

# BENCHMARKS FOR SECONDARY SCHOOLS

SCORE is a collaboration of organisations which aims to improve science education in schools and colleges in England by supporting the development and implementation of effective education policy. SCORE is currently chaired by Professor Julia Buckingham and comprises the Association for Science Education, the Institute of Physics, the Royal Society, the Royal Society of Chemistry and the Society of Biology.

SCORE has produced these benchmarks to provide common guidance to schools and colleges on the resourcing expectations of practical work in the sciences, to ensure all students receive a well-rounded science education. They have been developed in consultation with teachers, technicians and CLEAPSS. The benchmarks indicate the level of resourcing that SCORE considers reasonable to enable inspirational and effective teaching across the sciences.

The intended uses of these benchmarks are as follows:

- 1. preparation of departmental spending plans and development plans;**
- 2. planning for a rolling programme of resource replacement;**
- 3. reviewing equipment stocks and identifying deficiencies;**
- 4. reviewing levels of technician staffing and identifying deficiencies;**
- 5. reviewing access to outdoor space for science teaching and identifying deficiencies;**
- 6. equipping new laboratories, refurbishing existing ones and dealing with the aftermath of disasters such as fire, flood, etc.;**
- 7. forecasting future needs and costing new courses.**

Benchmarks have been produced in the following areas: equipment and consumables, laboratory facilities, access to outside learning space and access to technician staffing.

## Equipment and consumables

The benchmark for equipment and consumables is in the format of an Excel spreadsheet<sup>1</sup> and is to be used as a tool from which equipment/consumable lists for specific purposes can be generated. The spreadsheet is separated into the following columns:

- **item;**
- **technician support – Items needed by the technician. They may keep a spreadsheet specifically for their own use;**
- **mains electrical – Items subject to regular portable appliance testing;**
- **class set (pairs) – Items intended for use in whole class sets for pupil practical work;**
- **single item - Items needed in small numbers (although possibly more than one) for class demonstrations and large group activities;**
- **Key Stage 3 – Items required for Key Stage 3 science;**
- **GCSE physics – Items required for GCSE physics;**
- **GCSE chemistry – Items required for GCSE chemistry;**
- **GCSE biology – Items required for GCSE biology;**
- **A level physics – Items required for A level physics;**
- **A level chemistry – Items required for A level chemistry;**
- **A level biology – Items required for A level biology.**

<sup>1</sup> The equipment and consumables spreadsheet can be downloaded from the SCORE website at <http://score-education.org/policy/curriculum/practical-work-in-science>

## Laboratory facilities

1. There should be a sufficient number of laboratories in secondary schools to enable all science lessons to be timetabled in a laboratory.
2. Full-sized laboratories should be adequately resourced to cater for Key Stage 3 and Key Stage 4 science lessons with a few having specialist features such as dim-out or fume cupboards. There should be fume cupboards, preferably ducted, in 33–50% of the laboratories, and for A-level chemistry at least one laboratory should have two ducted fume cupboards. All fume cupboards should be serviced with gas, cold water, drainage, and electricity. All prep rooms must also have a ducted fume cupboard.
3. Laboratory space must be available for allocation to long-term investigations.
4. Under the Equality Act (2010), education providers have a duty to make reasonable adjustments for any students with special educational needs and/or disability, for example ensuring that all students using wheelchairs are able to access laboratories.
5. Science accommodation/the science suite should comprise:
  - science laboratories;
  - at least one prep room;
  - a secure chemicals store room;
  - a secure radioactive store cabinet;
  - equipment storage space;
  - staff work space/science office;
  - storage space for students' bags and coats;
  - IT and computing provision;
  - other areas, such as a greenhouse, clean areas for microbiology experiments and a social/refreshment area, toilet facilities.

Every **science laboratory** should meet the demands of all science subjects in terms of space, layout, good quality furniture and fittings, IT requirements, security and safety. The laboratory environment should be conducive to learning with good heating (18–28 °C), lighting (generally 300 lux plus task lighting), ventilation (six air changes/hour plus controlled humidity) and sound levels ( $\leq 40$  dB), and at any occupied time, including teaching, the occupants should be able to lower the concentration of carbon dioxide to 1000ppm. A good standard of decoration should be maintained at all times.

## All teaching laboratories should:

- have enough space for effective practical teaching. For example, 90 m<sup>2</sup> is considered appropriate for teaching a practical class of 30 Key Stage 3 or Key Stage 4 pupils, working in pairs, and would also accommodate extra support staff if required;
- permit a wide range of teaching and learning approaches, including direct teaching and the use of IT resources, as well as facilitating good classroom management and discipline. The shape and layout of the laboratories should allow for good visibility between pupils and teachers;
- have good circulation space between the benches;
- have level flooring, which is water-, chemical-, and slip-resistant;
- have the appropriate work surfaces for pupils – ie  $\geq 0.36$  m<sup>2</sup> per pupil, with linear frontage of  $\geq 600$  mm per pupil. The height of the benches should be 900 mm, with good clearance for legs when seated. The benches should be sufficiently robust and water-resistant to cope with the demands of frequent, high-quality practical work;
- have one stool per pupil plus four spare stools for teaching and support staff;
- have sufficient free bench space for setting out equipment to be selected by pupils, data loggers and other items not on pupil work spaces;
- have sufficient storage space for common equipment such as Bunsen burners, clamps and stands;
- have storage facilities for pupils' coats and bags;
- have at least one teacher presentation area, which has access to whiteboards and/or projection screens and all services – water, gas and electricity – for demonstrations;
- have a teacher base – a secure storage area for laptop and personal items;
- have display areas for posters and other stimulus material;
- have a readily accessible area for health and safety equipment – an eyewash station, which has a constant supply of cold water; two 2 kg carbon dioxide fire extinguishers and a fire blanket – one of the extinguishers and the fire blanket should be next to the demonstration area;
- have good quality blinds on the windows to protect against glare and solar gain;



