6 Fig. 6.1 shows part of a bridge rectifier circuit that can be used for rectification of an alternating input voltage V_{IN}.

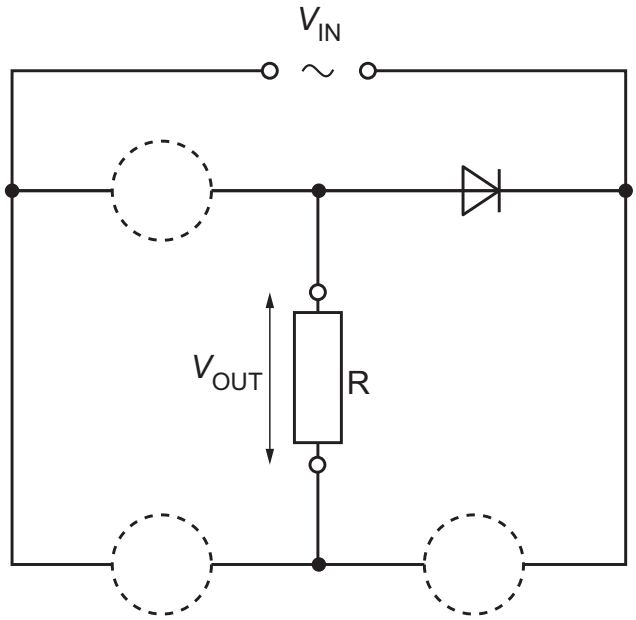

Fig. 6.1

The circuit contains four diodes, one of which is shown.
The rectified output voltage V_{OUT} is applied across load resistor R.

(a) (i) State what is meant by rectification.

.....

..... [1]

(ii) State the name of the type of rectification produced by a bridge rectifier circuit.

..... [1]

(iii) Complete the circuit in Fig. 6.1 by drawing the three missing diodes inside the dashed circles. [2]

(b) The input voltage varies with time t according to the equation

$$V_{IN} = 34 \sin 18t$$

where V_{IN} is in V and t is in s.

(i) Show that the period of the input voltage is 0.35 s.

[2]

(ii) Calculate the root-mean-square (r.m.s.) input voltage.

r.m.s. voltage = ... V [1]

(iii) On Fig. 6.2, sketch the variation of V_{OUT} with t from $t = 0$ to $t = 0.35$ s.

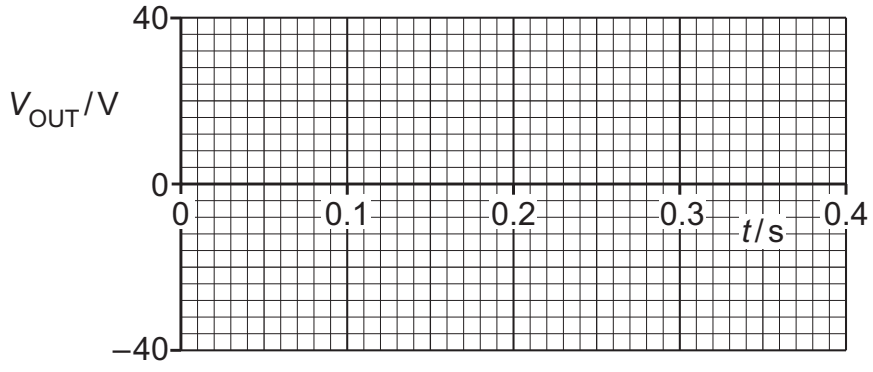

Fig. 6.2

[3]

(c) Resistor R has a resistance of 56 kΩ. A capacitor of capacitance 12 μF is connected into the circuit of Fig. 6.1 in order to smooth the output voltage.

(i) On Fig. 6.1, draw the capacitor correctly connected into the circuit. [1]

(ii) Calculate the time constant of the smoothing circuit.

time constant = ... s [2]

(iii) During each discharge cycle, the time for which the capacitor is discharging is 0.14 s.

