Q1. A transformer has 1150 turns on the primary coil and 500 turns on the secondary coil. The primary coil draws a current of 0.26 A from a 230 V ac supply. The current in the secondary coil is 0.50 A. What is the efficiency of the transformer?

A 42%

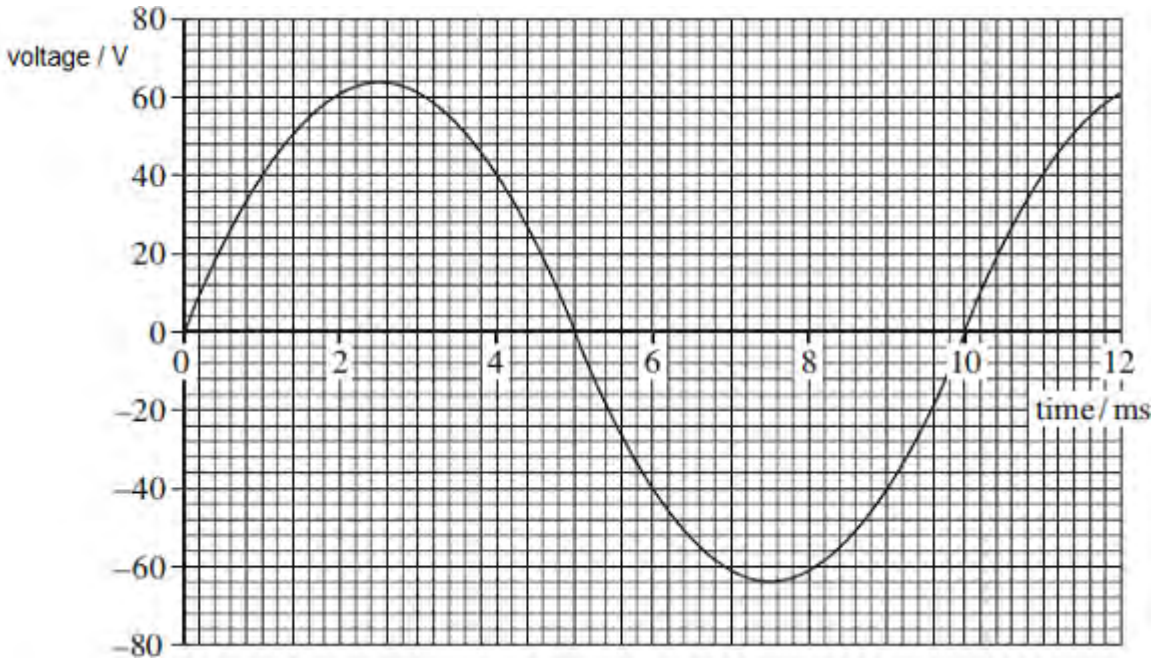
B 50%

C 84%

D 100%

(Total 1 mark)

Q2. The graph below shows how a sinusoidal alternating voltage varies with time when connected across a resistor, R.



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

peak-to-peak voltage.....V

(1)

(ii) State the peak voltage.

peak voltage.....V

(1)

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

rms voltage.....V

(2)

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

frequency.....unit .....

(3)

(b) On the graph above 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)

(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 the graph above so that two complete cycles are visible.

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(3)
(Total 12 marks)

Q3. 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 1** below shows the screen of the oscilloscope when the y-input is not connected to a voltage source.

