

SUBJECT 2.—*Mechanics: Pumping-appliances and Mine-drainage; Tapping Water and Dam-construction in Mines; Winding in Shafts; Hauling on Underground Planes; Compressed-air and Steam-power Plants; Strength of Materials; Elementary Electricity.*

1. Give sketch of general arrangement of appliances required for the installation of endless-rope haulage, showing driving-gear, tension arrangement, and clips. Assume quantity of coal to be hauled at 600 tons per shift, length of line 1,000 yards, and grade 1 in 10 against the load.
2. Describe and show by sketches the class of steam-boiler you consider most suitable for colliery-work. State reasons for preference.
3. What class of pump would you prefer to install to raise 600 gallons of water per minute from the dip-workings of a colliery? Give detailed description of pump, the driving-medium you would adopt and power required, allowing you obtain 60 per cent. efficiency; the pump to be placed underground one mile from the shaft, the head to be 500 ft.
4. Give sketch showing how a siphon should be erected. State the law which governs the working of this appliance, and advantages derivable from the working of same.
5. If required to transmit energy for application underground, state whether you would prefer electricity or compressed air, reasons for preference, and under what conditions you would install either of these forms of energy in preference to the other.
6. If required to build a dam or dams for resisting water-pressure of 100 lb. per square inch, show by sketch the form of dam, and give description of material and its application to the work. All dimensions to be assumed by candidate.
7. What are the terms applied by electricians to indicate (a) electrical pressure, (b) electrical quantity, and (c) electrical resistance?
8. Having to install a 25 horse-power electric motor (continuous current) at a point in the underground workings $1\frac{1}{2}$ miles from the generating-station, where the voltage is 480, and the line consists of No. 2 standard wire gauge, copper, the total length being 3 miles, what would the drop in voltage be, for what voltage should the motor be constructed, and what power would be required at the generating-station, assuming 60 per cent. efficiency?

SUBJECT 3.—*Ventilation: Ventilation of Mines and Knowledge of Mine-gases; Spontaneous Combustion of Coal, and Methods of Dealing with Underground Fires; Rescue Apparatus; Practical Knowledge of Gas-testing with a Safety-lamp.*

1. Explain the theory of ventilation of mines, and why artificial ventilation is more reliable than natural.
2. Give rules which should be followed in splitting air, and state what is the practical limit to the number of splits, and why.
3. In what velocities of an explosive mixture are certain forms of safety-lamps unsafe?
4. Describe the conditions requiring mines to be worked with locked safety-lamps, and state provision.
5. What means would you adopt to secure the best possible results from a fan of limited capacity and on which the demand is dangerously near the limit?
6. What are the factors determining the quantity of air passing in a mine at any given time?
7. State how you would guard against underground fires, and the means you would adopt in dealing with same, having special regard to the safety of persons employed in connection with the work required to be done.
8. If 20,000 cubic feet of air be produced in an airway 3,000 ft. long, 8 ft. wide, and 5 ft. high, how many feet would be produced if the air was split in three splits, the first airway being as above, the second 3,500 ft. long by 9 ft. wide and 5 ft. high, the third 4,000 ft. by 10 ft. wide and 6 ft. high, the power being unchanged?
9. If water-gauge shows a depression of 3 in. and an anemometer reading taken in main intake, which is 12 ft. by 7 ft., shows a velocity of 985 ft. per minute, what is the horse-power of the ventilating-current?
10. Having a current of 96,000 cubic feet of air circulating in a mine, the water-gauge being 1.2 in., what will be the water-gauge if current increased to 130,000 cubic feet per minute?

SUBJECT 4.—*Arithmetic and Law: A Knowledge of Mine Accounts; Fractions, Decimals, Percentages, Square Root, Area of Rectangle, Trapezoid, Circle, &c.; Measurement of Timber; Calculation of Workable Coal in a Mine, &c.; a Knowledge of the Coal-mines Act and Amendments.*

1. What are the contents in tons in an area of 20 acres, the seam lying flat and 5 ft. thick; specific gravity, 1.5.
2. Taking the output of a colliery at 9,000 tons per fortnight, of which 15 per cent. is unsaleable, the cost per ton of the gross quantity is 5s. 3.5d.: what is the cost of the net disposable quantity, and what should be the selling-price to return a gain of $12\frac{1}{2}$ per cent.?
3. If pillars are 22 yards by 13 yards, bords 6 yards wide, and headings 4 yards wide, what percentage of the coal is being won in the solid workings?
4. Find the length of a circular fence to enclose 10 acres.
5. Write such a report as may be considered necessary from the manager of a mine to his directors at the end of each fortnight, dealing with the pay-sheets and such features connected with the mine-workings as are, in your opinion, essential for the information of a board of directors.