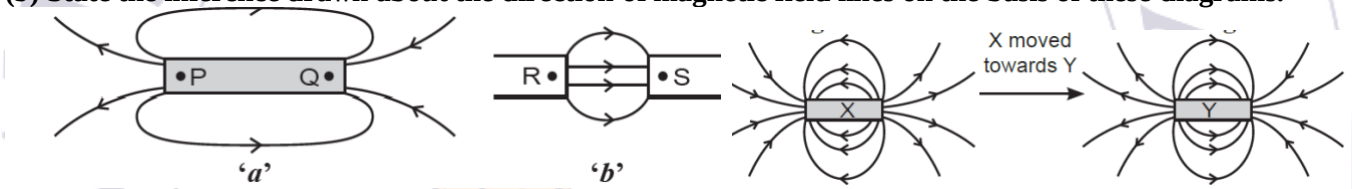
Magnetic field and field lines

1. **Magnetic needle is/an [CBSE 2021(C)]**
   - ***(a)*** **isolated north pole pivoted at its centre of mass. (*b*) isolated south pole pivoted at its centre of mass.**
   - ***(b)*** **ordinary needle made of soft iron and pivoted at its centre of mass**
   - ***(c)*** **small bar magnet pivoted at its centre of mass.**

2. **A freely suspended magnet always rests in geographically north and south direction because[CBSE 2021(**
   - ***(a)*** **the Earth has two poles. (*b*) the Earth behaves as a huge magnet.**
   - ***(b)*** **the magnetic north pole of the Earth magnet is located very close to its south pole.**
   - ***(c)*** **the magnetic south pole of the Earth magnet is located very close to its south pole.**

3. **No two field lines are found to intersect each other. If they intersect, then at the point of intersection, the compass needle would point**
   - ***(a)*** **in two different directions which is possible. (*b*) in two different directions which is not possible.**
   - ***(b)*** **in a particular direction. (*d*) nowhere**

4. **Name the poles P, Q, R and S of the magnets in the following figures '*a*' and '*b*'.**
   (*b*) State the inference drawn about the direction of magnetic field lines on the basis of these diagrams.



5. **"Magnetic field is a physical quantity that has both direction and magnitude". How can this statement be proved with the help of a magnetic field lines of a bar magnet? [CBSE 2022]**

   A magnetic field has both a direction and a magnitude. The north pole of the compass needle's movement inside the magnetic field is taken to indicate the magnetic field's direction. The field lines are assumed to arise from the North Pole and combine at the South Pole as a result of convention. Field lines inside the magnet go from its south pole to its north pole. These closed curves are the magnetic field lines.

   The degree of closeness of the field lines reveals the relative intensity of the magnetic field. Where there are more field lines, there is a stronger field, meaning that there is more force acting on the pole of another magnet.

6. **The figure shows two magnets X and Y kept near each other. Their poles are not marked, but the magnetic field lines are shown in the figure. If magnet X is moved towards magnet Y as indicated by the arrow, will the two magnets attract or repel each other? Justify your answer by describing how you interpret the field lines.[CFPQ, CBSE]**
7. **Mention the direction of magnetic field line inside a bar magnet and outside a bar magnet**

8. **Define magnetic field. What are magnetic field lines? Justify the following statements**
   - ***(a)*** **Two magnetic field lines never intersect each other. [CBSE 2014]**
   - ***(b)*** **Magnetic field lines are closed curves. [CBSE 2015]**

9. **A student dipped a bar magnet in a heap of iron fillings and pulled it out. He found that iron fillings**

got stuck to the magnet.

