NAME: ……..……..……

SCHOOL:……

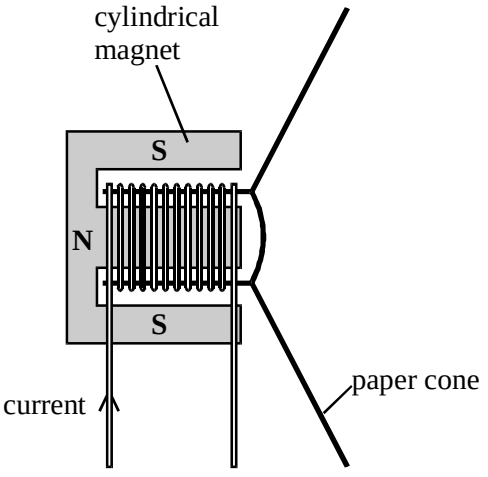
DATE: .....

ELECTROMAGNETIC INDUCTION

INSTRUCTIONS TO CANDIDATES

*Answer **ALL** questions in this paper in the spaces provided.*

1. The diagram shows a moving coil loudspeaker.



(a) (i) When the current is in the direction shown in the diagram, the paper cone moves to the right.

Describe the movement of the paper cone when the direction of the current is reversed.

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(1)

(ii) Explain why the paper cone moves when a current passes in the coil.

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(2)

(b) An alternating current passes in the coil.
Describe the movement of the paper cone.

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(1)

(c) The loudspeaker is used to produce a sound that has a frequency of 800 Hz.
The wavelength of the sound as it leaves the loudspeaker is 0.40 m.
Calculate the speed of the sound in air.

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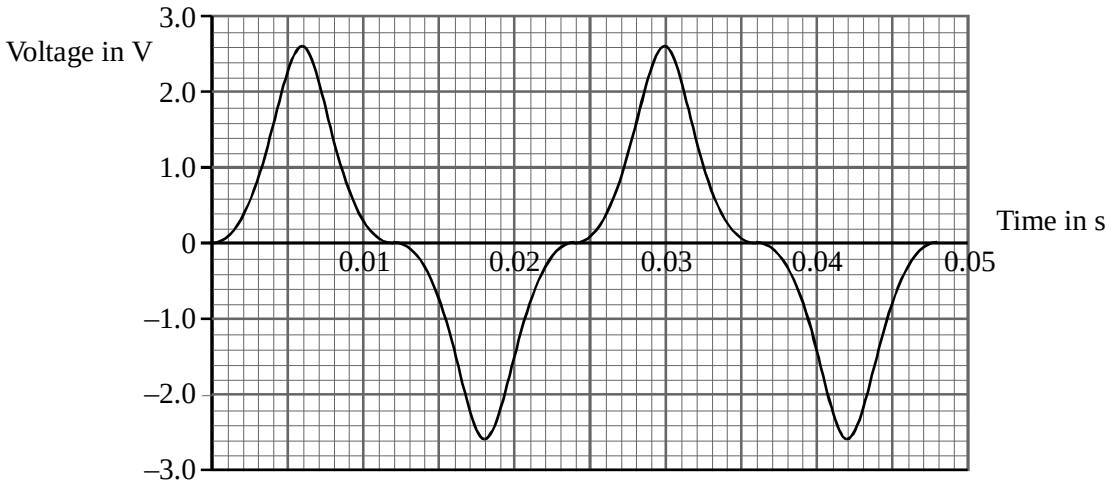
(3)
(Total 7 marks)

2. (a) The graph shows how the output voltage of a bicycle dynamo changes with time.



(i) How can you tell that the dynamo produces an alternating voltage?

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(1)

(ii) Use the graph to write down the values of

the amplitude of the voltage.....

the period of the voltage.....

(2)

(iii) Calculate the frequency of the alternating voltage.

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(2)

(b) A dynamo consists of a magnet that rotates inside a coil of wire.

(i) Explain why a voltage is generated in the coil when the magnet rotates.

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(2)

(ii) A dynamo is used as the energy source for the lights on a bicycle.
The bicycle speeds up.
State and explain the effect this has on the brightness of the lights.

