

2. If a water-gauge of 1·10 inches gives a current of 20,000 cubic feet of air per minute, what will be the water-gauge with 30,000 cubic feet per minute?
3. A water-gauge of 1 inch and 50,000 cubic feet of air are produced by a fan and steam-pipes in the upcast. The steam-pipes alone produce 10,000 cubic feet. What quantity will the fan give, if the steam-pipes are transferred to the downcast pit?
4. A fan at 50 revolutions produces 100,000 cubic feet of air with 2 inches of water-gauge, what will be the water-gauge, the number of revolutions, and the horsepower when the production increases to 120,000 cubic feet of air per minute?
5. A ventilating-current is passing at 5 feet per second. What increase of power will be required to double the velocity?
6. The temperature of a downcast is 40° Fahr., that of the upcast being 70° Fahr. What volume of air in the upcast will weigh the same as 1 cubic foot in the downcast?
7. The pillars about the shaft-bottom are to be 120 yards square from the shaft in all directions. Show by a large sketch, giving dimensions with description, how you would arrange the airways during the formation of the pillars. The coal gives off fire-damp freely.

Paper IV.—Modes of Working.—(Time, 3 hours.)

1. What instructions would you give to shot-firers in coal-mines?
2. Describe the safety-lamp that you like best, and name the make that you prefer for use at the working-face, on hauling-roads, and for official examinations.
3. Describe a method for securing a circular shaft with wood. Give the sizes of timbers for a shaft 10 feet in diameter.
4. Sketch and describe different methods of timbering a main-road in a flat seam.
5. Describe arrangements for getting coal from the working-faces to the main-roads underground in mines with considerable dip, and mention precautions to ensure the safety of the workmen.
6. Describe fully some system of underground-haulage, and mention the conditions in the mine that would govern your selection of that particular system.
7. On opening a seam of coal in a new field unaffected by old workings, what conditions would lead you to advise the selection of bord and pillar in preference to longwall?
8. Sketch, with measurements, the openings about a pit-bottom laid out for longwall.

Paper V.—Surveying.—(Time, 2½ hours.)

1. Lay down the following underground survey on the scale of 2 chains to 1 inch:—

Distance.	Chains.	Horizontal Angles.
Shaft to A.	1·90 ...	A 145° 15'
A. B.	6·75 ...	B 177° 30'
B. C.	4·30 ...	C 213° 54'
C. D.	9·77 ...	D 97° 20'
D. E.	3·90 ...	E 130° 13'
E. F.	6·13 ..	F 167° 30'
F. G.	3·01	

NOTE.—The horizontal angles are those on the left hand of a person travelling in the direction of the survey, and the magnetic bearing of the