

6. What will be the steam-pressure in a boiler at blow-off point, the safety-valve being 3 in. diameter, total length of lever 32 in., distance from fulcrum to centre of valve  $3\frac{1}{2}$  in., and weight on lever  $30\frac{5}{8}$  lb.?
7. State conditions you would require to have for the site of a dam to resist a pressure of 50 lb. per square inch with a factor of safety of 3; assume dimensions, and show by sketches the form of dam you prefer; also state kind of material to be used, and show by calculation how conclusion arrived at.
8. State rules for calculating the strength of (a) beams of timber, and (b) ropes and chains, giving sample calculation relating to each.

### QUESTIONS FOR MANAGERS' SECOND-CLASS CERTIFICATES OF COMPETENCY.

SUBJECT 6.—*Arithmetic, and a Knowledge of the Coal-mines Act and Amendments, also First Aid to the Injured.*

1. Having to sink a shaft 1,200 ft. deep by 14 ft. diameter inside of bricking, how much debris (in cubic feet) would be produced, allowing for 18 in. brickwork? And how many bricks would be required to line the shaft throughout?
2. Having a coalfield of 500 acres with seam averaging 10 ft. thick (bituminous quality), state the total contents in tons. If £20,000 is expended in mine-development, how much should the annual profit be to provide for the repayment of the capital together with 10 per cent. interest within ten years?
3. A plan is drawn to a scale of 198 ft. to an inch: what proportion is it to natural size, and how would such a scale be expressed?
4. The hypotenuse of a right-angle triangle measures 765 links and the perpendicular 314 links: what is the length of its base?

#### *First Aid to the Injured.*

1. Have you passed examination and been awarded a certificate from the St. John Ambulance Society?
2. Describe fully any artificial-breathing apparatus of which you have a knowledge, stating the experience you have had with such, and the precaution to be observed when using it.
3. Describe (a) the application of first aid to persons suffering from severe burns, (b) the treatment of those suffering from the inhalation of noxious gases.

#### *Knowledge of the Coal-mines Act and Amendments.*

1. Briefly state the duties of the manager, underviewer, fireman, and deputies under the Coal-mines Act, giving the numbers of such rules as you may consider very important; and state what you consider should be the position of the mine-owners regarding the supply of explosives for use in coal-mines.

#### SUBJECT 4.—*Mine Drainage and Haulage; also Practical Electricity.*

1. What do you consider the most economical and safe means of transmitting power for application in the underground workings of coal-mines? Give your reasons.
2. If required to raise 600 gallons per minute to a height of 600 ft., what power (direct current, 500-volt electric motor) would you install to efficiently do the work, allowing that 60 per cent. efficiency is obtained? And what size cable would be required, the transmission being one mile?
3. What factor of safety would you allow in winding-ropes, and at what rate would you depreciate the factor? Assuming a pair of winding-ropes raising 1,000 tons daily from a depth of 1,000 ft., how long would you consider it safe to continue their use?
4. What are the most prolific causes of accident in coal-mines? State what precautions you would advise the adoption of in order to reduce the number of accidents.
5. Describe the endless-rope systems of haulage—(a) the under-tub and (b) the over-tub system. State what is in your opinion the best working-speed, and where you would install the motive power for working the system underground.
6. Briefly describe the operation of blasting in coal-mines, stating how coal should be prepared for same, and the dangers to be apprehended from blown-out shots.
7. Why is coaldust considered to be explosive under certain conditions? State what those conditions are.

#### *Practical Electricity.*

1. Having to provide electric power for application to (a) pumping (150 b.h.p.), (b) winding (400 b.h.p.), (c) screening (50 b.h.p.), (d) ventilation (100 b.h.p.), (e) workshop and lighting (100 b.h.p.), what would the power of the generating-sets (in kilowatts) require to be?
2. Describe in detail the dangers to be guarded against when introducing electrical machinery into the underground workings of a coal-mine; and where in your opinion its use would be safe, and the contrary.