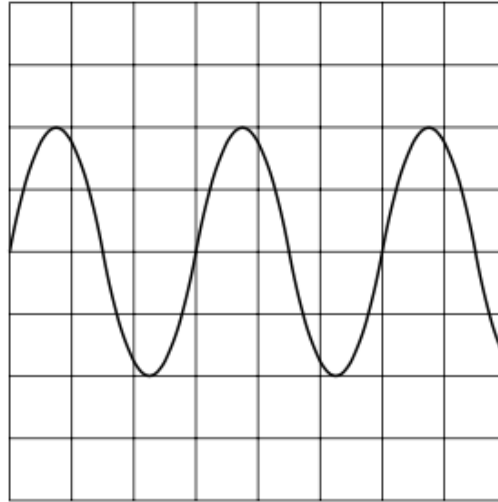


1)

An alternating current (ac) source is connected to a resistor to form a complete circuit. The trace obtained on an oscilloscope connected across the resistor is shown in **Figure 3**.

Figure 3

The oscilloscope settings are: Y gain 5.0 V per division
time base 2.0 ms per division.

(a) (i) Calculate the peak voltage of the ac source.

answer = V
(1 mark)

(a) (ii) Calculate the rms voltage.

answer = V
(1 mark)

(a) (iii) Calculate the time period of the ac signal.

answer = ms
(1 mark)

(a) (iv) Calculate the frequency of the ac signal.

answer = Hz
(2 marks)

2)

An oscilloscope is used to investigate various voltage sources. In order to do this a voltage source is connected to the y-input and the time base is switched off. **Figure 2** shows the screen of the oscilloscope when the y-input is not connected to a voltage source.

Figure 2

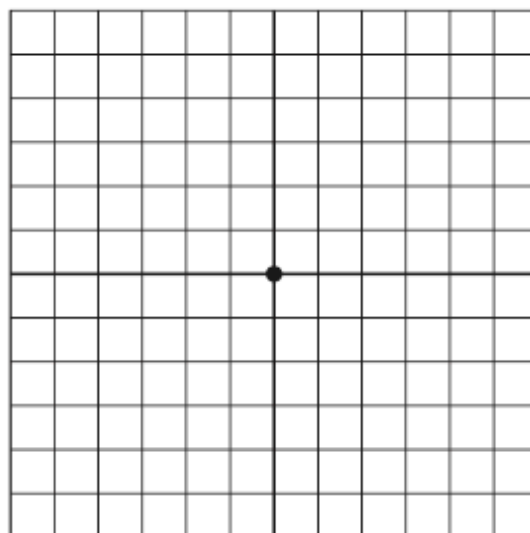
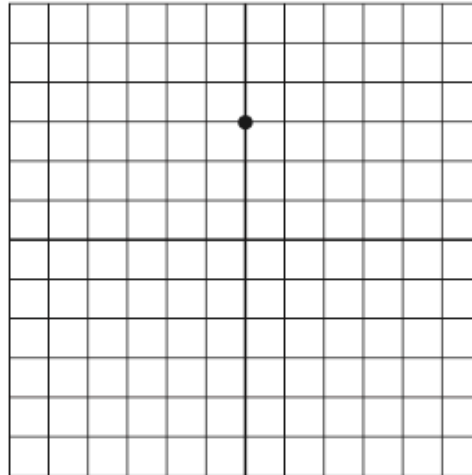
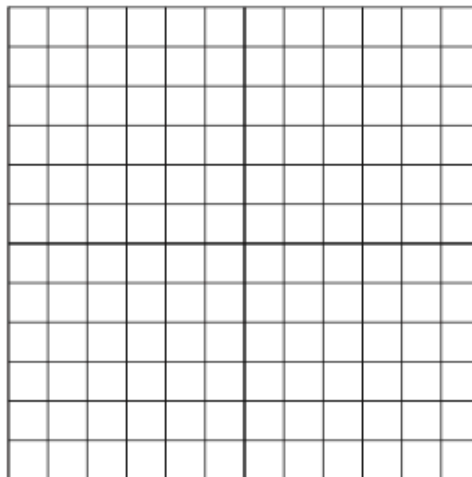


Figure 3 shows the screen when a 1.5 V cell is connected to the y-input.

Figure 3



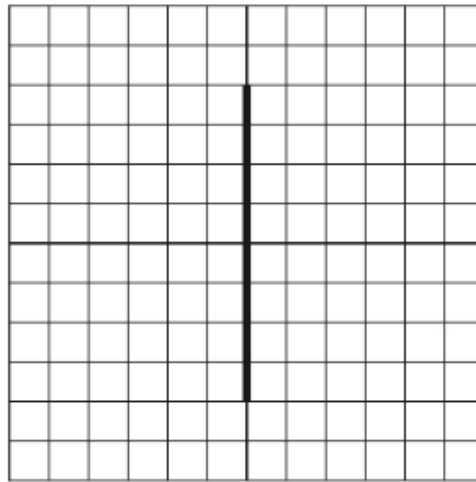
- (a) On the grid below show the appearance of the screen if the y-input is connected to a 2.5 V dc supply.



