Question 16 **(15 marks)**

Figure 1 shows a power station that supplies electricity to a small community. The owners decided to switch from DC generation to AC (Figure 2) to save costs and reduce greenhouse gas emissions.

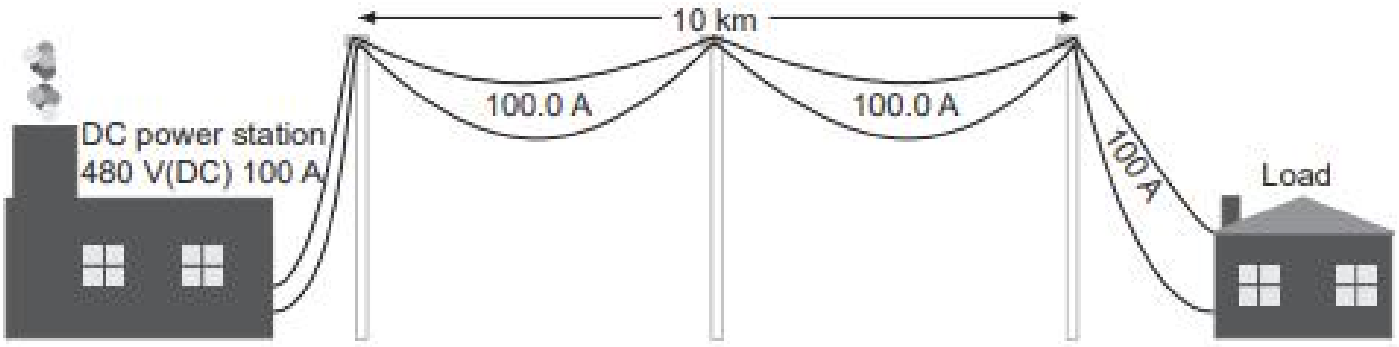

Figure 1: A DC power station

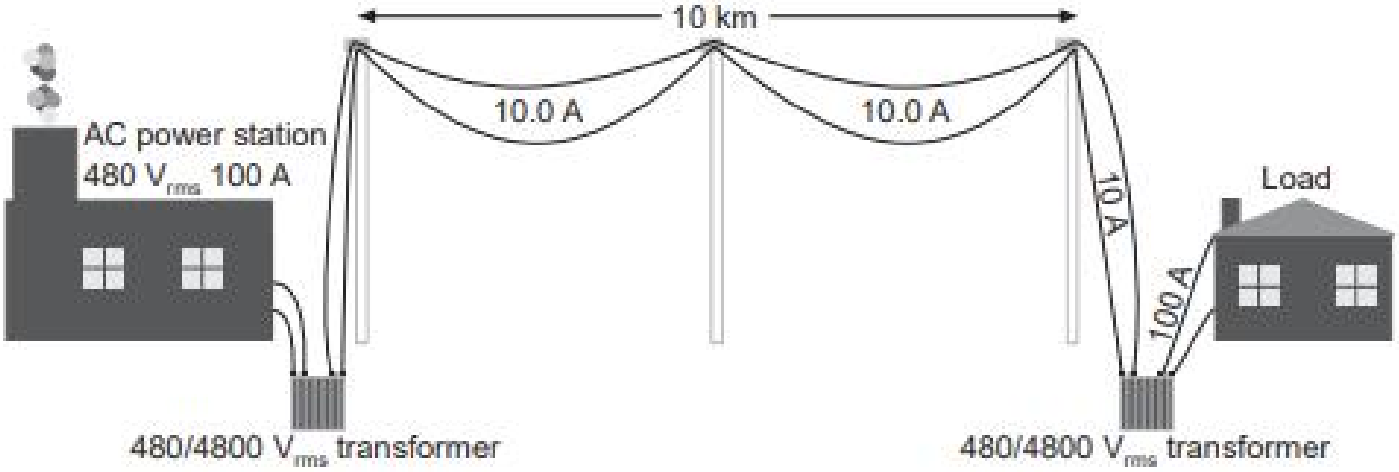

Figure 2: An AC power station

(a) Calculate the power output of both stations in kW. (2 marks)

DC power station

Answer: _____ kW

AC power station

Answer: _____ kW

(b) If the resistance of the transmission lines between the pylons is $2.19 \times 10^{-4}\ \Omega\ m^{-1}$, estimate the efficiencies of both systems by calculating power loss in the wires. Assume negligible power losses in the lines to the pylons from the station, and from the pylons to the houses. (6 marks)

DC power station: _____ % AC power station: _____ %

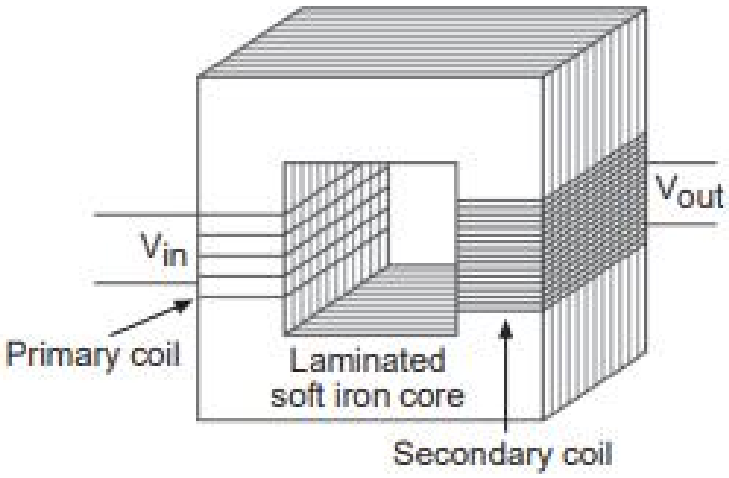

Figure 3: A step-up transformer with a laminated core

(c) Figure 3 shows a step-up transformer. One of the features that increases efficiency is the laminated soft iron core. Explain why laminating the core increases the transformer's efficiency. (3 marks)

(d) Explain why transformers require AC current to function in electricity transmission.

(4 marks)