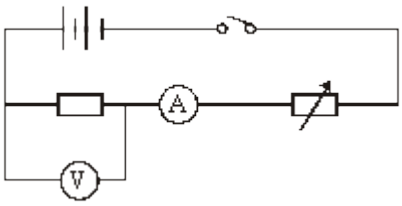
Mark schemes

1

(a) all symbols correct



accept push switch symbol switch may be open or closed
*any lines through symbols = **0** marks*

1

correct circuit drawn

polarity of cells not relevant provided they are joined correctly

1

voltmeter must be across resistor only

two cells are required in the diagram
ignore the order of the components
allow small gaps in circuit
*omission of any component = **0** marks*

1

(b) (i) potential difference = current × resistance

accept voltage or p.d. for potential difference
accept V= I × R

accept 

provided I R subsequent use correct

*do **not** accept C for current*

1

(ii) 2

*allow **1** mark for correct substitution*
wrong working loses both marks

2

(iii) straight line drawn <u>through the origin</u>

judge by eye

straight line passes through I = 0.4, V = their (b)(ii) / 2 **and** 0.0

this mark may be awarded if all points shown including these points are correct even if no line is drawn
*N.B. a curve scores **0** marks*

1

(c) temperature <u>increases</u>

accept filament lamp / it gets <u>hotter</u>
allow heat for temperature

1

[8]

2 (i) power = potential difference × current

accept voltage for potential difference
accept P = V × I
or *correct transposition*

accept 

provided subsequent method correct

1

(ii) 8

*allow **1** mark for correct substitution or transformation **or** an answer 2.67 / 2.7*

2

[3]

3 (a) (i) $A_1 = 0.5$

ignore any units

1

$A_4 = 0.5$

*allow **1** mark for $A_1 = A_4 \neq 0.5$*

1

(ii) the resistance of **P** is more than 20 Ω

1

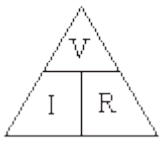
a smaller current goes through P / A_2 (than 20 Ω)

dependent on getting 1st mark correct
accept converse

1

(b) (i) potential difference = current × resistance

accept pd / voltage for potential difference
accept V = I × R, correct symbols and correct case only
accept volts = amps × ohms
accept



provided subsequent method is correct
allow combination of
physical quantities and named units
allow voltage = I × R

1

(ii) 6

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

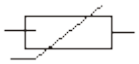
2

(iii) 6

accept their (b)(ii)

1

(c) thermistor or



accept correct circuit symbol
allow phonetic spelling

1

resistance goes down (as temperature of thermistor goes up)

*do **not** accept changes for goes down*
*do **not** accept an answer in terms of current only*
answers in terms of other components are incorrect

1

[10]

4

(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]

5

(a) 800 (W)

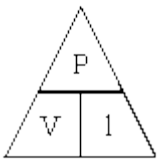
accept 0.8kW but this answer must have the unit

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

$$current = \frac{power}{voltage}$$

or $(I =) \frac{800}{230}$

2

(iii) 5 (A)

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

1

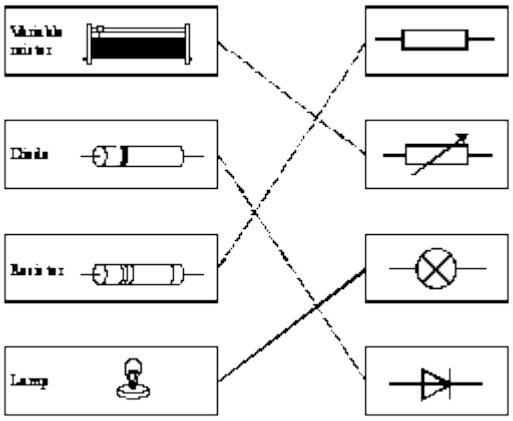
(c) 0.95 **or** 95 (%)

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

2

[7]

6 (a) all 3 lines drawn correctly



(1only correct, 1 mark)

deduct one mark if more than one line from or to a single box

2

(b) (i) series

1

(ii) any **one** from:

- both lamps **or** lights must be on together
- if one blows, the other goes out
- switch controls both bulbs

