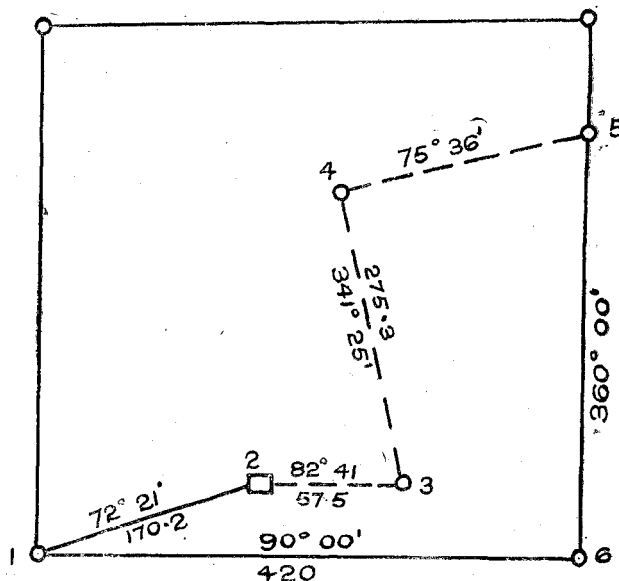


SUBJECT 5.—(a.) *Mine-surveying, Levelling, and Making of Plans.*

1. The accompanying diagram represents a mining claim, the positions of a shaft (2) and points (3 and 4) in the underground workings. Compute the distance which should be driven from 4 to 5 to strike the eastern boundary of the claim; and compute and give the distance 5 to 6. (Note.—The distances are given in links.)



2. The angle of elevation from the bottom of the shaft to station 3, allowing for height of instrument and signal, is $1^{\circ} 15'$; the angle of depression from 3 to 4 is $2^{\circ} 53'$: give the difference of height between the bottom of the shaft and station 4 in feet.
 3. State the difference between a Y and transit theodolite. Which is the better instrument for mining surveying? Give your reasons.
- (b.) *Geology, Prospecting for Coal, Origin and Mode of Formation of Coal-seams, Faulting; also a General Knowledge of the Geology of Stratified Rocks, and more particularly of New Zealand Coal-measures.*
1. A fairly flat area of about 4,000 acres (say, 3 miles by 2 miles), free of forest, is known to be underlain at a moderate depth by a coal-seam of varying thickness. State how you would examine the area by surface work, boring, &c., so as to ascertain the probable amount of coal, the depth of seam, and the best positions for working shafts. Show by diagrams the number and positions of the bores you would drill (a) if the area appeared to be free from faults, and (b) if it was traversed by several faults of unknown throw.
 2. What classes of coal are mined in New Zealand? State principal localities for each class, and give approximate chemical composition of coal in three or more different localities.
 3. Describe briefly the "growth in place" and the "drift" theories of the origin of coal. Explain how vegetable matter may be transformed into bituminous coal and anthracite.
 4. In a New Zealand district the rocks appearing at the surface are limestone and calcareous claystone with fossils of Miocene age; the nearest coal-outcrop is many miles away. Discuss as fully as you can the probability of coal being present. (Reference may be made to any locality that fulfils the conditions of the question.)

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

1. Assume a colliery being worked on the bord-and-pillar method, bords being driven 22 yards, centres 50 yards long by 6 yards wide, inclines 4 yards wide with air-slit in centre of each length of pillar, seam being 8 ft. thick: show by calculation the tonnage obtained from the solid workings, the specific gravity of the coal being 1.25.
2. How many cubic yards of debris would be extracted from a shaft 14 ft. diameter, 75 fathoms deep, and how many gallons of water would such shaft contain?
3. Two men worked eleven days, hewed 150 tons at 1s. 10d. per ton, cut 6 yards at 6s. per yard: what is the total amount earned, and each man's average, and what would the average be if the tonnage rate was increased 8 per cent.?
4. If 2,000 tons large coal cost 9s., and 1,500 tons small coal cost 4s., what would the sales price require to be in order to produce 9 per cent. profit?
5. Suppose a colliery produces 7,500 tons of coal per fortnight, the total cost being 7s. 9d. per ton on wagons at pit-mouth: you are required to apportion the cost to each heading given hereunder, in accordance with what, in your judgment, such costs should be (results to be shown correct to two places of decimals): (a) Coal-hewing, (b) trucking, (c) timbering, (d) haulage, (e) pumping, (f) deputies, (g) underviewer, (h) manager, (i) horse-drivers, (j) incidentals, including stores.