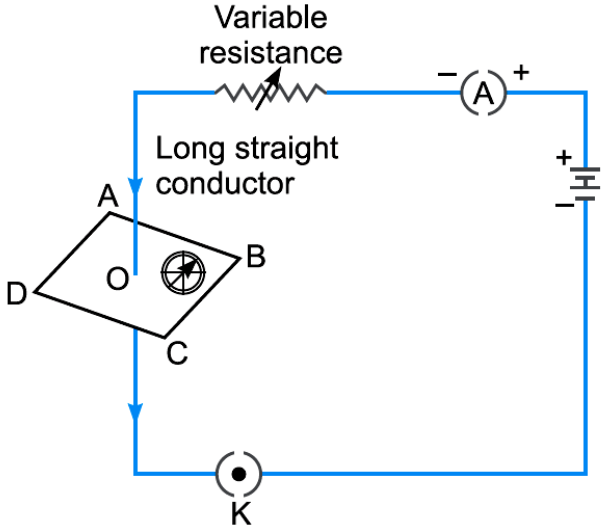
SCIENCE
WORKSHEET_120324
CHAPTER 12 MAGNETIC EFFECTS OF ELECTRIC CURRENT

SUBJECT: SCIENCE **MAX. MARKS : 40**
CLASS : X **DURATION : 1½ hrs**

General Instructions:
(i). **All** questions are compulsory.
(ii). This question paper contains 2**0** questions divided into five Sections A, B, C, D and E.
(iii). **Section A** comprises of **10 MCQs** of **1 mark** each. **Section B** comprises of 4 questions of **2 marks** each. **Section C** comprises of 3 questions of **3 marks** each. **Section D** comprises of 1 question of **5 marks** each and **Section E** comprises of 2 Case Study Based Questions of **4 marks** each.
(iv). There is no overall choice.
(v). Use of Calculators is not permitted

SECTION – A
Questions 1 to 10 carry 1 mark each.

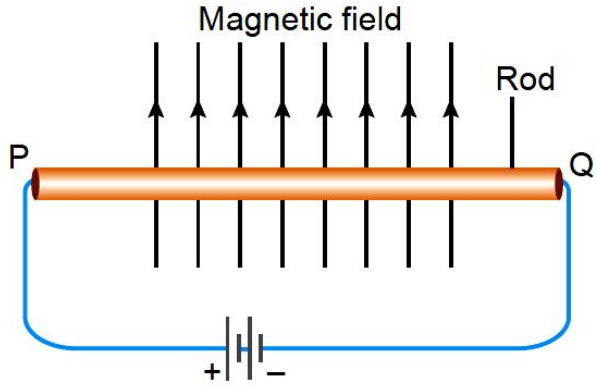
1. If the key in the arrangement as shown below is taken out (the circuit is made open) and magnetic field lines are drawn over the horizontal plane ABCD, the lines are:



(a) concentric circles
(b) elliptical in shape
(c) straight lines parallel to each other
(d) concentric circles near the point O but of elliptical shapes as we go away from it

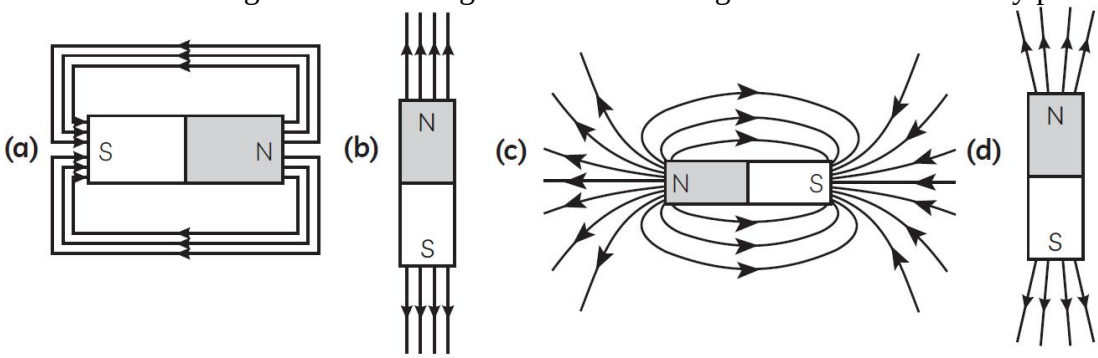
2. For a current in a long straight solenoid, N and S-poles are created at the two ends. Among the following statements, the incorrect statement is:
(a) The field lines inside the solenoid are in the form of straight lines, which indicates that the magnetic field is the same at all points inside the solenoid.
(b) The strong magnetic field produced inside the solenoid can be used to magnetise a piece of magnetic material like soft iron, when placed inside the coil.
(c) The pattern of the magnetic field associated with the solenoid is different from the pattern of the magnetic field around a bar magnet.
(d) The N and S-poles exchange position when the direction of current through the solenoid is reversed.

