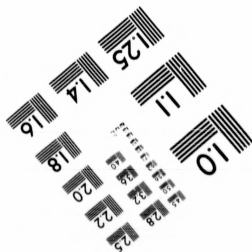
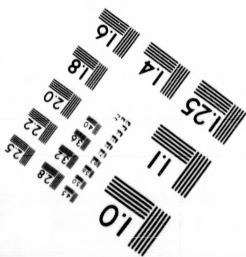
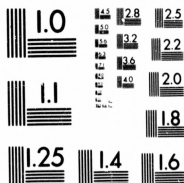


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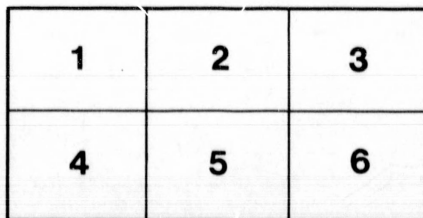
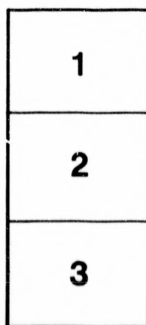
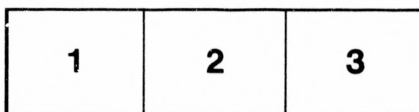
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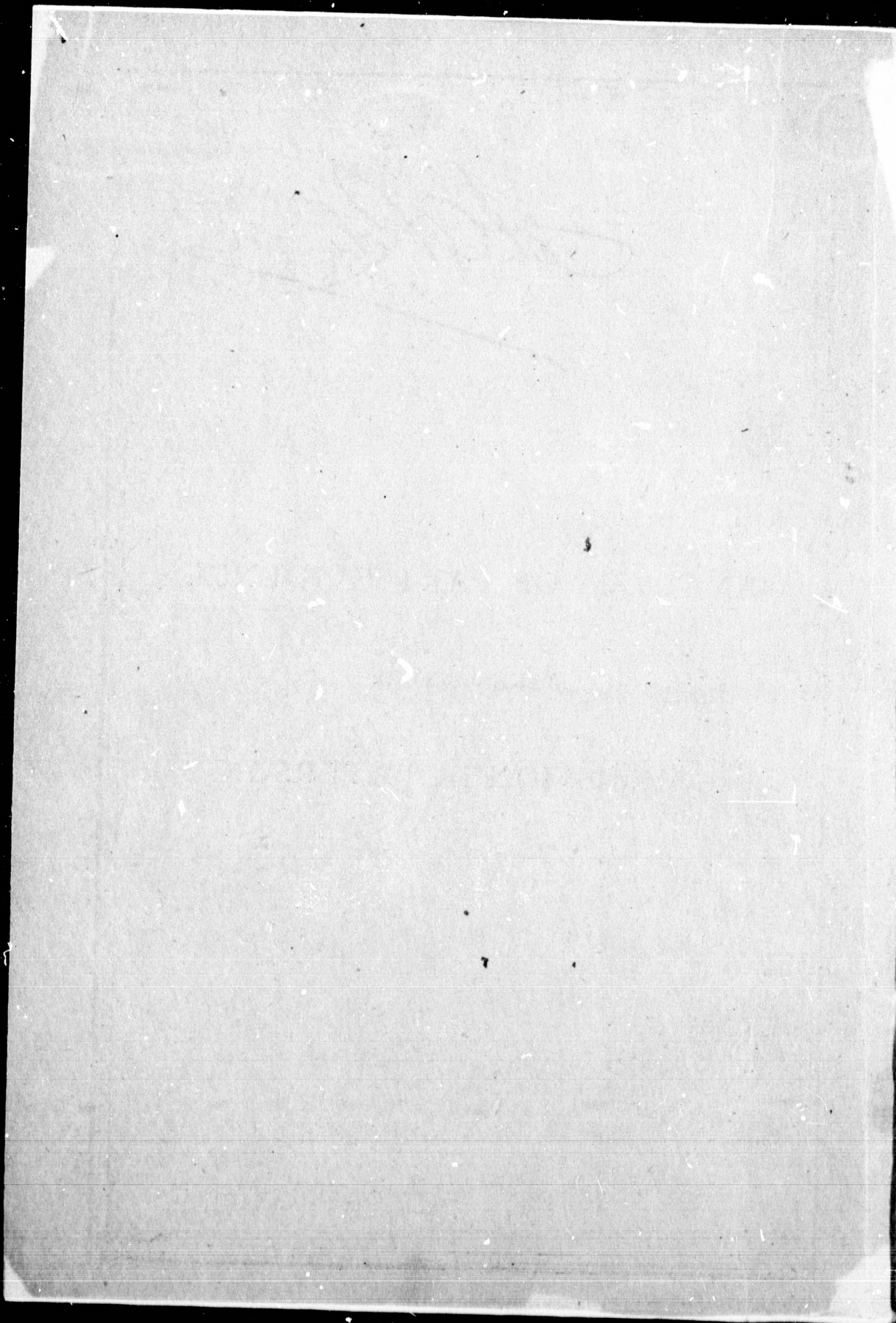
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Wm G. Paterson

