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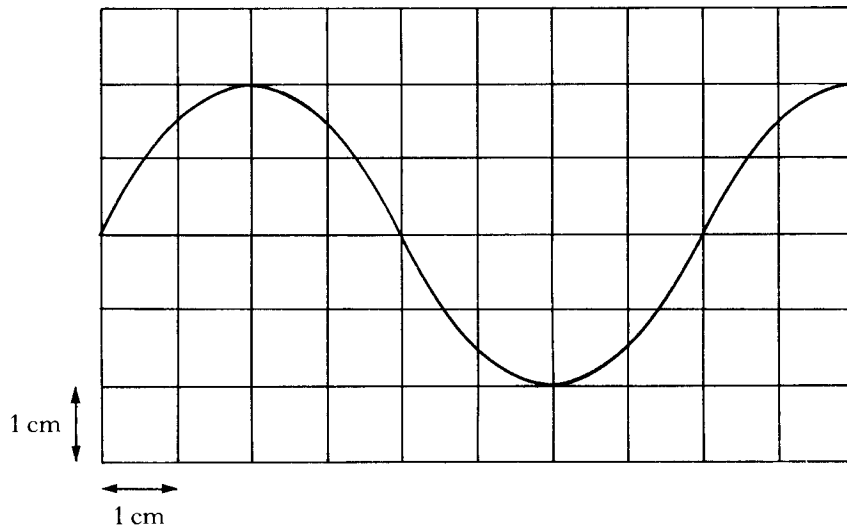
a.c.

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**Past Paper questions
1991 - 2010**

1993 Q34

An oscilloscope is connected across a resistor in a circuit.
The trace obtained is shown below.



The peak voltage shown on the oscilloscope is 10 volts and the time base setting is 0.2 ms cm^{-1} .
Calculate

- the r.m.s. voltage across the resistor.
- the frequency of the a.c. voltage.

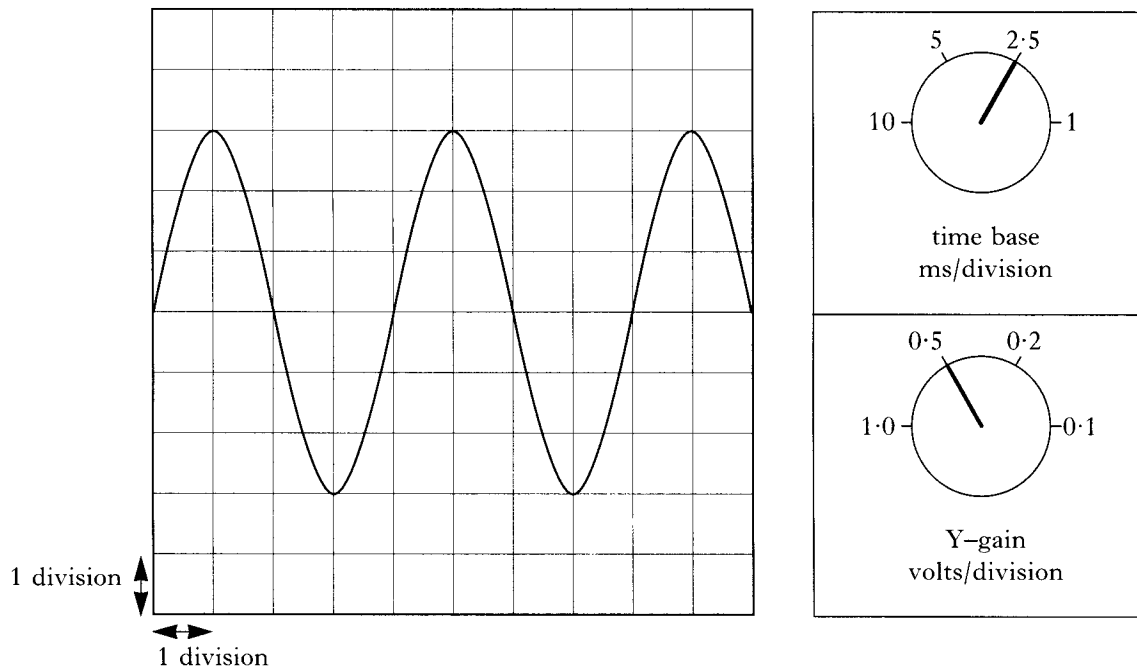
1996 Q34

The peak value of an a.c. voltage is 12 V.
Calculate

- the r.m.s. voltage;
- the power dissipated in a 4Ω resistor by the r.m.s. voltage.

