

SUBJECT 2.—WORKING OF COAL AND TIMBERING UNDERGROUND.

1. Describe the systems of working coal of which you have had practical experience. Give sketches, and state the conditions under which any one of the systems is better than others.
2. Describe in detail, and give sketches of, the various systems of timbering in use in coal-mines, and the conditions which would guide you in adopting any one of the systems for the main roads in a mine having a soft floor and seam highly inclined.
3. If you are working chocks in a seam of coal 6 ft. thick with a strong roof, what is the most essential point that the officials should pay attention to? Give the reasons for your answer.
4. When drawing timber, what precautions would you take (a) when loosening the timber, (b) when removing it from the fall? What tools do you consider necessary for this work?

SUBJECT NO. 3.—GASES OF MINES, SPONTANEOUS COMBUSTION, AND VENTILATION.

1. Describe the gases most commonly met with in coal-mines, giving their chemical symbols, how they may be detected, and the dangers to be feared from their presence.
2. What are the provisions of the Coal-mines Act with regard to the ventilation of mines? and what are the effects of atmospheric changes upon the ventilation of mines?
3. In the event of a mine being on fire what dangers are likely to be encountered, and what precautions would you take in extinguishing the fire to protect the workmen engaged from loss of life by suffocation or explosion, and the possible destruction of the mine?
4. Ventilate the attached plan, and show by conventional signs stoppings, overcasts, &c., and direction of air-currents.
5. In which of two airways, one 6 ft. by 6 ft., the other 9 ft. by 4 ft., and of equal length, would the friction be the greater? Show by figures how you arrive at the result.
6. If 100,000 ft. of air is produced by 50 h.p., what is the water-gauge?
7. Clearly distinguish the meaning of the terms "pressure" and "power" as applied to ventilation.

SUBJECT 4.—DEALING WITH OLD WORKINGS AND OTHER SOURCES OF DANGER.

1. In driving towards old workings known to contain a large accumulation of water under a head of 150 ft., what measures would you adopt to secure the safety of the workmen, and to control the water so that it may be let off without flooding the workings?
2. How would you deal with a "creep" induced by pillars being too small and a hard roof?
3. In making examination of a mine you find it necessary to work certain places with safety-lamps: what other precautions are necessary?
4. Give a sketch of any good form of steam-boiler of which you have a knowledge. Enumerate the various fittings required. Give sketch showing their positions on the boiler; and say what you would do in the event of finding a boiler so short of water that none was visible in the gauge-glass?
5. Calculate the horse-power of a single-cylinder steam-engine—the cylinder 16 in. diameter by 32 in. stroke, running at a speed of 85 revolutions per minute, with a mean effective pressure of 60 lb. per square inch.
6. If you found when a ventilating-fan was running at maximum speed that by opening the doors between the intake and return the quantity of air was not increased, what conclusions would you arrive at, and what steps would you take to improve the ventilation of the mine?

SUBJECT 5.—MINE DRAINAGE AND HAULAGE, AND APPLIANCES FOR SAME.

1. Describe the best system with which you are acquainted for pumping water from dip workings, and state what you consider the most economical and suitable power for application in fiery mines.
2. Give the principle which governs the working of a siphon, with sketch showing how applied. Also give sketch of the working parts of an ordinary lifting set of pumps.
3. Show by sketches the various systems of haulage applicable to coal-mines, and say which in your opinion is the most generally applicable and economical in working, giving reasons.
4. What power would be required to haul 500 tons per shift of 8 hours from a dip the grade of which is 1 in 5 and length 1,000 yards?
5. What is the lowest grade at which a self-acting inclined plane will run? Show by sectional sketch which should be the steepest part of such an incline.

SUBJECT 6.—ARITHMETIC, AND A KNOWLEDGE OF "THE COAL-MINES ACT, 1905."

1. If two pits are winding respectively—No. 1, 1,250 tons 10 cwt. per shift, and No. 2 759 tons 10 cwt. per shift, the cost of production in No. 1 being 4s. 1½d. per ton, and in No. 2 6s. 1d., what will be the average cost per ton of the two together?
2. The shaft-pumps at a colliery raise 150 gallons of water per minute: what storage-room would be required to enable the pumps to be stopped for twelve hours at a time? Give the answer in cubic feet.
3. If 13,146 cubic feet of air weigh one pound, what would be the weight of air in a chamber 18 ft. diameter and 12 ft. high?
4. Plot the following on a scale of 100 ft. to an inch:—

A to B, N. 15° W., 275 ft.	C to D, S. 20° W., 430 ft.
B to C, S. 65° E., 325 ft.	D to E, N. 85° W., 360 ft.

 Find the closing course and distance.
5. Cutting 25 yards of bottom, 28 in. thick, 7 ft. wide, is paid for at the rate of 1d. per inch for a width of 5 ft.: how much does the work cost per lineal yard, and what is the total cost?
6. What would be the length of a branch driven at a rise of 6 in. to the yard from one seam to another lying 6 yards above it in level strata?