

SUBJECT D.—*Cyanide, Chlorination, and other Chemical Processes of recovering Gold and Silver from Ores.*

1. How is cyanide of potassium made? What are its impurities, and how do they affect the extraction of gold and silver? What advantage or disadvantage is there in using crude as compared with pure KCN?
2. What causes deterioration of cyanide-solutions, and what compounds are the result?
3. In treating tailings, is there any limit to the weakness of a KCN solution where zinc is the precipitant used? If so, state why.
4. What substitute for zinc can be used where the KCN solutions are very weak?
5. Describe fully the method of testing the strength of KCN solutions—(a) by standard silver-nitrate; (b) by standard mercurial-chloride solutions; (c) by standard iodine-solutions. State how these solutions are made up.
6. State how you would make up a stock solution of 2 tons, to contain 15 per cent. KCN, by using crude cyanide containing 63 per cent. of KCN.
7. How many pounds of crude cyanide containing 71 per cent. KCN would be required to make up 20 tons of a sump solution containing 0.04 per cent. KCN to 0.3 per cent. KCN?
8. What quantity of a standard solution containing 15 per cent. KCN would be required to make up 40 tons of a sump solution containing 0.08 per cent. KCN to 0.22 per cent. KCN?
9. What is meant by agitation of KCN solutions? How is it produced—(a) mechanically, and (b) by compressed air? Why is agitation required? Explain fully.
10. What means are adopted for extracting the cyanide liquor from slimes? Describe fully the different systems.
11. What antidote would you use in case of KCN poisoning? How would you apply it, and what steps would you take to relieve the sufferer?
12. (a.) What class of ore is best suited to be subjected to chlorination? (b.) How would you prepare it for chlorination? (c.) How is chlorine gas made, and how is it applied? (d.) How is gold precipitated in chlorine solutions?
13. How is gold and silver precipitated by zinc from KCN solutions; also, by an electrical process? State what advantage, if any, is gained by precipitation by electricity.
14. (a.) How is the bullion prepared for market? (b.) What process does it go through after precipitation? (c.) How is the gold separated from silver?

SUBJECT E.—*Sampling and Testing of Ores.*

1. How would you take a sample for assay (a) from a large heap of tailings, (b) from several truck-loads of ore?
2. Shortly describe the fire assay of a sample of quartz for gold and silver, and carefully explain the chemistry of the various processes involved.
3. How would you determine the percentage of lead in a sample of ore containing galena and copper-pyrites?
4. How would you identify arsenic, bismuth, cadmium, lead, mercury, nickel, tin, and zinc when occurring singly in rocks?
5. Describe how you would prove the presence of the following in a sulphide ore: Zinc, silver, bismuth, antimony.

SUBJECT F.—*A Knowledge of Arithmetic and the Method of keeping Battery Accounts.*

1. A steam-engine with double cylinders gives 200 indicated horse-power; the initial pressure of steam is 90 lb. per square inch, which is cut off at $\frac{2}{3}$ of the stroke; the piston-speed is 375 ft. per minute. Required, the mean pressure and diameter of cylinders, neglecting the area of the piston-rod.
2. A cylindrical vat 5 ft. in depth holds 9,801 imperial gallons of KCN solution. Required, the diameter of the vat, and the number of square feet in its internal surface.
3. The diameter of a nozzle delivering water on to a Pelton wheel is $3\frac{1}{2}$ in.; the water at the nozzle is under a pressure of 52 lb. per square inch. Required, the number of cubic feet of water per minute, and the horse-power developed by the Pelton wheel, allowing it to give 80 per cent. of the theoretical power of the water.
4. An incline tramway 2,000 ft. in length has a rising gradient of 1 in 9 against the load; the tramway is worked with an endless rope; trucks weighing 18 cwt. each are placed along the whole length of the rope 30 ft. apart; the weight of the rope is 25 lb. per fathom, and the rope is travelling at the rate of two miles per hour. Required, the strain on rope in tons, neglecting friction.
5. The value of bullion containing 46.8 per cent. of gold and 53.2 per cent. of silver was £1,476 10s. 6d.; the value of the gold was £4 3s. per ounce, and the silver 2s. 7d. per ounce. How many ounces were there of gold and silver?