1997 Q34

The output from a signal generator is connected to the input terminals of an oscilloscope. A trace is obtained on the oscilloscope screen. The oscilloscope control settings and the trace on the oscilloscope screen are shown in the diagram below.

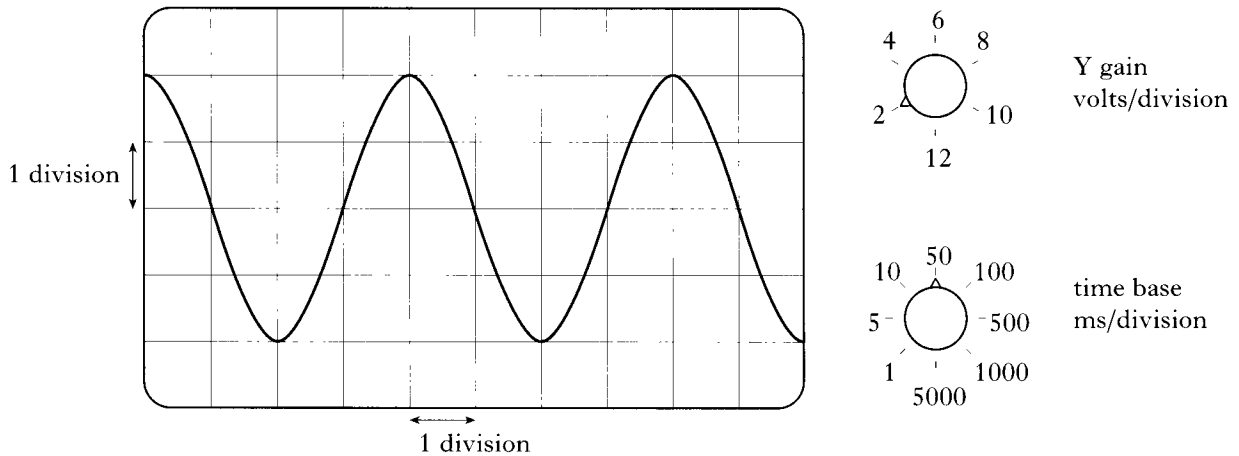


- (a) Calculate the frequency of the output from the signal generator.
- (b) The frequency and amplitude of the output from the signal generator are kept constant. The time base control setting is changed to 5 ms/division. What will be the effect on the trace shown on the oscilloscope?

2000 Q34

An a.c. supply is connected to an oscilloscope.

The trace on the oscilloscope and the oscilloscope settings are shown below.