ANALYSIS OF PART EVIDENCE,

TAKEN BEFORE

COMMISSIONER PATERSON.



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COMPARISON
OF THE
EXAMINATION QUESTIONS
ON
CHEMISTRY AND PHYSICS,

GIVEN BY DR. McLELLAN, EXAMINER OF PUBLIC SCHOOL TEACHERS,
WITH THE
QUESTIONS GIVEN TO NORMAL SCHOOL STUDENTS BY MR. KIRKLAND A
FEW WEEKS BEFORE THE TIME OF EXAMINATION, IN 1874.

CHEMISTRY.

Dr. McLellan's Examination Paper.
June, 1874.

QUES. 1.—What is ozone? How is it prepared, and what are the physical and chemical differences between it and oxygen?

QUES. 3.—How would you obtain evidence of the presence of ammonia, whether pure or combined, in a given solution?

QUES. 4.—We inhale air and throw off carbonic acid from our lungs: How would you show experimentally that the amount of carbonic acid in a given volume of air which comes from our lungs is far greater than the quantity of carbonic acid which is found in an equal volume of air which we inhale?

Mr. Kirkland's Questions.
June, 1874.

2. What is ozone? How is it obtained, and what are its properties?

5. How is ammonia obtained? Give derivation of name, and express the reaction by an equation. What are its properties? How would you detect the presence of ammonia, (1) pure, (2) in combination with some other substance.

6. How would you detect the presence of a carbonate? What takes place when carbonic acid is passed into lime water to saturation? If a vessel contained a mixture of nitrogen and carbonic acid, how would you proceed to measure the nitrogen and how to weigh the quantity of carbonic acid? If you wanted to determine the volume of carbonic acid, how would you do it?

Dr. McLellan.—(Continued.)

QUES. 5.—Describe the process for the manufacture of sulphuric acid, with an explanation of the reactions. Describe and explain the reaction by which you would identify it.

The value of a ton of Sicilian sulphur, containing 94 per cent. of S, is \$25; that of a ton of iron pyrites, Fe S₂, containing 46.5 per cent. of sulphur, is \$7 10; ascertain which can be most profitably worked in the manufacture of sulphuric acid, having regard merely to the respective sources of sulphur.

QUES. 6.—A specimen of spring water is supposed to contain sulphuretted hydrogen. How would you ascertain whether sulphuretted hydrogen is really present?

QUES. 7.—By what experiment would you prove that common phosphorus and red or amorphous phosphorus are allotropic modifications of the element phosphorus?

QUES. 8.—Describe Marsh's test for arsenic, with its modifications and fallacies.

QUES. 9.—State the composition of the ordinary ores of iron, the chemical principles involved in the reduction, and the composition of cast iron and steel. How would you distinguish iron from copper chemically?

QUES. 10.—How would you treat a silver coin containing a small quantity of gold, in order to extract the latter metal from it?

Mr. Kirkland.—(Continued.)

7. How is sulphuric acid manufactured? Explain the reaction by an equation. What are its properties and uses, and explain fully how you would detect its presence in any form in a solution?

8. How much sulphuric acid could you obtain from a ton of iron pyrites?

3. What are the usual impurities of spring water? How are they detected, and how are they removed?

11. State in general terms how phosphorus is prepared. In what two forms does it occur? Show that these two forms are virtually the same.

