

Mark schemes

1

(a) switch

allow answer circled in box

1

(b) 24

1

(c) equal to 0.25 A

1

(d) 4

1

[4]

2

(a) a light-dependent resistor

1

(b) any **three** from:

- resistance starts at 500 (kilohms)
- (resistance) falls rapidly as intensity increases from 0
accept resistance falls
accept brightness for intensity
- (resistance) halves between 10 and 20 lux
- (resistance) falls slightly between 20 and 50 lux
or
- (resistance) almost constant / levels out between 20 and 50 lux
- at 50 lux, resistance = 10 (kilohms)
for full credit the word resistance must be used correctly at least once
an answer resistance falls as intensity increases gains 2 marks - this may be combined with one of the bullet point marks for full credit

3

(c) (i) decrease

1

(ii) resistance increases

this can score without (c)(i)

1

(d) A circuit to switch on security lighting when it gets dark.

1

[7]

3

(a) (i) light dependent resistor / LDR

accept ldr

1

(ii) 25 (kilohms)

accept 24 - 26 inclusive

accept 25 000 Ω

1

(iii) 5 (V) or their (a)(ii) correctly converted to ohms $\times 0.0002$ correctly calculated

allow 1 mark for converting 25 k Ω /

their (a)(ii) to ohms

or

allow 1 mark for correct substitution

ie 0.0002 \times 25(000)

or 0.0002 \times their (a)(ii)

allow an incorrect conversion from kilohms providing this is clearly shown

2

(b) (i) linear scale

using all of the available axis

must cover the range 4 - 6 v

or *their (a)(iii) - 6 v and lie within the range 0 - 15 inc.*

1

(ii) negative gradient line

*do **not** allow lines with both positive and negative gradients*

1

passing through 20 lux and their (a)(iii)

only scores if the first mark is awarded

only scores if line does not go above 6 volts

1

(c) (i) 37.5 (k Ω) or their (a)(ii) + 50 % (a)(ii) correctly calculated

1

(ii) light intensity value would be unreliable / not accurate

1

due to variation in resistance value

accept because resistance varies by $\pm 50\%$

accept tolerance of resistor is too great

*do **not** accept results are not accurate*

1

[10]

4

(a)



accept 'the humpback bridge' symbol

accept circle with cross but no lines

if more than one symbol drawn, no mark unless lamp is labelled

1

(b) (i) 24

allow 1 mark for correct substitution ie $\frac{2800}{120}$

allow 1 mark for an answer 1440

ignore any unit

2

(ii) watt

1

(c) larger than

accept correct indication inside the box

accept an answer meaning larger than ie greater than

1

[5]

5

L

N

M

K

all four in the correct order

2 marks for 2 correct

1 mark for 1 correct

[3]

6

(a) voltmeter

*and no other
do **not** accept voltage*

1

(b) (i) variable resistor

1

(ii) 0.10 – 0.30

accept 0.1 – 0.3

accept 0.3 – 0.1

accept 0.30 – 0.10

1

(iii) 3.3 (W)

allow 1 mark for correct data choice

*allow 2 marks for substitution of correct
data i.e. 0.30×11.0*

the following answers gain 2 marks

0.10 / 0.30 / 0.80 / 1.75

*allow 1 mark for substitution of incorrect
of data incorrectly calculated e.g.*

$0.20 \times 4.0 = 0.6$ scores 1 mark

3

(c) increases

1

[7]

7

(i) 30

allow 1 mark for showing correct method i.e. 5×6 or $12 \div 0.4$

2

(ii) connected in series

insufficient they are not connected in parallel

1

(iii) 0.4

1

(iv) equally/ evenly

the same is insufficient

allow credit for candidates that correctly mention pd across the connecting wires