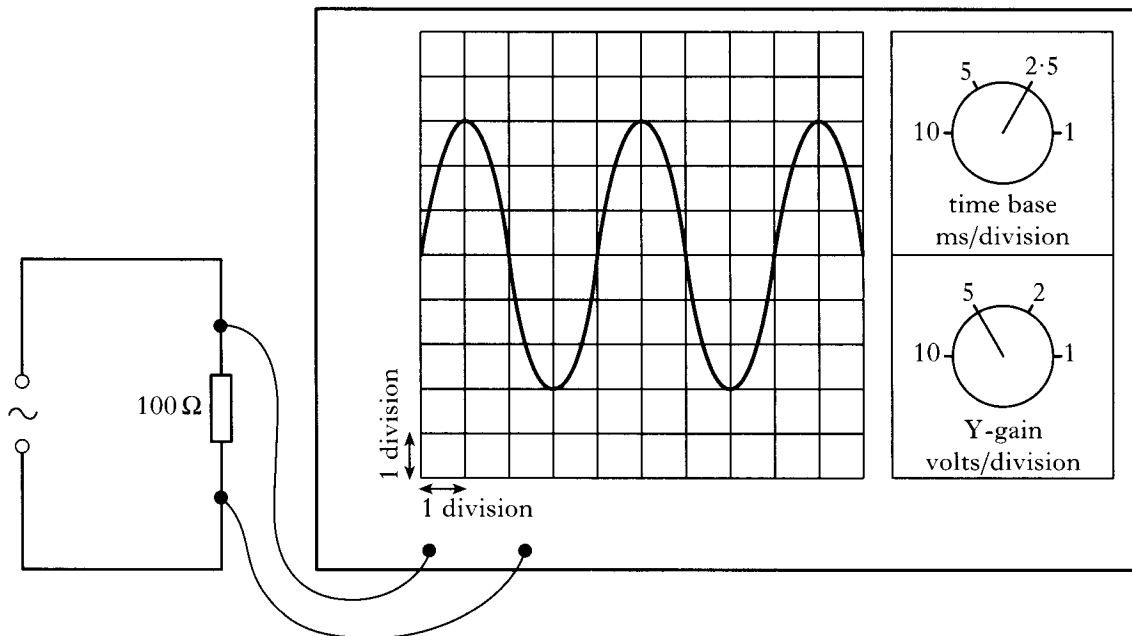


- Calculate the r.m.s. voltage of the a.c. supply.
- Calculate the frequency of the voltage from the a.c. supply.

2001 Q34

A student uses an oscilloscope to measure an alternating voltage across a $100\ \Omega$ resistor.

The settings of the oscilloscope controls and the trace on the screen are shown in the diagram.

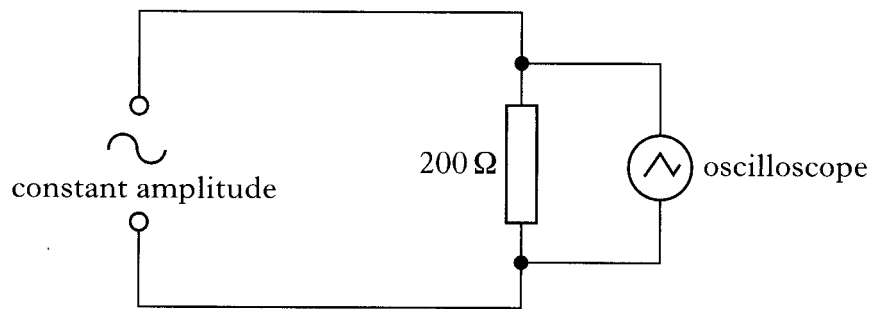


- What is the peak voltage across the $100\ \Omega$ resistor?
- Calculate the **r.m.s. current** in the $100\ \Omega$ resistor.

2000 Q26

A circuit is set up as shown below.

The amplitude of the output voltage of the a.c. supply is kept constant.

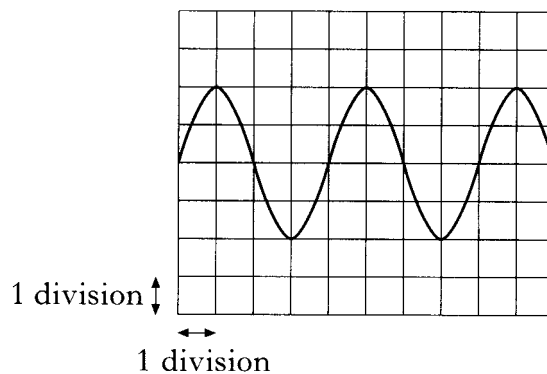


The settings of the controls on the oscilloscope are as follows:

y-gain setting = 5 V/division

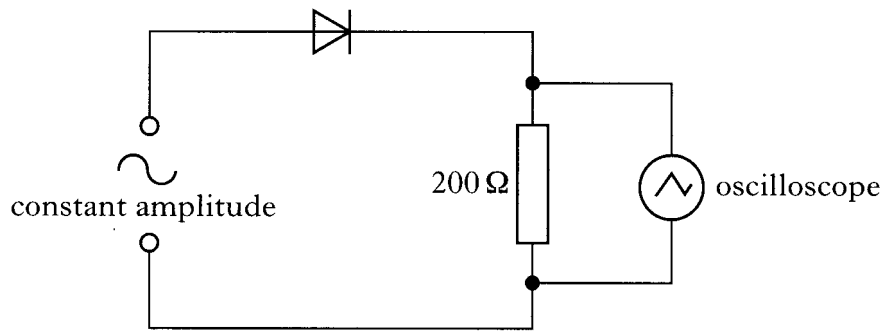
time-base setting = 2.5 ms/division

The following trace is displayed on the oscilloscope screen.



- (a) (i) Calculate the frequency of the output from the a.c. supply.
(ii) Calculate the **r.m.s. current** in the 200 Ω resistor.

