01. 0625_m20_MS_62 Q: 3

(a)(i)	V = 2.1 (V) and I = 0.26 (A)	1
(a)(ii)	R_0 = 8.1 / ecf	1
(b)	1 / I = 2.86	1

(c)	graph:	
	• axes labelled with quantity and unit	1
	• appropriate scales (plots occupying at least ½ grid)	1
	• plots all correct to ½ small square and precise plots	1
	• well judged line and thin line	1
(d)(i)	G present and triangle method seen on graph line	1
(d)(ii)	E in range 2.0 (V) to 2.9 (V)	1
(e)	l = 30(.0) cm	1
	reference to ammeter forming greater proportion of total resistance	1

02. 0625_p20_MS_60 Q: 3

(a) correct symbol [1]
correct position [1]

(b) table:
1.68 (V) [1]

(c) (brightness) decreases (as length increases) [1]

(d) statement: no [1]
justification matches statement and by reference to results
e.g. V / l not constant, as l increases V decreases, V does not double as l doubles [1]

(e) any one from:
width of sliding contact
achieving exact same position on wire
accept heating changes resistance of wire
accept other sensible practical reason [max 1]
NOT human error

(f) do not touch (bare/hot) wire
OR do not allow C to touch terminal between lamp and supply [1]

---

03. 0625_s20_MS_62 Q: 2

(a)	V = 0.2	1
	I = 0.28	1
	cm, V, A	1

(b)	graph: axes correctly labelled and right way round	1
	suitable scales	1
	all plots correct to $\frac{1}{2}$ small square	1
	good line judgement, thin, continuous line	1
(c)(i)	conclusion matching readings (expect I constant)	1
(c)(ii)	justification to match (i) with reference to results expect I values very close / equal	1
(d)	method shown clearly on graph	1
	V_L correct to $\frac{1}{2}$ small square	1

---

04. 0625_m19_MS_62 Q: 3

(a)(i)	correct voltmeter symbol in parallel with **P** and **Q**	**1**
(a)(ii)	V = 2.6 (V)	**1**
	I = 0.36 (A)	**1**
(b)	correct units: V, A	**1**
(c)(i)	correct calculations of R	**1**
	consistent 2 or consistent 3 sig. figs.	**1**
(c)(ii)	correct calculations or R / l	**1**
(d)	R_{25} = 2.0 (Ω) and clear method seen e.g. proportion from other value(s) of R or use of R / l value(s)	**1**
(e)	any **one** from: difficult to judge position of crocodile clip, difficult to measure wire to nearest mm, contact between wire and crocodile clip not precise, difficult to interpolate readings on meters between marks	**1**
(f)	correct symbol for variable resistor	**1**
	in series and with all circuit elements in correct arrangement	**1**

---

05. 0625_s19_MS_61 Q: 2

(a)(i)	I = 0.47(A)	**1**
(b)(i)	V/l 0.025 0.023 0.027 0.026 0.024	**1**
(b)(ii)	V/l consistent 2 significant figures or consistent 3 significant figures	**1**
	V/cm	**1**
(c)	Box 1 ticked	**1**
	Values are close OR values are within the limits of experimental accuracy	**1**
(d)	5.1(1)	**1**
	2 or 3 significant figures	**1**
	Unit Ω	**1**
(e)	Keep current low OR switch off between readings	**1**
(f)	Correct symbol	**1**

---

06. 0625_s19_MS_62 Q: 3

(a)	3.6(0) (V) 0.3(0) (A)	1 1
(b)	12 (Ω)	1
(c)	8 and unit Ω	1
(d)(i)	11/11.3/11.29 (Ω)	1
(d)(ii)	statement to match results justification to match results (with idea of within or beyond limits of experimental accuracy explained)	1 1
(e)	brightness/intensity of lamp changes	1
(f)	correct symbols with resistors and lamp in parallel one voltmeter correctly positioned – accept across power supply	1 1
(g)	variable resistor	1

