NCERT Solutions for Class 10 Science Chapter 12 – Magnetic Effects of Electric Current

Intext Questions with Solutions of Class 10 Science Chapter 12 – Magnetic Effects of Electric Current

1.

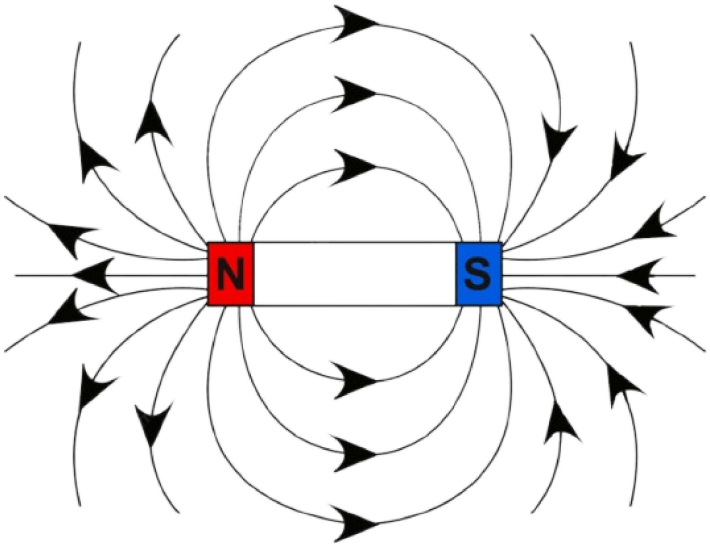
Why does a compass needle get deflected when brought near a bar magnet?

Ans: A compass needle is like a miniature bar magnet. Its magnetic field lines would interact with the bar magnet when it is brought closer to it. So, when you bring a compass needle close to a bar magnet, it moves.

2.

Draw magnetic field lines around a bar magnet.

Ans: It is common knowledge that the magnetic field lines of a bar magnet begin at the north pole and will eventually reach their conclusion at the south pole. Additionally, the field lines would originate from the south pole within the magnet and would end at the north pole, as seen in the diagram that can be found below.



3.

List the properties of magnetic field lines.

Ans: The following characteristics of magnetic lines of force are known to exist:

1. It is recognized that the north pole is the source of magnetic field lines.
2. The south pole is always where magnetic field lines end.
3. It is known that the magnet's field lines run from the south pole to the north pole.
4. There is no intersection between magnetic lines.

4.

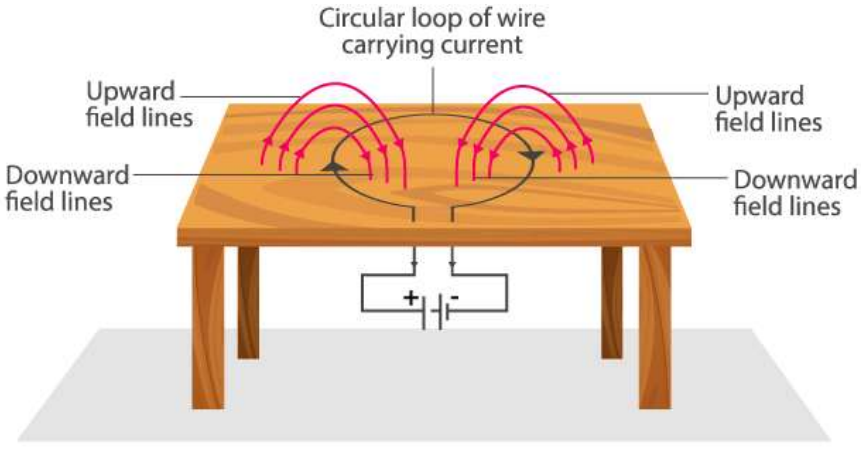
Why don't two magnetic field lines intersect each other?

Ans: This is because there is only one possible direction for the force that results on a north pole at any given location. However, the resultant force on the north pole located at the intersection will be along two directions, which is impossible, if the two magnetic field lines cross.

5.

