Resisting

1  True or false? Put T or F in the boxes.  
A filament bulb is an ohmic conductor.  
Increasing the resistance in a circuit increases the current flowing through it.  
Increasing the value of the resistance of a variable resistor reduces the speed of a motor in the circuit.  
An ohmic resistor produces a straight line graph of voltage against current.  

2  Sketch the shape of an ohmic resistor and a filament bulb on the graphs below:  

3  Complete the table below by calculating the unknown value  

<table>
<thead>
<tr>
<th>Voltage (V)</th>
<th>Current (A)</th>
<th>Resistance (Ω)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>20</td>
<td>5</td>
</tr>
<tr>
<td>12</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td></td>
<td>48</td>
</tr>
</tbody>
</table>

4  Complete the paragraph using the words below  
length  thickness  electrons  protons  resistance  current  
The resistance in a variable resistor is altered by changing the _____ of the wire. The gradient of a voltage/current graph of a filament bulb varies as the _____ changes.  
Increasing the _____ causes the resistance of the bulb to increase as the increasing temperature causes more collisions between the _____ flowing through the wire and the fixed nuclei.
Dividing the voltage

1 Complete the following crossword. [F/H]

1 Two resistors in series will _____________ the voltage between them.
2 The first word in the initials pd – the scientific name for voltage.
3 The name given to a resistor whose value can change.
4 A resistor whose resistance depends on its temperature.
5 The longer the length of wire the greater is its ____________.
6 An LDR’s resistance depends on the amount of __________ present.
7 To have a constant output in a potential divider then the resistors must have a __________ value.

2 True or false? Put T or F in the boxes. [F/H]

Two resistors in series in a circuit can be used as a potential divider. T
As the temperature increases the resistance of a thermistor (ntc) also increases. T
Potential divider circuits with LDRs and thermistors can be used as sensors. T
If one of the resistors in a potential divider is variable then the output is fixed. T

3 Fill in the gaps. [H]

An LDR can be used in a _______ divider circuit to provide an _______ signal that depends on the _______ conditions. If the amount of _______ goes up then the resistance of the LDR goes _______ and the _______ across it goes _______.

4 Calculate the output pd in the potential divider circuit below: answer = __ [H]
It’s logical

1. Complete the truth table for an AND gate. [F/H]

<table>
<thead>
<tr>
<th>Input A</th>
<th>Input B</th>
<th>Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

2. True or false? Put T or F in the boxes. [F/H]

An LDR gives a high output in the dark.  
A microphone gives a high signal when there is silence.  
A thermister gives a low output when it is cold.  
A moisture sensor gives a high output when it is wet.

3. Complete the following truth table for a NOR gate [H]

<table>
<thead>
<tr>
<th>Input A</th>
<th>Input B</th>
<th>Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

4. Complete the paragraph using the words below. [H]

light  higher  decrease  resistor  temperature  potential  variable  lower  
An LDR can be used with a fixed resistor in a ________ divider circuit to generate a signal for a logic gate depending on the _____ level. If a circuit is switching when it is still light the fixed resistor can be replaced with a _______ one. Increasing the resistance of the variable resistor will _______ the voltage across the LDR. This means that the resistance of the LDR will have to be _____ before the voltage is high enough to switch on the light.
Logic circuits

1. Complete the truth table for the following logic circuit: [F/H]

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>X</th>
<th>Y</th>
<th>O</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

2. Put T or F for true or false in the boxes. [F/H]

   - The output of a NOT gate is always opposite to its input. [ ]
   - If a logic system has three separate inputs then it has eight possible input levels. [ ]
   - An LED is often used an input for a logic gate. [ ]
   - A relay uses a large current to switch on a small current. [ ]
   - A latch can be used to keep an alarm on once it has been triggered. [ ]

3. Which of the following explains why a resistor is placed in series with an LED when the LED is being used as an indicator for an output of a logic circuit? [H]

   (a) The output from the logic gate is too small for the LED.
   (b) The resistor protects the LED from burning out when the output is 5 V.
   (c) The resistor shares the current with the LED.

4. Draw the electrical symbol for a relay. [F]
**Motoring**

1. Solve the clues across. The shaded column is a word for a device that transfers electrical energy into kinetic energy. [F/H]

   1. 
   2. 
   3. 
   4. 
   5. 

1. Increasing the strength of this speeds up a motor.
2. The wire wrapped around the rotor is called a _______
3. Changing the direction of this makes a motor turn in the opposite direction.
4. All devices with a motor tend to do this.
5. The angle at which a current-carrying wire experiences a force when passing through a magnetic field.

