

6. State the minimum grade at which a self-acting or incline tram 2,000 ft. in length can be satisfactorily worked with a full load of 4,000 lb., and the empty load 2,000 lb.
7. Explain the difference between direct-current and alternating-current generators, and state purposes for which the respective systems may be especially adapted.

SUBJECT III.—*Ventilation: Ventilation of Mines and Knowledge of Mine Gases; Rescue Apparatus used in Mines; Methods of Dealing with Underground Fires.*

1. What are the chemical composition and principal physical properties of marsh-gas, carbon dioxide, and carbon monoxide? Write the formula which shows the chemical reaction which takes place when marsh-gas is burnt in oxygen.
2. Under what conditions are fumes or gases derived from nitro-glycerine compounds and from gun-powder? What fumes or gases are so derived? To become harmless to what proportion must they be reduced?
3. An electrically driven fan has been installed at an upcast shaft previously used as such for natural ventilation; to the fan-motor is attached measuring-instruments: describe how the efficiency of the fan may with accuracy be ascertained. Give an example, with formulæ, to illustrate your answer.
4. An air-course 14 ft. wide, 10 ft. high, and 3,000 ft. long is to be regulated to pass 28,000 cub. ft. per minute; ventilating-pressure is equal to 1 in. water-gauge: find the area of the regulator.
5. Compare the area of equivalent orifice in the two following mines: (a) passes 250,000 cub. ft. per minute with 4 in. W.G.; (b) 100,000 cub. ft. per minute with 2 in. W.G.
6. What is the object in splitting the air in mines? To what general result is it conducive, and how is it effected?

SUBJECT IV.—*Arithmetic and Law.*

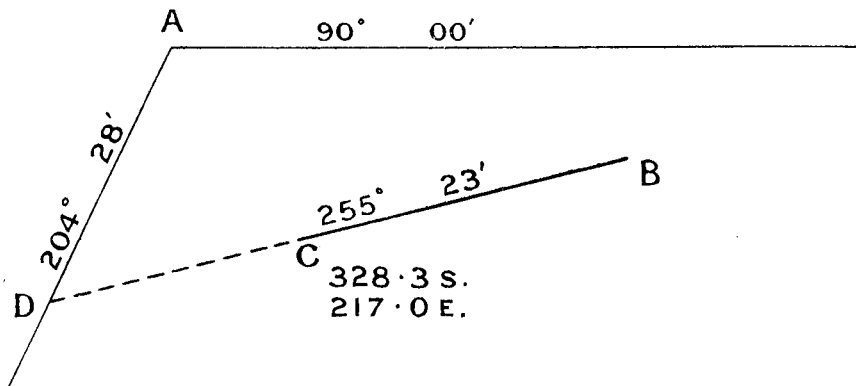
Arithmetic.

1. The cost of cementing the walls of a rectangular tank 21 ft. long, 15 ft. 9 in. wide, and 11 ft. 8 in. deep is £9 12s. 6d.: find the cost of cementing the floor at the same rate.
2. Two cog-wheels, one of 15 and the other of 28 teeth, work together: if the smaller makes 16 revolutions in $1\frac{1}{2}$ seconds, how many revolutions will the larger make in 21 seconds?
3. Ten men begin a work which they could finish in 100 days, but at the end of every 10 days 10 additional men are put on: how long does the work take?
4. Give the value of 1,875 oz. of bullion of 0.3675 in gold, it being alloyed with silver—taking pure gold at £4 4s. per ounce and pure silver at 2s. 4d. per ounce.
5. The distance driven on two levels on a lode is 240 ft., the height of backs between the levels is 1,000 ft. perpendicular, but the lode has an underlie of 23 degrees from vertical, and has an average width of 2 ft. 10 in. at one end and 5 ft. 8 in. at the other end. How many tons of ore is there between the two levels, taking 15 cubic feet to a ton?
6. If you purchased 24 picks at 3s. 4½d. each, 48 shovels at 4s. 5½d. each, and 129 lb. of powder at 8½d. per pound, state the total amount of purchase.

Law.

1. State the requirements with regard to the use and storage of explosives in a quartz-mine.
2. What are the requirements with reference to permanent ladders for the ascent and descent of persons?
3. What is required of the mine-manager with reference to safety appliances or gear?
4. Can instantaneous fuse be used?

SUBJECT V.—*Surveying.*



1. The above diagram represents the position of an underground drive BC; the end of the drive C is 328.3 links south and 217.0 links east from the corner of the claim A: how far will the drive have to be continued to meet the boundary at D?
2. A slope dips 1 ft. in 8 ft. for a distance of 504 ft. measured on the slope: what is the difference in elevation of the ends of the slope, and what is the horizontal distance between them?