STD VII

ELECTRICITY

SOME IMPORTANT TERMS

1. CURRENT - THE FLOW OF ELECTRICITY ACROSS A CIRCUIT IS CALLED CURRENT.

- IT FLOWS FROM POSITIVE TERMINAL (ANODE) TO THE NEGATIVE TERMINAL (CATHODE) IN A CIRCUIT.

- WE DENOTE CURRENT BY "I".

-THE UNIT OF CURRENT IS AMPERE,WHICH IS DENOTED BY 'A'. (FOR Eg. 5A OF I).

- THE DEVICE WHICH IS USED TO MEASURE CURRENT IS AMMETER.

2. POTENTIAL DIFFERENCE

-IT IS THE DIFFERENCE IN THE CONCENTRATION OF CHARGES BETWEEN THE TWO POINTS THAT IS POSITIVE ELECTRODE(ANODE) AND THE NEGATIVE ELECTRODE (CATHODE), IN AN ELECTRIC CIRCUIT.

-IT IS MEASURED IN VOLTS ,WHICH IS DENOTED BY 'V'.

-THE DEVICE USED TO MEASURE VOLTAGE OR POTENTIAL DIFFERENCE IS VOLTMETER.

3. ELECTRIC CIRCUIT

- THE PATH ALONG WHICH AN ELECTRIC CURRENT CAN FLOW IS CALLED AN ELECTRIC CIRCUIT.

-THE REPRESENTATION OF AN ELECTRIC CIRCUIT USING SYMBOLS FOR ITS COMPONENTS ,IS KNOWN AS CIRCUIT DIAGRAM.

-IT CONSISTS OF A CELL OR A BATTERY , AMMETER, RESISTANCES, A VOLTMETER AND A SWITCH.

Q1. WHAT IS ELECTRICAL RESISTANCE? ON WHAT DOES THE RESISTANCE OF A PIECE OF MATERIAL DEPEND?

A1. RESISTANCE (R) IS THE FORCE THAT OPPOSES THE FLOW OF CURRENT IN A CIRCUIT.

THE UNIT OF RESISTANCE IS OHM.

RESISTANCE DEPENDS ON -

1.NATURE OF THE MATERIAL USED.

2.THICKNESS OF THE MATERIAL.(RESISTANCE IS INVERSELY PROPORTIONAL TO THE CROSS SECTIONAL AREA OF THE MATERIAL).

3. LENGTH OF THE MATERIAL.(R IS DIRECTLY PROPORTIONAL TO THE LENGTH OF THE MATERIAL).

Q2.EXPLAIN OHM'S LAW.

A2. OHM'S LAW JUSTIFIES THE RELATION BETWEEN CURRENT , VOLTAGE AND RESISTANCE.

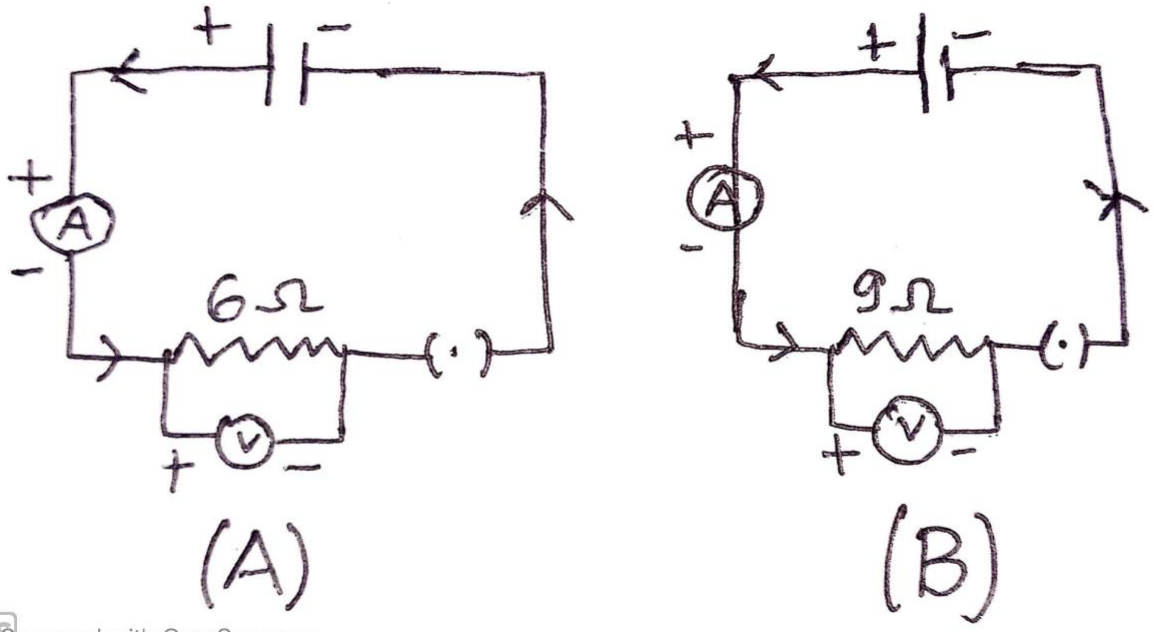
-ACCORDING TO OHM'S LAW;

$$V = IR$$

THAT IS, I IS DIRECTLY PROPORTIONAL TO V WHICH MEANS THAT IF THE VOLTAGE IN A CIRCUIT INCREASES, THE CURRENT ALSO INCREASES.