Determine the minimum value of the smoothed output voltage.

minimum voltage = ... V [2]

[Total: 15]

6 Fig. 6.1 shows a circuit that rectifies an alternating input voltage V_{IN} and produces an output voltage V_{OUT} across a resistor R.

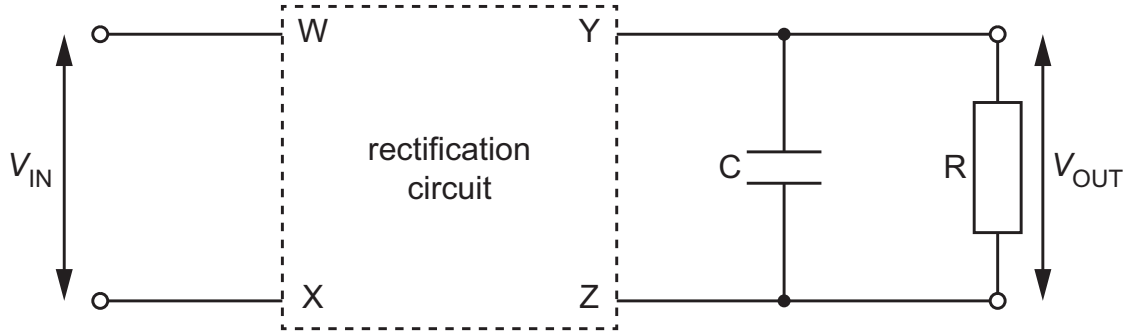

Fig. 6.1

The four terminals of the rectification circuit are labelled W, X, Y and Z.
A capacitor C is connected in parallel with resistor R.

(a) (i) State what is meant by rectification.

.....

..... [1]

(ii) State the purpose of capacitor C.

.....

..... [1]

(b) Fig. 6.2 shows the variations with time t of the potential differences (p.d.s) V_{IN} and V_{OUT}.

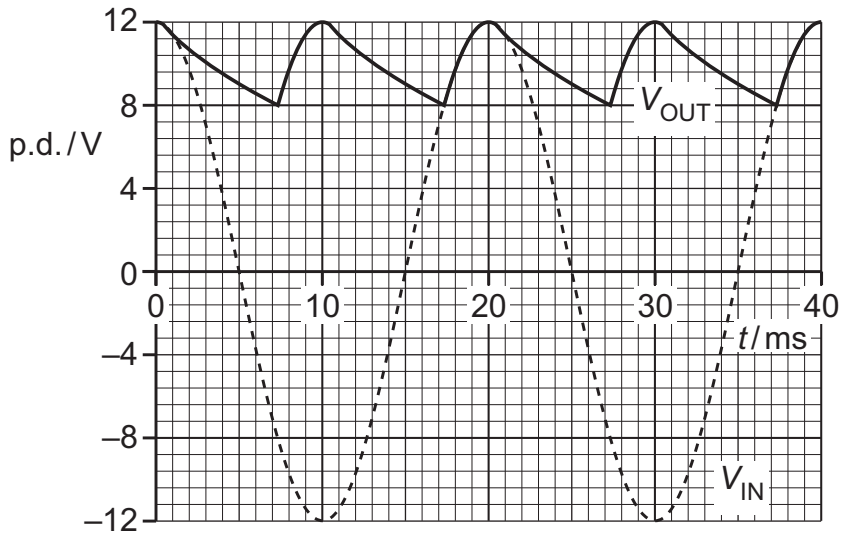

Fig. 6.2

(i) The variation of V_{IN} with t can be represented by

$$V_{IN} = A \cos Bt$$

where A and B are constants.

Determine the values of A and B. Give a unit with your answer for A.

A = ... unit .....

B = ... rad s^{-1} [2]

(ii) Determine the type of rectification produced by the circuit in Fig. 6.1.

..... [1]

(iii) On Fig. 6.3, draw the circuit diagram for the components inside the rectification circuit.

