

The resultant of forces 7, 1, 1, 8 acting from one angle of a regular pentagon towards the other angles taken in order, is $\sqrt{71}$.

5. What is a couple? Prove that if the moments of the forces composing a couple are taken with respect to any point in the plane, the sum is constant both in sign and magnitude.

A weight of given magnitude moves along the circumference of a circle in which are fixed two other weights. Prove that the locus of the centre of gravity of the three weights is a circle.

6. State the laws of friction, and describe some method of verifying them experimentally.

Solve the rider to Quest. 1, assuming the co-efficient of friction between the first mass and the table to be $1/6$, the other conditions remaining the same.

7. State the law of stability of flotation.

What weight of lead or specific gravity 11.4 attached by a fine cord to one end of a uniform rod of length 6 feet, weight $6\frac{1}{2}$ lbs., and specific gravity .64, will cause it to float in water, with its axis vertical?

8. Define the measure of the elasticity of a fluid. Prove that if the elasticity is equal to the pressure, the pressure is inversely proportional to the volume.

There are two barometers, one in perfect order in which the mercury stands at a height of 30 in., the other with an imperfect vacuum of 9 in. above 25 in. of mercury. If it were possible for the force of gravity to become less by a quarter, what would be the effect on these barometers?

PHYSICS.

FIRST CLASS TEACHERS.

Examiner: J. C. GLASHAN.

1. "The very law which moulds a tear,
And bids it trickle from its source,
The law preserves the earth a sphere,
And guides the planets in their course."

What is the force which "moulds a tear," and what the force which "guides the planets?"

Explain how it is that a globule of mercury can float on water.

2. How can the velocity of sound in a gas be experimentally determined? How can it be determined in a short rod?

A cubic foot of air at 32°F , and a pressure of 2116.4 lbs. to the square foot, weighs .080728 lbs., the ratio of increase of elasticity on account of heat of compression is 1.404: find the velocity of sound in air at 42°F ; $g = 32.17$.

3. What is meant by specific heat and what by atomic heat? In exhibiting the conversion of mechanical energy into heat by hammering a metal, what metal would be the best to select for the experiment, and why?

The specific heat of water is four and a fifth times, and its density 778 times that of air. Supposing a cubic mile of water to yield up one degree of its heat, by how many degrees would it suffice to heat 100 cubic miles of air?

4. Describe fully some one experiment by which the mechanical equivalent of heat has actually been ascertained.

If the heat evolved in the burning of one pound of coal is capable of raising 100 lbs. of water from 70°F to 186°F , required the mechanical equivalent of the amount of heat evolved in the burning of one ton of such coal.

5. What is the relation between refrangibility and wave lengths? Describe the structure of an achromatic combination of lenses.

A series of concave lenses, each of focal length 81, are placed with their axes coincident, and such that the interval between the r th and the $(r+1)$ th lenses, is equal to the distance of the focus after the r th refraction from the r th lens. If the original pencil be parallel, prove that the distance of the 5th focus from the 5th lens is 16.

6. Describe briefly the structure and use of the spectroscope. What are the lengths of the A and the H_2 Fraunhofer lines? How are these lengths measured?

Which are the primary colours? How do you explain the colour of a mixture of two fine powders, one blue the other yellow?

7. Describe the Leyden jar. What is meant by the residual charge? Give an explanation of its cause.

A battery of Leyden jars was connected with a spark micrometer, and when a certain charge had been given the battery, a spark passed between the balls at the distance of half an inch.

The balls were afterwards brought to within $\frac{1}{2}$ of an inch and a second spark passed. What part of the entire charge was the residual charge?

8. State Ohm's Law, and explain the terms used.

The resistance of 160 yards of iron wire of diameter .18 was found to be 2.1 Ohms. Compare the conductivity of this wire with that of pure copper.

9. Describe a Daniell's cell, the rheostat, and the tangent galvanometer.

A tangent galvanometer, a rheostat, and a Daniell's cell were joined in circuit, and by adjusting the resistance a deflection of 45° was obtained. On introducing 80 more turns of the rheostat wire the deflection was reduced to 40° . A Grove's cell was then substituted for the Daniell's, and the resistance adjusted till the deflection was 45° . To reduce the deflection to 40° , it was necessary to introduce 50 turns of the rheostat wire. Compare the electromotive forces of the Daniell and Grove cells.

10. What is the most advantageous manner of arranging 24 cells of E. M. F. 20 and resistance 12, to overcome a resistance of 18?

Eight of the above questions will be counted a full paper.

Answers to Correspondents.

To CORRESPONDENTS.—All requests for information, as well as communications intended for insertion in the School Journal, should be accompanied by the name and address of the sender.

Teacher, Collingwood.—The Copy-books you refer to have doubtless formed part of an old stock, as a series, published by a Toronto firm, was at one time "authorized." No series is now authorized. School Boards are at liberty to use the Copy-books which they deem best, and it is gratifying to know that both teachers and parents are taking a much deeper interest in this subject than formerly.

Teacher.—There are three conditions, each of which must be fulfilled before a second-class certificate can be obtained: (1.) Passing the academic or non-professional examination for this grade. (2.) One year's experience in teaching. (3.) Training at the Normal School. The order in which the above conditions must be satisfied is not absolute. A student who has already obtained a certificate of satisfactory attendance at the Normal, is not compelled to return for a second term before obtaining a second-class certificate.

Teacher.—1. If a candidate fails when writing for a second-class certificate will a third-class be granted to him? If so, for how long? Yes, if in the opinion of the Examiners he is entitled to it, and does not already hold one. For three years.

2. Can third-class certificates be renewed in the County where issued? Yes, by the Minister of Education on the recommendation of the County Examining Board.

3. Can a third-class teacher obtain a third-class certificate in another County, after teaching three years in the County where he first obtained his third? No.

4. Every candidate will in future be required to be trained at a County Model School before obtaining a third-class certificate.

Notes and News.

ONTARIO.

J. C. Harstone, B.A., Silver Medallist in Mathematics in the University of Toronto for 1877, has been appointed Mathematical Master in the Port Hope High School.

At the close of the recent session of the Carleton County Model School, the Inspector, Rev. John May, delivered a brief but admirable address to the teachers of the school and the students who had just been examined. After complimenting the former he continued, addressing the passed candidates:—"I regard this experiment as a most gratifying success; and if a similar remark will apply to the other Model Schools of Ontario, the Hon. the Minister of Education has substantial reason to congratulate himself on the gratifying results of this change in the school system. I confess that when the change was first mooted, I had but little faith in its success. I am converted. The value of a school like this is simply incalculable. Here, ladies and gentlemen, you have had daily before your eyes, model teachers—model in every sense, and let me beseech you to imitate their example in every particular. You have seen high discipline as the result, not of harshness, or sternness, or scolding words uttered by grating voices; but of dig-