GCSE
PHYSICS

Topic Paper: 2.1 Current, potential difference and resistance
Part 1 & 2 Mark Scheme

MARK SCHEME

90 Marks

M1. (a) each hair gains the same (type of) charge

or

(each) hair is negatively charged

*do **not** accept hair becomes positively charged*

or

(each) hair gains electrons

1

similar charges repel

accept positive charges repel

providing first marking point is in terms of positive charge

or

negative charges repel

or

electrons repel

1

(b) 0.000002

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

or

2×10^{-6}

ie 30 / 15 or .03 / 15000 or 30 / 15000 or .03 / 15

or

2 μ C

*answers 2 and 0.002 gain **1** mark*

2

(c) current

*do **not** accept amp / amperes*

1

[5]

M2. (a) (i)

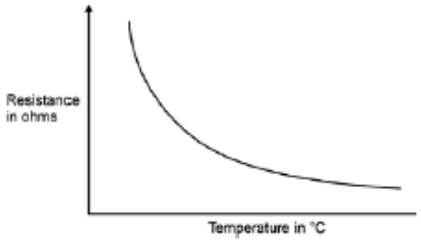
1

(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]

M3. (a) 35

*an answer with more than 2 sig figs that rounds to 35 gains **2** marks*
*allow **2** marks for correct method, ie* $\frac{230}{6.5}$
*allow **1** mark for I = 6.5 (A) **or** R =* $\frac{230}{26}$
*an answer 8.8 gains **2** marks*
*an answer with more than 2 sig figs that rounds to 8.8 gains **1** mark*

3

(b) (i) (maximum) current exceeds maximum safe current for a 2.5 mm^2 wire

accept power exceeds maximum safe power for a 2.5 mm^2 wire

or

(maximum) current exceeds 20 (A)

(maximum) current = 26 (A) is insufficient

1

a 2.5 mm^2 wire would overheat / melt

accept socket for wire

*do **not** accept plug for wire*

1

(ii) (contains) live, neutral and earth wires

accept is a three-core cable

1

cross-sectional area of (live and neutral) wire(s) (minimum of) 4 mm^2

accept 6 mm^2 for 4 mm^2

1

wire / cable should be insulated

accept a suitable named insulator, eg PVC / rubber / plastic

1

(c) a.c. is constantly changing direction

accept a.c. flows in two directions

accept a.c. changes direction

a.c. travels in different directions is insufficient

1

d.c. flows in one direction only

1

[10]

M4. (a) diode

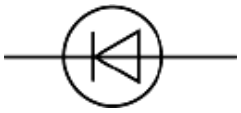
accept LED

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

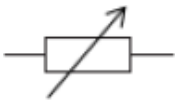
2

[6]

M5. (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]

M6. (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 resistance value

accept because resistance varies by ± 50 %

accept tolerance of resistor is too great

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

1

[10]

M7. (a) (i) 0.25 (A)

1

(ii) 75

*allow **1** mark for converting 5 minutes to 300 seconds*

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

ie 0.25 ×300

*allow **1** mark for an answer 1.25*

*allow **1** mark only for their (a)(i) ×300 correctly calculated*

2

coulombs or C

*do **not** accept c*

1

(b) any **two** from:

fault not repaired

accept if a fault was to occur

larger current will (still) flow

aluminium foil will not melt (if a fault)

accept aluminium foil needs a higher current / charge to melt

wiring will overheat / (may) cause a fire

accept idea of fire hazard

*do **not** accept explode etc*

2

[6]

M8. (a) (i) 50(Hz)

ignore any unit given

1

(ii) any **two** from:

(some) current flows to Earth

accept ground for Earth

current flows through copper braid

accept current flows through the earth wire

accept electricity for current in either the first or second marking point but not both

RCCB detects difference between current in live and neutral wire

2

(iii) can be reset

accept does not need replacing

or

faster acting

accept switches circuit off faster

1

(b) (i) 79 200

*allow **1** mark for correct substitution, ie* $11 = \frac{Q}{2 \times 3600}$

*an answer 22 gains **1** mark*

2

coulombs / C

*do **not** accept c*

1

(ii) 18 216 000

*accept for **2** marks 18 216 kJ **or** 18.216 MJ*

or

230 ×their (b)(i) correctly calculated

*allow **1** mark for correct substitution, ie 230 ×their (b)(i) **or***
*allow **1** mark for power calculated as 2530(W)*

2

(c) increases temperature of thermistor

1

changes resistance (of thermistor)

*do **not** accept increases resistance (of thermistor)*

*an answer decreases resistance (of thermistor) gains **2** marks*

1

[11]

M9. (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

1

(b) 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*

1

this current causes the fuse to melt

accept blow for melt

*do **not** accept break / snap / blow up for melt*

1

[4]

M10. (a) (i) 50 000

*allow **1** mark for correct substitution, ie*

6 = 0.00012 ×R

***or** 6 = 0.12 ×R*

***or** answers of 25 000 or 50 gain **1** mark*

***or** allow 1 mark for an incorrect answer caused by one error only ie using 3V or an incorrect conversion of current*

2

ohm / Ω

*an answer 50kΩ gains **3** marks*

1

(ii) (body) resistance changes

or

body fat/resistance affected by (many) factors

accept named factor, eg age, gender, height, fitness, bone structure, muscle, drinking water related to body fat / resistance

1

(iii) gives misleading / wrong/inaccurate value

do not credit if specifically linked to a change in mass / weight

1

(because) high water content changes body resistance

accept a specific change to resistance

water changes body mass is insufficient

1

(b) (i) RCCB – detects difference between current in live and neutral (wires)

accept RCCB can be reset

1

fuse – (overheats and) melts

accept blows for melts

1

(ii) switches the circuit / hedge trimmers off within 60 milliseconds

*allow for **1** mark the RCCB / it is (very) fast.*

do not accept the bigger the current the faster the RCCB switches off

2

[10]

M11. (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]