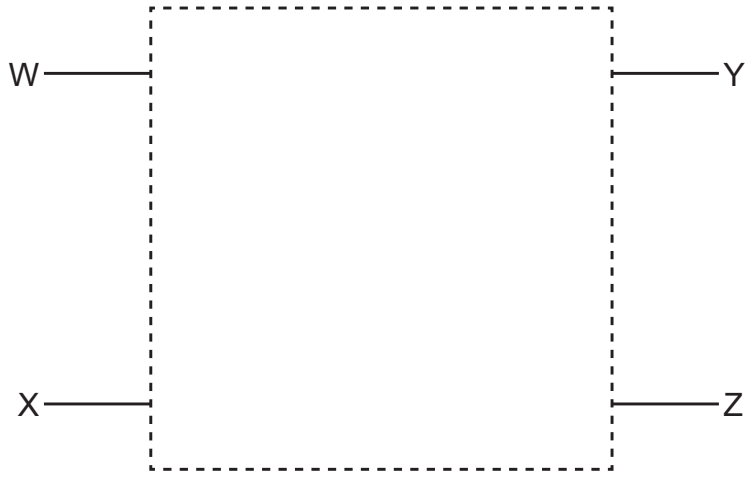

Fig. 6.3

[2]

(iv) Determine a value for the time constant for the discharge of the capacitor C through the resistor R in Fig. 6.1.

time constant = ... s [3]

(c) The capacitor C has a capacitance of 570 μF.

Use your answer in **(b)(iv)** to determine the resistance of resistor R.

resistance = ... Ω [2]

[Total: 12]

8 Fig. 8.1 shows a circuit that produces rectification of an alternating input voltage.

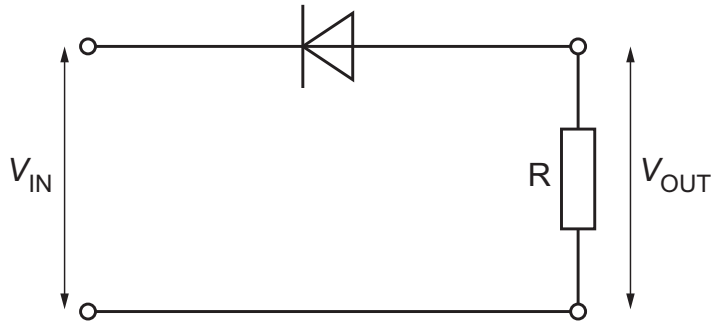

Fig. 8.1

The input voltage V_{IN} is sinusoidal. The rectified output voltage V_{OUT} is applied across resistor R.

The variation of V_{IN} with time t has amplitude V_0 and period T, as shown in Fig. 8.2.

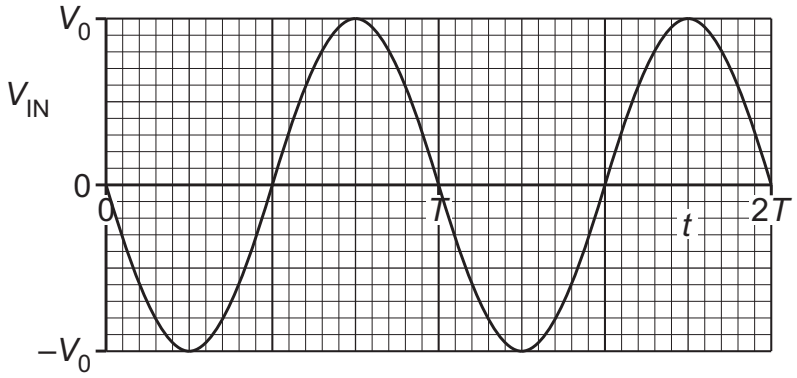

Fig. 8.2

The root-mean-square (r.m.s.) value of V_{IN} is 6.0 V.

(a) (i) State the type of rectification produced by the circuit of Fig. 8.1.

..... [1]

(ii) Calculate V_0.

V_0 = ... V [1]

(b) Resistor R has resistance 45 Ω.

Assume that there is no p.d. across the diode when it is conducting.