---

07. 0625_w19_MS_62 Q: 2

(a)	0.56	1
	with correct unit A	1
(b)(i)	1.07 / 1.1	1
	2 or 3 significant figures	1
(b)(ii)	V, Ω	1
(c)(i)	2nd box ticked	1
(c)(ii)	justification – only award if the 2nd box is ticked	1
(d)(i)	value approximately halfway between the 40 cm and 60 cm values	1
(d)(ii)	correct *R* value from candidate's value in **(d)(i)**	1
	2 or 3 significant figures	1
(e)	use a low(er) current / voltage / switch off between readings / add a resistor in series / use a thinner wire	1

---

08. 0625_w19_MS_63 Q: 1

(a)	correct voltmeter symbol in parallel with lamp	1
(b)(i)	V = 0.6(V) and I = 0.14(A)	1
(b)(ii)	R = 4.3(Ω)	1
(c)	graph:	
	axes labelled correct orientation, with quantity and unit	1
	appropriate scales (plots occupying at least ½ grid)	1
	plots all correct to less than ½ small square and precise plots	1
	well-judged line and thin line	1
(d)	resistance increases as temperature increases	1
	temperature / resistance increases with length	1
(e)	variable resistor symbol correct (rectangle with strike-through arrow only)	1
	in series and rest of circuit correct	1

---

09. 0625_s18_MS_63 Q: 2

(a)	correct voltmeter symbol in parallel with **X**	1
(b)(i)	I = 0.86 (A)	1
	V = 0.9 (V)	1
(b)(ii)	Ω	1
	A, V	1
(c)	correct calculations of P (0.77 / ecf, 0.94, 0.58(W))	1
	consistent 2 or consistent 3 significant figures	1
(d)	increases (at first)	1
	to a maximum AND *then* decreases	1
(e)	any 2 additions from: draw a graph; different / more resistors / values of resistance / greater range of values for resistance; use (at least) 5 sets of values for resistance	2

10. 0625_w18_MS_61 Q: 2

(a)	I = 0.48	1
(b)	V = 0.5	1
(c)	cm, V	1
(d)	Graph: Axes correctly labelled and right way round	1
	Suitable scale	1
	All plots correct to ½ small square	1
	Good line judgement, single, thin, continuous line	1
(e)(i)	Triangle method seen on graph	1
	At least half of candidate's line used	1
(e)(ii)	R in range 0.040 to 0.055. No ecf allowed	1
	Unit Ω / cm OR Ω	1

11. 0625_w18_MS_63 Q: 2

(a)	correct voltmeter symbol in parallel with wire **X**	**1**
(b)	V = 1.9 (V)	**1**
(c)(i)	graph:	
	axes labelled correct orientation, with quantity and unit	**1**
	appropriate scales (plots occupying at least ½ grid)	**1**
	plots all correct to ½ small square and precise plots	**1**
	well-judged line and thin line	**1**
(c)(ii)	G present and triangle method seen on graph	**1**
(c)(iii)	l = 4.5 (cm) and L = 13.5 (cm)	**1**
(c)(iv)	R in range 0.17 to 0.23	**1**
	2 / 3 sig figs and unit = Ω or Ω / cm	**1**
(d)	Any **one** from: use smaller current / potential difference; use wire with greater resistance; open switch / switch off circuit in between readings.	**1**

12. 0625_m17_MS_62 Q: 2

(a)	correct voltmeter symbol shown in parallel	**1**
(b)	V = 2.7 (V)	**1**
	I = 0.48 (A)	**1**
(c)	correct calculations of R – 5.63 / ecf, 3.20, 2.59	**1**
	consistent 2 or consistent 3 sig figs	**1**
(d)(i)	correct calculations of r – 6.26, 6.40, 6.48 or ecf from R values	**1**
	Ω / m seen at least once and not contradicted	**1**
(d)(ii)	statement matching results	**1**
	justification matching statement and results – 'within limits of experimental accuracy' / owtte	**1**
(e)	arrow on wire between the inside edge of each crocodile clip	**1**
(f)	any suitable precaution: reduce current / voltage, use longer / thinner resistance wires,	**1**
	Total:	**11**

