Electric circuits

Mark Scheme 8

Level	IGCSE
Subject	Physics
ExamBoard	CIE
Topic	Electricity and Magnetism
Sub-Topic	Electric circuits
Paper Type	(Extended) Theory Paper
Booklet	Mark Scheme 8

Time Allowed: **90 minutes**

Score: /75

Percentage: /100

1 **(a** energy transferred per coulomb/<u>unit</u> charge
        OR energy supplied in driving coulomb/<u>unit</u> charge around a circuit
        ACCEPT p.d./voltage across battery/power supply   B1

   (b) (i) $V = IR$ in any form OR $(I =) V \div R$ C1

             2.0 A OR 2 A   A1

        (ii) electrons   B1

        (iii) arrow right to left by heater OR indication of clockwise   B1

   (c) $(E =) VIt$ OR V^2t/R OR I^2Rt in any form   C1

        14 000 J   A1

2 **(a (i)** NAND   B1

        (ii) output and one input correctly labelled   B1

   (b) rectangle with longitudinal line in middle third, no input or output wire required   B1

   (c) (i) temperature (decreases)   B1

        (ii) correctly relates change of resistance to change of temperature   B1
             voltage of mid-point (of potential divider)/left of LED increases OR higher V across
             thermistor   B1
             current flows through/enough V to light LED   B1

   (d) $1/R_p = 1/R_1 + 1/R_2$ or $(R_p) = R_1R_2/(R_1 + R_2)$ C
         $(R = 1/(1/4 -1/6) =)$ 12 Ω   A1

                                                                                                    [Total: 9]

3   **(a**   **(i)**   rectifier / diode

         (ii)   frequency (of A.C. supply)   B1

   (b) $(P =)\, IV$ **OR** 0.5×5.3 **OR** 500×5.3 C1
                2.6 W   **OR**   2600 mW

        (ii) $(E =)\, Pt$ **OR** IVt **OR** $2.65 \times 1.5 \times 3600$ **OR** $0.5 \times 5.3 \times 1.5 \times 3600$ C1
              14000 J   A1

   (c)   energy only underlined   B1

                                                               [Total: 7]

4   **(a)(i)(ii** $R \propto L$ in words or symbols

         (ii)   AND $R \propto 1/A$ in words or symbols   B1

  (b) $P = IV$ OR $(I =)\, P/V$ OR $60/230$
           0.26 A   A1

  (c)   length change divides resistance by 2 / multiplies current by 2   C1
       cross-section change multiplies resistance by 3 / divides current by 3   C1
       (overall) resistance of Y is 3/2 times bigger / 3/2 × 885 Ω / 1327 Ω
       OR current in Y 2/3 of 0.26 A = 0.17 A   C
       current in Y / Current in X = 2/3   A1

                                                               [Total: 7]

5 **(a** (one third length so) one third *R*, accept any division by 3   C1

        (half area so) twice *R*, accept any doubling, including divide by ½   C1

        (resistance = 0.45 × 2/3) = 0.3(0) Ω accept 1 sig. fig.   A1   [3]

  (b)   1(Ω) and 3(Ω) used in correct parallel formula   C1

            2(Ω) added to candidate's <u>parallel</u> resistance   C1

            2.7 or 2.8 or 2.75 Ω A1   [3]

   (ii) any 2 from:
           $I_1 = I_4$ OR $I_1 = I_2 + I_3$ OR $I_4 = I_2 + I_3$
           OR other correct relevant equation/inequality e.g. $I_4 = 4I_3$, $I_4 > I_3$ B2   [2]

  (iii) any 2 from:
           $V_1 = V_4$ OR $V_1 = V_2 + V_3$ OR $V_4 = V_2 + V_3$
           OR correct relevant inequality e.g. $V_1 > V_3$ B2   [2]

                                                                 [Total: 10]

6 **(a)** triangle with bar at apex, pointing either way   NOT circle at apex   B1   [1]
        condone:
        enclosing circle (but must have horizontal lines to/from triangle), no line through
        triangle, triangle filled in

    (b)   deflection/reasonable value/no deflection
                must be <u>consistent</u> with direction of recognisable arrow   B1   [1]
                if no recognisable direction in symbol of **(a)**, assume arrow L to R

        (ii) his **(i)** <u>different way round</u>
                i.e. if deflection in **(i)** must be no deflection in **(ii)**;
                if no deflection in **(i)** must be deflection in **(ii)**;   B1   [1]

    (c) half waves up or down on alternate half cycles   B1
        reasonable shapes of correct frequency AND amplitude 2.5–3V AND flats 0V
        (±1 small square)   B1   [2]

    (d) (i) transistor   B1   [1]

        (ii) 1st line of table : both off   B1
                2nd line of table : both on   B1   [2]
                give one compensatory mark : 1st line both on AND 2nd line both off
                accept HIGH/LOW or 1/0 for on/off   ignore ticks/crosses/yes/no

7 **(a)** rheostat/<u>variable</u> resistor AND control/vary/change/ limit
current /resistance/power/voltage <u>across heater</u>   B1

(b) $P = VI$ in any form OR ($I=$) P/V C1
1.25 A   A1

   (ii) ($R =$) V/I in any form words or numbers   C1
(voltage across X =) 2.4 (V) OR 6 - 3.6 (V)   C1
1.92 Ω   e.c.f. from **(b) (i)**   A1

(c) battery running down/going flat/energy <u>of battery</u> used up OR V or e.m.f. less
OR more/increasing resistance (of heater) NOT resistance of X increases   B1

(d) (transformer condone step-up OR potential divider/potentiometer NOT extras   B1

   (ii) diode OR rectifier OR L.E.D. NOT extras   B1   [9]

8 **(a** increases (as current increases)   M1
at an increasing rate   A1

(b)   25 Ω   B1

   (ii) IR in any form   OR   0.070 x 25   C1
1.7/1.8 V   A1

   (iii) ($P =$) IV OR I^2R OR V^2/R in any form, numbers, symbols or words   C1
0.12 W e.c.f. from **(i)/(ii)**   A1

(c)   answer to **(b)(ii)**   B1

   (ii) use of $1/R = 1/R_1 + 1/R_2$ OR $R = R_1R_2/(R_1 + R_2)$ C
12.5 Ω   A1

                                                                                    [Total: 10]

9 **(a)**		current = power/voltage or 150/12	**C1**	
		value is 12.5 A	**A1**	**2**
(b) (i)		sum of currents at junction = current after junction/12.5 A = 5.0 A + I	**C1**	
		value is 7.5 A	**A1**	
(ii)		power = VI or is 7.5 x 12 e.c.f from **(i)**	**C1**	
		value is 90 W	**A1**	
(iii)		resistance = voltage/current or 12/7.5 e.c.f. from **(i)** but not from **(a)**	**C1**	
		value is 1.6Ω	**A1**	**6**
			[8]	