*do **not** accept bulbs dimmer*

1

(iii) any **two** from

- each lamp **or** light can be switched on independently
- if one lamp blows the other stays on
- switching the second lamp on does not affect brightness of first **or** bulbs brighter (than in first circuit) or energy explanation

2

[6]

7 (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) (i) (metal) cover

accept (heating) element

*do **not** accept the mains cable*

1

[3]

8 (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) **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]

9 (a) C

award mark if A and B identified as not filament lamp

1

resistance increases

negated by wrong statement e.g. current goes down

1

as the lamp gets hot

*accept as current (through lamp) **or** voltage (across lamp) increases*

*do **not** accept non-ohmic reason independent of choice of component*

1

(b) ammeter wire and battery only in series

non standard symbols acceptable if correctly identified (labelled) for ammeter, voltmeter and battery

1

voltmeter only in parallel with wire **or** battery

*all in series **or** ammeter in parallel neither of these two marks awarded*

1

all symbols correct

ignore lines drawn through centres of symbols

1

(c) (i) voltage = current × resistance

accept V = I × R
accept volts = amps × ohms
*do **not** accept V = C × R*

accept 

if subsequent method correct

1

(ii) 30

*accept correct substitution for **1** mark (9/0.3)*

2

ohms

accept correct symbol Ω

1

(iii) goes up

must be a comparison
accept calculation if answer is larger than c (ii)

1

[11]

10 (a) (i) electrons

1

(ii) ammeter

*do **not** accept ampmeter*

1

***must** be capital A*
horizontal lines not required no e.c.f.

1

(b) light bulb

answers in either order

1

hairdryer

1

[5]

11 (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 <u>no earth</u> (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]

12 (a) (i) any **one** from:

water to the mug
water to the air
mug to the air
mug to the table

***both** required*

direction of transfer must be correct

1

(ii) when temperatures are the same

accept a specific example eg when the temperature of the water and mug are the same

accept radiant heat transfer will never stop

1

(b) wood

1

(c) (i) conduction

accept convection if not given as 3rd answer

1

insulator

1

convection

1

(ii) any **one** from:

*do **not** accept any rebuilding of house*

double glazing

loft insulation

accept roof for loft

1

carpets

(cavity) wall insulation

*do **not** accept closing doors and windows*

draft excluders

foil behind radiators

accept blocking chimney

paint inside walls white

[7]

13 (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]

14 level drops as petrol used;
causes circuit resistance to increase;
causes current to decrease

for 1 mark each

or if change not specified;
(one correct and two vague statements gains 2 marks, three vague statements gains 1 mark)
e.g. level changes;)
so resistance changes;) = 1 mark
so current changes)

[3]

15 (a) in range $6 < I \geq 13$ 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 (I^2 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]

16 (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]

17 (a) Sun
Any valid

for 1 mark each

2

(b) From electric/pe or chemical in battery

for 1 mark

to ke, light, sound, heat

3 for 1 mark each

4

(c) Gravitational pe OR just pe
For any gravity feed
OR Elastic pe
any valid
OR Food
For maintaining body/life etc.
OR Any descriptive answer
e.g. water in a high lake used to produce hydroelectric power

2 for 1 mark each

2

[8]

18 (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]

19 (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]

20 (a) becomes (electrically) charged or description of electron movement
for 1 mark **1**

(b) comb attracts paper
for 1 mark **1**

(c) charge/electricity gone to Earth/body
for 1 mark each **2**

[4]

21 (a) to switch on/off
independently OWTTE
for 1 mark each **2**

(b) 9
for 1 mark **1**

(c) B and E
for 1 mark **1**

(d) 1

Two/least number of LED used

for 1 mark each

2

[6]

22 (a) (i) Ends have charge
Which is opposite on each rod

2

(ii) Attracts

1

(b) (i) Repulsion

1

(ii) Ends have same charge

1

(c) Electrons move between cloth and rod
Where gather is negative
Where move from is positive

3

[8]

23 (a) (i) S_3

for 1 mark

1

(ii) S_1, S_2 and S_3

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]

24 (a) (i) the lamp will be on/will give out light

1

(ii) the lamp will be off/will not give out any light

1

(b) (very) large current flows
or damage the battery/overheat the battery
or short circuit
or wire get hot

1

(c) switch connected in series with lamp and battery

1

[4]