(a) **Which regions of the magnet have more iron fillings sticking to it? What are these regions called?**

(b) **What conclusion would you like to draw from the amount of iron fillings clinging to these regions?**

10. **A student fixes a white sheet of paper on a drawing board. He places a bar magnet in the centre and sprinkles some iron filings uniformly around the bar magnet. Then he taps gently and observes that iron filings arrange themselves in a certain pattern.**

(a) **Why do iron filings arrange themselves in a particular pattern?**

(b) **Which physical quantity is indicated by the pattern of field lines around the bar magnet?**

(c) **State any two properties of magnetic field lines. [CBSE Sample Paper 2023]**

Magnetic field Due to a current carrying Straight conductor

1. **When a current flows through a straight conductor, a magnetic field is produced around it. Consider the following statements about this field:**

I The direction of the magnetic field of a current carrying straight conductor is determined by right-hand thumb rule.

II. A charged body placed in this field experiences a force whose direction is given by Fleming's left hand rule.

III. The magnetic field lines around a current carrying straight conductor are in the form of concentric circles with the conductor as the centre.

The correct statement(s) is/are: [CBSE 2021(C)]

(*a*) I only (*b*) III only (*c*) I and II (*d*) I and III

2. **The resultant magnetic field at point 'P' situated midway between two parallel wires (placed horizontally) each carrying a steady current *I* is [CBSE 2023]**

(a) in the same direction as the current in the wires. (b) in the vertically upward direction.

(b) zero (d) in the vertically downward direction.

3. **The diagram below shows the magnetic field lines due to a current in a straight conductor.**
4. **Something was done to the current because of which the magnetic field lines changed as shown below. What was done to the current? [CFPQ, CBSE]**

(a) Its magnitude was increased and its direction reversed.

(b) Its magnitude was decreased and its direction reversed.

(c) Its magnitude was increased.

(d) Its magnitude was decreased.

5. **A compass needle is placed near a current-carrying wire. State your observation for the following cases, and give reason for the same in each case -**

(a) Magnitude of electric current in the wire is increased.

(b) The compass needle is displaced away from the wire.

6. **A student performs an experiment to study the magnetic effect of current around a current carrying straight conductor. He reports that**

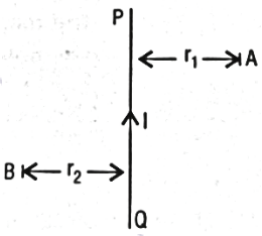
(a) for a given battery, the degree of deflection of a N-pole decreases when the compass is kept at a point farther away from the conductor.

(b) the direction of deflection of the north pole of a compass needle kept at a given point near the conductor remains unaffected even when the terminals of the same battery sending current in the wire are interchanged.

Which of the above observations of the student appears to be wrong and why? [HOTS]

7. How is the strength of magnetic field near a straight current-conductor
   (a) related to the strength of current in the conductor? [CBSE 2014]
   (b) is affected by changing the direction of flow of current in the conductor?

8. List two factors on which the magnitude of magnetic field produced by a current carrying straight conductor depends. State the rule which determines the direction of magnetic field in the above case.
9. Draw the pattern of magnetic field lines produced in this case. [CBSE 2023] . PQ is a current carrying conductor in the plane of the paper as shown in the figure below. Find the directions of the magnetic fields produced by it at points R and S.
   (*ii*) Given $r_1 < r_2$, where will the strength of the magnetic field be larger? Give reasons.
   (*iii*) If the polarity of the battery connected to the wire is reversed, how would the direction of the magnetic field be changed?



10. Explain the rule that is used to find the direction of the magnetic field for a straight current carrying conductor. [CBSE Sample Paper 2021]
11. Draw the magnetic field lines around a straight current carrying conductor. [CBSE Sample Paper 2021]
12. The given diagram shows two parallel straight conductors carrying same current. Copy the diagram and draw the pattern of the magnetic field lines around them showing their directions. What is the magnitude of magnetic field at a point 'X' which is equidistant from the conductors? Give justification for your answer.

13. How does the strength of the magnetic field produced change:
    (i) with the distance from the conductor?
    (ii) with an increase in current in a conductor?

