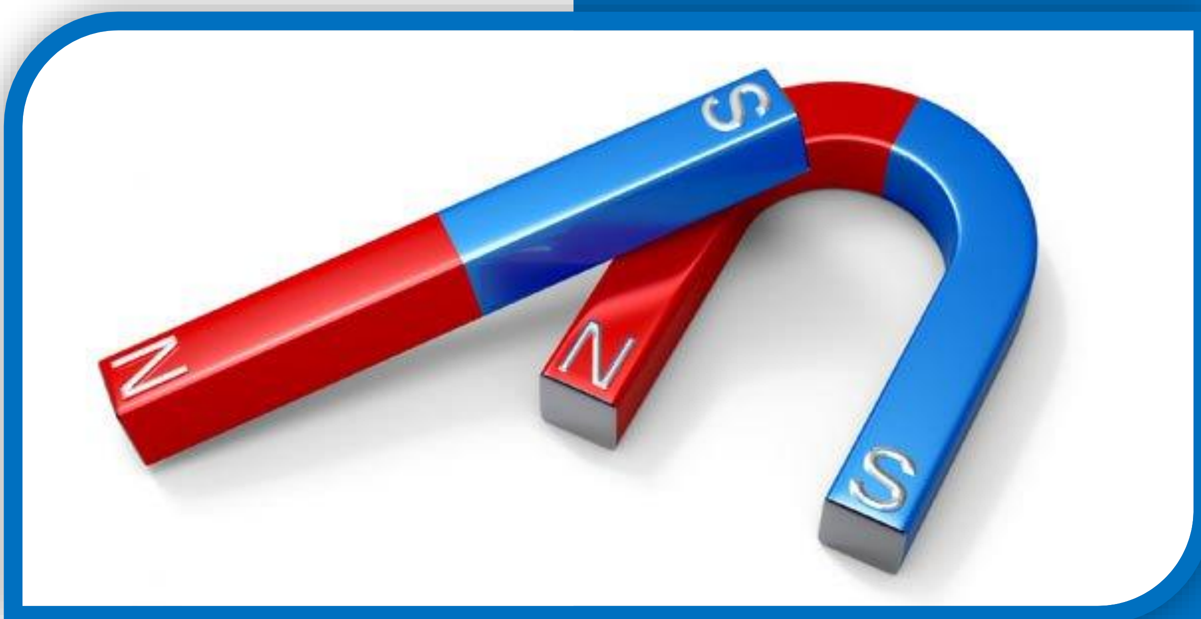
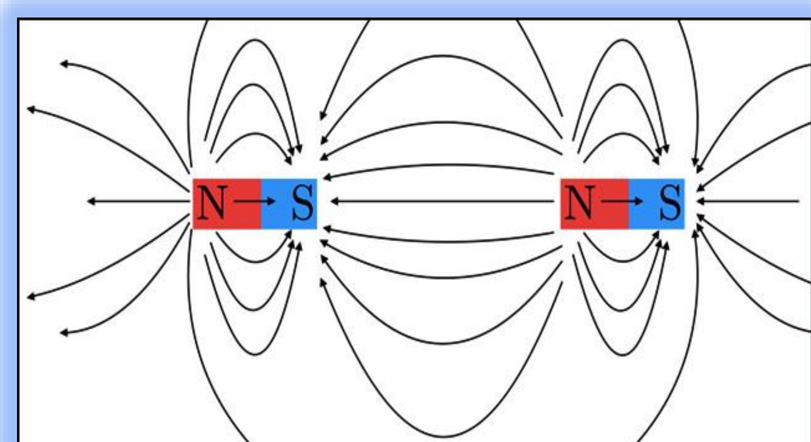
2020

MAGNETISM





TEACHERS OF PHYSICS

www.teachersofphysics.com

9/21/2020

1. State two properties of magnets. (2mk)

a) Magnetic poles

b) Directional property

2. Distinguish between soft and hard magnetic materials. (1mk)

Soft magnetic materials are easily magnetized and demagnetized while hard magnetic materials are not easily magnetized and demagnetized.

3. Given a bar magnet, a steel bar and a string describe a simple experiment to distinguish between the magnet and the steel bar. (4mk)

Suspend both the magnet and the steel bar in the earth's magnetic field. Change their rest position and note the direction in which each will rest. Repeat this procedure several times and record the direction. It is noted that the bar magnet rests in the North – south diction each time it is disturbed while the steel bar rests in different directions each time.

4. Give a reason why attraction in magnetism is not regarded as a reliable method of testing for polarity. (1mk)

Attraction can occur between magnets and between a magnet and a magnetic material.

5. Why is it advisable to store magnetized magnetic tapes in an iron box?(2mks)

Magnets tend to lose their magnetism due to self demagnetization. The iron box acquires polarities opposite to those of the tape thus forming complete loops. The dipoles thus retain their orientation at the poles hence magnetism of the tape is maintained.

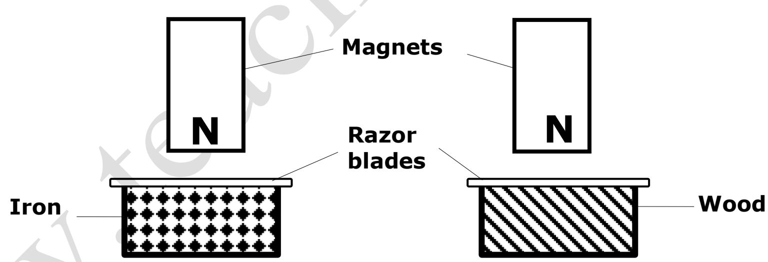
6. Four bars of metal A, B, C and D are tested for magnetism. B attracts both A and C but not D. D does not attract A, B or C. A and C sometime attract one another and sometimes repel one another. What conclusion can you draw about?

(a) Bar A – a magnet

(b) Bar B – a magnetic material

(c) Bar D – non- magnetic material

7. Two similar razor blades were placed on a wooden block and the other on an iron block as in the figure.

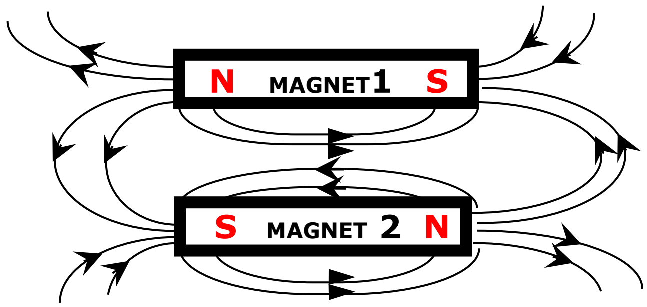


It was observed that the razor blade on the wooden block is attracted by the magnet while that on the iron block was not. Explain. (2 mk)