25 (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) <u>insulator</u> / very <u>poor conductor</u>

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]

26 (a) ... ammeter

for 1 mark

1

(b) 5 right

gains 4 marks

4 right

gains 3 marks

3 right

gains 2 marks

2 right

gains 1 mark

4

[5]

27 (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]

28 (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]

29 (a) (i) …….. light …… electri

for 1 mark each **2**

(ii) …….. electrical……chemi

for 1 mark each **2**

(iii) …….. electrical ….. kinet

for 1 mark each **2**

(b) (i) 1500 / 10

gains 1 mark **1**

but

150

gains 2 marks **1**

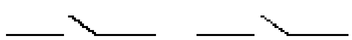
(ii) heat (thermal) or sound

for 1 mark **1**

[9]

30 (a) 4 symbols correct accept

(accept  *for bulb; lose 1 mark if line through symbols, lose 1 mark if circuit incorrect, switch may be open or closed)*

(*allow*  **or**)

gains 1 mark **4**

but

all correct

gains 2 marks

ammeter in series with lamp

for one mark

voltmeter in parallel with lamp / lamp and switch / lamp, switch and ammeter

for one mark

(b) (i) 5 points correctly plotted
allow (0, 0) correct if graph goes through the origin even if no × or O
gains 1 mark

but
6 points correctly plotted
gains 2 marks

smooth curve through points – not straight line / curve + straight line
for one mark

3

(ii) 2 (A)

allow ± 0.05 (½ square) from candidates' graph
for one mark

1

(iii) R = V / I **or** R = 10 / 2
gains 1 mark

but
R = 5 (Ohms) ecf
gains 2 marks

2

(c) (i) resistance increases
for one mark

(ii) temperature (of filament) has increased / filament gets hot
for one mark

2

[12]

31 (a) **Using wind (advantage)**

any **one** from

can be used in remote locations

renewable

clean
accept does not cause pollution to the air / land

1

Using wind (disadvantage)

any **one** from

does not generate much (electrical) energy
many hundreds wind turbines would be needed

*accept many hundreds wind turbines would be needed **or** too much land would be needed for wind farms **or** wind energy is 'dilute'*

the wind is unreliable

*accept the wind does not blow all of the time **or** the wind is not always strong enough*

noise / visual pollution

*do **not** accept just the word pollution*

1

Using coal (advantage)

any **one** from

can generate electricity all of the time

accept reliable electrical / energy supply

generates a lot of (electrical) energy

1

Using coal (disadvantage)

any **one** from

pollution by carbon dioxide / greenhouse gas

*accept slow start-up time **or** production of ash **or** difficult to transport (coal) **or** there's not much coal left*

non renewable

pollution by sulphur dioxide acid rain

1

(b) all link lines correct

accept one link line correct for one mark

2

[6]

32 (a) (i) variable resistor

accept rheostat

1

(ii) potential difference = current × resistance

*accept V = IR **or** any correct combinations*

1

(b) (i) as the potential difference increases, the current increases

accept it increases

1

at low values of the potential difference the current is (directly) proportional

accept at low values of the potential difference (the filament) obeys Ohm's law

1

or

at higher values of potential difference the current is not (directly) proportional

or

accept at higher values of the potential difference (the filament) does not obey Ohm's law

accept it increases but not proportionally for 2 marks

the resistance (of the filament) increases

1

the temperature (of the filament) increases

1

[6]

33 (a) (i) resistor

1

(ii) voltage / potential difference / volts / v

1

(iii) current / amps / A

1

(b) potential difference = current × resistance

no mark if more than one box ticked

1

[4]

34 (a) variable resistor

accept rheostat

1

(b) voltmeter

1

(c) straight line correct between 0.2 and 0.8

if line incorrect, or no line, and correct plots 0.2 to 0.8 award 1 mark

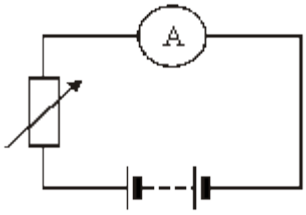
2

(d) diode / rectifier

1

[5]

35 (a)



3

one mark for each symbol
allow more than 2 cells joined

max. 2 marks if symbols incorrectly allow rheostat arrow in either direction

(b) current will decrease

1

since resistance greater

1

[5]