9. Describe minutely Marsh's test for arsenic, and state all the precautions necessary in making the experiment.

17. Give the formula for the most characteristic oxides and sulphates of potassium, iron, and copper.

10. You have a mixture of silver and potassium; how would you separate them?

18. How is silver obtained, and state the principles involved?

Dr. McLellan.—(Continued.)

QUES. 11.—100 cubic centimetres of ammonia gas are completely decomposed by a series of electric sparks, yielding 200 centimetres of mixed hydrogen and nitrogen; an excess of oxygen is next added, when the volume of mixed gases is found to amount to 290 centimetres; the mixture is now exploded, when 65 cubic centimetres of gas remain. Show from these data that the symbol of ammonia is NH_3 .

Mr. Kirkland.—(Continued.)

21. 100 cubic centimetres of ammonia are completely decomposed by a series of electric sparks, yielding 200 cubic centimetres of mixed hydrogen and nitrogen; an excess of O is next added, when the volume of mixed gases is found to amount to 290 centimetres. The mixture is now exploded, when 65 cubic centimetres of gas remain. Calculate from the data the composition of NH_3 .

QUES. 1 of examination paper is fully covered by Kirkland's No. 2.

QUES. 3 is more than covered by Kirkland's No. 5.

QUES. 4 is fully covered by Kirkland's No. 6. Ability to ascertain the quantity of carbonic acid, as required in Kirkland's No. 6, would be quite equal to the task of estimating the quantity of carbonic acid, whether coming from the lungs or in a room.

QUES. 5 is fully covered by Kirkland's No. 7. The rider to this question is in no principle of chemistry different from Kirkland's No. 8; it is on the same subject, and differs only in the arithmetic involved, and therefore it is fully covered by Kirkland's No. 8.

QUES. 6 (omitting the word "usual") is fully covered by Kirkland's No. 3. This question is referred to further on.

QUES. 7 is fully covered by Kirkland's No. 11.

QUES. 8 is fully covered by Kirkland's No. 9; and it is worthy of remark that Roscoe's Chemistry, the authorized text-book, makes no mention of Marsh's test.

QUES. 9 is fully covered by Kirkland's No. 17, as far as iron ores are concerned.

QUES. 10, though not the same as Kirkland's No. 18 and No. 10, is on the same subject—silver.

QUES. 11 is identical with Kirkland's No. 21, even to phraseology.

*Questions given by Dr. McLellan,
Examiner, July, 1874.*

QUES. 3.—How may an aqueous solution of ammonia be formed from chloride of ammonia? Describe the process and represent the chemical action.

QUES. 4.—How is carbonic acid made? Give the equations representing the reaction. Describe fully what takes place when a stream of carbonic acid is passed into lime water to saturation; also what occurs when the liquid so produced is boiled. How would you prove that carbonic acid really consists of carbon and oxygen in the proportion stated in the formula?

QUES. 5.—Describe the manufacture of sulphuric acid.

A vitriol maker prepares ten tons of vitriol of specific 1.4, containing 80 per cent. of acid. How many tons of pyrites containing 40 per cent. of sulphur must for this purpose be burnt? Suppose 5 per cent. of the theoretical yield of sulphur remained unburnt in the pyrites, what would be the difference in the production of the sulphuric acid?

QUES. 6.—A few grains of white arsenic are put into an ounce or two of soup. State as fully as you can how you would proceed to detect its presence there?

QUES. 7.—What are the sources of iodine? How is it prepared? Describe the properties of iodine? How would you proceed to detect the presence of a soluble (a) chloride, (b) iodide, (c) fluoride, present singly in a liquid?

*Questions given by Mr. Kirkland,
Teacher, previous to July, 1874.*

5. How is ammonia obtained? Give the derivation of the name and express the reaction. What are its properties? How would you detect the presence of ammonia, (1) pure, (2) in combination with some other substance?

6. How would you detect the presence of a carbonate? What takes place when carbonic acid is passed into lime water to saturation?

7. How is sulphuric acid manufactured? Explain the reaction by an equation. What are its properties and uses? and explain fully how you would detect its presence in any form in a solution.