Figure 1

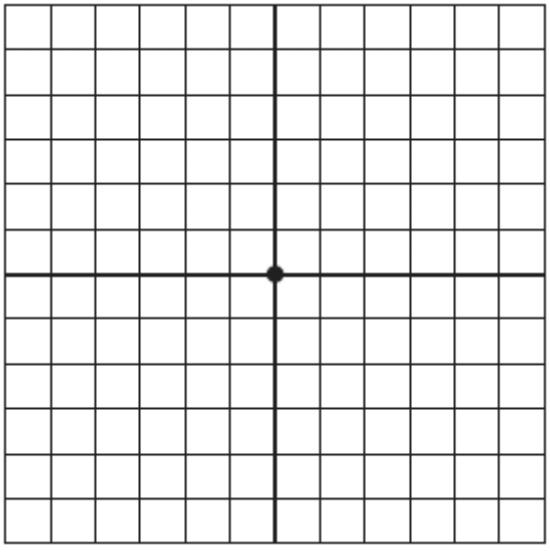
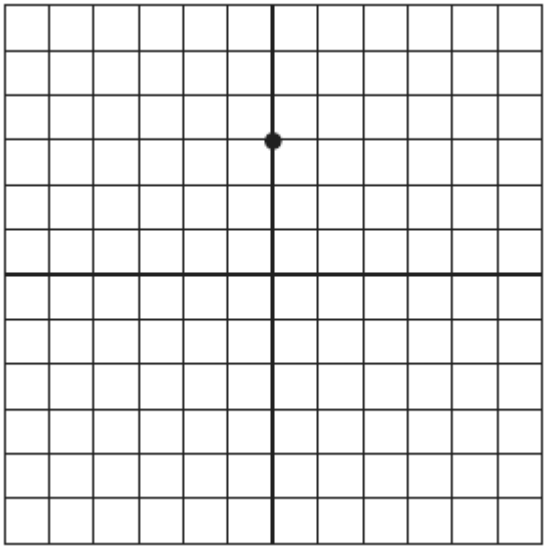
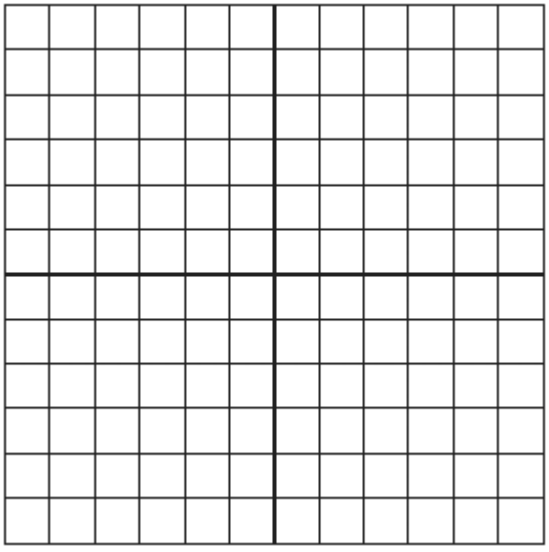


Figure 2 shows the screen when a 1.5V cell is connected to the y-input.

Figure 2



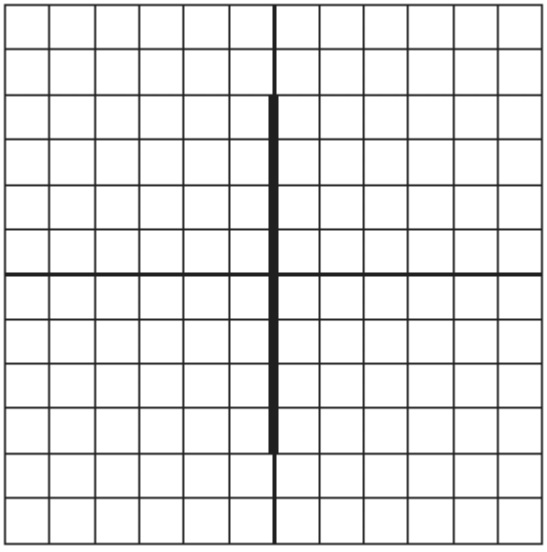
(a) On the grid below show the appearance of the screen if the y-input is connected to a 2.5V dc supply.



(1)

(b) The y-input is now connected to a sinusoidal ac voltage supply and the screen is shown in **Figure 3**.

Figure 3



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

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(2)

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

answer = ... V

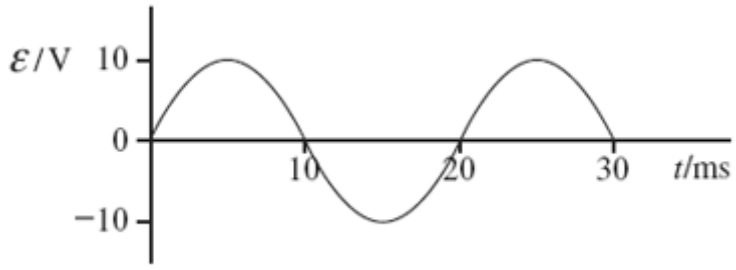
(2)

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

answer = ... V

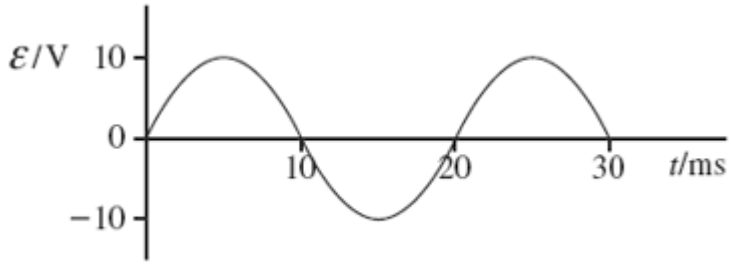
(2)
(Total 7 marks)

Q4.

