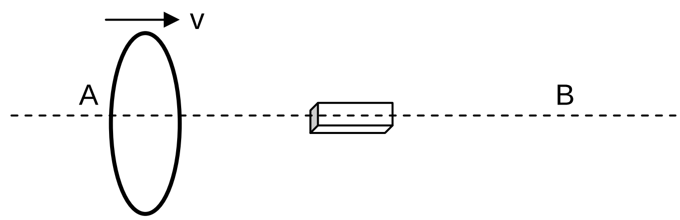
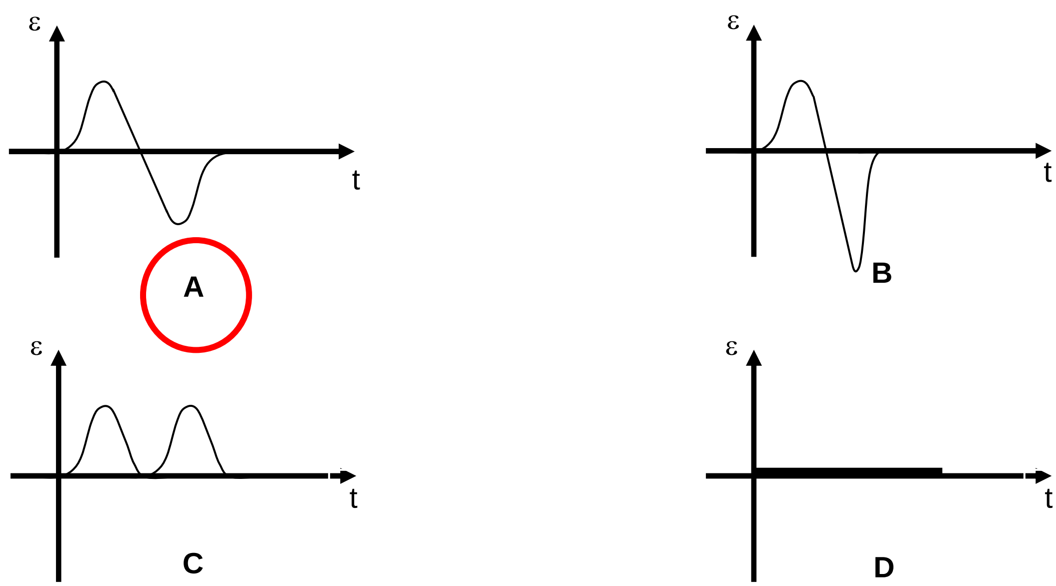
Name:………………………………………….. (   )   Class: ……………….

Electromagnetic Induction Post-Test

Answer all the MCQs in the OAS provided. All explanations should be written on the question paper. (30 Mins)

1 A coil is moved along its axis towards a short stationary magnet from point A to B, at constant speed v. Which graph best represents how the induced e.m.f (ε) in the coil varies with time (t)?





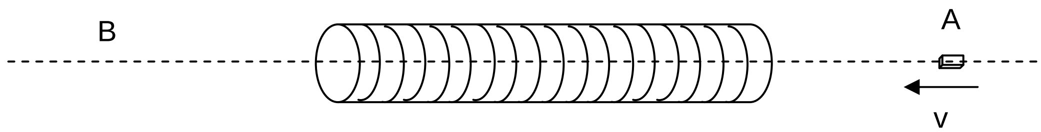
Explain your reasoning.

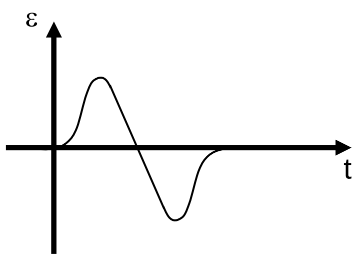
<u>When the coil approaches the magnet, there's an increase in flux linking the coil causing an induced emf in one direction. When the coil is leaving the magnet, there's a decrease in flux linking the coil which causes the induced emf to act in the opposite direction. (Lenz's law)</u>

<u>When coil approaches and leaves the magnet, the change in flux linkage (area under the graph) is the same.</u>

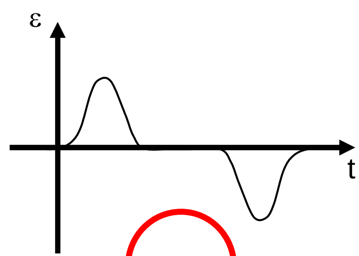
<u>Since speed is constant, the change of flux in both directions would take place over the same period of time, hence induced emf have the same maximum value. (Faraday's Law)</u>

2 A short magnet is moved along its axis towards a stationary long solenoid from A to B, at constant speed v. Which graph best represent how the induced e.m.f (ε) in the solenoid varies with time (t)?

