Notes from the Reports of Public Analysts.

The Editor would be glad to receive the Annual or other Reports of Public Analysts containing matter of interest to the Society. Notes made from such Reports would be submitted to the Publication Committee.

DEPARTMENT OF SCIENTIFIC AND INDUSTRIAL RESEARCH.

Food Investigation Board.

REPORT ON HEAT INSULATORS.*

A report has been issued by the Engineering Committee of the Department giving the results of experiments by E. Griffiths, D.Sc. Special apparatus has been devised for the measurement of thermal conductivity in absolute measure. This is described with diagrams, and a typical example of the method of making the test is described at length. The results, which are given both in C.G.S. units and in the usual British measures, are tabulated in full, and cover the range of temperature met with in cold storage work.

The data obtained indicate that cork, slag wool, charcoal and wood fibres, when of good quality and dry, have practically the same thermal conductivity, viz., 0·00011 grm. cal. per sec. per cm. per 1°C. [=0·32 B.T.U.'s per sq. ft. per hour for 1″ and for 1° Fahr. diff.]. Different brands of cork, etc., of good quality do not show any very considerable differences in their efficiency as insulators, and the extravagant claims sometimes made for such insulating materials are devoid of foundation.

The thermal conductivity of materials such as cork is not an invariable physical constant like the thermal conductivity of pure metals. Hence it is advisable to test samples of various consignments. The tests indicate that a considerable decrease in the insulating efficiency of certain materials may take place in use. In the case of coarse granular materials the phenomenon of heat transmission is complicated by the circulation of convection currents.

Rubber expanded by gas into a highly cellular substance, with a density varying from 0·059 to 0·12, gave the most promising results as a heat insulator.

* Special Report No. 5. H.M. Stationery Office, Kingsway, London, W.C. 2. Price 3s. net.

The conductivity of this material was found to be about 0·000085, which is lower than that of cork or any other substance examined, being only one and a half times that of still air. A sample of spongy rubber, as used for upholstery work, was volume for volume, considerably heavier than the cellular expanded rubber. It weighed 14 lbs. per cb. ft., and its conductivity was greater than that of cork (0·00013 as compared with 0·00010 to 0·00012 for various samples of cork).

An appendix to the Report describes the method and apparatus used for determining the specific heats of the materials examined.

THE CLEANING AND RESTORATION OF MUSEUM EXHIBITS.*

This Bulletin contains a report upon investigations conducted at the British Museum, under the direction of Dr. A. Scott.

PRINTS.—Brown or coloured spots, which are almost invarably due to the growth of mould fungi, may be best removed by treatment with very dilute (0·5 to 1 per cent.) bleaching agents. The prints should be immersed for 10 to 20 minutes in dilute hydrochloric acid (1 fl. oz. per quart, and then, without washing, in a solution of bleaching powder (0·25 to 0·5 oz. per quart) for the same length of time, and again transferred to the acid bath, this treatment being alternately repeated until no further improvement is noted. The prints are then thoroughly washed for some hours in water, to which finally a *small* quantity of sodium sulphite may be added to remove every trace of free chlorine.

The so-called "solution of chlorinated soda" may be used instead of bleaching powder, but, if too alkaline, may dissolve the size and render the paper soft and tender.

Thymol and similar antiseptic agents have given promising results as mould preventatives, especially when aided by heat, but formalin can hardly be regarded as a "safe" reagent, owing to the readiness with which it will yield formic acid, the presence of which might prove dangerous to many colours.

The white portions in many drawings and coloured pictures are intensified by means of white lead or lead carbonate (ceruse), and will therefore, in time, become discoloured, and finally quite black, through the action of hydrogen sulphide in the air. The original white tone may be restored by oxidising the lead sulphide to sulphate by means of hydrogen peroxide. This may be safely applied in the form of vapour by saturating a plaster of Paris block with the hydrogen peroxide solution, and exposing the blackened print, face downwards, at a distance of about an eighth of an inch for a few hours. This treatment will also remove many of the mouldy brown spots (foxiness) which disfigure prints, but the treatment will require a much longer time than the whitening of lead sulphide.

Brown stains in drawing or prints due to oils or varnishes do not yield to any of the ordinary bleaching agents or the more usual paint-removing solvents. They can be removed, however, in many cases by means of pyridine (which must be colourless and anhydrous). This solvent should be applied by means of a brush of silky glass fibre, and the liquid removed after a short time with pure white blotting paper. The paper of the print is not affected.