*ALSO, R IS INVERSELY PROPORTIONAL TO I , THAT IS, IF WE INCREASE THE RESISTANCE, CURRENT DECREASES.

Q3.WHICH CIRCUIT WILL HAVE GREATER CURRENT FLOWING THROUGH IT AND WHY?



A3. CIRCUIT (A) WILL HAVE GREATER CURRENT FLOWING THROUGH IT BECAUSE-

*POTENTIAL DIFFERENCE IN BOTH CIRCUITS IS THE SAME.

*THE RESISTANCE IN CIRCUIT (A) IS LESS THAN THAT OF CIRCUIT (B) ,SO GREATER CURRENT WOULD FLOW THROUGH THE CIRCUIT.(RESISTANCE IS INVERSELY PROPORTIONAL TO CURRENT).

Q4. HOW IS THE HEAT PRODUCED BY AN ELECTRIC CURRENT RELATED TO RESISTANCE AND THE MAGNITUDE OF THE CURRENT?

A4. * THE HEAT PRODUCED BY AN ELECTRIC CURRENT IS DIRECTLY PROPORTIONAL TO THE RESISTANCE, PROVIDED THE VALUE OF CURRENT REMAINS CONSTANT.

H IS DIRECTLY PROPORTIONAL TO R.

*THE HEAT PRODUCED IS DIRECTLY PROPORTIONAL TO THE SQUARE OF THE CURRENT,PROVIDED THE VALUE OF RESISTANCE REMAINS CONSTANT

H PROPORTIONAL TO $(I)^2$

Q5.WHY DOES THE BULB GET WARMER THAN THE WIRES THAT CONNECT IT TO A BATTERY?

A5. THE BULB GETS WARMER THAN THE WIRES AFTER SOMETIME, WHEN CONNECTED TO A BATTERY BECAUSE:

* THE RESISTANCE OF THE FILAMENT OF THE BULB IS HIGHER THAN THAT OF THE WIRES.

*HENCE , MORE HEAT IS GENERATED IN THE BULB AND THUS THE BULB GETS WARMER.

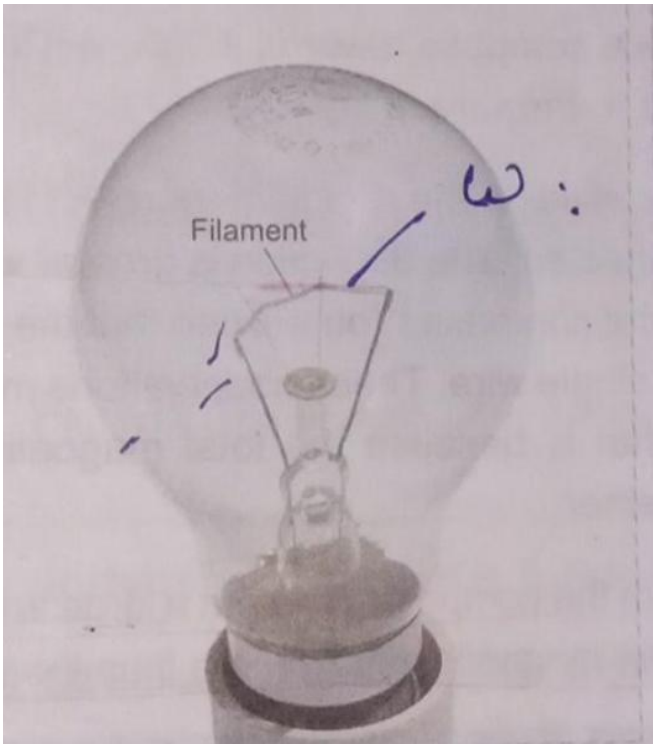
* THE WIRES ARE FOR CONDUCTING CURRENT AND HENCE HAVE A LOWER RESISTANCE.

Q6. WHICH TYPE OF MATERIAL/FILAMENT IS USED IN BULB AND WHY?

A6. THIN AND LONG TUNGSTEN FILAMENT IS USED IN BULB.

*WHEN CURRENT IS PASSED THROUGH A BULB,IT FACES GREATER RESISTANCE DUE TO THE LONG- THIN COILED FILAMENT OF TUNGSTEN.THUS,MORE HEAT IS PRODUCED.

*THE FILAMENT BEGINS TO GLOW AND THE BULB EMITS LIGHT.