2. Fill in the gaps using words from the list. Choose different words from the list. [F/H]
   
   current direction magnetic coil speed size field

   When a _______ flows through the coil of wire in a motor the _______ field produces a turning effect. The _______ of the motor depends upon the strength of the _______, the _______ of the current and the number of turns on the _______. The direction of rotation can be changed by altering the _______ of the current or the magnetic field.

3. Highlight or circle the three errors in the following paragraph and then correct them [H]
   
   The direction of the force on a coil in an AC electric motor is maintained by a change in current direction every turn. This is done using split ring commutators. Practical motors have a radial field produced by flat pole pieces.
Generating electricity

1. At what frequency is mains electricity supplied in the UK? __ Hz [F]

2. Complete the following crossword. [F/H]

```
   1    2    3    4    5    6    7    8
1   The type of magnet used in a power station generator.
2   What type of generator is a motor (with a commutator) working in reverse?
3   The number of these affects the size of the voltage generated.
4   This is generated when a wire is moved near a magnet.
5   This happens to the direction of the current in a DC generator when the poles of a magnet are swapped around.
6   This is increased when the speed of rotation of a generator is increased.
7   What do the coils do in a generator?
8   The opposite of direct in electricity.
```

3. Fill in the gaps using words from the list. [F/H]

wire fast reversed rotates dynamo alternating

The ______ effect is the name given when a magnet is moved near a ______. If the magnet is turned round then the voltage is ______. This can also be seen when a magnet ______ inside a coil of wire, in this case the voltage is said to be ______ and the size of the induced voltage depends on how ______ the magnet turns.

4. Underline the correct answer to explain the purpose of the slip rings and brushes in an AC generator: [H]

To provide a continuous circuit.
To reverse the connections every half turn.
Transforming

1 Solve the clues

<p>| | | | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1 The type of current produced by transformers.
2 The part of a transformer wrapped around the core.
3 This increases in a step-down transformer.
4 The units of the property that is increased in a step-up transformer.
5 A step-_____ transformer is used before power is sent along the grid.
6 The loss of this is related to the square of the current flowing through transmission lines.
7 There are an equal number of these on both sides of an isolating transformer.
8 A step-____ transformer increases current and decreases voltage.

2 Fill in the gaps using words from the list. Choose four different words from the list.

All transformers work due to a changing _________ in the primary coil inducing an output _________ in the secondary coil. An _________ transformer has an equal number of _________ on both coils. These are used to limit the risk of contact between _________ parts and the earth lead.
Rectification and capacitors

1 Complete the following crossword. [F/H]

The highlighted word is what is happening to a capacitor when the pd across it is increasing.

1 The type of current that flows in one direction only.
2 A single diode produces this type of rectification.
3 This device stores electric charge.
4 How many diodes are required for full-wave rectification?
5 The flow of this produces an electric current.
6 This is the process used to change an alternating current into a direct current.
7 The output becomes more _____ when a capacitor is used to smooth a rectified voltage.
8 The name given to the circuit that produces full-wave rectification.

2 Draw or sketch the following: [F]

(a) The electrical symbol for a diode.
(b) The electrical symbol for a capacitor.
(c) A voltage–time graph showing half-wave rectification.
(d) A voltage–time graph showing full-wave rectification.

3 The following paragraph contains nine mistakes. Underline and number the mistakes and then put the correct answer on the lines below. [H]

A silicon diode has a high resistance in the forward direction and a low resistance in the reverse direction. This allows an electric current to flow in both directions. The diode is particularly useful in rectifying a DC current. A tunnel circuit of four diodes can be used to produce half-wave rectification, in this circuit the diodes are arranged so that the current flows both ways through a load resistor. A capacitor can be used to store current and this can then be used to reverse the rectified voltage.

1 ________ 2 ________ 3 ________ 4 ________ 5 ________ 6 ________ 7 ________ 8 ________ 9 ________
It’s logical

1. Complete the truth table for an AND gate. [F/H]

<table>
<thead>
<tr>
<th>Input A</th>
<th>Input B</th>
<th>Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

2. True or false? Put T or F in the boxes. [F/H]
   - An LDR gives a high output in the dark.  
   - A microphone gives a high signal when there is silence.  
   - A thermistor gives a low output when it is cold.  
   - A moisture sensor gives a high output when it is wet.  

