2022 Sec 4 Physics Assignment 17
Magnetism - Answers

Problem solving approach

- Consider the nature of the materials used: permanent magnet or magnetic material.
- Consider processes of magnetisation, magnetic induction, magnetic screening (or shielding).
- Apply law of magnetism where relevant.

1(a) No.
At least one piece must be a permanent magnet and the other could be a magnet or could be made of a magnetic material such as soft iron. A magnet always induces an opposite pole in the magnetic material such that only attraction can occur.

(b) Yes.
They must have like poles facing each other for repulsion. Hence both pieces of metal must be permanent magnets.

2.

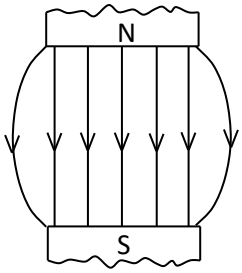


Fig. 2.1
[1]

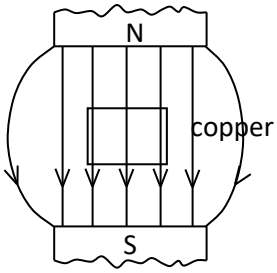


Fig. 2.2
[1]

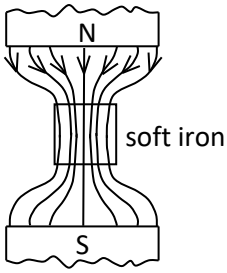


Fig. 2.3
[1]

Note:
- A non-magnetic material (such as copper) does not affect the external magnetic field (*provided it is not carrying a current or not moving relative to this field*).
- A magnetic material (such a soft iron) has the tendency to concentrate magnetic field lines within itself (e.g. in magnetic screening).
- (a) and (b) have the same field pattern!

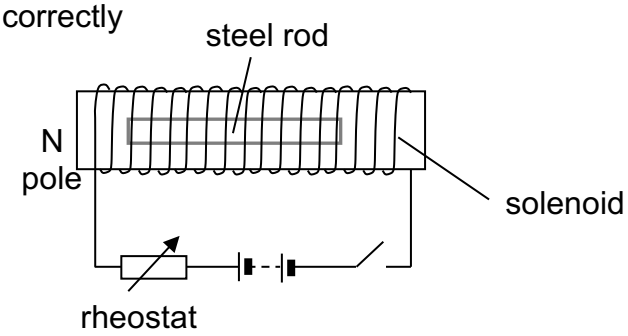
3(a) an electromagnet.

(b)
- It is because the magnetism of an electromagnet can be switched on and off.
- When the electromagnet is switched on, it will pick up iron objects. When the electromagnet is switched off, iron objects fall from the electromagnet. This makes disposal of iron objects easy.

(c) Any one of the following:
- Increase the voltage of the power supply to increase the current in the coil
- Use a coil of less resistance/use thicker wire to make the coil, to increase the current in the coil
- Use a coil with more turns.

4(a) **Reference**: textbook (pages 404 & 405)
Labelled diagram (at steel rod, solenoid and rheostat labelled)
One magnetic pole labelled correctly

Draw the solenoid clearly to shown the front/back of the turns.



Connect a solenoid to a d.c. battery. Place the steel rod in the solenoid as shown in the diagram. Switch on the circuit. The current flowing through will induce a strong magnetic field in the solenoid. Withdraw the magnet along the north-south direction.

(b) Connect the solenoid to an a.c. voltage source (instead of a d.c. battery). Switch on the circuit and remove the demagnetized steel bar slowly along the east-west direction far away from the solenoid.

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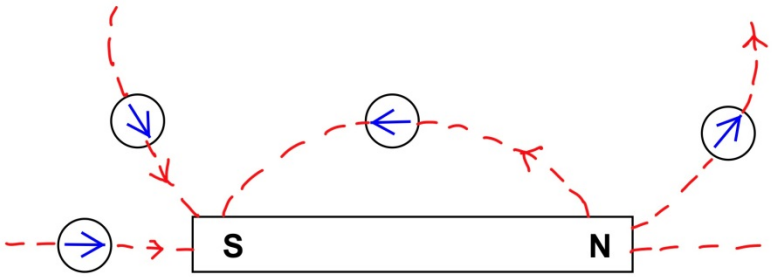

6(a) Arctic: magnetic south pole; Antarctic: magnetic north pole

(b) Although the earth is a giant magnet, the strength of its magnetic field is very weak, (so the magnetic force is much smaller than the gravitational force on such objects).

Note:

- *The magnetic field of the earth is only about 1/2000 of that between the poles of a horseshoe magnet. Therefore, objects on the earth are attracted more strongly by the gravitational force as compared to the magnetic force.]*