3. Calculate the capacity in gallons of an excavated tank which is 100 ft. square at the bottom; three sides have a batter of 2 to 1, and the fourth side has a batter of 5 to 1; the depth of water is 10 ft. when the tank is full.

Subject E.—*Blasting and the Use of Explosives.*

1. (*a.*) Do explosives exert an equal force in every direction?
   (*b.*) In what direction do they take effect?
   (*c.*) At what point of the charge does that direction begin?
   (*d.*) How does the necessary quantity of explosive vary?
2. Describe and illustrate by sketch a dynamo or magneto-electric firing-machine. State (*a*) what precautions are essential when using it, and (*b*), if electrical missfires or hangfires are possible.
3. What are the chief differences between the three classes of explosives used in mining? Give examples of one of each, with their respective compositions; and describe the special precautions which should be taken with each class.
4. After blasting in a place where rock-drills are used, how may the dust and smoke caused by such blasting be immediately allayed without the aid of ventilation, and before any person returns to the place?

Subject F.—*A Knowledge of Arithmetic and the Method of keeping Mining Accounts.*

1. If 30 gallons of water run in and $22\frac{1}{2}$ gallons per hour run out of a cistern capable of holding 200 gallons, in what time will the cistern be filled?
2. Divide an income of £1,350 into two parts so that the income-tax on one part at 9d. in the pound may be three times the income-tax on the other part at 1s. in the pound.
3. The cost of keeping 25 horses being at the rate of £11 6s. $0\frac{1}{2}$d. per week, what will be the cost of keeping 13 horses during September and October?
4. Draw out a form for a monthly sheet in connection with a gold-quartz mine which, when filled up, will give at a glance such quantities and costs as a board of directors is likely to require.

Subject G.—*Practical Elementary Electricity.*

1. Define concisely the meaning of " direct current "; " alternating current "; " series, shunt, and compound dynamos."
2. What is " pressure drop "? Calculate what would be the P.D. for each 100 yards of a cable one mile in length wherein a current of 80 amperes is flowing and the resistance is 0·5 ohm per mile.
3. Give a brief description of the principle of transformers; and, as an example, the transforming of a voltage of 3,000 and a current of 80 amperes to meet the requirements of twenty motors of 14 horse-power at 500 volts.
4. Give the relative advantages and disadvantages of steam, compressed air, and electricity for driving ventilating-fans at the surface, and for operating pumps in deep mines.

Subject I.—*Pumping Appliances and the Drainage of Mines.*

1. Describe the action and illustrate by sketch a three-throw plunger pump. State (*a*) the usual piston-speed, (*b*) revolutions of crank-shaft per minute. Compare pumps of this type with Cornish and turbine pumps for the drainage of metal-mines.
2. Describe and illustrate by sketches, beginning at the collar of the shaft, a single-acting Cornish pumping system suitable for a vertical shaft 1,000 ft. deep, and adequate for dealing with 2,000,000 gallons in twenty-four hours. State (*a*) the diameter of the pump, (*b*) the type and B.H.P. of the engine, (*c*) the number and type of the valves, (*d*) the over-all efficiency of the engine and pumps.
3. Describe the action and illustrate by sketch Davy differential valve gear. For what purpose is it employed with both the single and double system of rods?

Subject J.—*The Haulage in Shafts and on Underground Planes, also the Strength of Haulage Ropes and Chains.*

1. What size and type of winding-engine would you employ for raising 125 tons of mineral per hour from a depth of 1,800 ft., with a boiler-pressure of 100 lb. per square inch?
2. What is the truck drawbar pull, at the moment of starting, when the load to be hauled is 15 loaded trucks of 3,000 lb. each, on (*a*) a level track, (*b*) an incline of 10 per cent.? (*c.*) What is the horse-power required to haul this load up the incline, 3,000 ft. long, at a speed of 10 miles an hour, the haulage-rope weighing 1·5 lb. per foot, and taking rolling friction at one-fortieth of the load. (Allow 13 per cent. of the weight of the load for the resistance of rope and pulley, and 50 per cent. of efficiency for hauling-engine.)
3. What size of plough-steel winding-rope would you put in a shaft 1,950 ft. deep to wind 150 tons of mineral per hour? Describe and sketch the form of capping you would use, and say how often you would recap.

Subject K.—*The Effect that Faults, Slides, and Mullock-bars have on Lodes, and how to ascertain the Direction of Slides and Heavals.*

1. Explain the meaning (that is, give definitions) of the following terms : Normal fault; reversed fault; throw; heave. Give diagrams to illustrate your definitions.
2. Quote two or three examples of faults occurring in New Zealand mining-fields, and briefly state what you know about each.