

6. Ventilate the sketch section of mine-workings (not here shown), show by arrows the direction of the air-current round all the miners, and by dotted lines the position of any air-boxes, gollars, or brattice necessary; and state how the natural ventilation may be improved without having recourse to machinery, water, steam, or furnace.

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

1. In sinking a shaft through solid rock, at 50 ft. in depth a fissure is encountered which produces a considerable flow of water; the shaft is to be sunk to a depth of 1,000 ft.: what steps would you take to prevent the flow of water getting down the shaft as the sinking proceeded? Give full details of the measures you would adopt.

2. A crosscut in hard rock is to be utilised as a dam; the crosscut is 7 ft. by 6 ft.; the water is to rise to a height of 4 ft.: describe fully the material you would use, and your mode of construction.

3. A breastwork is to be constructed in a similar crosscut to the above, where the water is to rise to a height of 300 ft. above the centre of the breastwork: give the total pressure on the structure; also (a) your mode of construction, (b) the material you would use, and your reasons.

4. A winze (securely timbered with black-birch) has been sunk on the lode to a depth of 70 ft., and is then allowed to fill with water; after twelve months an uprise to connect with the bottom of the winze is within 20 ft. of the holing through; the survey can be relied on: what precautions (if any) would you now take to insure the safety of the workmen when making the connection?

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

1. A borehole 2 in. in diameter is filled with blasting-gelatine to a depth of 6 in.: required the weight of the charge.

2. In a similar borehole to the above, what weight of gelignite would be required to do the same work?

3. What explosives would you use for the following works: (a) Sinking a wet shaft; (b) driving a level through very hard rock; (c) stoping on medium-hard quartz? Give your reasons in each case.

4. Give the weight and composition of charge of a No. 6 detonator (Thistle brand), (a) for safety fuse, (b) for electric blasting.

5. In case of a misfire, what time would you allow to elapse before returning to the face?

6. What is the most powerful blasting-explosive known? and give its composition.

7. What do you consider the best fuse for blasting in water or very wet ground?

8. A hole is to be charged with gelignite; the temperature is 40° Fahr.: describe fully what steps (if any) you would take before charging the hole; also state the six operations required in charging the hole.

9. To fire a group of holes simultaneously by electricity, give sketches showing how you connect the wires in series and in parallel, and state what fuses you would use in each case; also state what test you would apply to make certain that there was no break in the circuit.

10. A missed shot in electric blasting may occur from either one of four causes: name them.

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

1. Evaluate $\sqrt{\frac{246}{169}}$ and $\sqrt[3]{\cdot 000125}$.

2. A bar of gold as produced from a mine contained 302.67 oz., which after melting at the mint was worth 320.10 oz. of standard gold. What is the value per ounce of the gold as produced from the mine, the mint value of standard gold being £3 17s. 10½d. sterling per ounce?

3. An analysis of expenditure at a large quartz mine is subdivided under the following headings: (a) Mining; (b) Treatment; (c) Realisation of Bullion; (d) General Expenses; (e) Total Working Expenses; (f) Development; (g) Capital Account; (h) Total. Specify the principal items which should appear under the above headings.

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

1. What quantity of coal per indicated horse-power per hour would be consumed under favourable circumstances by a pumping-engine?

2. Is electric driving suitable for single- or double-acting plunger or bucket pumps? State the reasons for your answer.

3. What do you consider the practical limit to the length of a draw-lift section of pumps? State the disadvantages of exceeding such a limit.