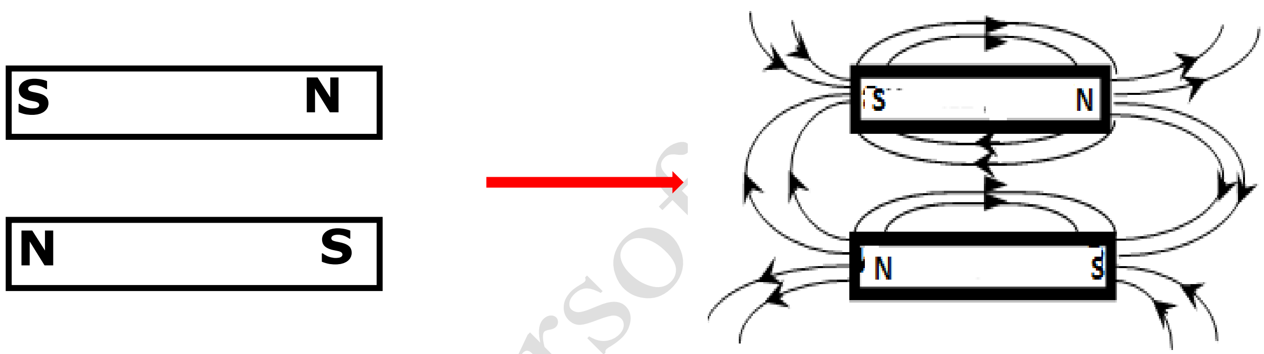
The razor on the wooden block was attracted by the magnet because when the north pole is brought close magnetism is only induced on the razor while wood is non - magnetic. In the case of iron block both the razor and iron are magnetized by induction so the razor is attracted back by temporary magnetism induced in the iron block.

MAGNETIC FIELD PATTERNS

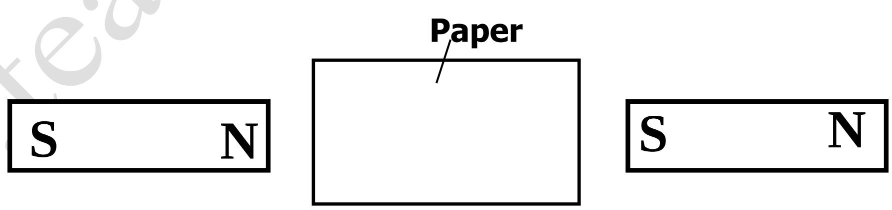
1. The figure below shows the magnetic field pattern around two bar magnets placed side by side. Indicate on the diagram the poles of each magnet (1mk)

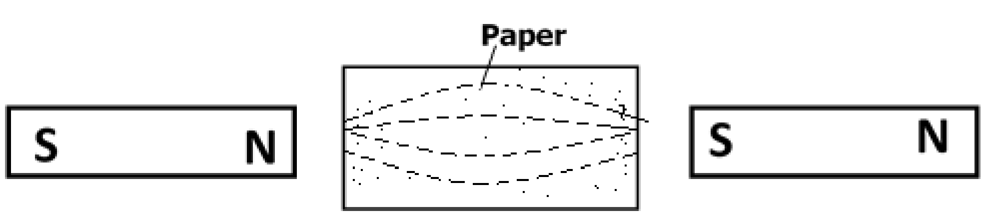


2. The figure below shows two parallel magnets with unlike poles adjacent to each other. Sketch the magnetic field pattern around the magnets. (2mk)



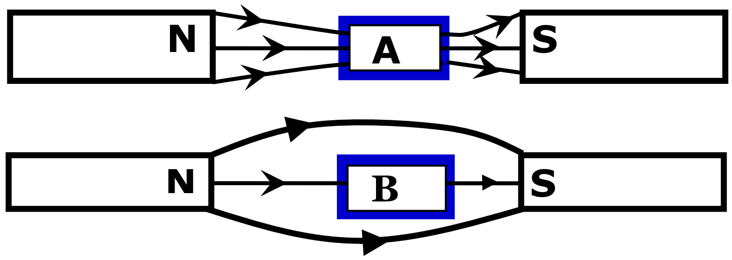
3. In the arrangement below iron fillings are sprinkled on the paper to depict the magnet field between the two bar magnets.





Indicate on the diagram the field pattern on the paper. (1 mk)

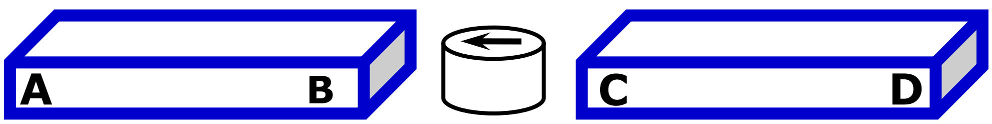
4. Figure below shows the effect on the magnetic field when two materials A and B are placed in the magnetic field.



State the difference between materials A and B (1mk)

- ✓ *A is a magnetic material hence concentrates the magnetic field lines while B is non- magnetic has no effect on the magnetic field lines.*

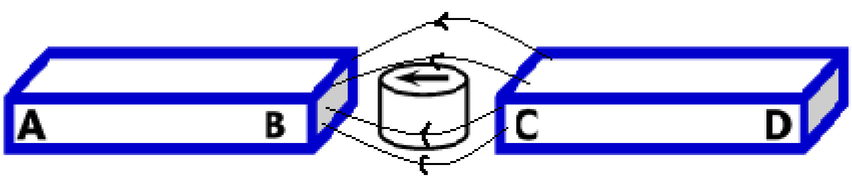
5. Figure below shows a plotting compass placed between two strong magnets; the tip of the arrow represents the north pole of the compass;



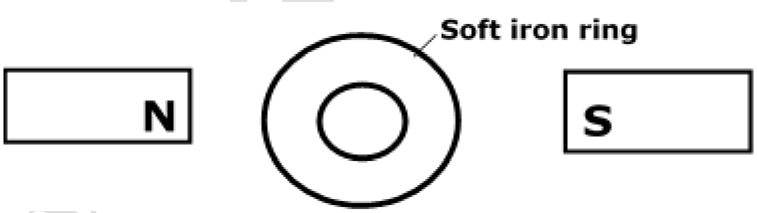
(i) What is the polarity of end C of the magnet? (1mk)

- ✓ ***North pole***

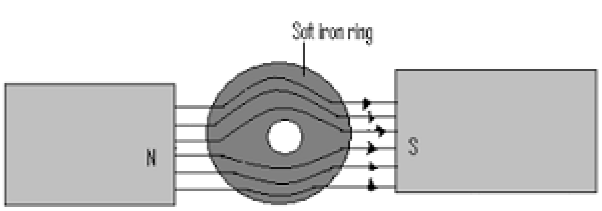
(ii) Draw the set-up of the magnets as seen from above and sketch the magnetic field lines in the region between B and C. (1 mk



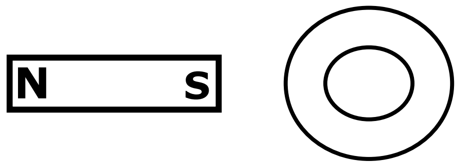
6. A soft iron ring is placed between two magnets. Draw the magnetic field pattern between the two magnets.

