Mark schemes

1 (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]

2 (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]

3 (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]

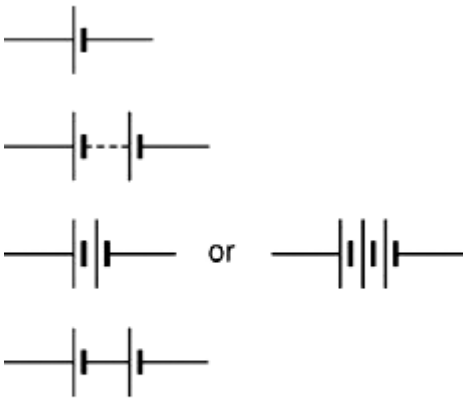
4

(a) (i) ammeter and battery **in series** with the **gauge**

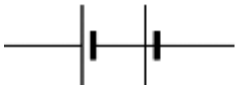
symbols must be correct

ignore a voltmeter drawn in series

accept



not



or cells reversed to cancel out

1

voltmeter in parallel with the gauge

symbol must be correct

accept a freestanding circuit

diagram provided strain gauge is labelled or a resistor symbol used for the strain gauge

1

(ii) d.c. flows only in one direction

a.c. changes direction is insufficient

1

(b) (i) 75

this answer only

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

ie resistance = $\frac{3.0}{0.040}$

2

(ii) increases

1

(iii) elastic / strain potential

*do **not** accept potential*

1

[7]

5 (a) (i) potential difference = current × resistance

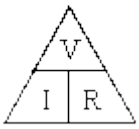
*accept voltage **or** pd for potential difference*

accept $V = I \times R$

accept correct transformation

*do **not** accept $V = C \times R$*

*do **not** accept $V = A \times R$*

accept 

provided

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) × 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]

6 (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 (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]

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) (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]

9 (a) (i) (connect) 30 (cells)

1

in series

1

(ii) current always flows in the same direction
or
current only flows one way

1

(iii) 36 000

*allow **1** mark for correctly converting 2 hours to 7200 seconds*
*answers 10 or 600 score **1** mark*

2

coulombs / C

*do **not** accept c*

1

(b) (i) 2160

*allow **1** mark for correct substitution, ie ½ × 120 × 6^2*
*answers of 1620 or 540 score **1** mark*

2

(ii) reduce it

1

any **one** from:

- draws a larger current (from battery)
- motor draws greater power (from battery)
  accept energy per second for power
  accept more energy needed to move the bicycle
- greater resistance force (to motion) / air resistance / drag / friction
  accept less streamlined
  more mass to carry is insufficient

1

[10]

10 (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]

11 (a) *attempt to draw four cells in series*

1

correct circuit symbols

circuit symbol should show a long line and a short line, correctly joined together

example of correct circuit symbol:

1

(b) (i) 6 (V)

*allow **1** mark for correct substitution, ie*
*V = 3 × 2 scores **1** mark*
provided no subsequent step

2

(ii) 12 (V)

ecf from part (b)(i)
18 – 6
or
*18 – their part (b)(i) scores **1** mark*

2

(iii) 9 (Ω)

ecf from part (b)(ii) correctly calculated
3 + their part (b)(ii) / 2
or
*18 / 2 scores **1** mark*
provided no subsequent step

2

(c) (i) need a.c.

1

battery is d.c.

1

(ii) 3 (A)

*allow **1** mark for correct substitution, ie*
*18 × 2 = 12 × I_s scores **1** mark*

2

[12]