(i) Determine the peak power P_0 in the resistor.

P_0 = ... W [2]

(ii) On Fig. 8.3, sketch the variation of the power P in the resistor with t between $t = 0$ and $t = 2T$.

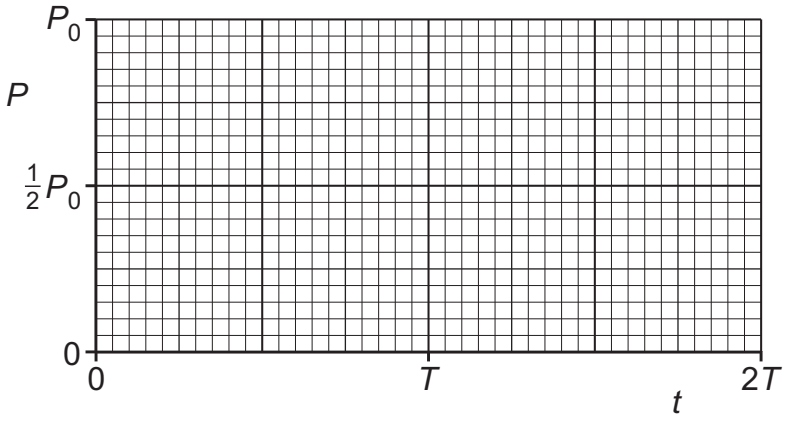

Fig. 8.3

[3]

(iii) Use the answer in **(b)(ii)** to explain why the mean power in the resistor is $\frac{1}{4}P_0$.

.....

.....

..... [2]

(iv) Use the information in **(b)(iii)** to determine the r.m.s. value of V_{OUT}.

r.m.s. voltage = ... V [1]

[Total: 10]

6 Fig. 6.1 shows a circuit that rectifies an alternating input voltage V_{IN} and produces an output voltage V_{OUT} across a resistor R.

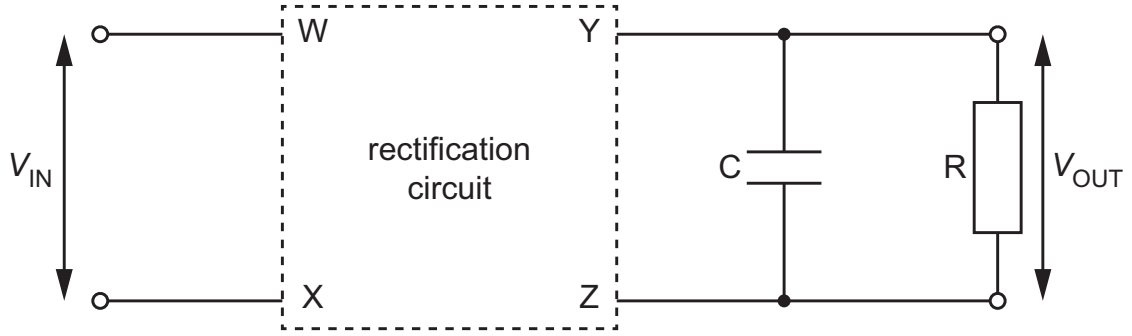

Fig. 6.1

The four terminals of the rectification circuit are labelled W, X, Y and Z.
A capacitor C is connected in parallel with resistor R.

(a) (i) State what is meant by rectification.

.....

..... [1]

(ii) State the purpose of capacitor C.

.....

..... [1]

(b) Fig. 6.2 shows the variations with time *t* of the potential differences (p.d.s) V_{IN} and V_{OUT}.