3. Complete the following truth table for a NOR gate [H]

<table>
<thead>
<tr>
<th>Input A</th>
<th>Input B</th>
<th>Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

4. Complete the paragraph using the words below. [H]

light higher decrease resistor temperature potential variable lower

An LDR can be used with a fixed resistor in a _______ divider circuit to generate a signal for a logic gate depending on the _____ level. If a circuit is switching when it is still light the fixed resistor can be replaced with a _______ one. Increasing the resistance of the variable resistor will _______ the voltage across the LDR. This means that the resistance of the LDR will have to be _______ before the voltage is high enough to switch on the light.
Logic circuits

1. Complete the truth table for the following logic circuit:  

   \[A \quad B \quad C \quad X \quad Y \quad O\]
   
<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>X</th>
<th>Y</th>
<th>O</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

2. Put T or F for true or false in the boxes.  

   The output of a NOT gate is always opposite to its input. \[\square\]
   If a logic system has three separate inputs then it has eight possible input levels. \[\square\]
   An LED is often used an input for a logic gate. \[\square\]
   A relay uses a large current to switch on a small current \[\square\]
   A latch can be used to keep an alarm on once it has been triggered \[\square\]

3. Which of the following explains why a resistor is placed in series with an LED when the LED is being used as an indicator for an output of a logic circuit?  

   (a) The output from the logic gate is too small for the LED. \[\square\]
   (b) The resistor protects the LED from burning out when the output is 5 V. \[\square\]
   (c) The resistor shares the current with the LED. \[\square\]

4. Draw the electrical symbol for a relay. \[\square\]
Resisting

1. True or false? Put T or F in the boxes. [F/H]
   - A filament bulb is an ohmic conductor. F
   - Increasing the resistance in a circuit increases the current flowing through it. F
   - Increasing the value of the resistance of a variable resistor reduces the speed of a motor in the circuit. T
   - An ohmic resistor produces a straight line graph of voltage against current. T

2. Sketch the shape of an ohmic resistor and a filament bulb on the graphs below: [F/H]
   - An ohmic resistor
   - A filament bulb

3. Complete the table below by calculating the unknown value. [H]
   - | Voltage (V) | Current (A) | Resistance (Ω) |
     | 100        | 20          | 5             |
     | 12         | 3           | 4             |
     | 24         | 0.5         | 48            |

4. Complete the paragraph using the words below. [H]
   - length, thickness, electrons, protons, resistance, current
   - The resistance in a variable resistor is altered by changing the length of the wire. The gradient of a voltage/current graph of a filament bulb varies as the resistance changes.
   - Increasing the current causes the resistance of the bulb to increase as the increasing temperature causes more collisions between the electrons flowing through the wire and the fixed nuclei.
**Dividing the voltage**

1. Complete the following crossword.  

   |   |   | DIVIDE |   | POTENTIAL |
   |   | VARIABLE |   | THERMISTOR |   | RESISTANCE |
   |   |   | VARIABLE |   |   | LIGHT |

1. Two resistors in series will ____________ the voltage between them.
2. The first word in the initials pd – the scientific name for voltage.
3. The name given to a resistor whose value can change.
4. A resistor whose resistance depends on its temperature.
5. The longer the length of wire the greater is its ____________.
6. An LDR’s resistance depends on the amount of _________ present.
7. To have a constant output in a potential divider then the resistors must have a _________ value.

2. True or false? Put T or F in the boxes.

   Two resistors in series in a circuit can be used as a potential divider.  
   [T/F]

   As the temperature increases the resistance of a thermistor (ntc) also increases.  
   [T/F]

   Potential divider circuits with LDRs and thermistors can be used as sensors.  
   [T/F]

   If one of the resistors in a potential divider is variable then the output is fixed.  
   [T/F]

3. Fill in the gaps.

   An LDR can be used in a potential divider circuit to provide an output signal that depends on the light conditions. If the amount of light goes up then the resistance of the LDR goes down and the voltage across it goes down.