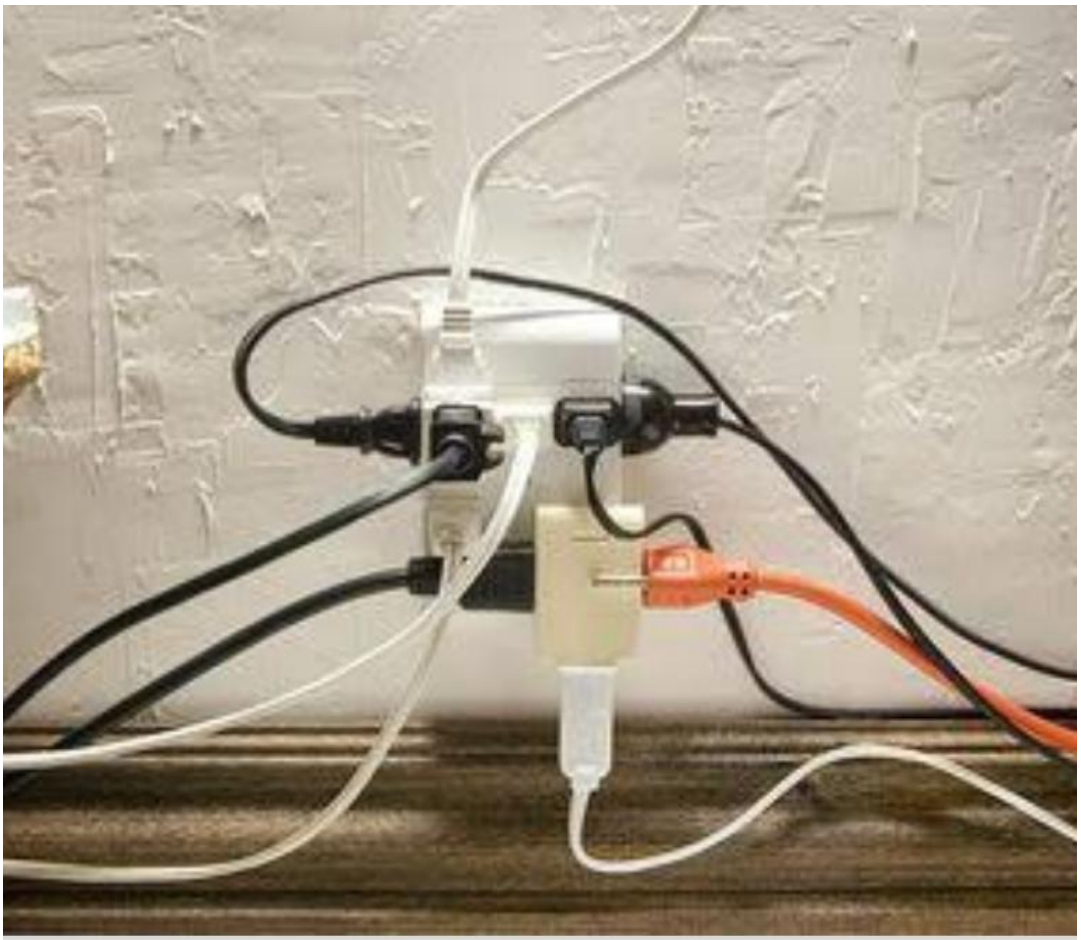
*ALSO TUNGSTEN HAS VERY HIGH MELTING POINT AND DOES NOT GET EASILY OXIDIZED.

Q7. MENTION SOME PROBLEMS ASSOCIATED WITH THE HEATING EFFECT OF ELECTRIC CURRENT.

A7.THE PROBLEMS ASSOCIATED WITH THE HEATING EFFECT OF CURRENT ARE-

1. A PART OF THE ELECTRICAL ENERGY IS DISSIPATED AS HEAT AND HENCE WASTED.

2.IF WE DRAW CURRENT MORE THAN THE PERMISSIBLE LIMIT, IT CAUSES EXCESSIVE HEATING OF THE WIRE.THIS IS OVERLOADING .



3. DUE TO THE OVERLOAD,THE INSULATION COVER OF THE WIRE MELTS,OPPOSITE WIRES COME IN CONTACT AND THE RESISTANCE OF

THE CIRCUIT BECOMES VERY LOW.THIS CAUSES A HEAVY FLOW OF CURRENT WHICH CAN CAUSE FIRE. THIS IS SHORT CIRCUIT.

Q8.WHAT IS A FUSE?

