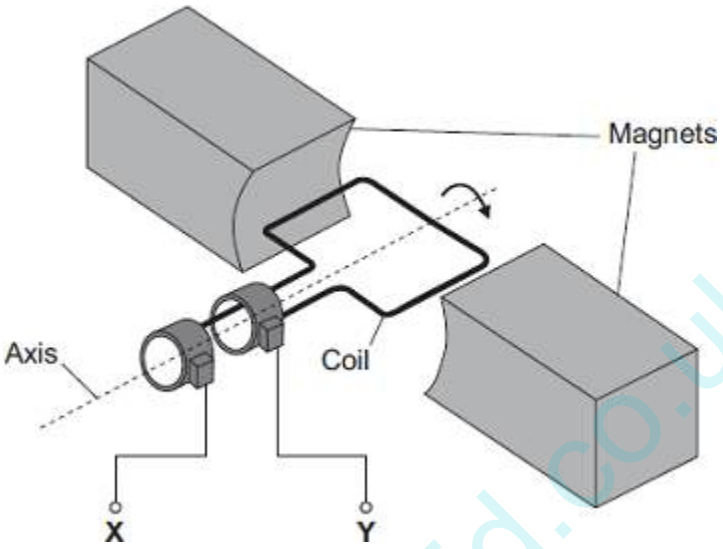
Q1.

The diagram shows an a.c. generator.

The coil rotates about the axis shown and cuts through the magnetic field produced by the magnets.



(a) (i) A potential difference is induced between **X** and **Y**.

Use the correct answer from the box to complete the sentence.

electric	**generator**	**motor**	**transformer**

This effect is called the _____ effect.

(1)

(ii) What do the letters a.c. stand for?

_____

(1)

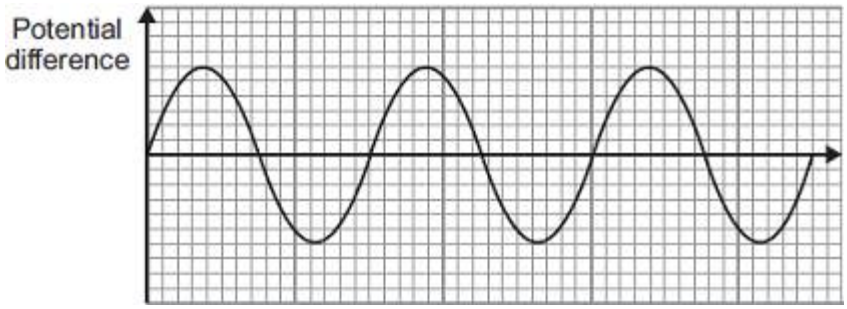
(iii) Name an instrument that could be used to measure the potential difference between **X** and **Y**.

_____

(1)

(b) **Graph 1** shows the output from the a.c. generator.

Graph 1



(i) One of the axes on **Graph 1** has been labelled 'Potential difference'.

What should the other axis be labelled?

_____

(1)

(ii) The direction of the magnetic field is reversed.

On **Graph 1**, draw the output from the a.c. generator if everything else remains the same.

(2)

(c) The number of turns of wire on the coil is increased. This increases the maximum induced potential difference.

State **two** other ways in which the maximum induced potential difference could be increased.

1. _____

_____

2. _____

_____

(2)

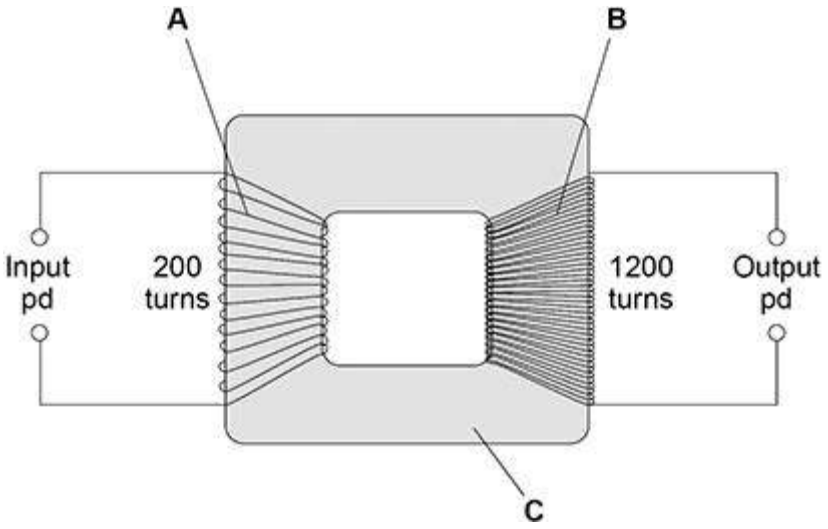
(Total 8 marks)

Q2.

The National Grid uses transformers to change potential difference (pd).

Figure 1 shows a transformer.

Figure 1



(a) Identify the parts of the transformer labelled in **Figure 1**.

A _____

B _____

C _____

(2)

(b) There is an alternating input pd of 230 V.

Determine the output pd.

Use the Physics Equations Sheet.

_____

_____

_____

_____

_____

Output pd = _____ V

(3)

(c) The input pd causes an alternating current.

Explain why there is an alternating current in the output when the transformer is connected to a circuit.

_____

_____

_____

_____

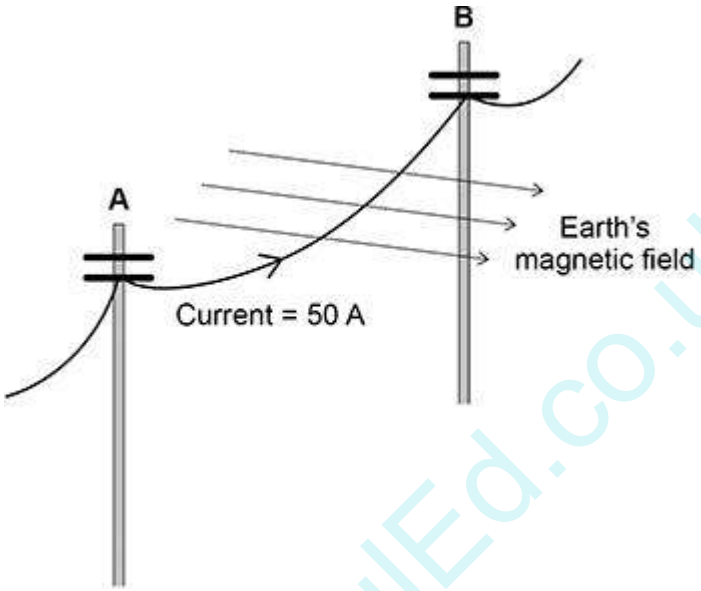
_____

_____

(3)

Figure 2 shows a large cable supported by two wooden poles. The cable is connected to an electricity supply.

Figure 2



(d) There is a force on the cable due to the Earth's magnetic field when the current is in the direction **A** to **B**.

What is the direction of this force?

Tick (✓) **one** box.

Down ☐

Left ☐

Right ☐

Up ☐

(e) The cable experiences a force of 0.045 N due to the Earth's magnetic field.

magnetic flux density = 60 μT

current = 50 A

Calculate the length of the cable between **A** and **B**.

Use the Physics Equations Sheet.

Length = _____ m

(4)

(f) State **one** assumption you made in your calculation.

_____

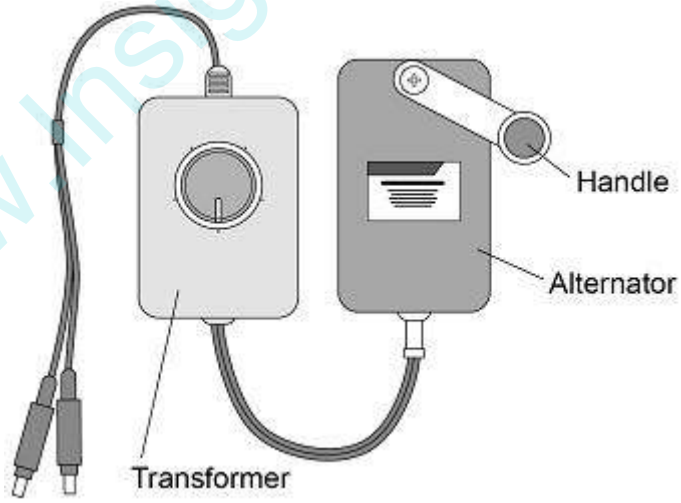
(1)

(Total 14 marks)

Q3.

Figure 1 shows a portable power supply.

Figure 1



(a) The portable power supply has an alternator connected to a transformer.

The transformer can be adjusted to have different numbers of turns on the secondary coil.