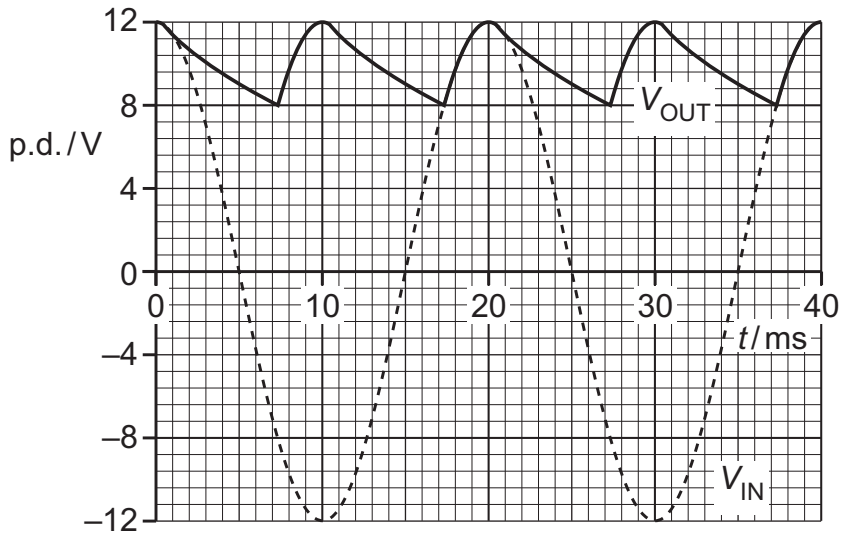

Fig. 6.2

(i) The variation of V_{IN} with t can be represented by

$$V_{IN} = A \cos Bt$$

where A and B are constants.

Determine the values of A and B. Give a unit with your answer for A.

A = ... unit .....

B = ... rad s^{-1} [2]

(ii) Determine the type of rectification produced by the circuit in Fig. 6.1.

..... [1]

(iii) On Fig. 6.3, draw the circuit diagram for the components inside the rectification circuit.

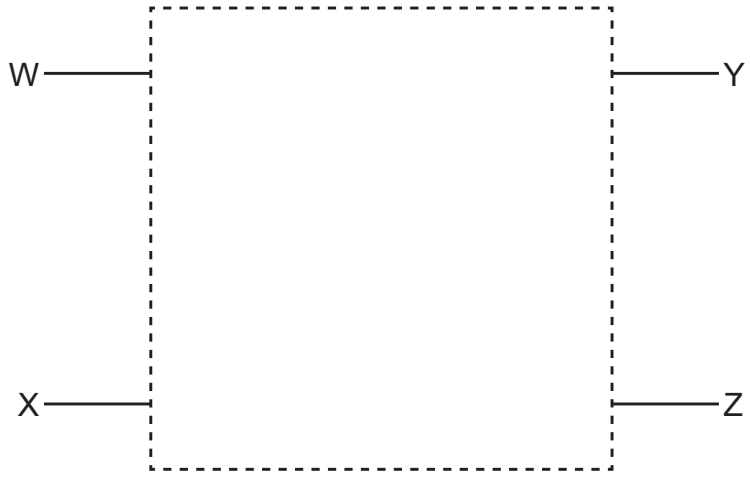

Fig. 6.3

[2]

(iv) Determine a value for the time constant for the discharge of the capacitor C through the resistor R in Fig. 6.1.

time constant = ... s [3]

(c) The capacitor C has a capacitance of 570 μF.

Use your answer in **(b)(iv)** to determine the resistance of resistor R.

resistance = ... Ω [2]

[Total: 12]

