

ARITHMETIC.

1. State, and derive the Rule for the so-called Multiplication of Fractions, and simplify :

$$\frac{1}{3} \text{ of } \frac{13}{14} - \frac{1\frac{2}{3}}{13\frac{1}{2}} \text{ of } \frac{19}{20} + \frac{5}{11} \text{ of } \frac{6\frac{5}{12}}{3\frac{3}{4}}$$

2. Bring $\frac{3}{4}$ of £3 12s. 6d. Sterling to that fraction of \$12 Canadian currency which has $4\frac{1}{2}$ for its numerator.

3. Explain the Nature of "Stocks" and "Shares." (1) If 3 per cents are at 89 $\frac{3}{4}$, what should be the price of the 3 $\frac{1}{2}$ per cents? (2) If the latter are at 104, which is the better investment? (3) What income will a man receive who invests \$3,107 in each?

4. Prove that Bank Discount exceeds True Discount by the Simple Interest on the True Discount. Supposing the alloy in a shilling to be $\frac{1}{4}$ of its mass, and the coin to be worth a farthing if it were all alloy, what would be its exact value if it were all pure silver?

5. On a certain day mackerel were being sold at a certain price per dozen; on the next day, as many fish could be bought for 1 shilling as dozens for £1 the day before. The whole price of 20 fish, 10 bought one day and 10 the other, was 2s. 2d. Find the price of a fish on each day.

6. If three men and 4 women could do a piece of work in $11\frac{1}{19}$ days, and 5 men and 3 women could do the same work in $1\frac{1}{4}$ days, and 1 man and 1 woman actually do the work, divide \$40, the price paid for it, equitably between them.

PRACTICAL MATHEMATICS.

1. Define Logarithm, Mantissa, Characteristic. Explain the properties of Common Logarithms.

2. State and demonstrate the theorem for the solution of oblique triangles when two sides and the contained angle are given.

3. The base A B of a triangular field A B C is 1200 links in length, the side A C 1000 links, and B C 800 links. A part containing 1 acre, 2 rods, 16 poles is cut off by a line D E parallel to the base. Require the distance of D and E from the vertex C.

4. Describe in detail Mercator's projection. Explain Leeway, Rhumb Line, Course, Middle Latitude Sailing, and distinguish between variation and deviation of the Compass.

5. What is the area of an isosceles triangle inscribed in a circle whose diameter is 24 ft., the angle included by the equal sides of the triangle being 30°.

6. If a spherical shell, when formed into a solid sphere, be equal in volume to its own cavity, what must be the thickness of the shell?

7. Describe each of the *Mechanical Powers*, and state the law of equilibrium for each.

ALGEBRA.

1. Simplify
$$\sqrt{\frac{\left(x^2 + \frac{1}{x^2}\right) + 2\left(x - \frac{1}{x}\right) - 1}{x^2 + x - 1}}$$

2. Divide $x^4 - y^4$ by $x^2 - y^2$

3. A vintner draws a certain quantity of wine from a full vessel holding 256 gallons; and then, filling the vessel with water, draws off the same quantity of liquor as before, and so on for four draughts, until there were only 81 gallons of pure wine left. How much wine did he draw each time.

4. Solve the simultaneous equations :

$$x^2 + xy = 15$$

$$xy - y^2 = 2$$

5. A sets out for a certain place, and travels 1 mile the first day, 2 the second, 3 the third, and so on. Five days afterwards B sets out and travels 12 miles a day. How long will A travel before he is overtaken by B?

6. The sum of three terms in Geometrical Progression is 63, and the difference of the first and third terms is 45. Find the terms.

GEOMETRY.

1. If two triangles have two sides of the one equal to two sides of the other, each to each, but the angle contained by the two sides of one of them greater than the angle contained by the two sides equal to them of the other; the base of that which has the greater angle must be greater than the base of the other. Prove by a method other than Euclid's.

2. Construct a triangle having given the base, the difference of the angles at the base, and the difference of the remaining sides.

3. To divide a given straight line into two parts, so that the rectangle contained by the whole and one of the parts shall be equal to the square on the other part.

4. If two chords in a circle cut one another, the rectangle contained by the segments of the one of them is equal to the rectangle contained by the segments of the other.

5. To describe a circle which shall touch a given circle and touch a given straight line at a given point.

6. To describe an isosceles triangle, having each of the angles at the base double of the third angle.

7. Trisect a triangle by lines drawn from a point in one of its sides

SCHOOL MANAGEMENT AND TEACHING.

1. State and discuss the purpose of a *recitation*.

2. Distinguish carefully between *Organization* and *Classification*. As to different methods of latter, state your preference, with reasons in full.

3. *School Hygiene*. Explain fully the more important matters included in this expression, and your proposed methods of dealing with them.

4. State your views as to the value of mathematics as a means of mental discipline, and unfold the leading principles you would observe in teaching arithmetic.

5. Write full notes of a model lesson on the *Form of the Earth*.

6. On what incentives would you chiefly rely, (1) for awakening an interest in study, (2) for promoting a sentiment in favor of order.

7. Write short notes defining *education, instruction, method, discipline*.

PHYSIOLOGY.

1. Describe the capillaries. Distinguish between arteries and veins.

2. Explain the mechanism of the respiratory movements.

3. What is the source of bodily heat? How is the latter equalized, and how does evaporation regulate the temperature.

4. Describe the teeth.

5. Write a note on the chief artificial means for the purification of the air "when being rapidly contaminated by foul or poisonous exhalations.

6. State the effects of (1) excess in diet, (2) deficiency of diet.

(Candidates are at liberty, as per Syllabus of Examination, to write on such two of the three subjects given below as they may choose. No credit will be given to papers on all subjects from the same candidate.)

CHEMISTRY.

1. Give the sources, modes of preparation and properties of the chief compounds of *Nitrogen*.

2. Name the various forms and uses of *Carbon*. Give the source and properties of CO₂.

3. Give symbol and atomic weight of Sulphur. What compounds are produced in the burning of a Lucifer match?

4. Explain the term Atomic Equivalence.

5. Name the chief inorganic substances found in the soil. Explain in detail what you mean by a fertile soil.

6. Write a note on "Bones as a Manure," with particular reference to Liebig's process of preparing super-phosphates of Lime.

PHYSICS.

1. Explain Porosity, Density, Mass, Cohesion. State the generally adopted theory of the constitution of matter.

2. Describe the Hydrostatic Press.

3. Give Newton's three laws of motion. Explain and illustrate curvilinear motion.

4. Explain the construction and graduation of a Thermometer. How do you convert Centigrade degrees to Fahrenheit degrees, and vice versa?

5. Define Specific Heat, Thermo-Dynamics, Correlation and Conservation of Energy.

6. Name some of the most useful applications of Electricity, and describe any one of them.

FRENCH.

Translate into English :

Le Maître de Philosophie. La physique est celle qui explique les principes des choses naturelles, et les propriétés des corps; qui dis-court de la nature des éléments, des métaux, des minéraux, des