13. 0625_s17_MS_61 Q: 5

	MP1 Diagram showing power supply, ammeter, voltmeter and resistance wire correctly connected (variable resistor optional)	**1**
	MP2 Correct symbols for ammeter and voltmeter. Variable resistor symbol correct if included.	**1**
	MP3 Measure potential difference (voltage) and current and calculate resistance.	**1**
	MP4 Repeat with other (types of) wires	**1**
	MP5 Key variables length AND diameter stated	**1**
	MP6 One of: Repeat with different voltages (or currents). Repeat and take average (voltage and current) readings. Repeat entire experiment with different length or different diameter. Use low current to prevent wire heating up. Keep temperature of wire constant / switch off between readings Use micrometer screw gauge to measure diameter / thickness of wire.	**1**
	MP7 Table with columns for type of wire, voltage, current, resistance with correct units (V, A and Ω)	**1**
	Total:	**7**

14. 0625_s17_MS_62 Q: 1

(a)(i)	V = 0.8 (V)	**1**
	I = 0.65 A both units correct	**1**
(a)(ii)	R = 1.2(3) (Ω)	**1**
(b)(i)	1.31(Ω) (e.c.f.)	**1**
(b)(ii)	length (directly) proportional to resistance/$l \propto R/l = kR$	**1**
(c)	second box down to be ticked	**1**
(d)	different heating effects on wires/wires may be at different temperatures different interpolation of readings between marks on meters/difficult to read the meter (or ammeter/voltmeter/current/voltage) accurately difficult to measure length of wire to nearest mm/to judge the position of the sliding contact cell may run down/power of cell may be less **Any 2 × 1 mark each**	**2**
	Total:	**8**

15. 0625_s17_MS_63 Q: 2

(a)(i)	correct voltmeter symbol connected in parallel across **P** and **Q**	**1**
(a)(ii)	I = 0.38(A)	**1**
(b)	graph: axes labelled with quantity and unit	**1**
	appropriate scales (plots occupying at least ½ grid)	**1**
	plots all correct to ½ small square	**1**
	well-judged straight line and thin line, precise plots	**1**
(c)(i)	M present and triangle method seen on graph	**1**
(c)(ii)	R in range 1.8 to 2.4 Ω	**1**
	2 or 3 sig figs and unit = Ω	**1**
(d)	suitable reason: wire becomes too hot, current exceeds full scale deflection(owtte) of meter / becomes too large	**1**
(e)	correct symbol for variable resistor (rectangle with strike-through arrow only)	**1**
	Total:	**11**

---

16. 0625_m16_MS_62 Q: 1

(a) arrow indicating 0.4 V [1]

arrow indicating 0.08 A [1]

(b) graph:
- axes labelled with quantity AND unit [1]
- appropriate scales (plots occupying at least ½ grid) [1]
- plots all correct [1]
- well-judged line AND thin line, neat plots [1]

(c) **(i)** G present and triangle method seen using at least ½ line [1]

(ii) R in range 4.6 Ω to 4.9 Ω [1]

to 2 / 3 significant figures and with correct unit [1]

(d) statement matching graph with reference to straight line [1]

reference to passing through origin (within limits of experimental accuracy / owtte) [1]

(e) suitable change: [1]
e.g. reduce supply voltage / current,
use thinner / longer wire,
material with greater resistivity

[Total: 12]

---

17. 0625_p16_MS_60 Q: 3

(a) correct symbol [1]
correct position [1]

(b) table:
1.68 (V) [1]

(c) (brightness) decreases (as length increases) [1]

(d) statement: no [1]
justification matches statement and by reference to results
e.g. V / l not constant, as l increases V decreases, V does not double as l doubles [1]

(e) any one from:
width of sliding contact
achieving exact same position on wire
accept heating changes resistance of wire
accept other sensible practical reason [max 1]
NOT human error

(f) do not touch (bare/hot) wire
OR do not allow C to touch terminal between lamp and supply [1]

---

18. 0625_s16_MS_61 Q: 2

(a)	8.2 0.44–0.45 Units V and A	1 1 1
(b)	19(°C)	1
(c)	Perpendicular to scale and at bottom of meniscus	1
		Total 5

---

19. 0625_s16_MS_61 Q: 3

(a)(i)	R values 1.60, 1.51, 1.35, 1.21 R values all to 2 significant figures or all to 3 significant figures.	1 1
(a)(ii)	Column headings m, V, A, Ω	1
(b)	No; there is a current reading	1
(c)	filament changes brightness, owtte increase / decrease / change in temperature of filament / lamp	1 1
(d)(i)	Variable resistor (rheostat)	1
(d)(ii)	Correct symbol for variable resistor Correct diagram, with variable resistor in series with power supply	1 1
		Total 9