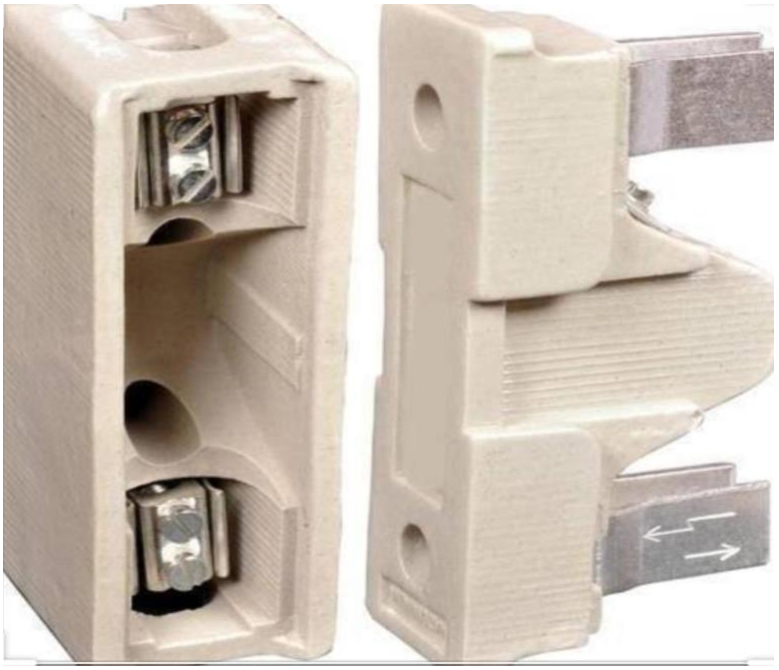
A8. A FUSE IS A SAFETY DEVICE IN AN ELECTRIC CIRCUIT.IT BREAKS THE CIRCUIT WHEN CURRENT IS MORE THAN THE PERMISSIBLE LIMITS.IT THUS PROTECTS THE ELECTRICAL DEVICES FROM DAMAGE.

*IT ACTS AS A SAFETY DEVICE BECAUSE THE WIRE MELTS AND THE CIRCUIT IS BROKEN, IN CASE OF OVERLOADING.

*THUS, THE ELECTRICAL DEVICES ARE SAVED AND SHORT CIRCUIT IS PREVENTED.

* FUSE WIRE IS MADE UP OF SOLDER THAT IS AN ALLOY OF TIN(Sn) AND LEAD (Pb)AND HAS A LOW MELTING POINT.

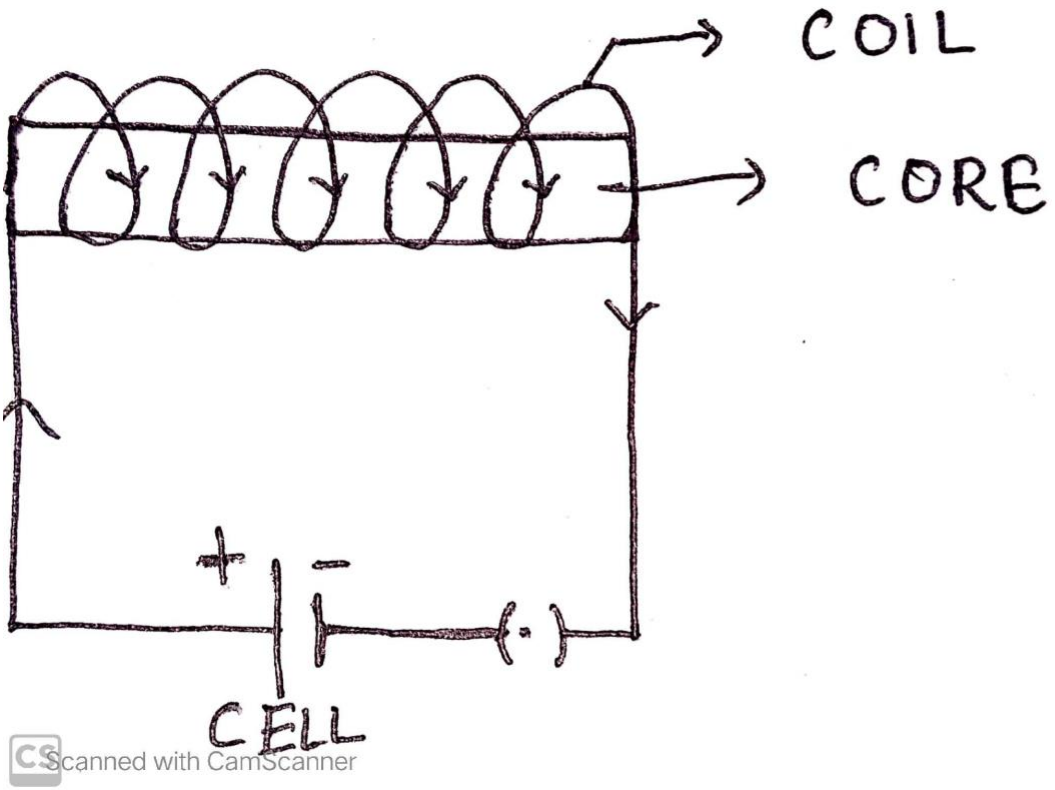
* FUSE WIRE IS ENCLOSED IN A CERAMIC ,GLASS OR PLASTIC BODY.



Q9.WHAT IS AN ELECTROMAGNET?

