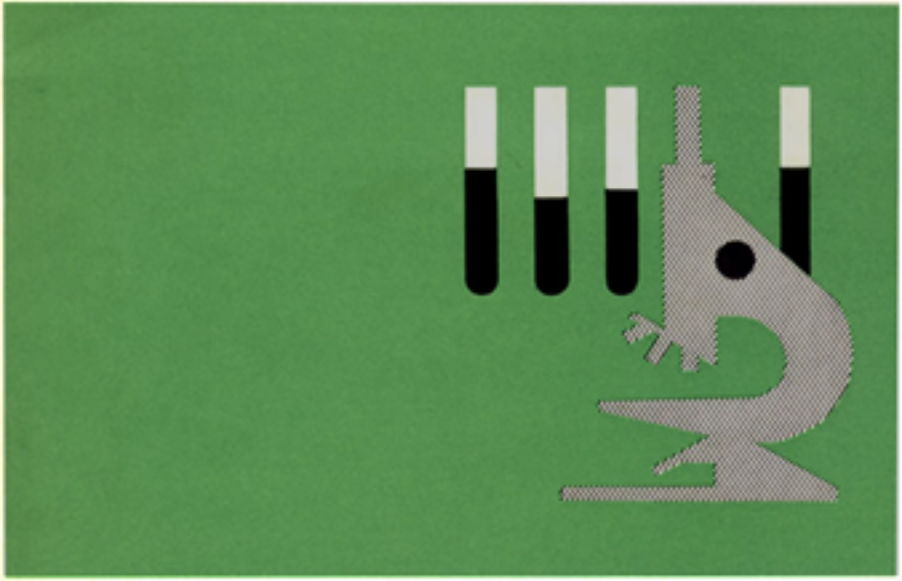
SOILS BULLETIN 3

GUIDE ON GENERAL AND SPECIALIZED EQUIPMENT FOR SOILS LABORATORIES



FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
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GUIDE ON GENERAL AND SPECIALIZED EQUIPMENT

FOR SOILS LABORATORIES

Contents

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FOR SOILS LABORATORIES

1. INTRODUCTION

From time to time during the course of several years the Soil Survey and Fertility Branch of FAO have been asked to advise on the supply of equipment for the soils laboratories of several member countries. These requests have ranged through all types of soils work but in general the emphasis has been on Soil Chemistry laboratory equipment and Chemicals.

To a great extent the basic equipment needs of soil analysts are standard items. Generally speaking, little variation in equipment is required to analyze regardless of either soil group or region. Also the variation as between suppliers is small. Therefore it is possible to make an equipment and chemicals list required for a soils laboratory regardless of location provided the necessary ancillary services are available.

A standard list saves considerable tedious work every time a new laboratory is established or an old one is refurnished. It avoids omissions which inevitably occur when equipment lists are prepared from catalogues. It permits a quick estimate of costs as these can be quickly jotted down beside the required items of the standardized list. Last but not least a carefully prepared equipment list gives guidance to FAO member countries which have not had experience with this type of purchase.

It is necessary to emphasize that this publication is not an attempt to standardize soils laboratory equipment. Rather it is an effort to assemble standard information in an easily available and useable form. All the items listed are not required for every soil laboratory; many of the items can be used for more than one technique of analysis. Items and quantities must be adjusted according to the sample and analytical requirements; even personal preference may modify the equipment list of any one laboratory.

2. General Layout of the Lists

2. GENERAL LAYOUT OF THE LISTS

The itemized "Lists of General Equipment" are divided into six sections as follows:

Section 3A - Chemicals	Codes 001 to 499
Section 3B - Glassware and Porcelain	" 500 to 799
Section 3C - Polythene and Plastic ware	" 800 to 899
Section 3D - Sundries	" 900 to 1099
Section 3E - Large Equipment (including spare parts)	" 1100 to 1299

There are two sections for specialized material:

Section 4. - Special Equipment for Soil Physics	Codes 1300 to 1499
Section 5. - Special Equipment for soil Microbiology	Codes 1300 to 1499

The items listed under these Sections are only likely to be necessary when soil physical and microbiological determinations are to be carried out.

Section 6. - List of Suppliers

The estimates of requirements, except for Sections 4, 5 are based on quantities for the analysis of approximately 10,000 samples over a period of two years, viz. 5,000 samples per year. The analysis includes the determinations of particle size distribution (mechanical analysis), pH, conductivity, organic matter, nitrogen, calcium carbonate equivalent, gypsum requirement, soluble ions or salts in saturation extract, exchange capacity, exchangeable Ca, Mg, K, Na, H, free iron oxide, elemental analysis, etc. Sufficient supplies will also be available for the analysis of a limited number of rock, fertilizers, water and plant samples.

There will, of course, be a considerable variation in the methods of analysis used in different laboratories and changes will be necessary in the lists to allow for individual laboratory variations.

Under the heading "Possible source" the following codes are used: X equals the item that can normally be bought from most good laboratory suppliers. X (US) equals the item that can be bought at any good laboratory furnisher in the United States of America. When reference is made to a number, a specific source of supply is mentioned and can be found under 6, List of Suppliers. This is done in order to facilitate the procurement of items not normally universally available and it does not imply that this is the only source of supply.

The lists do not include items which are not regularly stocked by the suppliers and must be ordered.

The minimum basic stock of any items of chemicals, glassware or small equipment, including spares for instruments is half the quantity listed. It follows therefore that a periodic inventory of stocks should be made and a replenishment stock of half the above quantities ordered when the stock has been used down to about half the quantity listed.

For example, the amount of Sulphuric Acid (Analytical Grade) ordered on this list is 220 liters. When this initial stock reaches a level of approximately 110 liters by use, a new order for 110 liters should be placed. Similarly, the original quantity of 20 cc. burettes ordered is 10. When the stock is reduced to about 5, then another 5 should be ordered. This applies to almost all items in sections 3A to 3D and also to spares for instruments listed under section 3E. For the larger items, instruments, etc. under section 3E, the problem of continued supply is overcome by providing an adequate quantity of spare parts. The inventory check should take place at least every 12 months but preferably every 6 months. A system such as this is essential in any laboratory but even more so when the laboratory is situated far from the normal sources of supply.

3. Lists of General Equipment

3. LISTS OF GENERAL EQUIPMENT

Section 3A - Chemicals

All items listed are to be of high grade analytical quality, except for items specifically marked "Technical", in which case somewhat lower standards are acceptable.

Chemicals of the desired quality are obtainable from a number of sources. However, the necessity of buying chemicals from a reliable supplier cannot be too strongly emphasized. Normal commercial grades of laboratory chemicals, though cheaper, are often quite useless for soil analytical work.

For certain items, e.g. Complexone and related materials, a specific source of supply is mentioned. In these instances, it is recommended that supplies be obtained from the sources mentioned.

Section 3B - Glassware and Porcelain

Most of the items in this section are standard and can be found at any laboratory suppliers. Trade names are generally not given as there are usually several suitable makes of any particular item. Thus, borosilicate glass could be Pyrex, Hysil, Jena or any of several other makes while porcelain could be Doulton, Sillax, etc.

Descriptions are taken from a variety of sources, which are mentioned only when the item is such that it is unlikely to be found in nearly all suppliers.

Section 3C - Polythene

Several sources of supply are available and suitable.

Section 3D - Sundries

Items listed are almost all universally obtainable.

Section 3E - Large Equipment

Many items here are mentioned by name. In general, the item described is that having the minimum suitable specification. In many instances, other suitable makes are available which will be equally good for the work in question and several of these alternatives are listed. Generally speaking, the items mentioned as alternatives in this list are more expensive though in several instances they will carry out work which is not possible with the corresponding item specified.

Sources of supply are nearly all quoted in this section.

Section 4 - Specialized Equipment for Soil Physics

A Survey carried out recently by FAO, Brogan (1965), shows that only a small percentage of soil laboratories include physical analysis in their routine work, exception is made to the particle size distribution (mechanical analysis), which is nearly always used in all soils laboratories. The determinations most currently worked out are bulk density, structure, and moisture retention at different pressures. These and some other physical determinations are, however, very important in soil studies, being increasingly applied. The inclusion in this publication of a section regarding soil physics was considered useful. The proposal is to provide information on the specialized equipment for the establishment of a soil physics laboratory including those items required for the more common determinations, and some others which may be required for some special analysis. When making the list it was assumed that some basic equipment to be found in any normal laboratory, or enumerated under Section 3, General Equipment, would be available.

In many cases more than one item is mentioned for the same determination, to allow the choice of the most suitable for the particular purpose.

Section 5 - Specialized Equipment for Soil Microbiology

Of the different branches of soil sciences, soil microbiology often is neglected or is the last to receive attention. This neglect is not justified particularly since soil microorganisms and their activities are basic to a fertile soil. They have the very important role of decomposing organic matter and releasing in available form a large part of many of the elements necessary for plant nutrition. They also have the unique ability to fix atmospheric nitrogen biologically in significant amounts.

This publication contains a basic list of the equipment and chemicals that are required for routine microbiological studies and ordinary research work. Elaborate research problems might require additions to the list. The items listed do not include the chemical glassware and equipment that is necessary for the chemical determinations that are a part of nearly every microbiological study. It is assumed that these items can be drawn from chemical stores as needed, particularly as every soil microbiology laboratory is either connected with a chemical analytical laboratory or has a section for this side of the work.

3A. Chemicals

Item No.	Description	Quantity	Possible source
001	Acetic Acid, 99-100 percent	50 l	x
002	Acetone	10 l	x
003	Alizarin	25 g	x
004	Aluminium, metal, foil	500 g	x
005	Aluminium, powder, fine	500 g	x
006	Aluminium ammonium sulphate $Al_2(SO_4)_3 . (NH_4)_2SO_4 . 24H_2O$	1 kg	x
007	Aluminium Chloride $AlCl_3 . 6H_2O$	500 g	x
008	Aluminium oxide	1 kg	x
009	Aluminium sulphate $Al_2(SO_4)_3 . 18H_2O$	1 kg	x
010	Aluminon	25 g	x
011	1-Amino-2-Naphtol-4-Sulphonic acid	25 g	x
012	Ammonium acetate	200 kg	x
013	Ammonium carbonate $(NH_4)_2CO_3 . H_2O$	1 kg	x
014	Ammonium carbonate, acid (bicarbonate)	1 kg	x
015	Ammonium chloride	5 kg	x
016	Ammonium citrate, di-	1 kg	x
017	Ammonium fluoride	1 kg	x
018	Ammonium hydroxide, sp. gr. 0.88	120 l	x
019	Ammonium molybdate	3 kg	x
020	Ammonium oxalate $(NH_4)_2C_2O_4 . H_2O$	2 kg	x
021	Ammonium phosphate, mono-H $(NH_4)_2HPO_4$	500 g	x
022	Ammonium phosphate, di-H $NH_4H_2PO_4$	500 g	x
023	Ammonium purpurate (M REXIDE)	10 g	x
024	Ammonium sulphate $(NH_4)_2SO_4$	2 kg	x
025	Ammonium sulphate, peroxidi- $(NH_4)_2 S_2O_8$	500 g	x
026	Ammonium tartrate	500 g	x
027	Ammonium thiocyanate	500 g	x
028	Ammonium vanadate, meta-	500 g	x
029	Antifoam A, silicone fluid	1 kg	x
030	Antimony chloride, tri-	250 g	x
031	Arsenic oxide, tri-	500 g	x

