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for die-casting; as a protective coating for other metals to prevent corrosion; for electrical apparatus, especially dry cell batteries, household utensils, castings, printing plates, building materials, railroad car linings, automotive equipment; as reducing agent in organic chemistry; for deoxidizing bronze; extracting gold by the cyanide process, purifying fats for soaps; bleaching bone glue; manuf sodium hydrosulfite; insulin zinc salts; as reagent in analytical chemistry, e.g., in the Marsh and Gutzeit test for arsenic; as a reducer in the determination of iron. It is a nutritional trace element.

10181. Zinc Acetate. [557-34-6] Galzin. $C_4H_6O_4Zn$; mol wt 183.49. C 26.18%, H 3.30%, O 34.88%, Zn 35.64%. $Zn(C_2H_3O_2)_2$. Prepn of anhydr salt from zinc nitrate and acetic anhydride: Späth, *Monatsh.* **33**, 235 (1912). Clinical evaluations in Wilson's disease: G. M. Hill *et al.*, *Hepatology* **7**, 522 (1987); G. J. Brewer *et al.*, *J. Lab. Clin. Med.* **109**, 526 (1987). Toxicity: H. F. Smyth *et al.*, *Am. Ind. Hyg. Assoc. J.* **30**, 470 (1969).

Dihydrate. Crystallizes from dil acetic acid; faint, acetous odor; astringent taste; slightly efflorescent. d 1.735; mp 237°. One gram dissolves in 2.3 ml water, 1.6 ml boiling water, 30 ml alcohol, about 1 ml boiling alcohol. The aq soln is neutral or slightly acid to litmus; pH about 5-6. *Keep in well-closed containers.* LD₅₀ orally in rats: 2.46 g/kg (Smyth).

USE: Preserving wood; as mordant in dyeing; manuf glazes for painting on porcelain. As a reagent in testing for albumin, tannin, urobilin, phosphate, blood.

ThERAP CAT: Styptic, astringent. In treatment of Wilson's disease.

ThERAP CAT (VET): Antiseptic, astringent, protective (topical). Has been used as an emetic.

10182. Zinc Bromide. [7699-45-8] Br_2Zn ; mol wt 225.19. Br 70.96%, Zn 29.04%. $ZnBr_2$. Usually contains at least 97% $ZnBr_2$, the remainder being chiefly water.

Very hygroscopic, granular powder; sharp, metallic taste. d 4.22; mp 394°; bp 697° with partial decompn. One gram dissolves in 0.25 ml water, 0.5 ml 90% alcohol; sol in ether, solns of alkali hydroxides. The aq soln is acid to litmus; pH about 4. *Keep tightly closed.*

USE: Making silver bromide collodion emulsions for photography; in the shielding of viewing windows for nuclear reactions.

10183. Zinc Caprylate. [557-09-5] Octanoic acid zinc salt. $C_{16}H_{30}O_4Zn$; mol wt 351.85. C 54.61%, H 8.61%, O 18.19%, Zn 18.58%. $Zn(C_8H_{15}O_2)_2$. Prepn from ammonium caprylate and zinc sulfate: van Renesse, *Ann.* **171**, 380 (1874). Lustrous scales from alc, mp 136°. Sparingly sol in boiling water; moderately sol in boiling alcohol. *Keep well closed.* Dec in moist atm giving off caprylic acid.

USE: As fungicide like zinc propionate.

10184. Zinc Carbonate. [3486-35-9] CO_3Zn ; mol wt 125.40. C 9.58%, O 38.28%, Zn 52.15%. $ZnCO_3$. Occurs in nature as the minerals *smithsonite*, *zincspar*. Prepn: Hüttig *et al.*, *Monatsh.* **72**, 31 (1939).

Rhombohedral structure. Solubility in water at 15° 0.001 g/100 g; sol in dil acids, alkalies, solns of NH_4^+ salts.

Basic carbonate. Zinc carbonate hydroxide; zinc subcarbonate. Variable composition, usually characterized as $3Zn(OH)_2 \cdot 2ZnCO_3$. Occurs as the mineral *hydrozincite*. Reagent specification: 70% ZnO minimum.

USE: As pigment; manuf of porcelains, pottery, rubber.

ThERAP CAT: Astringent, topical antiseptic.

ThERAP CAT (VET): Astringent, antiseptic, protective (topical). Also used in rations to prevent Zn deficiency diseases.

10185. Zinc Chloride. [7646-85-7] Butter of zinc. Cl_2Zn ; mol wt 136.29. Cl 52.02%, Zn 47.98%. $ZnCl_2$. Usually contains at least 95% $ZnCl_2$; remainder is chiefly water and oxychloride. Toxicity: Bruner, *Fed. Proc.* **9**, 260 (1950).

White, odorless, very deliquescent granules, or fused pieces or rods. d²⁵ 2.907; mp ~290°; bp 732°. Solubility in H_2O : 432 g/100 g (25°); 614 g/100 g (100°). One gram dissolves in 0.25 ml of 2% HCl, in 1.3 ml alcohol, 2 ml glycerol; freely sol in acetone. With much water some zinc oxychloride is formed.