36 (a) ammeter anywhere in series in the circuit

accept just letter A or box with A

voltmeter across **or** in parallel with the fixed resistor only

accept just letter V or box with V

2

(b) (i) four correct plots

deduct one for any incorrect plot

a straight line through the points

no requirement to extrapolate through origin

*do not credit bar charts unless correct line drawn **or** correct points*

2

(ii) 0.25

ecf rule applies if graph is wrongly plotted

1

[5]

37 (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]

38 (a) (i) power ÷ voltage = current **or**
2800 ÷ 240 = 11.6 – 11.7 **or** 12

2 marks for correct answer 1 mark for 2.8 ÷ 240

2

(ii) resistance = voltage ÷ current

240 ÷ 11.7

(efc here)

1

20.5 **or** 20.57 **or** 20.6 **or** 21

2 marks for correct answer

1

ohms **or** Ω

do not credit R

1

(b) 850 ÷ 1500 × 100

marks only available for division of power

1

= 56.7

2 marks for correct answer
for 1 mark accept 5670

1

[7]

39 (a) changes the sound wave(s)

to a varying **or** changing (electric) potential difference **or** p.d. **or** voltage **or** current **or** to an irregular alternating current or a.c. **or** transfers sound energy to electrical energy (1) mark is vibrations **or** pulses **or** of sound **or** in air become electrical waves

do not credit just 'to electricity' ***or*** *'to a.c'*

2

(b) (i) decrease **or** reduce the amplitude

accept less amplitude nothing else added

1

(ii) increase the frequency **or** decrease wavelength

accept higher frequency nothing else added

1

[4]

40 (a) 0.9

1

1.1

accept the value of A_4 + 0.2

1

(b) V = I R **or** 12 = 0.6 R **or** $\frac{12}{0.6} = ?$

accept V = A R
V = I × ohm's sign
do not credit Ohm's law triangle

2

R = 20

correct numerical answer earns both marks

ohms

1

(c) A_3 = 0.3

A_4 = 0.3

accept the same numeric value as A_3

A_5 = 0.5

accept the value of A_4 + 0.2

3

[8]

41 (a) (i) (bottom **or** other ends) move apart or repel

accept they move apart

1

(ii) have <u>same</u> charge

accept both have negative charge
(from part (b) do not credit both have positive charge

same **or** like charges repel

not just opposite charges attract

2

(b) positive

1

electrons

1

cloth

1

polythene

accept strips

1

(c) (i) conductors

accept metals

1

(ii) insulators

accept non-conductors/poor conductors do not credit non-metals

1

[9]

42 (a) (i) the same as

1

(ii) less than

1

(iii) the same as

1

(iv) more than

1

(b) 3

accept D

because there is more **or** twice the current in this part of the circuit **or** the resistance is less

accept only one lamp to go through, (not two) ***or*** *on its own not sharing the voltage* ***or*** *energy with another*

do not credit one lamp to go through ***or*** *sharing current*

2

[6]

43 (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***

$W = V \times A$

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]

44 (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) $V = I \times R$

or equivalent

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

1

(ii) $(230 = 10 \times R =)\ 23$

ohms **or** Ω

2

[10]

45 (a) (i) 0.2

1

(ii) 0.2

1

(b) (i) a series circuit must contain two cells the correct way round and an ammeter

accept the components in any order in the series circuit but there must be no obvious gaps in the wires at corners
***or** joins*

1

the symbol for a variable resistor a rectangle with a diagonal arrow drawn through it

accept a diagram for a 'slide resistor'

1

(ii) decrease

1

[5]

46 (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 5 A

1

[8]

47 (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]

48 (i) **EITHER**

30 000 (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]

49 (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

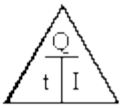
do not credit any reference to the electromagnet

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]

50 (a) A = battery (of cells)/cells/cell
B = thermistor/temperature dependent resistor
C = transistor
D = LED/light emitting diode
E, F, G = resistors

each for 1 mark

5

(b) *ideas that* (resistance) falls from 3000 to 200 units – ohms/Ω – referred to at least once

each for 1 mark

(*credit quickly at first then more slowly with 2 marks*) (*max 4 for part (b)*)