8 An incomplete circuit diagram of a bridge rectifier is shown in Fig. 8.1.

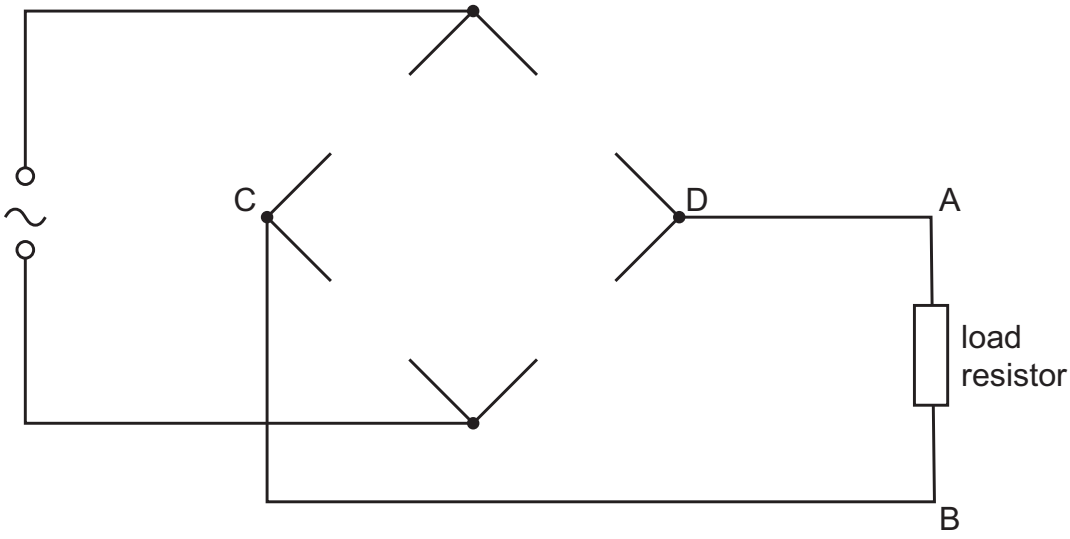

Fig. 8.1

(a) Complete Fig. 8.1 for the bridge rectifier such that the point A is at a positive potential with respect to point B. [2]

(b) The variation with time t of the potential difference (p.d.) V across the load resistor is shown in Fig. 8.2.

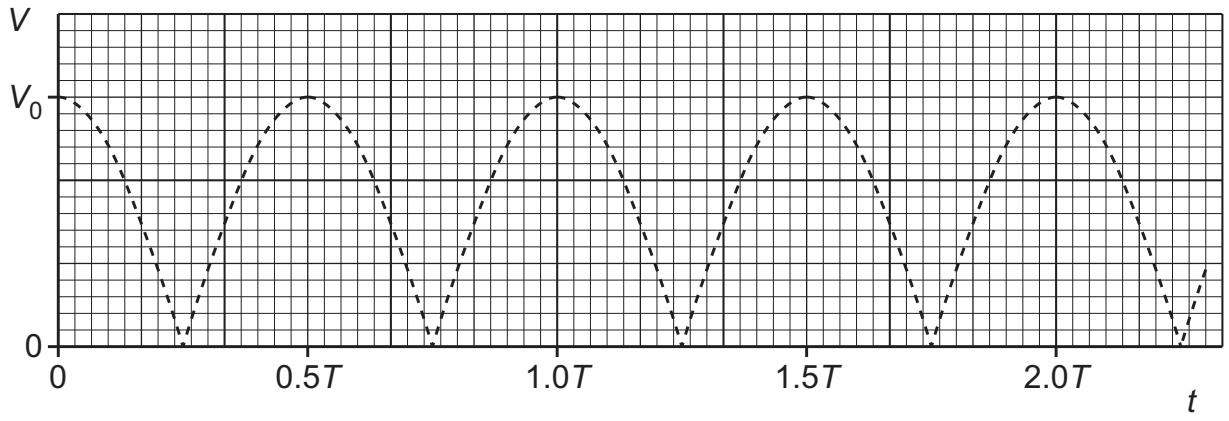

Fig. 8.2

A capacitor is now connected between points C and D of the bridge rectifier. This results in smoothing of the p.d. across the load resistor. The difference between the maximum and minimum values of the smoothed p.d. is 33% of the peak p.d. V_0.

(i) On Fig. 8.2, draw a line to show the variation of the potential difference V across the load resistor with time t. Your line should extend from $t = 0.5T$ to $t = 2.0T$. [3]

(ii) Use your line in **(b)(i)** to determine, in terms of *T*, the time constant of the smoothing circuit.

time constant = ... *T* [3]

(iii) The resistance of the load resistor is now increased. The capacitance of the capacitor is unchanged.

State and explain the effect of this change on the smoothed output p.d.

.....

.....

..... [2]

[Total: 10]