3. A metal rod PQ is placed in the magnetic field. The ends of the rod are connected with a battery using wires. Where will the rod move?



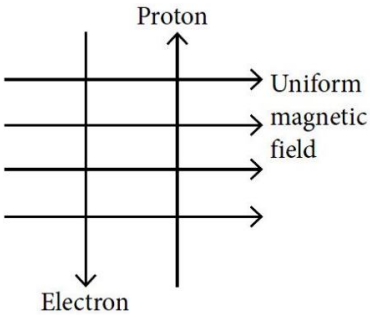
(a) Into the field. (b) Upward (c) Downwards (d) Out of the field.

4. A student learns that magnetic field strength around a bar magnet is different at every point.



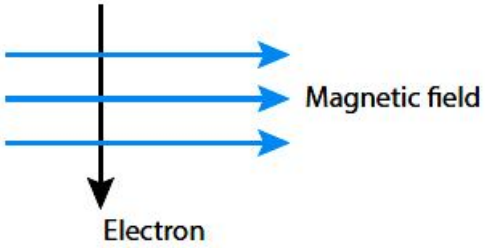
Which diagram shows the correct magnetic field lines around a bar magnet?

5. A uniform magnetic field exists in the plane of paper pointing from left to right as shown in the figure.



In the field, an electron and a proton move as shown. The electron and the proton experience:
(a) forces both pointing into the plane of paper
(b) forces both pointing out of the plane of paper
(c) forces pointing into the plane of paper and out of the plane of paper, respectively
(d) forces pointing opposite and along the direction of the uniform magnetic field respectively

6. An electron enters a magnetic field at right angle to it, as shown in figure.

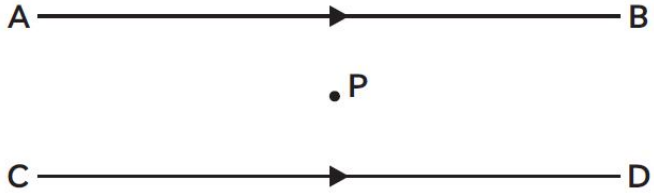


The direction of force acting on the electron will be:
(a) to the right (b) to the left (c) out of the page (d) into the page

7. Which of these statements is true for the lines of a magnetic field?

(I) Lines of a magnetic field can sometimes cross each other.
(II) Lines of a magnetic field emerge from the north pole and meet at the south pole.
(III) Lines of a magnetic field can sometimes change direction.
Options:
(a) Only (I) (b) Both (I) and (II) (c) Both (II) and (III) (d) Both (I) and (III)

8. The resultant magnetic field at point 'P' situated midway between two parallel wires (placed horizontally) each carrying a steady current I is:



(a) in the same direction as the current in the wires.
(b) in the vertically upward direction.
(c) zero.
(d) in the vertically downward direction.

In the following questions 9 and 10, a statement of assertion (A) is followed by a statement of reason (R). Mark the correct choice as:
(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).
(b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).
(c) Assertion (A) is true but reason (R) is false.
(d) Assertion (A) is false but reason (R) is true.

9. **Assertion (A):** A compass needle is placed near a current carrying wire. The deflection of the compass needle decreases when the magnitude of the current in the wire is increased.
Reason (R): The strength of a magnetic field at a point near the conductor increases on increasing the current.

10. **Assertion (A):** The strength of the magnetic field produced at the centre of a current carrying circular coil increases on increasing the number of turns in it.
Reason (R): The current in each circular turn has the same direction and the magnetic field due to each turn then just adds up.

SECTION – B

Questions 11 to 14 carry 2 marks each.