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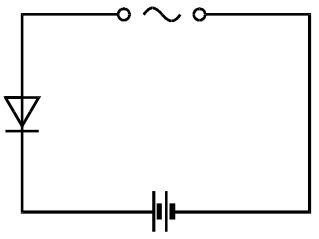
(2)

(c) The dynamo can also be used to recharge a battery. The diagram shows the circuit that is used.



Suggest why the diode is included in the circuit.

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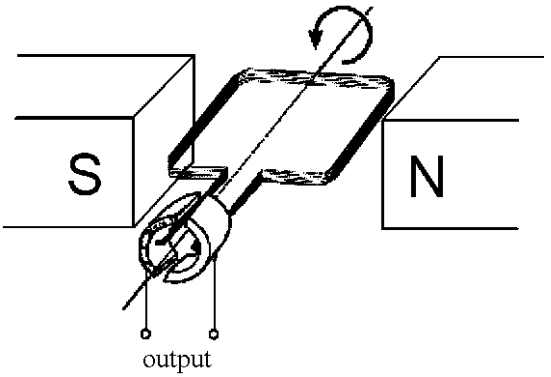
(2)
(Total 11 marks)

3. (a) The diagram shows the construction of a simple electrical generator. When the coil is rotated, an alternating voltage is produced at the output.



(i) Explain what is meant by an alternating voltage.

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(1)

(ii) State **two** ways in which the voltage output could be increased.

1 .....

2 .....

(2)

(b) The generators at a power plant produce a voltage of 25 000 V. For long distance transmission, on overhead power lines, this is stepped up to 400 000 V. It is later stepped down to 240 V for domestic use.

(i) Explain why the voltage is stepped up to 400 000 V.

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(2)

(ii) A transformer is used to step up the voltage. Calculate the ratio of primary turns to secondary turns needed for this transformer.

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(3)

(c) Give **one** advantage and **one** disadvantage of increasing the thickness of overhead power lines.

Advantage .....

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Disadvantage .....

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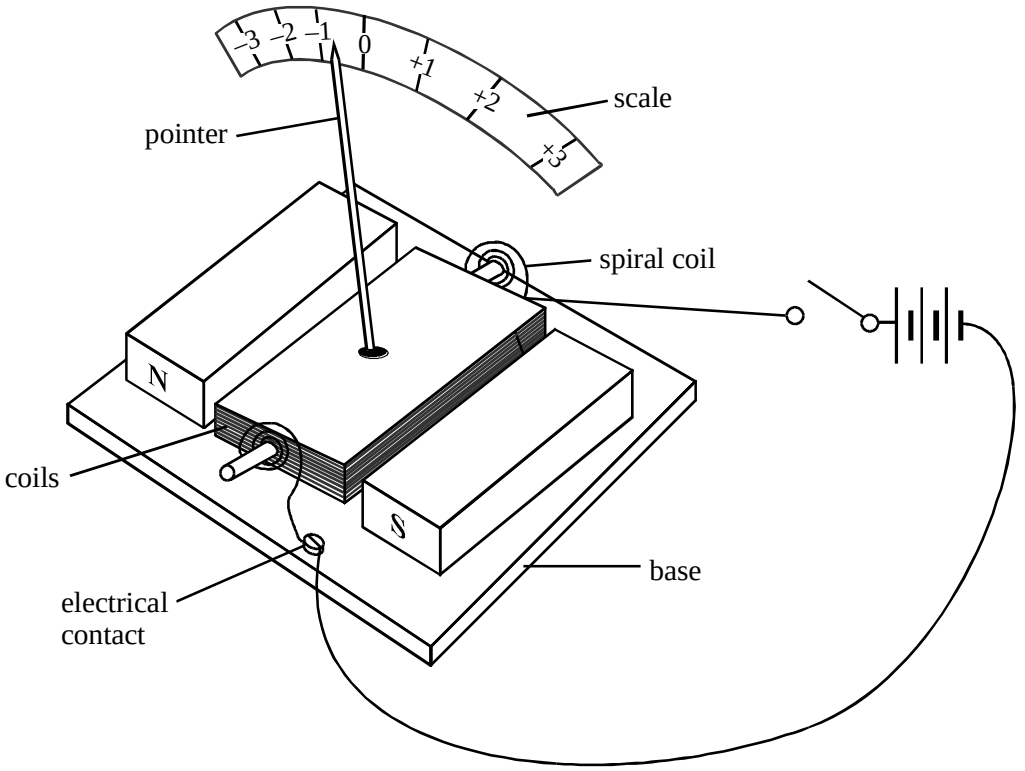
(2)
(Total 10 marks)

4. (a) The diagram shows a model ammeter built by a pupil.



