5 Part of an electric circuit is shown in Fig. 5.1.

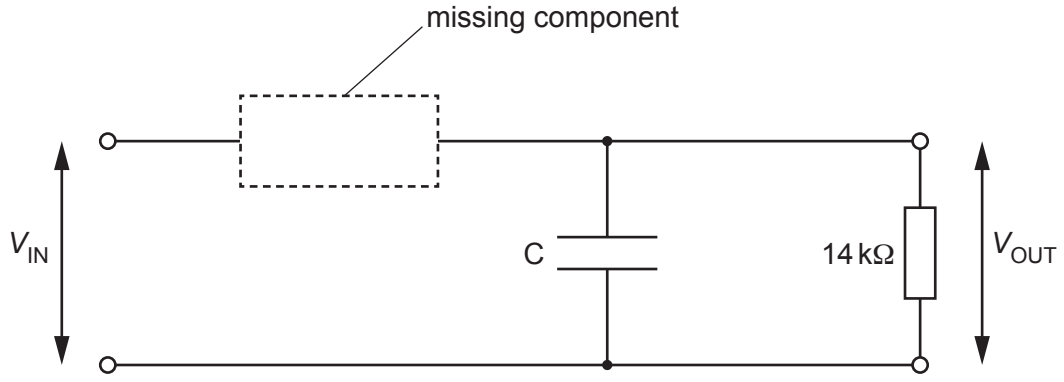

Fig. 5.1

The circuit is used to produce half-wave rectification of an alternating voltage of potential difference (p.d.) V_{IN}.

The output p.d. across the 14 kΩ resistor is V_{OUT}.

(a) (i) A component is missing from the circuit of Fig. 5.1.

Complete the circuit diagram in Fig. 5.1 by adding the circuit symbol for the missing component, correctly connected. [1]

(ii) A capacitor C is shown in the circuit of Fig. 5.1.

State the effect on V_{OUT} of including the capacitor in the circuit.

..... [1]

(b) Fig. 5.2 shows the variation with time t of V_{IN}.

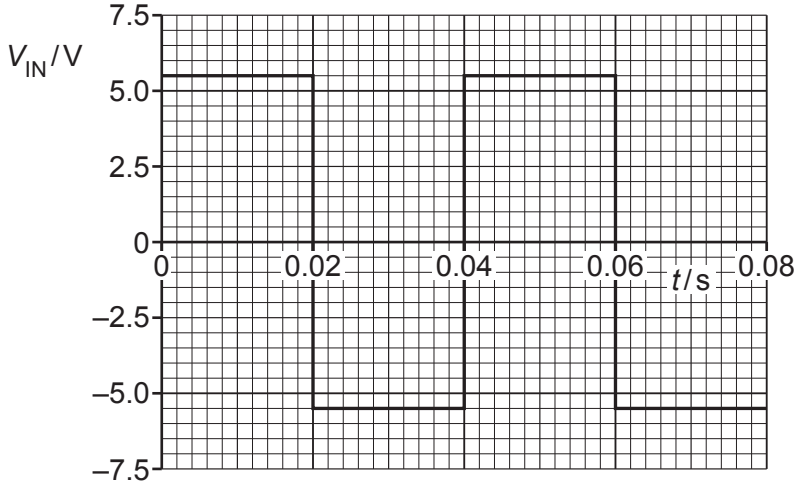

Fig. 5.2

Fig. 5.3 shows the variation with t of V_{OUT}.

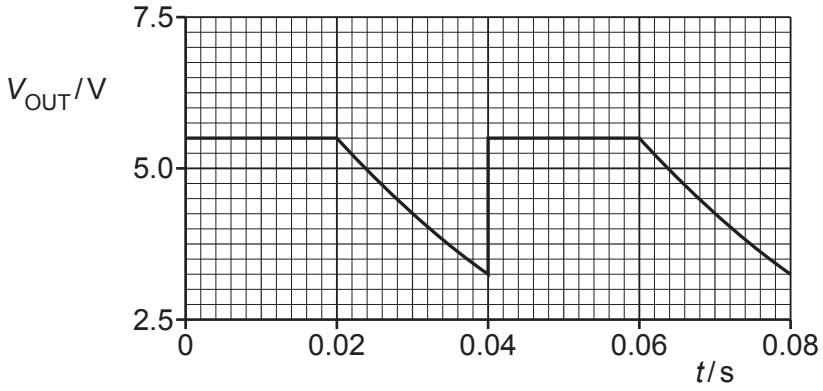

Fig. 5.3

(i) Determine the frequency of V_{IN}.

frequency = ... Hz [1]

(ii) Show that the time constant τ for the discharge of the capacitor through the resistor is 0.038 s.

[2]

(iii) Calculate the capacitance of C. Give a unit with your answer.

capacitance = ... unit ..... [2]

(c) The circuit of Fig. 5.1 is modified so that it produces full-wave rectification of an input voltage.

Suggest, with a reason, how V_{OUT} now varies with time when V_{IN} is as shown in Fig. 5.2.

.....

.....

..... [2]

[Total: 8]