Item No.	Description	Quantity	Possible source
032	Asbestos for Gooch crucibles	1 kg	x
033	Barium acetate	1 kg	x
034	Barium carbonate	500 g	x
035	Barium chloride $BaCl_2 . 2H_2O$	2 kg	x
036	Barium chromate	500 g	x
037	Barium diphenylaminosulphonate	10 g	x
038	Barium hydroxide $Ba(OH)_2, 8H_2O$	500 g	x
039	Barium sulphate	1 kg	x
040	Bentonite, powder	2 kg	x
041	Benzene	5 l	x
042	Benzoic acid	500 g	x
043	Beryllium sulphate $BeSO_4 . 4H_2O$	100 g	x
044	Bismuth carbonate, basic	100 g	x
045	Boric acid, crystals	1 kg	x
046	Bromine	250 g	x
047	Bromocresol green	10	x
048	Bromoform	1 l	x
049	Bromophenol Blue	10 g	x
050	Bromothymol Blue	20 g	x
051	Brucine	25 g	x
052	Buffer, pH 7.0 ± 0.02	100 tablets	x
053	Butanol-iso (150 Butyl alcohol)	1 l	x
054	Cadmium chloride $Cd Cl_2 - 2\ 1/2\ H_2O$	100 g	x
055	Calcium acetate $Ca (CH_3COO)_2 . H_2O$	2 kg	x
056	Calcium carbonate	3 kg	x
057	Calcium chloride $Ca Cl_2 . 6H_2O$	1 kg	x
058	Calcium chloride, fused $Ca Cl_2$	5 kg	x
059	Calcium cyanamide	3 kg	x
060	Calcium hydroxide, powder	2 kg	x
061	Calcium oxalate $Ca C_2O_4 . H_2O$	1 kg	x
062	Calcium oxide, powder	1 kg	x
063	Calcium sulphate, $CaSO_4 . 2H_2O$	1 kg	x

Item No.	Description	Quantity	Possible source
064	Canada Balsam, neutral	1 l	x
065	Capryl alcohol	2 l	x
066	Carbon disulphide	2 l	x
067	Carbon tetrachloride	10 l	x
068	Carmine	25 g	x
069	Castolit plastic with hardener	2 kg	22
070	Celulose acetate	2 kg	
071	Cerium ammonium sulphate (ic) $Ce(S04)_2 . 2(NH_4)_2 S0_4 . 2H_20$	100 g	x
072	Charcoal, decolorizing, purified	8 kg	x
073	Chloroform	1 l	x
074	Chlorophenol red	10 g	x
075	Chromium oxide, sesqui-(ic) Cr_20_3	250 g	x
076	Citric acid	1 kg	x
077	Cobalt chloride (ous) $C_oCl_2 . 6H_20$	250 g	x
078	Cobalt nitrate (ous) $Co (NO_3)_2 . 6H_20$	250 g	x
079	Cobalt sulphate (ous) $Co SO_4 . 7H_20$	250 g	x
080	Cochineal	10 g	x
081	Collodion solution	1 l	x
082	Complexone III	3 kg	6
083	Copper metal, foil	500 g	x
084	Copper acetate (ic) $Cu (CH_3COO)_2 . H_2O$	500 g	x
085	Copper chloride (ic) $Cu Cl_2 . 2H_2O$	500 g	x
086	Copper oxide (ic)	250 g	x
087	Copper sulphate (ic) $Cu SO_4 . 5H_2O$	1 kg	x
088	Cupferrom	25 g	x
089	Curcumin	10 g	x
090	Devarda's metal (alloy)	3 kg	x
091	1,1 - Dianthrimide, reagent for B	10 g	x
092	Diethyl ether	4 l	x
093	Dimethyl glyoxime	25 g	x
094	Dimethyl Yellow (range pH 3.0 to 4.0)	25 g	x
095	2,4 - Dimitrophenol	10 g	x
096	Diphenylamine	250 g	x
097	Diphenylamine sulphate	250 g	x

Item No	Description	Quantity	Possible source
098	Diphenyl benzidine	5 g	x
099	Diphenyl thiocarbazone	25 g	x
100	Dipicrylamine	10 g	x
	Dithizone (see Diphenyl triocarbazone)		
101	Eriochrome blue black B	50 g	x
102	Eriochrome black T	50 g	6
103	Ethanol 95 (Ethyl alcohol)	250 l	x
104	Ethanol absolute	2 l	x
105	Ethanolamine 99	2 l	x
106	Ether anhydrous	2 l	x
107	Ethylenediamine tetraacetil acid	500 g	x
108	Ethylene glycol	5 l	x
109	Ferric ammonium sulphate $Fe\ NH_4(SO_4)_2 \cdot 12H_2O$	1 kg	x
110	Ferrous ammonium sulphate $Fe\ (NH_4)_2\ (SO_4)_2 \cdot 6H20$	40 kg	x
111	Ferric chloride $Fe\ Cl_3 \cdot 6H_2O$	500 g	x
112	Ferrous chloride $Fe\ Cl_2 \cdot 4H_2O$	500 g	x
113	Ferric sulphate $Fe_2\ (SO_4)_3 \cdot MH_2O$	500 g	x
114	Ferrous sulphate, technical	10 kg	x
115	Ferrous sulphate $Fe\ SO_4 \cdot 7H_2O$	2 kg	x
116	Glucose	500 g	x
117	Glycerin	1 l	x
118	Gum Acacia	1 l	x
119	H.H.S.N.N. indicator	50 g	6
120	Hydrazine sulphate	250 g	x
121	Hydrochloric acid, Sp. Gr. 1.16 about 32 w/w HC1, Technical	50 l	x
122	Hydrochloric acid, Sp. Gr. 1.18, 36 w/w HC1	80 l	x
123	Hydrofluoric acid, 48	1 l	x
124	Hydrogen peroxide, 100 bls.	60 l	x

Item No.	Description	Quantity	Possible source
125	Hydroquinone	250 g	x
126	Hydroxylamine hydrochloride	250 g	x
127	8-Hydroxyquinoline	250 g	x
128	Iodine, resublimed	100 g	x
129	Iso-amyl alcohol	1 l	x
130	Kieldahl digestion catalyst granules	5 kg	x
131	Lactic acid, sp. gr. 1.21, 85 percent	250 ml	x
132	Lactose $C_{12}H_{22}O_{11}.H_2O$	500 g	x
133	Lead acetate $Pb(C_2H_3O_2)_2.3H_2O$	250 g	x
134	Lead nitrate	250 g	x
135	Ligroin, B.P. 35^o - 60^o	1 kg	x
136	Lithium carbonate	500 g	x
137	Lithium chloride	500 g	x
138	Litium hidroxide, anhydrous	250 g	x
139	Magnesium acetate $Mg(C_2H_3O_2)_2.4H_2O$	500 g	x
140	Magnesium carbonate	250 g	x
141	Magnesium chloride $MgCl_2.6H_2O$	1 kg	x
142	Magnesium complexonate	2 kg	6
143	Magnesium hydroxide	1 kg	x
144	Magnesium nitrate $Mg(NO_3)_2.6H_2O$	500 g	x
145	Magnesium oxide, heavy	15 kg	x
146	Magnesium sulphate $MgSO_4.7H_2O$	500 g	x
147	Manganese chloride $MnCl_2.4H_2O$	500 g	x
148	Manganese oxide, di-	500 g	x
149	Manganese sulphate $MnSO_4.H_2O$ (ous)	3 kg	x
150	D-Manitol	500 g	x
151	Mercury chloride (ic)	100 g	x
152	Mercury iodide (ic)	250 g	x

Item No.	Description	Quantity	Possible source
153	Mercury, metal	2 kg	x
154	Mercury, nitrate (ic) $Hg(NO_3)_2.H_2O$	250 g	x
155	Mercury, nitrate (ous) $Hg NO_3.H_2O$	100 g	x
156	Mercury oxide (ic)	250 g	x
157	Mercury sulphate (ic)	1 kg	x
158	Meta-methyl red	10 kg	x
159	Methanol,	10 l	x
160	Methyl Orange	25 g	x
161	Methyl Red	25 g	x
162	Methylene Blue	25 g	x
163	Metol	500 g	x
164	Molybdenum oxide, tri-	250 g	x
	Murexide (see Ammonium purpurate)		
165	1-Naphthylamine	100 g	x
166	Nickel chloride (ous) $Ni Cl_2.6H_2O$	250 g	x
167	Nickel sulphate, (ous) $Ni SO_4.6H_2O$	250 g	x
168	Nitric acid, Sp. Gr. 1.39	25 l	x
169	Nitric acid, fuming, Sp. Gr. 1.50		
170	p-Nitrophenol	1 kg	x
171	Nitroso-R salt	100 g	x
172	Oleic acid, Sp. Gr. 0.89	500 m	x
	Orthophosphoric acid (see Phosphoric acid)		
173	Oxalic acid, anhydrous $C_2O_4H_2.2H_2O$	500 g	x
174	Paraffin oil (mineral oil)	4 l	x
175	Paraffin wax, filtered, soft. M. pt. 46°C	1 kg	x
176	Paraffin wax, filtered, hard. M. pt. 57° to 60°C	5 kg	x
177	Perchloric acid, Sp. Gr. 1-54, 60 w/w	3 l	x
178	Petroleum spirit, B. pt. 60° to 80°C	10 l	x
179	0-Phenantroline ferrous sulphate complex (Ferroin)	100 g	x
180	Phenol, Cristals	500 g	x
181	Phenolphtaleine	50 g	x
182	Phenol Red	10	x

Item No.	Description	Quantity	Possible source
183	Phenol sulphonic acid solution 75 w/w	1 kg	x
184	Phenyl anthranilic acid	100 g	x
185	Phosphoric acid, ortho-, Sp. Gr. 1.76, 85	60 l	x
186	Phosphorus oxide pent-P_2O_5	1 kg	x
187	Piperine	100 g	x
188	Potassium acetate	250 g	x
189	Potassium bisulphate $KHSO_4$	500 g	x
190	Potassium bromide	250 g	x
191	Potassium carbonate	500 g	x
192	Potassium carbonate, acid (bicarbonate)	500 g	x
193	Potassium chloride	10 kg	x
194	Potassium chromate	500 g	x
195	Potassium cyanide	500 g	x
196	Potassium dichromate	10 kg	x
197	Potassium ferricyanide	250 g	x
198	Potassium ferrocyanide $K_4F_2(CN)_6 . 3H_2O$	250 g	x
199	Potassium hydroxide, pellets	3 kg	x
200	Potassium iodide	500 g	x
201	Potassium metabisulphite (pyrosulphite)	500 g	x
202	Potassium nitrate	500 g	x
203	Potassium nitrite	250 g	x
204	Potassium periodate, meta	500 g	x
205	Potassium permanganate	1 kg	x
206	Potassium phosphate K_3PO_4	1 kg	x
207	Potassium phosphate, mono-H K_2HPO_4	1 kg	x
208	Potassium phosphate, di-H KH_2PO_4	1 kg	x
209	Potassium phtalate, acid	1 kg	x
210	Potassium pyrosulphate	500 g	x
211	Potassium sulphate	500 g	x
212	Potassium tartrate $K_2C_4H_4O_6 . 1/2H_2O$	500 g	x
213	Potassium thiocyanate	500 g	x
214	Propionic acid	250 g	x
215	iso-Propyl alcohol	1 l	x
216	Pumice, gran, 5-10 mm	5 kg	x
217	Pyrogallol	100 g	x

Item No.	Description	Quantity	Possible source
218	Quinalizarin	100 g	x
219	Resin, 200 to 400 mesh	2 kg	x
220	Salicylic acid	1 kg	x
221	Sand, acid washed	100 kg	x
222	Selenium, powder	100 g	x
223	Silica gel, self indicating, 4-6 mm	3 kg	x
224	Silver nitrate	2 kg	x
225	Silver sulphate	250 g	x
226	Soda lime, 3-6 mm, indicating grade	5 kg	x
227	Sodium acetate $CH_3COONa.3H_2O$	15 kg	x
228	Sodium bismuthate	250 g	x
229	Sodium bisulphite $NaNSO_3$	1 kg	x
230	Sodium borate, tetra, Borax $Na_2B_4O_7.10H_2O$	250 g	x
231	Sodium carbonate, anhydrous Na_2CO_3	5 kg	x
232	Sodium carbonate, acid (bicarbonate) $NaHCO_3$	1 kg	x
233	Sodium chloride	2 kg	x
234	Sodium citrate $Na_3C_6H_5O_7.2H_2O$	1 kg	x
235	Sodium cobaltinitrite	250 g	x
236	Sodium cyanide	100 g	x
237	Sodium dichromate $Na_2Cr_2O_7.2H_2O$	1 kg	x
238	Sodium diethyldithiocarbomate $(C_2H_5)_2NOSSNa.3H_2O$	100 g	x
239	Sodium dithionate $Na_2S_2O_6.2H_2O$	100 g	x
240	Sodium hexametaphosphate $Na_6(PO_3)_6$(?)	5 kg	x
241	Sodium bydroxide, pellets	2 kg	x
242	Sodium hydroxide, technical, flakes	200 kg	x
243	Sodium hydroxide, solution concentrated to make 1N solutions	12 bottles	x
244	Sodium metabisulphite (pyrosulphite)	1 kg	x
245	Sodium molybdate $Na_2MoO_4.2H_2O$	500 g	x
246	Sodium nitrate	500 g	x
247	Sodium nitrite	1 kg	x
248	Sodium oxalate	1 kg	x
249	Sodium oxide, di-(peroxide)	250 g	x