8. How much sulphuric acid could you obtain from a ton of iron pyrites?

9. Describe minutely Marsh's test for arsenic, and state all the precautions necessary in making the experiment.

14. State generally how iodide may be obtained, and how it may be detected in any compound.

Dr. McLellan.—(Continued.)

QUES. 8.—Classify the common metals according to their equivalency. Give the formula of the characteristic oxide, chloride, and sulphide of each.

QUES. 9.—What is the most important ore of tin, and how is the metal extracted therefrom? How is the presence of tin in a solution detected?

Mr. Kirkland.—(Continued.)

16. Classify the common metals according to their equivalency.

17. Give the formula of the most characteristic oxides and sulphates (sulphides?) of potassium, iron, and copper.

19. How is tin obtained? How would you test the presence of a compound of tin in any solution?

10. Name and give the composition of the workable ores of tin, and the method of obtaining tin from its ores and the principles involved.

QUES. 3 of this examination paper is fully covered by Kirkland's No. 5.

QUES. 4 is partly identical with Kirkland's No. 6, "What takes place when carbonic acid is passed into lime water to saturation?" is an uncommon question, and is not to be found in other examination papers on "Elementary Chemistry."

QUES. 5 is fully covered by Kirkland's No. 7. The rider involves the same principle of chemistry, and differs only in the arithmetic of the problem.

QUES. 6 is fully covered by Kirkland's No. 8.

QUES. 7 is covered by Kirkland's No. 14, so far as iodine is concerned.

QUES. 8 is fully covered by the first part of Kirkland's No. 16; the latter part could be answered by Kirkland's No. 17, if the word sulphide (which, as Professor Croft thought, was probably intended, as the natural sulphates are rare) were used for sulphate.

QUES. 9 is fully covered by Kirkland's No. 19 and No. 10.

PHYSICS.

Examination Paper for Public School Teachers throughout the Province, July, 1874: Dr. McLellan Examiner.

Questions given to Normal School Students by Mr. Kirkland a few weeks before the regular Examination.

QUES. 1.—How would you cool a mixture in the absence of ice or snow? Give the theory of the process.

6. How would you cool a mixture without either ice or snow? Explain clearly the principle involved.

QUES. 2.—Describe the relation of the heat *spectrum* to the light *spectrum*?

7. Compare the heat *spectrum* and the light *spectrum*.

QUES. 3.—What is the “thermal unit” generally adopted?

3. How is heat measured? What is the thermal unit usually adopted? What do you mean by the mechanical equivalent of heat.

A pound of mercury, at a temperature 102° C., is immersed in a pound of water at 40° C.; how many degrees will the temperature of the water be raised, taking the specific heat of mercury at $.03^{\circ}$?

4. What do you mean by specific heat? A pound of mercury at 100° is immersed in a pound of water at 40° . How many degrees will the temperature of water be raised, the s. heat of mercury being $1/30$ th?

QUES. 6.—Explain by a diagram the compound microscope.

10. Describe the common microscope.

QUES. 7.—Describe an experiment to illustrate electrical induction. What is the phenomenon known as the “return shock?” Explain it.

18. What is meant by electrical induction?

19. What is meant in treatises on electricity by the return shock.

QUES. 8.—If the point of a fine needle in metallic connection with the prime conductor of an electrical machine in action, be brought near a candle, the light will probably be extinguished. Explain clearly the cause of this.

21. If a point is brought near the prime conductor of an electric machine, what effect is produced?

22. If a lighted candle be brought near the point, what is the effect and what is its cause?

QUES. 9.—Describe in general terms a magneto-electric machine.

26. Describe the magneto-electric machine, and the principle on which it acts.

QUES. 1 of examination paper is fully covered by Kirkland's No. 1.

QUES. 2 is fully covered by Kirkland's No. 7.

QUES. 3 is fully covered by Kirkland's No. 3 (first part). The rider to this question is fully covered by Kirkland's No. 4, even to the principles of arithmetic involved.

QUES. 6 is fully covered by Kirkland's No. 10. The compound microscope is the one most commonly used, and is therefore the *common* microscope. When a distinction is observed between the two kinds of microscopes, they are known as the *simple* or *single*, and the *compound*. Moreover, a question on the microscope is no *type* or *test* question in Optics. Balfour Stewart in his *Physics*, a book of 360 pages, devotes 74 pages to Optics, and has less than *one-third* of a page on the microscope. Parkinson's *Optics*, a book of 300 pages, the University text-book, contains only 3 pages on the microscope and 28 pages on the telescope.