Suggest why.

_____

(2)

(b) A lamp is connected to the power supply.

The lamp requires an input potential difference of 5.0 V.

The alternator generates a potential difference of 1.5 V.

The primary coil of the transformer has 150 turns.

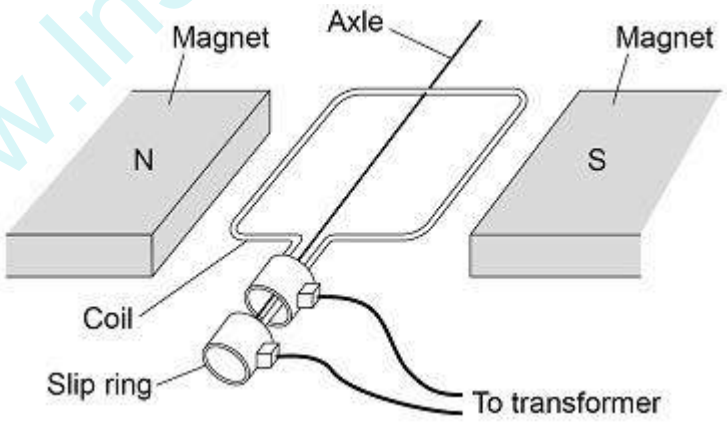
Calculate the number of turns needed on the secondary coil.

Number of turns on the secondary coil = _____

(3)

Figure 2 shows the inside parts of the alternator.

Figure 2



(c) The handle of the alternator is turned, causing the coil to rotate.

Explain why an alternating current is induced in the coil.

(5)

(d) Suggest the purpose of the slip rings.

(1)

(e) The alternator from the portable power supply is disconnected from the transformer and lamp.

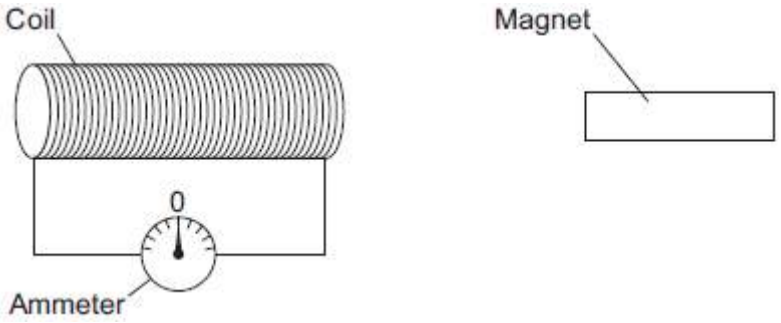
Explain why the handle of the alternator becomes much easier to turn.

(3)

(Total 14 marks)

Q4.

The figure below shows a coil and a magnet. An ammeter is connected to the coil.



The ammeter has a centre zero scale, so that values of current going in either direction through the coil can be measured.

(a) A teacher moves the magnet slowly towards the coil.

Explain why there is a reading on the ammeter.

(6)

(b) The table below shows some other actions taken by the teacher.

Complete the table to show the effect of each action on the ammeter reading.

Action taken by teacher	**What happens to the ammeter reading?**

Holds the magnet stationary and moves the coil slowly towards the magnet	
Holds the magnet stationary within the coil	
Moves the magnet quickly towards the coil	
Reverses the magnet and moves it slowly towards the coil	

(4)

(c) The magnet moves so that there is a steady reading of 0.05 A on the ammeter for 6 seconds.

Calculate the charge that flows through the coil during the 6 seconds.

Give the unit.

_____

_____

_____

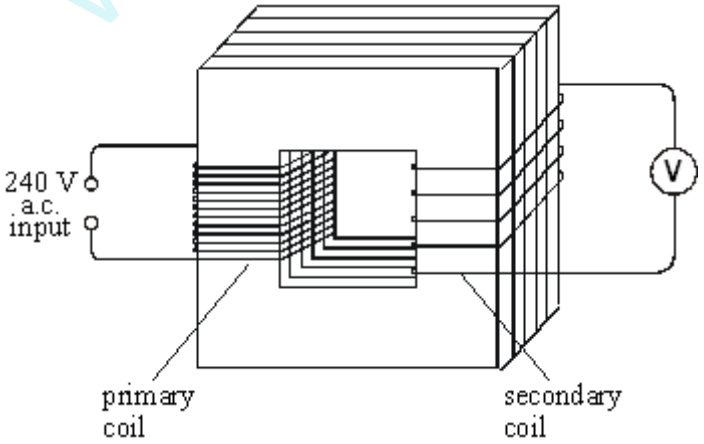
Charge = _____

(3)

(Total 13 marks)

Q5.

The diagram below shows a transformer.



(i) Name the material used to make the core of the transformer.

_____

(1)

(ii) The primary coil has 48 000 turns and the secondary coil 4000 turns.

If the input voltage is 240 V a.c., calculate the output voltage.

_____

_____

Answer _____ V

(2)

(iii) Explain how the use of such a transformer could be adapted to transform a low voltage into a higher voltage.

_____

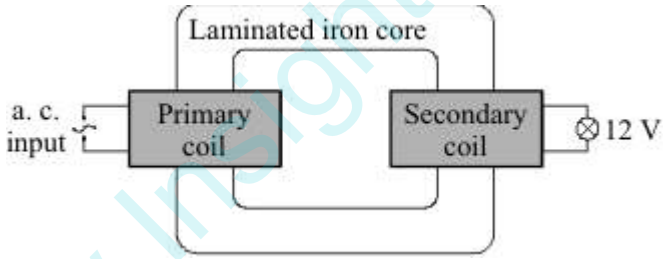
_____

(1)

(Total 4 marks)

Q6.

(a) The diagram represents a simple transformer used to light a 12 V lamp. When the power supply is switched on the lamp is very dim.



(i) Give **one** way to increase the voltage at the lamp without changing the power supply.

_____

_____

(1)

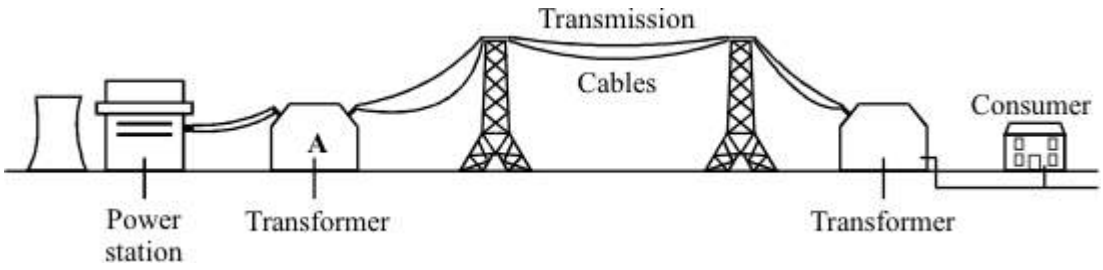
(ii) What is meant by the iron core being *laminated*?

_____

_____

(1)

(b) Electrical energy is distributed around the country by a network of high voltage cables.



(i) For the system to work the power is generated and distributed using alternating current rather than direct current. Why?

_____

_____

(1)

(ii) Transformers are an essential part of the distribution system. Explain why.

_____

_____

_____

(2)

(iii) The transmission cables are suspended high above the ground. Why?

_____

(1)

(c) The power station generates 100 MW of power at a voltage of 25 kV. Transformer **A**, which links the power station to the transmission cables, has 44 000 turns in its 275 kV secondary coil.

(i) Write down the equation which links the number of turns in each transformer coil to the voltage across each transformer coil.

_____

_____

(1)

(ii) Calculate the number of turns in the primary coil of transformer **A**. Show clearly how you work out your answer.

_____

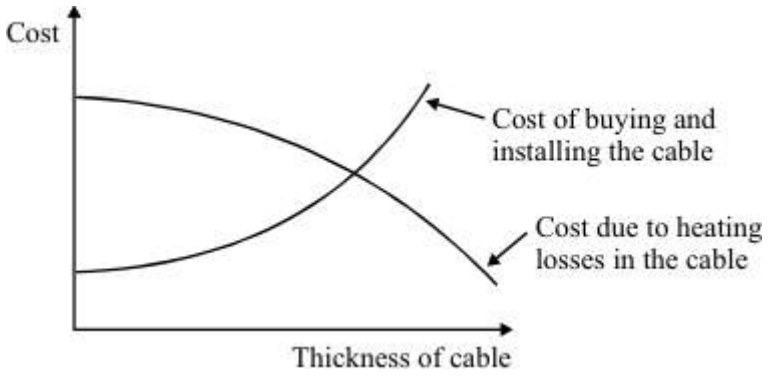
_____

_____

Number of turns = _____

(2)

(d) The diagram shows how the cost of transmitting the electricity along the cables depends upon the thickness of the cable.



