



Chapter 15 Electromagnetism

Name: _____

Class: _____

Date: _____

Time: **36 minutes**

Marks: **36 marks**

Comments:

1

(a) **In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.**

There are two types of traditional transformer; step-up and step-down.

Describe the similarities and differences between a step-up transformer and a step-down transformer.

You should include details of:

- construction, including materials used
- the effect the transformer has on the input potential difference (p.d.).

You should **not** draw a diagram.

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Extra space

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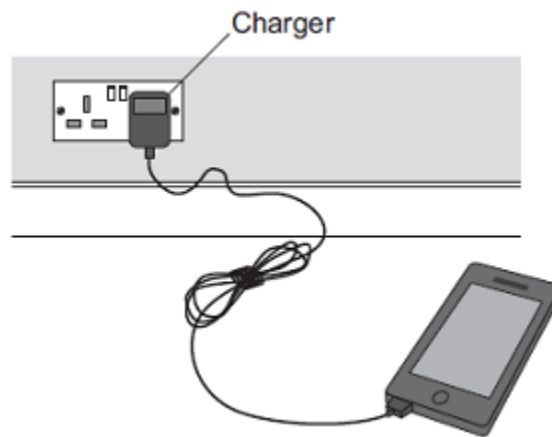
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(6)

(b) The figure below shows a mobile phone and charger.



Mobile phone chargers use a different type of transformer, which is smaller and lighter than a traditional transformer.

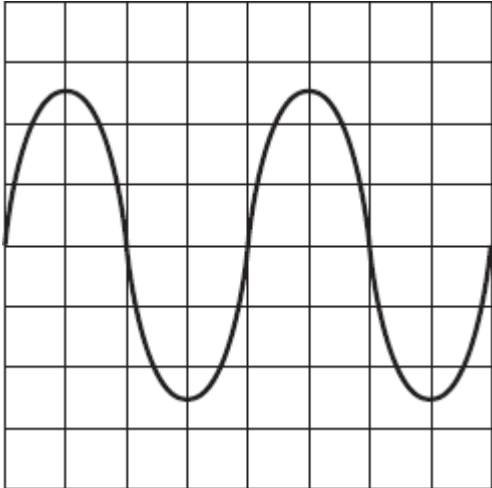
What name is given to the type of transformer used in a mobile phone charger?

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(1)
(Total 7 marks)

2

An oscilloscope is connected to an alternating current (a.c.) supply. The diagram shows the trace produced on the oscilloscope screen.



Each horizontal division on the oscilloscope screen represents 0.002 s.

(a) Calculate the frequency of the alternating current supply.

Show clearly how you work out your answer and give the unit.

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

Frequency =

(3)

(b) What is the frequency of the a.c. mains electricity supply in the UK?

.....

(1)

(Total 4 marks)

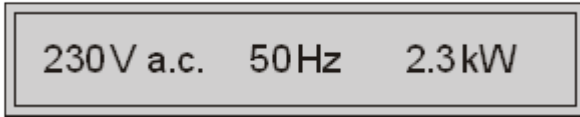
3

(a) Describe the difference between an alternating current (a.c.) and a direct current (d.c.).

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.....
.....

(2)

(b) The diagram shows the information plate on the bottom of an electric wallpaper steamer.



(i) Use the equation in the box to calculate the current used by the steamer.

power = current \times potential difference

Show clearly how you work out your answer.

.....
.....

Current A

(2)

(ii) Which **one** of the following fuses should be used inside the plug of the steamer?

Draw a ring around your answer.

1 A **3 A** **5 A** **10 A** **13 A**

(1)

(Total 5 marks)

4

In the UK mains electricity is a 230 volt a.c. supply.

(a) What is the frequency of the a.c. mains electricity in the UK?

.....

(1)

(b) (i) What is an electric current?

.....

(1)

(ii) Explain the difference between an a.c. (alternating current) electricity supply and a d.c. (direct current) electricity supply.

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

(2)

(c) A householder has a 10.8 kW electric shower installed in the bathroom.

(i) Calculate the current drawn from the mains electricity supply by the shower.

Write down the equation you use, and then show clearly how you work out your answer.

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

Current = A

(2)

(ii) The table gives the maximum current that can safely pass through electric cables of different cross-sectional area.

Cross-sectional area in mm ²	Maximum safe current in amps
1.0	11.5
2.5	20.0
4.0	27.0
6.0	34.0
10.0	46.0
16.0	62.0

The existing power sockets in the house are wired to the mains electricity supply using 2.5 mm² cable.

