SECOND DAY.—TIME: 2 P.M. TO 5 P.M.

SUBJECT 7.—*On the Drainage of Mines, and Pumping Appliances.*

1. Describe the most approved kind of pumping-engine for raising water from deep mines.
2. A pit 300ft. deep, and from the bottom of it is a rising drift 600 yards long rising 1 in 12; the pit is full of water up to the surface, but the water has been unable to rise up the drift: what is the air-pressure at the face of the drift?
3. Plunger 12in. diameter, stroke 5ft., 12 strokes per minute, depth 600ft. How many gallons per minute, and what engine-power will be required?
4. Explain the action of the "siphon," and its application in draining underground workings.
5. Describe the management of pumps while sinking.
6. Two feeders of water are met with in a sinking shaft, one near the surface and one at 20 yards above the seam of coal to be worked: what steps would you take in each case?

SUBJECT 8.—*The Haulage of Coal on Underground Planes and Shafts; also, Different Systems of such, and Horse-power required to do the Work.*

1. Describe the action and requirements of the incline plane.
2. Describe fully the different methods of underground haulage—say, first, the "endless-rope"; second, direct haulage; third, the trail-rope: and state under what circumstances each would be most economical?
3. Give a description of the latest appliances for prevention of overwinding that you consider best, with reasons.
4. Give dimensions and description of an engine suitable for drawing 800 tons of coal per day of eight hours from a pit 900ft. deep.
5. What size of steel rope suitable for last question, and weight per fathom?

THIRD DAY.—TIME: 9 A.M. TO 12 NOON.

SUBJECT 9.—*The Theoretical and Effective Power of Steam-engines and Boilers; also on the Strength of Hauling-ropes and -chains.*

1. Find the horse-power of an engine whose mean steam-pressure is 15lb. and vacuum-pressure 2·4lb., the length of stroke 4ft. 6in., the diameter of cylinder 44in., and number of revolutions 31 per minute, allowing 1½lb. for friction.
2. State the respective advantages and disadvantages of the Lancashire and Cornish boilers compared with egg-ended boilers.
3. Iron ropes £2 5s. per hundredweight, steel ropes £3 12s. per hundredweight: which is cheapest for equal strength, and how much?
4. What would be the size of chain for a maximum load of 16 tons?
5. What size hauling-engine would be required to draw 80 tons per hour up an incline 1,200 yards long, gradient 1 in 8, at a speed of 4 miles an hour, the engine to be geared to the drum in the proportion of 4 to 1?

SUBJECT 10.—*The Incrustation in Steam Boilers: Causes of same, and Remedies therefor.*

1. When the water in a boiler is found to be dangerously low, what would you do?
2. How may scale be avoided in boilers? What is the effect of it?
3. What is meant by "priming"? How is it dangerous? What is the cause of it? How may it be cured?
4. What are the advantages of using hot feed-water? How may it be done? What is a feed-water heater?

THIRD DAY.—TIME: 2 P.M. TO 5 P.M.

SUBJECT 11.—*Tapping Water in Mines, and Mode of constructing Dams underground.*

1. A dam 8ft. x 6ft. high, head of water 1,800ft.: what is the total pressure?
2. Sketch and describe a "frame dam," and a brick dam suitable for withstanding 600ft. vertical pressure.
3. What precautions are necessary in approaching old workings containing dangerous accumulations of water? Give three sketches—(1) with no trouble intervening; (2) with a rise trouble; (3) with a dip trouble.

SUBJECT 12.—*Blasting, and the Use of Explosives.*

1. Give a short description of what you consider the safest explosives for fiery mines, and state your opinion when and how shots should be fired.
2. Name any "high explosive" with the use of which you have had experience. Explain how it is used, and what advantages are claimed for it.
3. Give composition and specific gravity of blasting-powder, dynamite, and tonite.

SUBJECT 13.—*The Effect that Faults produce in Coal-seams, and how to ascertain Direction of a Coal-seam when severed by a Fault.*

1. In driving the west levels in a seam of coal dipping to the south at an angle of 1 in 6, an upthrow fault of 45ft. is met with: what would you do to recover the seam?
2. What is the meaning of the term "whindyke"? How may it be formed, and what is the general effect it has upon coal-seams?