(i) Why does the cost due to the heating losses go down as the cable is made thicker?

_____

(1)

(ii) By what process is most heat energy lost from the cables?

_____

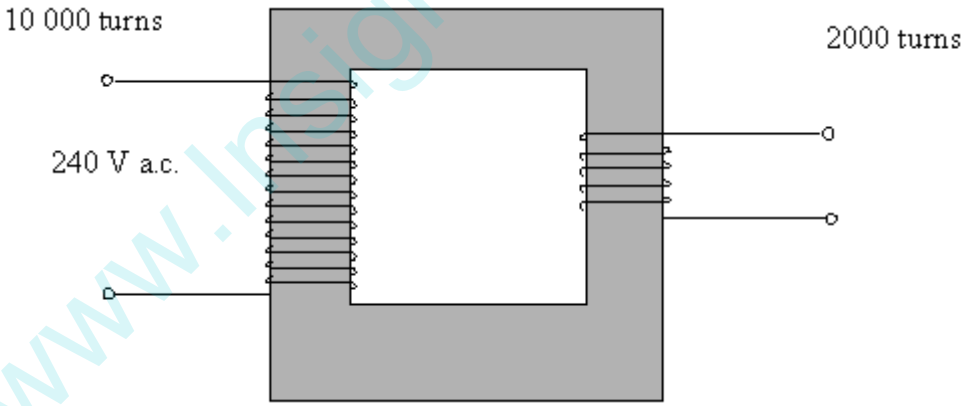
(1)

(Total 11 marks)

Q7.

(a) An appliance in a house has a transformer. The transformer is used to reduce the voltage to the level needed by the appliance.

The diagram shows the transformer.



(i) Name the material used for the core of the transformer.

_____

(1)

(ii) The transformer has 10 000 turns on the input side and 2000 turns on the output side. If the mains voltage of 240 volts is applied to the input, calculate the output voltage. You may find the following information helpful:

$$\frac{\text{output voltage}}{\text{input voltage}} = \frac{\text{number of turns on output coil}}{\text{number of turns on input coil}}$$

(3)

(b) Explain, in terms of magnetic fields, how a transformer works.

(4)

(c) A 12 V car battery is connected to the input leads of the transformer. It is hoped to reduce the voltage to 2.4 V in order to run a small motor. When the output voltage is measured it is found to be zero.

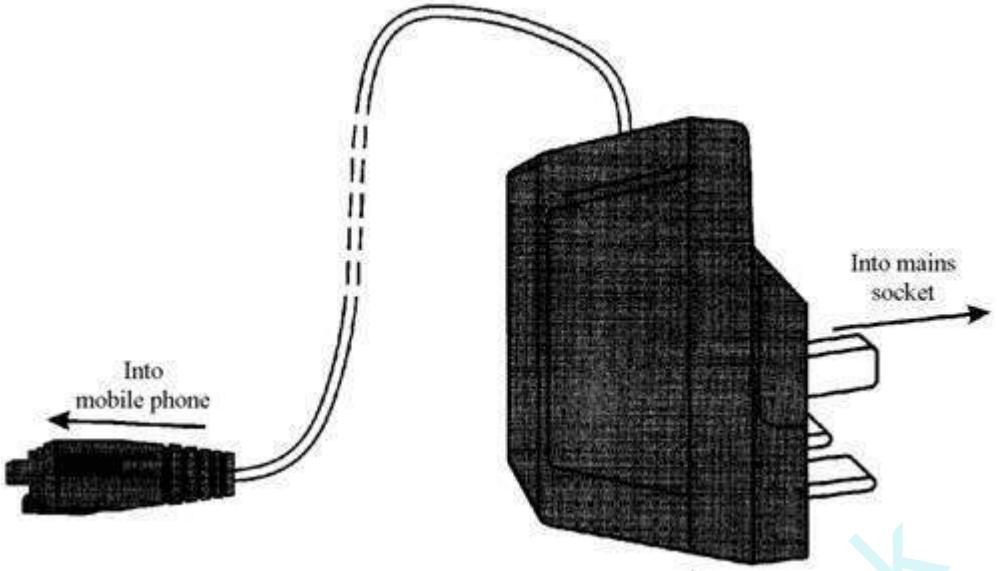
Explain why the output voltage is zero.

(2)

(Total 10 marks)

Q8.

(a) The drawing shows a small transformer used to recharge the battery in a 4.2 V mobile phone from a 230 V mains supply.



Explain how you know that this is a *step-down* transformer.

_____

_____

(1)

(b) A transformer consists of an insulated coil of wire, called the primary coil, on one side of a core. Another coil of insulated wire, called the secondary coil, is on the other side.

Give **two** features of the *core*.

1. _____

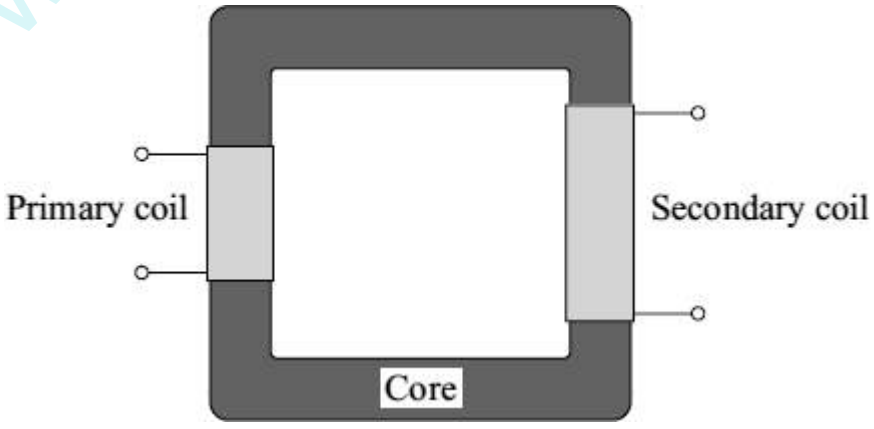
2. _____

(2)

(Total 3 marks)

Q9.

(a) The diagram shows the basic structure of a step-up transformer.



(i) What is the core made of?

_____

(1)

(ii) Explain how an alternating input produces an alternating output.

_____

_____

_____

_____

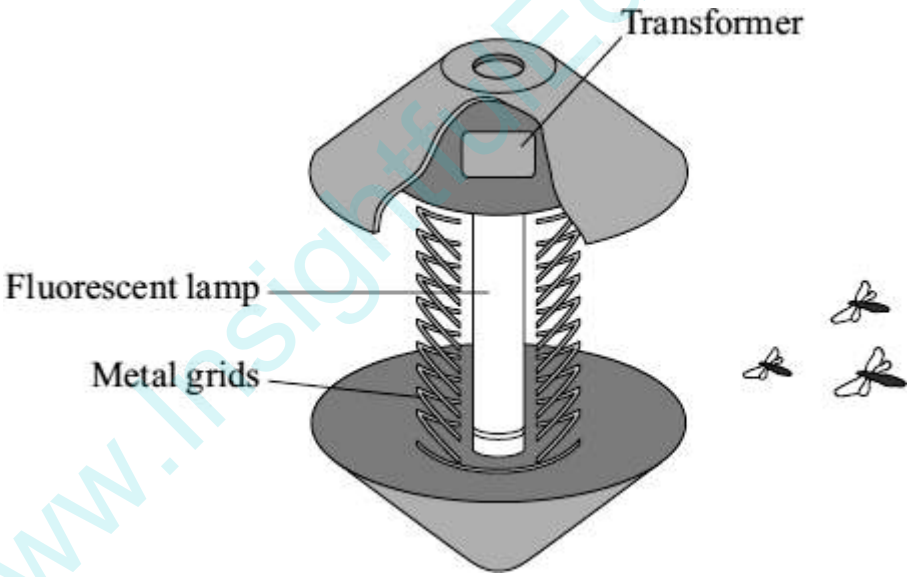
_____

_____

(3)

(b) Fly killers are used in kitchens and food stores because flying insects carry diseases which cause food poisoning.

The diagram shows the inside of one design. Insects are attracted to a fluorescent lamp. The metal grids have a high potential difference (p.d.) between them. The insects are killed as they fly between the grids.



A transformer is used in the fly killer. There is a p.d. of 230 V across the primary coil. There are 300 turns of wire on the primary coil and 4000 turns on the secondary coil.

