Mark Scheme DC Circuits Test

Section A

1. C
2. B
3. C
4. B
5. D
6. A
7. B
8. C

SECTION B:

Question 9.

Question Number	Answer	Mark
11	Use of $V = IR$ to find total resistance or terminal p.d.	1
	Subtraction of resistance or p.d.s	1
	$r = 8.2\ \Omega$ (accept 8 Ω)	1
	OR see $E = I(R+r)$	1
	Substitution of values into equation	1
	$r = 8.2\ \Omega$ (accept 8 Ω)	1
	Example of answer	
	Total $R = 1.5\ V \div (17 \times 10^{-3}\ A) = 88.2\ \Omega$	
	$r = 88.2 - 80 = 8.2\ \Omega$	
	Total for question	3

Question Number	Answer	Mark
11	p.d. is electrical energy(/coulomb) transferred between two points/electrical energy transformed/converted to other forms (1) e.m.f is the energy(/coulomb) supplied to a circuit/given to the charge/energy output of the cell (1) (full credit if wording implies emf as electrical energy source and pd as electrical energy sink) If neither mark scored but reference to energy/charge is made scores 1 mark only	2
	Total for question	2

10.

(a)	Use of $Q = It$ **(1)** $Q = 450$ C / A s **(1)** Example of calculation $Q = 15\,000$ A $\times$ 3.0 $\times$ 10^{-2} s $Q = 450$ C		**2**
(b)	Use of $R = \rho l/A$ **(1)** Length of conductor = 24 (m) **(1)** Height of statue = length – 1 m = 23 m **(1)** *Assumption:* **ANY ONE** Included height of plinth. Conductor/wire doesn't carry on in ground Conductor/wire vertical/straight/parallel **(1)** Example of calculation $l = \frac{RA}{\rho}$ $l = \frac{2.7 \times 10^{-3}\ \Omega \times 1.5 \times 10^{-4}\ \text{m}^2}{1.7 \times 10^{-8}\ \Omega\ m}$ $l = 23.8$ m Height of statue = 23.8 – 1 = 22.8 m		**4**
(c)	**ANY ONE** The idea that the lightning is attracted to /strikes/hits the conductor **OR** Lightning takes shortest path (from cloud) /strikes highest point **OR** Action of points **(1)**		**1**

11

Question Number	Answer	Mark
14(a)	Use of resistors in parallel formula $R = 9.1\ \Omega$ **Example of answer** $1/R = 1/10 + 1/100$ $1/R = 11/100$ $R = 9.1\ \Omega$	**1** **1**
(b)	Voltmeter is connected in parallel (stated or implied) OR voltmeter draws little current Resistors in parallel formula with either R_v or large value used $1/R_v$ is very small / negligible OR calculated value of 9.1 Ω plus comment	**1** **1** **1**
	Total for question	**5**

12.

Question Number	Answer	Mark
16(a)(i)	Resistance at 20 °C = 1250 - 1300 (Ω)	**(1)**
(a)(ii)	Converts kΩ → Ω [look for 1000 (Ω)] Use of potential divider formula **OR** use of 2300 (Ω) to find current Reading on voltmeter = 2.6 - 2.7 V (ecf value from (a)(i)) <u>Example of calculation</u> V = (1000 Ω ÷ 2300 Ω) × 6 V V = 2.6 V	**(1)** **(1)** **(1)**
(b)	(decreasing temp causes) resistance of <u>thermistor</u> to increase Voltmeter reading decreases Candidates who think resistance will decrease leading to voltmeter increase can get 2nd mark.	**(1)** **(1)**
	Total for question	**6**

13.

Question Number	Answer	Mark
17 (a)	There must be a circuit with a power supply **and** a labelled wire/identifiable ends of a wire/wavy line/resistor/lamp in order to score any marks **ANY TWO** Ammeter symbol in series with wire (not in the middle of) Voltmeter symbol in parallel with wire Variable power supply/variable resistor	 (1) (1) (1) **(max 2)**
(b)	Use of $P = VI$ Rate of work = 4.5 W / J s^{-1}	(1) (1)
(c)(i)	Correct use of $I = nqvA$ with e = 1.6×10^{-19} C $v = 3.0 \times 10^{-5}$ ms^{-1} <u>Example of calculation</u> $v = 1.5/ (1.0 \times 10^{29} \times 1 .6 \times 10^{-19} \times 3.1 \times 10^{-6}$ $v = 3.02 \times 10^{-5}$ ms^{-1}	(1) (1)
(c)(ii)	Increased lattice/ions/atoms vibrations (causing) resistance to increase OR increased electron collisions with ions/atoms (This leads to a) reduction in the drift velocity / v	(1) (1) (1)
	Total for question	**9**

14.

Question Number	Answer	Mark
18(a)	Use of $V=IR$ V = 3.0 V	**1** **1**
(b)	pd across 30 Ω resistor = 6.0 V ecf their answer (a) I_2 = 6.0/30 = 0.20 A	**1** **1**
(c)	I_1 = 0.60 - 0.20 = 0.40 A R = 15 Ω full ecf their answer for I_2 and their V across 30 Ω	**1** **1**
	Total for question	**6**

15.

Need MS