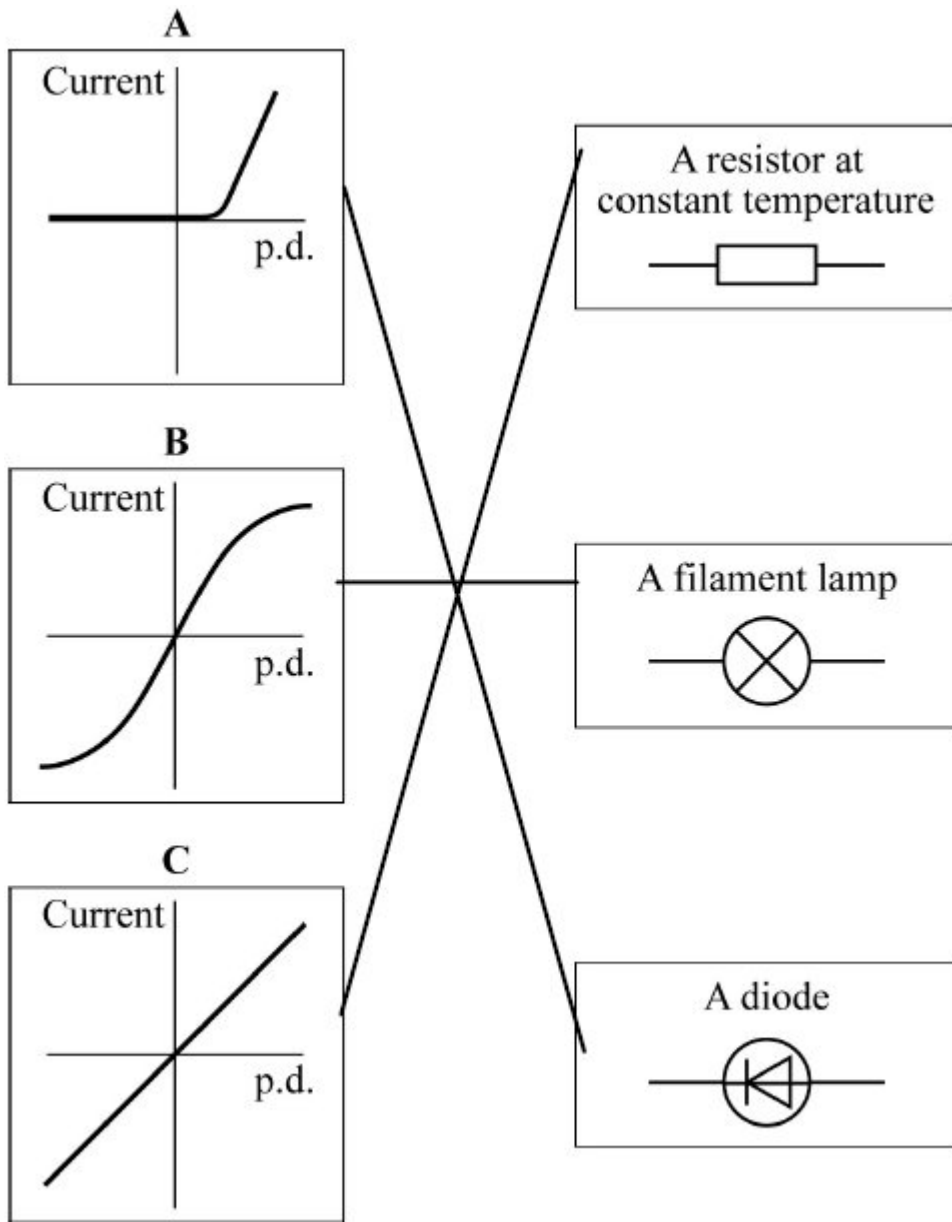
accept (nearly) 2 V (each)

1

[5]

8

(a) **three** lines drawn correctly



allow 1 mark for 1 correct line

if more than one line goes from a graph, both are incorrect

2

(b) **J**

1

[3]

9

(a) (i) 6

1

(ii) 6 (volts)

accept their (a) (i) ignore any units

1

- (b) 0.30
accept 0.3 1
- (c) smaller(than)
accept correct alternatives to smaller than e.g. less than 1
- a bigger current flows through the lamp
only accept if 'smaller than' is given
accept converse
accept a correct calculation
accept resistance is half of 60
accept resistance = 30 (Ω)
*do **not** accept answers in terms of p.d* 1

[5]

10

- (a) (i) 0.0046
accept 4.6 mA
allow 1 mark for correct substitution and transformation
- $$\text{i.e. current} = \frac{230}{50000}$$
- 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

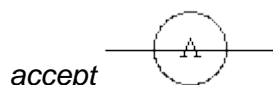
accept blow for melt

2

[8]