11. When is the force experienced by a current – carrying straight conductor placed in a uniform magnetic field:
(i) Maximum (ii) Minimum K
Ans. (i) The force experienced by a current carrying straight conductor placed in a uniform

12. (a) Name the poles P, Q, R and S of the magnets in the following figures 'a' and 'b':

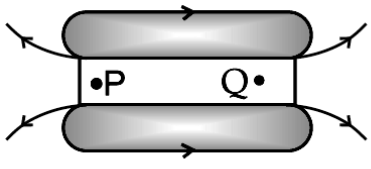


Figure 'a'

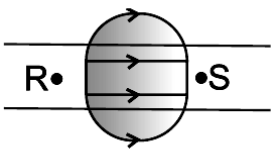


Figure 'b'

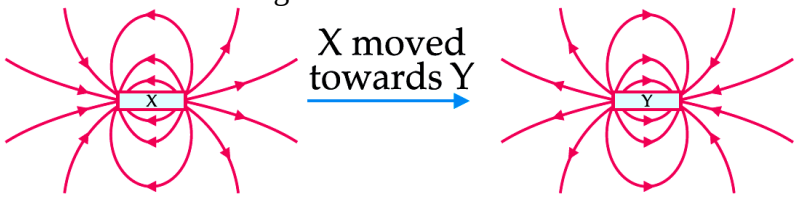
(b) State the inference drawn about the direction of the magnetic field lines on the basis of these diagrams.

OR

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

Ans. Sometimes, the insulation of live wire is torn and due to this the live wire touches the metallic body of the appliances. This causes the flow of current in metallic body. This current flows to the Earth through the earth wire and does not harm the user of the appliances. Therefore, to prevent the user getting an electric shock, due to leakage of current to metallic body, earth wire must always be used.

13. 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.

14. State any two factors on which the magnetic field produced by a current carrying straight conductor depends.
Mention the rule which helps to find the direction of its magnetic field.

OR

A compass needle is placed near a current carrying wire. State your observations for the following cases and give reasons for the same in each case-
(a) Magnitude of electric current in wire is increased.
(b) The compass needle is displaced away from the wire.

SECTION – C

Questions 15 to 17 carry 3 marks each.

15. (a) A student wants to use an electric heater, an electric bulb and an electric fan simultaneously. How should these gadgets be connected with the mains? Justify your answer giving three reasons.
(b) What is an electric fuse? How is it connected in a circuit?

OR

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

16. A student fixes a white sheet of paper on a drawing board. he places a bar magnet in the centre and sparkles 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.

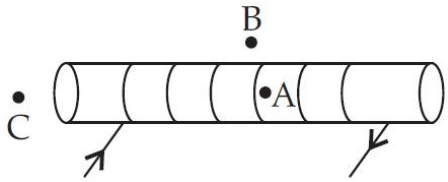
OR

List the four properties of magnetic field lines.

17. (i) Why is an alternating current (A.C.) considered to be advantageous over direct current (D.C.) 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?

OR

For the current carrying solenoid as shown, draw magnetic field lines and give reason to 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?



SECTION – D

Questions 18 carry 5 marks.

18. What is an electromagnet? List any two uses.

(a) Draw a labelled diagram to show an electromagnet is made.

(b) State the purpose of soft iron core used in making an electromagnet.

(c) List two ways of increasing the strength of an electromagnet if the material of the electromagnet is fixed.

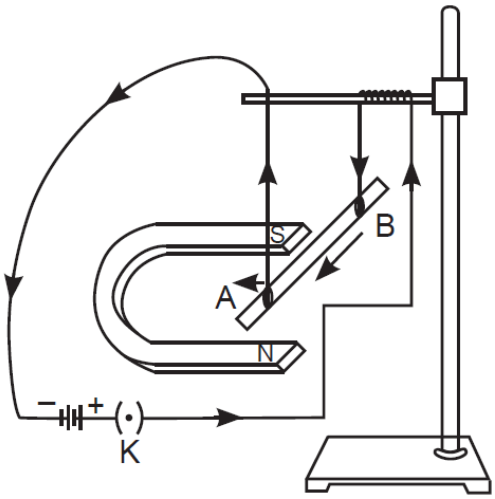
OR

Draw the pattern of magnetic field lines produced around a current carrying straight conductor passing perpendicularly through a horizontal cardboard. State and apply right-hand thumb rule to mark the direction of the field lines. How will the strength of the magnetic field change when the point where magnetic field is to be determined is moved away from the straight conductor? ? Give reason to justify your answer.