- have **appropriate services**. For example:
  - pipes should be colour coded according to contents;
  - pupil services (gas and electricity) should be within 600 mm of their work/seating area;
  - there should be one gas tap and one electricity socket per pair of pupils, with other taps and sockets fitted on demonstration benches, perimeter benching and in the fume cupboards;
  - there should be sufficient sinks for pupils to do effective practical work and the sinks should be fitted with easily accessible anti-siphon bottle traps;
  - there should be one large sink (at least 500 x 300 x 150 mm deep) with a supply of hot and cold water through ordinary taps, and grooved drainers;
  - gas, electricity and water should all have emergency cut-off controls, which are easily accessible by the teacher but not the pupils and are not shared with adjacent laboratories or prep rooms.
- have locked doors when unoccupied, and be supervised by a technician or science teacher when open;
- have a ducted fume cupboard with gas, cold water, drainage and electrical services;
- have vented provision in the chemicals store room for storing fuming or volatile chemicals;
- other facilities should include: a dishwasher; a large sink with hot and cold water taps; a still for producing distilled water; a drying cabinet; a fridge; a freezer; an ice maker; emergency eye wash; carbon dioxide fire extinguisher(s) and a fire blanket; computer and printer with Internet connection; and a telephone;
- good lighting, heating and ventilation (six air changes per hour as in laboratories);
- flooring which is water-, chemical-, and slip-resistant.

**Each prep room should:**

- be central to the laboratories it serves. If it serves several laboratories on different floors there should be a lift (which is also necessary to meet the requirements of the Equality Act 2010), which could be used to move equipment between floors or as a hoist between the laboratory and prep room;
- be  $\geq 0.5\text{m}^2$  per pupil work space in total, including all associated storage space, so that 25–30% is work space; 20–30% is fixed storage (including a secure chemical store room); 10% is for mobile (trolley) storage; and the remainder is circulation space;

The **chemicals store room** – should be  $\geq 10\text{ m}^2$ , larger for schools with more than 1000 pupils and for A-level work; it should be ventilated (2 air changes per hour) and fire-resistant up to 60 min, open directly off the prep room and be in a position which avoids direct heat. The flooring should be water-, chemical- and-slip-resistant, sloped towards the back and have no drains.

The **radioactive store cabinet** – a secure metal cabinet, labelled and fastened to a wall at least 2 m away from where anyone spends extended periods of time, not in the chemicals store room, and not near flammables or gas cylinders.

## OPPORTUNITIES FOR LEARNING OUTSIDE THE CLASSROOM

	<b>'Habitat' access biology</b>	<b>'Habitat' access chemistry</b>	<b>'Habitat' access physics</b>
<i>Pre-16 science</i>	<p>Easy access to a pond or natural water habitat – e.g. to study adaptations, distribution of organisms, population dynamics, biodiversity, pollution indicators</p> <p>Easy access to trees or hedges – e.g. to study invertebrate distribution, biodiversity or adaptation</p> <p>Easy access to grassland (not just the school playing field) – e.g. to study the ecology and the factors that influence the distribution of organisms</p>	<p>Local access to an outside resource to demonstrate the different properties of rocks; the effects of processes (e.g. erosion) on rocks; and to monitor air quality. Access could be school grounds or further afield</p>	<p>Easy access to an open space for a variety of activities – e.g. modelling the solar system; measuring speed; launching rockets; measuring noise pollution; estimating the speed of sound; measuring the irradiance from the sky; carrying out solar furnace investigations etc</p> <p>Easy access to a real functioning renewable energy source that can be used in teaching – e.g. photovoltaic or wind</p>
<i>Post-16 science</i>	<p><b>In addition to the above in pre-16</b></p> <p>Access to varied ecology and habitats which are different to those around the school – i.e. field trip(s) – not necessarily residential</p> <p>Access to a research facility for gene technology (could be a local university department)</p>	<p><b>In addition to the above in pre-16</b></p> <p>Access to a research facility for spectroscopy (could be local university department)</p>	<p><b>In addition to the above in pre-16</b></p> <p>Access to a research facility (accelerator) to study particle and/or nuclear physics or medical physics department in a hospital to consider the physics behind various diagnostic tools (e.g. X-rays or MRI)</p>

### Technician staffing

SCORE organisations endorse the existing benchmark developed by the Association for Science Education (ASE), which links the number of periods of science per week, or the total hours of science taught per week, to the number of technician hours required per week<sup>2</sup>. The figure in the formula below of 0.65 is known as the service factor. This figure was recommended by the ASE to ensure adequate technical support for the science curriculum.

**Technician hours per week = total science teaching hours per week × 0.65**

This is for technicians employed for 52 weeks a year; for those employed on 39-week contracts, there is an explanation of how to calculate the service factor in the CLEAPSS document *Technicians and their jobs G228*<sup>3</sup>.

<sup>2</sup> Royal Society and Association for Science Education *Supporting success: Science technicians in schools and colleges*, January 2002, ISBN 0854035710.

<sup>3</sup> CLEAPSS *Technicians and their jobs G228*, December 2002 (updated August 2009), available on the CLEAPSS website at <http://www.cleapss.org.uk/attachments/article/0/G228.pdf?FreePublications/>

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