11

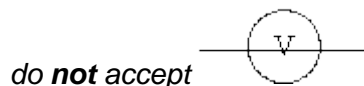
- (a) (i) ammeter symbol correct and drawn in series



do not accept lower case a

1

voltmeter symbol correct and drawn in parallel with the material



1

- (ii) adjust / use the variable resistor

accept change the resistance

or change the number of cells

accept battery for cell

accept change the p.d / accept change the voltage

accept increase / decrease for change

1

- (b) (i) data is continuous (variable)

1

- (ii) 36 (Ω)

correct answer only

1

- (iii) 5.4 or their (b)(ii) \times 0.15

allow 1 mark for correct substitution

2

- (c) (i) the thicker the putty the lower the resistance

answer must be comparative

accept the converse

1

(ii) any **one** from:

- measuring length incorrectly
accept may be different length
- measuring current incorrectly
*do **not** accept different currents*
- measuring voltage incorrectly
*do **not** accept different voltage*
- ammeter / voltmeter incorrectly calibrated
- thickness of putty not uniform
- meter has a zero error
accept any sensible source of error eg putty at different temperatures
*do **not** accept human error without an explanation*
*do **not** accept pieces of putty not the same unless qualified*
*do **not** accept amount of putty not same*
*do **not** accept systematic / random error*

1

(iii) repeat readings

- accept check results again*
- accept do experiment again*
- accept do it again*
- accept compare own results with other groups*
- do **not** accept take more readings*

1

[10]

12

(a) (i) 4 (V)

allow 1 mark for correct substitution

2

(ii) 5 (V) or (9 – their (a)(i)) correctly calculated

e.c.f

*do **not** allow a negative answer*

1

(b) (i) thermistor
c.a.o

1

(ii) 0°C to 20°C

1

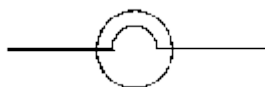
[5]

13

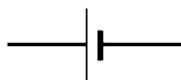
(a) circuit symbol for a lamp correct



accept



accept any standard of drawing providing circuit would work



1

circuit symbol for a cell correct

1

2 lamps drawn in parallel with 3 cells

polarity of cells must be correct (+ to -) but cells may be either way around

1

(b) 4.5

1

(c) the same as

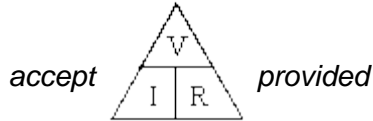
accept any clear indication of the correct answer

1

[5]

14

- (a) (i) potential difference = current \times resistance
 accept voltage **or** pd for potential difference
 accept $V = I \times R$
 accept correct transformation
 do **not** accept $V = C \times R$
 do **not** accept $V = A \times R$



subsequent use of Δ correct
 do **not** accept an equation expressed in units

1

- (ii) 46

credit correct transformation for **1** mark
 allow 1 mark for use of 11.5 V or division of final resistance by 20
 a final answer of 920 gains **2** marks only

3

ohm(s)

accept symbol Ω
 do **not** accept Ω s
 unit / symbol mark can be awarded in (iii) provided unit / symbol is omitted in (ii)

1

- (iii) 920 (ohms) **or** their (a)(ii) \times 20

1

- (b) as temperature increases, resistance increases

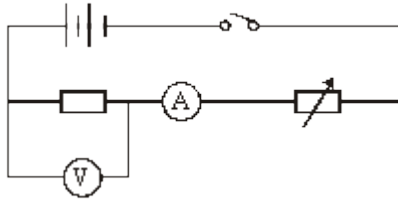
accept hotter for temperature increase
 do **not** accept a reference to resistance only i.e. it / resistance goes up

1

[7]

15

(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 \times resistance

accept voltage or p.d. for potential difference

accept $V = I \times R$

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 through the origin

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 increases

*accept filament lamp / it gets hotter
allow heat for temperature*

1

[8]


16

(i) power = potential difference \times current

accept voltage for potential difference

accept $P = V \times I$

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]

17

(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 20Ω

1

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

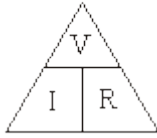
dependent on getting 1st mark correct

accept converse

1

(b) (i) potential difference = current \times resistance

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



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

1

(ii) 6

allow 1 mark for correct substitution

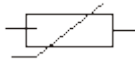
2

(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)