SECTION – E (Case Study Based Questions)

Questions 19 to 20 carry 4 marks each.

19. A student was asked to perform an experiment to study the force on a current carrying conductor in a magnetic field. He took a small aluminum rod AB, a strong horse shoe magnet, some connecting wires, a battery and a switch and connected them as shown. He observed that on passing current, the rod gets displaced. On reversing the direction of current, the direction of displacement also gets reversed. On the basis of your understanding of this phenomenon answer the following questions:



(a) Why does the rod get displaced on passing current through it ? (1)

(b) State the rule that determines the direction of the force on the conductor AB. (1)

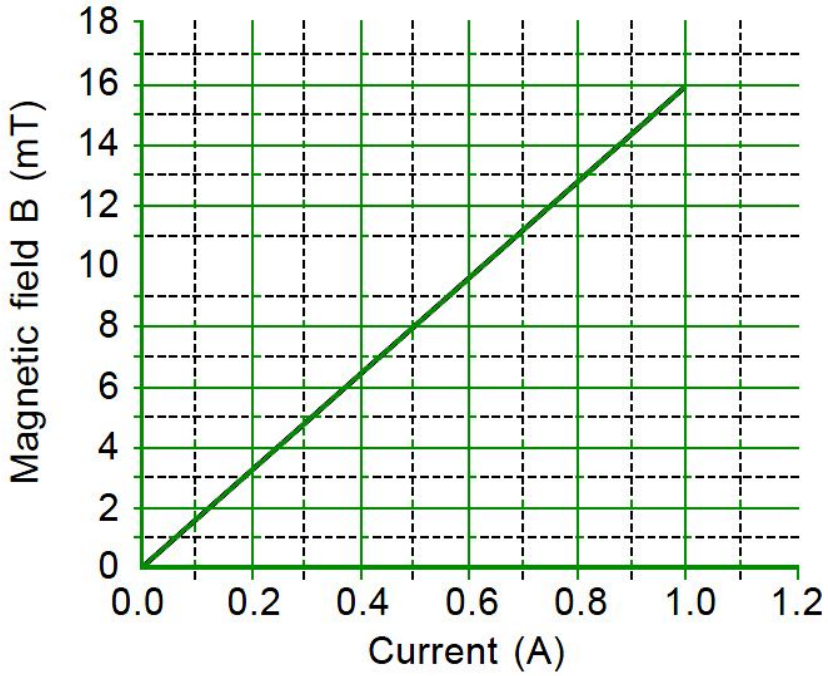
(c) (i) In the above experimented set up, when current is passed through the rod, it gets displaced towards the left. What will happen to the displacement if the polarity of the magnet and the direction of current both are reversed ?

(ii) Name any two devices that use current carrying conductors and magnetic field. (2)

OR

(c) Draw the patten of magnetic field lines produced around a current carrying straight conductor held vertically on a horizontal cardboard. Indicate the direction of the field lines as well as the direction of current flowing through the conductor. (2)

20. A solenoid is a long helical coil of wire through which a current is run in order to create a magnetic field. The magnetic field of the solenoid is the superposition of the fields due to the current through each coil. It is nearly uniform inside the solenoid and close to zero outside and is similar to the field of a bar magnet having a north pole at one end and a south pole at the other depending upon the direction of current flow. The magnetic field produced in the solenoid is dependent on a few factors such as, the current in the coil, number of turns per unit length etc.
The following graph is obtained by a researcher while doing an experiment to see the variation of the magnetic field with respect to the current in the solenoid.



The unit of magnetic field as given in the graph attached is in milli-Tesla (mT) and the current is given in Ampere.
(a) What will happen if a soft iron bar is placed insid the solenoid
(b) What conclusion would you like to draw after analysing the graph?
(c) (i) From the graph deduce the magnitude of magnetic field inside the solenoid if it carries a current of 0.8 A.

OR

(ii) List the two distinguishing features between the magnetic field of a current carryingsolenoid and a bar magnet.