QUES. 7 is fully covered by Kirkland's Nos. 18 and 19.

QUES. 8 is fully covered by Kirkland's Nos. 21 and 22.

QUES. 9 is fully covered by Kirkland's No. 26.

Mr. Kirkland's questions were given in two papers; the first chiefly on heat, the second chiefly on *light* and *electricity*. It is evident that he intended the two papers to cover the whole limit prescribed for first class certificates ("a good general acquaintance with the subjects of *heat, light* and *electricity*"); and therefore, for convenience in referring to them, they are numbered from 1 to 27 in the comparisons given above. It is worthy of remark that Prof. Croft, in his evidence before the commissioner, besides recognizing the remarkable similarity between Kirkland's questions and the examination papers, stated in very positive terms that *such a similarity could not occur in the ordinary course of teaching*.

A technical knowledge of the sciences involved is not necessary to be struck with the following points in the preceding comparison:—

- 1st. The striking similarity of phraseology throughout between the examination papers and Kirkland's questions.
- 2nd. The comprehensiveness of Kirkland's questions, as compared with those on the same subject on the examination papers.
- 3rd. The order of the questions on the two papers. Here we have Kirkland giving questions 3 and 4, 6 and 7, 18 and 19, 21 and 22, corresponding to consecutive numbers on the examination paper; and the last question on the examination paper is the same as the last but one given by Kirkland. Now the order of subjects on McLellan's paper is not the order in which the subjects come in any school or college text-book in use; but, singularly enough, it is nearly the order of subjects on Kirkland's papers.

- 4th. There were 9 questions on the examination paper; and Mr. Kirkland was able, a few weeks before the time of examination, to write out for his students no fewer than 7 of the very questions of the examination paper.

There is nothing in question 1 (of the Physic paper) about cooling a mixture that would suggest question 2 on the *spectrum*; yet it seems to have occurred to both McLellan and Kirkland that it would be the proper order of subjects. Again, one of these gentlemen thinks that the question on the "thermal unit" should be followed by a long problem on heat, involving fractions; and, strange to say, the other thinks precisely the same. One of them asks a question on "electrical induction;" the other asks the same question, and the one thinks that this question should be followed by a question on the "return shock," (a term not used in the authorized text-book on Physics, and one considered by Prof. Croft as uncommon); and the other, without any collusion, and by the merest coincidence of course, thinks the same. The one states in *his* question what will take place when "the point of a fine needle in metallic connection with the prime conductor of an electric machine is brought near a lighted candle;" and the other, with marvellous exactness, asks for this information in *his* question. The one considers that *his* paper should end with a question on the magno-electric machine; and the other concludes his paper with a question on the very same subject. And yet we are gravely told by these men that this is the result of the merest coincidence.

No attempt has been made by Dr. McLellan, Mr. Kirkland, or indeed by any one, to question the statement made by Brown that he obtained the 21 questions in Chemistry and the 27 questions in Physics from Mr. Kirkland: they dare not do this, as others received the same questions. Their defence and explanation of the remarkable similarity between the questions submitted by Kirkland to his students towards the end of the session, and the examination paper prepared by McLellan, the examiner for teachers' certificates, are:

- 1st. That the subjects are so elementary in their character, and so limited in their scope, that it is impossible to prepare a variety of questions on the prescribed limit; and that Kirkland's questions, as shown in Brown's note-book, are type questions in Elementary Physics and Chemistry.
- 2nd. The questions found to resemble each other are from a common source, viz.: Four different works on Chemistry, and the examination papers of three different Universities.

Now first, as to the Chemistry: is the subject so limited that it is possible to foretell at any time, and to prepare within the compass of 21 questions, over two-thirds of the questions of *two* examination papers? The work prescribed for first-class teachers in Chemistry is thus given in the regulations affecting the examinations:

"*Chemistry*.—As for second-class teachers; and to be familiar with the definitions, nomenclature, laws of chemical combinations, and to possess a good general knowledge of the chemistry of the metals and the metalloids."—[Text-book, Roscoe's Chemistry.]