Use the equation in the box to calculate the p.d. across the secondary coil.

$$\frac{\text{p.d. across primary}}{\text{p.d. across secondary}} = \frac{\text{number of turns on primary}}{\text{number of turns on secondary}}$$

Show clearly how you work out your answer.

_____

_____

_____

_____

_____

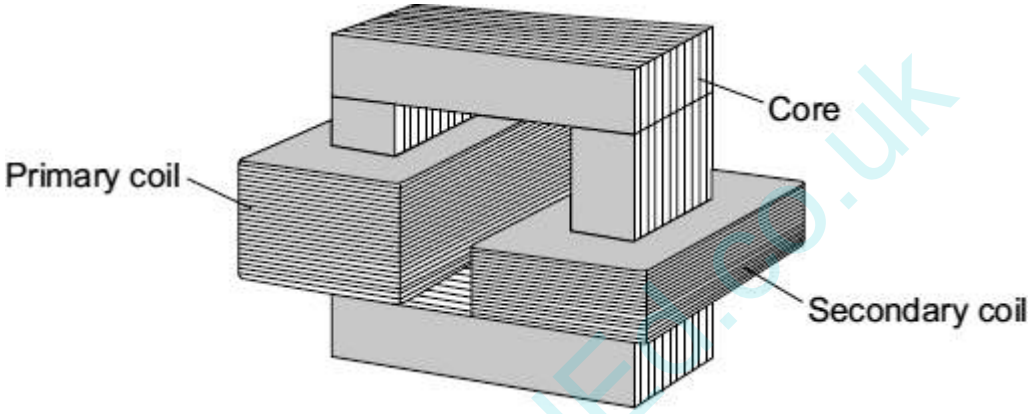
Potential difference = _____V

(3)

(Total 7 marks)

Q10.

A teacher demonstrates a small transformer.



(a) (i) What is the core made of?

Draw a ring around the correct word in the box.

aluminium	**copper**	**iron**

(1)

(ii) The potential difference (p.d.) across the secondary coil is less than the p.d. across the primary coil.

What sort of transformer is it?

_____

(1)

(b) Where is a step-up transformer used as part of the National Grid?

_____

(1)

(c) The teacher writes a note about the transformer but leaves **five** spaces.

Use the correct words from the box to complete the spaces.

coil	**core**	**current**	**ends**	**field**	**wire**

A transformer works because an alternating _____ in the

primary _____ produces a changing magnetic

_____ in the _____ and then in the

secondary coil.

This induces an alternating potential difference across the _____

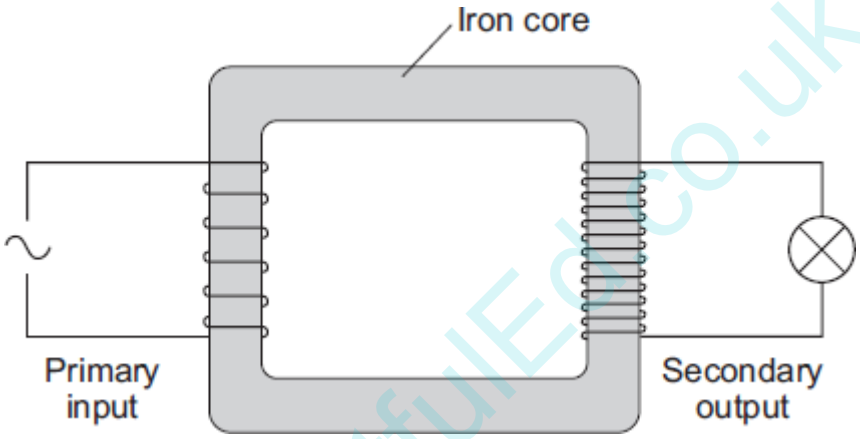
of the secondary coil.

(5)

(Total 8 marks)

Q11.

The diagram shows a transformer.



(a) (i) Is the transformer in the diagram being used as a step-up transformer or as a step-down transformer?

Put a tick (✓) in the box next to your answer.

a step-up transformer ☐

a step-down transformer ☐

Give a reason for your answer.

_____

_____

(1)

(ii) Why is the core made of iron?

_____

_____

(1)

(b) The power supply to a laptop computer contains a transformer designed to change the 230 V mains input to a 15 V output. The transformer has 920 turns on its primary coil.

Use the equation in the box to calculate the number of turns on the secondary coil.

$$\frac{\text{p.d. across primary}}{\text{p.d. across secondary}} = \frac{\text{number of turns on primary}}{\text{number of turns on secondary}}$$

Show clearly how you work out your answer.

_____

_____

_____

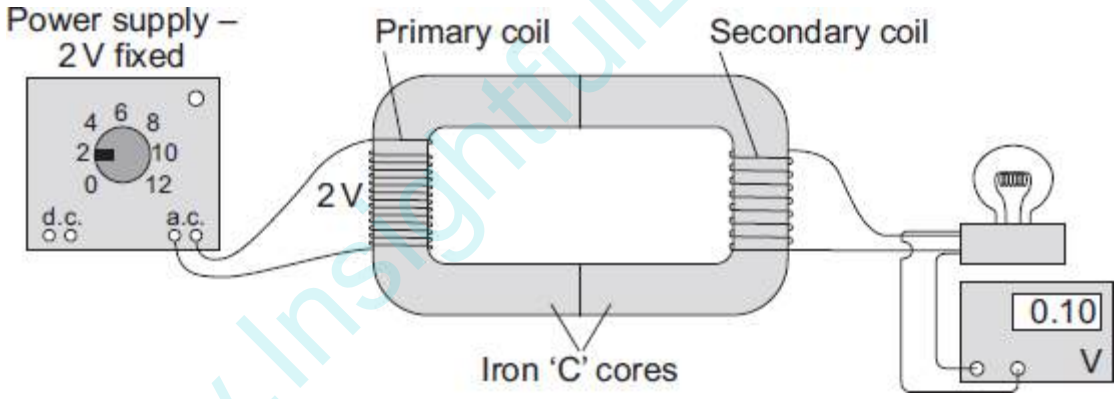
Number of turns on the secondary coil = _____

(2)

(Total 4 marks)

Q12.

The diagram shows the apparatus used by a student to investigate a transformer.



(a) The transformer made by the student would not have worked if the core had been made from aluminium and not iron.

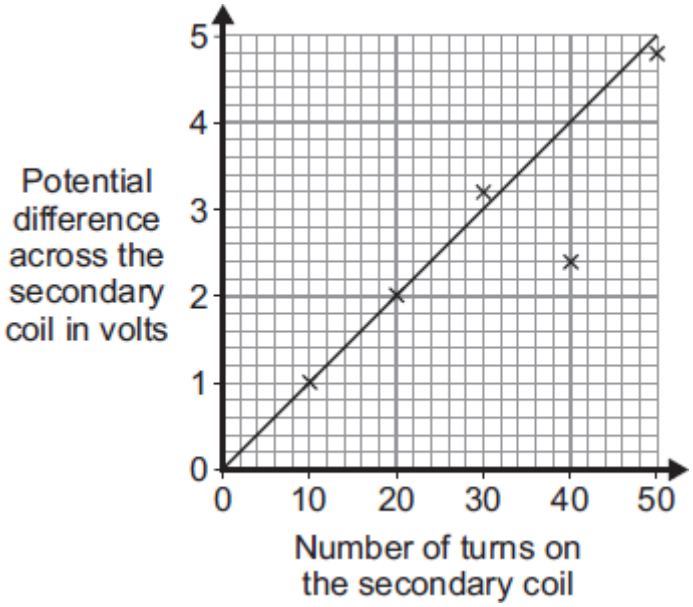
Why?

_____

_____

(1)

(b) The student made changes to the number of turns used to make the secondary coil. He then measured the potential difference across the secondary coil after each change.
The graph shows the student's results.



(i) What range of values was used for the number of turns on the secondary coil?

From _____ to _____

(1)

(ii) When he drew the line of best fit, the student ignored one of the data points.

Why?

_____

_____

(1)

(iii) What is the minimum number of turns needed on the secondary coil for the transformer to act as a step-up transformer?

_____

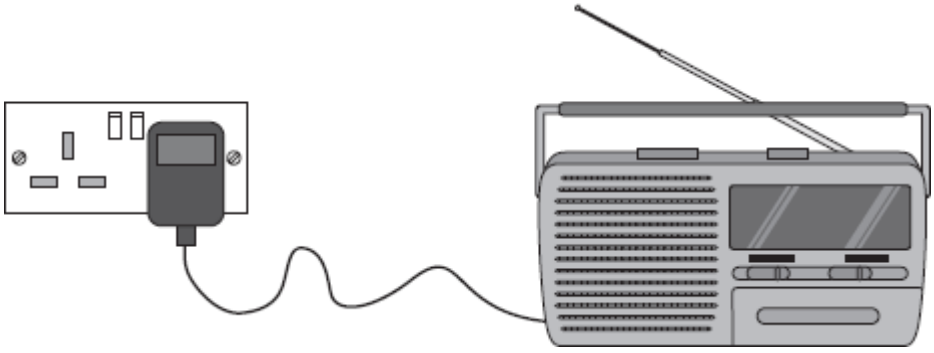
Give a reason for your answer.