Use the data in the table to explain why the shower must **not** be connected to the mains electricity supply using 2.5 mm² cable.

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

(2)

- (iii) The circuit connecting the shower to the mains electricity supply must include a residual current circuit breaker (RCCB) and not a fuse.

Give **two** advantages of using a RCCB to protect a circuit rather than a fuse.

1

.....

2

.....

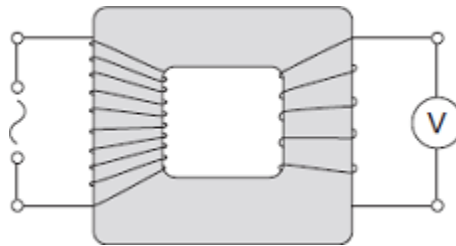
(2)

(Total 10 marks)

5

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.

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

(2)

(ii) Explain how a transformer works.

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.....
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.....
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(4)

(Total 10 marks)

Mark schemes

1

- (a) Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also apply a 'best-fit' approach to the marking.

0 marks

No relevant / correct content.

Level 1 (1–2 marks)

Either there is an attempt at a description of the construction of a transformer

or

a correct statement of the effect of one type of transformer on the input p.d.

Level 2 (3–4 marks)

There is a description of the construction of a transformer

and

a correct statement of the effect of one type of transformer on the input p.d.

Level 3 (5–6 marks)

There is a clear description of the construction of a transformer

and

there is a correct description of how transformers affect the input p.d.

details of construction:

extra information

a (laminated) core

core is made from a magnetic material / iron

2 coils

the coils are made from an electrical conductor / copper

the coils are covered in plastic / insulation

the coils are (usually) on opposite sides

step-up transformer has more turns on secondary coil than (its) primary (or vice versa)

step-down transformer has fewer turns on secondary coil than (its) primary (or vice versa)

effect on input p.d. :

step-up transformer, the output p.d. is greater (than the input p.d.)

accept voltage for p.d.

step-down transformer, the output p.d. is lower (than the input p.d.)

(b) switch mode (transformer)

1

[7]

2

(a) 125

allow 1 mark for obtaining time period = 0.008 (s)

or

frequency = 1 / time period (or their calculated time period)

2

hertz

or

Hz

*do **not** accept hz*

1

(b) 50 (hertz)

1

[4]

3

(a) d.c. flows in (only) one direction

1

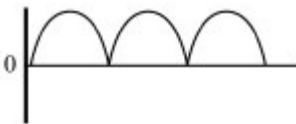
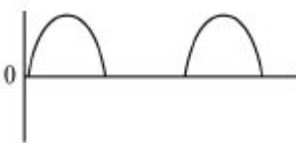
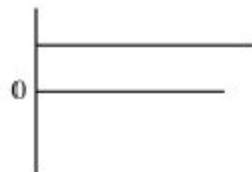
a.c. changes direction (twice every cycle)

accept a.c. constantly changing direction

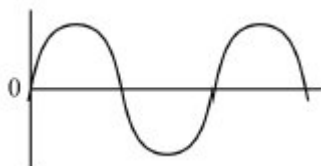
ignore references to frequency

accept answers presented as a clear diagram

e.g.



ac:



1

(b) (i) 10

allow 1 mark for correct transformation and substitution i.e.

$$\frac{2.3}{230} \text{ or } \frac{2300}{230} \text{ an answer 0.01 gains 1 mark}$$

2

(ii) 13 A

e.c.f.

accept the fuse size that is the next listed value greater than answer (b)(i)

1

[5]

4

(a) 50 hertz

1

(b) (i) a flow of charge / electrons

1

(ii) a.c. is constantly changing direction

1

whilst d.c. always flows in the same direction

1

(c) (i) 46.9

accept 47.0

allow 1 mark for correct transformation and substitution

$$\text{ie } \frac{10800}{230}$$

2

(ii) current (46.9 A) exceeds maximum safe current for 2.5 mm² cable

accept cable needs to be 16.0 mm²

1

therefore if a 2.5 mm² cable were used it would overheat / melt

cable needs to be 10.0 mm² limits maximum credit to 1 mark

1

(iii) can be reset

1

disconnects circuit faster (than a fuse)

1

[10]

5

(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 changing / alternating magnetic field 1
- (magnetic field) in the (iron) core
current in the core negates this mark
accept voltage for p.d. 1
- (and so) an alternating p.d. 1
- (p.d.) is induced across secondary coil 1

[10]