Consider a circular loop of wire lying in the plane of the table. Let the current pass through the loop clockwise. Apply the right-hand rule to find out the direction of the magnetic field inside and outside the loop.

Ans:



Within the loop, Pierce is located inside the table.
Outside the loop = Seem to arise from the table

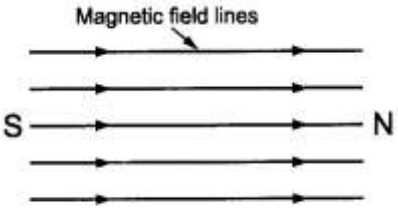
In the downward direction of current flowing through the circular loop, the magnetic field lines appear to emanate from the table outside the loop and converge onto the table within the loop. In the upward direction of the current traversing the circular loop, the magnetic field lines appear

to emanate from the table outside the loop and converge onto the table within the loop, as illustrated in the accompanying picture.

6.

The magnetic field in a given region is uniform. Draw a diagram to represent it.

Ans: A uniform magnetic field in a region is depicted by parallel straight lines, all oriented in the same direction.
The uniform magnetic field within a current-carrying solenoid can be depicted by parallel straight lines directed from the S-pole to the N-pole, as illustrated in the figure.



The uniform magnetic field inside a current-carrying solenoid

7.

Choose the correct option. The magnetic field inside a long straight solenoid-carrying current
(a) is zero.
(b) decreases as we move towards its end.
(c) increases as we move towards its end.
(d) is the same at all points.

Ans: (d) is the same at all points.

8.

Which of the following property of a proton can change while it moves freely in a magnetic field? (There may be more than one correct answer.)
(a) mass (b) speed (c) velocity (d) momentum

Ans: The correct options are (c) velocity, (d) momentum.

9.

In Activity 12.7, how do we think the displacement of rod AB will be affected if
(i) current in rod AB is increased;
(ii) a stronger horse-shoe magnet is used; and
(iii) length of the rod AB is increased?

Ans:

i. The force on the conductor gets stronger as the current in rod AB goes up, which makes the rod travel farther.
ii. Using a stronger horseshoe magnet makes the magnetic field stronger. Because of this, the rod's force and displacement both go up.
iii. The rod's displacement increases as the length of rod AB increases, which means that more force is applied to the conductor.

10.

A positively-charged particle (alpha-particle) projected towards west is deflected towards north by a magnetic field. The direction of magnetic field is
(a) towards south (b) towards east
(c) downward (d) upward

Ans: (d) Upward.

Using Fleming's Left-hand rule, you can find out which way the magnetic field is going. If we put our thumb, forefinger, and middle finger of the left hand right next to each other, the thumb will point in the direction of the magnetic force, the middle finger will point in the direction of the current, and the forefinger will point in the direction of the magnetic field. The current will likewise go west because the positively charged particle is going west. The magnetic force is pulling things north. Fleming's Left-hand rule says that the magnetic field will go up.

11.

Name two safety measures commonly used in electric circuits and appliances.

Ans: The following are the safety precautions that are most often used in electrical circuits:

Fuse: Each circuit should contain a fuse to stop too much current from flowing. When the current in the circuit goes over the fuse element's maximum limit, the fuse melts. This stops the flow of electricity and protects the appliance that is connected to the circuit.

Earthing: It keeps people from getting shocked. Earthing sends any current that leaks from an appliance to the earth, which keeps people from getting shocked.

12.

An electric oven of 2 kW power rating is operated in a domestic electric circuit (220 V) that has a current rating of 5 A. What result do you expect? Explain.

Ans: The electric oven consumes a current specified by

$$I = \frac{P}{V} = \frac{2kW}{220V} = \frac{2000W}{220V} = 9.09A$$

Consequently, the electric oven consumes significantly more current than the rated 5 A. The circuit is overloaded. The fuse wire will rupture due to excessive current, resulting in a circuit interruption.

13.

What precaution should be taken to avoid the overloading of domestic electric circuits?