4

(c) any figure in the range 22 – 26 (inclusive)

gains 1 mark

but 24

gains 2 marks

2

[11]

51 (a) current rises/starts lower/starts from zero

for 1 mark

ideas that: *
smaller/only 0.45 (A) change in current
quicker/only 2 (ms) for current to settle
slightly lower/0.45 (A) final current
maximum only 0.45 (A) rather than 1.5 (A)
(*must **compare** e.g. “only...” or state figure from first graph)

any 2 for 1 further mark each

3

(b) resistance of filament rises as temperature rises/higher at operating temperature
resistance of X falls as temperature rises/low(er) at operating temperature
total resistance stays roughly the same as temperature rises
so current stays roughly the same as temperature rises
(must be related to previous point)

resistance of X falls faster at first than resistance of filament rises
so current rises (*must be related to previous point*)
operating resistance slightly increased
so operating current slightly reduced
(*must be related to previous point*)
resistance of X high at start
so current zero/low

each gains 1 mark
(must be related to previous point)
(to a maximum of 4)

4

[7]

52 (a) motor

1

(b) fuse or circuit breaker

1

(c) voltmeter

each for 1 mark

1

[3]

53 (a)
- diode
- voltmeter
- ammeter

for 1 mark each

3

(b) *idea that*

- current increases or goes up (with voltage)

  gains 1 mark

- 'It' refers to current
  but current increases steadily (with voltage)

  gains 2 marks

- (*allow* in proportion) – but not simply a description of the shape of the graph

  gains 1 mark

- no current at first
  but no current until voltage is more than 0.3 (volts)
  gains 2 marks

4

[7]

54 (a) *idea that*

it/current increases (with voltage)
gains 1 mark

but
current increases steadily (with voltage)
(allow in proportion)
gains 2 marks

4

no current at first
gains 1 mark

but
no current until voltage is more than 0.3 (volts)
gains 2 marks

(b) (i) reverse component X/power supply/change battery round
for 1 mark

(ii) *idea that*
X doesn't conduct in opposite/let current through/no current (in opposite direction)
(credit X is a diode*)*
for 1 mark

2

[6]

55 (a) (i) diode

[Do not accept 'rectifier' or LED]

(ii) lamp / bulb / light

each for 1 mark

2

(b) • P = voltage / potential difference / p.d. / volts / V

[Allow 'Voltmeter]

• Q = current / amperes / amps / A

[Allow 'ammeter]

each for 1 mark

2

[4]

56 (a) cell and bulb / light correctly labelled

for 1 mark <u>each</u>

2

(b) ordinary cell has higher voltage (normally / at start)

for 1 mark

or

ordinary cell 1.3V nicad 1.2V (normally / at start)

voltage of ordinary cell falls more slowly (*accept* lasts longer)

gains 1 mark

but

as above with relevant quantification e.g. falls to zero in 60 seconds compared to 6 seconds e.g. falls to zero in 70 seconds compared to 16 seconds – from time zero

or

nicad falls to zero 10 times as fast

gains 2 marks

3

(c) (i) answer in range 32-34 (seconds) (inclusive)
gains 1 mark

but
answer in range 22-24 (seconds) (inclusive)
gains 2 marks

(ii) 12 (seconds)
gains 1 mark

but
2 (seconds)
units not required in (c)
gains 2 marks

4

[9]

57 (a) ordinary cell has higher voltage (normally / at start)
or
ordinary cell 1.3V nicad 1.2V (normally / at start)
for 1 mark

voltage of ordinary cell falls more slowly
gains 1 mark

(*accept* ordinary cell lasts longer)
but
as above with relevant quantification e.g. falls to zero in 60 seconds compared to 6 seconds
or
nicad falls to zero 10 times as fast
gains 2 marks

3

(b) (i) answer in range 32-34 (seconds) (inclusive)
gains 1 mark

but
answer in range 22-24 (seconds) (inclusive)
gains 2 marks

(ii) 12 (seconds)
gains 1 mark

but
2 (seconds)
gains 2 marks

4

(c) resistance of the lamp / filament changes / increases

gains 1 mark

but

resistance of the lamp / filament decreases

gains 2 marks

because the temperature of the filament falls / filament cools

for 1 mark

3

[10]