**M1.**          (a)     earth at top

**1**

neutral on left

**1**

live on right

**1**

(b)     (i)      (when a short occurs to the metal case) electricity flows to earth

*a logical sequence of events is required  
which address each of the key aspects*

**1**

electricity **or** current flows to earth

*accept flows to ground* ***or*** *down the earth wire*

**1**

(a surge of current) blows the fuse

this breaks the (live) circuit

*do not accept a short circuit*

**1**

         stops electricity flowing (through person **or** appliance)

*do not accept it stops an electric shock*

**1**

(ii)     3 A

*accept 5A*

**1**

**[8]**

**M2.**          (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]**

**M3.**          (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***



*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]**

**M4.**          (a)     (i)      0.0046

*accept 4.6 mA*

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

*i.e. current =*



*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]**

**M5.**          (a)     (i)      7

**1**

(ii)     (electrical) power = voltage x current

*accept P = V × I (correct standard symbol)  
accept watts = volts x amps  
accept a correct rearrangement*

*accept  if subsequent use of  is correct*



**1**

(iii)     1610  
**or** their (a)(i) × 230

*1.61 kW =* ***2*** *marks*

*do* ***not*** *accept 7 × 240*

**2**

         watts

*accept watt  
accept W  
accept .J/s*

(iv)    melts

*accept burns out  
accept blows  
accept breaks  
do* ***not*** *accept stops working  
do* ***not*** *accept burns*

**2**

         current greater than 13(A)  
**or** current exceeds fuse rating **or** current 15(A)

*do* ***not*** *accept too much current  
unless qualified*

          (b)     (i)      if live wire touches case

*accept if case becomes live*

*accept metal for case*

**2**

         current flows to earth **or** ground  
**or** fuse melts **or** stops iron becoming live

*accept electricity flows to earth*

*do* ***not*** *accept - you will get a shock*

*accept with no earth (wire) you would or could get a shock for* ***1****mark*

(ii)     (outer) case is made of insulator

*accept outside is plastic*

*accept outside is not made of metal* ***or*** *conductor*

cable is (also) insulated

*accept wires for cable*

*do* ***not*** *accept it has two layers of insulation without explanation*

*do* ***not*** *credit answers in terms of heat*

**2**

**[10]**

**M6.**          (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*

*ie*



**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]**

**M7.**          (a)     d.c. flows in (only) one direction

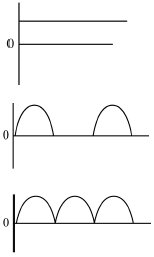
**1**

          a.c. changes direction (twice every cycle)

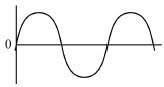
*accept a.c. constantly changing direction*

*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.  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]**