_____

_____

(2)

(c) A radio can be used with a 9 V battery or it can be plugged into the 230 V mains electricity supply using an adapter. The mains adapter contains a transformer.



Why must the mains adapter contain a transformer?

_____

_____

(1)

(Total 6 marks)

Q13.

(a) In the National Grid, very large step-up transformers link power stations to the transmission cables.

A transformer used for this purpose has 800 turns on its primary coil and 12 800 turns on its secondary coil. The p.d. (potential difference) across its primary coil is 25 kV.

Use the equation in the box to calculate the p.d. across its secondary coil.

$$\frac{\text{p.d. across primary}}{\text{p.d. across secondary}} = \frac{\text{number of turns on primary}}{\text{number of turns on secondary}}$$

Show clearly how you work out your answer.

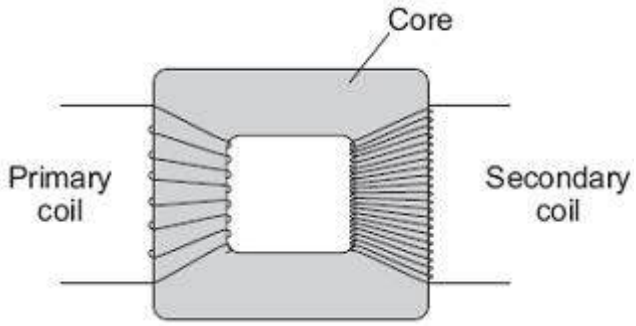
_____

_____

p.d. across secondary coil = _____ volts

(2)

(b) The diagram shows the structure of a transformer.



(i) The primary and secondary coils of a transformer are made of insulated wire.

Why is this insulation necessary?

_____

_____

(1)

(ii) Why is the core made of iron?

_____

_____

(1)

(iii) Explain how the transformer works.

_____

_____

_____

_____

_____

_____

(3)

(c) Before 1926, large towns had their own local power stations. After 1926, these power stations were connected to form the National Grid.

Give **two** advantages of having a National Grid system.

1. _____

_____

2. _____

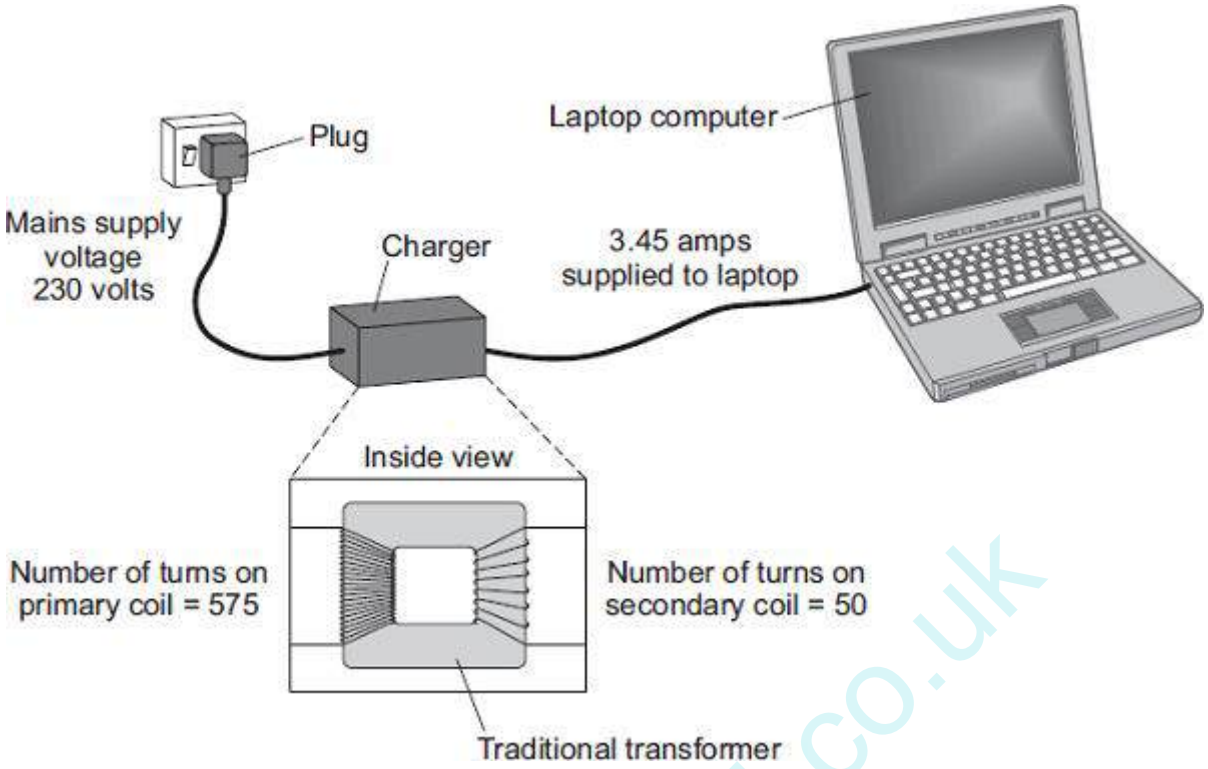
_____

(2)

(Total 9 marks)

Q14.

Batteries inside laptop computers are charged using laptop chargers. The laptop charger contains a traditional transformer.



(a) The alternating current flowing through the primary coil of the transformer creates an alternating current in the secondary coil.

Explain how.

(3)

(b) (i) Use information from the diagram to calculate the potential difference the charger supplies to the laptop.

Potential difference = _____ V

(2)

(ii) Calculate the current in the primary coil of the transformer when the laptop is being charged.

Assume the transformer is 100% efficient.

_____

_____

_____

_____

Current = _____ A

(2)

(c) Laptop batteries and mobile phone batteries can only be recharged a limited number of times. After this, the batteries cannot store enough charge to be useful. Scientists are developing new batteries that can be recharged many more times than existing batteries.

Suggest **one** other advantage of developing these new batteries.

_____

_____

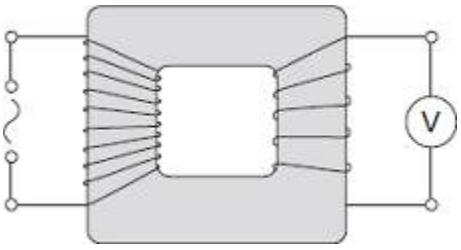
_____

(1)

(Total 8 marks)

Q15.

The diagram shows a transformer with a 50 Hz (a.c.) supply connected to 10 turns of insulated wire wrapped around one side of the iron core.
A voltmeter is connected to 5 turns wrapped around the other side of the iron core.



(a) What type of transformer is shown in the diagram?

Draw a ring around the correct answer.

step-down **step-up** **switch mode**

(1)

(b) The table shows values for the potential difference (p.d.) of the supply and the voltmeter reading.

p.d. of the supply in volts	Voltmeter reading in volts
6.4	3.2
3.2	
	6.4

(i) Complete the table.

(2)

(ii) Transformers are used as part of the National Grid.

How are the values of p.d. in the table different to the values produced by the National Grid?

_____

_____

(1)

(c) Transformers will work with an alternating current (a.c.) supply but will **not** work with a direct current (d.c.) supply.

(i) Describe the difference between a.c. and d.c.

_____

_____

_____

_____

(2)

(ii) Explain how a transformer works.

