<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
<th>Mark</th>
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<tbody>
<tr>
<td>1(a)(i)</td>
<td>Light emitting diode OR LED</td>
<td>B1</td>
</tr>
<tr>
<td>(a)(ii)</td>
<td><img src="image" alt="Diode OR LED" /></td>
<td>B1</td>
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<tr>
<td>(b)</td>
<td>column C</td>
<td>column E</td>
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<td>(c)</td>
<td>Replace the OR gate with an AND gate</td>
<td>B1</td>
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<td>Total: 6</td>
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</tbody>
</table>
2  (a)  AND (gate)  

(b)  

\[
\begin{array}{ccc}
0 & 0 & 1 \\
1 & 0 & 0 \\
0 & 1 & 0 \\
1 & 1 & 0 \\
\end{array}
\]

(c)  

\[
\begin{array}{ccc}
A & B & F \\
1 & 1 & \\
\end{array}
\]

[Total: 6]

3  (a)  output of A: 1, 1, 0, 0 c.a.o.  
output of B: 0, 1, 0, 0 e.c.f. from candidate’s output of A  

(b)  dark AND hot owtte  
note: must be consistent with answer to (a)  

(c)  B cannot provide enough power / current for lamp, or equivalent  
OR allows remote lamp  
note: statement of function of a relay without reference to context gains 1 mark  

[1] [1] [1] [2]
4. (a) (i) OR (gate)  
   (ii) 1 input and 1 output labelled with words  
   (iii) correct symbol

(b) (i) needle not deflected  
   (ii) needle not deflected  
   (iii) needle deflected either way  

[Total: 6]

5. (a) (i) NAND  
   (ii) output and one input correctly labelled

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

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

(d) \( 1/R_p = 1/R_1 + 1/R_2 \) or \( (R_p) = R_1R_2/(R_1 + R_2) \)  
   \( (R = 1/(1/4 -1/6) = 12 \, \Omega) \)

[Total: 9]
6 (a) row 1 0 0 accept low/off  
row 2 0 1 accept low/off and high/on  
row 3 1 1 accept high/on  

(b) 2 wires to flat (input) side, 1 wire from curved (output) side  
do not accept pointed curved side or small circle  

(c) NOT gate connected to output of AND gate  
accept labelled boxes for gates  
do not allow any extra gates or inputs  
NOT gate correct way round  

[Total: 6]

7 (a) in order downwards: 1 1 1 0 c.a.o.  

(b) 1 AND 0 (e.c.f. from (b)(i))  
(ii) NOT (gate) (allow NOR (gate))  

(c) R = 1 AND S = 0 (e.c.f. from (b)(i))  
T = 1  

[Total: 6]
8 (a) (i) AND gate

(ii) correct symbol must have 2 inputs, 1 output concave input side, somewhat pointed on output side with small circle

(b) (i) HIGH/1

(ii) HIGH/1

(c) transistor circled

B1 [2]

B [2]

B1 [1]

[Total: 5]