetisation (for the same magnetising field) when cooled ?

b. Why is diamagnetism , in contrast , almost independent of temperature ?

c. If a toroid uses bismuth for its core, will the the field in the core be (slightly) greater or (slightly) less than when the core is empty ?

d. Is the permeability of a ferromagnetic material independent of the magnetic field ? If not, is it more for lower or higher fields ?

e. Magnetic field lines are always nearly normal to the surface of ferromagnet at every point .

(This fact is analogous to the static electric field lines being normal to the surface of conductor at every point). Why ?

f. Would the maximum possible magnetisation of paramagnetic sample be of the same order of magnitude as the magnetisation of ferromagnet ?



[Watch Video Solution](#)

3. Answer the following questions .

a. Why does a paramagnetic sample display greater magnetisation (for the same magnetising field) when cooled ?

b. Why is diamagnetism , in contrast , almost

independent of temperature ?

c. If a toroid uses bismuth for its core, will the the field in the core be (slightly) greater or (slightly) less than when the core is empty ?

d. Is the permeability of a ferromagnetic material independent of the magnetic field ? If not, is it more for lower or higher fields ?

e. Magnetic field lines are always nearly normal to the surface of ferromagnet at every point .

(This fact is analogous to the static electric field lines being normal to the surface of conductor at every point). Why ?

f. Would the maximum possible magnetisation

of paramagnetic sample be of the same order of magnitude as the magnetisation of ferromagnet ?



[Watch Video Solution](#)

4. Answer the following questions .

- a. Why does a paramagnetic sample display greater magnetisation (for the same magnetising field) when cooled ?
- b. Why is diamagnetism , in contrast , almost independent of temperature ?

c. If a toroid uses bismuth for its core, will the the field in the core be (slightly) greater or (slightly) less than when the core is empty ?

d. Is the permeability of a ferromagnetic material independent of the magnetic field ? If not, is it more for lower or higher fields ?

e. Magnetic field lines are always nearly normal to the surface of ferreomgnet at every point .

(This fact is analogous to the static electric field lines being normal to the surface of conductor at every point). Why ?

f. Would the maximum possible magnetisation of paramagnetic sample be of the same order

of magnitude as the magnetisation of ferromagnet ?



[Watch Video Solution](#)

5. Answer the following questions .

- a. Why does a paramagnetic sample display greater magnetisation (for the same magnetising field) when cooled ?
- b. Why is diamagnetism , in contrast , almost independent of temperature ?
- c. If a toroid uses bismuth for its core, will the

the field in the core be (slightly) greater or (slightly) less than when the core is empty ?

d. Is the permeability of a ferromagnetic material independent of the magnetic field ? If not, is it more for lower or higher fields ?

e. Magnetic field lines are always nearly normal to the surface of ferromagnet at every point .

(This fact is analogous to the static electric field lines being normal to the surface of conductor at every point). Why ?

f. Would the maximum possible magnetisation of paramagnetic sample be of the same order

of magnitude as the magnetisation of ferromagnet ?



[Watch Video Solution](#)

6. Answer the following questions .

- a. Why does a paramagnetic sample display greater magnetisation (for the same magnetising field) when cooled ?
- b. Why is diamagnetism , in contrast , almost independent of temperature ?
- c. If a toroid uses bismuth for its core, will the

the field in the core be (slightly) greater or (slightly) less than when the core is empty ?

d. Is the permeability of a ferromagnetic material independent of the magnetic field ? If not, is it more for lower or higher fields ?

e. Magnetic field lines are always nearly normal to the surface of ferromagnet at every point .

(This fact is analogous to the static electric field lines being normal to the surface of conductor at every point). Why ?

f. Would the maximum possible magnetisation of paramagnetic sample be of the same order

of magnitude as the magnetisation of ferromagnet ?



[Watch Video Solution](#)

7. Answer the following questions

a. Explain qualitatively on the basis of domain picture the irreversibility in the magnetisation curve of a ferromagnet.

b. The hysteresis loop of soft iron piece has a much smaller area than that of a carbon steel piece. If the material is to go through

repeated cycles of magnetisation , which piece will dissipate greater heat energy ?

c. 'A system displaying a hysteresis loop such as a ferromagnet , is a device for storing memory ? ' Explain the meaning of this statement.

d. What kind of ferromagnetic material is used for coating magnetic tapes in a cassette player , or for building ' memory stores ' in a modern computer ?

e. A certain region of space is to be shielded from magnetic fields . Suggest a method.



Watch Video Solution

8. Answer the following questions

a. Explain qualitatively on the basis of domain picture the irreversibility in the magnetisation curve of a ferromagnet.

b. The hysteresis loop of soft iron piece has a much smaller area than that of a carbon steel piece. If the material is to go through repeated cycles of magnetisation, which piece will dissipate greater heat energy?

c. 'A system displaying a hysteresis loop such as a ferromagnet, is a device for storing

memory ? ' Explain the meaning of this statement.

d. What kind of ferromagnetic material is used for coating magnetic tapes in a cassette player , or for building ' memory stores ' in a modern computer ?

e. A certain region of space is to be shielded from magnetic fields . Suggest a method.