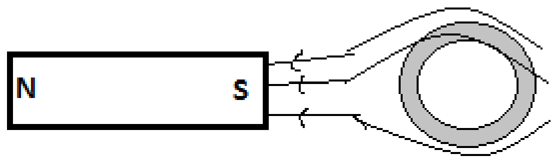


(2mk)



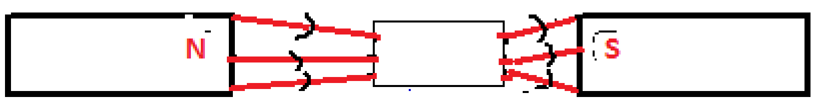
7. Figure below shows a copper ring lying next to the North pole of magnet





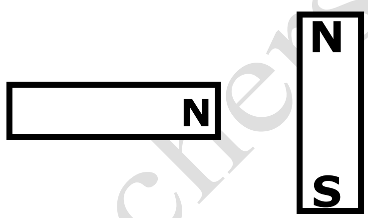
Complete the diagram to show the correct magnetic field patterns for the arrangement. (2mk)

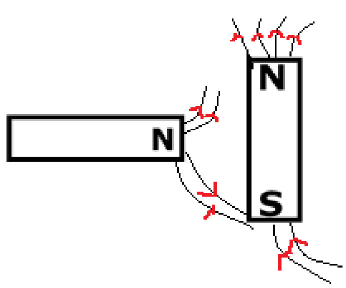
8. Figure below shows a soft iron rod placed between two poles of a magnet



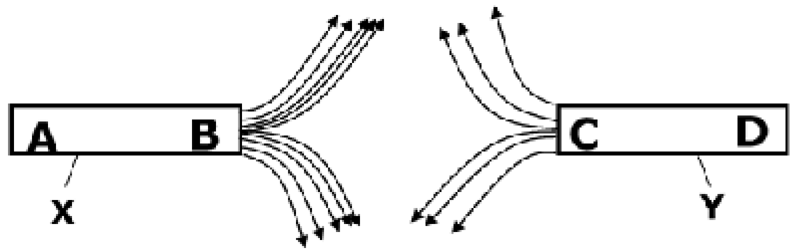
On the same figure sketch the magnetic field lines between the poles. (2mk)

9. Draw the magnetic field in the set up below 1mk





10. The diagram below shows two bar magnets X and Y and the magnetic pattern



(i) Identify B and C (1mk)

B: North pole

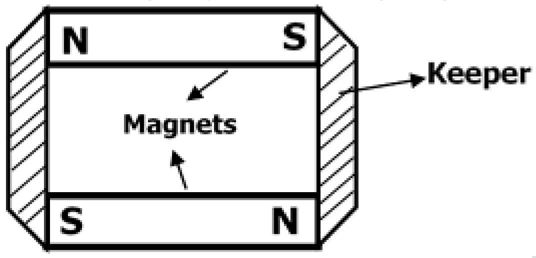
C: North pole

(ii) State with a reason which magnet X or Y is stronger (1mk)

X is stronger because the magnetic field lines are closer to each other.

DEMAGNETIZATION

1. The figure below shows how magnets are stored in pairs with keepers at the end. Explain how this method of storing helps in retaining magnetism longer

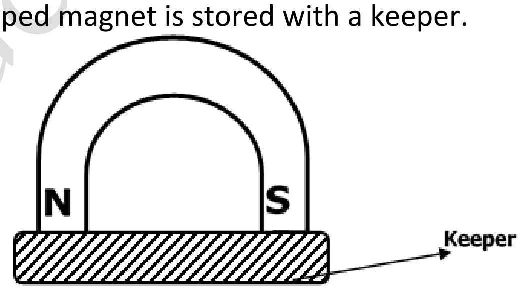


The keepers acquire polarities opposite to those of the magnet so that the dipoles of the magnet and those of the keepers form complete loops. The dipoles thus retain their orientation.

2. Explain how hammering demagnetizes a magnet.

When hammered the magnetic dipoles a set into vibration they are deviated in different directions hence the net magnetic field is cancelled.

3. Figure below shows a U-shaped magnet is stored with a keeper.



Explain how this method helps to retain magnetism longer. (2mks)

The keepers acquire polarities opposite to those of the magnet so that the dipoles of the magnet and those of the keepers form complete loops. The dipoles thus retain their orientation. The magnet maintains its magnetism longer.

4. Increase in temperature weakens or destroys magnetism of a magnet. Explain (2mk)

An increase in temperature increases the kinetic energy of the dipoles hence start vibrating hence losing their alignment hence weakens or destroys the magnetism.

5. Explain in terms of domain theory what happens when a bar magnet is placed in a solenoid in which an alternating current flows. (2mk)

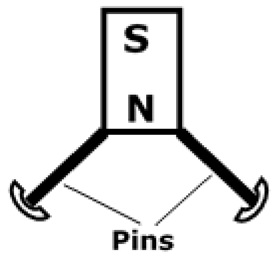
The alternating current demagnetizes the magnet because it alternates in opposite direction 50 times per second. When withdrawn slowly different domains attain random polarities.

MAGNETIZATION

1. Name two methods of demagnetizing a magnet. (2mk)

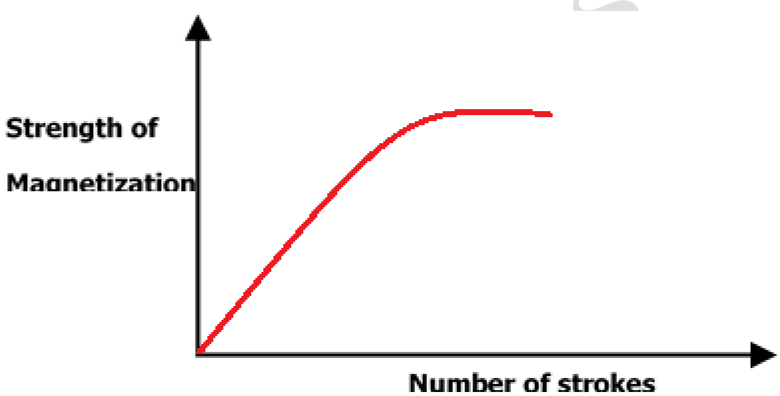
- *Electrical method (using alternating current)*
- *Hammering or heating while facing in an East – west direction*

2. The figure below shows two pins hanging from a magnet. Explain why they do not hang vertically downwards (2mk)

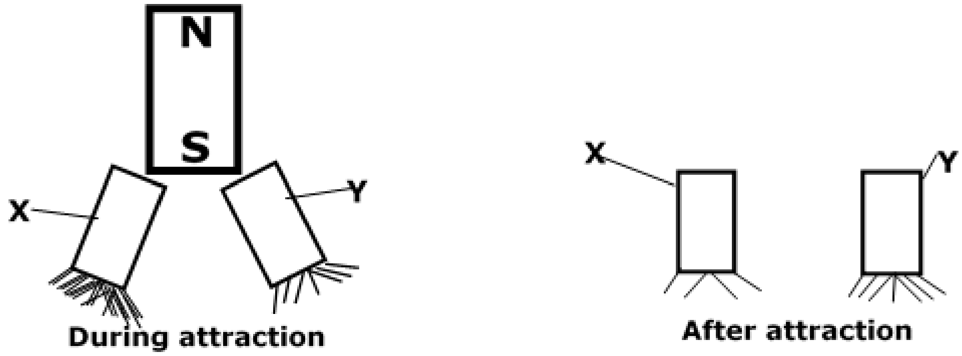


The pins are magnetized by induction acquire similar poles at the ends hence they repel each other

3. A ferromagnetic material is being magnetized by single stroking method. On the axes provided, sketch a graph to show how the strength of the magnet being created varies with the number of strokes (2mk)



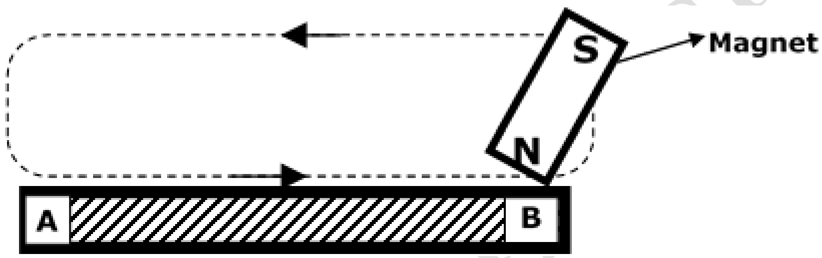
4. The below shows a simple experiment using a permanent magnet and two metal bars X and Y and the iron fillings attracted to each.