(1 mark)

- (b) The y-input is now connected to a sinusoidal ac voltage supply and the screen is shown in **Figure 4**.

Figure 4



- (b) (i) Explain why a vertical line is now seen on the screen.

.....
.....
.....
.....
.....
.....

(2 marks)

- (b) (ii) Calculate the peak-to-peak voltage of the ac supply.

answer = V
(2 marks)

(b) (iii) Calculate the root mean square voltage of the supply.

answer = V
(2 marks)

3)

An electric oven is connected to a 230 V root mean square (rms) mains supply using a cable of negligible resistance.

(a) (i) Calculate the peak-to-peak voltage of the mains supply.

[2 marks]

peak-to-peak voltage = _____ V

(a) (ii) The resistance of the heating element in the oven at its working temperature is 12 Ω .

Calculate the power dissipated by the heating element in the oven.
Give your answer to an appropriate number of significant figures.

[3 marks]

power = _____ W

(b) In practice the resistance of the cable connecting the oven to the mains supply is not negligible. Each of the **two** wires connecting the heating element to the mains electricity supply has a length of 3.15 m. Each metre of wire has a resistance of 0.0150Ω .

(b) (i) Explain why the rms voltage across the heating element in the oven will be less than 230 V.

[2 marks]

(b) (ii) Calculate the rms voltage across the heating element in the oven when it is at its working temperature.

[3 marks]

rms voltage = _____ V

(b) (iii) Calculate the average power wasted in the cable due to the heating effect of the electric current.

[2 marks]

average power = _____ W

(b) (iv) State **two** reasons why it is important that the cable has a low resistance.

[2 marks]

1 _____

2 _____

4)

- (a) An alternating current supply provides an output voltage of 12 V rms at a frequency of 50 Hz . Describe how you would use an oscilloscope to check the accuracy of the rms output voltage and the frequency of the supply.

The quality of your written communication will be assessed in your answer.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(6 marks)

(b) The power supply in part (a) is connected to a 12 V 24 W lamp.

(b) (i) Calculate the rms current in the lamp.

answer = A
(1 mark)

(b) (ii) Calculate the peak current in the lamp.

answer = A
(1 mark)

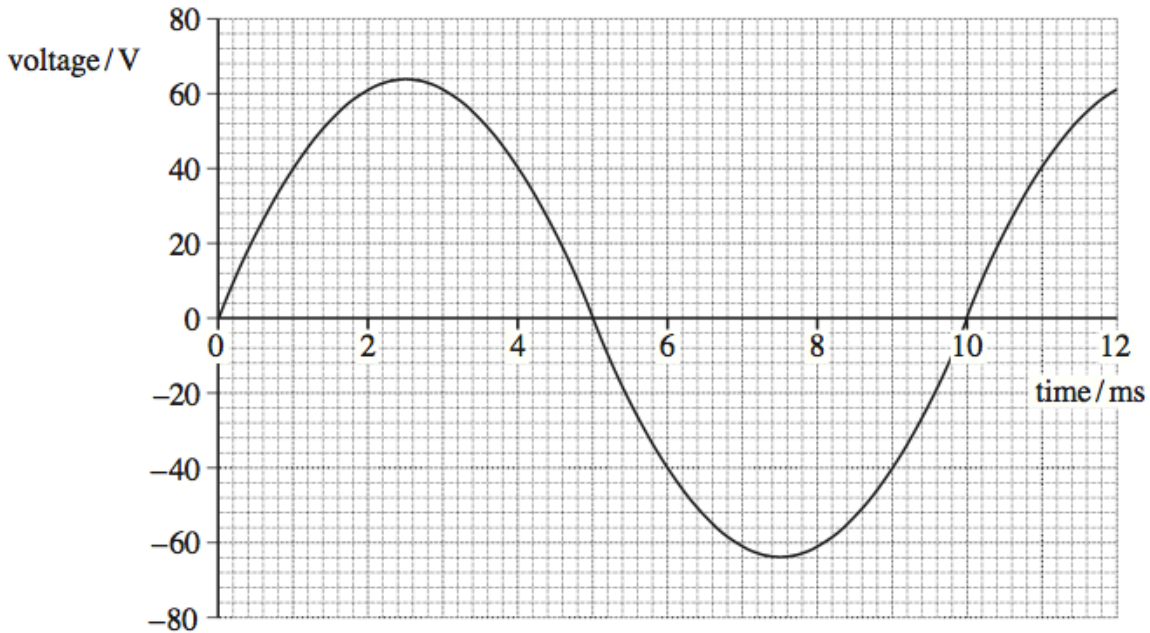
(b) (iii) Calculate the peak power of the lamp.

answer = W
(2 marks)

5)

Figure 2 shows how a sinusoidal alternating voltage varies with time when connected across a resistor, R.