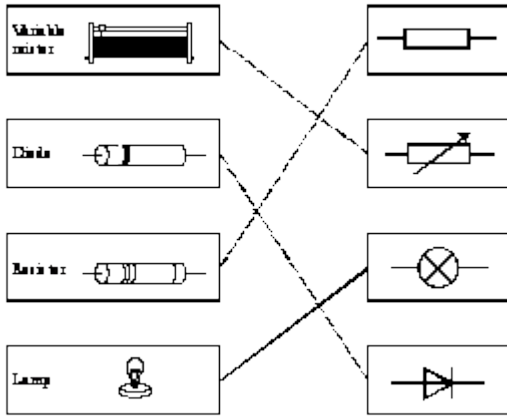
*do **not** accept changes for goes down*
*do **not** accept an answer in terms of current only*
answers in terms of other components are incorrect

1

[10]

18

(a) all 3 lines drawn correctly



(1 only 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]

19

(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

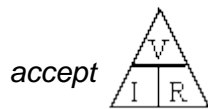
1

(c) (i) voltage = current \times resistance

accept $V = I \times R$

accept volts = amps \times ohms

do not accept $V = C \times R$



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]

20

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]

21

(a) in range $6 < I \leq 13$ 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]

22

- (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) $I = 0.2A$
 $P = 48W$
for 1 mark each
BUT may get equation mark here if not in (c)

2

- (e) $P = V.I.t$ (1)
 $P = 240 \times 0.2 \times 6 \times 3600$
OR $P = 48 \times 6 \times 3600$
gets 1 mark

$P = 1036800$ W
gets 1 mark

3

[12]

23

- (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]

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) ... 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]

26

(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 x 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 ($\frac{1}{2}$ 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]

27

- (a) (i) variable resistor
accept rheostat

1

- (ii) potential difference = current \times 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]

28

- (a) (i) resistor
- (ii) voltage / potential difference / volts / v
- (iii) current / amps / A
- (b) potential difference = current x resistance
no mark if more than one box ticked

1
1
1
1

[4]

29

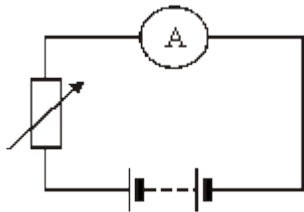
- (a) variable resistor
accept rheostat
- (b) voltmeter
- (c) straight line correct between 0.2 and 0.8
if line incorrect, or no line, and correct plots 0.2 to 0.8 award 1 mark
- (d) diode / rectifier

1
1
2
1

[5]

30

(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]

31

- (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]

32

- (a) (i) power \div voltage = current **or**
 $2800 \div 240 = 11.6 - 11.7$ **or** 12
2 marks for correct answer 1 mark for $2.8 \div 240$ 2

- (ii) resistance = voltage \div current
 $240 \div 11.7$
(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) $850 \div 1500 \times 100$

marks only available for division of power

1

$= 56.7$

*2 marks for correct answer
for 1 mark accept 5670*

1

[7]

33

(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 $V = A R$
 $V = I \times \text{ohm's sign}$
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]

34

- (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]

35

(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 \times current
accept $P = V I$ or $W = V \times A$
or any transformation 1
- [B] $1600 \div 230 = \text{current}$ 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 \times resistance
accept $V = I R$ or any transformation 1
- [B] $230 \div 7 = \text{overall } R = 33$
accept $230 \div 6.96 = \text{overall } R = 33$ 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]

36

- (a) (i) $P = V \times I$
 or equivalent
credit a triangle if part (ii) correctly uses the relationship
credit power = volts \times amps or watts $V \times A$
do not accept C for current 1
- (ii) ($P = 230 \times 10 =$) 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) $(230 = 10 \times R \Rightarrow) 23$
ohms or Ω 2

[10]

37

- (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]

38

- (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]

39

- (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]

40

(a) motor

1

(b) fuse or circuit breaker

1

(c) voltmeter

each for 1 mark

1

[3]

41

(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]

42

(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]

43

- (a) (i) diode
[Do not accept 'rectifier' or LED]
- (ii) lamp / bulb / light
each for 1 mark
- (b) • P = voltage / potential difference / p.d. / volts / V
[Allow 'Voltmeter']
- Q = current / amperes / amps / A
[Allow 'ammeter']
each for 1 mark

2

2

[4]

44

- (a) cell and bulb / light correctly labelled
for 1 mark each

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]

45

- (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]