---

20. 0625_s16_MS_62 Q: 4

	Circuit diagram: **MP1** Sample of wire must be clearly identifiable by a label on the diagram or by letters on the diagram with an explanation in the text **MP2** All circuit symbols correct (even if circuit is incorrect) Method: **MP3** Take readings of V and I **MP4** For 5 or more lengths **MP5** Range of lengths must be between 5 cm and 2 m **with the largest length at least twice the smallest** Table drawn with headings: **MP6** l / m, V / V, I / A, R / Ω Key variables to control: **MP7** Any one from • Material / resistivity / conductivity / type of wire • Diameter / radius / thickness / cross sectional area • Temperature of wire	**1** **1** **1** **1** **1** **1** **1**
		Total: 7

21. 0625_w16_MS_62 Q: 2

(a)(i)	V_1 = 1.7 (V) I_1 = 0.32 (A)	**1** **1**
(a)(ii)	R = 5.3125 Ω	**1**
(b)	statement YES justification to include the idea of within the limits of experimental accuracy	**1** **1**
(c)(i)	variable resistor / rheostat	**1**
(c)(ii)	correct symbol for variable resistor circuit correct	**1** **1**
	Total:	**8**

22. 0625_w16_MS_63 Q: 3

(a)	Four correct *I* values (0.12, 0.15, 0.17, 0.19 and 0.21) present The fifth one is also correct	1 1
(b)	correct calculations of *R* (4.2, 6.7, 8.8, 10.5, 11.9) or ecf from **(a)**	1
(c)	graph: axes correct way round, labelled with quantity and unit appropriate scales (plots occupying at least ½ grid) plots all correct to ½ small square well-judged line and thin line, precise plots	 1 1 1 1
(d)	simple statement matching candidate's line (e.g. resistance increases with p.d.) qualified (e.g. changes less rapidly for greater p.d. values)	1 1
(e)	correct symbol for variable resistor (rectangle with strike-through arrow only) in correct series circuit	1 1
	Total	**11**

---

23. 0625_m15_MS_62 Q: 3

(a) correct voltmeter symbol with appropriate parallel connection [1]

(b) (i) meter with 5 V range circled [1]

(ii) arrow indicating 1.5 V on circled meter [1]

(c) *R* calculations correct (9.6 or 9.62, 7.9 or 7.89, 4.5 or 4.55) [1]

consistent 2 or consistent 3 sig. figs. [1]
note: allow 1 sig. fig. fewer for l = 20 cm

(d) link consistent with results [1]
figures to support, matching statement – at least two *R* values compared [1]

(e) increased supply voltage [1]
use of variable resistor OR variable voltage supply clearly indicated as such [1]
any other suitable point, e.g. [1]

- voltmeter with larger range
- ammeter with larger range
- variable resistor symbol and connection correctly shown

[Total: 10]

---

24. 0625_s15_MS_63 Q: 3

(a) correct symbol in parallel between crocodile clip and zero end of wire [1]

(b) R = 7.1(0), 6.22, 5.45, 4.7(0), 3.93 [1]

(c) Graph:
- axes labelled correctly, right way round and with units [1]
- suitable scales, plots occupying at least half grid in both directions [1]
- plots correct to within ½ small square [1]
- well-judged straight line, thin line, precise plots [1]

(d) (i) G present and triangle method seen on graph [1]

(ii) r in range 7.4 – 8.5 [1]

2 or 3 sig. figs. AND unit Ω/m [1]

[Total: 9]

---

25. 0625_w15_MS_61 Q: 2

(a) (i) V = 2.2 (V) [1]

(ii) I = 0.2(0) (A) [1]

(b) graph:
- axes both correctly labelled, right way round and with units [1]
- suitable scales, to include origin [1]
- all plots correct to within ½ small square [1]
- good best-fit line judgement, single, thin, continuous line [1]

(c) (i) intercept correct to ½ small square [1]

(ii) ratio correct AND R value equal to ratio, ignore any unit, e.c.f. allowed [1]

(iii) 2 or 3 sig. figs. AND unit of Ω [1]

[Total: 9]