Item No.	Description	Quantity	Possible source
250	Sodium periodate, meta	500 g	x
251	Sodium phosphate $Na_3PO_4 . 12H_2O$	3 kg	x
252	Sodium phosphate, mono-H $Na_2HPO_4 . 7H_2O$	1 kg	x
253	Sodium phosphate, di-H $NaH_2PO_4H_2O$	5 kg	x
254	Sodium potassium tartrate $NaKC_4H_4O_6 . 4H_2O$	500 g	x
255	Sodium salicilate	1 kg	x
256	Sodium silicate	500 g	x
257	Sodium sulphate $Na_2SO_4 . 10H_2O$	12 kg	x
258	Sodium sulphate, acid (bisulphate) $NaHSO_4 . H_2O$	500 g	x
259	Sodium sulphide, mono $Na_2S . 9H_2O$	500 g	x
260	Sodium sulphide, hydro NaHS	250 g	x
261	Sodium sulphite, anhydrous	500 g	x
262	Sodium sulphite, hypo $Na_2S_2O_4 . 2H_2O$	500 g	x
263	Sodium tartrate $Na_2C_4H_4O_6 . 2H_2O$	250 g	x
264	Sodium thiocyanate	250 g	x
265	Sodium tungstate $Na_2WO_4 . 2H_2O$	100 g	x
266	Stannic chloride $Sn Cl_4 . 5H_2O$	250 g	x
267	Stannous chloride $SnCl_2 . 2H_2O$	500 g	x
268	Starch, soluble	500 g	x
269	Strontium chloride $SrCl_2 . 6H_2O$	250 g	x
270	Succinic acid	250 g	x
271	Sulphanilic acid $4\text{-}NH_2C_6H_4SO_3H . H_2O$	100 g	x
272	Sulphuric acid, Technical about 97% H_2SO_4	50 l	x
273	Sulphuric acid, Sp. Gr. 1.84	220 l	x
274	Sulphuric acid, fuming, 25% SO_3	5 l	x
275	Tannic acid	250 g	x
276	Thioglycolic acid	100 g	x
277	Thymol blue	10 g	x
278	Thymolphtaleine	10 g	x
279	Tin, metal, granulated	500 g	x
280	Tiron, indicator	25 g	x
281	Titanium oxide, di-	250 g	x
282	Titanium sulphate $Ti (SO_4)_2 . 9H_2O$	250 g	x
283	Titan yellow (Clayton yellow) reagent for Mg	25 g	x
284	Toluene, purified	1 l	x
285	Triethanolamine, technical Sp. Gr. 1.126	2 l	x

Item No.	Description	Quantity	Possible source
286	Turmeric, powder	250 g	x
287	Uranyl zinc acetate $(VO_2(C_2H_3O_2)_2 2Zn(C_2H_3O_2)_2 . 2H_2O$	500 g	x
288	Urea	1 kg	x
289	Vaseline white	2 kg	x
290	Wood cotton, nonabsorbent, white	5 kg	x
291	Zinc, metal, powder	2 kg	x
292	Zinc carbonate	500 g	x
293	Zinc dibenzyldithiocarbamate	25 g	x
294	Zincon	5 g	x
295	Zinc sulphate $ZnSO_4 . 7H_2O$	1 kg	x

3B. Glassware and Porcelain

Item No.	Description		Quantity	Possible source
501	Beakers, boro-silicate glass, low form, with spout, capacity	50 ml	20	x
502	- ditto -	100 ml	30	x
503	- ditto -	150 ml	30	x
504	- ditto -	250 ml	30	x
505	- ditto -	400 ml	30	x
506	- ditto -	600 ml	30	x
507	- ditto -	1000 ml	10	x
508	- ditto -	2000 ml	5	x
509	Beakers, boro-silicate glass, tall form, with spout, capacity	50 ml	20	x
510	- ditto -	100 ml	20	x
511	- ditto -	150 ml	20	x
512	- ditto -	250 ml	20	x
513	- ditto -	400 ml	10	x
514	- ditto -	600 ml	10	x
515	- ditto -	1000 ml	10	x
516	Bottles, aspirator, boro-silicate glass, outlet for stopper, capacity	1000 ml	4	x
517	- ditto - with glass stopcock	10 l	2	x
518	- ditto - with glass stopcock	20 l	2	x
519	Spare glass stopcock for Nos. 517 and 518		4	x
520	Bottles, dropping, flat stopper cap.	50 ml	10	x
521	- ditto -	100 ml	10	x
522	Bottles, dropping, with rubber bulb, capacity	50 ml	10	x
523	Bottles, gaswash, drechsel, ground glass head fitting, capacity	250 ml	2	x
524	- ditto -	500 ml	2	x
525	Bottles, narrow mouth, boro-silicate glass, capacity	12.5 l	2	x
526	Bottles, reagent, plain narrow mouth, flat T stopper, capac.	125 ml	10	x
527	- ditto -	250 ml	20	x
528	- ditto -	500 ml	20	x
529	- ditto -	1000 ml	20	x
530	- ditto -	2000 ml	5	x
531	- ditto -	3000 ml	10	x
532	- ditto -	5000 ml	4	x

Item No.	Description		Quantity	Possible source
533	Bottles reagent, narrow mouth, amber glass, coin head stopper, capac.	500 ml	20	x
534	- ditto -	1000 ml	10	x
535	Bottles, specific gravity, cap.	25 ml	10	x
536	- ditto -	50 ml	10	x
537	- ditto -	100 ml	10	x
538	Bottles, wash, borosilicate glass, complete unit, capacity	1000 ml	5	x
539	Bottles, weighing, low form, cylindrical, capacity	35 ml	10	x
540	- ditto -	60 ml	20	x
541	Bottles, wide mouth, threaded neck, screw cap, capacity	1000 ml	10	x
542	Bulbs, connecting kjeldahl, diam.	65 mm	15	x
543	Burettes, automatic, with 2 liter reservoir graduated to 0.05 ml, capacity	10 ml	3	x
544	- ditto - graduated to 0.1 ml	25 ml	3	x
545	- ditto - graduated to 0.1 ml	50 ml	3	x
546	Burettes, dispensing, with standard stopcock	100 ml	3	x
547	- ditto -	250 ml	3	x
548	Burettes, Grade B, with pinchcock (Mohr), graduated to 0.1 ml, cap.	10 ml	5	x
549	- ditto -	25 ml	5	x
550	- ditto -	50 ml	5	x
551	- ditto -	100 ml	5	x
552	Burettes, Grade B, with standard glass stopcock, capacity	10 ml	5	x
553	- ditto -	25 ml	5	x
554	- ditto -	50 ml	5	x
555	- ditto -	100 ml	5	x
556	Burettes, Grade A, standard glass stopcock, capacity	25 ml	2	x
557	- ditto -	50 ml	2	x
558	Microburette graduated 0.02 ml, straight glass stopcock, capacity	10 ml	2	x
559	Clock glasses, diameter	60 mm	30	x
560	- ditto -	90 mm	30	x

Item No.	Description		Quantity	Possible source
561	Clock glasses, diameter	150 mm	30	x
562	Condensers, cold finger, length below flange 110 mm, diam. below	20 mm	20	x
563	Condenser, Liebig, length	300 mm	5	x
564	Crucibles, Gooch, perforated base, capacity	25 ml	30	x
565	Crucibles, Gooch, boro-silicate glass, low form, with fused in fritted disk, medium-grade porosity, capacity	50 ml	10	x
566	- ditto - fine grade por.	50 ml	10	x
567	Crucibles, porcelain, with lid, capacity	15 ml	10	x
568	- ditto -	30 ml	20	x
569	- ditto -	50 ml	20	x
570	- ditto -	100 ml	10	x
571	Crucibles, silica, with lid, capacity	50 ml	10	x
572	- ditto -	100 ml	10	x
573	Cylinders, Grade B, graduated, with pourout, capacity	25 ml	10	x
574	- ditto -	50 ml	10	x
575	- ditto -	100 ml	10	x
576	- ditto -	250 ml	10	x
577	- ditto -	500 ml	5	x
578	- ditto -	1000 ml	10	x
579	Desiccators, with cover, inside diameter	250 mm	5	x
580	Desiccator, porcelain plates for No. 579 above		5	x
581	Desiccator, perforated zinc plates, for No. 579 above		5	x
582	Extraction apparatus Soxhlet with interchangeable ground glass joints, complete, flask capacity	250 ml	2	x
583	Spare flasks for No. 582 above		10	x
584	Evaporating dishes, porcelein glazed	75 ml	50	x
585	- ditto -	150 ml	25	x
586	- ditto -	250 ml	25	x
587	- ditto -	500 ml	10	x
588	Evaporating dishes, porcelain glazed, flat pattern	75 ml	20	x
589	Flasks, boiling, flat bottom, vial mouth, boto-silicate glass, capacity	250 ml	20	x

Item No.	Description		Quantity	Possible source
590	Flasks, boiling, flat bottom, vial mouth, boto-silicate glass, capacity	500 ml	30	x
591	- ditto -	1000 ml	20	x
592	- ditto -	2000 ml	10	x
593	Flasks, boiling, flat bottom, wicker-covered neck, boro-silicate glass, capacity	1000 ml	5	x
594	Flasks, boiling, round bottom, wicker-covered neck, boro-silicate glass, capacity	500 ml	20	x
595	- ditto -	1000 ml	30	x
596	Flasks, boiling, round bottom, boro-silicate glass, capacity	250 ml	20	x
597	- ditto -	500 ml	30	x
598	- ditto -	1000 ml	30	x
599	Flasks boilling, short neck, T joint	250 ml	10	x
600	Flasks, Erlenmeyer, boro-silicate glass, conical, capacity	50 ml	100	x
601	- ditto -	125 ml	100	x
602	- ditto -	250 ml	50	x
603	- ditto -	500 ml	20	x
604	- ditto -	1000 ml	20	x
605	- ditto -	2000 ml	5	x
606	Flasks, extraction, boro silicate glass, capacity	250 ml	10	x
607	Flasks, filtering, boro-silicate glass, with side tube, capacity	250 ml	10	x
608	- ditto -	500 ml	10	x
609	- ditto -	1000 ml	10	x
610	Flasks, Kjeldhal, micro, boro-silicate glass, capacity	30 ml	30	x
611	Flasks, Kjeldahl, round bottom, long neck, capacity	100 ml	30	x
612	- ditto -	800 ml	30	x
613	Flasks, volumetric, Grade B, gound glass stoppers, boro-silicate glass, capacity	25 ml	10	x
614	- ditto -	50 ml	10	x
615	- ditto -	100 ml	10	x
616	Flasks, volumetric, Grade A, ground glass stoppers, boro-silicate glass, capacity	200 ml	20	x
617	- ditto -	250 ml	20	x

