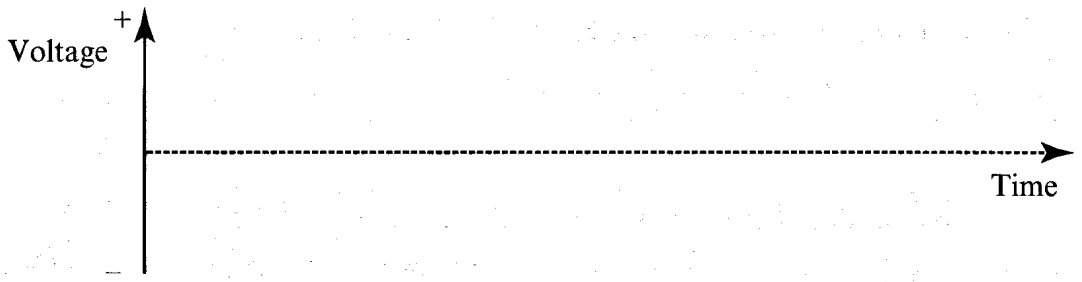
2. **(5 marks)**

On a particular generator in a bicycle, the rotating coil has 500 loops, each of area 2.50 x 10^{-4} m^2.
The magnetic field can be assumed to be uniform and of magnitude 0.400 T. When the bicycle is ridden at a particular speed the magnet rotates at 8.00 Hz.

a) What is the magnitude of the average induced emf at this speed? (3 marks)

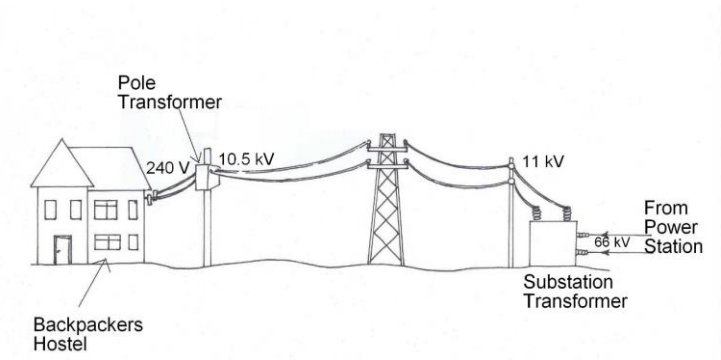
b) Complete the following sketch graph of voltage against time for two complete rotations of the magnet starting at time, T = 0. You need to show the scale on the time axis only. (2 marks)



5. (14 marks)

For a new Backpackers Hostel, electric power is transmitted at 66 kV AC to a substation transformer where it is converted to 11 kV AC for distribution to a pole transformer. It is then delivered to the hostel at 240 V AC.

Energy is delivered at a rate of 50 kW at the secondary coil of the substation transformer, where the voltage is 11 kV AC.



a) Determine the average current flowing in the secondary coil of the substation transformer? (3 marks)

b) When energy is being delivered at 50 kW at the secondary coil of the substation transformer, the voltage at the primary coil of the pole transformers is 10.5 kV. Calculate the power loss in the wires joining the substation transformer and street pole transformer? (3 marks)

c) If there are 6.3×10^3 turns in the primary of the pole transformer, how many turns are in the secondary coil? What current flows in the secondary coil? Assume the transformer is ideal. (3 marks)

d) Explain why AC is used in the primary coil of a transformer rather than DC? (2 marks)

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e) Explain why electricity is transmitted at high voltages between power stations and the cities where it is used. (3 marks)

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