4. Calculate the output pd in the potential divider circuit below: answer = 8 V
**It’s logical**

1. Complete the truth table for an AND gate.  

<table>
<thead>
<tr>
<th>Input A</th>
<th>Input B</th>
<th>Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

2. True or false? Put T or F in the boxes.  

- An LDR gives a high output in the dark.  
  - F  
- A microphone gives a high signal when there is silence.  
  - F  
- A thermister gives a low output when it is cold.  
  - T  
- A moisture sensor gives a high output when it is wet.  
  - T

3. Complete the following truth table for a NOR gate  

<table>
<thead>
<tr>
<th>Input A</th>
<th>Input B</th>
<th>Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

4. Complete the paragraph using the words below.  

light higher decrease resistor temperature potential variable lower  

An LDR can be used with a fixed resistor in a potential divider circuit to generate a signal for a logic gate depending on the light level. If a circuit is switching when it is still light the fixed resistor can be replaced with a variable one. Increasing the resistance of the variable resistor will decrease the voltage across the LDR. This means that the resistance of the LDR will have to be higher before the voltage is high enough to switch on the light.
Logic circuits

1. Complete the truth table for the following logic circuit: [F/H]

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>X</th>
<th>Y</th>
<th>O</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

2. Put T or F for true or false in the boxes. [F/H]

   The output of a NOT gate is always opposite to its input. **T**
   
   If a logic system has three separate inputs then it has eight possible input levels. **T**
   
   An LED is often used as an input for a logic gate. **F**
   
   A relay uses a large current to switch on a small current. **F**
   
   A latch can be used to keep an alarm on once it has been triggered. **T**

3. Which of the following explains why a resistor is placed in series with an LED when the LED is being used as an indicator for an output of a logic circuit? [H]

   (a) The output from the logic gate is too small for the LED.
   (b) **The resistor protects the LED from burning out when the output is 5 V.**
   (c) The resistor shares the current with the LED.

4. Draw the electrical symbol for a relay. [F]
Motoring

1 Solve the clues across. The shaded column is a word for a device that transfers electrical energy into kinetic energy. [F/H]

1 M A G N E T
2 C O I L
3 C U R R E N T
4 R O T A T E
5 R I G H T

1 Increasing the strength of this speeds up a motor.
2 The wire wrapped around the rotor is called a ________
3 Changing the direction of this makes a motor turn in the opposite direction.
4 All devices with a motor tend to do this.
5 The angle at which a current-carrying wire experiences a force when passing through a magnetic field.

2 Fill in the gaps using words from the list. Choose different words from the list. [F/H]
current direction magnetic coil speed size field

When a current flows through the coil of wire in a motor the magnetic field produces a turning effect. The speed of the motor depends upon the strength of the field, the size of the current and the number of turns on the coil. The direction of rotation can be changed by altering the direction of the current or the magnetic field.

3 Highlight or circle the three errors in the following paragraph and then correct them [H]
The direction of the force on a coil in an AC electric motor is maintained by a change in current direction every turn. This is done using split ring commutators. Practical motors have a radial field produced by flat pole pieces.

DC half turn curved
Generating electricity

1. At what frequency is mains electricity supplied in the UK? 50 Hz [F]

2. Complete the following crossword. [F/H]

   1. ELECTROMAGNET
   2. DIRECT
   3. TURNS
   4. ELECTRICITY
   5. REVERSED
   6. VOLTAGE
   7. ROTATE
   8. ALTERNATING

   1. The type of magnet used in a power station generator.
   2. What type of generator is a motor (with a commutator) working in reverse?
   3. The number of these affects the size of the voltage generated.
   4. This is generated when a wire is moved near a magnet.
   5. This happens to the direction of the current in a DC generator when the poles of a magnet are swapped around.
   6. This is increased when the speed of rotation of a generator is increased.
   7. What do the coils do in a generator?
   8. The opposite of direct in electricity.

3. Fill in the gaps using words from the list. [F/H]
   wire fast reversed rotates dynamo alternating

   The dynamo effect is the name given when a magnet is moved near a wire. If the magnet is turned round then the voltage is reversed. This can also be seen when a magnet rotates inside a coil of wire, in this case the voltage is said to be alternating and the size of the induced voltage depends on how fast the magnet turns.

4. Underline the correct answer to explain the purpose of the slip rings and brushes in an AC generator: [H]

   To provide a continuous circuit.

   To reverse the connections every half turn.
# Transforming

1. Solve the clues  

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>T</td>
<td>C</td>
<td>V</td>
<td>O</td>
<td>L</td>
<td>T</td>
<td>S</td>
</tr>
<tr>
<td>E</td>
<td>U</td>
<td>P</td>
<td>C</td>
<td>E</td>
<td>5</td>
<td>U</td>
<td>P</td>
</tr>
<tr>
<td>P</td>
<td>O</td>
<td>W</td>
<td>E</td>
<td>R</td>
<td>R</td>
<td>I</td>
<td>N</td>
</tr>
<tr>
<td>L</td>
<td>A</td>
<td>E</td>
<td>L</td>
<td>A</td>
<td>E</td>
<td>T</td>
<td>N</td>
</tr>
</tbody>
</table>

[F/H]

1. The type of current produced by transformers.
2. The part of a transformer wrapped around the core.
3. This increases in a step-down transformer.
4. The units of the property that is increased in a step-up transformer.
5. A step-____ transformer is used before power is sent along the grid.
6. The loss of this is related to the square of the current flowing through transmission lines.
7. There are an equal number of these on both sides of an isolating transformer.
8. A step-____ transformer increases current and decreases voltage.