Magnetic field Due to a current carrying Circular loop

1. Find the direction of magnetic field due to current carrying circular coil held:
   (a) Vertically in North-South plane and an observer looking it from east sees the current to flow in anticlockwise direction.
   (b) Vertically in East-West plane and an observer looking it from south sees the current to flow in anti-clockwise direction.
2. Draw the pattern of magnetic field lines through and around a current carrying loop of wire.
   Mark the direction of
   (i) electric current in the loop
   (ii) magnetic field lines.
3. How would the strength of magnetic field due to current, carrying loop be affected if
   (a) radius of the loop is reduced to half its original value?
   (b) strength of current through the loop is doubled?
4. Why does magnetic field at the centre of current carrying circular loop appear straight.
5. Why is it that the magnetic field of a current carrying coil having n turns, is 'n' times as large as that produced by a single turn (loop)?
   Ans. If there is a circular coil having n turns, the magnetic field produced by this current carrying circular coil will be n times as large as that produced by a circular loop of a single turn of wire, because the current in each circular turn of coil flows in the same direction and magnetic field produced by each turn of circular coil then just adds
6. Shruti draws magnetic field lines close to the axis of a current carrying circular loop. As she moves away from the centre of circular loop, she observes that the lines keep on diverging. Explain the reason for her observation. [2012

Or, Explain with the help of the pattern of magnetic Master field lines the distribution of magnetic field due to a current carrying a circular loop.

7. **Explain the effect on the magnetic field produced at a point in a current carrying circular coil due to:**
   (i) increase in the amount of current flowing through it.
   (ii) increase in the distance of point from the coil.
   (iii) increase in the number of turns of the coil.

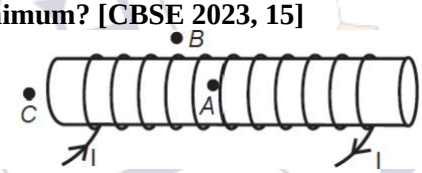
Magnetic field Due to a current in Solenoid

1. **What will happen if a soft iron bar is placed inside the solenoid?**
   i. **The bar will be electrocuted resulting in short circuit.**
   ii. **The bar will be magnetised as long as there is current in the circuit.**
   iii. **The bar will be magnetised permanently.**
   iv. **The bar will not be affected by any means. [CBSE Sample Paper 2021]**

2. **The strength of magnetic field of a current carrying solenoid is [CBSE 2021C]**
   (A)minimum at its ends (*b*) uniform inside it at all points (*c*) maximum at its centre (*d*) zero at its centre

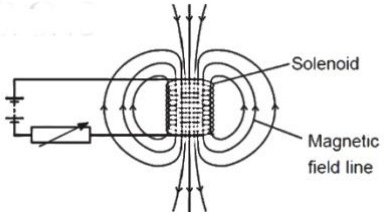
3. **What type of energy conversion is observed in a current carrying linear solenoid? CBSE 2021]**
4. **Mechanical to Magnetic (*b*) Electrical to Magnetic(*c*) Electrical to Mechanical (*d*) Magnetic to Mechanical**
5. **The magnetic field lines produced inside the solenoid are similar to that of _____ [CBSE 2021]**
   (a) **a bar magnet (*b*) a straight current carrying conductor**
   (b) **a circular current carrying loop (*d*) electromagnet of any shape**

6. **What is a solenoid?**
7. **How is a uniform magnetic field in a given region represented? Draw a diagram in support of your answer**
8. **Draw the pattern of magnetic field lines of the magnetic field produced by a solenoid through which a steady current flows. [CBSE 2022]**
9. **For the current carrying solenoid as shown below, draw magnetic field lines and giving reason explain that out of the three points *A*, *B* and *C* at which point the field strength is maximum and at which point it is minimum? [CBSE 2023, 15]**

10. 