A9.AN ELECTROMAGNET CONSISTS OF A CORE AROUND WHICH A COIL IS WOUND AND IS CONNECTED TO A SOURCE OF POTENTIAL DIFFERENCE.

*AS SOON AS THE CIRCUIT IS CLOSED, CURRENT STARTS FLOWING THROUGH THE COIL AND THE CORE GETS MAGNETISED.



Q10. WHAT ARE THE FACTORS ON WHICH THE STRENGTH OF THE ELECTROMAGNET DEPENDS?

A10. THE STRENGTH OF AN ELECTROMAGNET DEPENDS UPON,

1. THE NATURE OF THE CORE.

2.THE MAGNITUDE OF THE CURRENT PASSED.

3.THE NUMBER OF TURNS OF THE COIL.

4.THE TIME DURATION FOR WHICH THE CURRENT FLOWS THROUGH IT.

Q11.SHOW THAT A CURRENT CARRYING CONDUCTOR BEHAVES LIKE A MAGNET?

A11. WE WOULD TAKE AN ELECTRIC CIRCUIT AND PLACE A MAGNETIC COMPASS CLOSE TO IT.

*WHEN WE CLOSE THE CIRCUIT , THE COMPASS SHOWS DEFLECTION.

*WHEN THE CURRENT IS STOPPED, THE DEFLECTION ALSO STOPS.

*IF THE POLARITY OF THE CURRENT IS REVERSED, THE DIRECTION OF DEFLECTION OF THE COMPASS NEEDLE ALSO CHANGES.

*IF THE AMOUNT OF CURRENT FLOWING IN THE CIRCUIT IS INCREASED ,THE DEFLECTION ALSO INCREASES

HENCE, THIS SHOWS THAT A CURRENT CARRYING CONDUCTOR HAS A MAGNETIC FIELD ASSOCIATED WITH IT.

Q12. WHY DO WE USE SOFT IRON CORE IN AN ELECTROMAGNET?

A12. A SOFT IRON IS USED TO MAKE ELECTROMAGNET BECAUSE-

1. IT GETS EASILY MAGNETISED.

2.IT LOSES ITS MAGNETISM THE MOMENT CURRENT STOPS FLOWING.THIS MAKES IT POSSIBLE TO BE USED IN CRANES AND ELECTRIC BELL.

Q13. DO YOU THINK ELECTROMAGNET CAN BE USED FOR SEPARATING PLASTIC BAGS FROM A GARBAGE HEAP? EXPLAIN.

A13. NO, AN ELECTROMAGNET CANNOT BE USED TO DO SO.

* IT CAN ONLY ATTRACT MAGNETIC MATERIALS.

*PLASTIC BAG IS A NON-MAGNETIC MATERIAL AND WILL NOT BE ATTRACTED BY AN ELECTROMAGNET.

Q14.WHAT HAPPENS WHEN YOU PLACE AN IRON NAIL IN A CURRENT-CARRYING COIL?

A14. THE IRON NAIL WOULD GET MAGNETISED, WHEN PLACED IN A CURRENT CARRYING COIL. HOWEVER, IT WILL LOSE ITS MAGNETISM WHEN THE CURRENT STOPS FLOWING THROUGH THE CONDUCTOR.

Q15. NAME ANY TWO EFFECTS OF ELECTRIC CURRENT.

A15. 1. HEATING EFFECT OF ELECTRIC CURRENT- WHEN A ELECTRIC CURRENT IS PASSED THROUGH A WIRE,THE WIRE BECOMES HOT AND A PART OF ELECTRIC ENERGY IS CONVERTED INTO HEAT.

THIS IS CALLED HEATING EFFECT OF THE ELECTRIC CURRENT.

USES OF HEATING EFFECT OF ELECTRIC CURRENT

2. MAGNETIC EFFECT OF ELECTRIC CURRENT - WHEN ELECTRIC CURRENT PASSES THROUGH A WIRE, IT BEHAVES LIKE A MAGNET.THIS IS CALLED THE MAGNETIC EFFECT OF ELECTRIC CURRENT.

Q16.EXPLAIN THE CONSTRUCTION AND WORKING OF AN ELECTRIC BELL.

A16. STRUCTURE:.

