**Mark schemes**

Q1.

(a) 230

1

 50

1

(b) (i) has a plastic case

accept outside is plastic

accept cover / handle/ hair dryer is

plastic / non-conductor

 or does not have a metal case or plastic is an insulator

accept is double insulated

1

(ii) copper

1

[4]

Q2.

(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]

Q3.

(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]

Q4.

(a) electric drill C

1

 MP3 player E

1

 toaster B

1

(b) (i) 2100

no unit required / ignore units

accept 2.1 kW must have units for this

1

(ii) Y

1

(iii) bar drawn with any height greater than Y

ignore width of bar

1

(c) (i) any one from:

answers must be a comparison

• holds more water

do not accept 1 litre of water on its own

• works in other countries

accept a named country

accept works at 2 voltages

• boils faster

• has a more powerful element

do not accept 1 kW element on its own

• can filter water

1

ignore can wash filter

(ii) any one from:

• it weighs less

• smaller to pack

• cheaper to use

answers must be a comparison

or state why the chosen feature is an advantage

accept boils enough for one drink

1

[8]

Q5.

(a) (i) hairdryer 13

all correct

 saw 3

allow 1 mark for 2 correct

1

 mixer 13

1

(ii) fuse melts

accept blows/ breaks/ snaps for melts

do not accept blows up

do not accept fuse gets hot on its own

do not accept does not work on its own

1

(b) (i) 920

allow 1 mark for correct substitution

2

(ii) no earth (wire)

1

 outside / case may become live

cause a fire insufficient

 or danger of electric shock

1

(c) (i) L and N

both required

1

(ii) 9 (volts)

correct answer only

1

[9]

Q6.

(a) (i) blue

1

(ii) earth

1

(iii) rubber / plastic

accept any suitable named non conductor eg polypropylene

do not accept bakelite

do not accept an insulator

1

(iv)

1

(b) any two from:

• draws too high a current

accept power for current

do not accept electricity/ electric for current

accept too much current goes through the socket

do not accept too many currents go through the socket

• socket overloaded

it = socket do not accept circuit for socket

• wiring gets too hot / melts

accept socket for wiring

do not accept fuse melts or blows

do not accept plug/ appliances overheating

• (may) cause a fire

• (may) cause sparking

• (possible) physical damage to the socket

a physical reason, such as stick out from the wall is insufficient

ignore reference to electric shocks

2

[6]

Q7.

(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]

Q8.

(a) earth yellow and green

accept green and yellow

1

live brown

1

neutral blue

1

 (b) (i) path shows electricity flowing from washing machine through to

the person (and on to earth)

ignore direction of arrows

1

(ii) electricity flows through earth wire

(to earth) or goes to ground

not escaping electricity

not fuse wire blowing

1

 not through the person or miss the person or not electrocuting

not electric shock

1

(c) hairdrier

hairdrier needed for second mark except allow double insulated if iron or fridge but not plastic case

1

double insulated or plastic case

accept ‘It’s made of plastic’

accept ‘it does not conduct’

1

[8]

Q9.

(a) 800 (W)

accept 0.8kW but this answer must have the unit

1

(b) (i) power = voltage × current

accept the equation rearranged

accept P = VI

do not accept C for current

do not accept P = VA

do not accept power = VA

do not accept

unless subsequent calculation shows understanding

1

(ii) 3.5 (A)

accept a larger number of d.p. but you must be able to round to 3.5

allow 1 mark for

current =

or (I =)

2

(iii) 5 (A)

independent of (ii) unless e.c.f from part (b)(ii)

1

(c) 0.95 or 95 (%)

allow I mark if useful energy output is given as 760 ignore any incorrect unit

2

[7]

Q10.