State with reason, which bar is a soft magnetic material (2mk)

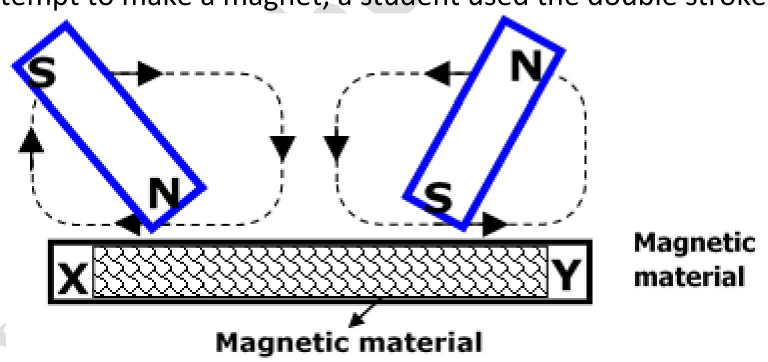
X: It is easily magnetized hence picks more iron filings when magnetized by induction and when the magnet is removed it easily loses magnetism hence most of the iron filings drop from the metal bar.

5. The figure below shows one method of making a magnet.



Name the polarity formed at:
(i) A: North pole (ii) B: *South pole* (1 mk)

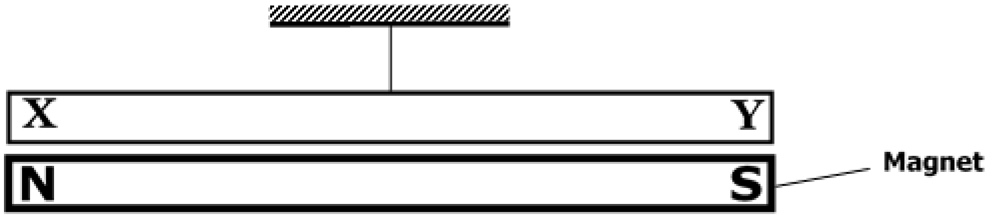
6. In an attempt to make a magnet, a student used the double stroke method as shown below.



State the polarity at end X and Y. (2mk)

X: South pole
Y: North pole

7. A bar magnet was suspended freely above another bar magnet with marked poles as shown.

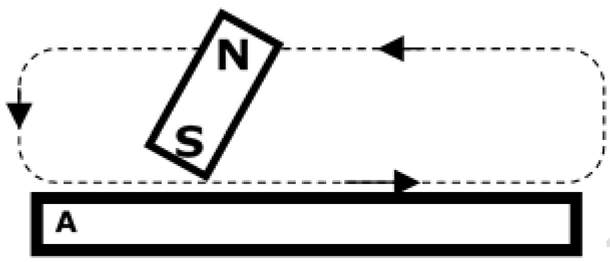


State the poles at X and Y of the suspended magnet (2mks)

X: south Pole

Y: north Pole

8. The South Pole S of a magnet is stroked along a metal bar in the direction shown.



a) Name a metal which could become permanently magnetized by stroking in this way

Steel

b) State the polarity of end A (1mk)

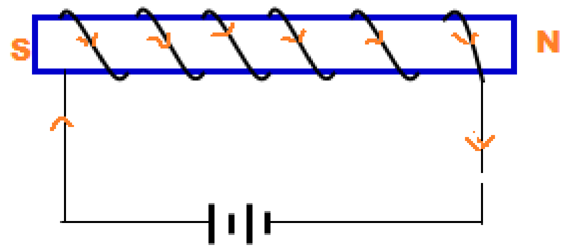
A: south Pole

9. Explain using the domain theory of magnetism how an iron bar can be magnetized to saturation level by placing it in a magnetic field whose strength can be varied. (2mks)

When the iron bar is placed in the magnetic field most of the domains are aligned in one direction. All the domains are aligned until the bar becomes magnetically saturated.

ELECTROMAGNETS

1. The figure below shows a solenoid with a ferromagnetic core connected to a battery, ammeter and a rheostat.



On the diagram indicate.

i) The current direction in the external circuit and around the solenoid. (1mk)

ii) The polarity of the resulting electromagnet. (1mk)

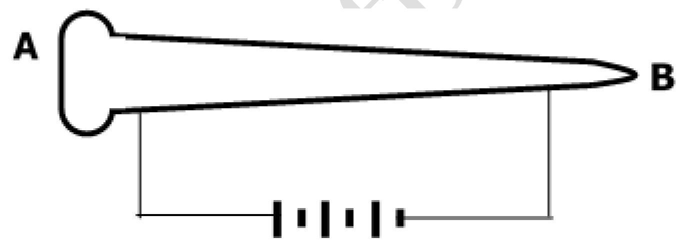
2. An electromagnet is made by winding insulated copper wire on an iron core. State <u>three</u> changes that could be made to increase the strength of the electromagnet. (3mks)

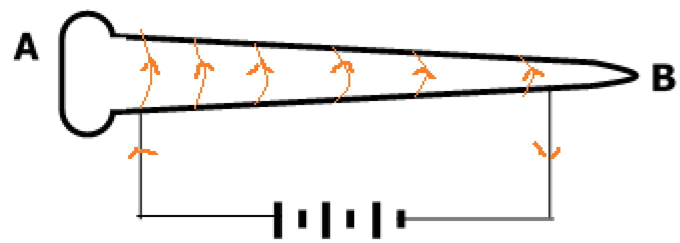
i) Increasing the current passing through

ii) Increasing the number of turns of the copper wire

iii) Using a horse shaped soft iron as a core

3. The figure below shows a mail on which a wire is to be would to make an electromagnet





By drawing, show how the wire should be wound around the nail so that end A becomes a north pole and end B a south pole (1mk)

4. State one advantage of an electromagnet as compared to a permanent magnet (1mk)

The magnetic strength of the magnet can be varied by altering a number of factors but for a permanent magnet the strength is fixed.

