Version 1.0

**General Certificate of Secondary Education**
**June 2011**

# Electronics 44301

# (Specification 4430)

# Unit 1: Written Paper

# Final

# *Mark Scheme*

Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation events which all examiners participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for standardisation each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, examiners encounter unusual answers which have not been raised they are required to refer these to the Principal Examiner.

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**Question 1**

| | | | |
|---|---|---|---|
| 1 (a) | transformer✓ correct symbol✓<br>fuse✓ correct symbol✓<br>switch✓ correct symbol✓<br>rectifier/diode✓ correct symbol✓ | | **8** |
| 1 (b)(i) | isolates/reduces voltage✓ | | **1** |
| 1 (b)(ii) | blows when too much current flows✓ | | **1** |

**Question 2**

| | | | |
|---|---|---|---|
| 2 (a)(i) | light sensor✓ | | **1** |
| 2 (a)(ii) | lamp✓ | | **1** |
| 2 (a)(iii) | inverter✓ | | **1** |
| 2 (b)(i) | light sensor✓ | | **1** |
| 2 (b)(ii) | driver✓ | | **1** |
| 2 (b)(iii) | comparator✓ | | **1** |
| 2 (c) | driver✓ | | **1** |
| 2 (d) | comparator✓ | | **1** |
| 2 (e) | comparator switches low, inverter goes high✓<br>driver switches on the lamp✓ | | **2** |

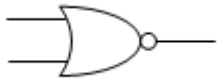
**Question 3**

| | | | |
|---|---|---|---|
| 3 (a)(i) | LED✓ | | **1** |

| | | | |
|---|---|---|---|
| 3 (a)(ii) | resistor✓ | | **1** |
| 3 (b) | to limit the flow of current✓ | | **1** |
| 3 (c)(i) | 9 – 2.2 = 6.8V✓ | | **1** |
| 3 (c)(ii) | 6.8 ÷ 0.02✓ = 340Ω✓ | | **2** |
| 3 (c)(iii) | 360Ω✓ | | **1** |
| 3 (c)(iv) | orange, blue✓ brown✓gold✓ | | **3** |

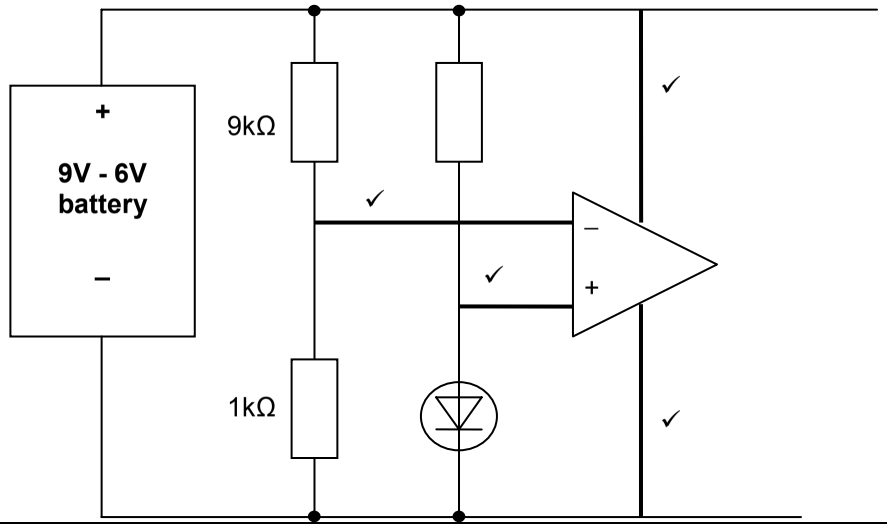
**Question 4**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 4 (a) | | **Comment** | **A** | **B** | **Q** | | **6** |
| | | Both sensors unblocked | 1✓ | 1✓ | 0✓ | | |
| | | Only sensor A blocked | 0 | 1 | 0 | | |
| | | Both sensors blocked | 0 | 0 | 1 | | |
| | | Only sensor B blocked | 1✓ | 0✓ | 0✓ | | |

| | | | |
|---|---|---|---|
| 4 (b) | NOR✓ | | **1** |
| 4 (c) |  <br>shape of symbol inc bubble✓ inputs, output labelled✓ | | **2** |
| 4 (d) | It would still detect the correct box position to print✓ | | **1** |

