

6. Show by arrows, &c., how you would conduct air through the workings shown on accompanying sketch, ventilation to be by some power which will prevent the reversals of current which occur when natural ventilation is relied on. State what power you would adopt, and show where you would apply it. (Note.—Levels connected to main shaft by crosseuts.)

SUBJECT D.—*Tapping Water in Mines, and the Mode of constructing Dams in Underground Workings to keep the Water back.*

1. If you were driving in the direction of old workings known to contain water in large quantity, what precautions would you adopt? Explain fully.

2. Describe the construction of a suitable dam to be built in a tunnel 6 ft. wide by 7 ft. high, and to resist water having a pressure due to a vertical head of 170 ft. Give leading dimensions and state total pressure on the dam.

3. Explain how you would construct a water-tunnel in ground subject to swell.

4. What methods are adopted in shafts to obviate feeders of water having to be pumped? Particularise as far as possible.

SUBJECT E.—*On Blasting and the Use of Explosives.*

1. What explosives do you consider the best to use in crosscutting in hard rock? Give your reasons fully.

2. What is the relative strength of dynamite, rackarock, compressed powder, and blasting-gelatine in comparison with the ordinary blasting-powder?

3. What method would you use to thaw dynamite when in a frozen condition, and at what temperature does it freeze?

4. What explosive do you consider the best to use in wet and hard ground? Give your reasons fully.

5. If a shot were to miss fire, what precautions would you take, and how would you proceed to disintegrate the rock that the miss-charge was in?

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

1. The wages of 9 men and 5 boys for 48 hours in doing a certain piece of work was £36. Assuming that 4 boys did as much as 3 men, how much did each receive, and how long would it have taken 5 men and 3 boys to do the same work?

2. The excavation for a battery on the side of a hill was 90 ft. long. At one end the width was 30 ft., and the height of the bank measured on a slope of 1 in 4 was 21 ft.; at the other end the width was 13 ft., and the height of the bank on a slope of 1 in 4 was 9 ft. 2½ in. How many cubic feet were there in the excavation?

3. How many cubic feet of timber are there in two poppet-head legs, each 90 ft. long, 2 ft. 4 in. in diameter at the one end and 1 ft. 3 in. at the other?

4. The distance between two levels vertically is 100 ft. A quartz lode is lying on an angle of 45 degrees, the average thickness of the lode is 6 ft. 5 in. at one end of a block 150 ft. in length, and 3 ft. 9 in. at the other. At 75 ft. from either end the lode has an average thickness of 7 ft. 7 in. How many tons of quartz are there in the block between the two levels, allowing 16 cubic feet to a ton?

5. A bar weighing 415 oz. bullion contained gold of 2251 fine and silver 5632 fine. Taking pure gold at £4 4s. an ounce, and silver at 2s. 3d. per ounce, required the value of the gold and silver.

SUBJECT G.—*A Knowledge of Part V. of "The Mining Act, 1898."*

SUBJECT H.—*Pumping Appliances and the Drainage of Mines.*

1. Describe the leading features of a large steam-pump to be placed underground, and to work against a vertical head of 800 ft. Economy of steam and accessibility of parts most liable to derangement to be fully considered.

2. What is a pulsometer? Explain its action, uses, and limits of application.

3. In sinking a shaft, a considerable amount of water is met with, and has to be raised in tanks. Describe how this may be effected without the tanks dipping into the water, or being filled by baling.

4. An ordinary bucket pump working sixteen hours daily has a diameter of 18 in. and a travel of 88 ft. per minute. It has to be replaced by a steam-pump capable of raising the water in twelve hours. Assuming the latter to have two double-acting rams, and to work at a speed of 100 ft. per minute, what will be the diameter of the rams?

SUBJECT I.—*The Haulage in Shafts and on Underground Planes; also the Strength of Haulage Ropes and Chains.*

1. Give diameter of cylinders, length of stroke, and diameter of drum (on first motion) required to raise 500 tons per shift from a depth of 800 ft. Boiler pressure 80 lb. per square inch.

2. Explain how (at deep shafts) the weight of winding-ropes is balanced, and also the advantages and disadvantages attending any system of balancing.

3. Sketch the ground plan and general arrangements of an endless-rope tramway, and explain its leading features. Give reasons for and against the rope being placed (a) under, and (b) over, the trucks, and show how you would secure the trucks to the rope when the tramway has undulating gradients.

4. Give in detail the particulars of steam plant required to haul 20 tons per hour up an incline 75 chains long with one line of rails only, and having a gradient of 1 in 3.