_____

_____

_____

_____

_____

_____

_____

_____

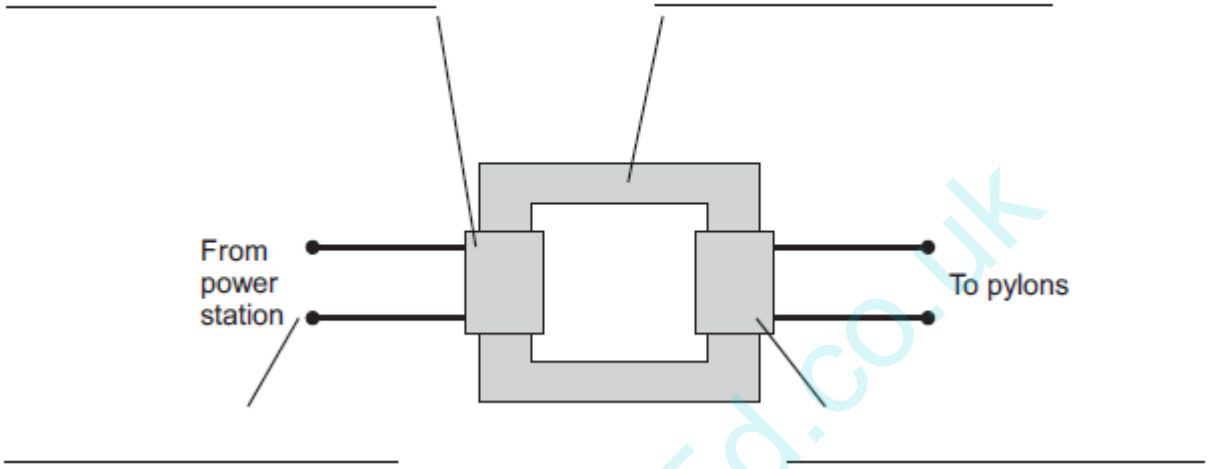
(4)
(Total 10 marks)

Q16.

Transformers are used to change potential differences (p.d.) in the National Grid.

Figure 1 shows a step-up transformer that is used at a power station.

Figure 1



(a) (i) Use words from the box to label **Figure 1**.

Input p.d.	**Iron core**	**Output p.d.**
Primary coil	**Secondary coil**	

(4)

(ii) One of the coils in **Figure 1** has a p.d. of 25 kV across it and has 1000 turns.

The other coil has a p.d. of 400 kV across it.

Calculate the number of turns on this other coil.

Number of turns = _____

(2)

(iii) Explain why a step-up transformer is used at a power station.

_____

_____

_____

_____

(3)

(b) **Figure 2** shows a mobile phone charger.

Figure 2

The charger contains a step-down transformer. A switch mode transformer is used rather than a traditional transformer.

Describe the advantages of using a switch mode transformer in the charger rather than a traditional transformer.

_____

_____

_____

_____

_____

_____

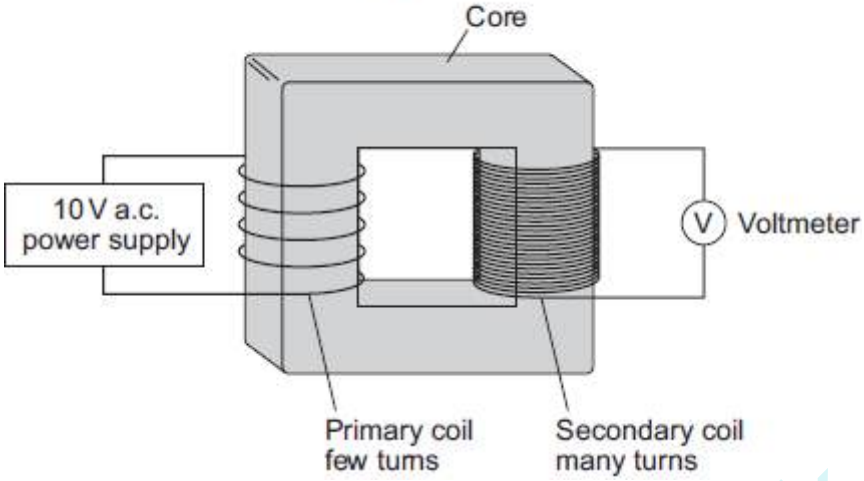
(3)

(Total 12 marks)

Q17.

Figure 1 shows a traditional transformer.

Figure 1



(a) (i) Which metal should the core of the transformer be made from?

Tick (✓) **one** box.

aluminium ☐

copper ☐

iron ☐

(1)

(ii) What would the reading be on the voltmeter shown in **Figure 1**?

Draw a ring around the correct answer.

2 V **10 V** **50 V**

Give the reason for your answer.

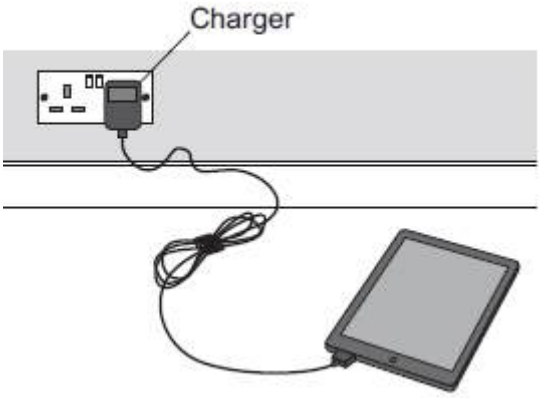
_____

_____

(2)

(b) **Figure 2** shows a tablet computer and its charger.

Figure 2



The charger contains a switch mode transformer.

(i) Use the correct answer from the box to complete the sentence.

200	1000	20 000

Switch mode transformers operate at frequencies

from 50 kHz to _____ kHz.

(1)

(ii) Give **one** advantage of a switch mode transformer over a traditional transformer.

_____

_____

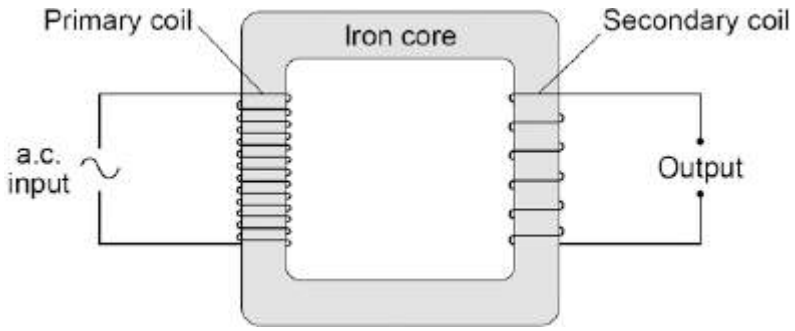
(1)

(Total 5 marks)

Q18.

Figure 1 shows the construction of a simple transformer.

Figure 1



(a) Why is iron a suitable material for the core of a transformer?

Tick **one** box.

It is a metal. ☐

It will not get hot. ☐

It is easily magnetised. ☐

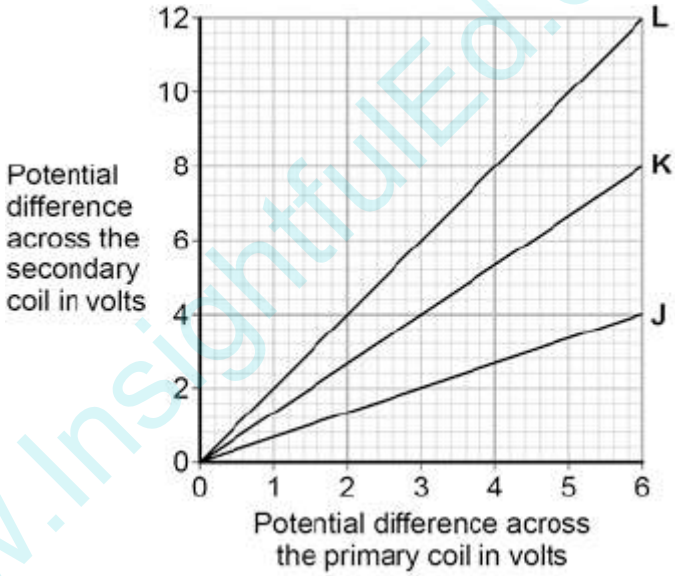
It is an electrical conductor. ☐

(1)

(b) A student makes three simple transformers, **J**, **K** and **L**.

Figure 2 shows how the potential difference across the secondary coil of each transformer varies as the potential difference across the primary coil of each transformer is changed.

Figure 2



How can you tell that transformer **J** is a step-down transformer?

_____

_____

(1)

(c) Each of the transformers has 50 turns on the primary coil.

Calculate the number of turns on the secondary coil of transformer **L**.

Use the correct equation from the Physics Equations Sheet.

_____

_____

Number of turns on the secondary coil = _____

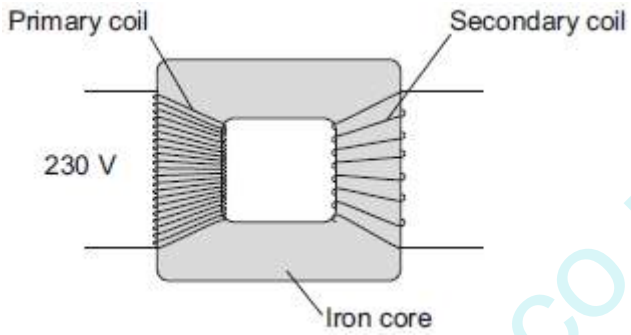
(3)

(Total 5 marks)

Q19.