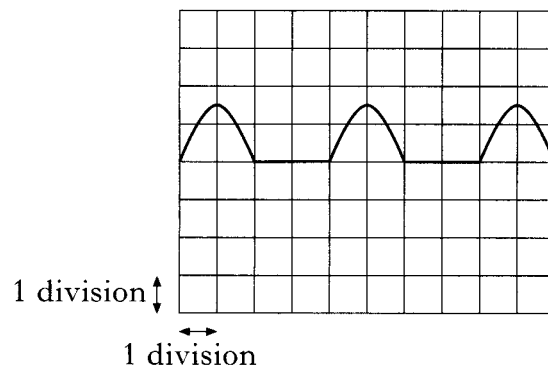
(b) A diode is now connected in the circuit as shown below.



The settings on the controls of the oscilloscope remain unchanged.

Connecting the diode in the circuit causes **changes** to the original trace displayed on the oscilloscope screen.

The new trace is shown below.



Describe and explain the changes to the original trace.

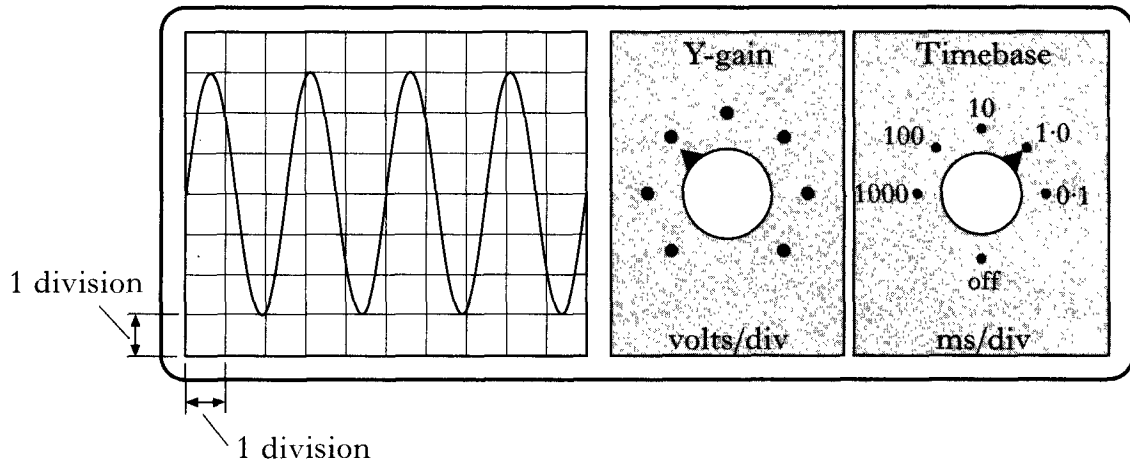
2003 Q25

- (a) A signal generator is connected to an oscilloscope.

The output of the signal generator is set to a peak voltage of 15 V.

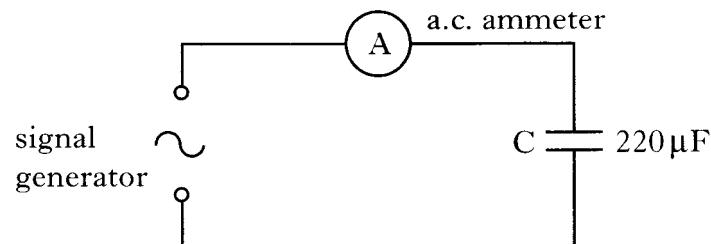
The following diagram shows the trace obtained, the Y-gain and the timebase controls on the oscilloscope.

The scale for the Y-gain has been omitted.



Calculate:

- (i) the Y-gain setting of the oscilloscope;
 - (ii) the frequency of the signal in hertz.
- (b) The signal generator is now connected in the circuit shown below.



The signal generator is adjusted to give a peak output voltage of 12 V at a frequency of 300 Hz. The internal resistance of the signal generator and the resistance of the a.c. ammeter are negligible.

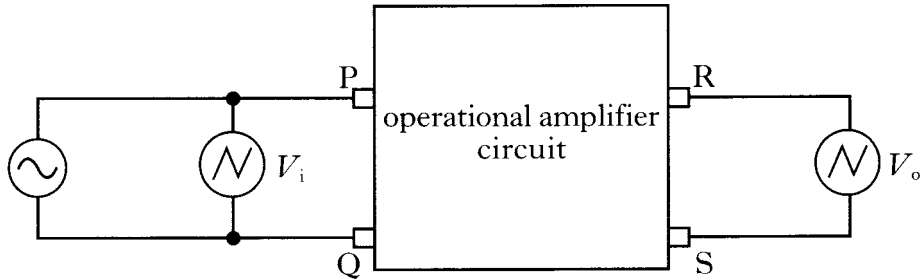
- (i) Calculate the r.m.s. value of the output voltage from the signal generator.
- (ii) Calculate the **maximum** energy stored by the capacitor during one cycle of the supply voltage.
- (iii) The frequency of the signal generator is gradually increased. What happens to the reading on the ammeter?
- (iv) When a capacitor is connected to a d.c. supply, the current quickly falls to zero. Explain why the current does **not** fall to zero in the circuit above.

