# Digital electronics (extended candidates)

## Mark Scheme 4

| Level | IGCSE |
|---|---|
| Subject | Physics |
| ExamBoard | CIE |
| Topic | Electricity and Magnetism |
| Sub-Topic | Digital electronics (extended candidates) |
| Paper Type | (Extended) Theory Paper |
| Booklet | Mark Scheme 4 |

**Time Allowed:** 51 minutes

**Score:** /42

**Percentage:** /100

1   **(a)**     when temperature rises resistance falls   (or v.v.)         M1

               p.d. across it falls or equivalent        (or v.v.)         A1

               idea of causes transistor to switch on lamp (or lamp off)         A1   [3]

    **(b)**     change value of $R_1$/use variable res/swap $R_1$ with something        B1

               brief explanation in terms of potential divider         B1   [2]

    **(c)**     fire alarm/refrigerator fail light/other automatic lighting system         B1   [1]

                                                                                         **[Total: 6]**

2  **(a)**  **(i)**   low/0/off/no output         B1

       **(ii)**   low/0/off/no output         B1

   **(b)**  **(i)**   temp sensor to NOT gate input, correct symbol         B1
               output of NOT gate (condone incorrect symbol) and humidity
               sensor to AND inputs (condone labelled box for AND gate)         B1

       **(ii)**   NOT low in, high out         B1
               AND both inputs high, high output         B1
               Note: B0, B0 for states on wrong diagram.

                                                                                        **[Total: 6]**

| 3 | **(a)** | A – resistor | C – transistor | (–1 each incorrect) | B2 | [2] |

**(b)** C    B1    [1

**(c)** resistance of LDR low in light, high in dark    B1
increase of resistance/potential in circuit cause transistor to conduct ($V_{be} > 0.6$ V)    B1
switches lamp on    B1    [3]

**[Total: 6]**

| 4 | **(a) (i)** | to change a.c. to d.c. or rectify (a.c.) | B1 | |
| | **(ii)** | full sine wave at least 1.5 full waves | B1 | |
| | | half wave rectified at least two d.c. 'bumps' | B1 | **3** |
| | **(b)** | correct symbol | B1 | |
| | **(ii)** | when input high or 1, output low or 0 or off | B1 | |
| | | when input low or 0 or off, output high or 1 or on | B1 | **3** **[6]** |

| 5 | **(a)** | correct symbol | **B1** | |
| | | correct labels | **B1** | **[2]** |
| | **(b) (i)** | low, OFF or 0 | | |
| | **(ii)** | low, OFF or 0 need both correct | **B1** | **[1]** |
| | **(c)** | need 4 boxes correct for 2 marks, -1 for e.e.o.e. | **B2** | |
| | **(ii)** | no change | **B1** | **[3]** **Total [6]** |

6   (a)          Analogue, continuously increasing / decreasing
                 readings                                                    **B1**
                 Digital, readings increase / decrease by one unit           **B1**      **2**

    (b)   (i)    Transistors + other components such as resistors            **B1**
          (ii)   Standard symbol, must have labeled inputs and output        **B1**
          (iii)  Both inputs 0 (off), or either one input 0 (off), output 0
                 (off)                                                       **B1**
                 Both inputs 1 (on), output 1 (on)                           **B1**      **4**
                 OR correct truth table drawn (**C1**)
                 Some explanation of what truth table shows (**A1**)

                                                                                         **[6]**

7   (a)   (i)    switch, relay or amplifier                                  1

          (ii)   any one of the three versions below, each 2 marks

                 1.  vary base current                                       1
                     transistor switches on for $V_{be}$ >0.6 V              1

                 2.  small change in base current                           1
                     produces a large change in collector/emitter current   1

                 3.  vary potential divider connected to transistor base    1
                     transistor switches on for $V_{be}$ > 0.6 V             1          3

    (b)   (i)    standard symbol with 2 inputs and an output labelled        1

          (ii)   one or both inputs 1, output 1 (accept on, high for 1)      1
                 both inputs 0, output 0 (accept off, low for 0)             1          3
                                                                                        (6)