**Question 5**

| | | | |
|---|---|---|---|
| 5 (a) | op-amp✓ comparator✓ | | **2** |

| | | | |
|---|---|---|---|
| 5 (b) |  | | **4** |
| 5 (c) | 1 ÷ (1 + 9) × 6✓ = 0.6✓V✓ | | **3** |
| 5 (d) | 6V✓ | | **1** |

**Question 6**

| | | | |
|---|---|---|---|
| 6 (a) | Aerial✓ Rf tuned circuit✓ demodulator✓ af amplifier✓ loudspeaker✓ | | **5** |
| 6 (b)(i) | 20 Hz – 20 kHz ✓ | | **1** |
| 6 (b)(ii) | LM386✓ | | **1** |
| 6 (b)(iii) | 0.6 W✓ | | **1** |
| 6 (c) | range of frequencies✓ over which (any) gain is max/2 or max/√2 ✓ | | **2** |

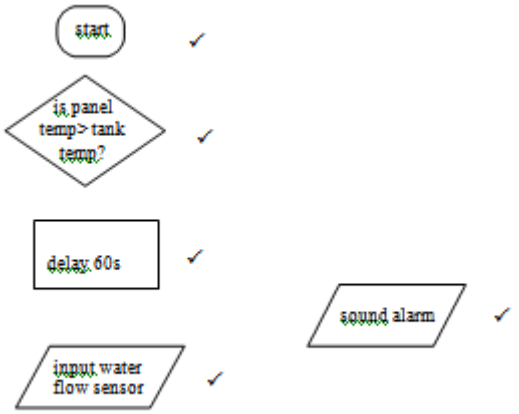
| | | | |
|---|---|---|---|
| 6 (d)(i) | amplitude✓ | | **1** |

| | | | |
|---|---|---|---|
| 6 (d)(ii) | audio signal (much lower f than modulated signal) ✓<br>correct phase relationship with input✓ | | **2** |

| | | | |
|---|---|---|---|
| 6 (e)(i) | the ability to select one frequency/station✓ and reject the others/from all the others✓ | | **2** |

| | | | |
|---|---|---|---|
| 6 (e)(ii) | the ability to detect✓ weak signals✓ | | **2** |

**Question 7**

| | | | |
|---|---|---|---|
| 7 (a) |  | | **5** |

| | | | |
|---|---|---|---|
| 7 (b) | decision box  ✓<br><br>input box  ✓<br><br>a loop is any line that returns to a point earlier in the flow chart✓<br><br>output box  ✓<br><br>process box  ✓ | | **5** |

| | | | |
|---|---|---|---|
| 7 (c)(i) | solar panel temp must be higher than tank temp✓ | | **1** |