(a) **(i)** 1.9 (V) [1]

0.26 (A) [1]

(ii) R = 7.3 (7.3077) (Ω) accept any sig. figs. > 2, ecf allowed [1]

all units V, A, Ω correct, symbols or words [1]

(b) brightness increases (from X to Z) [1]

(c) one from:
- exact placement of S
- width of S
- battery running down / voltage changed
- wire/lamp getting hot
- resistance of lamp / wire changed [max 1]

(d) increases (note: if this mark is not scored, the next mark cannot be scored) [1]

V increases more quickly than I (accept greater rate)
or V increases proportionately more than I
or doubling V causes I to increase by less than double
allow gradient is increasing [1]

[Total: 8]

27. 0625_s14_MS_62 Q: 3

(a) (i) 2.1 (V) [1]

0.45 (A) [1]

(ii) R = 4.7 accept 4.67 (Ω) e.c.f. **(a)(i)** [1]

all units correct, V, A, Ω, symbols or words [1]

(b) (current) decreases [1]

(c) correct symbol for variable resistor (rectangle with strike-through arrow) [1]

(d) clear description or diagram showing triangle method with large triangle **or** taking **two** co-ordinates far apart on line [1]

how to calculate gradient, e.g. equation or rise / run, etc. [1]

[Total: 8]

---

28. 0625_s14_MS_63 Q: 3

(a)(b) 2.8 [1]

0.9(0) [1]

units both correct, symbols or words, V, A [1]

(c) (i) 3.1(1) / ecf, 2.0 / 1.95, 1.0(0) penalise rounding errors [1]

correct unit seen once and not contradicted [1]

(ii) statement matches results (expect 'Yes' but allow 'No' if ecf >10%)
with matching and correct justification (which refers to figures)
(e.g. 'within limits of experimental accuracy' owtte for 'Yes' or 'too different' for 'No') [1]

(d) any one from:
- switch off between readings
- only switch on for short time
- use smaller currents / p.d.s
- suitable means of dissipating thermal energy [1]

[Total: 7]

---

29. 0625_w14_MS_61 Q: 3

(a) *R* calculated correctly:
0.49, 0.99, 1.5(1), 1.99 or 2.0, 2.5(0)
note: accept more significant figures for this mark [1]

all *R* values expressed to suitable precision, expect 2 decimal places
OR 2 significant figures used throughout OR 3 significant figures used throughout [1]

(b) graph:
axes correctly labelled and right way round [1]
suitable scales, with plots using at least half of grid [1]
all plots correct to ½ small square [1]
good line judgement [1]
single, thin, continuous line, no large 'blobs' greater than ½ small square [1]

(c) statement to match graph (expect yes) [1]

justified by reference to straight line through the origin
OR when l doubles, *R* doubles owtte [1]

(d) additional readings with greater l values [1]

[Total: 10]

---

30. 0625_w14_MS_62 Q: 3

(a) all units correct: m, V, A, Ω – symbols and/or words [1]

(b) graph:
axes correctly labelled and correct orientation [1]
suitable scales, plots using more than half available axes [1]
all plots correct to ½ small square [1]
good line judgement, thin, continuous, [1]
note: do not allow 'blobs' greater than half square diameter

(c) triangle method shown on graph [1]
note: do not allow use of y/x if graph does not go to origin

G using large triangle/half of candidate's line used [1]
note: second mark can be given from coordinates used in equation if nothing shown on graph

(d) R_1 value to 2 or 3 significant figures – ignore unit [1]
note: this mark does not depend on actual value being correct

R_1 in range 5.8 to 6.2Ω
OR accept R_1 = *G* value if outside tolerance [1]

[Total: 9]

---

31. 0625_w14_MS_62 Q: 5

(a) tape measure [1]

(b) **(i)** symbols for ammeter, voltmeter and resistor (for copper wire) correct [1]
note: accept in wrong places for this mark

variable resistor or potential divider present with symbol [1]
NOT if labelled "copper wire"

ammeter in series and voltmeter in parallel with copper wire / resistor [1]
note: do NOT award this mark if there is no power supply

