

SUBJECT III.—*Ventilation.*

1. What is understood by the expression "diffusion of gases"? Given four gases whose comparative densities are as 1, 4, 9, and 16, at what relative rates will each of the three last diffuse into the first when brought into contact with it separately, and under such conditions that there is no mechanical movement in either of them, and that the lighter gas is uppermost?
2. What do you understand by the term "vapour density"? Explain how it is that an increase of moisture in the atmospheric air causes the barometer to go down.
3. What is the object of splitting the air in mines? To what general result is it conducive, and how is it effected?
4. Describe and sketch the most efficient ventilating-fan, also the most efficient blower for mine-ventilation with which you are acquainted. State the conditions for which each is adapted.
5. The quantity of air passing through the downcast shaft of a mine is 100,000 cubic feet per minute at a temperature of 40° F.; the quantity in the upcast is 106,000 cubic feet per minute at a temperature of 65° F.: find the amount of gas being given off in the mine-workings.
6. Explain the general principles upon which self-contained breathing-appliances work. Describe, with simple sketch, any type of such apparatus with which you are familiar.
7. A fan running at a speed of 100 revolutions per minute produces 125,000 cubic feet of air under a water-gauge of 2 in.: what would be the required speed of the fan and the water-gauge to produce a circulation of 150,000 cubic feet of air per minute in the same mine?

SUBJECT IV.—*Arithmetic, First Aid, and Law.**Arithmetic.*

1. If 9 men and 6 boys can do in 2 days what 5 men and 7 boys could do in 3 days, in what time could 2 men and 5 boys do the same?
2. An engine working steadily day and night consumes a hundredweight of coal in $7\frac{1}{2}$ hours: how many tons will be used in 150 days?
3. Standard gold consists of 11 parts by weight of pure gold and 1 part of copper. If a sovereign weighs 123 grains, find how many can be coined from a bar of standard gold containing 1 lb. avoirdupois of pure gold.
4. Miners earn on the average 10s. 5d. each per day, and 234 men are employed: find the total sum paid in wages for a week of 6 days.
5. Extract the square root of 50,085,018,863,929 and the cube root of 26,463,502.
6. Make up a pay-sheet in proper form for 4 weeks' wages in connection with a mine, a day being reckoned as 8 hours—116 men at 1s. $1\frac{1}{2}$ d. per hour; 47 men at $11\frac{3}{4}$ d. per hour; 540 men at 1s. $4\frac{1}{2}$ d. per hour; 87 boys at $5\frac{1}{2}$ d. per hour.

First Aid.

7. Describe Sylvester's method of treating the apparently drowned.
8. Explain the terms "abrasions," "incised wounds," "contused wounds," "lacerated wounds," and "punctured wounds."
9. Give a diagram of and name the arteries of the lower limbs.
10. What are the symptoms of and treatment for a case of cyanide poisoning?

Law.

11. What are the provisions of the Act relating to the employment of manual labour in mines on Sundays?
12. State the uniform code of signals to be used at each mine.
13. What are the conditions as to the ventilation of mines?
14. State generally the procedure to be followed in connection with accidents in a mine.

SUBJECT V.—*Surveying.*

1. The accompanying diagram shows a traverse in the underground workings of a mine: compute the bearing and distance of the line V-I.