| | | | |
|---|---|---|---|
| 7 (c)(ii) | 60s✓ | | **1** |

| | | | |
|---|---|---|---|
| 7 (c)(iii) | the delay loop✓ | | **1** |

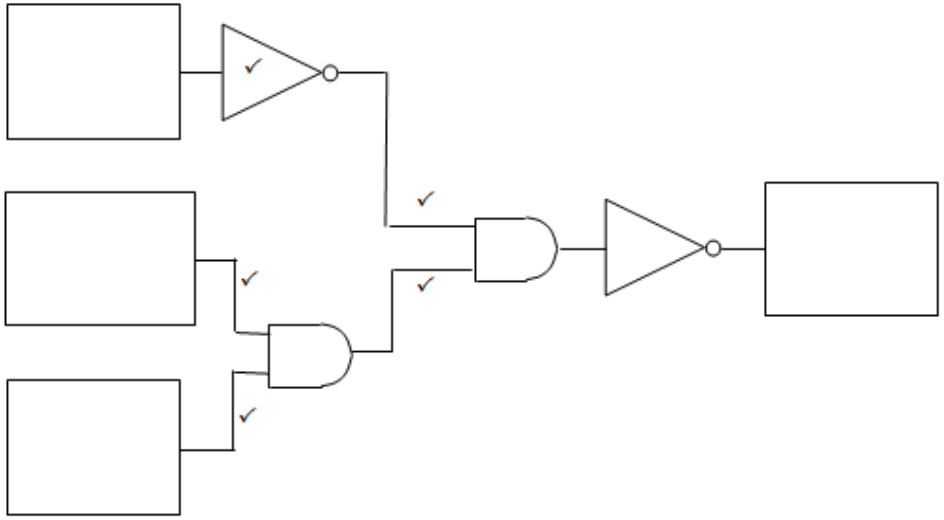
| | | | |
|---|---|---|---|
| 7 (d) | The marking scheme for this part of the question includes an assessment of the Quality of Written Communication (QWC). There are no discrete marks for the assessment of written communication but QWC will be one of the criteria used to assign the answer to an appropriate level below.<br><br>**Level Marks**<br>3 4-5<br>**Descriptor**<br>- an answer will be expected to meet most of the criteria in the level descriptor<br>- answer is full and detailed and is supported by an appropriate range of relevant points such as those given below<br>- argument is well structured with minimal repetition or irrelevant points<br>- accurate and clear expression of ideas with only minor errors in the use of technical terms, spelling, punctuation and grammar<br><br>**Level Marks**<br>2 2-3<br>**Descriptor**<br>- answer has some omissions but is generally supported by some of the relevant points below<br>- the argument shows some attempt at structure<br>- the ideas are expressed with reasonable clarity but with a few errors in the use of technical terms spelling, punctuation and grammar<br><br>**Level Marks**<br>1 0-1<br>**Descriptor**<br>- answer is largely incomplete, it may contain some valid points which are not clearly linked to an argument structure<br>- unstructured answer<br>- errors in the use of technical terms, spelling, punctuation and grammar or lack of fluency | | **5** |

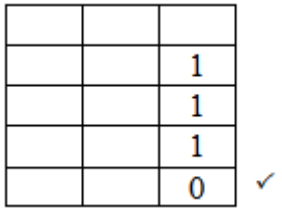
| | | | |
|---|---|---|---|
| | An example of the type of answer that may be produced would be:<br><br>The panel temperature is fed in to the system, as is the tank temperature.<br>Since the panel temperature is highest, the pump is switched on.<br>After the 60s delay the water flow sensor is monitored and water is found to be flowing.<br>The system loops back the first time and goes through the cycle again.<br>The system loops back for the second time and water is not flowing.<br>The alarm is sounded and the pump is switched off. ✓✓✓✓✓ | | |

| | | | |
|---|---|---|---|
| 7 (e)(i) | After the "is water flowing" YES decision box, in the loop✓ | | **1** |

| | | | |
|---|---|---|---|
| 7 (e)(ii) | After the "is water flowing" NO decision box, before end✓ | | **1** |

**Question 8**

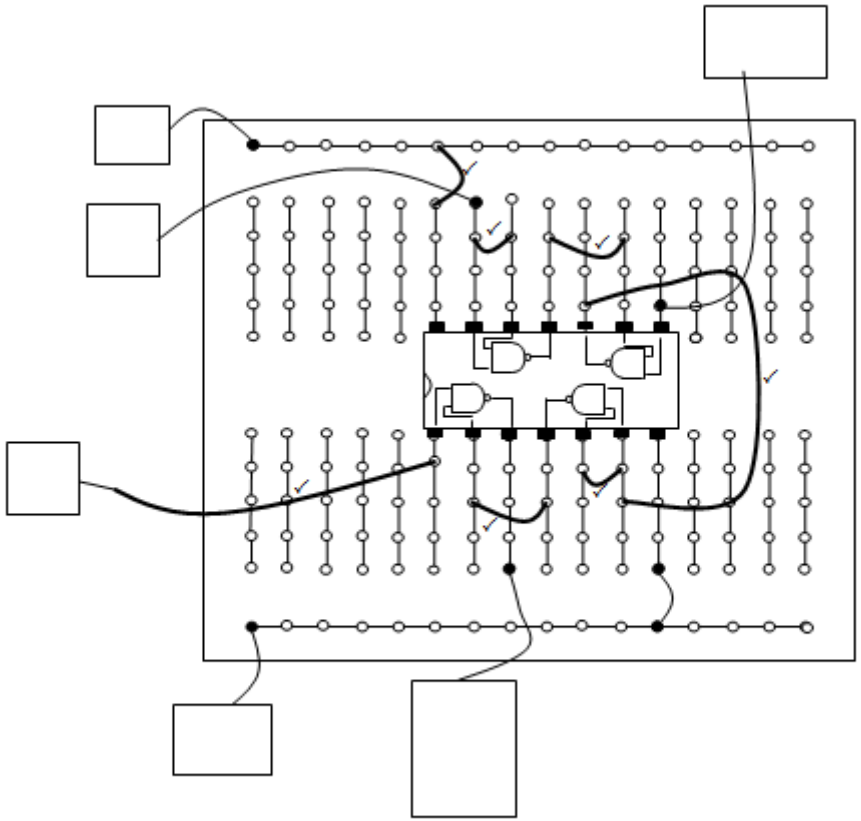
| | | | |
|---|---|---|---|
| 8 (a) |  | | **5** |