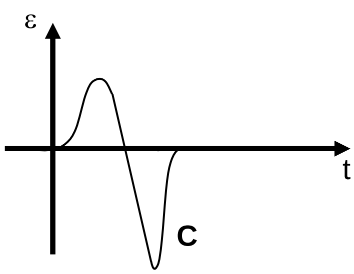




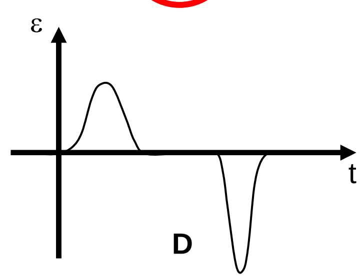
A



B



C



D

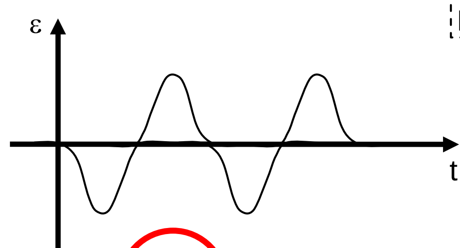
Explain your reasoning.

<u>When the whole magnet is in the long solenoid, there's no rate of change of flux, hence no emf induced. (Faraday's law)</u>

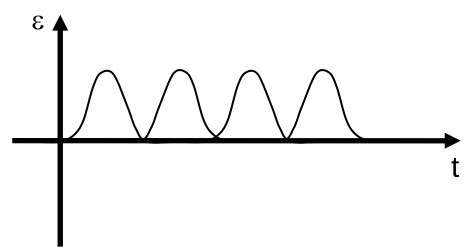
<u>When magnet is entering and leaving the solenoid, the change in flux linkage (area under the graph) is the same.</u>

<u>Since speed is constant, the change of flux in both directions would take place over the same period of time, hence induced emf have the same maximum value. (Faraday's Law)</u>

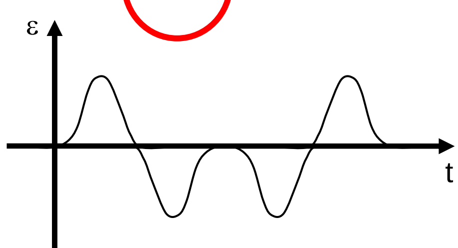
3 A magnet is moved at constant speed from above a coil to below. Without rotating the magnet, it is then moved back to the top again with the same constant speed. The e.m.f (ε) induced over time (t) will be



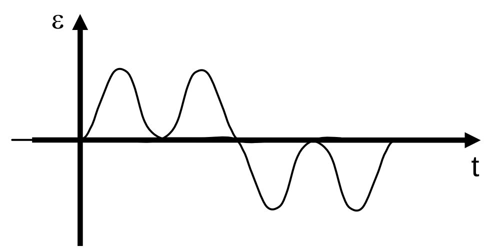
A



B



C



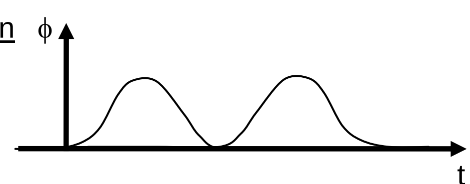
D

Explain your reasoning.

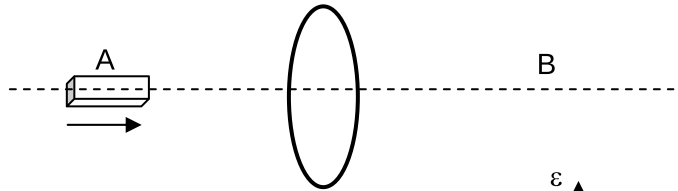
When magnet passes from above the coil to below it, the magnetic flux linking the coil increases and then decreases. Thus the induced emf changes from negative to positive.

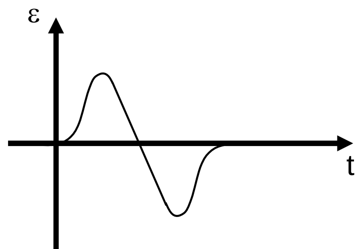
When magnet now passes from below the coil to above it, the magnetic flux linking the coil still increases and then decreases. Thus the induced emf changes from negative to positive again.