Item No.	Description		Quantity	Possible source
618	Flasks, volumetric, Grade A, ground glass stoppers, boro-silicate glass, capacity	500 ml	10	x
619	- ditto -	1000 ml	5	x
620	- ditto -	2000 ml	3	x
621	Flasks, volumetric, certified grade A, with certificate, capacity	500 ml	3	x
622	- ditto -	1000 ml	3	x
623	Funnels, boro-silicate glass, diam. 50 mm, stem length	60 mm	10	x
624	- ditto - 75 mm, stem length	75 mm	20	x
625	- ditto - 100 mm, stem length	100 mm	20	x
626	- ditto - 150 mm, stem length	200 mm	10	x
627	Funnels, Buchner, boro-silicate glass, fritted, medium porosity, capacity	60 ml	5	x
628	- ditto -	150 ml	5	x
629	Funnels, Buchner, porcelain plate type, diam.	56 mm	5	x
630	- ditto -	91 mm	5	x
631	- ditto -	151 mm	5	x
632	Funnels, separatory, cylindrical, graduated from stopcock, capacity	500 ml	5	x
633	Funnels, separatory, boro-silicate glass, Squib type, capacity	125 ml	5	x
634	Funnels, separatory,large capacity	4000 ml	2	x
635	Glass bals, 5 TO 6 mm diameter		1 kg	x
636	Glass rod, boro-silicate glass diam.	5 mm	2 kg	x
637	- ditto -	8 mm	2 kg	x
638	Glass stopcock, 10 cm side arm, bore	4 mm	20	x
639	Glass stopcock, three way, bore	4 mm	20	x
640	Glass tubing, standard wall thickness, boro-silicate glass, outside diameter	4 mm	2 kg	x
641	- ditto - outs. diam.	6 mm	5 kg	x
642	- ditto - outs. diam.	8 mm	5 kg	x
643	- ditto - outs. diam.	10 mm	5 kg	x
644	- ditto - outs. diam.	12 mm	2 kg	x
645	- ditto - outs. diam.	15 mm	2 kg	x
646	- ditto - outs. diam.	20 mm	2 kg	x
647	- ditto - outs. diam.	25 mm	2 kg	x
648	- ditto - outs. diam.	35 mm	2 kg	x
649	Glass tubing, heavy wall, boro-silicate glass, outside diam.	6 mm	1 kg	x

Item No.	Description		Quantity	Possible source
650	Glass tubing, heavy wall, boro-silicate glass, outside diam.	8 mm	1 kg	x
651	- ditto - outside diameter	10 mm	2 kg	x
652	- ditto - outside diameter	12 mm	1 kg	x
653	Hydrometer, shot weighted, two hundred degree series, length 22-24 cm, range 0.60-0.80		1	x
654	- ditto - range 0.80-1.00		1	x
655	- ditto - range 1.00-1.20		1	x
656	- ditto - range 1.20-1.40		1	x
657	Jars, low form, flint glass, plastic screwtop, capacity	500 ml	100	x
658	Mortar and pestle, porcelain, diam. of mortar 200 mm, capacity 1.5 or 2 liters		2	x
659	Mortar and pestle, porcelain, diam. of mortar 150 mm, capacity	400 ml approx.	2	x
660	Mortar and pestle, agate, polished, external diam. of mortar 85 mm, internal 75 mm		1	x
661	Plates, spotting, porcelain, glazed 12-hole, 120 x 80 mm, approx.		4	x
662	Pipettes, Grade B, volumetric, transfer, capacity	1 ml	5	x
663	- ditto -	2 ml	5	x
664	Pipettes, Grade B, volumetric, transfer, capacity	5 ml	10	x
665	- ditto -	10 ml	10	x
666	- ditto -	20 ml	10	x
667	- ditto -	25 ml	10	x
668	- ditto -	40 ml	5	x
669	- ditto -	50 ml	10	x
670	- ditto -	100 ml	5	x
671	Pipettes, Grade A, volumetric, transfer, capacity	5 ml	2	x
672	- ditto -	10 ml	2	x
673	- ditto -	25 ml	2	x
674	Pipettes, measuring (Mohr), boro-silicate glass, graduation internal 1/10 ml to deliver	1 ml	5	x
675	- ditto -	5 ml	5	x
676	- ditto -	10 ml	5	x
677	- ditto -	25 ml	5	x

Item No.	Description		Quantity	Possible source
678	Pipette automatic, T joint, with flask 300 ml, capacity	1 ml	2	x
679	- ditto -	2 ml	2	x
680	- ditto -	3 ml	2	x
681	- ditto -	5 ml	2	x
682	- ditto -	10 ml	2	x
683	Pipette automatic 15 ml T. joint with flask 500 ml, capacity	20 ml	2	x
684	- ditto -	25 ml	2	x
685	- ditto -	30 ml	2	x
686	- ditto -	50 ml	2	x
687	T. pieces, glass, outside diameter	8 mm	20	x
688	- ditto -	12 mm	20	x
689	Y pieces, glass, outside diameter	8 mm	20	x
690	- ditto -	12 mm	20	x
691	Test tubes, boro-silicate glass, without lip	18x150 mm	200	x
692	Test tubes, boro-silicate glass, without lip	10x100 mm	50	x
693	Test tubes, soda glass	18x150 mm	200	x
694	Thermometers, general laboratory range -5 to 110°C.		5	x
695	- ditto - range -5 to 200°C.		3	x
696	- ditto - range -5 to 360°C.		2	x
697	Thermometers range 0 to 40°C. with 0.2 intervals		5	x
698	Thermometers, armored, 2° interval range -6 to 500° C.		2	x
699	Tubes, calcium chloride absorption, 150 x 20 mm, bulb, 30 mm.		20	x
700	Tubes, centrifuge, boro-silicate glass, graduated, tapered	15 ml	25	x
701	Tubes, centrifuge, boro-silicate glass, round bottom	50 ml	25	x
702	Tubes, centrifuge, conical	12 ml	20	x
703	- ditto -	50 ml	20	x
704	Tubes, leaching, straight body 30 mm, internal diameter, length of body 200 mm, stem 40 mm long, by internal diameter 5 to 6 mm		60	x

3C. Polythene and Plastic ware

Item No.	Description		Quantity	Possible source
801	Beakers, Polythene, squat form with spout, capacity	25 ml	20	4
802	- ditto -	50 ml	50	4
803	- ditto -	100 ml	50	4
804	- ditto -	250 ml	20	4
805	- ditto -	400 ml	20	4
806	- ditto -	600 ml	20	4
807	- ditto -	1 l	10	4
808	- ditto -	2 l	10	4
809	Bottles, Aspirator, Polythene complete, with polythene stopcock, capacity	4 l	5	4
810	- ditto -	9 l	5	4
811	- ditto -	23 l	5	4
812	Spare stopcock for the above items 809 to 811		4	4
813	Bottles, dropping, Polythene	50 ml	25	4
814	Bottles, polythene, medium weight, wide mouth, polythene screw cap and rubber sealing ring, capacity	600 ml	50	4
815	Spare rubber sealing rings for N^{O} 814 above		50	4
816	Bottles, Polythene, rigid type, narrow mouth with screw cap and gasket, capacity	600 ml	50	4
817	- ditto -	1250 ml	20	4
818	- ditto -	4.5 l	5	4
819	- ditto -	9 l	5	4
820	Bottles, specimen, polythene, capacity	30 ml	50	4
821	Bottles, wash, polythene, squeeze type, capacity	250 ml	20	4
822	- ditto -	500 ml	20	4
823	Bowls, Polythene, square 30 cm x 30 cm x 11 cm		5	4
824	Buckets, Polythene, rigid type, calibrated in liters.Capacity 12 l		5	4
825	Clips, spring, Polythene coated, closed type	0.5/8 in.	12	4
826	- ditto -	3/8 in.	12	4
827	- ditto -	5/8 in.	12	4
828	- ditto -	3/4 in.	12	4

Item No.	Description		Quantity	Possible source
829	Clips, spring, Polythene coated, closed type		12	4
830	- ditto -	1 1/8 in.	12	4
831	- ditto -	1 1/4 in.	12	4
832	- ditto -	1 1/2 in.	12	4
833	Covers, burette, Polythene		50	4
834	Cylinders, graduated, Polythene	25 ml	2	4
835	- ditto -	50 ml	5	4
836	- ditto -	250 ml	2	4
837	- ditto -	500 ml	2	4
838	- ditto -	1000 ml	2	4
839	Film, Polythene, 200 gauge (0.05 mm), 120 cm wide		10 meters	3
840	Funnels, filter, Polythene 3.7 cm diam.		50	4
841	- ditto - 9 cm diam.		50	4
842	Funnels, filter, Polythene, heavy weight, 15 cm diam.		5	4
843	- ditto - 25 cm diam.		2	4
844	- ditto - 30 cm diam.		2	4
845	Rod, perspex	12 mm diam.	5 meters	3
846	Rod, perspex	19 mm diam.	5 meters	3
847	Rod, polythene	6 mm diam.	10 meters	3
848	Rod, polythene	12 mm diam.	10 meters	3
849	Scoops, polythene, set of 4 assorted sizes		4 sets	4
850	Sheet polythene, 150 x 75 cm each sheet, thickness 1.5 mm		1	3
851	Spatulas, polythene		10	4
852	Stirrer polythene, 3-bladed propeller 6 mm rod, 450 mm long		3	3
853	Stoppers polythene interchangeable size	C 7	20	4
854	- ditto -	C 10	20	4
855	- ditto -	C 12	20	4
856	- ditto -	C 14	20	4
857	- ditto -	C 19	20	4
858	- ditto -	C 24	10	4
859	- ditto -	C 29	10	4
860	Syphon, carboy, polythene, selfpriming		2	4
861	Syringes, nylon	2 ml	4	4

Item No.	Description		Quantity	Possible source
862	Syringes, nylon	5 ml	4	4
863	- ditto -	10 ml	3	4
864	- ditto -	12 ml	3	4
865	Tanks with Spigot, polythene, capacity	120 l	2	7
866	Cover for No. 865 above		2	7
867	Tape, adhesive plastic, 25 mm wide, roll of 65 meters		2	3
868	Tiles, spotting, P.V.C., 12 holes		10	4
869	Trays, plastic, 30 x 50 cm		50	x
870	Tubes, centrifuge, conical, hard, heat resistant, polypropylene	15 ml	24	7
871	- ditto -	45 ml	24	7
872	Tubes centrifuge, round bottom, polypropylene	18 ml	24	7
873	- ditto -	50 ml	24	7
874	Tubes T, vinyl plastic, bore	8 mm	20	3
875	- ditto - bore	12 mm	20	3
876	Tubes Y, vinyl plastic, bore	8 mm	20	3
877	- ditto - bore	12 mm	20	3
878	Tubing, P.V.C., translucent, elastic grade	6 mm	9 m	4
879	- ditto -	8 mm	18 m	4
880	- ditto -	11 mm	18 m	4
881	- ditto -	13 mm	18 m	4
882	- ditto -	18 mm	9 m	4
883	Washer, pipette, automatic, polythene, complete unit		1	4

3D. Sundries

Item No.	Description	Quantity	Possible source
900	Acid, pump, dispenser, with lead tubing	2	x
901	Adhesive, laboratory, suitable for joining nonporous surfaces such as glass, metals, plastics, heat and water resistant, in tubes	10	x
902	Asbestolite sheet, 120 x 90 cm, acid resistant finish, thickness 110 mm	2	3
903	Asbestos mats, round, diameter 150 mm	25	x
904	Aspirator bulb, complete with 50 cm of tubing for use with wash-bottles, burettes, etc.	20	x
905	Bossheads, right angle type to take rods up to 20 mm	50	x
906	Bossheads, swivel type to take rods up to 20 mm	20	x
907	Brushes, burette, handle 50 cm, diameter of head 112 mm	10	x
908	- ditto - 60 cm 115 mm	10	x
909	- ditto - 75 cm 188 mm	6	x
910	Brushes, cylinder, overall length 60 cm diameter of head 122 mm	5	x
911	Brushes, test-tube, small	10	x
912	" " large	10	x
913	Brushes "camel hair", small	20	x
914	" " large (2.5 cm)	10	x
915	Brushes, flat paint, width 1 inches	20	x
916	- ditto - 2 inches	10	x
917	Burners, "Amal" type (state type of gas) size: minor	15	3
918	- ditto - size: major	10	3
919	Jet key for Nos. 917 and 918 above	2	3
920	Spare set of jets for above 917 and 918, four jets per set (state type of gas)	10	3
921	Burner mekea (state type of gas)	6	3
922	Burner support for attaching to retortstand	10	x
923	Caliper, for external and internal measurement to 15 cm complete with vernier and lock	1	x
924	Clamps, hose, hoffman, screw type, extra large size	5	x
925	Clamps, laboratory universal type, capable of retaining objects from 2 mm to 90 mm diam	60	3
926	Clamps, beaker	5	3

