

5. Give two different sizes which you would make the districts in opening up separate mines, and give the reasons fully for the difference.

SUBJECT II.—*The Various Methods adopted in Securing Shafts and Workings in a Mine, showing the relative Advantage and Efficiency of each Class of Material used.*

1. How would you secure your sets of timbering so that if one came away it should not bring others with it?
2. Give a sketch showing how you would secure your lining in sinking a rectangular shaft.
3. What is the relative strength of M. iron and timber used as cap-pieces?
4. What thickness of bricking would you put in in a 13ft. shaft at a depth of 500ft.? Would you pack behind it, and, if so, with what?
5. Give a formula for finding the thickness of C. I. tubing, and explain its terms.

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FIRST DAY.—TIME: 2 P.M. TO 5 P.M.

SUBJECT III.—*The Various Methods of Hewing and Cutting Coal of Different Classes to Advantage, and Securing the Ground whilst so engaged.*

1. Why are the roads sometimes driven at other than right angles to the levels in longwall workings, and what disadvantage does it entail?
2. In driving to cut a fault in steep measures, with a soft roof and hard floor, explain fully if it would make any difference if you met it on the level or in a dip drive.
3. Describe the system of working in any mine you are acquainted with, and mention if there is any improvement you can think of.
4. How would you work a 4ft. coal-seam with fireclay pavement and sandstone roof?
5. Has the amount of cover any bearing on the system adopted in working pillars? and, if so, explain fully in regard to depths of 60ft. and 600ft. respectively.

SUBJECT IV.—*The Various Methods of Ventilation, and the Construction of Airways so as to produce a Good Circulation of Fresh Air in any Part of a Mine.*

1. In a mine with one shaft 70ft. deep and another 110ft. deep, what is the direction of the air-current—(a) in summer, (b) in winter, with natural ventilation? Explain why.
2. Give the quantity of air in cubic feet per minute which a well-constructed furnace should circulate, as a general thing, for each foot in width of fire-bars; and enumerate the circumstances which modify this.
3. You have a furnace and steam-jet for ventilation, in a shaft 20 fathoms deep, which circulate 24,000 cubic feet of air per minute. When the furnace is out, only 8,000ft. circulate. How much would pass if only the furnace were used?
4. Describe and give sketch of the Mueseler safety-lamp.
5. If you double the length of an air-course, how much will the friction be increased?

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SECOND DAY.—TIME: 9 A.M. TO 12 NOON.

SUBJECT V.—*On the Areas of Airways, the Velocity and Divisions of Currents, and the Deductions to be made for Friction.*

1. Give a sketch in section of a ventilating-furnace, and its position in relation to the upcast shaft.
2. Thirty thousand cubic feet of air are passing in two splits: how much circulates in each if one measures 7ft. by 4ft. and the other 7ft. by 8ft.?
3. Give a description of the Capell fan, and state what you know of it as a ventilating-machine.
4. At a fiery mine, ventilated by a fan, what safeguard should be provided against the breakdown of the fan-engine?
5. What are the uses of the barometer at fiery mines?

SUBJECT VI.—*On the Nature and Composition of Explosive and Dangerous Gases occurring in Coal-mines, and on Spontaneous Combustion.*

1. What is the composition of heavy carburetted hydrogen? Is it more dangerous than the ordinary firedamp or not?
2. Can a gas which burns be a non-supporter of combustion?
3. In workings where you suspected a tendency to spontaneous combustion, what steps would you take to ascertain if it were in progress?
4. What is the composition of white-damp?
5. What is the temperature of ignition of firedamp?

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SECOND DAY.—TIME: 2 P.M. TO 5 P.M.

SUBJECT VII.—*On the Drainage of Mines, and Pumping Appliances.*

1. Give a sketch of an ordinary bucket, in plan and section.
2. In what circumstances should the pump-rods and weight of water in the pipes be equal? Give a case in which they should not, and state which should be heavier, and why?
3. What size of spears would you use for 20in. pumps?
4. What pressure per square inch will be caused by a head of 50 fathoms of water, and what thickness of metal would be needed for the pipes?
5. Give a full description of a centrifugal pump.
6. Describe the air-vessel and its uses for a forcing-pump.