

3. How would you ventilate (a) a drive 8 ft. wide and 6 ft. high, rising 1 in 4, and making CH_4 freely; (b) the face of an underlie of 1 in 4 giving off a large quantity of CO_2 ?

4. Describe, and illustrate by diagram, the action of a Roots' blower, and state under what conditions its employment is advisable.

5. In the case of two ventilating-shafts, each 600 ft. deep, the temperature in the downcast is 60° Fah. and in the upcast shaft 180° Fah., and the barometer reads 30 in.: state the height of motive column in feet.

6. What is the horse-power, in the air, of a fan running 110 revolutions per minute and producing 50,000 cubic feet of air per minute with a water-gauge of 2 in.? If the quantity of air is increased to 70,000 cubic feet per minute, what will the water-gauge then be; also the horse-power in the air, and the number of revolutions of the fan?

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

1. At 450 ft. from the collar of shaft a crosscut 520 ft. in length connects with old workings full of water. We are now to open up the old workings by driving from the present bottom of the shaft, which is 1,100 ft. below the collar of shaft, and 130 ft. below the old workings. The length of tunnel to connect is 640 ft., and 130 ft. of uprise to break through. What precautions would you take before breaking through, and what risks, in your opinion, have you to provide against? Describe fully.

2. Show, by sketch, how you would construct a breastwork dam to dam back water in a crosscut; the dimensions of the crosscut are 7 ft. by 6 ft., and the water is to rise to a height of 300 ft. above the centre of the breastwork. Describe fully the whole process and the materials you would use.

3. Show by calculation the pressure in pounds on the above breastwork.

4. If you only had to dam the water back to a height of 4 ft., state the materials you would use and your mode of construction.

SUBJECT E.—Blasting, and the Use of Explosives.

1. The diameter of a breasthole in a level is 2 in., the depth of the hole is 5 ft.: what weight of blasting-gelatine would you use for the charge?

2. Give the formulæ for the weight of explosives in small blasts.

3. A borehole is 3 in. in diameter, and filled with gelignite to a depth of 8 in.: what is the weight of the charge?

4. In charging a hole bored at an angle of 45° above the horizontal the plugs sometimes slip back with the tamping-bar: what do you do in this case?

5. During frosty weather how do you prepare the charge if you are using nitro-glycerine compounds?

6. In selecting a site for a magazine for explosives, what contingencies would you provide for? Would you keep the explosives, fuse, and caps in the same building? If not, give your reasons.

7. Give a list of the appliances required for blasting by electricity.

8. How would you test low-tension fuses, and how would you know that the fuse was good?

9. In blasting by electricity you have a missed shot: describe fully the steps you would now take.

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

1. The area of a circle is 24052.875 square feet: what is (a) the diameter, and (b) the circumference, in feet.

2. A bar of gold as produced from a mine contained 976 oz., which, after melting at the Mint, was worth 720 oz. of fine gold: what is the money value per ounce of the gold as produced from the mine?

3. Given the following assays and measurements of a gold-bearing reef taken 10 ft. apart, what is the correct average width and cash value of the total lengths sampled?—

Width, 12 in.; assay per ton, 20 dwt. fine.

" 18 in.; " 26 dwt. "

" 15 in.; " 20 dwt. "

" 18 in.; " 25 dwt. "

" 10 in.; " 18 dwt. "

" 3 in.; " 6 dwt. "

4. The monthly expenditure at an important metalliferous mine is divided under seven headings: state what these would be, and specify the chief items chargeable to each.

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

1. To deal permanently with an inflow of 2,000 gallons of water per minute from a depth of 400 ft., describe the plants you would install under the following conditions: (a) At a metalliferous mine where steam-power is used; (b) at a deep-lead alluvial mine where the water contains some sand and the supply is irregular: the pump to be electrically driven by a motor of 85 per cent. efficiency.

State the horse-power necessary of the engine in case (a), and of the motor in case (b); also the principal dimensions of the pumps.