

## Value Based Questions

### Magnetic effects of current and Magnetism

1) While watching Discovery Channel, Sheela was impressed that certain organisms have the ability to sense the field lines of earth's magnetic field. They use this ability to travel from one location to another. Sheela wanted to find the angle of dip at her place. She got a magnetic compass, using which she found the magnetic meridian. She then mounted the compass on a cardboard and placed it vertically along the magnetic meridian. She was able to measure the angle of dip.

- What values did Sheela have?
- Define the magnetic elements of the earth.

2) Shama, a science student, while studying, was impressed that the nervous system in animals depends on the electrical signals to work. Neurons pass on signals from sense organs to the brain. The passage of an electrical signal constitutes an electric current. Shama was curious to know the range of currents in different situations. She found that current in domestic appliances is a few amperes. During lightning, the electric current is in tens of thousands of amperes, while in the nervous system, it is only a few microamperes. She further discussed with her teacher about the magnitude of the magnetic field created by these currents.

- What values did Shama have?
- A galvanometer coil has a resistance of 15 ohms and the meter shows full scale deflection for a current of 4 milliamperes. How will you convert the meter into an ammeter of range 0 m- 6 amperes?

3) Alka and her sister were watching a movie in which the phenomena of aurora borealis was shown. Alka could not believe her eyes that such a colorful display like the one during commonwealth games could be created by nature. She went to the library, but could not find the right book. So she consulted her teacher who guided her. Hence, Alka understood that during a solar flare, a large number of electrons and protons are ejected from the sun. Some of these get trapped in the earth's magnetic field and move in a helical path along the field lines. As the density of the field lines increases near the poles, these particles collide with atoms and molecules of the atmosphere emitting green and pink light. Alka shared this knowledge with her class when they studied the chapter of moving charges in magnetic field.

- What values did Alka have?
- What is the radius of the path of an electron moving at a speed of  $3 \times 10^7$  m / sec in a magnetic field of 6 Gauss perpendicular to it? What is its frequency? Calculate its energy in kilo electron volt.

4) Renu saw her aunt suffering from severe joint pain. Her aunt could not take any pain killer as she was allergic to them. Renu in her quest to help her aunt found the use of magnets. She read Dr. Philpott's work on magnetic therapy, that most people are negative magnetic field deficient due to electromagnetic pollution. Supplementing the body with negative field energy has shown to restore balance and encourage healing. Renu takes her aunt to the doctor daily without fail for the treatment. Her aunt is improving at a phenomenal speed.

(i) What values does Renu have?

(ii) A short bar magnet has a magnetic moment of  $0.48 \text{ J/T}$ . Give the direction and magnitude of the magnetic field produced by the magnet at a distance of  $10 \text{ cm}$  from the centre of the magnet on a) axial line b) the equatorial line of the magnet.

5) Two girls Pooja and Ritu were very good observers and performed in the school function using their cassette player. One day when they were performing, tape got stuck up and the music stopped. But Pooja was determined not to let down the performance so she sang the song instead of dancing and Ritu completed the dance.

- What were the values displayed by Pooja and Ritu?
- What kind of Ferro magnetic material is using for coating magnetic tapes used in cassette players or building memories stories in modern computers?

6) Tushar was using a galvanometer in the practical class. Unfortunately it fell from his hand and broke. He was upset, some of his friends advised him not to tell the teacher but Tushar decided to tell his teacher. Teacher listened to him patiently and on knowing that the act was not intentional, but just an accident, did not scold him and used the opportunity to show the internal structure of galvanometer to the whole class.

(i) What are the values displayed by Tushar.

(ii) Explain the principle, Construction and working of moving coil galvanometer.

7) Income tax raid on a trader revealed that he has hidden wires made of gold in iron pipes embedded in walls and has his own means to trace them. The department was in a mess to find them because they could not demolish the building as the information might be wrong. Can you help the department? What advice will you give to the trader on values ground?

8) A manufacturer sells invertors of various capacities at different rates. i.e, higher the capacity, higher the rate. A costumer intends to buy an invertor of higher capacity. The manufacturer shows the current carrying capacity with the help of ammeters fixed on to the invertors. The customer buys the invertor and finds that it is not handling the desired loads though meter shows rated current. What help can you extend to the customer and valuable advice to the manufacturer?

9) A patient is recommended MRI scan to detect structural abnormalities in his body. This scan is must for him but he is reluctant to get it done. How can you help him to save his precious life. What is the principle behind MRI scan?

10) A door to door seller convinces residents about the benefits of magneto therapy. He has different types of magnets for this purpose. e.g, bracelet for controlling blood pressure, tablets for putting them in drinking water, pain relieving pads, magnetic soles of feet etc. What is your opinion about the success rate? What advice will you give to the seller and prospective buyers?

11). Imran on entering the airport was asked to remove the contents from his pant and shirt pockets; his hand bags and luggage were also checked by airport authorities by using a metal detector. Imran got annoyed and argued with the airport authority as to the reasons for such procedure. The authority tells him that all the passengers and their belongings will be checked for security check to ensure safe travel.

- a) What is the value that imparts us in the above scenario.
- b) Briefly explain the working principle of a metal detector.

12). Suhasini's uncle, was advised by his doctor to have an MRI scan of his chest. Her uncle did not know much about the details and significance of this test. He also felt that it was too expensive and thought of postponing it. When Suhasini learnt about her uncle's problems, she immediately decided to do something about it. She took the help of her family, friends and neighbors and arranged for the cost of the test. She also told her uncle that an MRI (Magnetic Resonance Imaging) scan of his chest would enable the doctors to know of the condition of his heart and lungs without causing any (test related) harm to him. This test was expensive because of its set up that needed strong magnetic fields (0.5 T to 3T) and pulses of radio wave energy. Her uncle was convinced and had the required MRI scan of his chest done. The resulting information greatly helped his doctors to treat him well.

- (a) What according to you, are the values displayed by Suhasini and her family, friends and neighbours to help her uncle ?

(b) Assuming that the MRI scan of her uncle's chest was done by using a magnetic field of 1.0 T, find the maximum and minimum values of force that this magnetic field could exert on a proton (charge =  $1.6 \times 10^{-19}$ ) that was moving with a speed of 104 m/s. State the condition under which the force has its minimum value.