(a) (i) live and neutral wrong way around

accept blue and brown wrong way round or in the wrong place

for credit both wires must be given

do not accept the wires are in the wrong holes

1

(ii) to protect the appliance

accept melt or blow or burns out if too much current or power or energy or electricity flows

accept to stop too much current or power or energy or electricity flowing

accept stop overheating or a fire

do not accept 'safety’ unless qualified by above

1

(b) (metal) cover

accept (heating) element

do not accept the mains cable

1

[3]

Q11.

(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]

Q12.

(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 1mark

(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]

Q13.

(a) A – fuse

B – (cable) grip

for 1 mark each

2

(b) X – brown/red

Y – green + yellow/green

Z – blue/black

for 1 mark each

3

(c) any plastic/rubber

for 1 mark

1

(d) (i) earth

for 1 mark

1

(ii) metal appliance needs earthing/safety qualified

for 1 mark

1

(e) cut less insulation on earth; neutral wire needs connecting;

fit fuse properly; cable grip needs to be an outer cable or allow identifying faults

for 1 mark each

4

[12]

Q14.

(a) in range 6 < I ≥ 13 A

for 1 mark

(no unit no mark)

1

(b) 4

gains 2 marks

 (else working

gains 1 mark

 (resistance of circuit correctly worked (2Ω))

2

(c) 72 (I2 R) ecf

gains 2 marks

 else working

gains 1 mark

 an answer of 36W (ie for one lamp) – (1)

2

(d) 1000 or 16.7 min (ecf from (c))

gains 2 marks

 else working

gains 1 mark

(formula with incorrect substitution – no mark (12V)

2

[7]

Q15.

(a) Mains socket – once only

Shower cable can get wet

Trailing cable to fire (not heater unless fire clearly identified)

Use of fire

Free running cable from ceiling

Appliance on side of bath

Use of ordinary light switch

Free cable to sink light

any 3 each for1 mark

3

(b) (i) 7, 4, 1, 80.5

Four right – 2

Three right – 1

All right in W – 1

2

(ii) Toaster

1

(iii) 32p

gets 3 marks

Else 8 × 4

gets 2 marks

Else unit cost = 8p

gets 1 mark

3

[9]

Q16.

(a) Current = 0.4A (1)

R = V/I or 240/0.4 (1)

R = 600 ohm (1)

3

(b) Doubles

gets 2 marks

 OR gets bigger

gets 1 mark

2

(c) P = V.I or 240 × 0.4

P = 96W

for 1 mark each

2

(d) 1 = 0.2A

P = 48W

for 1 mark each

BUT may get equation mark here if not in (c)

2

(e) P = V.I.t (1)

P = 240 × 0.2 × 6 × 3600

OR P = 48 × 6 × 3600

gets 1 mark

P = 1036800 W

gets 1 mark

3

[12]

Q17.

(a) Earth

return/neutral

live

for 1 mark each

3

(b) (i) rubber/plastic

for 1 mark

1

(ii) cable/wire/grip

cable/wires

fuse

for 1 mark each

3

(iii) case

for 1 mark

1

[8]

Q18.

(a) (i) S3

for 1 mark

1

(ii) S1, S2 and S3

for 1 mark

1

(b) (i) increases/current passes through heaters/current unaffected in fan

for 1 mark

1

(ii) (fan) blows/air moving prevents dryer overheating

for 1 mark each

2

(c) (i) brown

blue

any order

for 1 mark each

2

(ii) earth/green and yellow

for 1 mark

1

(iii) (case is) plastic

plastic does not conduct (electricity)

for 1 mark each

2

(d) (i) 1300/power

for 1 mark

1

(ii) time/units of time

for 1 mark

1

[12]

Q19.

(a) heat / thermal

kinetic / movement

each for 1 mark

2

(b) (i) its a good (electrical) conductor

for 1 mark

1

(ii) its a good (electrical) insulator / very poor conductor

for 1 mark

1

(c) (i) 2.75 × 6

gains 1 marks

 but

16.5

gains 2 marks

2

(ii) (c)(i) × 7 or no. of kW h × cost/kW h

gains 1 marks

 but

115.5 or e.c.f if correct

gains 2 marks

2

(d) it would heat and melts / blows / burns out / breaks circuit

any two for 1 mark each (fuse wire just breaks – gains 1)

(blows up – gets 0)

(fuse causing wire to melt gets 1)

2

[10]

Q20.