5. State TWO factors that affect the strength of an electromagnet.

- ***size of the current in the circuit***
- ***Length of the solenoid***

- ***Shape of the core***

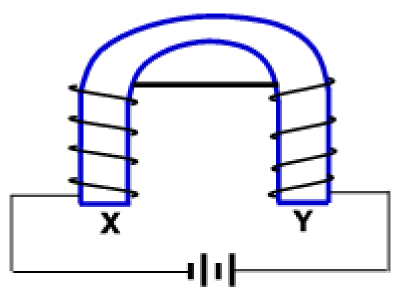
6. One way of demagnetizing bar is to place it in a solenoid in which an alternating current (ac) flows. How is the demagnetization achieved?

The alternating current demagnetizes the magnet because it alternates in opposite direction 50 times per second. When withdrawn slowly different domains attain random polarities.

7. An electromagnet is made by winding insulated copper wire on an iron core. State three changes that could be made to increase the strength of the electromagnet. (3mks)

- ***Increasing the magnitude of the current in the solenoid,***
- ***Increasing the number of turns of the copper solenoid***
- ***Use a horse shoe shaped iron core.***

8. Figure shows a magnetic material being magnetized

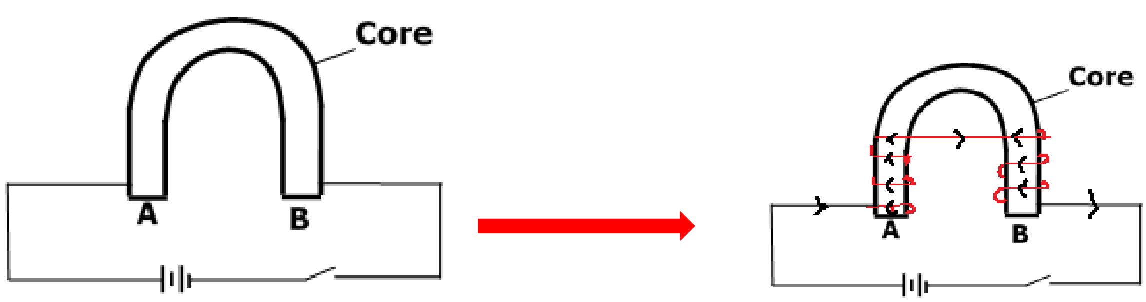


Identify the polarities of X and Y (2mks)

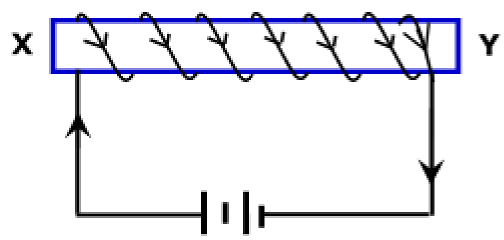
X: North pole

Y: South pole

9. Figure below shows an incomplete circuit of an electromagnet. Complete the circuit by drawing the windings on the two arms of the core such that A and B are both North poles when the switch is closed. Indicate the direction of the current on the windings drawn.

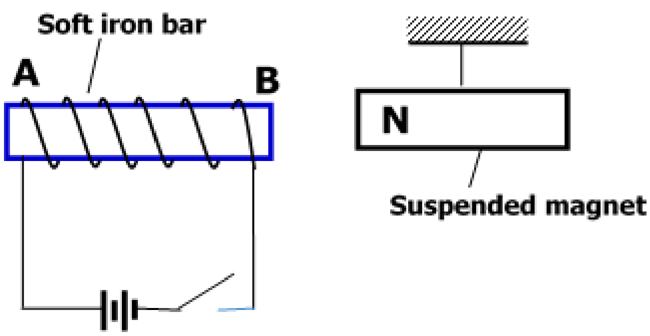


10. An iron rod XY is placed inside a coil of wire. What type of magnetic pole is induced at the end X and Y when the current flows through the coil? (2mk)



X: south pole
Y: north pole

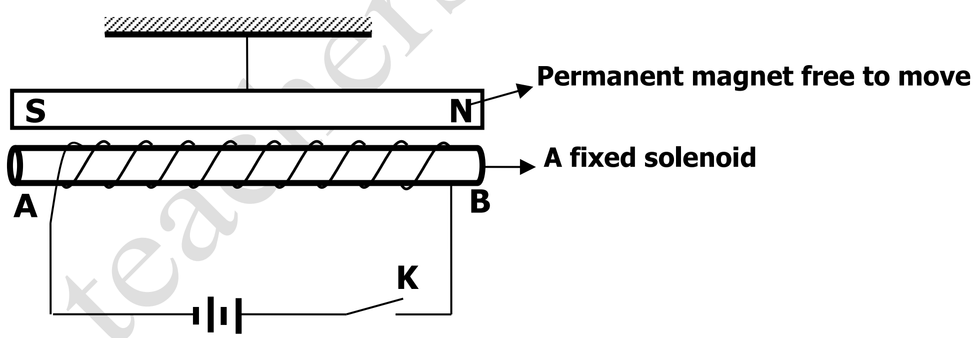
11. The figure below shows a soft iron bar AB placed in a coil near a freely suspended magnet.



Explain the observation made when the switch is closed. (2mk)

The iron bar becomes magnetized by electrical method and it is attracted to the magnet.

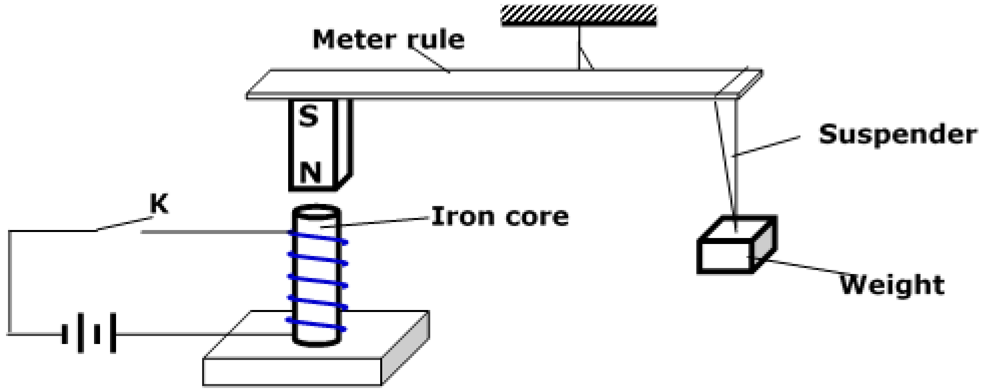
12. Figure below shows an arrangement of a cylindrical bar magnet suspended freely close and parallel to a fixed solenoid.



Explain what motion you are likely to observe in the arrangement when switch K is closed. (3mks)

The magnet tends to move away from the solenoid.
When current flows through the solenoid the solenoid becomes a magnet with end A being a south pole and end B being a north pole. Like poles repel each other hence the magnet tends to move away.

13. In the set up, the suspended meter rule is in equilibrium balanced by the magnet and the weight shown. The iron core is fixed to the bench.



