Resistors

Mark Scheme

Name: _____

Class: _____

Date: _____

Time: **87 minutes**

Marks: **86 marks**

Comments:

Mark schemes

1 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]

2 (a) electric current
(rate of) flow of (electric) charge / electrons

accept $I = \frac{Q}{t}$

with Q and t correctly named

1

potential difference
work done / energy transferred per coulomb of charge
(that passes between two points in a circuit)

accept $V = \frac{W}{Q}$

with W and Q correctly named

1

(b) metals contain free electrons (and ions)

accept mobile for free

1

as temperature of filament increases ions vibrate faster /
with a bigger amplitude

accept atoms for ions

accept ions/atoms gain energy

accept vibrate more for vibrate faster

do not accept start to vibrate

1

electrons collide more (frequently) with the ions
or
(drift) velocity of electrons decreases

do not accept start to collide

*accept increasing the p.d. increases the temperature (**1** mark)*

and

*(and) resistance increases with temperature (**1** mark) if no other marks scored*

1

(c) 7.8

*allow **1** mark for obtaining value 1.3 from graph*

***or** allow **1** mark for a correct calculation using an incorrect current in the range 1.2-1.6 inclusive*

2

[7]

3

(a) (i) 2

*allow **1** mark for correct substitution i.e. 0.8 × 2.5 provided no further step shown*

2

(ii) straight line drawn from origin to 2, 0.8
or
their (a)(i), 0.8

1

curve from 2, 0.8 to 12,2
or
their (a)(i) 0.8 to 12,2

accept curve from 2, 0.9 to 12,2

or

their (a)(i) 0.9 to 12,2

'convex' curve required

accept a curve that flattens between 10 and 12V

1

(iii) filament / lamp gets hot

accept temperature increases

1

(b) 108

*allow **1** mark for correct substitution i.e. 1.5 × 72 provided no further step shown*

2

[7]

4

(a) diode

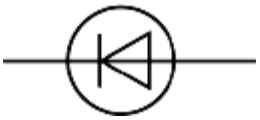
accept LED

1

(b) all symbols correct

must include at least voltmeter and diode

1



diode

allow ecf from part (a) if the component is not identified as a diode

allow symbol without the line through triangle

ignore polarity of diode

voltmeter in parallel with component added in series

*any additional components must not affect the ability to measure **V** and **I** for the diode / their (a)*

1

(c) (i) 0.05

accept 50 mA

accept between 0.048 and 0.050 inclusive

1

(ii) 16

$\frac{0.8}{}$

their (c)(i) correctly calculated gains both marks

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

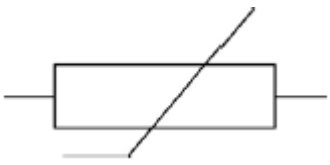
$\frac{0.8}{0.05}$ or $\frac{0.8}{\text{their (c)(i)}}$

allow 17 if using 0.048

2

[6]

5 (a) (i)



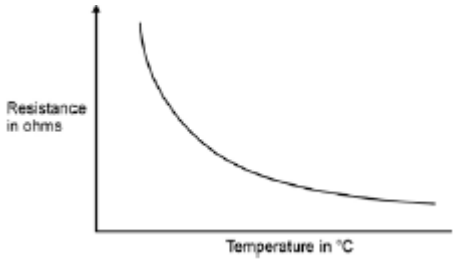
1

(ii) 360

*allow **1** mark for correct substitution, ie 9 = 0.025 × R*

2

(iii) sketch graph of correct shape, ie



1

(iv) An automatic circuit to switch a heating system on and off.

1

(b) so ammeter reduces / affects current as little as possible

accept so does not reduce / change the current (it is measuring)

accurate reading is insufficient

not change the resistance is insufficient

1

(c) gives a common understanding

accept is easier to share results

accept can compare results

do not need to be converted is insufficient

prevent errors is insufficient

1

(d) replace Bunsen (and water) with a lamp

accept any way of changing light level

1

replace thermometer with light sensor

accept any way of measuring a change in light level

datalogger alone is insufficient

1

[9]

6 (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 × 0.0002 correctly calculated

*allow **1** mark for converting 25 kΩ /*

their (a)(ii) to ohms

or

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

ie 0.0002 × 25(000)

***or** 0.0002 × 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 (kΩ) or their (a)(ii) + 50 % (a)(ii) correctly calculated

1

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

1

due to variation in <u>resistance</u> value

accept because resistance varies by ± 50 %

accept tolerance of resistor is too great

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

1

[10]

7

(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

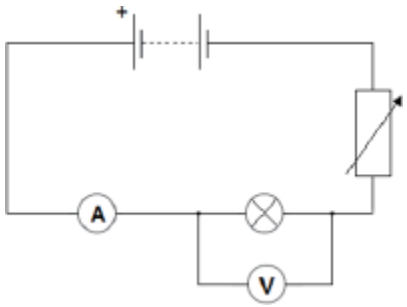
but
resistance of the lamp / filament decreases
gains 2 marks

because the temperature of the filament falls / filament cools
for 1 mark

3

[10]

8 (a)



battery in series with bulb and ammeter

1

voltmeter in parallel with bulb

1

variable resistor
or
variable power pack
or
potentiometer

1

(b) A is brighter because it has a higher current (than lamp B at any p.d.)

1

(therefore A has a) higher power output (than bulb B)
accept higher energy output per second

1

(c) lower current (than lamp A) for the same potential difference
accept answer in terms of R = V / I

1

lower gradient (than lamp A)

1

(d) 0 – 2 Volts
allow a range from 0 V up to any value between 1 and 2 V.

1

(for an ohmic conductor) current is directly proportional to potential difference
allow lines (of best fit) are straight and pass through the origin

1

(so) resistance is constant

1

[10]

9 (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

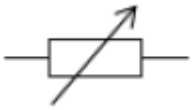
3

[12]

10 (a) (i) symbol for a diode 

accept 

1

symbol for a variable resistor 

1

(ii) voltmeter is in series **or** voltmeter is not in parallel

1

ammeter is in parallel **or** ammeter is not in series

accept an answer in terms of how the circuit should be corrected

voltmeter and ammeter are wrong way around is insufficient

1

(b) (i) 0.2 (V)

accept any value between 0.20 and 0.21 inclusive

1

(ii) 37.5

*allow **1** mark for I = 0.008*
or
*allow **2** marks for correct substitution, ie 0.3 = 0.008 × R*
or
*allow **1** mark for a correct substitution using I = 0.8 **or** I = 0.08*
***or** I = 0.009*
or
*allow **2** marks for answers of 0.375 **or** 3.75 **or** 33(.3)*

3

(c) (i) 25

*allow **1** mark for obtaining period = 0.04(s)*

2

(ii) diode has large resistance in reverse / one direction

1

so stops current flow in that / one direction

allow diodes only let current flow one way / direction

*allow **1** mark for the diode has half-rectified the (a.c. power) supply*

1

[12]