ENAMELS.—The occurrence of cracks in enamels is due to the enamel having a different coefficient of expansion from that of the metal with which it is fused, and appears to be inevitable unless the metal is thin enough or its form such that it can adapt itself to expansions and contractions caused by changes in temperature. An effective method of preserving cracked enamels is to place them in

* Bull. No. 5. Dept. Scientific and Industrial Research, H.M. Stationery Office, Imperial House, Kingsway, W.C. Price 2s. net.

a flat dish under the receiver of an air pump, and, after maintaining a good vacuum for half an hour, to run a 10 per cent. benzene solution of dried Canada balsam over the surface of the enamel, through a separating funnel passing through the rubber stopper of the receiver. On then admitting air the balsam solution is forced into each tiny crack and underneath those portions of the enamel which have separated from the metallic base. The thin film of Canada balsam on the surface can be removed, if desired, by treatment with benzene, but it is advisable to leave it as a protection to the enamel.

SILVER.—When objects of pure silver or of an alloy with copper are exposed to the air and to the action of a solution of common salt, silver chloride is formed, and also sodium hydroxide, which soon becomes sodium carbonate. If any copper is present in the alloy it reduces the silver chloride to metallic silver, and the copper chloride simultaneously formed continues the corrosion of the silver.

A warm dilute (5 to 25 per cent.) solution of formic acid is a safe reagent to remove the copper crust of oxides, carbonates and oxychlorides, without attacking either the silver or the alloy. Any lead present will also be dissolved as lead formate.

Other suitable reagents are: (1) A solution of ammonium sulphite and ammonia containing some cuprous sulphite; (2) A solution of ammonia and ammonium formate; (3) "Zinc dust" moistened with very dilute sulphuric acid. The last is particularly useful for removing silver chloride and the stains produced by the action of light in presence of organic matter.

LEAD.—Under certain conditions lead may be rapidly converted into a basic carbonate, and it is well known that objects of lead should not be stored in oak cabinets, although mahogany and various other woods are quite safe.

To prevent corrosion, when once started, it is necessary to remove from the lead all organic matter. For this purpose two reagents have proved of great value. (1) A solution of sodium hydroxide containing some methylated spirit; (2) A solution of basic lead acetate. After warming the object with either of these solutions it should be thoroughly washed, then heated with a dilute solution of lead acetate (the normal salt), and again thoroughly washed.

Zinc dust with dilute acetic acid is also useful for separating hard incrustations and reducing them to a porous mass of metallic lead, which must be removed by careful brushing.

RUSTING OF IRON.—The ordinary constituent of soil most injurious to iron is common salt. In the presence of water, carbon dioxide, and often organic substances of acidic character, iron is rapidly attacked by sodium chloride, with the formation, first, of ferrous chloride, which, with air and moisture, yields basic chlorides of iron, and these, in turn, give ferrous chloride once more, together with ferric hydroxide.

For the prevention of rusting, therefore, it is essential that all chlorine should be removed from the iron. Basic chlorides must be decomposed by treatment with sodium hydroxide or carbonate solution, and the iron then thoroughly washed and boiled with distilled water until no more soluble matter is extracted.

Final traces of chlorine may also be eliminated by means of an electric current, the iron core being used as the cathode, so that chlorine ions are driven to the anode, which is of zinc. A dilute solution of sodium hydroxide is used as the bath in which the rust-covered iron object is immersed.

COPPER AND COPPER ALLOYS.—The reagents found of value for removing the superficial deposits from objects of copper, bronze, and brass, include dilute ammonia solution, which, however, attacks the copper when air has free access. Ammonium chloride, either alone or with the addition of stannous chloride and a

little hydrochloric acid, appears to be safer and trustworthy. An alkaline solution of Rochelle salt has also given good results, and, in other cases, formic or acetic acid, with or without the addition of zinc dust, has proved effective.

PREHISTORIC PAINTINGS ON ROCKS.—The lichens on paintings from Northern Rhodesia could not be removed by mechanical means, but they could be softened and apparently gelatinised by treatment with a dilute solution of ammonia. They were painted with this solution, and, after a few minutes, the lichens were removed by gentle brushing, and the face of the painted rock washed with distilled water, and finally with absolute alcohol.