The aq soln is acid to litmus; pH about 4. *Keep tightly closed.* LD i.v. in rats: 60-90 mg/kg (Bruner).

Caution: Potential symptoms of overexposure to fumes are conjunctivitis; irritation of skin, eyes, nose and throat; coughing, copious sputum; dyspnea, chest pain, pulmonary edema and bronchopneumonia; pulmonary fibrosis, cor pulmonale; fever; cyanosis; tachypnea; skin burns. *See NIOSH Pocket Guide to Chemical Hazards* (DHHS/NIOSH 97-140, 1997) p 338.

USE: Deodorant, disinfecting and embalming material; alone or with phenol and other antiseptics for preserving railway ties; fireproofing lumber; with ammonium chloride as flux for soldering; etching metals; manuf parchment paper, artificial silk, dyes, activated carbon, cold-water glues, vulcanized fiber; browned steel, galvanizing iron, copper-plating iron; in magnesia cements; petroleum oil refining; cement for metals and for facing stone; mordant in printing and dyeing textiles; carbonizing woolen goods; producing crepe and crimping fabrics; mercerizing cotton; sizing and weighting fabrics; vulcanizing rubber; solvent for cellulose; preserving anatomical specimens; in microscopy for separating silk, wool, and plant fibers; as dehydrating agent in chemical syntheses. Dentin desensitizer.

ThERAP CAT: Astringent.

ThERAP CAT (VET): Antiseptic, astringent. Has been used in ulcers, fistulas, pododermatitis.

10186. Zinc Chromate(VI) Hydroxide. [13530-65-9] Zinc yellow; buttercup yellow; C.I. Pigment Yellow 36. A basic salt of somewhat variable composition. Approx $Zn_2CrO_4(OH)_2$.

Hydrate. Yellow, odorless, fine powder. Slightly sol in water; sol in dil acids, including acetic acid.

Note: This substance has been listed as a known human carcinogen: *Ninth Report on Carcinogens* (PB2000-107509, 2000) p III-22.

USE: As pigment in paints, varnishes, oil colors, linoleum, rubber, etc.

10187. Zinc Citrate. [546-46-3] 2-Hydroxy-1,2,3-propanetricarboxylic acid zinc salt. $C_{12}H_{10}O_{14}Zn_3$; mol wt 574.39. C 25.09%, H 1.76%, O 39.00%, Zn 34.15%. $Zn_3(C_6H_7O_7)_2$. Prepn from zinc carbonate and citric acid: Heldt, *Ann.* **47**, 157 (1843).

Dihydrate. Odorless powder. Slightly sol in water; sol in dil mineral acids, in alkali hydroxides.

USE: In toothpaste and mouthwash.

10188. Zinc Cyanide. [557-21-1] C_2N_2Zn ; mol wt 117.43. C 20.45%, N 23.86%, Zn 55.68%. $Zn(CN)_2$. Usually contains about 85% zinc cyanide, some water and oxide.

White powder. **Poison!** Insol in water; sol in solns of alkali cyanides or hydroxides; not appreciably attacked by organic acids, but readily dec by dil mineral acid with evolution of hydrogen cyanide.

USE: Electroplating; removing NH_3 from producer gas.

10189. Zinc Fluoride. [7783-49-5] F_2Zn ; mol wt 103.39. F 36.75%, Zn 63.25%. ZnF_2 . Prepn from $ZnCO_3$ and HF: Ruff, *Die Chemie des Fluors* (Berlin, 1920) p 36; Emeleus in *Fluorine Chemistry* vol. 1, J. H. Simons, Ed. (Academic Press, New York, 1950) p 38; Kwasnik in *Handbook of Preparative Inorganic Chemistry* vol. 1, G. Brauer, Ed. (Academic Press, New York, 2nd ed., 1963) p 242.

Tetragonal needles (rutile lattice) or white cryst mass. d²⁵ 5.00: Haendler *et al.*, *J. Am. Chem. Soc.* **74**, 3167 (1952). mp 872°. bp 1500°. Soly in water: 5×10^{-5} moles/l, Kwasnik, *loc. cit.* Slightly sol in aq HF, more sol in HCl, HNO_3 , NH_4OH . Zinc fluoride used for fluorinations should be slightly hydrated.

Tetrahydrate. Rhombohedral crystals, becomes anhydr at 100°. Soly in water: 1.516 g/100 ml. May be stored in glass bottles.

USE: In the fluorination of organic compds, manuf phosphors for fluorescent electric lights, glazes and enamels for porcelain, preserving wood, in electroplating baths.

10190. Zinc Formate. [557-41-5] $C_2H_2O_4Zn$; mol wt 155.43. C 15.45%, H 1.30%, O 41.18%, Zn 42.07%. $Zn(HCOO)_2$. Forms dihydrate readily. Prepn from zinc car-