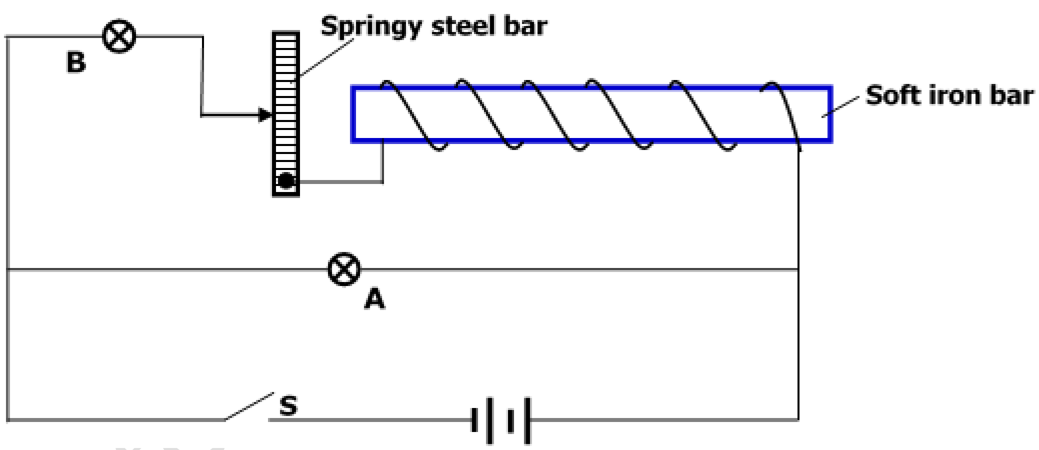
i) State and explain the effect on the meter rule when the switch K is closed (3mk)

The rule tilts in an anticlockwise direction. The iron core is magnetized by the electrical method and the end close to the magnet acquires a south pole hence attraction occurs and the meter rule tilts in anti – clockwise direction.

ii) What would be the effect of reversing the battery terminals? (1mk)

The meter rule tilts in a clockwise direction.

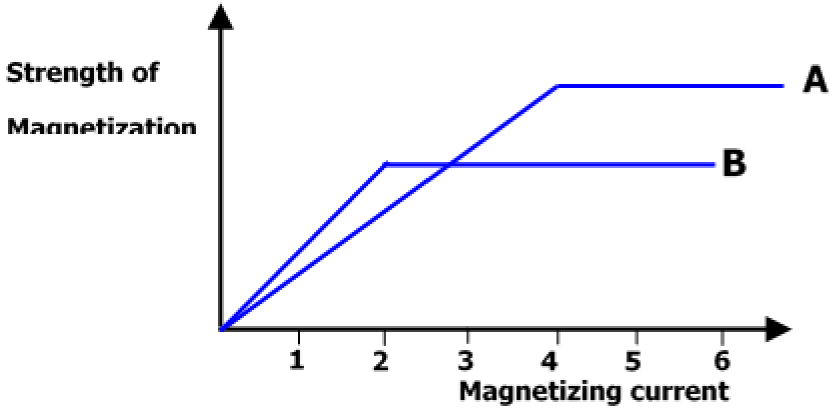
14. The figure shows a circuit with two bulbs, A and B



It is noted that when the switch S is closed, bulb A lights continuously while B flickers. Explain this observation (3mk)

Bulb B flickers because when current flows through the solenoid the soft iron is magnetized and attracts the steel bar opens the contacts and bulb B goes off. This switches off the current and the iron bar loses magnetism releases the steel bar the contact closes the current flows once more and the process is repeated hence the flickering of bulb B.

15. Figure shows a graph of magnetisation against magnetizing current for two materials A and B.



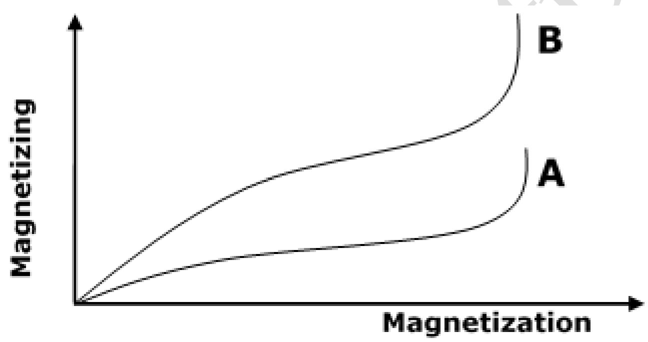
a) State with a reason, the material which is more suitable for use in a transformer to concentrate the magnetic fields. (2mk)

B – It is easily magnetized (it's a soft magnetic material)

b) Determine the current required to obtain saturation for the material which is suitable for making a permanent magnet. (1mk)

4 amperes

16. In an experiment to magnetize two substances A and B using electric current. Two curves were obtained as shown below.

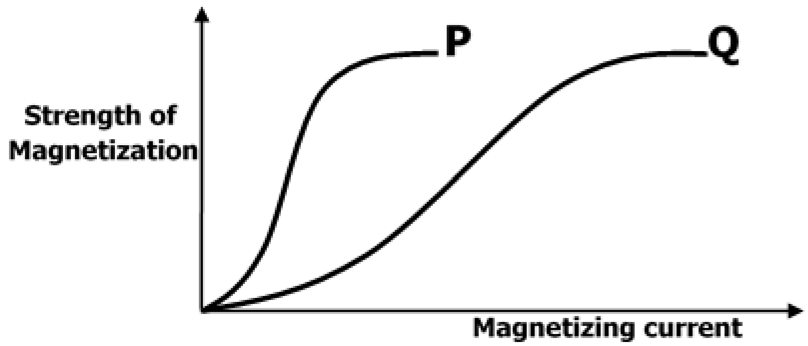


Using the information above explain the difference between the substances A and B with reference to the domain theory (3mk)

A is a soft magnetic material. When current flows through the materials the domains are easily aligned in a north South direction until all the dipoles are aligned in north - south direction (magnetic saturation).

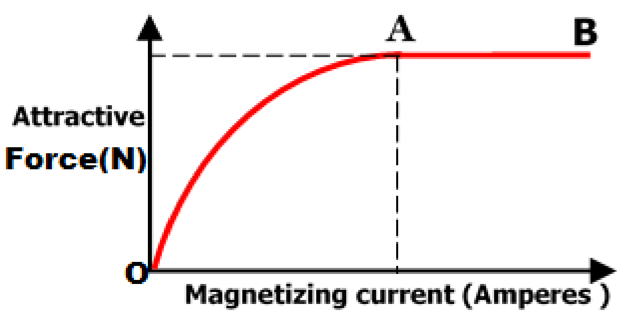
On the other hand B is a hard magnetic material, a larger current is required to align the dipoles in a north- south direction until magnetic saturation when the curve flattens.

17. In an experiment to magnetize two substances P and Q using electric currents, two curves (graphs) were obtained as shown. Explain the differences between the substance P and Q with reference to the domain theory.



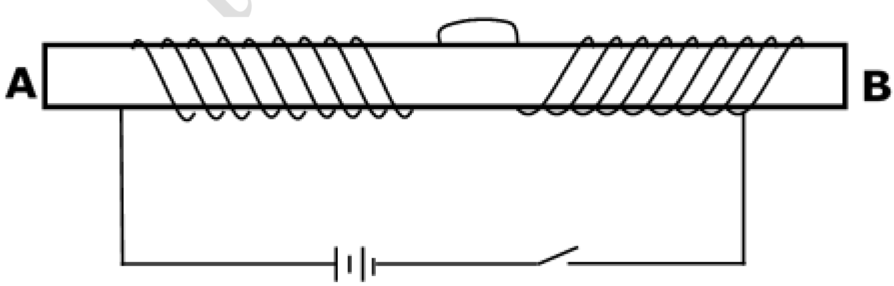
When the magnetizing current is increased the dipoles align more and more until magnetic saturation is attained where the magnetism becomes maximum and remains constant. Substance P requires less current then Q to attain magnetic saturation. This means P is easily magnetized than Q. This also means that P can form a temporary magnet while Q can form a permanent magnet. Therefore P is a soft magnetic material while Q is a hard soft magnetic material

18. The graph in the figure shows the relationship between the attractive forces of an electromagnetic and the magnetizing current. Give reasons for the shape of the curve in terms of the domain theory.