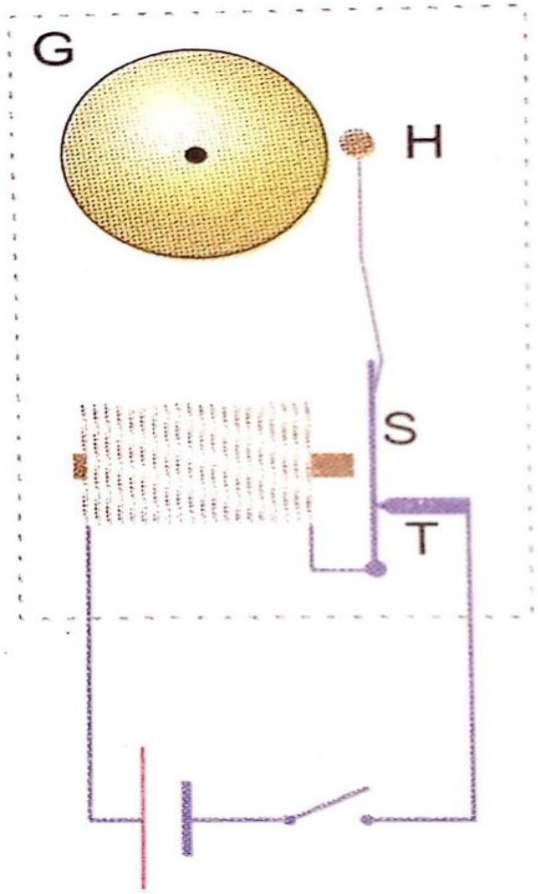
* AN ELECTROMAGNET WITH A CORE THAT CAN BE MAGNETISED TEMPORARILY IS USED.

*AN OUTER SWITCH IS AT THE DOOR STEP.

*AN INNER SWITCH HAVING A FIXED METALLIC PART (T) AND A SPRINGY IRON STRIP (S).

*TO THE IRON STRIP(S), HAMMER (H) IS CONNECTED.

* THIS HAMMER (H) HITS THE GONG(G), AND THE SOUND IS PRODUCED.



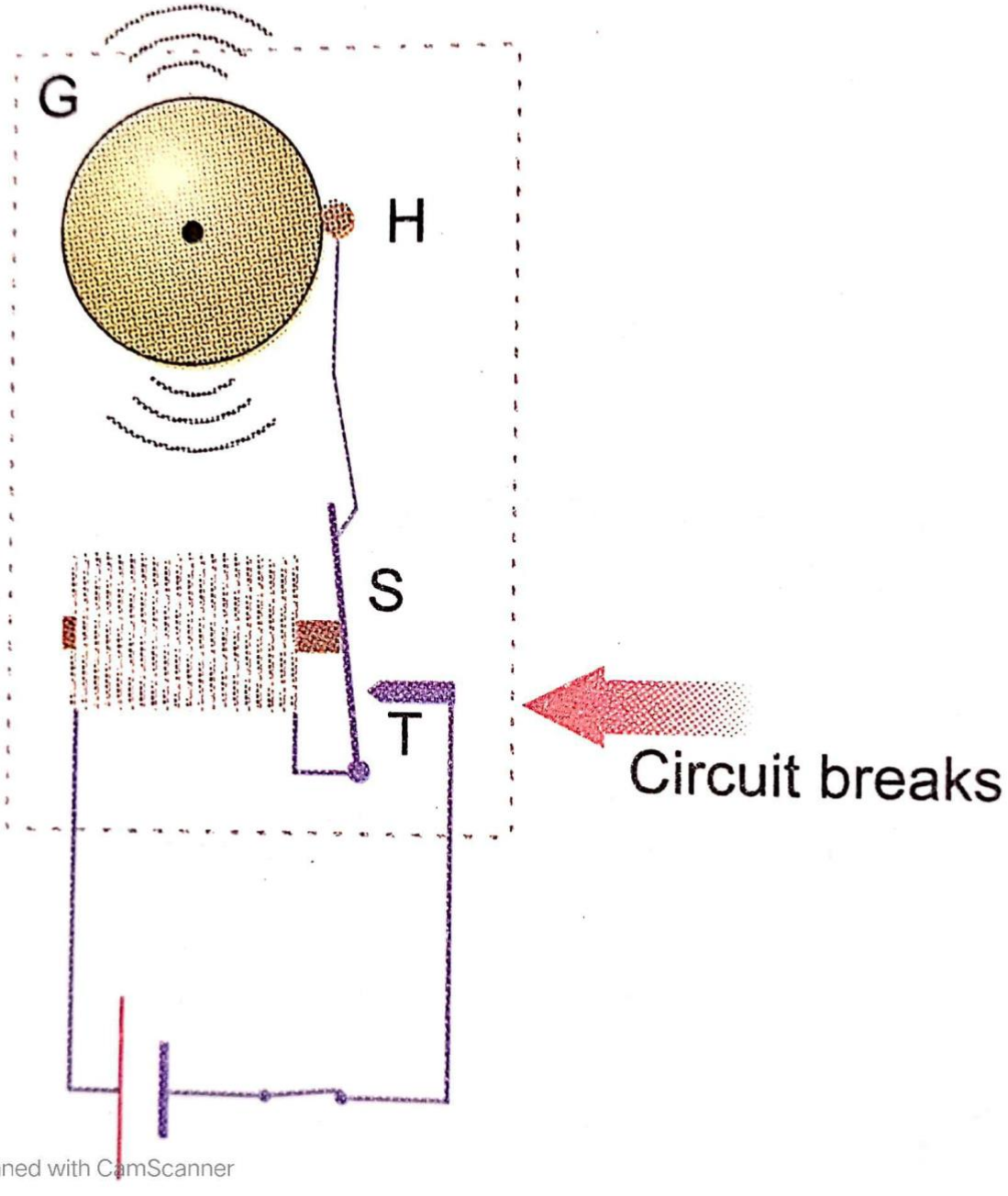
WORKING:

1. WHEN WE PRESS THE OUTER SWITCH, THE CURCUIT CLOSES AND CURRENT STARTS FLOWING IN THE COIL.

2.THE CORE IS TEMPORARILY MAGNETISED.