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Now, it is submitted that this is not such a limited course as these men would have the uninitiated to believe; that it is, in fact, the work prescribed for the *first year* in Toronto University, and that there is scarcely a limit to the number of questions that might be set on the subject; and judging from the kind of questions set by both Kirkland and McLellan, it is, on the whole, not elementary in its character. For example, "*Marsh's test*" is not a subject of investigation in Elementary Chemistry, and is not found in Roscoe; it is an experiment requiring the utmost skill, and should not be attempted by beginners at all; exception might be taken to *iodine* and *bromine*, on the ground that they are not *common* subjects of investigation. Questions on these subjects occur frequently in examination papers set for graduates in medicine, but they are not met with in the papers set for the first year at the University. Sulphuretted hydrogen as an impurity of water is found chiefly in regions where iron pyrites are decomposing; it is a common impurity of many spring waters throughout the whole of the geological formation from Niagara Falls to Manitoulin Island. If it is not a common impurity, why does Dr. McLellan ask out of the way questions?

In point of difficulty, the questions constituting the examination papers are, on the whole, above the average questions set on the limit prescribed; and it is simply impossible to compress within the compass of the notes taken by some of the Normal School students, the substance of such a wide range of study as the examination questions indicate. Supposing we accept Mr. Kirkland's statements that his questions, as shown in Brown's note-book, are common questions, how did he know that these few *common* questions were the ones likely to cover the examination papers? Does he claim superhuman prescience?

In view of the fact that these men characterized the work required for first-class certificates as very elementary, we may well ask why there are no questions on the *structure of flame, combustion, composition of the atmosphere* and the economy of its constituent gases, the composition of *water* and the methods of analysing it? Whoever saw a paper on Elementary Chemistry that had not some allusion to *carbon* and its modifications; or to the elements *hydrogen, nitrogen, oxygen, and chlorine*; or to *sulphur* and its modifications? Surely a question on combining proportions by weight and by volume, symbols and nomenclature, might be looked for on a paper on *Elementary Chemistry*. We find no question in Dr. McLellan's paper for 1874 bearing even indirectly on any one of the important features of Elementary Chemistry mentioned above. How did Mr. Kirkland know to omit these same subjects in preparing *his* list of 21 questions? How did he and Dr. McLellan come to overlook in their papers (prepared independently, of course) *silicon*, next to oxygen the most abundant element known? Why did they not include in their papers a question on *lead, gold, silver, mercury, copper, zinc*, as well as one on tin? What points in Elementary Chemistry do these men consider important if not these? Why do they each give a question on sulphuric acid and not one on hydrochloric? How is it that wherever the one goes for the subjects of his questions, the other happens to go there too?

If Kirkland's questions are common ones, and are prepared with the view of covering any and all fair examination papers on this limit, then we should find them on good examination papers prepared by other examiners. Now, what are the facts? In 33 examination papers on the same range of subjects, set for students of the *first year* in Toronto University, we find no fewer than 32 examination papers in which not a single one of Kirkland's questions occurs. There are—

2 papers in which part of one question occurs ;

8 papers in which one question occurs ;

1 paper in which two questions occur ;

and not a single paper in which more than two occur. It may be added that 15 of the 21 questions are not found on any of these examination papers. The absence of these type questions is very conspicuous on the examination papers of other Universities. In 100 consecutive questions from the London University Examination Papers, about 4 questions of Mr. Kirkland's 21 occur ; one per cent. are found on the Edinburgh University Papers ; less than one per cent. are found on McGill University Papers ; but no fewer than 75 per cent. of Kirkland's questions are found on Dr. McLellan's paper. To say that one can foretell 7-9ths the questions that another is going to ask, even on the most limited subject, is to tax to the utmost the credulity of the most credulous.

The second defence set up by these men is, that the questions having a resemblance are from a common source.

What are the sources ?

