Capacitors are components that store electrical energy. They are found in most electrical circuits and appliances, such as computers, radios and camera flashes.

Before you start, think about...

1. What all the switches do
2. Is it hard or easy to turn the handle?
3. Is it always the same— if not, why not?
4. Can you store energy in the capacitor for later use?

Experiment 1
1. Turn all the switches off. Now turn the generator handle and switch on one light bulb. Next switch on two, then three light bulbs.

Can you feel a difference? How do you know that you are using energy to light the bulbs?

More light bulbs makes it harder to turn the handle. More energy is needed to light the bulbs more energy is required to turn the handle.

Experiment 2
2a) Switch the capacitor on and all the light bulbs off.

Now charge the capacitor by turning the generator handle until the voltmeter reads 4V.

Switch on one bulb and measure how long it remains lit.

Record in the table below.

Repeat this process using two and three bulbs.

<table>
<thead>
<tr>
<th>Time (s)</th>
<th>1 Bulb</th>
<th>2 Bulbs</th>
<th>3 Bulbs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>approx. 30s</td>
<td>approx. 15s</td>
<td>approx. 10s</td>
</tr>
</tbody>
</table>

b) The energy stored in the capacitor is the same each time we charge it to 4V. Why do the timings change when we use different numbers of light bulbs?

More light bulbs require more energy, so the stored energy is used more quickly.
Experiment 3

3 a) Charge up the capacitor to 2V. Switch on all three bulbs at once and time how long they stay lit. Repeat for 4V, 6V ... up to 12V.

<table>
<thead>
<tr>
<th>Starting voltage (V)</th>
<th>Time 3 bulbs stay lit (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>approx. 0s</td>
</tr>
<tr>
<td>4</td>
<td>approx. 10s</td>
</tr>
<tr>
<td>6</td>
<td>approx. 18s</td>
</tr>
<tr>
<td>8</td>
<td>approx. 24s</td>
</tr>
<tr>
<td>10</td>
<td>approx. 30s</td>
</tr>
<tr>
<td>12</td>
<td>approx. 36s</td>
</tr>
</tbody>
</table>

b) Plot your results on the graph opposite

c) Use your graph to describe how the time the bulbs remain lit changes as you increased the voltage.

As the starting voltage increases the time the bulbs remain lit also increases

4. Put the following boxes in order to describe the sequence of events.

1) ____________________________
2) ____________________________
3) ____________________________
4) ____________________________

Electrical potential energy stored in the capacitor
Heat and light energy in the light bulb
Kinetic energy of the moving generator handle
Electrical energy in the circuit
5. Plot your results from Experiment 3 on the graph.

Title: Graph showing the relationship between capacitor voltage and time that bulbs are lit