When the switch is closed, the needle moves to the point +3 on the scale.

(i) Why does the needle move when the switch is closed?

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(2)

(ii) What will happen to the movement of the needle if the battery is reversed?

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(1)

(iii) What change would make the needle move further?

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(1)

(b) State why you think the wire is formed into spirals at each end.

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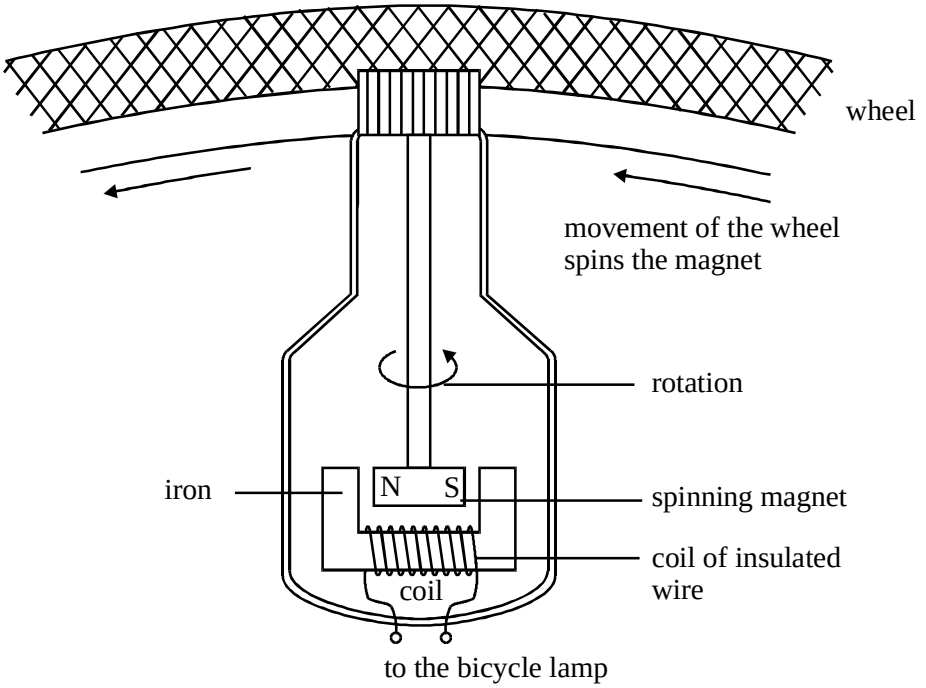
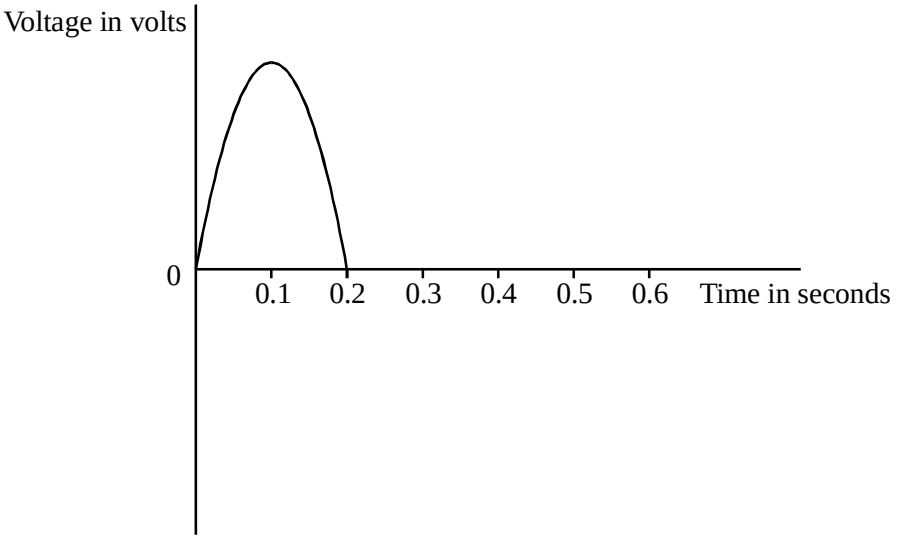
(2)

(Total 6 marks)

5. (a) The diagram shows a bicycle dynamo used to power the bicycle lamps.



