Magnetism - important terms

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- Electromagnet - A current carrying coil acts as a magnet. This coil is called an electromagnet

- Solenoid - An electromagnet which has a soft iron inside the coil is called a solenoid.

- Factors affecting strength of a solenoid -
  - Length of the coil,
  - current in the coil ,
  - material of the soft iron.

- How to reduce the heating effect in an experiment on electricity -
  - Heating effect is proportional to current in the coil.
  - so in order to reduce heating effect, reduce current
  - In order to keep Power (P = I x V) constant, reduce current and increase potential difference.

- Motor effect - A current carrying wire when placed in a magnetic field experiences a force.

- Fleming's left hand rule - Is used to find the direction of force experienced by a current carrying wire placed in a magnetic field
  - Thumb - direction of force (F)
  - first finger - direction of magnetic field (B)
  - Second finger - direction of current (I)

- Fleming's right hand rule - Used to find the direction of induced current in the coil rotated / moved in a magnetic field
  - Thumb - direction of motion
  - First finger - direction of magnetic field
  - second finger - direction of induced current

- Induced emf - When a coil is moved or rotated in a magnetic field, the magnetic flux linked with the coil changes. This results in a emf induced in the coil.

- Generator - Many turns of circular coils are placed within the mangetic fields and rotated mechanically. This results in emf induced in the coil. Since the direction changes periodically, this is ac generator. For dc generator, slip rings are used.

- Factors affecting the strength of induced current -
  - magnitude of a magnetic field
  - number of turns of the coil
  - angular speed of rotation of the coil.

- Transformers - Devices used to alter the potential difference supplied in an electric grid in a city / locality. There are two types of transformers : step up used to increase the PD and step down used to decrease the PD

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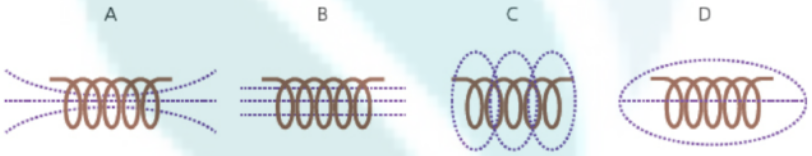
Criteria A based questions

(reference - Morris, Paul. Physics for the IB MYP 4 & 5: By Concept (MYP By Concept) (p. 578). (Function). Kindle Edition.

1. In a recycling factory, an electromagnet is used to separate different metals found in metal waste. The list in the box shows the materials found in the waste.
   a. State which materials will be attracted to the electromagnet.

Iron	aluminium	copper	steel	tin

   b. Explain your choice(s).
   c. State which of the diagrams A–D shows the correct shape of a magnetic field made around a solenoid.An engineer wants to increase the strength of the electromagnet. d State which of the following modifications to the design would increase the strength.

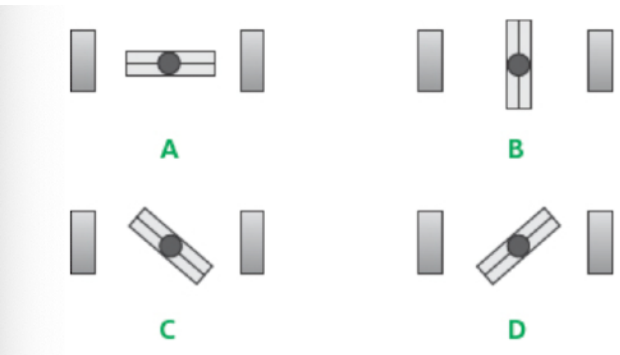


An engineer wants to increase the strength of the electromagnet.

d. State which of the following modifications to the design would increase the strength.
   A Use ac instead of dc through the electromagnet
   B Use a longer, thicker core
   C Join the two poles of the electromagnet with an iron bar placed across them
   D Increase the number of turns on the electromagnet