Watch Video Solution

9. Answer the following questions

a. Explain qualitatively on the basis of domain picture the irreversibility in the magnetisation curve of a ferromagnet.

b. The hysteresis loop of soft iron piece has a much smaller area than that of a carbon steel piece. If the material is to go through repeated cycles of magnetisation, which piece will dissipate greater heat energy?

c. 'A system displaying a hysteresis loop such as a ferromagnet, is a device for storing memory?' Explain the meaning of this

statement.

d. What kind of ferromagnetic material is used for coating magnetic tapes in a cassette player , or for building ' memory stores ' in a modern computer ?

e. A certain region of space is to be shielded from magnetic fields . Suggest a method.



[Watch Video Solution](#)

10. Answer the following questions

a. Explain qualitatively on the basis of domain

picture the irreversibility in the magnetisation curve of a ferromagnet.

b. The hysteresis loop of soft iron piece has a much smaller area than that of a carbon steel piece. If the material is to go through repeated cycles of magnetisation , which piece will dissipate greater heat energy ?

c. 'A system displaying a hysteresis loop such as a ferromagnet , is a device for storing memory ? ' Explain the meaning of this statement.

d. What kind of ferromagnetic material is used for coating magnetic tapes in a cassette player

, or for building ' memory stores ' in a modern computer ?

e. A certain region of space is to be shielded from magnetic fields . Suggest a method.



[Watch Video Solution](#)

11. Answer the following questions

a. Explain qualitatively on the basis of domain picture the irreversibility in the magnetisation curve of a ferromagnet.

b. The hysteresis loop of soft iron piece has a

much smaller area than that of a carbon steel piece. If the material is to go through repeated cycles of magnetisation, which piece will dissipate greater heat energy?

c. 'A system displaying a hysteresis loop such as a ferromagnet, is a device for storing memory?' Explain the meaning of this statement.

d. What kind of ferromagnetic material is used for coating magnetic tapes in a cassette player, or for building 'memory stores' in a modern computer?

e. A certain region of space is to be shielded from magnetic fields . Suggest a method.



Watch Video Solution

12. A long straight horizontal cable carries a current of 2.5 A in the direction 10° north of east . The magnetic meridian of the place happens to be 10° west of the geographic meridian The earth's magnetic field at the location is 0.33 G , and the angle of dip is zero. Locate the line of neutral points (ignore the

thickness of the cable) (At neutral points , magnetic field due to a current - carrying cable is equal and opposite to the horizontal component of earth's magnetic field).



[Watch Video Solution](#)

13. A telephonic cable at a place has four long straight horizontal wires carrying a current of 1.0amp . in the same direction east to west. The earth's magnetic field at the place is $0.39G$ and the angle of dip is 35° . The

magnetic declination is almost zero. What are the resultant magnetic fields at points 4.0cm below and above the cable?



[Watch Video Solution](#)

14. A compass needle free to turn in a horizontal plane is placed at the centre of a circular coil of 30 turns and radius 12 cm. The coil is in a vertical plane making an angle of 45° with the magnetic meridian when the current in the coil is 0.35amp. , the needle

points west to east.

(a) Determine the horizontal component of earth's magnetic field at the location.

(b) The current in the coil is reversed and the coil is rotated about its vertical axis by an angle of 90° in the anticlockwise sense looking from above. Predict the direction of the needle. Take the magnetic declination at the places to be zero.



[Watch Video Solution](#)

15. A magnetic dipole is under the influence of two magnetic fields. The angle between the two field directions is 60° and one of the fields has a magnitude of $1.2 \times 10^{-2} T$. If the dipole comes to stable equilibrium at an angle of 15° with this field, what is the magnitude of the other field?



Watch Video Solution

16. A monoenergetic (18 keV) electron beam initially in the horizontal direction is subjected to a horizontal magnetic field of 0.04 G normal to the initial direction. Estimate the up or down deflection of the beam over a distance of 30 cm ($m_e = 9.11 \times 10^{-31} \text{ kg}$). [Note: Data in this exercise are so chosen that the answer will give you an idea of the effect of earth's magnetic field on the motion of the electron beam from the electron gun to the screen in a TV set.]



Watch Video Solution

17. A sample of paramagnetic salt contains 2×10^{24} atomic dipoles, each of moment $1.5 \times 10^{-23} \text{ JT}^{-1}$. The sample is placed under a homogeneous magnetic field of 0.64 T and cooled to a temperature of 4.2 K . The degree of magnetic saturation achieved is equal to 15% . What is the total dipole moment of the sample for a magnetic field of 0.98 T and a temperature of 2.8 K . (Assume Curie's law).



[Watch Video Solution](#)

18. A Rowland ring of mean radius 15 cm has 3500 turns of wire wound on a ferromagnetic core of relative permeability 800. What is the magnetic field B in the core for a magnetising current of 1.2 A?



Watch Video Solution

19. The magnetic moment vectors $\vec{\mu}_s$ and $\vec{\mu}_l$ associated with the intrinsic spin angular momentum \vec{S} and orbital angular momentum

\vec{l} respectively, of an electron are predicted by quantum theory (and verified experimentally to a high accuracy to be given by

$$\vec{\mu}_s = - \left(\frac{e}{m} \right) \vec{S} \quad \text{and} \quad \vec{\mu}_l = - \left(\frac{e}{2m} \right) \vec{l}$$

Which of these relations is in accordance with the result expected classically? Outline the derivation of the classical result.



Watch Video Solution