Figure 1 shows the structure of a traditional transformer.

Figure 1



(a) There is an alternating current in the primary coil of the transformer.

State what is produced in the iron core.

_____

_____

(2)

(b) A transformer has only **one** turn of wire on the secondary coil.
The potential difference across the secondary coil is 11.5 V
The potential difference across the primary coil is 230 V

Calculate the number of turns on the primary coil.

_____

_____

_____

_____

Number of turns on the primary coil = _____

(2)

(c) In most transformers, the power output is less than the power input.

State why.

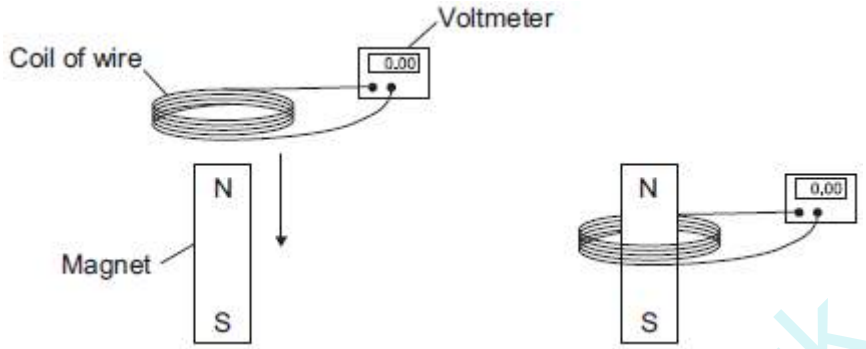
_____

_____

(1)

(d) Two students investigated how magnets can be used to produce a potential difference.
The students held a coil of wire above a magnet. The students quickly lowered the coil so that the magnet was inside the coil, as shown in **Figure 2**.

Figure 2



The students recorded the maximum potential difference for coils with different numbers of turns of wire. The results are shown in the table.

Number of turns of wire in the coil	**Maximum potential difference in volts**	
	Results from student 1	**Results from student 2**
5	0.09	0.08
10	0.20	0.15
15	0.31	0.25
20	0.39	0.33
25	0.51	0.39

(i) State the resolution of the voltmeter.

Give **one** reason why the resolution of the voltmeter is suitable for this investigation.

Resolution _____

Reason _____

_____

(2)

(ii) The two students used exactly the same equipment to carry out their investigations.
Both students recorded their results correctly.

Give the reason why student 2 got different results from student 1.

_____

_____

(1)

(iii) The students decided that even though the results were different, there was no need to repeat the investigation.

How do the results show that the investigation is reproducible?

_____

_____

(1)

(iv) State the name of the process which causes the potential difference to be produced in this investigation.

_____

(1)

(e) A transformer has been developed that can be used with many different devices.

Suggest **one** advantage of having a transformer that can be used with many different devices.

_____

_____

(1)

(Total 11 marks)

Q1.

(a) (i) generator

1

(ii) alternating current

1

(iii) voltmeter / CRO / oscilloscope / cathode ray oscilloscope

1

(b) (i) time

1

(ii) peaks and troughs in opposite directions

1

amplitude remains constant

dependent on first marking point

1

(c) any **two** from:

- increase speed of coil
- strengthen magnetic field
- increase area of coil

*do **not** accept larger*

2

[8]

Q2.

(a) **A** primary coil
and
B secondary coil

1

C iron core

1

(b) $\frac{230}{V_s} = \frac{200}{1200}$

1

$V_s = \frac{1200 \times 230}{200}$

1

V_s = 1380 (V)

1

(c) (the alternating current causes) a changing magnetic field around the primary (coil)

1

creates magnetic field that changes direction in the core

allow creates a changing magnetic field in the core

1

this induces an alternating potential difference across the secondary (coil (causing an alternating current)

1

(d) down

1

(e) $B = 60 \times 10^{-6}$ T

1

$0.045 = 60 \times 10^{-6} \times 50 \times l$

allow correct substitution of incorrectly / not converted value of B

1

$$l = \frac{0.045}{60 \times 10^{-6} \times 50}$$

allow correct rearrangement using an incorrectly / not converted value of B

1

$l = 15$ (m)

allow a correct calculation using an incorrectly / not converted value of B

1

(e) the wire / force is at right angles to the magnetic field

allow the current is constant

allow the cable is straight

allow the field is uniform

allow the force is constant

1

[14]

Q3.

(a) to vary the (output) potential difference

allow different devices require different potential differences

1

so that you don't need a different generator for each type of device

allow so that it is compatible with different devices

*do **not** allow answers in terms of power*

1

(b)

$$\frac{1.5}{5.0} = \frac{150}{N_s}$$

1

$N_s = \frac{150}{0.3}$

1

$N_s = 500$

1

(c) the coil moves through the magnetic field

or

the coil cuts magnetic field lines

1

a potential difference is <u>induced</u> (across the coil)

1

there is a complete circuit, so a current is induced (in the coil)

1

every half turn the potential difference reverses direction

1

so (every half turn) the current changes direction

1

(d) provides a continuous / moveable contact / connection (between the coil and the transformer / contacts / brushes)

or

stops the wires from twisting together

1

(e) (after disconnection) there is no induced current

1

so no magnetic field (produced around / by the coil)

1

to oppose the movement of the coil

1

[14]

Q4.

(a) *there is a* magnetic field *(around the magnet)*

1

(this magnetic field) changes / moves

1

and cuts through coil

accept links with coil

1

so a p.d. *<u>induced</u>* across coil

1

the coil forms *a* complete circuit

1

so a current (*is* induced)

1

(b) ammeter reading does not change

must be in this order

accept ammeter has a small reading / shows a current

1

zero

1

greater than before

accept a large(r) reading

1

same as originally but in the opposite direction

accept a small reading in the opposite direction

1

(c) 0.30

*allow **1** mark for correct substitution, ie 0.05 = Q / 6*

2

C / coulomb

allow A s

1

[13]

Q5.

(i) iron

for 1 mark

1

(ii) 20

gains 2 marks

else working

gains 1 mark

2

(iii) reverse input/output

for 1 mark

or increase secondary turns

1

[4]

Q6.

(a) (i) **one** of the following:

- increase number of turns on the secondary coil
- decrease number of turns on the primary coil

1

(ii) constructed in (thin) layers

1

(b) (i) transformers only work with a c

1

(ii) used to increase **or** decrease **or** change voltage **or** current

reducing the energy **or** heat **or** power loss (along the cables)

1

or reduce to safe domestic level

must be consistent with first answer

1

(iii) (several metres of) air gives good electrical insulation (between cables and earth)
or reduce chance of earthing **or** sparks **or** arcing
or to avoid people touching it

1

(c) (i) $$\frac{\text{voltage across primary}}{\text{voltage across secondary}} = \frac{\text{no of turns in primary}}{\text{no of turns in secondary}}$$

accept $\frac{VP}{VS} = \frac{NP}{NS}$

or $\frac{Vin}{Vout} = \frac{Nin}{Nout}$

1

(ii) Np = 4000

$\frac{25(000)}{275(000)} = \frac{NP}{44000}$ *for **1** mark*

2

(d) (i) resistance of cable decreases

1

(ii) convection (to the air)
or
conduction (to the air)

not radiation

1

[11]

Q7.

(a) (i) Iron

for 1 mark

1

(ii) V/240 = 2000/10 000
V = 48
V

for 1 mark each

3

(b) changing current in primary causes changing (magnetic) field in core links to secondary inducing voltage (emf) in secondary (**NOT** current) secondary voltage/current is alternating

for 1 mark each

4

(c) magnetic field not changing/no electromagnetic induction because direct current

for 1 mark each

2

[10]

Q8.

(a) output voltage less than (the) input voltage

*or p.d. across output less that p.d. across input **or** output is (only) 4.2 V (whereas) the input is 230V*
or WTTE (words to that effect)

1

(b) any **two** from

(made of soft) iron

laminated

***or** designed to reduce eddy currents*
***or** made of thin slices with slices of insulating material between them*

core(s) joined to make a ring

2

[3]

Q9.

(a) (i) (laminated soft) iron

*do **not** accept steel*

1

(ii) produces a <u>magnetic field</u>

accept <u>magnetic flux</u>

which is alternating / changing / varying

and which induces / produces an alternating / changing potential difference across the <u>secondary</u> coil

accept current / voltage

3

(b) 3067 (V)

*allow all **3** marks for 3060 to 3070 (V)*

$V = \frac{230 \times 4000}{300}$ *gains **2** marks*

$\frac{230}{V} = \frac{300}{4000}$ *gains **1** mark*

3

[7]

Q10.

