8. A bath can be filled by one pipe in 15 minutes, and in 12 minutes by another. It has also a pipe for emptying it; and when all three pipes are opened together the bath is filled in 20 minutes. If the bath is filled, and the waste-pipe be opened, how long will it take to empty the bath?

9. The first of two clocks gains 2 minutes in 24 hours of true time, and the second loses $1\frac{1}{2}$ minutes in the same interval. If they are both correct at 9 a.m. on Monday, what is the right time when the first is at noon on the following Wednesday? And what is the time by the second clock?

10. A certain 3-per-cent. stock is at $91\frac{1}{2}$, and a 4-per-cent. stock is at 123: one person buys £1,000 stock in each, and another invests £1,000 in each: compare the respective rates of interest obtained by the two persons on their whole investments.

11. A man pays into a building society in the course of a year twelve equal subscriptions, which are due on the first day of each calendar month, and the financial year closes on 31st December. If he desires to make a new arrangement and to pay all the twelve subscriptions in a single payment, find the day of the year on which the payment should be made.

12. Two persons walk round a ring which is a mile in circumference, and their rates of walking are $3\frac{1}{2}$ and $3\frac{1}{3}$ miles an hour respectively. If they both start from the same point and walk round in the same direction, find when and where they will first be together again.

If they had walked in opposite directions, find how far from the starting-point they will be when they pass each other for the first and the second times.

13. If the true weight of a cubic foot of water be 62·35lb. avoirdupois, find the error in calculating the weight of 1,000 cubic feet of water on each of the following approximate assumptions:—

(1) That one cubic inch of water weighs 252·5 grains;
(2) " cubic foot " 1,000oz. avoirdupois;
(3) " cubic fathom " 6 tons.

Arithmetic.—For Class E, and for Junior Civil Service. Time allowed: 3 hours.

(Candidates are expected to attempt at least ten Questions.)

[N.B.—The working must be shown. Simplicity and directness of method, clearness of explanation, and neatness of work, will be taken into account.]

1. By what number must thirty million one hundred thousand and ninety be diminished in order that one-fifth of the remainder multiplied by two hundred thousand may be equal to thirty-six thousand three hundred and sixty-four million? Write the answer in words.

2. A bag contains an equal number of shillings, half-crowns, and fourpences, and the sum of five shillings and threepence in coppers: if the total amount is £3 18s. 1d., how many silver coins of each kind are there in the bag?

3. Find by Practice the cost of 79a. 3r. $38\frac{1}{2}$p. at £6 16s. 8d. per acre.

4. On a certain day Venus crosses the meridian 2 hr. 17 min. $35\frac{1}{2}$ sec. after the sun. Convert this quantity into circular measure, of which 15° are equal to 1 hour of time.

5. Simplify $\dfrac{4+\frac{1}{3}\text{ of }5}{2\frac{3}{2\frac{1}{4}}} \div \dfrac{\frac{1}{4}\text{ of }\frac{2}{3}-\frac{5}{8\frac{1}{1}}}{\frac{3}{4}-\frac{2}{5}+2\frac{1}{2}}$.

6. A man buys oranges at $5\frac{1}{2}$d. per dozen, and sells them at five for 3d.: what is his gain per cent. on the money that he paid for the oranges?

7. Add 1,103·16, 24·257, 7·673, 102·5, 4,352·781, 690·23458, and 98·3852, making your answer correct to six places of decimals. Also, divide ·001 by 1,000.

8. If there are 7,000 grains troy in one pound avoirdupois, express an ounce troy as the decimal of $2\frac{1}{4}$lb. avoirdupois. Also, express 3·15 days as the fraction of $17\frac{1}{2}$ hours.

9. Find the interest on £197 15s. 9d. from 14th January, 1888, to 23rd July of the same year, at $4\frac{1}{2}$ per cent. per annum.

10. What quantity of tea at 1s. $1\frac{1}{2}$d. per pound must a grocer add to 15lb. of tea at 1s. 7d. per pound and 6lb. at 2s. 5d. per pound, in order that he may gain 12s. $5\frac{1}{2}$d. by selling the whole of the mixture at 1s. 8d. per pound?

11. If I buy a horse for £17 7s. 8d., how much must I sell him for so that $12\frac{1}{2}$ per cent. of what I get for him may be profit?

12. A and B can do a piece of work in five days; B and C can do it in six days: how long will it take A, working alone, to complete the job, if B can work twice as fast as C can?

13. Find the true discount on £1,579 12s. $11\frac{1}{4}$d., due in $8\frac{1}{2}$ months, the rate of interest being $6\frac{3}{4}$ per cent. per annum.

Arithmetic.—For Senior Civil Service. Time allowed: 3 hours.

1. The divisor is five hundred and eight thousand and seventy, the quotient is sixty thousand nine hundred and eight, and the remainder is four hundred and eighty thousand four hundred and forty-six: find the dividend, and write it down in words.

2. Calculate the number of revolutions made by a carriage-wheel $4\frac{1}{2}$ft. in diameter in passing over 10 miles, taking the ratio of the diameter to the circumference of a circle as 7 to 22.

3. Find, by Practice, the value of 242a. 3r. 26p. of land at £6 11s. 8d. per acre.

4. Define greatest common measure and least common multiple. Resolve into their prime factors the numbers 5628, 6432, and 8040; and hence find their G.C.M. and L.C.M.

5. Divide the continued product of $\dfrac{5\frac{1}{2}}{\frac{3}{4}\text{ of }2\frac{2}{7}}$, $\dfrac{1\frac{1}{7}}{1\frac{5}{7}-\frac{3}{4}}$, and $\frac{4}{7}(2\frac{1}{2}-1\frac{4}{11})$ by their sum.