Item No.	Description		Quantity	Possible source
927	Clips, Hoffman, screw type, hinged bottom bar,	20 mm	50	x
928	- ditto -	27 mm	20	x
929	- ditto -	32 mm	20	x
930	Clips, Mohr, tubing, length	60 mm	20	x
931	Corks, first quality, bag of 1500 (one thousand five hundred) varying in at least 15 sizes between 6 mm minimum diameter and 70 mm minimum diameter (approx. 100 of each size)		1 bag	x
932	Cork-boring drill, hand operated, bench model, complete with 1 set of 10 different interchangeable drills		1	x
933	Sharpener for cork-boring drills (ref. to 932 above)		2 each	x
934	Cork rings for supporting round-bottom flasks, external diameter	115 mm	10	x
935	- ditto - external diameter	155 mm	10	x
936	Cotton wool, best quality		2 kg	x
937	Counter, revolutions, spindle type for intermitente use, up to 3000 rpm		1	x
938	Drill, electric, portable model, to take drills to 100 mm, 1/2 hp model (State: voltage.. cycles... and AC or DC)		1	x
939	Drills, high speed quality, complete set containing the following sizes: 1 mm, 1.5 mm, 2 mm, 2.5 mm, 3 mm, 4 mm, 5 mm, 6 mm, 8 mm, 10 mm		2	x
940	Element charts, 50 cm x 40 cm approx. showing atomic weights and numbers		2	x
941	Filter adapters, rubber conical shaped, mean diameter	20 mm	5	x
942	- ditto -	30 mm	5	x
943	- ditto -	40 mm	5	x
944	- ditto -	50 mm	5	x
945	Filter papers, "Whatman" No. 1	55 mm	10	x
946	Filter papers, "Whatman" No. 2, box of 100 sheets, diameter	125 mm	200	x
947	- ditto -	70 mm		
948	- ditto -	150 mm	10	x
949	- ditto -	185 mm	10	x
950	Filter papers, "Whatman" No. 5 box of 100 sheets, diameter	150 mm	20	x

Item No.	Description		Quantity	Possible source
951	Filter papers "Whatman" No. 40 base of 100 sheets, diameter	150 mm	10	x
952	Filter papers, "Whatman" No. 41, box of 100 sheets, diameter	70 mm	50	x
953	- ditto -	90 mm	10	x
954	- ditto -	110 mm	10	x
955	Filter papers, "Whatman" No. 42,box of 100 sheets, diameter	55 mm	10	x
956	- ditto -	70 mm	10	x
957	- ditto -	90 mm	10	x
958	- ditto -	110 mm	10	x
959	- ditto -	125 mm	10	x
960	Filter papers "Whatman" No. 44 box of 100 sheets, diameter	90 mm	10	x
961	Filter papers"Whatman" No. 50,box of 100 sheets,diameter	90 mm	10	x
962	- ditto -	125 mm	10	x
963	Filter paper, qualitative sheets,		100	x
964	Filter paper tablets, "Whatman", box	100 tablets	10	x
965	Filter, Pasteur Chamberland, fineness "F"		10	x
966	Filter pump for attaching to water tap either plastic or metal construction		10	x
967	First-aid kit suitable for a laboratory, complete self-contained unit, easily accessible		1	2
968	Gauzes, wire squares with asbestos centers 15 cm. diameter		25	x
969	Glass blowing tools, set of 6 pieces		1	3
970	Glass cutter - hot wire		1	x
971	Heating wires for glass cutter No. 970		10	x
972	Glass cutter for tubing		5	x
973	Glass cutting diamond, mounted in metal head		1	x
974	Glass cutting knife		10	x
975	Glass heads, approx. 4 mm diameter		1 kg	x
976	Glass wool		2 kg	x
977	Gloves, rubber, medium weight, size 8 (medium size)		5 pairs	x
978	Gloves, rubber, medium weight, size 9 (large size)		5 pairs	x

Item No.	Description	Quantity	Possible source
979	Hacksaw, to take 25 cm blades	1	x
980	Blades, 25 cm for No. 979 above	20	x
981	Hammer, carpenters, weight, 400 g	1	x
982	Keys, Allen, set of 10 small sizes	1	x
983	Labels, bottle, self adhesive, approx. 25 x 50 mm Box of 500 labels	5 boxes	x
984	Laboratory Scalfolding connectors (90^{o})	50	3
985	- ditto - adapters (45^{o})	10	3
986	- ditto - (60^{o})	5	3
987	- ditto - (90^{o})	5	3
988	- ditto - swivel adapter	10	3
989	- ditto - setscrews	50	3
990	- ditto - key (for setscrews)	5	3
991	- ditto - Rods 15 cm x 12.5 mm	5	3
992	- ditto - 30 cm x 12.5 mm	5	3
993	- ditto - 60 cm x 12.5 mm	20	3
994	- ditto - 90 cm x 12.5 mm	20	3
995	- ditto - 120 cm x 12.5 mm	10	3
996	- ditto - 150 cm x 12.5 mm	4	3
997	- ditto - foot circular	10	3
998	- ditto - foot universal	10	3
	Items 984 to 998 inclusive should be purchased from the same source.		
999	Lubricant stopcock, 50-g tin	10	x
1000	Magnifyer, double lens, x 4 and x 10,pocket type	2	x
1001	Pencils, glass writing, four different colors	50	x
1002	Platinum foil, 0.05 mm thick, 40 x 40 mm	1	x
1003	Platinum wire, 0.4 mm approx. diameter	50 cm	x
1004	Pliers, with insulated handles, 20 cm	2	x
1005	Racks, wooden, test-tube, 10 holes, 20 mm each	20	x
1006	Rings, retort stand, fitted with bossheads, diameter 60 mm	10	x
1007	Rubber teats for droppers	20	x
1008	Rubber policemen, for use with glass rods 8 mm	50	x
1009	Scissors, stainless steel, 18 cm long	5	x
1010	Screwdrivers, insulated, plastic handle, set of 3 sizes: 100 mm, 150 mm, 200 mm	2	x
1011	Soldering iron, electrical, small head suitable for electrical connections (State voltage...AC or DC...)	1	x

Item No.	Description		Quantity	Possible source
1012	Solder, resin cored		250 g	x
1013	Spanner, set of all steel, double ended, in 10 sizes, from 5 to 15 mm		1	x
1014	Spatula, Chattaway pattern, nickel, length 100 mm		10	x
1015	Spatula Horn, length 200 mm		2	x
1016	Spatula, palette knife, stainless steel, length 300 mm		5	x
1017	Stand, circular top, 500 mm high		20	3
1018	Pipette stand to hold 12 pipettes horizontally, self-standing		5	x
1019	Retort stand, rod 50 cm x 10 mm		20	x
1020	- ditto - rod 75 cm x 12 mm		20	x
1021	- ditto - rod 100 cm x 15 mm		10	x
1022	Stoppers, solid rubber, having a 1 in 8 taper, of best quality rubber, an assortment containing 50 each of the following sizes: 5, 7, 9, 11, 13, 17, 21, 25, 29 and 33.		1	x
1023	Stoppers, solid rubber	Size 41	20	x
1024	- ditto -	Size 49	10	x
1025	- ditto -	Size 57	5	x
1026	- ditto -	Size 67	2	x
1027	- ditto -	Size 76	2	x
1028	- ditto -	Size 86	12	x
1029	Support burettes porcelain		5	x
1030	Support for 6 funnels		5	x
1031	Test papers, books of 20 leaves, litmus		20	x
1032	- ditto -	multirange	20	x
1033	Tongs, Fisher, for use with basin and dishes from 70 mm to 125 mm		3	x
1034	Tongs, Fisher, for flasks		3	x
1035	Tongs, Fisher, for beakers		3	x
1036	Tongs, crucible		4	x
1037	Tongs, furnace, long handled		2	x
1038	Triangles, pipe-clay	50 mm	10	x
1039	- ditto -	65 mm	10	x
1040	Triangles, silica	40 mm	5	x
1041	- ditto -	50 mm	5	x
1042	Tripods, iron		10	x
1043	Tripods, concentring rings		5	x

Item No.	Description		Quantity	Possible source
1044	Tubing, rubber with reinforced ends for Bunsen burners	60 cm	30	x
1045	- ditto -	90 cm	20	x
1046	Tubing, rubber, red, best quality normal wall thickness, coil of 20 meters internal diameter	6 mm	1	x
[redacted]				

3E. Large Equipment

Item No.	Description	Quantity	Possible source
1100	Air compressor and vacuum pump, Edwards, model RB 4, complete with base plate and 1/3 h.p. motor (State: voltage... cycles... AC or DC.... phases.....)	1	3
1101	Spare set of vanes for No. 1100 above	1	3
1102	Air pump, portable, piston type, 1/4 h.p. electric motor, complete with air reservoir and pressure gauge (State: voltage... cycles... AC or DC.....)	1	3
1103	Spare drive belts for No. 1102 above	4	3
1104	Lubricating oil for No. 1100 and 1102 above (SAE 10)	5	x
1105	Balance, analytical, single pan, air damped, capacity 200 g, accuracy 0.1 mg, optical scale readable to 0.1 covering range up to 10 mg, automatic taring device to at least 15 g, minimum pan diam. 10 cm, dial operated weights 200 g to 10 mg (State voltage...) The following manufacturers produce balances corresponding to the above specifications: Sartorius, Mettler Stanton, Ainsworth, Mondial, Oertling and others.	1	3
1106	Balance, weighing, precision, capacity 500 g, pans 10 cm diam., visual scale 0 - 2 g in 200 divisions, magnetic damping, accuracy 20 mg	2	5
1107	Plastic housing for No. 1106 above	2	5
1108	Balance, capacity 3 kg, optical, scale range 1 kg, automatic shifter weights to 2 kgs, reading to 0.2g, accuracy $\pm$ 0.2 g, magnetic damping, taring device to 500 g (State voltage.....)	1	5
1109	Analytical weights, class A, stainless steel or Rhodium plated, 2 x 200 g, 100 g, 50 g, 2 x 20 g, 10 g, 5 g, 2 x 2 g and 1 g to be included in set. Fractions not required	1 set	x
1110	Calcimeter, Collins, for estimation of carbonates in soils	1	3
1111	Flasks, 150 ml for No. 1110 above	20	3
1112	Acid holding vials for No. 1110 above	5	3
1113	Calculating slide rule for No. 1110 above	1	3
1114	Centrifuge, International No.1 Model CM (Stage voltage.... cycles....)	1	x(US)

Item No.	Description	Quantity	Possible source
1115	Head, eight places, for above No. 1114 to take 50 ml or 15 ml tubes	1	x(US)
1116	Trunion rings, 50 ml for above No. 1115	10	x(US)
1117	Trunion rings, 15 ml for above No. 1116	10	x(US)
1118	Metal shields, 50 ml for above No. 1116	10	x(US)
1119	Metal shields, 15 ml for above No. 1115	10	x(US)
1120	Rubber cushions for above No. 1118 (50 ml)	10	x(US)
1121	Rubber cushions for above No. 1119 (15 ml)	10	x(US)
1122	Carbon brushes, complete set for No. 1114 above	2	x(US)
	Note: Items 1114 to 1122 inclusive must all be purchased from same source. Other suitable makes might be MSE, Roto-Silenta, Pirouette, Gallenkamp, Prolabo, and others.		
1123	Conductivity Bridge, direct reading, portable model, completely transistorized and tropicalized, suitable for the measurement of conductivity of solutions, waters, soil extracts, soil suspensions and soil pastes	1	12
1124	Conductivity cell, suck-up type for above No. 1123	2	12
1125	Spare complete set of batteries for No. 1123 above	2	12
1126	Soil cup, US Bureau of Soils type, for use with No. 1123	1	8
	Note: Items Nos. 1123 to 1125 must be purchased from the same source and preferably item 1126.		
1127	Deionizer yield varying from 4000 liters between re-charges for water with a maximum of 50 ppm total hardness down to 1000 liters for 200 ppm total hardness water (Stage voltage....AC or DC...)	1	9
1128	Spare cartridge for No. 1127 above	2	9
1129	Pre-filter for use with Deionizer	2	x
1130	Water distillation apparatus, electrically heated (State voltage...AC or DC...) capacity 4.5 liters per hour, 3 KW heating element	2	3
1131	Heating elements with safety device for above No. 1130	10	3