(a) (i) iron

1

(ii) step-down (transformer)

1

(b) any **one** from:

- after the power station
- after the generator
- before the power lines
- before the pylons

1

(c) each correct (1)

in its correct place

current

coil

field

core

ends

5

[8]

Q11.

(a) (i) step-up

both parts required

more turns on the secondary / output (coil)

*do **not** accept coils for turns*

'secondary output is greater than primary input' is insufficient

1

(ii) (easily) magnetised (and demagnetised)

accept (it's) magnetic

it's a conductor negates answer

1

(b) 60

*allow **1** mark for correct substitution, ie* $\frac{230}{15} = \frac{720}{N_s}$

2

[4]

Q12.

(a) aluminium cannot be magnetised

accept aluminium is not magnetic
"it" refers to aluminium
*do **not** accept aluminium is not easily magnetised*
reference to conduction and aluminium negates mark
iron can be magnetised is insufficient

1

(b) (i) 10 to 50

either order

1

(ii) (data is) anomalous

*accept does **not** fit the pattern*
it is an error is insufficient

1

(iii) 21

accept 22
*do **not** accept any fraction of a turn ie 20.1*

1

secondary p.d. (just) larger than primary p.d.

accept output (just) larger than input/2V

or

there must be more turns on the secondary coil than primary coil

*do **not** accept coil for turns*

1

(c) to reduce/step-down the (input) p.d./voltage

mains p.d. is too high is insufficient
step-down transformer is insufficient
*answers in terms of changing/ stepping-up current **or** fuse blowing **or** not working with 230 volts are insufficient*
any mention of step-up negates mark
*stepping down both voltage/p.d. **and** current negates mark*

1

[6]

Q13.

(a) 400 000

*allow **1** mark for correct substitution ie*

$$\frac{25000}{?} = \frac{800}{12800}$$

or

$$\frac{25}{?} = \frac{800}{12800}$$

2

(b) (i) any **one** from:

*do **not** accept any response in terms of heat insulation, safety or electric shock*

- (so that there is) no short circuit
- (so that the) current goes around the coil

*do **not** accept electricity for current*

- (so that the) current does not enter the core

1

(ii) (easily) magnetised (and demagnetised)

accept '(it's) magnetic'
*do **not** accept 'because it's a conductor'*

1

(iii) alternating current in the primary (coil)

1

produces a changing magnetic field (in the core)

1

this induces an (alternating) potential difference across the secondary (coil)

1

(c) any **two** from:

- if the (local) power station breaks down / fails / demand / load exceeds supply
- electricity / power can be switched from elsewhere in the system / from other power station(s)
- electricity can be generated in places remote from customers
- (in total) fewer power stations are needed
- power available in rural / remote areas
- National Grid allows for (better) control of supply and demand

2

[9]

Q14.

(a) (the alternating current creates) a changing / alternating magnetic field

1

(magnetic field) in the (iron) core

accept that links with the secondary coil
current in the core negates this mark

1

(causing a) potential difference (to be) induced in / across secondary coil

accept voltage for p.d.

1

(b) (i) 20

*allow **1** mark for correct substitution, ie* $\frac{230}{V_s} = \frac{575}{50}$

or $\frac{V_s}{230} = \frac{50}{575}$

2

(ii) 0.3

or

correct calculation using $230 \times I_p$ = their (b)(i) × 3.45

*allow **1** mark for correct substitution, ie*
$230 \times I_p = 20 \times 3.45$
allow ecf from (b)(i) for 20
OR

substitution into this equation $\frac{I_p}{I_s} = \frac{N_s}{N_p}$

2

(c) any **one** from:

- fewer (waste) batteries have to be sent to / buried in land-fill
- the soil is polluted less by batteries in land-fill
- fewer (waste) batteries have to be recycled
- fewer batteries have to be made
- less raw materials are used in making batteries
- customers have to replace their batteries less often
  longer lifetime is insufficient
- customers have to buy fewer (replacement) batteries
  it costs less is insufficient

1

[8]

Q15.

(a) step-down

1

(b) (i) 1.6

correct order only

1

12.8

1

(ii) values of p.d. are smaller than 230 V

1

(c) (i) a.c. is constantly changing direction

accept a.c. flows in two / both directions

accept a.c. changes direction(s)

a.c. travels in different directions is insufficient

1

d.c. flows in one direction only

1

(ii) an alternating current / p.d. in the primary creates a <u>changing / alternating magnetic</u> field

1

(magnetic field) in the (iron) <u>core</u>

current in the core negates this mark

accept voltage for p.d.

1

(and so) an <u>alternating</u> p.d.

1

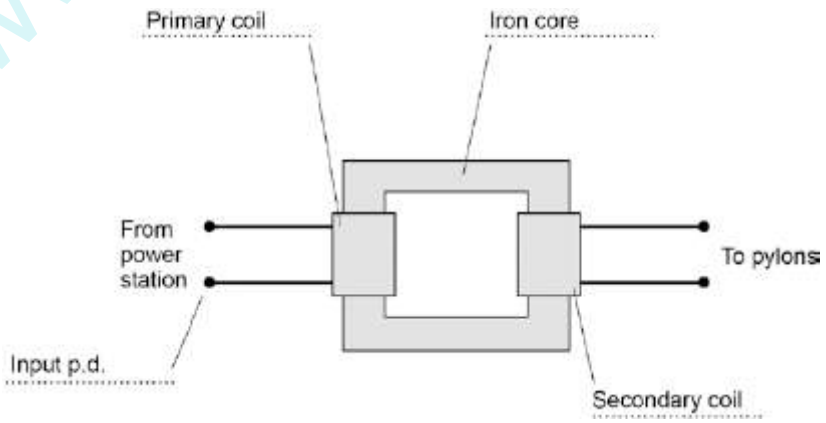
(p.d.) is <u>induced</u> across secondary coil

1

[10]

Q16.

(a) (i)



1
1
1
1

(ii) 16 000

allow 1 mark for correct substitution

ie 400 ÷ 25 = n ÷ 1000

2

(iii) p.d. increased (by transformer at power station)

do not accept energy increased

1

so current decreases

1

this reduces energy / power loss (in cables)

allow heat for energy

allow increases the efficiency

*do **not** accept no energy losses*

1

(b) smaller / lighter

1

uses little power / energy

1

when left switched on with no load applied

dependent on second marking point

1

[12]

Q17.

(a) (i) Iron

1

(ii) 50

ignore references to current

reason only scores if 50 chosen

1

there are more turns on the secondary coil (than the primary coil)

accept it is a step-up transformer

not more coils

1

(b) (i) 200

1

(ii) any **one** from:

- Lighter
- smaller
- use very little power / current (when switched on with no load / phone attached).

accept more efficient

do not accept uses no power / current

a disadvantage of a traditional transformer is insufficient on its own

1

[5]

Q18.

(a) It is easily magnetised.

1

(b) p.d. across the secondary coil is smaller (than p.d. across the primary coil)

1

(c) ratio $\frac{V_p}{V_s} = \frac{6}{12}$

accept any other correct ratio taken from the graph

1

$\frac{6}{12} = \frac{50}{N_p}$

use of the correct turns ratio and substitution or correct transformation and substitution

1

$N_p = 100$

*allow 100 with no working shown for **3** marks*

1

[5]

Q19.

(a) a magnetic field

accept electromagnetic field
heat is insufficient

1

that is alternating / changing

1

(b) 20

*allow **1** mark for correct substitution, ie*

$\frac{230}{11.5}$

provided no subsequent step

2

(c) (most) transformers are not 100% efficient

allow energy / power is lost to the surroundings
allow energy / power is lost as heat / sound
power is lost is insufficient

1

(d) (i) 0.01 (V)

1

because there is a change in p.d. each time (the number of turns changes)

allow because all the results (to 2 decimal places) are different

accept if results were to 1 decimal place, there might not be a difference

1

(ii) student 2 moved the coil more slowly (than student 1)

accept student 2 moved the coil at a different speed to student 1

do not accept student 2 moved the coil faster (than student 1)

1

(iii) both sets of results show the same pattern

accept trend for pattern

results are similar is insufficient

results follow a pattern is insufficient

1

(iv) (electromagnetic) induction

accept it is induced

do not accept electric / magnetic induction

1

(e) any **one** from:

- more economical / cheaper for the consumer

  allow more convenient

- easier/cheaper to replace if broken/lost

  allow in case one gets lost

- since fewer transformers need to be made less resources are used

  allow fewer plug sockets are needed

  allow fewer transformers are needed

  environmentally friendly is insufficient

1

[11]