1 question is found in the London University Examination Papers ;

1 question is found in the Edinburgh University Examination Papers ;

1 question is found in the Toronto University Examination Papers ;

4 questions are found in Barff's Chemistry ;

1 question is found in Wilson's Chemistry ;

1 question is found in Thorpe's Collection ;

8 of the 21 questions are found verbatim in other books ; 3 are found on the same subject in other places ; and the resemblance between the others is attempted to be explained away by the fact that they are very common questions. The discovery of the sources of all these questions, and the statement made by Mr. Kirkland that they were actually obtained from these sources, increases the difficulty immeasurably. How is it possible that two men could go to all these different sources and select the same questions, and put them in very nearly the same order ? These two worthy gentlemen, as they would have us believe, took Barff's Chemistry, containing upwards of 450 questions, and selected, independently of course, the same 4 questions. Then they took Wilson's Chemistry, containing 464 questions, and, without any prearrangement whatever, selected, accidentally of course, the same one question. Then they turned to Thorpe's Collection, containing 220 questions, and again singled out the same question. Then they went to the Edinburgh University Examination Papers, comprising many volumes ; and each, quite independently of course, fixed upon the same volume, turned to the same page, selected the same examination paper, and took therefrom the same question. They next bethought themselves of the Toronto University Examination Papers ; they independently singled out the 15th volume ; and without the knowledge of each other's intentions, and of course accidentally, selected the same examination paper, and again each took the same *one* question therefrom. Nor is this all. These reliable, trustworthy, and original gentlemen next thought of the London University Examination Papers. Now, there must be between 30 and 40 volumes of these papers : again they chanced to fix upon the same volume, and, by the merest coincidence, turned to the same page, selected the same examination paper, and singled out the very same question. But even yet the desired list of *type* questions was incomplete ; there were no more works on chemistry contain-

ing typical questions, possibly no more examination papers in the University Library; and so these men were forced finally to resort each to his own inner consciousness; and as a happy result of their having been boon companions and college chums, and having been subjected to the same course of mental discipline, each of himself is enabled to evolve by independent mental processes no fewer than 8 questions; and so charmingly harmonious were these two mental machines in their working, that they gave forth the same questions in nearly the same order.

This line of argument was put forward in all seriousness as a proper defence, and accepted by the defenders of these men as perfectly satisfactory; if we were to meet with it in an ordinary novel, we would ridicule it as a caricature.

In addition to all this, Mr. Kirkland claims that he is able to foretell the questions of other examiners to even a greater degree than that shown above. He offered on the 5th day of the investigation before the commissioner, to prove that a greater similarity existed between his questions and the examination papers in 1877, than in any of the instances adduced; that is to say, Mr. Kirkland was prepared to show that he was able to guess more than 7 out of 9 questions of examination papers last July. It was shown, by the investigation into the examination frauds then perpetrated, that there were others who could do the same thing too.

Nor are we to take Mr. Kirkland's uncorroborated statement that he is able to foretell from 60 to 90 per cent. of the very questions another is going to ask. One of his own witnesses, who was brought all the way from Ottawa, and whose evidence was held as perfectly satisfactory—notwithstanding the fact that she wrote a letter a few days after appearing before the commissioner, in which she made statements completely contradicting her sworn testimony—stated that Mr. Kirkland, shortly before the close of the session in the summer of 1872, gave to the students of the Normal School a list of *14 questions that was found to cover the ground taken up by the examination paper*; and what makes it a hundred times more suspicious, she states that Mr. Kirkland said that *if they wrote out the answers to these questions, they would be able to answer the greater part of the examination paper*.

It is worthy of observation that the July examination paper more closely resembled Mr. Kirkland's list of questions than the June paper. A reason for this is not far to seek. The papers in June were set only for Normal School students, and were answered at the Normal School; the competition was only among Mr. Kirkland's own students; whereas the July papers were submitted to candidates from all parts of the Province, and the examinations took place simultaneously in the different counties, under the supervision of the Public School Inspectors and the County Board of Examiners. Normal School students competing at these examinations, coached by the miraculous foreknowledge of the science master of that institution, would be enabled to pass their examinations so creditably as to lead the examiners to inquire at what institution they had been so exceedingly well trained. Mr. Kirkland best knows whether this would tend and has tended to enhance his professional reputation and income or not. We shall leave the further criticism of the evidence until another time, only asking the reader to carefully compare the examination papers and Mr. Kirkland's questions, and form his own opinion as to the fairness of the statement, "that it would be difficult to vindicate the honesty with which the questions were selected for collating, except at the expense of the competency of the critic who undertook the task."