2006 Q26.

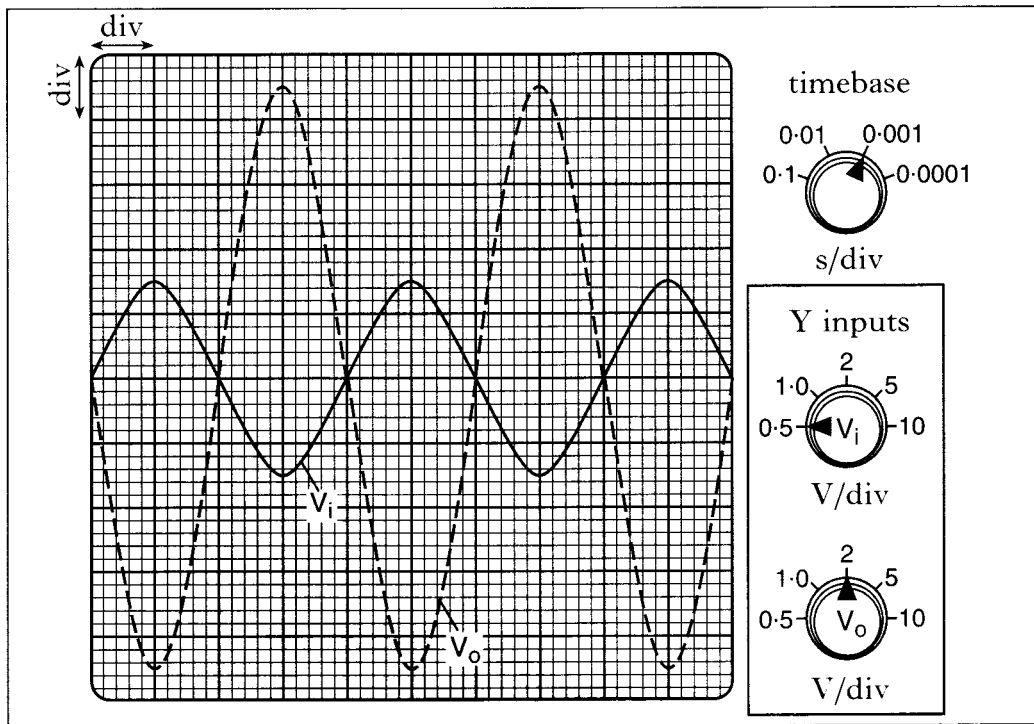
A double beam oscilloscope has two inputs which allows two signals to be viewed on the screen at the same time.

A double beam oscilloscope is connected to the input terminals **P** and **Q** and the output terminals **R** and **S** of a box containing an operational amplifier circuit.

The operational amplifier is operating in the inverting mode.



- (a) The oscilloscope control settings and the two traces displayed on its screen are shown in the diagram.



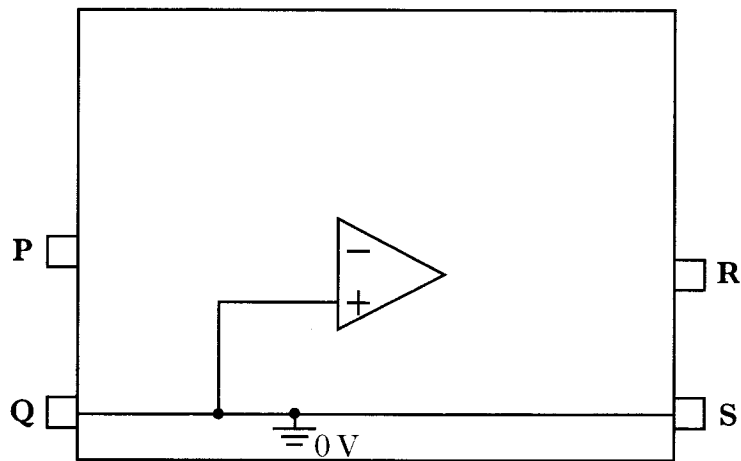
- (i) Calculate the frequency of the a.c. supply.
- (ii) Calculate the voltage gain of the amplifier circuit.
- (iii) Calculate the r.m.s. value of the output voltage of the amplifier circuit.