Item No.	Description	Quantity	Possible source
1132	Baffle cup for 1130 above	2	3
1133	Glass lid for 1130 above	2	3
1134	Laughborough Water still, all glass, fully automatic with 3 KW heating element, output 4 liters per hour (State voltage.....)	1	4
1135	Spare heating element complete with cut-out for No. 1134 above (State voltage.....)	2	4
1136	Digestion apparatus, semi-micro, complete with size 1 Silumin heaters 65 mm diam., to take 50 or 100 ml flasks, 6 unit model with variable heat control, 1800 watt total load, with support and glass fume tube (State voltage)	2	5
1137	Spare hot plate complete with heating element size 1, but without casing for No. 1136 above (State voltage....)	1	5
1138	Spare heating elements, size 1 for No. 1136 above (State voltage....)	6	5
1139	Spare glass fume extractor tube for semi-micro apparatus No. 1136 above	4	5
	Note: Items 1136 to 1139 above must all be purchased from same source. Similar equipment may be available from most laboratory suppliers.		
1140	Filter funnel apparatus for soil paste	2	8
1141	Flow meter for gasses suitable for measuring a flow of gas from 25 to 200 liters per hour, arbitrary scale suitable for use with propane, butane or air, for bench mounting tube connection	3	3
1142	Hot plate, electrically heated, bench model, totally enclosed elements, 20 cm diam., with variable control switch, single phase, 1.5 KW (State: voltage.... AC or DC....)	2	x
1143	Spare set of elements for No. 1142 above (State voltage.... AC or DC ....)	1	x
1144	Hot plate, electrically heated, for mounting on a retort stand, 15 cm diam., variable control switch, totally enclosed elements, 750 watts, single phase (State voltage.... AC or DC....)	2	x
1145	Spare set of elements for No. 1144 above (State voltage.... AC or DC....)	1	x

Item No.	Description	Quantity	Possible source
1146	Hot plate, large, rectangular (45 cm, by 30 cm), with variable control, electrically heated, for single phase current, four elements each 500W making a total loading of 2 KW (State voltage... AC or DC....)	2	3
1147	Spare elements for 1146 above, 500 watt (State voltage.... AC or DC....)	4	3
1148	Kjeldahl apparatus, electric, 6 units, for digestion and distillation, adjustable rack for various size flasks.	2	x
1149	Semi-micro Kjeldahl apparatus for steam distillation, consisting of a 100 ml flask with B. 19 socket joint, distillation head with B. 10 socket joint, B. 19 cone and 18/9 BS ball, Liebig condenser, 150 mm effective length with 18/9 BS cup joint, clip JC 9/18 and funnel plug with B10 cone	12	10
1150	Kjeldahl flasks, 100 ml with B. 19 socket joint	60	10
	Note: Items 1149 and 1150 above should be purchased from same source. Another make with the above minimum specification may be acceptable.		
1151	Muffle furnace for operation at temperatures up to 1100° C. for single phase AC current, 1000°C fuse, internal dimensions 380 mm x 190 mm x 135 mm, built in indicating pyrometer, power relay and energy regulator, and swing up door (State voltage...)	1	3
1152	Spare temperature fuse (1000°C) for No. 1151 above	12	3
1153	Spare temperature fuse (1100°C) for No. 1151	6	3
1154	Twin bore sleeve for temperature fuse in furnace, spare for No. 1151 above	6	3
1155	Thermo couple element for No. 1151 above	2	3
	Note: Items Nos. 1151 to 1155 should be purchased from same source. An item of similar specifications may be purchased from most laboratory suppliers.		
1156	Oven, gravity connection model, range room temperature to 200°C, with thermometer graduated in °C, electrically heated, load approximately 1 KW, single phase operation AC, internal dimensions 60 x 50 x 50 cm, 2 shelves (State voltage.....)	1	x

Item No.	Description	Quantity	Possible source
1157	pH meter, suitable for single phase mains operation, two pH scales covering the range of 0 to 14 pH reading to 0.05 unit accuracy, complete with built-in voltage stabilizer. Automatic temperature compensation over the range 0 to 100°C. Complete with normal type glass electrode and wick-type Calomel electrode, suitable for measuring pH of solutions or soil suspensions (State voltage... cycles AC or DC)	1	11
1158	Spare glass electrodes for No. 1151 above	2	11
1159	Spare Calomel electrodes for No. 1157 above	2	11
	Note: Nos. 1157 to 1159 must be purchased from the same source. Makes to that quoted might be: Beckman, Pye, Cambridge, Coleman, Hartmans-Braun, Marconi, Knick, Lange, Prolabo provided the specifications corresponding to above		
1160	pH meter, portable, battery operated model, transistorized, two scales covering the range 0 to 14 pH. Manually operated temperature compensator covering the range 0 to 100°C, measurement to 0.1 pH units. The instrument is to be supplied complete in a case suitable for field use which should also contain the electrodes, buffer solution, distilled water, potassium chloride solution, small beakers and a thermometer. Complete set.	1	13
1161	Spare glass electrodes for above No. 1160	2	13
1162	Spare calomel electrodes, fiber type for above No. 1160	2	13
1163	Spare complete set of batteries for No. 1160 above	2	13
1164	Photometer flame, Dr. B. Lange Model 6, complete with pointer galvanometer, compressor, gas pressure regulator, atomizer and 5 interference type filters for Ca, K, Mg, Na and Li (State voltage.... cycles.... AC or DC....)	1	14
1165	Burner, spare for No. 1164 above	2	14
1166	Atomizer, complete, spare for No. 1164 above	4	14
1167	Photocell, spare for No. 1164 above	1	14

Item No.	Description	Quantity	Possible source
1168	Magnesium double filter for No. 1164 above	2	14
1169	Set of five interference type filters for Ca, K, Na, Mg and Li, spares for No. 1164 above	1	14
1170	Petrol gas generator for use with No. 1164 above (State voltage... cycles... AC or DC....)	1	14
	Note: Items 1164 to 1170 above should be purchased from the same source. Alternate sources might be: Eel, Gallenkamp, Kipp, Perkin Elmer and others, provided the specification is the same or better.		
1171	Pye Scalamp, double reflection spot galvanometer, resistance 1400 ohms with sensitivity switch positions: direct XI, X 0.05, X 0.01 and shorted. This instrument is for use with No. 1164 above and may not be replaced by another make (State voltage)	1	15
1172	Blank scale, spare for No. 1171 above	4	15
1173	Repair kit for No. 1171 above	1	15
1174	Spare lamps for No. 1171 above	2	15
	Note: Items 1171 to 1174 must be purchased from the same source.		
1175	Spectrophotometer - Colourimeter Dr. B. Lange, for use over the range 400 to 700 millimicrons by continuous adjustment, suitable for use with tubes or rectangular cells and complete with holders for both types of cells (State voltage... AC or DC...)	1	14
1176	Cuvettes, 10 ml for use with No. 1175 above	60	14
1177	Rectangular cells for No. 1175 above	6	14
1178	Lamp, 6 V, 10 W for No. 1175 above	4	14
1179	Filter, normal type, spare for No. 1175 above	1	14
1180	Filter, interference type, spare for No. 1175 above	1	14
	Note: Above items Nos. 1175 to 1180 should be purchased from the same source. Alternate sources might be: Riele, Klett-Summerson, Spekker, Unicam, Beckman, Bausch-Lamb, Coleman, Gallenkamp, Prolabo and others, provided specifications are the same or better.		

Item No.	Description	Quantity	Possible source
1181	Platinum crucibles, complete with lid capacity 40 ml, approximate weight with lid 40 g	4	x
1182	Wooden form for reshaping platinum crucibles No. 1181 above	1	x
1183	Platinum dishes, 50 ml capacity	4	x
1184	Refrigerator, electrically operated, capacity approximately 300 liters, suitable for use in tropical countries (State voltage... cycles... AC or DC...)	1	x
1185	Sand bath, electrically heated, 45 x 25 cm, with variable heat control switch (State voltage... AC or DC...)	1	3
1186	Replacement element for 1185 above	1	3
1187	Sieves brass, 20 cm diam., ASTM or BS or equivalent grade. Hole size 4 mm No. 5	1	x
1188	- ditto - 2 mm No. 10	2	x
1189	- ditto - 0.84 mm No. 20	1	x
1190	- ditto - 0.42 mm No. 40	2	x
1191	- ditto - 0.25 mm No. 60	1	
1192	- ditto - 0.21 mm No. 70	5	x
1193	- ditto - 0.15 mm No. 100	1	x
1194	- ditto - 0.088 mm No. 170	2	x
1195	- ditto - 0.072 mm No. 325	2	x
1196	Pan brass to fit above Nos. 1187 to 1195	2	x
1197	Lid, brass with handle to fit No. 1196 above	2	x
	Note: Items 1187 to 1197 above should all be purchased from the same source		
1198	Sieve set for mechanical analysis according to the method of Bureau of Chemistry and soils 2 3/8 x 2 1/8 inches	1	8
1199	Sieve shaker, variable speed with timer	1	1
1200	Shaking machine, suitable for shaking flasks, bottles, jars, etc. in a reciprocating motion (State voltage... cycles... AC or DC)	1	3

Item No.	Description	Quantity	Possible source
1201	Soil hydrometer, improved pattern range-5g to 60g soil colloids per liter, for mechanical analysis	6	8
1202	Hydrometer jar, Bouyoucos pattern, graduated at 1130 and 1205 ml at 20°C, for mechanical analysis	40	8
1203	Hydrometer jar bath, Magni-Wirl, 10 jars capacity, constant temperature	1	8
1204	Mechanical analysis stirrer (State voltage... cycles...AC or DC...)	2	8
1205	Spare soil dispersion cup for No. 1204 above	4	8
1206	Spare disc paddle for No. 1204 above	50	8
	Note: Items 1204 to 1206 should be purchased from the same source.		
1207	Sampling pipette, 25 ml, 2 way stopcock for mechanical analysis	3	3
1208	Shaw pipette rack, vertical centimeter scale, for the pipette 1207 above	2	3
1209	Soil moisture box, aluminium, diam. 63 mm, height 45 mm	60	8
1210	Steam generator, copper, with outlet tube and glass gauge, capacity 4 liters	2	3
1211	Stirrer, electrically driven, laboratory model, variable speed control, changeable stirring rotor, suitable for attachment to a retort stand (State voltage... cycles... AC or DC)	1	x
1212	Stirring rotor for No. 1211 above (stainless steel)	2	x
1213	Stirrer, laboratory, magnetic, bench model, variable speed control (State voltage... cycles... AC or DC....)	1	x
1214	Magnetized followers polythene encased, each 2 cms long for use with 1213 above	10	x
1215	Thermograph, clockwork, weekly rewind and change sheet, range 10 to 40°C. Complete with 200 sheets and 2 bottles ink	1	x
1216	Testing meter, AVO Model 7 x, specially tropicalized	1	3

