

SUBJECT No. 8.—*Arithmetic, and Knowledge of the Coal-mines Act.*

1. If 2,000 tons of large coal costing 9s. be produced and 1,500 tons of small coal costing 4s., at what price must the mixture be sold to make 9 per cent. profit?
2. If the wages and stores account on 2,500 tons of coal, selling at 8s. a ton, amount to £850, what is the profit after  $7\frac{1}{2}$  per cent. advance in wages and stores and a corresponding rise of 1s. per ton in the selling-price?
3. A circular shaft 100 fathoms deep is filled with 2,513·28 cubic yards of water: what is the diameter of the shaft?
4. Two miners in 11 days hew 150 tons of coal at 1s. 10d. per ton, cut six yards at 6s. per yard, and receive 15s. consideration: what is the total amount, and each man's daily average; and what would the total amount and daily average be if the tonnage-rate was increased 8 per cent.?
5. A shaft sunk to a depth of 1,200 feet: 16 per cent. of the depth cost 35 per cent. per foot more than the other part, the total cost being £3,009 12s.: find cost per foot of each portion.
6. Briefly state requirements of Coal-mines Act as to—
  - (a.) Ventilation;
  - (b.) Blasting and storage of explosives;
  - (c.) Water, and precautions on approaching old workings;
  - (d.) The duties of manager and under-manager, also of fireman and deputies;
  - (e.) Safety-lamps and lamp-stations; and
  - (f.) Signals.

SUBJECT No. 1.—*On Prospecting, Shaft-sinking, Tunnelling, and Opening out a Colliery.*

1. Describe the method you would adopt in sinking a shaft 15 feet diameter 600 feet deep, first 300 feet being heavily watered. In your answer make special reference to ventilation, shot-firing, and other necessary precautions for the general safety of the sinkers.
2. Assume that a shaft is sunk through a seam of coal 4 ft. 6 in. thick at 450 feet deep: give size of shaft-pillars; also show by sketches how you would open out your main roads from the bottom of shaft, knowing the existence of a soft floor: give size of levels.
3. Show by sketches how you would carry out the walling of a shaft with brick when there are no hard beds to carry the walling-curbs.
4. Show by sketches the various systems of timbering applicable to coal-mining, having regard to main roads—
  - (a.) With soft floor and roof;
  - (b.) Longwall, and
  - (c.) Bord-and-pillar.
5. A heavy fall occurs in a main haulage-road: show by sketches how you would retimber same.
6. In sinking a shaft 400 feet deep, if you come across 20 feet of any soft ground say how you would secure same—first, temporarily; second, permanently.

SUBJECT No. 2.—*On working Coal and Timbering underground.*

1. Describe the different systems of working coal, with special reference to any with which you are practically acquainted.
2. Explain how you would timber a main road in a mine, the same to be 12 feet wide and 7 feet high, rising 1 in 4 through a fault, the roof being shale 6 feet thick, and depth from surface 300 feet. Give size of material you would use.
3. What precautions are necessary to prevent accidents at the working-faces?
4. Describe the different methods of pillar-extraction, and the conditions necessitating the different methods.
5. Give fully the reasons for dividing mines into districts, and explain the advantages arising therefrom.

SUBJECT No. 3.—*On Gases of Mines, Spontaneous Combustion, and Ventilation.*

1. Explain the various systems of ventilating mines, and state which method you prefer and reasons for same.
2. If a mine is ventilated by three splits of air, how would you ascertain whether any one of them was passing more than its proper quantity? and, if found to be so, how would you reduce it to its proper proportion?
3. If 36,000 cubic feet of air be passed through an airway at a velocity of 10 feet per second, what is the area?
4. Describe the gases most commonly met with in coal-mines, and give your practical experience in dealing with these.
5. What do you understand by the term "spontaneous combustion"? and what precautionary and other means would you adopt in dealing with an active fire underground?

SUBJECT No. 4.—*On dealing with Old Workings and other Sources of Danger.*

1. Suppose a series of bords approaching old workings containing noxious gas or water, what would you do? Explain fully the precautions you would take, and give sketches.
2. In a mine giving off explosive gas freely and in full work a fall suddenly occurs blocking up the return airway: what steps would you take in such difficulty?
3. To insure the greatest possible safety, what explosive would you use and what regulation would you enforce when firing shots in a seam giving off explosive gas, and being also dry and dusty?
4. In a mine where it is necessary to use safety-lamps, what regulation would you establish as to their proper use? Also explain why an unshielded lamp is unsafe.
5. What are the dangers likely to result from a blown-out shot? and how would you guard against such occurrences?