(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]

Q21.

(a) E – green and yellow

N – blue (not black but black / blue OK)

L – brown (not red but red / brown OK)

for 1 mark each

3

(b) fuse

screws to secure wires

cable grip (maybe described)

reference to an earth

(plastic case wrong)

any two for 1 mark each

2

[5]

Q22.

(i) power = current × voltage

or any correctly transposed version

accept watts = amps × volts

accept P = IV

do not credit P = CV

accept p.d. for voltage triangle acceptable only if used correctly in (ii)

1

(ii) 2 000 000 (1)

2000 kilowatts/kW (2)

accept KW

 watts/W (1)

2 megawatts/MW (2)

do not credit mW (1) if correct method is clearly shown but answer is numerically incorrect or unit is absent or incorrect

do not credit any working from an incorrect equation in (d)(i) but an appropriate unit should be credited

2

[3]

Q23.

(a) series circuit

all four components must be included

if a battery included the neatness mark may still be awarded

1

 circuit fully functional or properly connected

this is the neatness mark

do not credit a parallel circuit with one switch controlling both components

1

(b) case or outer parts are made of plastic or insulator or non-metallic

1

 there is no electrical pathway between inner and outer insulation

accept no connection between inner and outer part

do not credit two layers of insulation

1

(c) (i) [A] power = voltage × current

accept P = V I or

 W = V × A

or any transformation

1

[B] 1600 ÷ 230 =current

1

 6.96 or 7

accept with no working for two marks

accept 6.95

in [A] award a mark for a triangle if calculation correctly performed

1

(ii) [A] voltage = current × resistance

accept V = I R or any transformation

1

[B] 230 ÷ 7 = overall R = 33

accept 230 ÷ 6.96 = overall R = 33

1

 resistance of motor = 33 – 20 = 13

accept with no working for two marks

do not credit negative answer

accept consequential errors from c(i)

in [A] award a mark for a triangle if calculation correctly performed

1

[10]

Q24.

(a) (i) P = V × 1

or equivalent

credit a triangle if part (ii) correctly uses the relationship

credit power = volts × amps or watts V × A

do not accept C for current

1

(ii) (P = 230 × 10 =) 2300

credit 2.3

1

 W or J/s

kW

1

(b) (i) 15 A

credit 13 A or amps

1

(ii) any three from

earth

 any short (to the metal tank) causes fuse to blow

fuse is in the live wire

to prevent damage to the heater

credit to stop the current

3

(c) (i) V = I × R

or equivalent

credit a triangle if part (ii) correctly uses the relationship

1

(ii) (230 = 10 × R =) 23

ohms or Ω

2

[10]

Q25.

(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]

Q26.

(a) Formula mark

P = V × I

accept P = VI or W = V 5 A or any transformation

1

 Substitution mark I = 900 ÷ 230

1

 Calculation mark 3.9

accept 3.9 or 3.91 or 4 for three marks with no working

1

(b) 900 + 1300 = 2200 ÷ 230 = 9.6

accept 9.57 to 9.6 or 10 for both marks with no working

2

(c) 1.2 + 0.45 = 1.65

1

× 0.5 = 0.825

accept 0.8 or 0.83 for both marks with no working

1

(d) any one from

 use less energy (to cook something)

accept fewer energy losses or use less electricity

cook faster

do not credit a cost argument about buying two different ovens

1

[8]

Q27.

(i) EITHER

30000 (2) joules/J (1)

or 30 kilojoules/kj

3

 OR

power × time = energy

1

time = 120 (seconds)

1

(ii) vibration (of the food processor / some part of the food processor / the food)

1

[4]

Q28.

(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]