2. Fill in the gaps using words from the list. Choose four different words from the list.

- turns
- live
- magnetic field
- voltage
- isolating

All transformers work due to a changing **magnetic field** in the primary coil inducing an output **voltage** in the secondary coil. An **isolating** transformer has an equal number of **turns** on both coils. These are used to limit the risk of contact between **live** parts and the earth lead.
Rectification and capacitors

1 Complete the following crossword. [F/H]

The highlighted word is what is happening to a capacitor when the pd across it is increasing.

```
  1  D  I  R  E  C  T
  2  H  A  L  F  W  A  V  E
  3  C  A  P  A  C  I  T  O  R
  4  F  O  U  R
  5  C  H  A  R  G  E
  6  R  E  C  T  I  F  I  C  A  T  I  O  N
  7  C  O  N  S  T  A  N  T
  8  B  R  I  D  G  E
```

1 The type of current that flows in one direction only.
2 A single diode produces this type of rectification.
3 This device stores electric charge.
4 How many diodes are required for full-wave rectification?
5 The flow of this produces an electric current.
6 This is the process used to change an alternating current into a direct current.
9 The output becomes more _____ when a capacitor is used to smooth a rectified voltage.
10 The name given to the circuit that produces full-wave rectification.

2 Draw or sketch the following: [F]

```
a)  
c)  
```

3 The following paragraph contains nine mistakes. Underline and number the mistakes and then put the correct answer on the lines below. [H]

A silicon diode has a high (1) resistance in the forward direction and a low (2) resistance in the reverse direction. This allows an electric current to flow in both (3) directions.

The diode is particularly useful in rectifying a DC (4) current. A tunnel (5) circuit of four diodes can be used to produce half (6) - wave rectification, in this circuit the diodes are arranged so that the current flows both (7) ways through a load resistor. A capacitor can be used to store current (8) and this can then be used to reverse (9) the rectified voltage.

1 low  2 high  3 one  4 AC  5 bridge  6 full  7 one
8 charge  9 smooth  (1 and 2 could have ‘forward’ and ‘reverse’ changed instead)
**It’s logical**

1. Complete the truth table for an AND gate.

<table>
<thead>
<tr>
<th>Input A</th>
<th>Input B</th>
<th>Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

2. True or false? Put T or F in the boxes.

An LDR gives a high output in the dark. **F**

A microphone gives a high signal when there is silence. **F**

A thermister gives a low output when it is cold. **T**

A moisture sensor gives a high output when it is wet. **T**

3. Complete the following truth table for a NOR gate

<table>
<thead>
<tr>
<th>Input A</th>
<th>Input B</th>
<th>Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

4. Complete the paragraph using the words below.

light higher decrease resistor temperature potential variable lower

An LDR can be used with a fixed resistor in a **potential** divider circuit to generate a signal for a logic gate depending on the **light** level. If a circuit is switching when it is still light the fixed resistor can be replaced with a **variable** one. Increasing the resistance of the variable resistor will **decrease** the voltage across the LDR. This means that the resistance of the LDR will have to be **higher** before the voltage is high enough to switch on the light.
Logic circuits

1. Complete the truth table for the following logic circuit: [F/H]

```
<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>X</th>
<th>Y</th>
<th>O</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>
```

2. Put T or F for true or false in the boxes. [F/H]

- The output of a NOT gate is always opposite to its input. T
- If a logic system has three separate inputs then it has eight possible input levels. T
- An LED is often used as an input for a logic gate. F
- A relay uses a large current to switch on a small current. F
- A latch can be used to keep an alarm on once it has been triggered. T

3. Which of the following explains why a resistor is placed in series with an LED when the LED is being used as an indicator for an output of a logic circuit?
(a) The output from the logic gate is too small for the LED.
(b) The resistor protects the LED from burning out when the output is 5 V.
(c) The resistor shares the current with the LED. [H]

4. Draw the electrical symbol for a relay. [F]