   (a) **What is an electromagnet? List any two uses. CBSE 2020]**
   (b) **Draw a labelled diagram to show how an electromagnet is made.**
   (c) **State the purpose of soft iron core used in making an electromagnet.**
   (d) **List two ways of increasing the strength of an electromagnet if the material of the electromagnet is fixed.**

11. **What is meant by solenoid? How does a current carrying solenoid behave? Give its main use. [CBSE 2015]**
12. **What is a solenoid? Draw the pattern of magnetic field lines of (i) a current carrying solenoid and (ii) a bar magnet. List two distinguishing features between the two fields**
13. **A circuit contains a battery, a variable resistor and a solenoid. The figure below shows the magnetic field pattern produced by the current in the solenoid.**

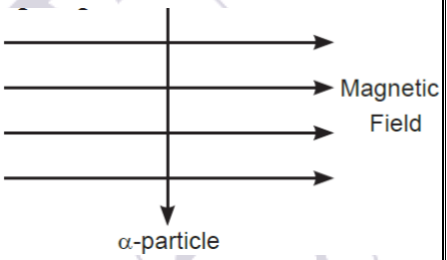


(*a*) State how the magnetic field pattern indicates regions where the magnetic field is stronger.
(*b*) What happens to the magnetic field when the current in the circuit is reversed?[CBSE Sample Question Paper 2022]

14. State three ways in which the strength of an electromagnet can be increased

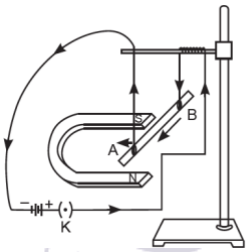
Force on a current carrying conductor in a magnetic field

1. The current in the wire can be reversed. The pole of the magnet can also be changed over. In how many of the four directions shown can the force act on the wire? [CBSE Sample Paper 2023]
   i. 1 (*b*) 2 (*c*) 3 (*d*) 4



2. An alpha particle enters a uniform magnetic field as shown. The direction of force experienced by the alpha particle is: [CBSE 2023]
   (*a*) towards right (*b*) towards left (*c*) into the page (*d*) out of the page

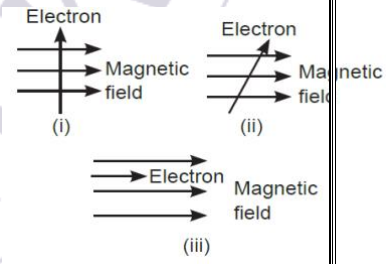
3. When is the force experienced by a current carrying straight conductor placed in uniform magnetic field (*a*) Maximum; (*b*) Minimum [CBSE 2022] As shown in the diagram an aluminium rod 'AB' is suspended horizontally between the two poles of a strong horse shoe magnet in such a way that the axis of rod is horizontal and the direction of the magnetic field is vertically upward. The rod is connected in series with a battery and a key.



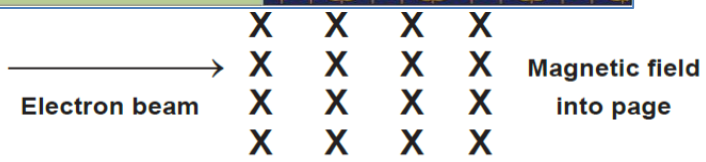
4. State giving reason:
   (*a*) What is observed when a current is passed through the aluminium rod from end B to end A?
   (*b*) What change is observed in a situation in which the axis of the rod 'AB' is moved and aligned parallel to the magnetic field and current is passed in the rod in the same direction?

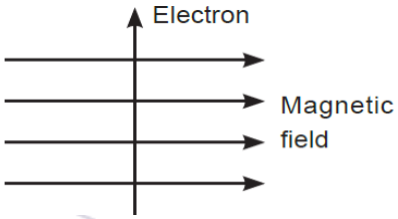
5. Why and when does a current carrying conductor kept in a magnetic field experience force? List the factors on which direction of this force depends? [CBSE 2014]

   (*a*) State the rule used to find the force acting on a current carrying conductor placed in a magnetic field.
   (*b*) Given below are three diagrams showing entry of an electron in a magnetic field. Identify the case in which the force will be (1) maximum and (2) minimum respectively. Give reason for your answer. [CBSE 2023]



6. Mention the factors on which the direction of force experienced by a current carrying conductor placed in a magnetic field depend.
7. A proton beam is moving along the direction of magnetic field. What force acting on proton beam?
8. The diagram shows a beam of electrons about to enter a magnetic field. The direction of the field is into the page.