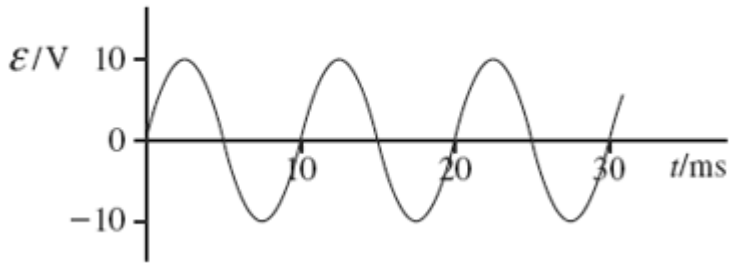


The above graph shows how the output emf, ε, varies with time, t, for a coil rotating at angular speed ω in a uniform magnetic field of flux density B. Which one of the following graphs shows how ε varies with t when the same coil is rotated at angular speed 2ω in a uniform magnetic field of flux density 0.5 B?

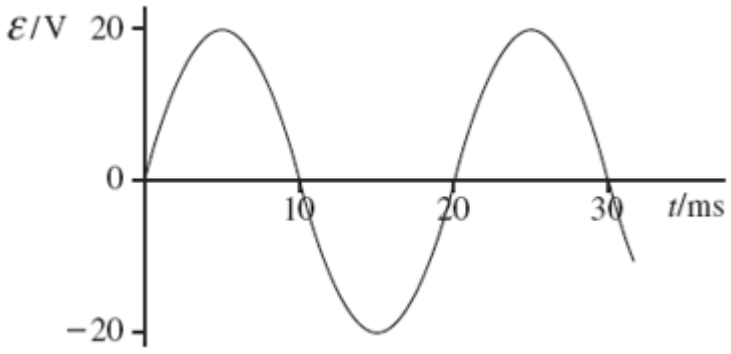
A



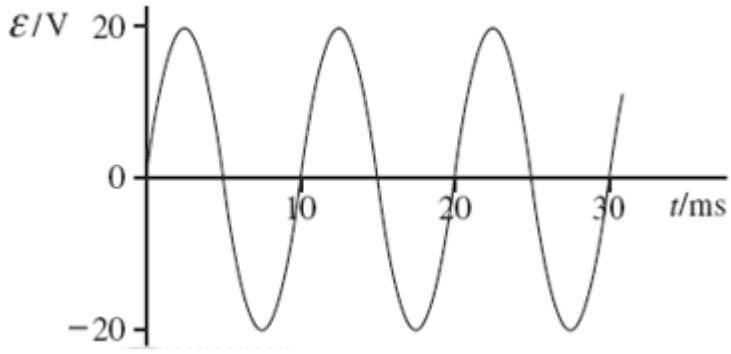
B



C



D



(Total 1 mark)

Q5. Domestic users in the United Kingdom are supplied with mains electricity at a *root mean square voltage* of 230V.

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

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(1)

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

answer = ... V

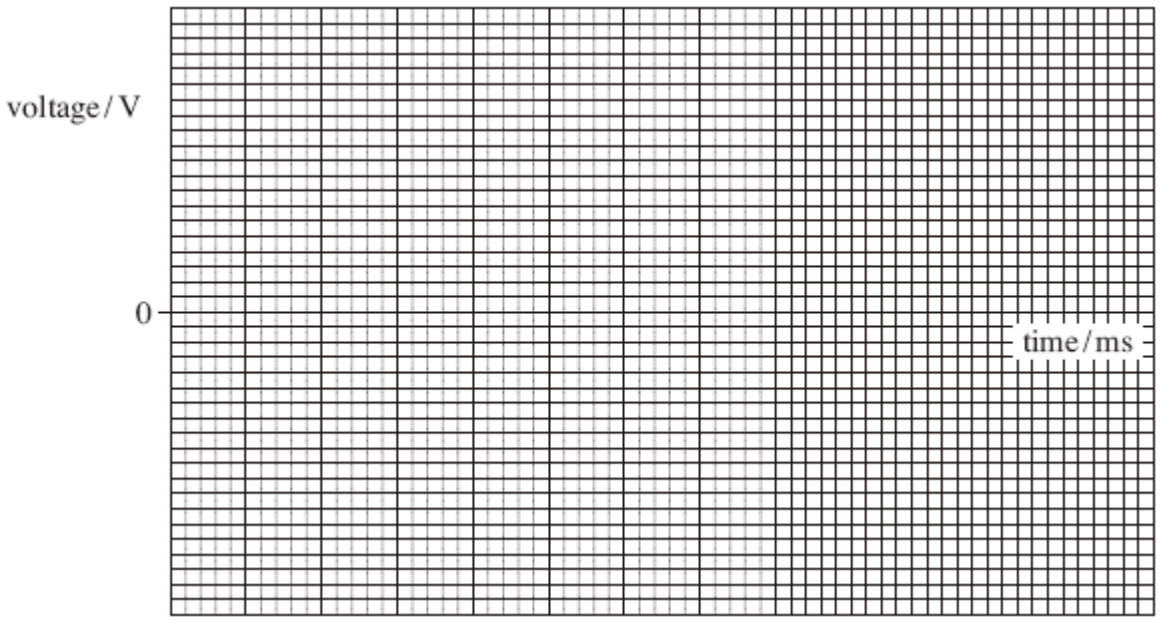
(2)