Region OA as the magnetizing current is increasing the attractive force increases because the current is aligning the dipoles in the North – south direction. In region AB the attractive force remains constant as magnetizing current increases because all the dipoles have been aligned in north south direction (the electromagnet has attained its magnetic saturation).

19. A student made a simple electromagnet by winding a coil of insulated copper around an iron bar as shown.

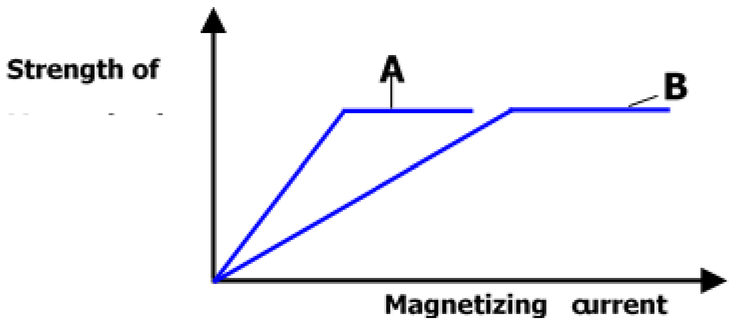


Determine the polarity of A and B. (1mk)

A: south pole

B: North pole

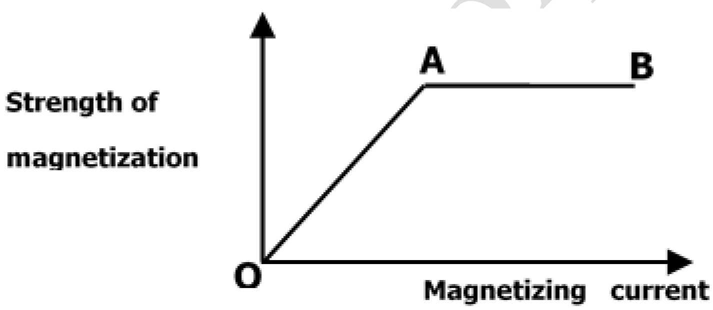
20. In an experiment to magnetize two substances A and B using a current, two curves were obtained as shown below



Explain the difference between A and B with respect to the domain theory

Substance A is a soft magnetic material less current is required to align the dipoles in a north south direction until it attains its magnetic saturation when the strength remains constant. On the other hand B is a hard magnetic material and more current is required to align the dipoles until magnetic saturation when the strength remains constant as current increases.

21. In an experiment to magnetize a certain substance using a current, the graph below was obtained.



Explain with respect to the domain theory what is happening between.

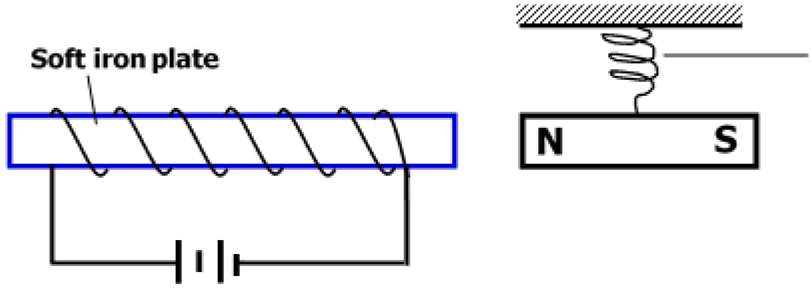
(i) O – A (1mk)

O – A – there is an increase in the magnetizing current and the dipoles are aligning themselves in one direction (North – south direction)

(ii) A – B (1mk)

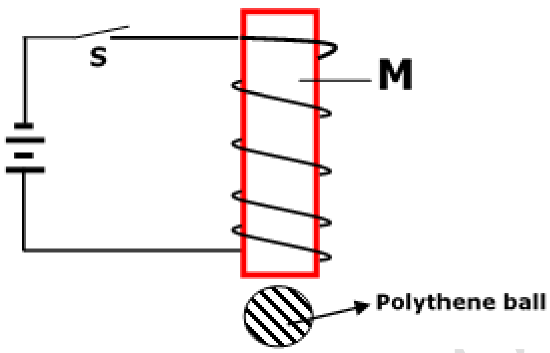
All the domains have aligned themselves in a North – South direction and there is no further magnetisation (it has attained magnetic saturation)

22. The diagram below shows a permanent magnet suspended by a spring. State with reason the behaviour of the magnet when the switch s is closed. (2mk)



The magnet moves away from the electromagnet towards the direction of the South Pole. When the switch is closed current flows through the solenoid and by the right hand grip rule the end of the solenoid close to the North Pole acquires a North Pole hence repel the north pole of the suspended magnet.

23. Figure below shows an electromagnet in an electric circuit.



a) State what happens to the polythene ball when the switch S is closed. (1mk)

It will be attracted to the electromagnet

b) Why soft iron is is preferred for material A than steel? (1mk)

It is easier to magnetize and demagnetize than steel.

c) State two ways in which the electromagnet could be made stronger. (2mk)

Increasing the magnitude of the magnetizing current.