Item No.	Description	Quantity	Possible source
1217	Timer interval clockwork model, to time all intervals from 0 to 60 minutes in 1 second intervals	2	x
1218	Plain stop-watch, divisions 1/5 sec.	2	x
1219	Variable transformer, output 3 Amps, complete with voltmeter and mains-switch, socket outlet and cable (State input voltage... cycles... AC or DC.... output voltage range:...)	2	x
1220	Water-bath, electrically heated, thermostatically controlled, model capable of maintaining temperatures to ± 1°C, size 760 mm long x 270 mm wide x 125 mm deep or other shape giving approximately the same surface area, in stainless steel, with flat cover having 12 holes each 100 mm diam. and fitted with stainless steel concentric rings, complete with temperature dial, drain cock and switch (State voltage... AC or DC...)	1	5
1221	Spare heating element for No. 1220 above (State voltage.... AC or DC....)	1	5
	Note: Items 1220 and 1221 should be purchased from same source.		
1222	Water-heater, electric, storage capacity 20 liters, adjustable thermostatic control, 1.5 KW model (State voltage.... AC or DC....)	1	x

4. Specialized Equipment for Soil Physics

Item No.	Description		Quantity	Possible source
1300	Aggregate shaker, 6 trays, 20 x 20 in., variable speed		1	8
1301	Beakers, alluminium, low form,	250 ml	10	x
1302	Bottles, specific gravity capacity	25 ml	10	x
1303	- ditto -	50 ml	10	x
1304	- ditto -	100 ml	10	x
1305	Constant, temperature bath temp. up to 100°C		1	x
1306	Crusher, 3h, p., openings from 1/1 in. to 1/4 in.		1	x
1307	Desintegration test set, with specimen mold and samples ejector		1	18
1308	Desiccator, vacuum, 250 m m with porcelain plate and external sleeve		2	x
1309	Field parafin warmer, fuel gasoline kerosene or white gas		1	8
1310	Gas pressure regulator for compressed air, delivery up to 225 psi, two-stage		1	x
1311	Gas pressure regulator, for compressed air, delivery up to 15 psi, two-stage		1	x
1312	Glass tubing 30 mm inside diameter		5 m	x
1313	Hydrometer-improved soil hydrometer, range -5 + 60 g of colloids		6	8
1314	Hydrometer jar graduated to contain 1130 and 1205 ml, Bouyoucos pattern		20	8
1315	Hydrometer jar graduated to contain 1000 ml		20	8
1316	Hydrometer jar bath, magni-whirl 38 x 15 in., ten jars capacity, constant temperature up 50°C, sensitivity ± 0.4°C.		1	8
1317	Lathe, soil, motorized with rotary trimming tool		1	8
1318	Level carpenter's		1	x
1319	Constant water level		2	x
1320	Water level indicator, battery operated and self contained, 300 ft. cable		1	x

Item No.	Description	Quantity	Possible source
1321	Liquid limit tester, hand operated, with brass cup and grooving tool	1	8
1322	Lucite tubing, 5 in outside diameter	10 m	21
1323	Moisture balance, torsion type, magnetic damping, scale in terms of moistures from 0 to 100 percent in 0.2 percent divisions, infrared radiation, samples 5 or 25 g weight	1	x
1324	Aluminum pans for the balance No. 1323	6	x
1325	Moisture boxes, aluminum, diam. 2 in. height 7/8 in	50	x
1326	Moisture boxes, aluminum, diam. 2 1/2 in height 13/4 in	20	x
1327	Diam. 3 in height 1 in	20	x
1328	Diam. 3 1/2 in 2 in	20	x
1329	Moisture equivalent centrifuge, complete with control panel, tachometer, MC 407 head, sixteen soil boxes MC 408, 6000 r.p.m.	1	8
1330	Bouyoucos, moisture meter, portable battery operated, 0-100 percent available moisture, designed for use with Bouyoucos soil blocks 1331	1	8
1331	Bouyoucos soil block, gypsum type, pair of stainless steel electrodes in a cast of plaster of Paris, 5 ft. rubber covered leads	1	8
1332	Moisture meter and density meter, nuclear test apparatus, portable, integrator with electronic circuits 2000 volts for moisture and 500 volts for density, moisture probe neutronic with source of fast neutrons, and electronic with geiger tube: density probe radioactive with source of gamma rays and electronic detector	1	20
1333	Super Moisture Teller, controlled temperature, adjustable time switch, armoured thermometer, drying temperature 150° 350°F. samples 50-100g	1	8
1334	Moisture Tester-calcium carbide additive, dial gauge calibrated as percentage of moisture, sensitive to 0.03g, sample weight 6g, portable	1	8
1335	Moisture tester reagent, tins 1 pound for use with 1334	20	8
1336	Mortar, iron, with pestle, 2 pint capacity	1	x

Item No.	Description	Quantity	Possible source
1337	Mortar, porcelain, 15 cm diameter, pestle with rubber tip, wooden hand	2	x
1338	Permeameter compactation, base porous stone, fittings for water inlet and outlet	1	1
1339	Compactation mold 1/30 cu. ft. cylinder for the permeameter 1338, internal diameter 4 inches	1	1
1340	Permeameter plastic, base porous stone, 2 1/2 inches diameter and 10 inches high specimen, with piezometer tube, fittings for water inlet and outlet	1	8
1341	Permeameter soil test, 1.3 inches diam. and 2.8 inches high sample, for constant or variable head permeability, fittings for water inlet and outlet	1	8
1342	Penetrometer pocket, scale in tons/sq. in.or kg/sq. cm	1	8
1343	Plastic limit set according A.S.T.M. specifications	1	8
1344	Porous plate apparatus with 4 porous plate assemblies	1	8
1345	Pressure membrane apparatus with mercury differential regulators, torque-wrench and socket, hose assembly, rubber soil sample retaining rings, 50 ft. roll cellulose casing for membrane dishes,	1	8
1346	Sandbox apparatus to determine pF curves in the range 0.4 to 2.7, complete	1	19
1347	Sample spliter, stainless steel, 14 chutes	1	x
1348	Sampler, field density, undisturbed samples, capacity 1/30 cubic feet	1	8
1349	Sampler, density tube, set with 12 tubes, head and drive hammer	1	8
1350	Sieves 8 inches diameter 5/16 inches = 7.94 mm	2	x
1351	3 1/2 inches = 5.66 mm	2	x
1352	No. 5 = 4.00 mm	2	x
1353	No. 10 = 2.00 mm	2	x
1354	No. 20 = 0.84 mm	2	x

Item No.	Description	Quantity	Possible source
1355	No. 40 = 0.42 mm	2	x
1356	No. 60 = 0.25 mm	2	x
1357	No. 70 = 0.21 mm	2	x
1358	No. 170 = 0.088 mm	2	x
1359	No. 325 = 0.044 mm	2	x
1360	Brass pan for 1350-1359 sieves	2	x
1361	Brass cover for 1350-1359 sieves	2	x
1362	The same size hole sieves with diameter 5 inches, 1 of each size, pan and cover	1	x
1363	Sieve set, mechanical analysis of soils, according to the method of the Bureau of Chemistry and Soils 2 3/8 x 2 1/8 inches	1	8
1364	Sieve shaker, to accommodate 8 inch sieves, 6 stand sieves 2 inches high, variable speed and sieve adapter for 5 in.diam.sieves	1	8
1365	Soil Colour Chart-Munsell	1	8
1366	Soil Colour Chart for tropical soils, extra sheet	1	8
1367	Soil rammer, falling weight type, diam.2 inches, weight 5.5 pounds, fall 12 inches	1	1
1368	Soil shrinkage apparatus, with porcelain crucible, evaporation dish and crystalizing dish	1	8
1369	Soil structure meter, pneumatic, method prof. Janert	1	17
1370	Spatula, flexible steel	3	x
1371	Stirrer, mechanical analysis	4	8
1372	Dispersing cup for stirrer No. 1371	8	8
1373	Spare mixing paddles for the stirrer No. 1371	100	8
1374	Pipette Robinson Köhn 20 or 25 ml 2-way stopcock, for mechanical analysis	3	3
1375	Shaw pipette rack to support pipette No. 1374	3	3
1376	Stokes law monographed, pads of 100 sheets, 8 1/2 x 11 in.	10	8

Item No.	Description	Quantity	Possible source
1377	Tensiometers, soilmoist gauge, porous tip 5/8 inch diam., scale reading moisture of soil 12 inches length	1	8
1378	24 inches length	1	8
1379	36 inches length	1	8
1380	48 inches length	1	8
1381	Installing tool for tensiometers 12 inches length 1410	1	8
1382	24 inches length 1411	1	8
1383	36 inches length 1412	1	8
1384	48 inches length 1413	1	8
1385	Tensiometer-Agriculture moisture indicator range 0-85 percent, no calibration necessary	1	8
1386	Soil Thermometer, range 20^{o}-180^{o}F. 16 in. long, brass tip	1	8
1387	Thermometer maximum and minimum	1	x
1388	Max-Min Soil Thermometer dial range -40^{o}F. + 120^{o}F. in 1^{o}F. divisions, bulb 13 inches long	1	8
1389	Volumeasure (density test), based on the liquid filled balloon principle, capacity 1/20 cu. ft. minimum graduation 0.00025 cu. ft.	1	8
1390	Volume change test apparatus, change of volume by absorption, adsorption and loss of water, according A.S.T.M. Proceedings	1	18
1391	Soil volume change meter, based on the short cut method, complete	1	8
1392	Warmer, paraffin, accurate temperature control, adjustable from 120^{o} to 350^{o}F.	1	8

Item No.	Description	Quantity	Possible source
002	Acetone		x
040	Bentonite, powder		x
041	Benzene		x
058	Calcium chloride anhydrous		x
069	Castolit plastic with hardener		22
070	Celulose acetate		x
103	Athanol 95 percent		x
108	Ethylene glycol		x
122	Hydrochloric acid, Sp. Gr. 1,18		x
124	Hydrogen peroxide, 100 Vols.		x
176	Paraffin wax, M. pt. 57° to 60°C.		x
186	Phosphorus pentoxide,		x
231	Sodium carbonate		x
240	Sodium hexamethaphosphate		x
253	Sodium phosphate, Di H		x
273	Sulphuric Acid, Sp. Gr. 1,84		x

5. Specialized Equipment for Soil Microbiology

Item No.	Description	Quantity	Possible source
1500	Auto clave. Horizontal. Double wall 28 in. long (inside) 21 in. diam. (inside) can be ordered for electric, gas or direct steam heat	1	2
1501	Incubator, Electric, Forced Air, Circulation, 30 x 30 x 35 cm inside, 37° - 110°C	2	2
1502	Incubator, Refrigerating, 283 cu. cm 5° to 50°C	1	2
1503	Colony Counter, Quebec Spencer dark field model	1	2
1504	Balance, Counter type, Torsion, capacity 500 g	1	1
1505	Balance, Torsion Prescription, capacity 120 gms., sensitivity 2 mg	1	1
1506	Warburg Apparatus, 20 unit including glassware and manometer supports	1	2
1507	Sterilizer, Arnold Type 49 x 31 x 36 cm gas heated	1	2
1508	Pipette Box, Cylindrical Aluminum 40 cm long x 7.5 cm diam.	6	2
1509	Culture Dish Box, polished copper capacity 13 dishes	6	2
1510	Sterilizer, Hot Air, Electric Despatch inside dimensions 45 x 35 x 35 cm	1	2
1511	Hemacytometer, Single Improved Neubauer, Ruling, Levy complete with 2 plane cover glasses and 2 Thoma diluting pipettes	1	2
1512	Clock, Interval	1	2
1513	Colony Counter, Dark field, Quebec, Apha - Spencer complete with lens, Wolffhuegel counting plate	1	2
1514	Counter, hand tally	1	2
1515	Filtering Crucibles, Fritted glass Disk High Form, Gooch Type, Pyrex. No. 4 50 ml Capacity Medium Porosity	9	2
1516	Culture Dishes, Moist Chamber Plain Cover, outside diam. 240 mm, height 85 mm	6	2

