Mains electricity A.C.

Domestic uses and safety

Name: _____

Class: _____

Date: _____

Time: **69 minutes**

Marks: **68 marks**

Comments: **Mark Scheme**

Mark schemes

1 (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

1

(b) a current flows through from the live wire / metal case to the earth wire

accept a current flows from live to earth

*do **not** accept on its own if the current is too high*

1

this current causes the fuse to melt

accept blow for melt

*do **not** accept break / snap / blow up for melt*

1

[4]

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) alternates

accept switches

accept (constantly) changes

accept goes up and down

1

between positive and negative

1

(b) potential difference between the neutral and earth (terminal)

accept voltage for p.d

or potential of the neutral terminal with respect to earth

1

(c) (i) 0.025 (s)

1

(ii) 40 (Hz)

accept 1 ÷ their (a)(i)

1

[5]

4 (a) (i) 0.25 (A)

1

(ii) 75

*allow **1** mark for converting 5 minutes to 300 seconds*

***or** allow **1** mark for correct substitution*

ie 0.25 × 300

*allow **1** mark for an answer 1.25*

*allow **1** mark only for their (a)(i) × 300 correctly calculated*

2

coulombs or C

*do **not** accept c*

1

(b) any **two** from:

- fault not repaired

  accept if a fault was to occur

- larger current will (still) flow

- aluminium foil will not melt (if a fault)

  accept aluminium foil needs a higher current / charge to melt

- wiring will overheat / (may) cause a fire

  accept idea of fire hazard

  *do **not** accept explode etc*

2

[6]

5 (a) horse completes circuit between wire and earth **or** horse earths the wire

1

charge **or** electrons **or** current **or** electricity flows through the horse

1

(b) (i) **two** from:

- RCB breaks circuit when it detects a difference between currents in live and neutral wires
- fuse breaks circuit only when fuse rating exceeded or when it melts
- RCB is resettable

2

(ii) 500 (ms)

*leakage current = 0.02A **1** mark only*

1

[6]

6 (a) any **two** from

(risk of) cutting (through the) cable

accept cutting the wire

grass may be wet

***or** it may rain*

wires may be loose (because cable experiences a lot of movement)

accept cable may be loose

(risk of) touching exposed part(s)

2

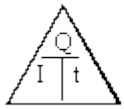
(b) some current will go through (the rest of) the lawnmower / the user / to earth

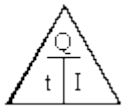
do not credit any reference to the electromagnet

1

(c) (i) charge = current × time

***or** any transposed version*
accept Q = I × t
***or** any transposed version*
accept C = A × s
***or** coulombs = amperes × seconds*
***or** any transposed version*

or 

or 

but only if subsequently used correctly

1

(ii) **EITHER**

1200 microcoulombs / μC

or *1.2 millicoulombs / mC*
or *0.0012 coulombs /C*

3

OR

correct arithmetic

either
converting milliamps to amps
and milliseconds to seconds
or correct multiplication

unit given as coulombs /C
or millicoulombs / mC
or microcoulombs / μC

example : charge = 30 × 40 = 1200 millicoulombs should be credited with 2 marks

1

[7]

7 (a) (i) 0.0046

accept 4.6 mA

*allow **1** mark for correct substitution and transformation*

i.e. current = $\frac{230}{50000}$

*an answer of 4.6 gains **1** mark*

2

(ii) • increases overall resistance

1

• (in event of a shock) gives a smaller current

accept gives smaller shock
*do **not** accept no shock/current*

1

(b) (i) 50 (hertz)

ignore units

1

(ii) NO has the lowest current at which people cannot let go

answer and reason needed
accept a sensible reason in terms of their answer to (b) (i)

or YES changing the frequency changes the current by only a small amount

1

(c) a current flows through from the live wire/metal case to the earth wire

accept a current flows from live to earth
*do **not** accept on its own if the current is too high*

this current causes the fuse to melt

accept blow for melt

2

[8]

8

(a) (i) 13A

for 1 mark

1

(ii) fuse heated melts owtte / blows / burns out **Not** explodes / burns
circuit breaks

any 2 for 1 mark each

2

(b) (i) 2750 × 6 or 2.75 × 6

gains 1 mark

but
16.5

gains 2 marks

2

(ii) 2750 × 6 × 7 or 2.75 × 6 ×7 or (b)(i) × 7 or kW h × cost / kW h

gains 1 mark

but
115p or 116p or 115.5p or £1.16 or £1.15

gains 2 marks

2

[7]

9

(a) (i) 50 000

*allow **1** mark for correct substitution, ie*
6 = 0.00012 × R
***or** 6 = 0.12 × R*
***or** answers of 25 000 or 50 gain **1** mark*
***or** allow 1 mark for an incorrect answer caused by one error only ie using 3V or an incorrect conversion of current*

2

ohm / Ω

*an answer 50kΩ gains **3** marks*

1

(ii) (body) resistance changes

or

body fat/resistance affected by (many) factors

accept named factor, eg age, gender, height, fitness, bone structure, muscle, drinking water related to body fat / resistance

1

(iii) gives misleading / wrong/inaccurate value

do not credit if specifically linked to a change in mass / weight

1

(because) high water content changes body resistance

accept a specific change to resistance

water changes body mass is insufficient

1

(b) (i) RCCB – detects difference between current in live and neutral (wires)

accept RCCB can be reset

1

fuse – (overheats and) melts

accept blows for melts

1

(ii) switches the circuit / hedge trimmers off within 60 milliseconds

*allow for **1** mark the RCCB / it is (very) fast.*

do not accept the bigger the current the faster the RCCB switches off

2

[10]

10 (a) (because the) potential of the live wire is 230 V

1

(and the) potential of the electrician is 0 V

1

(so there is a) large potential difference between live wire and electrician

1

charge / current passes through his body

allow voltage for potential difference

1

(b) diameter between 3.50 and 3.55 (mm)

*allow correct use of value of cross-sectional area of 9.5 to 9.9 (mm^2) with no final answer given for **1** mark*

2

(c) $18000 = I \times 300$

1

I = 18000 / 300 = 60

1

$13\ 800 = (60^2) \times R$

1

$R = 13\ 800 / 60^2$

1

3.83 (Ω)

1

*allow 3.83(Ω) with no working shown for **5** marks*

answer may also be correctly calculated using P = IV and V = IR if 230 V is used.

[11]