

# Contents

## *Introduction*

<b>1 Design of School Laboratories and Science Blocks</b>	<b>1</b>	Requisitioning and receipt of supplies	26
Introduction	1	The choice of supplies (and suppliers) 26; placement of the order 27; Receipt of goods 28; Authorisation of payment 28.	
Historical note	1	Security in a science department	28
Time allocation for science	2	Access to laboratories 28; Access to stores/preparation rooms 28; Services 28; Animals and plants 28.	
Number of laboratories	2	Safety	28
9–13 middle schools 3; 11–16 schools 3; 13–18 schools 3.		Bibliography	29
The siting of laboratories	4	<b>3 Safety in School Science Teaching</b>	<b>30</b>
Science block 4; Practical wing 4; Environmental considerations 4.		Introduction	30
Provision of special facilities	4	Factors affecting level of risk in schools	30
Indoors 4; Outdoors 5.		Safety as a positive activity	30
Laboratory design criteria	5	Eye protection	31
Practical work by individuals or small groups 5; Study activities 5; Lecture/demonstration 7; Discussion 7; Audio-visual activities 8; Display/exhibition areas 8.		Safety and laboratory design	31
Central workshop	8	The hazards of glassware	33
Maintenance, repair and construction of apparatus 8; Store for bulk materials 9; Base for chief technician 9.		The use of gas cylinders	33
Preparation and storage facilities	9	Toxic reagents	34
Services	11	Asbestos	36
Environmental services and controls	12	Chemical hazard warning labels	36
Heating and ventilation 12; Lighting 12; Noise 12.		Toxic plant material	38
Special subject requirements	13	Carcinogens	38
Biology 13; Chemistry 14; Physics 15.		Caustic and corrosive materials	39
Open plan laboratories	15	Uncontrolled chemical reactions	39
Check lists	15	Plastics and polymers	39
Bibliography	17	Radioactive materials	40
<b>2 Management and Laboratory Organisation</b>	<b>19</b>	X-rays	41
Introduction	19	Electrical hazards	41
The head of science as middle-manager	19	Lasers	42
Communication and discussion	19	Ultraviolet radiation	42
Delegation and leadership	20	Noise	42
Office management	21	Microbiological hazards	42
Timetables 21; Noticeboard 21; Filing system 21; Staff resources centre 21.		Keeping animals in schools	42
Money management	22	Experiments involving pupils	43
Capitation allowance 22; Special estimates 23.		Field work	43
Ancillary staff—role, training and job specification	23	Fire	44
Role of the chief technician 23; Training and qualifications of technicians 23; Technician task analysis 24; Ordering materials for lessons 24.		First aid procedures	46
Storage and retrieval	25	Some legal issues	48
		Waste disposal 48; Illegal experiments 48; Alcohol regulations 48; Storage regulations 49; Poisons legislation 49; Work with living animals 49; Radioactive materials 49; Contractual issues 49; Out-of-school activities 51; The Health and Safety at Work Act 51.	
		Bibliography	52

#### 4 Audio-Visual Aids

Introduction	53
Chalkboards	53
Markerboards	54
Display boards	54
Magnetic boards	55
Flannel boards	55
Screens	55
Wall charts	56
Samples and materials	57
Models	57
References for the production of atomic and molecular models	58.
Episcopes and epidiascopes	59
The slide projector	59
Slide viewers	61
The film-strip projector	61
The overhead projector	62
Microprojectors	64
Motion picture projection	64
8 mm film-loops and cassettes	66
Television and radio	67
Worksheets	67
Stencil duplication	68
Spirit or hectographic duplication	69
Dyeline or diazo duplication	69
Offset duplication	70
Electrostatic duplication	70
Thermal copying	70
Diffusion transfer copying	71
Electronic scanning stencil cutters	71
Preparation of originals for duplication	71
Reprography and the copyright laws	72
The selection of reprographic equipment for school use	72
Educational games	72
Bibliography	73

#### 5 Apparatus for School Science Teaching

*Information about materials and equipment widely used in school science teaching in alphabetical order.*