Item No.	Description	Quantity	Possible source
1517	Culture Dishes, Petri, Pyrex 100 x 120 mm	350	2
1518	Culture Dishes, Petri Pyrex 150 x 20 mm	50	2
1519	Culture Dish Holder Neoprene Coated Wire	6	2
1520	Staining and Preparation Dish, diam. 105 mm, inside depth 45 mm	12	2
1521	Staining and Preparation Dish, diam. 50 mm, height 32 mm	12	2
1522	Staining Dish, 10 grooves, 93 mm long x 70 mm wide x 48 mm high	6	2
1523	Staining Set, Removable glass Rack	6	2
1524	Culture Disk Bottom, Quadrant Felsen, Pyrex	24	2
1525	Drying Tubes, Calcium chloride. Two Bulb 15.5 cm x 5 mm diam	12	2
1526	Fermentation Tube, Durham, Apha consists of pair of culture tubes, 150 x 19 mm and 50 x 6 mm	24	2
1527	Fermentation Tubes, Smith, Plain Resistant glass 140 mm long, 15 mm I.D. diameter	24	2
1528	Fermentation Tube Support, copper	2	2
1529	Filter Apparatus, Bacteria, Fritted Glass Pyrex	2	2
1530	Flask, Culture, Kolle, Pyrex, capacity 320 mm	12	2
1531	Flask, Culture, Roux, Pyrex	12	
1532	Forceps, Bottle, length 250 mm	6	2
1533	Funnels, Chemical, Ribbed, Heavy Molded Glass (rapid filtering, bacterial media) diam. 175 mm	4	2
1534	Funnels, Porcelain, Buechner Table type, Cuars with removable perforated plate diam. 187 mm	2	2
1535	Microscope, Monocular, Bausch and Lomb Model CBV-8	1	2
1536	Microscope Illuminator, AO-Spencer Universal	1	2
1537	Microscope Slides, Non Corrosive, Laboratory grade	Box of 72	2

Item No.	Description	Quantity	Possible source
		Box of	
1538	Microscope Slides with Frosted Ends	72	2
1539	Microscope Slide, Culture Single	20	2
1540	Microscope Slide Box, Plastic Hinged Cover - for 100 slides	4	2
1541	Microscope Slide Cover Glasses, Square size 15 mm	boxes 10	2
1542	Pipettes, Serological, Long Tip, Kimax 1 ml capacity, 0.01 ml sub divisions	25	
1543	5 ml capacity 0.1 ml sub-divisions	25	
1544	Pipettes, Serological, Short Tip Kimax 1 ml capacity, 0.1 ml subdivisions	25	
1545	2 ml capacity, 0.1 ml subdivisions	25	2
1546	5 ml capacity, 0.1 ml subdivisions	25	2
1547	Pipettes, Transfer, Bacteriological Flint glass "Exax" 5 ml capacity		2
1548	10 ml capacity	50	2
1549	Culture Tubes, Bacteriological, Flint Glass "Exax" 150 mm x 19 mm	500	2
1550	200 mm x 25 mm	200	2
1551	Culture Tubes, Bacteriological Screw Cap,. Kimax 125 mm x 20 mm	100	2
1552	200 mm x 25 mm	100	2
1553	Screw Caps, Black Plastic, Rubber liners CGMI Threads 18-415	50	
1554	CGMI Threads 24-410	50	
1555	Culture dishes, Pyrex, 100 x 15 mm, (pkgs of 72)	6 pkg.	1
1556	Culture dishes moist chamber 200 x 70 mm	6	1
1557	Culture Flask (Bottle) pyrex 269 x 337 x 625 - (pkgs of 6)	1 pkg	1
1558	Test Tube Baskets, Stainless Steel Wire, Rectangular, 6 x 6 1/2 in	6	2

Item No.	Description	Quantity	Possible source
1559	Test Tube Support, Neoprene coated wire, length 10 1/2 in, width 4 1/2 in, height 4 1/8 in	6	2
1560	Serological Bath, Electrically Heated and Controlled	1	2
1561	Test Tube Racks 1 Wassermann type	1	2
1562	1 Kalmer type	1	2
1563	Bottle, Dilution, Screw Cap, Kimax 200 ml capacity	50	2
1564	Replacement Cap for Dilution Bottles (above) Cat. No. 24129 (above)	25	2
1565	Bottle, Balsam, wide mouth, capacity 60 ml	3	2
1566	Inoculating Needle Holder, Kolle Type ll inches long	12	2
1567	Slide, Agglutination Kline Test, length 3 in, width 2 1/4, thickness 1/8 in	2	2
1568	Inoculating Loops, Platinum - Ruthenium - inside diam. 1 mm, B and S gage no. 28;		2
1569	- inside diam. 2 mm, B and S gage no. 28	6	2
1570	Staining Rack, Tumbler Size	3	2
1571	Counting Chamber, Howard, AOAC Apha	1	2
1572	Cover glasses for use in Cat. No. 44340 replacement, size 28 x 33 mm,thickness 0.5 mm	1	2
1573	Thickness 1.0 mm	1	2
1574	Cotton, non absorbent	20 lbs.	2

Biological Chemicals

Biological Stains

Item No.	Description	Quantity		Possible source
1600	Methylene Blue, certified	100	4 x 25 g	16
1601	Fuchin, Basic, certified	100	4 x 25 g	16
1602	Fuchin, Acidic, certified	100	4 x 25 g	16
1603	Thionine, certified	20	2 x 10 g	16
1604	Crystal Violet	100	4 x 25 g	16
1605	Toluidine Blue 0, certified	25		16
1606	Malachite Green, certified	100	4 x 25 g	16
1607	Gentian Violet, Certified	100	4 x 25 g	16
1608	Gremsa's Stain, certified			16
1609	Aniline Blue, certified	50	2 x 25 g	16
1610	Azure I	10		16
1611	Azure II	10		16
1612	Eosin, Blinsk	100	4 x 25 g	16
1613	Brilliant Green	100	4 x 25 g	16
1614	Bismark Brown	100	4 x 25 g	16
1615	Rose Bengal	50	5 x 10 g	16
1616	Safranine	100	4 x 25 g	16
1617	Sudan Black - B	25		16
1618	Eosin Y	100		16
	Special Chemicals for Biological Tests			
1619	d Naphthel	2	2 x 1 lb	16
1620	d Naphthylamine	2	2 x 1 lb	16
1621	Bromo cresol purple	10	2 x 5 g	16
1622	Bromo cresol green	5	1 x 5 g	16
1623	Bromothymol blue	5	1 x 5 g	16

Item No.	Description	Quantity		Possible source
1624	Cresol U.S.P.	1	1 lb	16
1625	Potassium Tellurite	25	g	16
1626	Diphenylamine c.p.	1	1 lb	16
1627	Tarmic Acid USP powder	1	1 lb	16
1628	Azolitmin (Biological Stain)	10	g	16
1629	Sodium Selenite	100	g	16
1630	Sodium Thioglycollate	100	g	16
1631	Formaldehyde	5	5 x 1 lb	16
1632	Ammonium oxalate	5	5 x 1 lb	16
1633	Para-dimethyl-amino-benzaldehyde	100	g	16
1634	Amyl alcohol	5	5 x 1 lb	16
1635	Phenol c.p. crystals	5	1 lb	16
1636	Lactic Acid	1	1 lb	16
1637	Glycerin	5	1 lb	16
1638	Mercuric chloride, powder	5	1 lb	16
1639	Creatine	25	g	16
1640	Propylene glycol	2	2 x 1 kg	16
1641	Sodium ricinoleate	1	lb	16
1642	Sulfamidic Acid	1/4	lb	16
1643	Sodium formaldehyde sulfoxylate, technical	1	lb	16
1644	Urea	1	lb	16
	Microbiological Culture Ingredients			
1645	Agar powder, U.S.P.	1 x 10	lb	16
1646	dl - Alamine	25	g	16
1647	Anaerobic agar	1	lb	16
1648	l - arabinose	25	g	16
1649	l - arginine HCL	10	g	16

Item No.	Description	Quantity		Possible source
1650	Asparagine	100	g	16
1651	Antalyzed yeast	1	lb	16
1652	M-Bg Endo Booth	1	lb	16
1653	BTB Citrate agar	1	lb	16
1654	BTB Lactose agar	1	lb	16
1655	Beef Extract	1	lb	16
1656	Casein, Technical	500	g	16
1657	l - cystine	100	g	16
1658	Desoxycholate agar	1	lb	16
1659	Desoxycholic acid	25	g	16
1660	Dextrin	5 x 100	g	16
1661	Dextrose	500	g	16
1662	Dextrose agar	1	lb	16
1663	Dextrose Tryptone agar	1	lb	16
1664	EMB agar	1	lb	16
1665	Egg Albumin Salukle	300	g	16
1666	Endo agar	1	lb	16
1667	Fluid Thioglycollate, medium	1	lb	16
1668	d - Galactose	100	g	16
1669	Gelatin	1	lb	16
1670	Glycerol	500	g	16
1671	Kaser Citrate, medium	1	lb	16
1672	Lactose	2 x 500	g	16
1673	Litmus milk	1	lb	16
1674	Lysine	2 x 1	g	16
1675	Malt Extract	1	lb	16
1676	Maltose	500	g	16

Item No.	Description	Quantity		Possible source
1677	Nutrient agar	2 x 1	lb	16
1678	Peptine	2 x 1	lb	16
1679	Raffinose	100	g	16
1680	d' Sarbitol	100	g	16
1681	Trypsine 1:250	100	g	16
1682	Tryptone	1	lb	16
1683	Tryptose	1	lb	16
1684	Urease	10	g	16
1685	Yeast Extract	1	lb	16
1686	Mannitel	1	lb	16
1687	Meat Extract	1	lb	16
1688	Mannose	25	g	16

6. List of Suppliers

6. List of Suppliers:

Coding

Under the heading Sources of Supply, the following codes are used:

X = The item as described can normally be bought in most good laboratory furnishers.

X (US) = This item can be bought at any good laboratory furnisher in the United States of America. The item may, however, be available in other countries, or else, substitute items of suitable quality may be available.

When a specific source of supply is mentioned, it is done in order to facilitate in the procurement of items not normally universally available. It does not imply that this is the only source of supply and the authors of the list would be greatly indebted to the users if they would indicate from time to time additional sources of supply of items which are often hard to locate.

1 = Central Scientific, 1700 Irving Park Road, Chicago 13, Illinois, U.S.A.

2 = Arthur H. Thomas Company, Vine Street at Third, P.O. Box 779, Philadelphia 5, Pa., U.S.A.

3 = A. Gallenkamp and Co. Ltd., Technico House, Sun St., London, E.C. 2. England.

4 = Fisons Chemicals (Export) Ltd. (The Loughborough Glass Co.) 95 Wigmore St., London, W.1., England.

5 = Carlowitz and Co., Burchardstrasse 17, Hamburg 1, East Germany.

6 = B. Siegfried, Zofingen, Switzerland.

7 = Cole - Palmer Instruments and Equipment Co., 7330 North Clark Street, Chicago, Illinois, U.S.A.

8 = Soil Test Incorporated, 4711 West North Avenue, Chicago 39, Illinois, U.S.A.

9 = Elga Products Ltd., Lane End, Buckinghamshire, England.

10 = Quickfit and Quartz Ltd., Quickfit Works, Heart of Stone, Staffordalme, England.

11 = Electronic Instruments Ltd., Richmond, Surrey, England.

12 = Electronic Switchgear (London) Ltd., Wilbury Way, Hitchin, Herts., England.

13 Beckman Instruments Incorporated, South Pasadena, California, U.S.A.

14 Dr. B. Lange, Berlin - Zehlendorf, Hermannstr. 14-18, Germany.

15 W.G. Pye and Co. Ltd., Granta Works, York St., Cambridge, England.

16 Fisher, 633 Greenwhich Street, New York, U.S.A.

17 Karl Kolb, Frankfurt, Main 1, Germany.

18 Maruto Testing Machine Co., Kota-Ku, Tokyo, Japan.

19 Institute for Land and Water Management Research, Wageningen, Holland.

20 Compagnie générale de Télégraphie sans fils, 79 Boulevard Haussmann, Paris, France.

21 E.I. Dupont de Nemours Co. Inc., Plastic depart., 350 Fifth Avenue, New York, U.S.A.

22 The Woodstock Company, Woodstock, Illinois, U.S.A.