9. What will be the direction of deflection, if any, as the beam passes through the field?

(a) State one application of Fleming's left hand rule.

(b) An electron enters a magnetic field at right angles to it, as shown in figure. What will be the direction of force acting on the electron?

10. State whether an alpha particle will experience any force in a magnetic field if (alpha particles are positively charged particles)

(a) it is placed in the field at rest.

(b) it moves in the magnetic field parallel to field lines.

(c) it moves in a magnetic field perpendicular to field lines.

Justify your answer in each case. [CBSE 2016]

11. It is established that an electric current through a conductor produces a magnetic field around it. Is there a similar magnetic field produced around a thin beam of moving (i) alpha particles, (ii) neutrons? Justify your answer in each case. [2019 JMS/4

Ans. In case of movement of a charged particle, the magnetic field is created around the path on which charged particle moves.

(i) Alpha particles being positively charged constitute a current in the direction of motion, therefore magnetic field will be produced around a thin beam of moving alpha particles.

(ii) The neutrons being electrically neutral constitute no current, so no magnetic field will be produced around a thin beam of moving neutrons.

12. Mention the angle between a current carrying conductor and magnetic field for which the force experienced by this current carrying conductor placed in magnetic field is largest?

Ans. The force is the largest, when angle between the current carrying conductor and magnetic field direction is a right angle, i.e., 90°.

Domestic uses

1. At the time of short circuit, the electric current in the circuit [CBSE 2020]

(a)vary continuously (*b*) does not change (*c*) reduces substantially (*d*) increases heavily

2. In domestic electric circuits the wiring with 15 A current rating is for the electric devices which have [CBSE 2023]

(a) higher power ratings such as geyser. (*b*) lower power ratings such as fan.

(b) metallic bodies and low power ratings. (*d*) non-metallic bodies and low power ratings.

3. Explain any two situations that can cause electrical hazards in domestic circuits. [CBSE 2013]

4. Cable of a microwave oven has three wires inside it which have insulation of different colours black, green and red. Mention the significance of the three colours and potential difference between red and black one.

5. Why is an alternating current (A.C.) considered to be advantageous over direct current (D.C.) for the long distance transmission of electric power?

(a) **How is the type of current used in household supply different from the one given by a battery of dry cells?**

(b) **How does an electric fuse prevent the electric circuit and the appliances from a possible damage due to short circuiting or overloading? [CBSE 2023]**

6. **State the consequences that can lead to a short circuit.**
   ***Or* One of the major cause of fire in office building is short circuiting. List three factors which may lead to the short circuit. [CBSE 2014]**

7. **Explain the meaning of overloading of an ·electrical circuit. List two possible causes due to which overloading may occur in household circuits.**
8. **Write one preventive measure that should be taken to avoid overloading of domestic circuits. [CBSE 2023]**
9. **a) Distinguishing in brief any three important features of domestic electric supply lines.**
   (b) List two distinguishing features between overloading and short circuiting in domestic circuits
10. **(i) Why is an alternating current (AC) considered to be advantageous over direct current (DC) for the long distance transmission of electric power?**
    (ii) How is the type of current used in household supply different from the one given by a battery of dry cells?
    (iii) How does an electric fuse prevent the electric circuit and the appliances from a possible damage due to short circuiting or overloading

11. **Observe Madhu's and Rahul's circuits shown below. [CFPQ, CBSE]**

    (a) **In which circuit will the bulb glow when the switch is closed? Explain why.**

    (b) **Both Madhu and Rahul open the switches in their circuits to change the bulbs. For whom will changing the bulb be safe and for whom will it be dangerous? Explain why.**