Air-tracks	74,
ammeters	74,
amplifiers	74,
anatomical models	75,
aquaria	75,
asbestos	79,
atmometers	79,
autoclaves	79;
balances	80,
barometers	81,
batteries	82,
beakers	83,
blood-grouping apparatus	84,
blood lancets	84,
bottles	84,
buffer solutions	84,
burettes	85;
cages	86,
capacitors	88,
capillary tubing	90,
cells	90,
cellulose tubing	90,
centrifuges	90,
chart recorders	90,
choice chambers	91,
chromatography	91,
colorimeters and spectrophotometers	92,
conical flasks	92,
corks	93,
crucibles	93,
crucible tongs	93;

deionisers	94,
desiccators	94,
disposable laboratory ware	95,
dissecting apparatus	96,
dynamics trolleys and runways	98;
ecology apparatus	98,
electromagnetism	99,
electrophoresis	99,
electrostatics	99,
environmental comparators	99,
ergometers	100;
filter flasks	100,
filter papers	100,
filter pumps	101,
force meters	101,
freezing mixtures	101,
fume cupboards	101,
funnels	103,
fuses	104;
galvanometers	104,
gas analysis apparatus	104,
gas cylinders	105,
Geiger-Müller tubes	106,
generators	107,
glass rod	108,
glass syringes	108,
glass tubing	108,
gloves	109,
goggles	110;
haemocytometers	110;
incubators	112,
indicators	113,
interchangeable laboratory glassware	113;
kymographs	113;
lamps	114,
lasers	115,
leads	115,
lenses	115;
magnetic stirrers	116,
magnets	116,
magnifiers	116,
masses	117,
measuring cylinders	117,
mechanical stirrers	117,
meters	118,
microbiological apparatus	119,
microscopes—monocular	120,
microscope components	123,
microscopes—binocular	126,
microscope accessories	127,
microscopy apparatus	130,
mortars and pestles	132;
nets, collecting	132;
oil baths	134,
oscilloscopes	134,
ovens and drying cabinets	134;
pH meters	135,
photography	135,
pipettes	135,
plant growth apparatus	136,
plugs	136,
pneumatic troughs	136,
polystyrene spheres	137,
potometers	137,
power supplies	137;
radioactive materials	139,
ratemeters	139,
refrigerators	139,
resistance wire	140,
resistors	140,
respirometers	140,
retort stand bases and rods	140,
rheostats	140;
safety spectacles and eye-shields	140,
scalars	141,
signal generators	141,
silica ware	141,
sinks	141,
skeletal material	142,
sockets	142,
soil apparatus	142,
solid state detectors	143,
spirometers	143,
stills	144,
stopclocks/stopwatches	144,
stoppers	144,
strobe photography	145;
Teltron tubes	145,
test tubes	145,
test tube stands and racks	145,
thermometers	145,
three centimetre wave apparatus	147,
ticker tape vibrators	147;
vacuum pumps	147,
vacuum tubes	147,
van de Graaff generators	148,
vibration generators	148,
voltmeters	148;
wash bottles	148,
waste disposal	148,
water baths	148,
weights	149,
wire	149.
Bibliography	

<b>6 Improvisation of Apparatus</b>	<b>151</b>	<b>9 Biological Techniques</b>	<b>251</b>
Introduction	151	Microscopical techniques	251
General considerations	151	Fixation 251; Sectioning 251; Smearing 256;	
Abrasive cloths and papers	152	Maceration and squashing 256; Staining 257;	
Glass	152	Dehydration 258; Clearing 259; Mounting 260;	
Glues	153	Selected staining procedures (in alphabetical	
Metal framing	154	order) 261.	
Nails	154	The preservation of plant and animal specimens	265
Perspex	154	The preservation of plant specimens 266; The	
Screws	154	preservation of animal material 268; Low pres-	
Timber	154	sure freeze-drying 274; Resin embedding 274;	
Sources of information about the improvisation of		Agar embedding 276.	
apparatus	155	Microbiological techniques	276
Bibliography	164	Culture media 277; Preventing the entry of	
<b>7 Laboratory Reagents and Stains</b>	<b>166</b>	contaminating micro-organisms 277;	
Grades of reagent	166	Experimental procedures 279; Disposal of con-	
The purchase of reagents	167	taminated equipment 280; Safety precautions	
The concentration of a reagent	167	281.	
Mixing solutions	168	Setting up aquaria	281
The preparation of laboratory reagents	168	Freshwater aquaria 281; Marine aquaria 284.	
Alphabetical list of reagents, stains and culture		Miscellaneous biological techniques	286
media	168	Vertebrate skeletal preparations 286; Mulligan's	
Bibliography	194	techniques for differentiating white and grey	
<b>8 The Culture and Maintenance of Living</b>		matter in vertebrate central nervous systems 287;	
<b>Organisms</b>	<b>195</b>	Latex injection 287; Humane killing of small	
General sources of information	196	mammals 288.	
List of living organisms arranged in approximate		Bibliography	289
taxonomic order, with notes on their uses, supply		Appendix—Books for the identification of British	
and culture. Specific references at the end of each		fauna and flora.	290
section supplement the general sources of		Index	295
information	197		
Addresses of suppliers of living organisms	248		