MODEL ANSWER
A2 PHYSICS
MAGNETIC FIELD & EM INDUCTION

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3. The operation of transformer is based on the principle of electromagnetic induction. The primary coil is connected to power supply with an sinusoidal alternating current – a current where the magnitude and direction changes continuously at a certain frequency. The alternating current produces a flux or magnetic field lines which build a link between the primary coil and secondary coil. Soft iron core is used to increase the magnetic field strength. The magnetic flux produced varies in magnitude and direction. Such changing magnetic flux produces an induced e.m.f. across the secondary coil. The induced e.m.f. varies in magnitude and direction as well. Consequently, the secondary voltage is also a sinusoidal alternating voltage. A step up transformer is a type of transformer where secondary coil has more number of turns than the primary coil, therefore the rate of change of flux linkage is more and thus more e.m.f is induced across the secondary coil.

Using the formula, $\mathbf{V_p / V_s = N_p / N_s}$
The output voltage, $\mathbf{V_s = [N_s / N_p]\ V_p}$
$\mathbf{= [100 / 1200] \text{ X } 240}$
$\mathbf{= \underline{20\ V}}$

4. **Let d = distance between two adjacent turns of wire in the solenoid**
N = number of turns
L = length of solenoid
L = Nd
Number of turns per meter, N / L = 1 / d
= 1 / 0.016
$\mathbf{= \underline{62.5\ m^{-1}}}$

Magnetic field strength in the middle of the solenoid, B
$\mathbf{= \mu_0\ n\ I}$
$\mathbf{= 4\pi \text{ X } 10^{-7} \text{ X } 62.5 \text{ X } 0.50}$
$\mathbf{= \underline{3.9 \text{ X } 10^{-5}\ T}}$

When the compression pulse passes through the Hall probe, the magnetic field B increases because the coil gets closer together.

When the heavier metal slinky spring is used, the graph should be drawn as mirror image of the original graph, below the x-axis. It begins at the same, but negative direction of magnetic field strength. The decreases occurs over a longer time interval as the heavier metal slinky spring travels slower.

Heavier metal slinky spring, therefore the speed is less, due to

v = sqrt [tension/{mass over length}]

[REFER VIDEO SOLUTION]

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