(ii) observe current shown on ammeter (ignore any reference to a voltmeter) [1]
accept change variable resistor / use rheostat (to see if it then glows)
accept 'change current' as meaning changing variable resistor
ignore checking wires or changing power supply or use of a voltmeter
accept connect lamp directly across supply

(iii) no, deflection too small / range too large (owtte) [1]
accept 'scale' for range
accept suggestion of alternative maximum meter
accept readings not precise enough / sensitivity not sufficient;
accept accurate for precision, ignore misuse of 'reliable'
ignore 'circuit voltage not large enough'

[Total: 6]

---

32. 0625_s13_MS_61 Q: 3

(a) table:
R values correct 0.61, 1.82, 3.16, 4.27, 5.48 [1]
all *R* values to 2 or 3 significant figures [1]
cm, V, A, Ω [1]

(b) graph:
axes correctly labelled [1]
suitable scales [1]
all plots correct to ½ small square [1]
good line judgement [1]
single, thin, continuous line [1]

(c) triangle method shown on graph [1]
using at least half of line [1]
G = 0.31to 0.35 2 or 3 significant figures [1]

[Total: 11]

---

33. 0625_w13_MS_62 Q: 3

(a) **(i)** 0.30 A c.a.o. unit needed (accept 0.3 A) [1]

(ii) table:
0.40 (accept 0.4) [1]
1.33 (e.c.f. **(a)(i)**) accept any significant figures > 1 and recurring decimal [1]

(b) graph:
axes correctly labelled [1]
suitable scales (*x* axis 2 cm = 0.2 m/0.25 m) [1]
all plots correct to ½ small square [1]
good line judgement [1]
thin continuous line, carefully plotted points not large 'blobs' [1]

(c) *l* correct to ½ square – must see evidence on graph paper
condone no / incorrect unit, ignore significant figures [1]

(d) 9.5 to 10.5 (Ω) ignore significant figures [1]

[Total: 10]

---

34. 0625_w13_MS_63 Q: 3

(a) correct symbol connected in parallel [1]

(b) **(i)** axes labelled, with units [1]
appropriate scales (plots occupying at least ½ grid) [1]
plots correct to ½ square [1]
best-fit line and thin, neat line, neat plots [1]

(ii) triangle method seen on graph [1]
large triangle (at least 1/2 candidate's line) [1]

(iii) *R* correct from *M* and in range 0.7 to 0.8 [1]
2 or 3 significant figures and unit Ω (symbol or word) [1]

[Total: 9]

---

35. 0625_s12_MS_61 Q: 3

(a) (i) (cm, V, A) [no mark awarded]

(ii) Graph:
Axes correctly labelled with quantity and unit and correct way around [1]
Suitable scales – plots occupy at least half the grid [1]
All plots correct to ½ small square [1]
Good line judgement (ecf for curve if *d* plotted) [1]
Single, thin, continuous line [1]

(iii) Triangle using at least half of candidate's line clearly indicated on graph [1]
Evidence of subtraction seen [1]
G value 1.5 when rounded to 2 significant figures [1]

(b) Same as *G*, rounded to 2 or 3 significant figures [1]
unit Ω/ohms [1]

[Total: 10]

---

36. 0625_s12_MS_62 Q: 3

(a) (i) V_1 = 1.9 [1]
I_1 = 0.3 [1]
Units V and A both correct [1]

(ii)/(iii) R_P = 6.33 and $4R_P$ = 25.3/25.2 to 2 or 3 sig. figs. [1]
Ω [1]

(b) R_S = 23.8 (Ω) or 24 (Ω) [1]

(c) Correct statement (from candidate's work)
with matching justification (idea of within or beyond experimental accuracy) [1]

(d) Circuit: correct symbols for ammeter, voltmeter and lamp in correct series circuit [1]

(e) (i) Change/control current/voltage [1]

(ii) To obtain range of readings (or wtte) [1]

[Total: 10]

---

37. 0625_w12_MS_63 Q: 3

(a) Correct symbol for voltmeter [1]
In parallel with lamp [1]

(b) **(i)** Units all correct [1]

(ii) R values correct (10, 14, 18, 21) [1]
Consistent 2 or 3 significant figures in R column [1]

(c) Statement matches results (expect 'No') [1]
R figures quoted appropriately and matching statement [1]
Mention of brightness related to temperature [1]

[Total: 8]