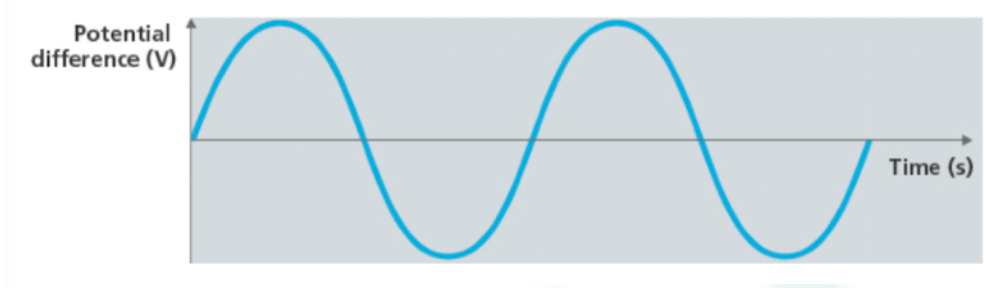
e. Outline why one of the modifications you rejected would not increase the strength of the electromagnet.

2. The diagrams below show the orientation of the coil of a dc electric motor between two bar magnets.

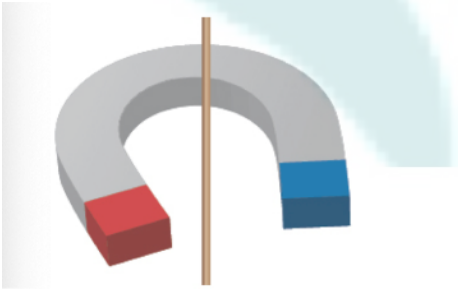


a. State which position gives the maximum force on the coil.
b. Explain your reasoning.
c. Outline how the force on the coil changes as the coil rotates between the magnets.

3. The graph in Figure below shows the variation in potential difference (p.d.) of an alternating current (ac) produced by a rotating generator.



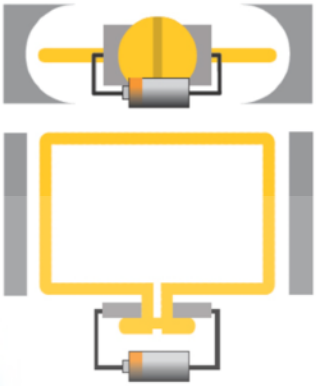
The ac completes one complete cycle every 5 seconds.
a. Alex puts this ac through a centre-zero dc voltmeter. Describe the motion of the needle for one complete cycle of the ac.
b. Alex now connects a light bulb to the ac supply. Describe what he will see for one cycle.
c. Alex now causes the generator to turn 10 times faster than before. Outline or sketch the new ac output.
d. Describe what Alex will now observe while watching the bulb connected to the ac supply. Explain your answer.
e. With reference to the cycle above, state whether the ac generator Alex is using has a commutator. Explain your answer, and suggest what alternative arrangement the ac generator may have to carry current from the coil.



4. A length of flexible, slack copper wire is fixed so that part of it is held vertically in the field of a horseshoe magnet
a. i Sketch what the wire might look like when a large current passes through it.
ii Explain why the wire looks like this.

b i On the same diagram, draw what the wire might look like if the current in a is reversed.
ii Explain why the wire looks like this.

5. The diagram in Figure shows one design for a demonstration electric motor.
a Label the diagram with the parts of the motor listed in the box below.



magnets	coil	axle	brushes	commutator

b Suggest two ways in which the amount of force produced by the motor could be increased.
Explain how each of these modifications will increase the force produced by the motor.
Jacopo notices that sometimes the motor stops and the coil gets 'stuck' in one position.
c Which position is this most likely to be? Describe with words or a diagram to show this.
d Explain your answer to c.
e Suggest a modification Jacopo could make to the motor, so that it is less likely to get 'stuck' and provide more force (you may use a diagram if you prefer).

Reference :
Morris, Paul. Physics for the IB MYP 4 & 5: By Concept (MYP By Concept) (p. 581). (Function). Kindle Edition.