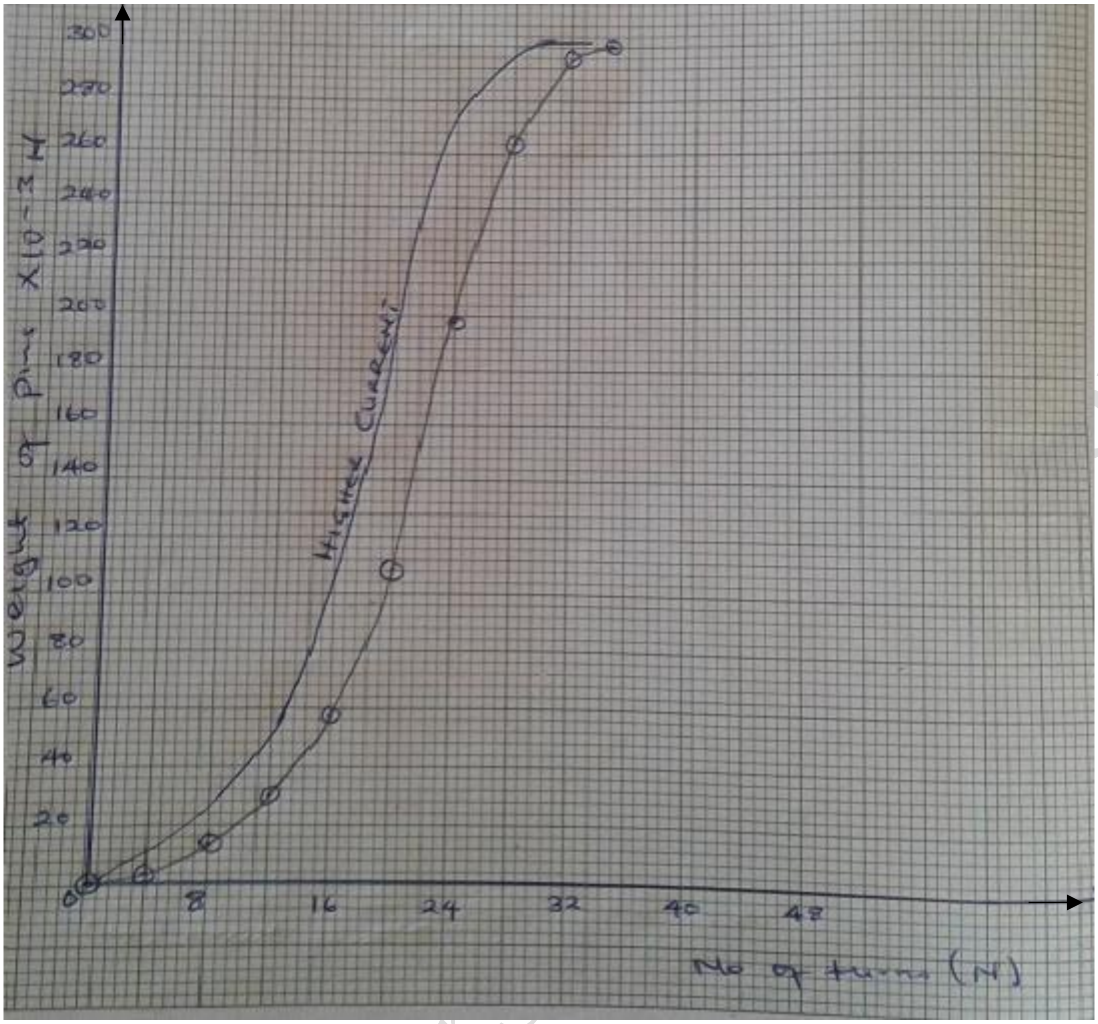
Increasing the number of turns of the coil of the solenoid.

24. In an experiment to determine the strength of an electromagnet; the weight of pins that can be supported by the electromagnet was recorded against the number of turns. The current was kept constant throughout the experiment.

The table below shows the data obtained;

Number of turns (n)	0	4	8	12	16	20	24	28	32	38
Weight W of pins x 10^{-3} (N)	0	4	14	30	58	108	198	264	296	300

(i) Plot a graph of weight W (y-axis) against the number of turns, n. (5 mks)

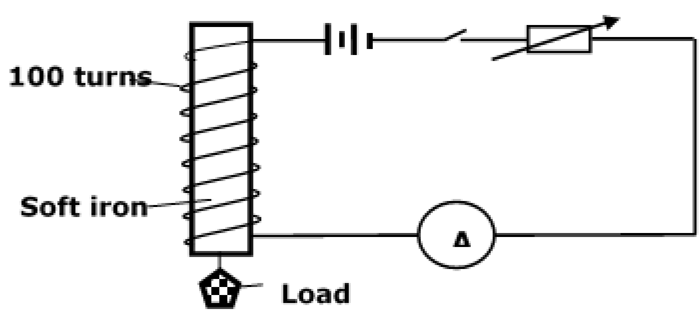


(ii) Use the domain theory to explain the nature of the curve. (2 mks)

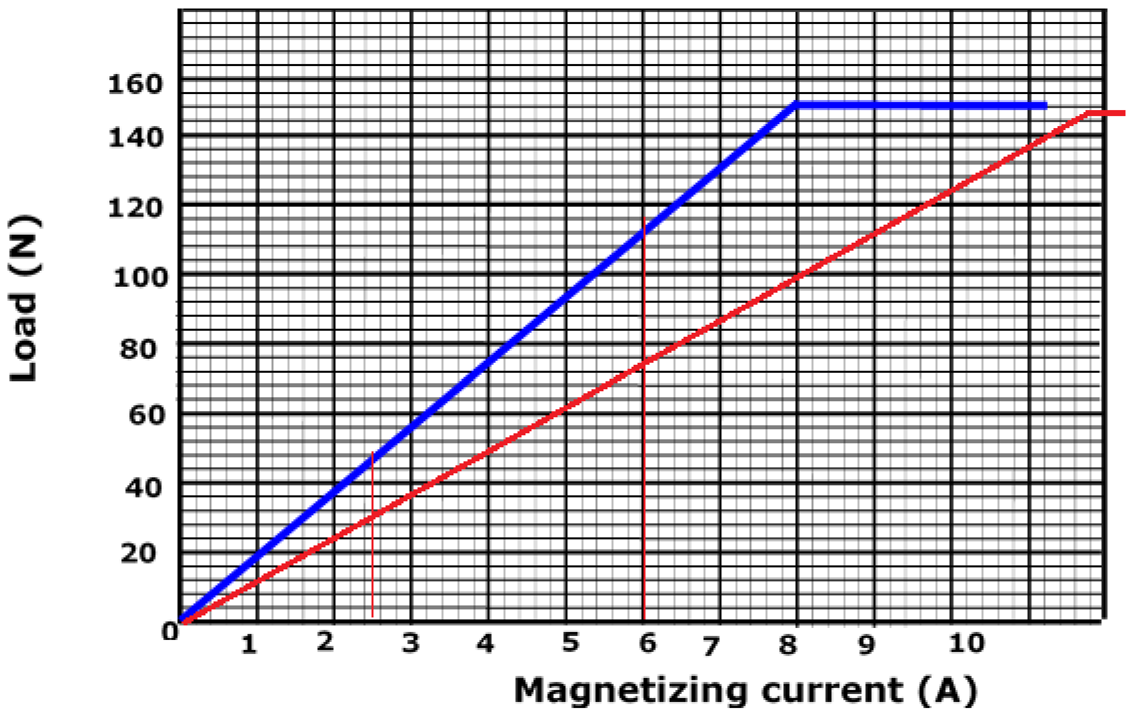
As the number of turns increases the dipoles are being aligned in a north – south direction hence an increase in the strength of the magnet (weight of pins attracted). When all the domains have been aligned in a north – south direction the magnet attains saturation and the magnetic strength remains constant as number of turns is increased.

b) Sketch in the same axes the curve that would be obtained using a higher current. (1 mk)

25. Two students investigated how the strength of an electromagnet depended on the current .The set up is as shown in the figure below.



They plotted the following graph showing how the load varies with the magnetizing current.



(a) From the graph determine the load that can be supported by the electromagnet when the current was

(i) 2.5 A(2mks)

48 N

(ii) 6.0A(2mks)

112 N

b) Sketch on the same axis a graph you would expect if coil of 50 turns was used (1mk)

c) (i) Using the domain theory explain what happens to the iron (2mks)

As the current increases the strength of the magnet increases because the current aligns the dipoles in the domains in one direction (north – south direction) hence increase in the load to be lifted.

(iii) State the reason for graph leveling off at the top

The graph levels at the top because at this point all the domains have been aligned in one direction (magnetic saturation has been attained) any increase in current does not increase the strength of the magnet