Ans: The following are some safety measures to prevent household electrical circuits from becoming overloaded:

- It is best to avoid plugging in too many gadgets at once.
- It is best to avoid using too many appliances at once.
- It is not advisable to connect defective equipment to the circuit.

Exercise Questions with Solutions of Class 10 Science Chapter 12 – Magnetic Effects of Electric Current

1.

Which of the following correctly describes the magnetic field near a long straight wire?
(a) The field consists of straight lines perpendicular to the wire.
(b) The field consists of straight lines parallel to the wire.
(c) The field consists of radial lines originating from the wire.
(d) The field consists of concentric circles centred on the wire.

Ans: (d) The field consists of concentric circles centred on the wire

2.

At the time of short circuit, the current in the circuit
(a) reduces substantially. (b) does not change.
(c) increases heavily. (d) vary continuously.

Ans: (c) Increases heavily.

3.

State whether the following statements are true or false.
(a) The field at the centre of a long circular coil carrying current will be parallel straight lines.
(b) A wire with a green insulation is usually the live wire of an electric supply.

Ans:

a. True
b. False.

4.

List two methods of producing magnetic fields.

Ans: The techniques for creating magnetic fields are as follows:

- Spreading iron filings over white paper while holding a magnet underneath the paper allows us to visualize the magnetic field created by a permanent magnet.
- A magnetic field is created by a straight wire carrying current.
- A magnetic field can be detected using a variety of conductor types, including solenoid and circular loops.

5.

When is the force experienced by a current–carrying conductor placed in a magnetic field largest?

Ans: The force exerted on the conductor is maximized when the current flows perpendicular to the magnetic field direction.

6.

Imagine that you are sitting in a chamber with your back to one wall. An electron beam, moving horizontally from back wall towards the front wall, is deflected by a strong magnetic field to your right side. What is the direction of magnetic field?

Ans: The current will flow in the opposite direction in this case, either from the front wall to the back wall or in our direction, as the electron beam is traveling from our rear wall to the front wall. The force or direction of deflection is to our right.

Two facts are now known to us:

- The force is moving to our right,
- while the current is moving forward toward us.

Now let's put our left hand's forefinger, middle finger, and thumb at right angles to each other. Now we move our hand such that our middle finger points toward us (the current) and our thumb points to the right side (the force). Now, if we look at our forefinger, it will be pointing straight down. The magnetic field is going straight down because the forefinger points in that way.

7.

State the rule to determine the direction of a
(i) magnetic field produced around a straight conductor-carrying current,
(ii) force experienced by a current-carrying straight conductor placed in a magnetic field which is perpendicular to it, and
(iii) current induced in a coil due to its rotation in a magnetic field.

Ans:

i. Maxwell's right-hand thumb rule is used to determine the direction of a magnetic field generated by a straight conductor carrying current.
ii. Fleming's left hand rule is used to calculate the force experienced by a current-carrying straight wire in a perpendicular magnetic field.
iii. Fleming's right-hand rule is used to calculate the current induced in a coil as it rotates in a magnetic field.

8.

When does an electric short circuit occur?

Ans: An electric short circuit occurs when:

a. When the resistance of an electric circuit decreases significantly, resulting in a substantial increase in the current flowing through the circuit. This results from the connection of multiple devices to a single socket or the attachment of high-power appliances to light circuits.
b. When the insulation of live and neutral wires deteriorates and they come into contact, there will be a sudden increase in the current flowing through the circuit.

9.

What is the function of an earth wire? Why is it necessary to earth metallic appliances?

Ans: The earth wire serves as a safety mechanism by offering a low-resistance conductive pathway for electrical current. Excessive heat or deterioration may cause the live wire to contact the metallic casing of appliances, resulting in an electric shock upon contact. To mitigate shock, the metallic component is grounded via a three-pin plug, allowing current to travel to the earth immediately during a short circuit.

Grounding metallic appliances is essential as it guarantees that in the event of current leakage from the metallic casing, the appliance's potential aligns with that of the earth. The earth's potential is null. Consequently, the individual operating the device will not experience an electric shock.