| | | | |
|---|---|---|---|
| 8 (b)(i) |  ✓ | | **1** |

| | | | |
|---|---|---|---|
| 8 (b)(ii) | | | **4** |

| | | | W | X | Y | Z |
|---|---|---|---|---|---|---|
| | | | 1 | 1 | 0 | 1 |
| | | | 1 | 1 | 0 | 1 |
| | | | 1 | 0 | 1 | 1 |
| | | | 1 | 0 | 1 | 0 |
| | | | 0 | 1 | 0 | 1 |
| | | | 0 | 1 | 0 | 1 |
| | | | 0 | 1 | 0 | 1 |
| | | | 0 | 1 | 0 | 1 |

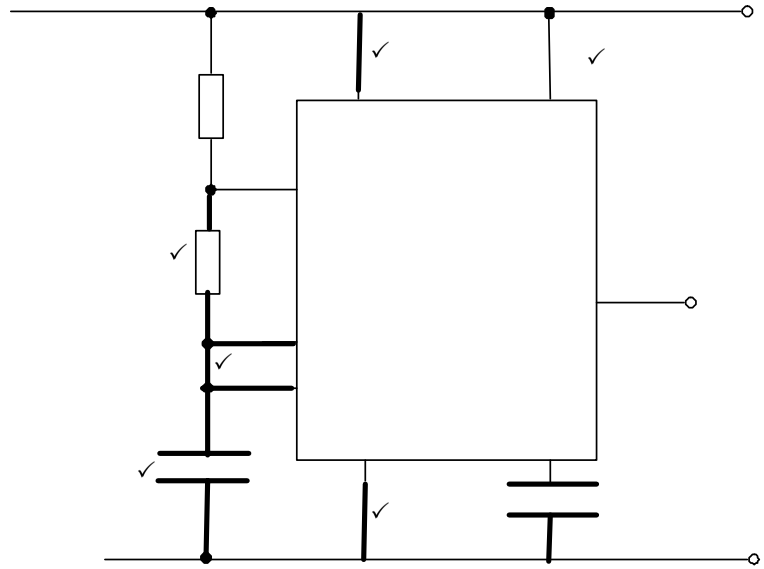
✓ ✓ ✓ ✓

| | | | |
|---|---|---|---|
| 8 (c) |  | | **7** |

**Question 9**

| | | | |
|---|---|---|---|
| 9 (a)(i) | correct symbol ammeter ✓ correct symbol voltmeter ✓ | | **2** |
| 9 (a)(ii) | ammeter in series ✓ voltmeter in parallel ✓ with resistor only ✓ | | **3** |
| 9 (a)(iii) | 0.1 A ✓ | | **1** |
| 9 (a)(iv) | P= VI✓ = 0.68 W✓ | | **2** |
| 9 (b)(i) | oscilloscope ✓ | | **1** |
| 9 (b)(ii) | 3 × 2 = 6V✓✓<br>one mark for value and one for correct units | | **2** |
| 9 (b)(iii) | 2 × 5 = 10 ms✓✓<br>one mark for value and one for correct units | | **2** |
| 9 (b)(iv) | f=1/T✓ = 100Hz✓<br>one mark for value and one for correct units | | **2** |
| 9 (c)(i) | D to barQ✓<br>CK labelled input✓<br>Q (or barQ) labelled output✓ | | **3** |
| 9 (c)(ii) | high for 2 div✓ low for 2 div✓ | | **2** |