3.THIS NOW ATTRACTS THE SPRING IRON STRIP(S) TOWARDS ITSELF.

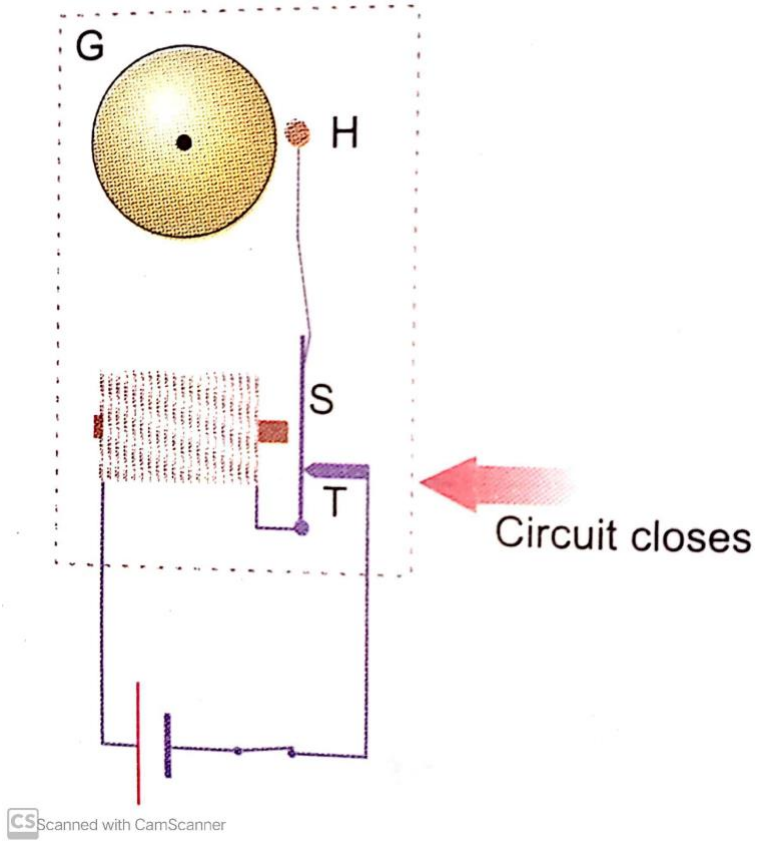
4.THUS, THE HAMMER HITS THE GONG AND THE BELL STARTS RINGING.



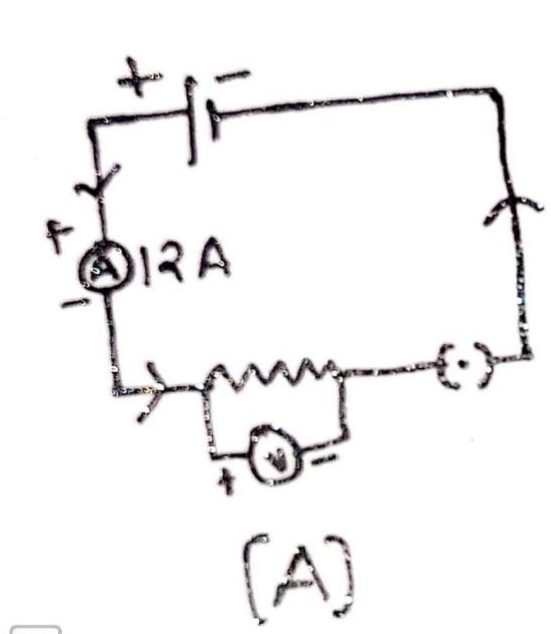
5. IN THIS PROCESS THE CONNECTION BETWEEN 'S' AND 'T' BREAKS AND SO CURRENT STOPS FLOWING IN THE CIRCUIT.

6. THE CORES LOSES ITS MAGNETISM AND THE SPRINGY IRON STRIP RETURNS TO 'T'.

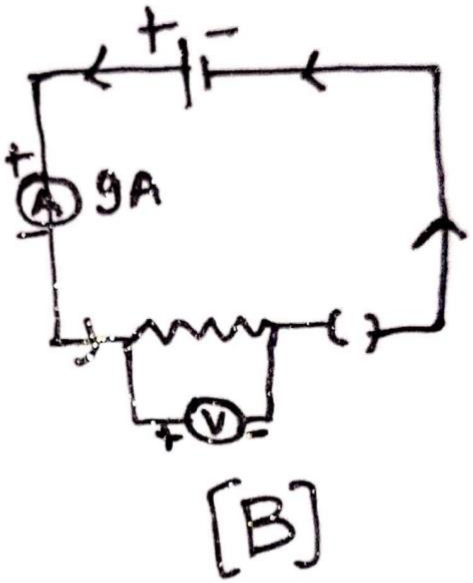
7. THE MOMENT THIS HAPPENS, CIRCUIT CLOSES AGAIN AND THE PROCESS IS REPEATED, TILL WE ARE PRESSING THE OUTER SWITCH.