The flux-time graph of the whole process is as shown

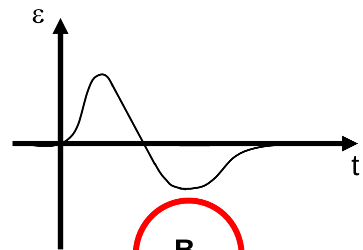


4 A short magnet is moved along its axis towards a stationary coil with **decreasing** speed. Which graph best represents how the induced e.m.f (ε) in the coil varies with time (t)?

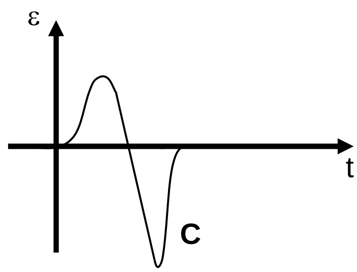




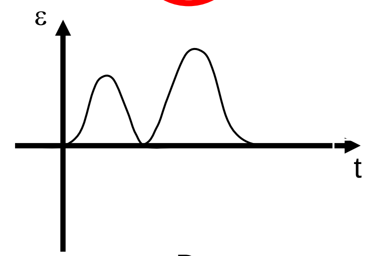
A



B



C

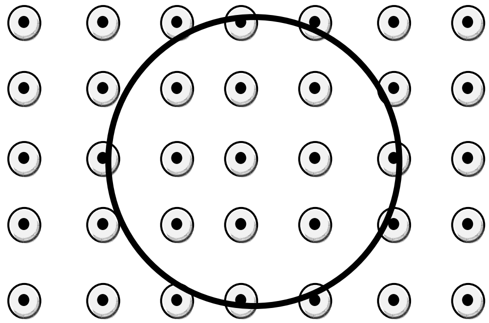


D

Explain your reasoning.

<u>The change in flux linking the coil when magnet enters the coil would be the same as the change in flux linking the coil when magnet leaves the coil (same area under the graph). Hence, with decreasing speed, the time taken for the change in flux to occur upon leaving the magnet will be longer with a lower emf induced. (Faraday's Law)</u>

5 A coil is placed in a region of magnetic field which is directing out of the plane of the paper. The field is **decreasing** in magnitude with time. What is the direction of induced current in the coil as seen from the top?



Top view

A clockwise

B anticlockwise

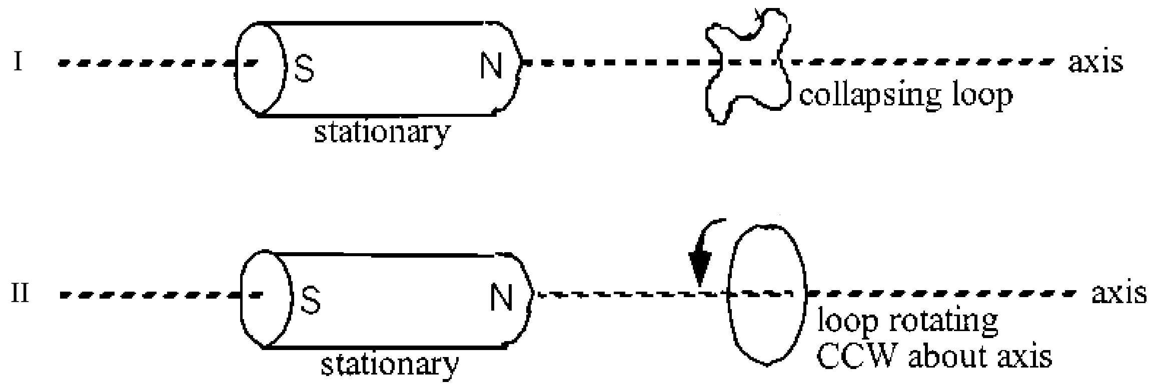
C alternating

D no current

Explain your reasoning.

The induced current flows anticlockwise to oppose the decreasing magnetic flux due to the decreasing magnetic field through the coil. (Lenz's Law)

6 The figures below involve a cylindrical magnet and a loop of copper wire. The plane of the wire loop is perpendicular to the axis. The state of motion of the magnet and wire loop is indicated in the diagram.



Which setup would produce an induced e.m.f in the loop?

A	I only	**B**	II only
C	I and II	**D**	None

Explain your reasoning.

For setup I, there is a rate of change of flux linking the loop as the loop collapses since area of loop is changing with time. Hence there is an induced emf.

However for setup II, there is no rate of change of flux linking the loop as it rotates. Hence, there is no induced emf. (Faraday's Law)