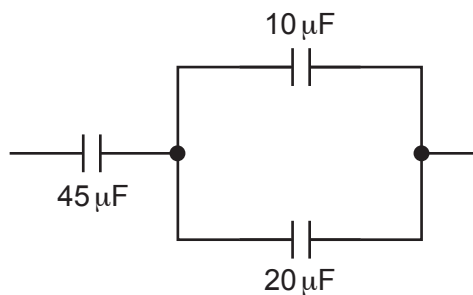4   **(a)**   Three capacitors are connected as shown in Fig. 4.1.

Fig. 4.1

Determine the total capacitance, in μF, of the network of three capacitors.

capacitance = ... μF [2]

(b)   A capacitor of capacitance $45\,\mu F$ is connected to a variable power supply initially set at 8.0 V. The output of the power supply increases so that the potential difference (p.d.) across the capacitor increases to 9.6 V.

Calculate the increase in energy ΔE stored in the capacitor.

ΔE = ... J [2]

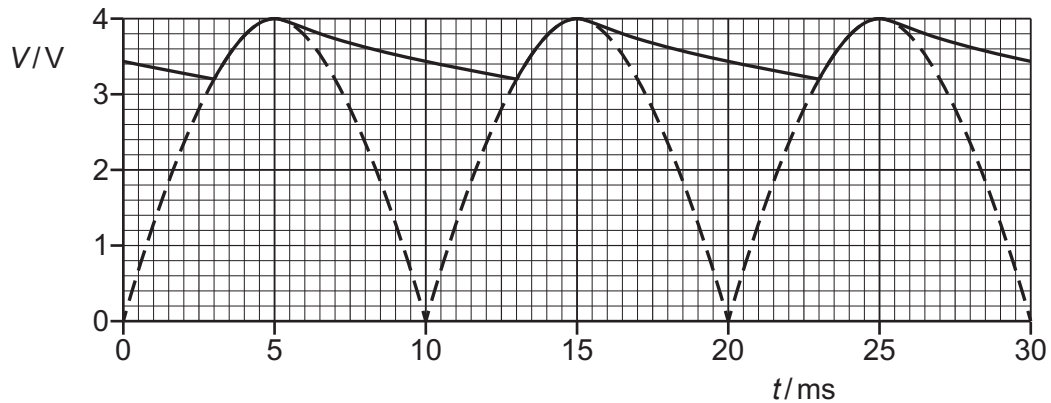**(c)**   A sinusoidal a.c. power supply is connected to the input of a bridge rectifier.
The output of the rectifier is connected to a load resistor.

   (i)   Complete the circuit in Fig. 4.2 by adding a capacitor to smooth the p.d. across the load resistor.
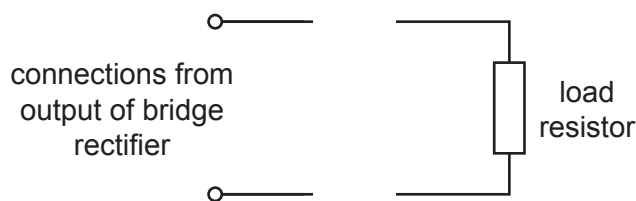
Fig. 4.2

[1]

(ii) The variation with time t of the p.d. V of the smoothed output is shown in Fig. 4.3.

Fig. 4.3

Determine the time constant, in ms, of the smoothing circuit.

time constant = ... ms [3]

(d) A sinusoidal a.c. power supply has a maximum power of 16 W.

State the value of the mean power when the output of the power supply is:

(i) full-wave rectified

mean power = ... W [1]

(ii) half-wave rectified.

mean power = ... W [1]