RCDs now needed in homes and schools under new regulations

The IEE Wiring Regulations have been changed: the new regulations [1] came into force on 1 July 2008. One of the main changes for schools and homes is additional protection for socket-outlets with residual current devices (RCDs) - additional in the sense that the RCD supplements the normal fault-condition protection provided by fuses and other overcurrent trips.

Indeed all wiring to a.c. socket-outlets that are for use by ordinary persons and are intended for general use should be protected by RCDs. (Fig. 1).

There are exceptions. If disconnection from the mains supply presents a danger or difficulty then the socket-outlet supplying the equipment need and possibly should not be protected with an RCD. This might apply to fume cupboards, other types of local exhaust ventilation (LEV), refrigerators holding flammable or microbiological substances and freezers. Excepted socket-outlets should be appropriately marked (such as "Freezer only"). However, as the dangers from disconnection may not be great, it may not be reasonably practicable to except them.

Another exception which we do not think will ever apply in schools is where socket-outlets are under the supervision of skilled or instructed persons. Additional protection might not be needed in these places. But because a skilled person means someone such as an experienced engineer or electrician and an instructed person means someone undergoing supervised training, the exemption does not apply to schools.

Product-safety standard for schools

SSERC makes wide use of standards. They help us decide whether a hot object is safe to handle, a bright lamp can be looked at, or a live wire is touchable. Standards come from the British Standards Institution (BSI). Most of them originate from international groups on which BSI is represented. BSI then adopt the standard for use in the UK.

While some of the general safety standards apply to all age groups, most of the standards on laboratory equipment relate to use by adults, not children.

For want of a suitable standard to which to design school laboratory equipment, in 1993 the British Educational Suppliers Association (BESA) with the guidance of SSERC and CLEAPPSS agreed that member companies should design electrical equipment to BS EN 61010-1 Safety requirements for electrical equipment for measurement, control and laboratory use. The title sets out its scope. It was fairly suitable for our purposes, but not entirely so in that it relates to the adult work-place and does not include power supplies. So SSERC, CLEAPPSS and BESA put in some extra conditions such as reducing aperture sizes from 4 to 1 mm and applying it to all electrical lab apparatus including power supplies.

Now we are pleased to report that BSI have published a draft standard (Fig. 2) being a safety specification for electrical products for use by children in schools [3]. Being derived from BS EN 61010-1, it sets additional conditions on fusing, the accessibility of dangerous parts, surface temperatures, water resistance and the emission of UV and laser radiation.

The scope covers use by children and young people in school under supervision. There are stricter temperature limits for products that might be used by children under 13. Laser sources can be used by children provided the child is aged 11 or over and the laser product is Class 1 or Class 2. This opens the way for SSERC to ask the Scottish Government to relax its current regulations for schools.

The following experiment highlights a method of determining the rate constant and the order of a reaction. It uses the reaction between household bleach and blue food colouring.

We came across the article [1] recently when seeking materials to address the lack of suggested activities in some parts of the Advanced Higher Chemistry syllabus [2] on Pages 33–34. In these experiments the household bleach decolours the solution of blue food dye within about ten minutes.

The overall rate equation is:

\[
\text{Rate} = k \cdot (\text{blue dye})^2 \cdot \text{bleach}^3
\]

The rate of dye decolourisation can be followed using a colorimeter, and by applying the Beer-Lambert Law the concentrations of dye can be calculated.

From these results, the rate constant for the reaction \(k\), and the orders of reaction \((a\) and \(b)\) can be determined with respect to dye and bleach concentration.

<table>
<thead>
<tr>
<th>Time / min</th>
<th>Absorbance at wavelength 590 nm</th>
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<tbody>
<tr>
<td></td>
<td>0.50 cm(^2) bleach</td>
</tr>
<tr>
<td>0</td>
<td>0.84</td>
</tr>
<tr>
<td>1</td>
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<tr>
<td>8</td>
<td>0.16</td>
</tr>
<tr>
<td>9</td>
<td>0.13</td>
</tr>
<tr>
<td>10</td>
<td>0.10</td>
</tr>
</tbody>
</table>

We used a WPA CO 7500 and the closest wavelength to 630 nm which could be selected was 590 nm. These results were obtained using this. If you happen to have 630 nm filter, then it should be used.

Firstly, calculate the dye concentrations using the Beer-Lambert Law:

\[
\text{Absorbance (A)} = I \times c \times \varepsilon
\]

where:

- \(I\) is the distance that the light passes through the solution
- \(c\) is the concentration of dye
- \(\varepsilon\) is the molar absorption for the blue dye
  (1.38 x 10^5 cm\(^{-1}\) mol\(^{-1}\) litre at 630 nm)

These absorbance values are used to calculate the concentrations of the dye. The calculation uses the molar absorptivity value of the blue dye which is quoted as being 1.38 x 10^5 cm\(^{-1}\) mol\(^{-1}\) litre at 630 nm.

Reference