Electromagnetic Induction Assignment Problems (Suggested Solutions)

A1 (a) It depend on the: B(magnetic flux density), L(Length of AB), v(velocity of cutting of flux)

(b) Graph of $E = NBA\omega \cos(\omega t)$, since rate of flux cutting is max at $t = 0$.
Comments:
A number of students draw a sine graph. Note the orientation of the coil at t=0.This is the orientation when the rate of change of flux is the maximum. Thus the induced emf is the greatest at t=0s.

A2 (a) $B \propto I$; Thus the shape of the graph is identical to I-t graph.
E = negative gradient of B-t graph.

(b)(i)

- Introduction of a ferrous core into the solenoid will increase the amplitude of E, as the magnetic flux density of the solenoid (due to the concentration of magnetic flux lines) and hence the rate of change of magnetic flux linkage through the coil is larger.
- The frequency of E remains unchanged since the frequency of E must be the same as that of I which is unchanged.

(ii)

- When the frequency of the current I in the solenoid is increased, the rate of change of magnetic flux density of the solenoid and hence the rate of change of magnetic flux linkage through the coil are increased. Thus, the amplitude of E will increase.
- The frequency of E increases since the frequency of E must be the same as that of I which has increased.

Comments:
Many students commented that the induced EMF remains unchanged.

PS: Do not merely memorise the solution. Please do look for me if further clarification and explanation is required.