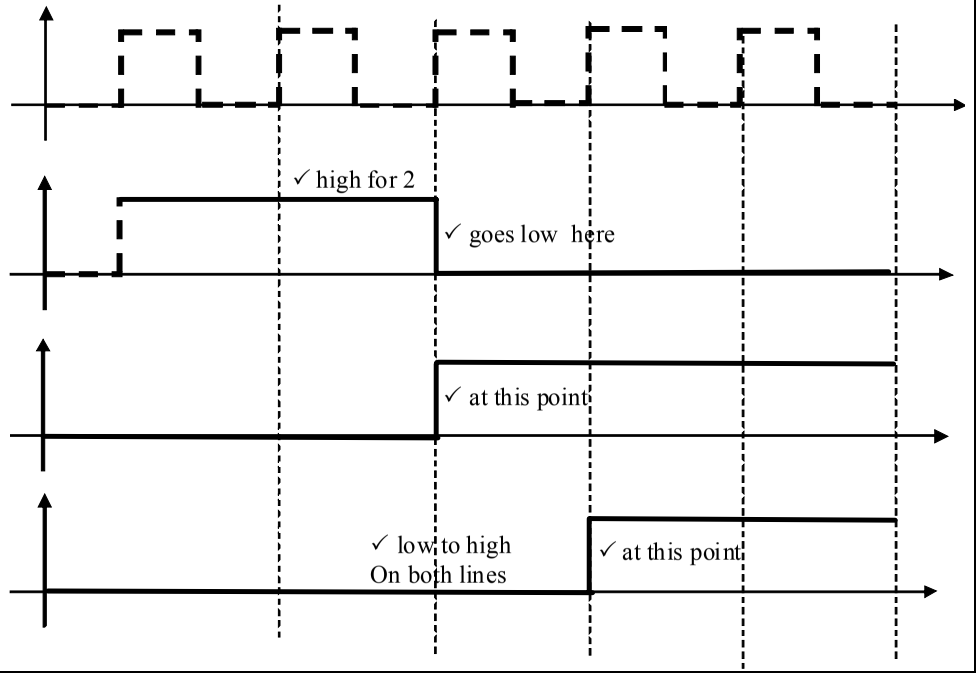
**Question 10**

| | | | |
|---|---|---|---|
| 10 (a)(i) |  | | **6** |

| | | | |
|---|---|---|---|
| 10 (a)(ii) | $T = (R_1 + 2R_2)C/1.4 = (10 \times 10^3 + 2 \times 100 \times 10^3) \times 100 \times 10^{-6} / 1.4$ ✓✓<br>$= 15$ s✓ | | **3** |

| | | | |
|---|---|---|---|
| 10 (b)(i) | 30s | | **1** |

| | | | |
|---|---|---|---|
| 10 (b)(ii) | 15s | | **1** |

| | | | |
|---|---|---|---|
| 10 (b)(iii) |  | | **5** |

| | | | |
|---|---|---|---|
| 10 (c)(i) | Position ✓ symbol ✓ labels✓ | | **3** |

| | | | |
|---|---|---|---|
| 10 (c)(ii) | correct position✓ correct orientation✓ | | **2** |

| | | | |
|---|---|---|---|
| 10 (d) | An example of the type of answer that may be produced would be:<br>Nowadays it is often cheaper to build a circuit using microcontrollers than separate integrated circuits. They are more versatile and can be used in many different appliances. If a microcontroller was used for this application then the time intervals and other functions of the circuit could be changed using software instead of having to unsolder components. They are usually more reliable because fewer components are needed and technicians do not need as many skills in order to use them. | | **5** |

UMS conversion calculator: www.aqa.org.uk/umsconversion