An alternating voltage is induced in the coil when the magnet rotates. The graph shows how the induced voltage changes with time for half a revolution of the magnet.



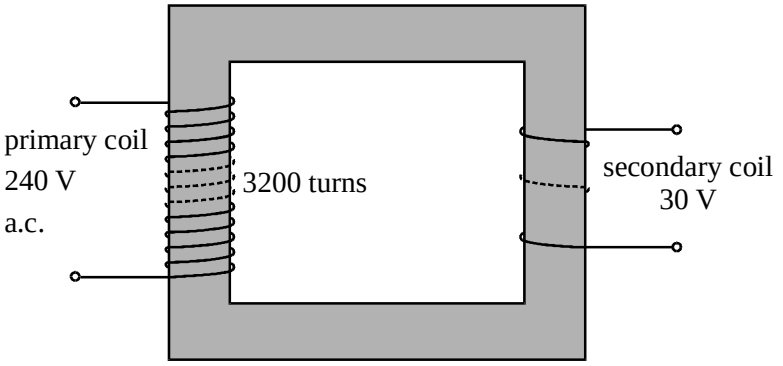
(i) Continue the graph to show the voltage as the magnet turns through a further half revolution.

(3)

(ii) On the same grid, sketch the voltage graph produced when the bicycle wheel is turning more slowly.

(2)

(b) A computer printer operates at 30 V. The diagram shows the transformer used to step down the mains voltage from 240 V to the 30 V needed by the printer.
There are 3200 turns on the primary coil.



(i) Calculate the number of turns on the secondary coil.

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(3)

(ii) The current in the printer is 0.4 A.
Calculate the energy supplied to the printer in one second.

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(2)

(iii) The energy supplied to the transformer by the mains in one second is 15 J.
Calculate the efficiency of the transformer.

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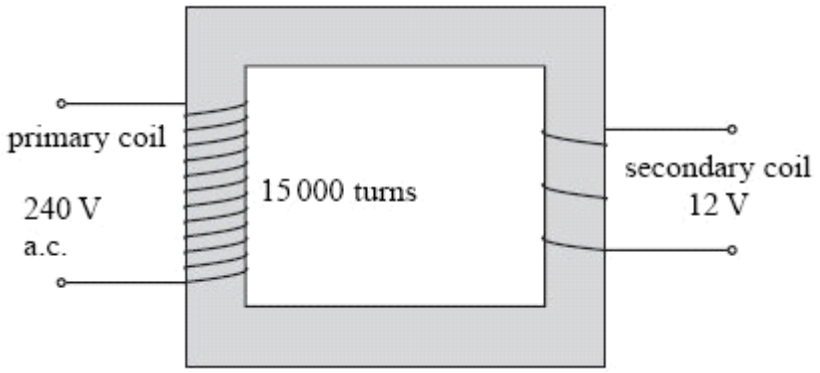
(3)
(Total 13 marks)

6. The diagram shows a transformer which is used to step down the 240 V mains voltage to light a 12 V lamp. The number of turns in the primary coil is 15 000.



(a) (i) Write down an equation which could be used to calculate the number of turns in the secondary coil.

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(1)

(ii) Calculate the number of turns in the secondary coil.

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(2)

(b) 250 J of electrical energy is supplied to the primary coil in 10 s.

Calculate the current in the primary coil.

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(3)

(c) (i) The energy output from the secondary coil is 225 J in 10 s.

Calculate the efficiency of the transformer.

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(2)

(ii) Explain why the efficiency is less than 100%.

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(2)

(Total 10 marks)