Figure 2



(a) (i) State the peak-to-peak voltage.

peak-to-peak voltage V
(1 mark)

(a) (ii) State the peak voltage.

peak voltage V
(1 mark)

(a) (iii) Calculate the root mean square (rms) value of the alternating voltage.

rms voltage V
(2 marks)

(a) (iv) Calculate the frequency of the alternating voltage. State an appropriate unit.

frequency unit
(3 marks)

(b) On **Figure 2** draw a line to show the dc voltage that gives the same rate of energy dissipation in R as produced by the alternating waveform.
(2 marks)

(c) An oscilloscope has a screen of eight vertical and ten horizontal divisions. Describe how you would use the oscilloscope to display the alternating waveform in **Figure 2** so that two complete cycles are visible.

.....
.....
.....
.....
.....
.....
.....
.....
.....
.....

(3 marks)

6)

Domestic users in the United Kingdom are supplied with mains electricity at a *root mean square voltage* of 230 V.

(a) State what is meant by root mean square voltage.

.....
.....
.....

(1 mark)

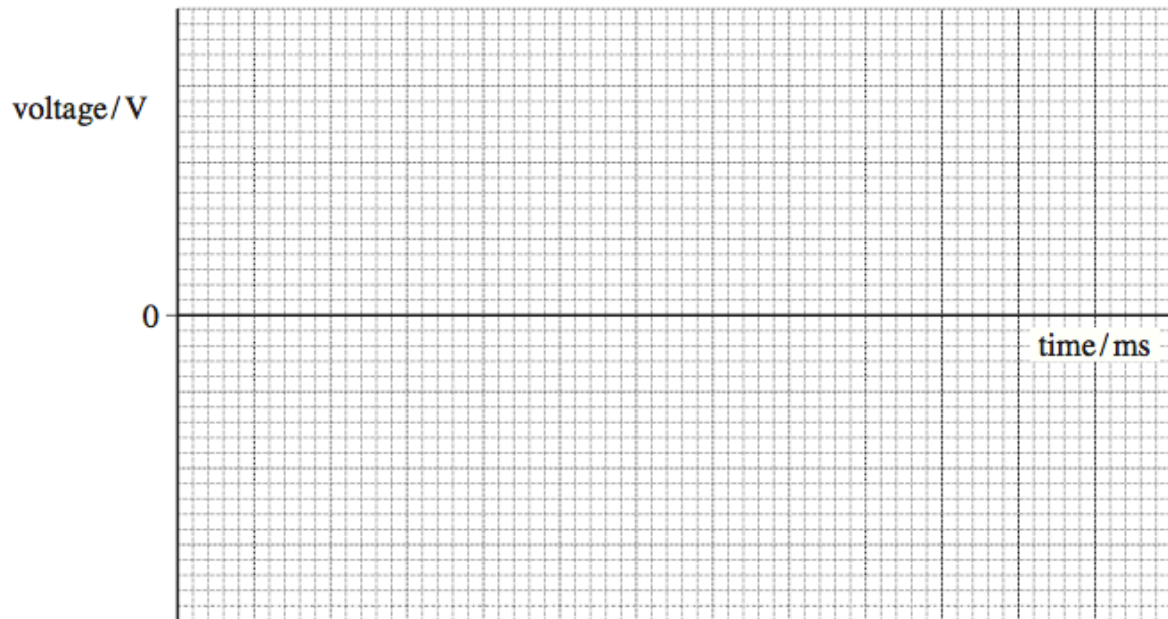
(b) (i) Calculate the peak value of the supply voltage.

answer = V
(2 marks)

(b) (ii) Calculate the average power dissipated in a lamp connected to the mains supply when the rms current is 0.26 A.

answer = W
(1 mark)

- (c) The frequency of the voltage supply is 50 Hz. On the axes below draw the waveform of the supplied voltage labelling the axes with appropriate values.

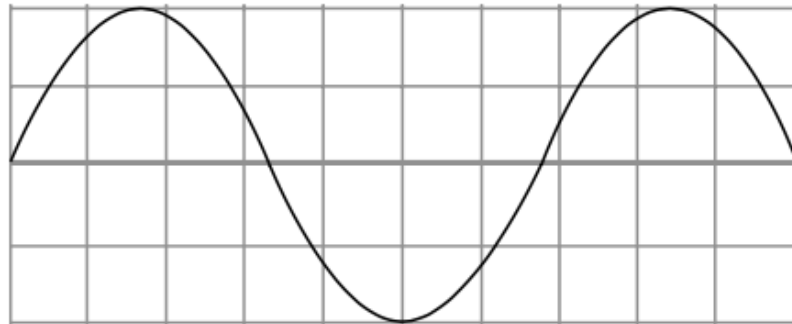


(4 marks)

7)

Figure 2 shows an ac waveform that is displayed on an oscilloscope screen.

Figure 2



The time base of the oscilloscope is set at 1.5 ms per division and the y-gain at 1.5 V per division.

(a) For the ac waveform shown,

(a) (i) Calculate the frequency

.....

.....

.....

.....

answerHz
(3 marks)

(a) (ii) Calculate the peak voltage

.....

.....

.....

.....

answerV
(2 marks)

(a) (iii) the rms voltage

.....
.....
.....
.....

answerV
(2 marks)

(b) State and explain the effect on the oscilloscope trace if the time base is switched off.

.....
.....
.....
.....
.....
.....

(2 marks)