Q17. WHICH OF THE TWO CIRCUIT WILL HEAT UP QUICKLY AND WHY?



(A)



(B)

A18. THE CIRCUIT (A) WILL GET HEATED QUICKLY BECAUSE-

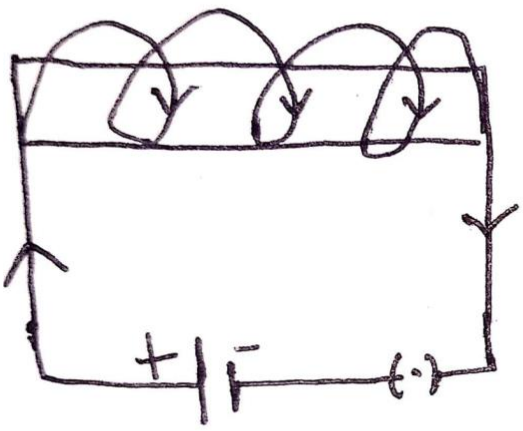
1. THE CURRENT IN (A) IS HIGHER THAN THAT OF (B), AND AS WE KNOW THAT ,HEAT IS DIRECTLY PROPORTIONAL TO THE SQUARE OF THE CURRENT.

$$H = I^2R$$

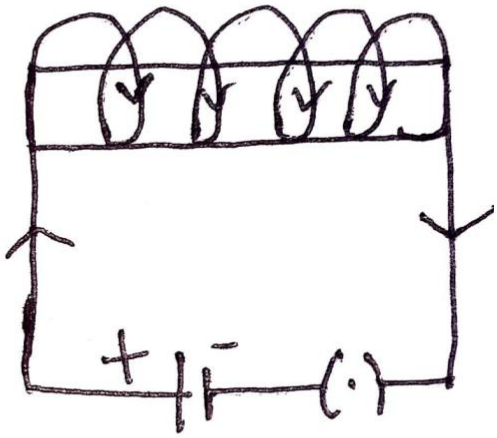
*GREATER IS THE CURRENT, GREATER IS THE HEAT PRODUCED.

DO IT YOURSELF:

Q1.WHICH WILL BE A STRONGER ELECTROMAGNET AND WHY?



(A)



(B)

Q2. WHICH FILAMENT IS USED IN ELECTRIC HEATERS?NAME ONE PROPERTY OF THAT FILAMENT.

Q3. WE HAVE 2 CIRCUITS (A) AND (B). (A) HAS A WIRE MADE OF Fe WHILE (B) HAS A WIRE MADE UP OF (Ag). KEEPING THE VOLTAGE CONSTANT, WHICH WIRE WILL MELT QUICKLY AND WHY?

Q4. DRAW AN ELECTRIC CIRCUIT BY THE FOLLOWING COMPONENTS.

*CONNECTING WIRES

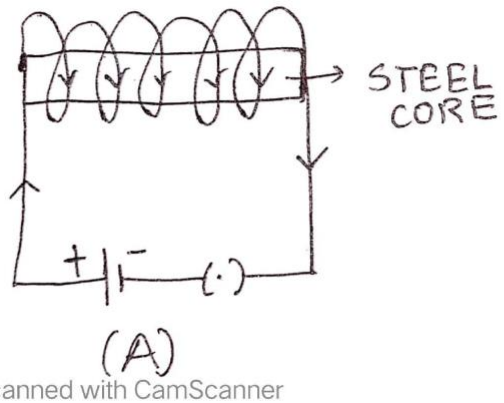
*SWITCH IN 'ON' POSITION.

*BULB

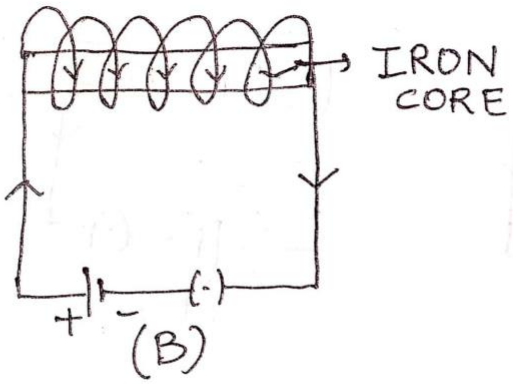
*CELL

*BATTERY

Q5. WHICH OF THE TWO WILL GET PERMANENTLY MAGNETISED AND WHY?



(A)



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