SUBJECT C.—*The Ventilation of Mines and Composition of Gases.*

1. What gases are usually met with in metalliferous mines? Give their composition, symbols, and specific gravities. State the effects of each gas on the human system, and explain how the presence of the several gases may be detected in the mine-workings.

2. Show the best means of ventilating (*a*) a stone tunnel in the driving of which six men are employed on each shift, and (*b*) a shaft which is being sunk, eight men being on the bottom at one time; efficiency and practical economy to be considered.

3. Describe the several methods used to secure the permanent ventilation of extensive mines. Compare their capabilities, advantages, and relative working economies.

4. If the H.P. of a ventilating-current is 40·5 and the water-gauge reading is 2·6 inches, what volume of air (in cubic feet per minute) is in circulation?

5. A fan circulates 60,000 cubic feet of air per minute at 1·5 W.G. Allowing 7½ per cent. of the indicated H.P. of the engine being spent on frictional resistances and the efficiency of the fan as compared with the effective H.P. of the engine is 74 per cent., what indicated H.P. will be required to circulate 90,000 cubic feet of air per minute, the airways remaining unaltered?

6. Show how you would ventilate the workings of a mine as per sketch-plan attached. Assume a heavy blower of CO_2 being struck at A.

What power would you employ for permanent ventilation, and where would you apply it?

SUBJECT D.—*Tapping Water in Mines, and the Mode of constructing Dams in Underground Workings to keep the Water back.*

1. In sinking a shaft, a feeder of water flowing at the rate of 10,000 gallons per hour is met with some 200 feet above the point at which the shaft will intersect the reef, and well clear of any crosscuts. Show how you would deal with this water, and give reasons for answer.

2. A reef has been worked to a depth of 300 feet and the mine abandoned: old workings consequently fill up with water and the shafts collapse. A new shaft is to be sunk to work the reef from the level of the old workings to a depth of 1,000 feet. The accumulated water must be dealt with so as to prevent its being a source of danger in the sinking of the shaft and subsequent working of the reef at lower levels. How would you accomplish this with efficiency and economy?

3. A roadway is 6 feet wide and 8 feet high. Show how you would construct a dam to keep back water having a vertical head of 160 feet above floor of roadway. Give total pressure on dam.

4. Under what conditions would you adopt dams of (*a*) wood, (*b*) brick, and (*c*) concrete?

SUBJECT E.—*Blasting, and the Use of Explosives.*

1. Give relative strengths of the explosives generally used in mines, taking that of blasting-powder as 1. Explain under what conditions each may be used to the best advantage, and the precautions to be taken to obtain the best results.

2. How would you fire a round of shots simultaneously?

3. In the case of a miss-fire what action would you take (*a*) where ordinary fuse is used, and (*b*) where the charges are fired electrically?

4. What precautions are necessary in the storage of nitro-glycerine compounds? High and low temperatures to be taken into consideration.

5. How would you prepare frozen nitro-glycerine compounds for effective use, and what precautions would you observe to prevent accident?

SUBJECT F.—*A Knowledge of Arithmetic and the Method of keeping Mining Accounts.*

1. Work out the cost of the following timber:—

6 pieces	20 ft.	long by	1 ft. 6 in.	broad by	1 ft.	thick
18 "	12 ft.	" by	9 in.	" by	6 in.	"
100 "	12 ft.	" by	4 in.	" by	3 in.	"

at 15s. per 100 superficial feet 1 in. thick.

1,500 props, each 7 ft. long, at 11s. 6d. per 100 lineal feet.

2. A block of quartz is proved in several levels, and the following measurements obtained at various places:—

Length.	Height of Backs.	Width.
Ft.	Ft.	Ft. in.
360	590	3 6
470	650	4 9
390	420	5 0
420	390	3 9
450	570	4 3

Allowing 38 cwt. per cubic yard, what tonnage of ore does this block contain?

3. Taking the tonnage obtained in answer to the preceding question, and an average assay value of £3 12s. 6d. per ton, what amounts will be recovered by amalgamation, cyanide treatment, and concentration, the extraction being 55 per cent., 22½ per cent., and 17½ per cent respectively? What is the balance of value lost?