(b) A student is given the task of altering the operational amplifier circuit inside the box to give a voltage gain of -47.

The following list shows resistor values available to the student.

Resistor value/k Ω
3.9
4.7
5.6
6.8
8.2
10
27
47
56

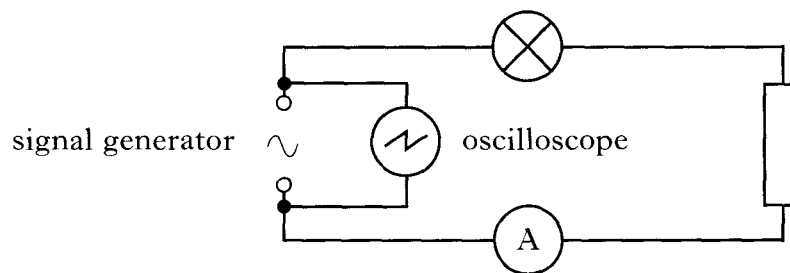
- (i) Select suitable resistor values to produce a voltage gain of -47.
- (ii) Copy the diagram shown below.



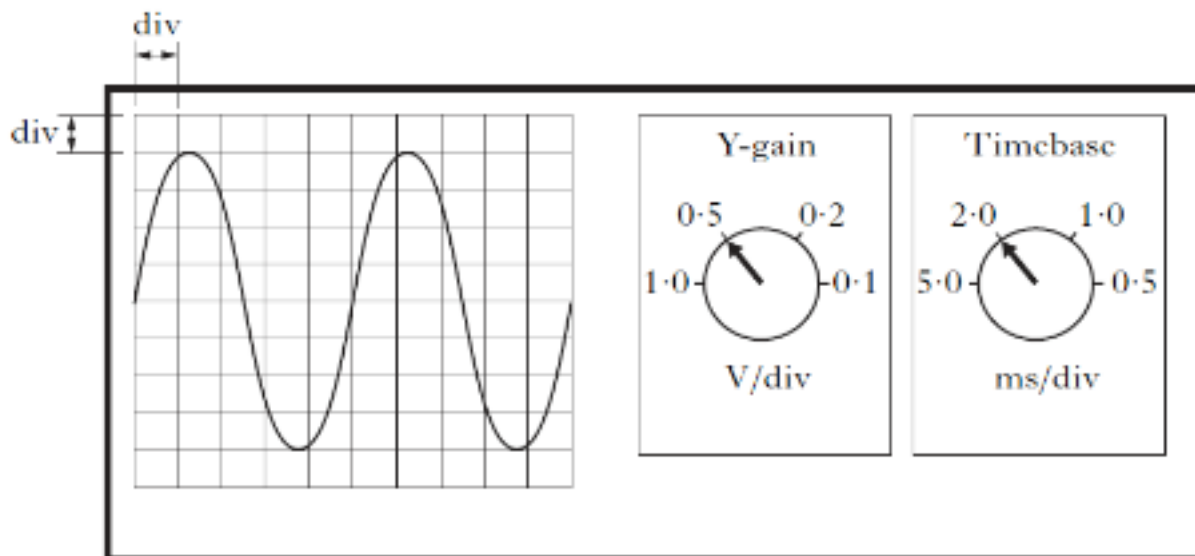
Complete the diagram, showing how your chosen resistors should be connected inside the box to complete the circuit.

2010 Q26.

A signal generator is connected to a lamp, a resistor and an ammeter in series.
An oscilloscope is connected across the output terminals of the signal generator.



The oscilloscope control settings and the trace displayed on its screen are shown.



- (a) For this signal calculate:
- the peak voltage;
 - the frequency.
- (b) The frequency is now doubled. The peak voltage of the signal is kept constant.
State what happens to the reading on the ammeter.
- (c) The resistor is now replaced by a capacitor.
The procedure in part (b) is repeated.
State what happens to the reading on the ammeter as the frequency is doubled.
- (d) The capacitor will be damaged if the potential difference across it exceeds 16 V.
The capacitor is now removed from this circuit and connected to a different a.c. supply of output $15 V_{\text{rms}}$.
Explain whether or not the capacitor is damaged.