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

answer = ... W

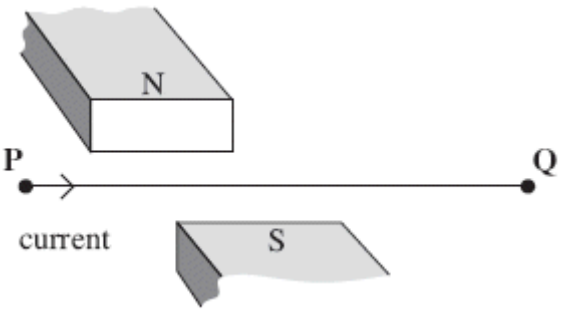
(1)

(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)
(Total 8 marks)

Q6. The figure below shows a horizontal wire, held in tension between fixed points at **P** and **Q**. A short section of the wire is positioned between the pole pieces of a permanent magnet, which applies a uniform horizontal magnetic field at right angles to the wire. Wires connected to a circuit at **P** and **Q** allow an electric current to be passed through the wire.



(a) (i) State the direction of the force on the wire when there is a direct current from **P** to **Q**, as shown in the figure above.

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(1)

(ii) In a second experiment, an alternating current is passed through the wire.

Explain why the wire will vibrate vertically.

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(3)

(b) The permanent magnet produces a uniform magnetic field of flux density 220 mT over a 55 mm length of the wire. Show that the maximum force on the wire is about 40 mN when there is an alternating current of rms value 2.4 A in it.

(3)

(c) The length of **PQ** is 0.40 m. When the wire is vibrating, transverse waves are propagated along the wire at a speed of 64 m s^{-1}. Explain why the wire is set into large amplitude vibration when the frequency of the a.c. supply is 80 Hz.

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(3)
(Total 10 marks)

Q7. A coil rotating in a magnetic field produces the following voltage waveform when connected to an oscilloscope.

With the same oscilloscope settings, which one of the following voltage waveforms would be produced if the coil were rotated at twice the original speed?

A 

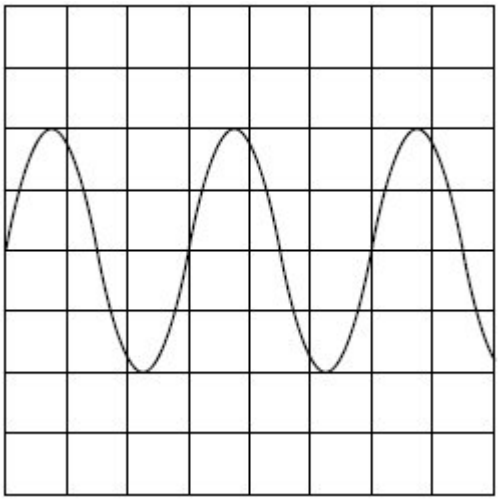
B 

C 

D 

(Total 1 mark)

Q8. 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 the diagram below.



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

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

answer = ... V

(1)

(ii) Calculate the rms voltage.

answer = ... V

(1)

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

answer = ... ms

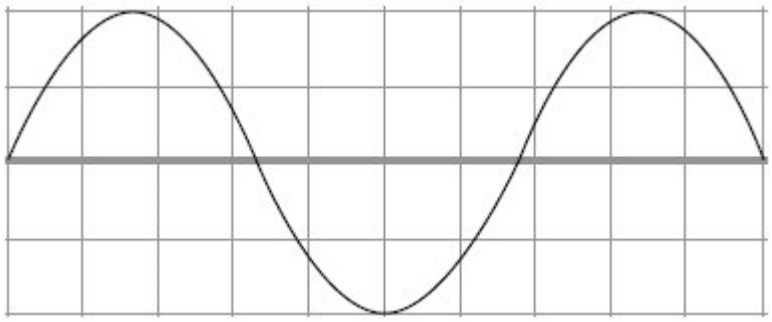
(1)

(iv) Calculate the frequency of the ac signal.

answer = ... Hz

(2)
(Total 5 marks)

Q9. The diagram below shows an ac waveform that is displayed on an oscilloscope screen.



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,

(i) Calculate the frequency

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answer ..... Hz

(3)

(ii) Calculate the peak voltage

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answer V

(2)

(iii) the rms voltage

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answer V

(2)

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

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(2)
(Total 9 marks)