# The Relative Value of Teaching Eighth Grade General Science Daily, As Compared with Teaching the Same Subject on Alternate Days for an Equivalent Number of Days.

by

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# CHAPTER I

## The Problem

This study proposes to show the relative value of teaching eighth grade General Science daily, as compared with teaching the same subject on alternate days for an equivalent number of days.

Alternation of classes is a widespread practice in Junior High School administration. It is common custom to alternate General Science with Physical Education as in Parsons, Kansas; Literature with Physical Education as in Fort Scott, Kansas; Penmanship with Music, as in Chanute, Kansas. If the daily recitation is conducive to greater gains than the alternate-day method, the problem then becomes of interest to the administrator whose duty it is to arrange class schedules for greatest efficiency.

The specific question in this study: "Will daily instruction in eighth grade General Science show greater gain than instruction on alternate days for an equivalent number of days?" involves the possibility of one of three answers. The daily recitation method, as measured by objective tests, will show greater gain, less gain, or an equal gain. This problem proposes to determine the answer to that question.

There is little contributory literature in the field on this study. H. Ebbinghaus worked with nonsense syllables, determining that greater efficiency was given when the same amount of time was distributed over three days than when concentrated in one. A. Jost verified this superiority. He found that when the material to be learned is of large mass the most extensive distribution is the most advantageous, both as to rapidity of learning and permanence of retention. The above mentioned investigations are typical of what has been done to date. Certain characteristics of learning curves have been determined for various spreads of time, but they are concerned with learning of skills such as ball tossing, typewriting, mirror tracing and the like. No literature is available on studies of progress of learning the school subjects.

## CHAPTER II

## The Method

The Equivalent Groups method was employed in this problem. On the basis of IQs determined the previous semester, the pupils were roughly divided into two groups as they enrolled the following Fall semester. Pupils new to the system were allocated to divisions on the basis of their chronological age. The daily group, hereafter referred to as $EF_1$ recited in the morning; one section at eight-five, and the other section at nine-ten. The alternate-day group, hereafter referred to as $EF_2$, recited in the afternoon; one section alternating with the other during the period beginning at three-ten. Class periods were fifty minutes, not, in every case.

After the school enrollment had become stable, each group was equated on the basis of Terman IQ, as shown in tables I and II. Late enrollments were allocated to the groups in even distribution in order to preserve as nearly as possible an equilibrium between the two groups. These late enrollments were not considered in this experiment. With the termination of $EF_1$ experiment at the end of the first semester,

all new enrollments were scheduled for work other than General Science. The original control groups had fifty-four pupils each. At the conclusion of the experiment $EF_1$ dropped in enrollment to forty-five, and $EF_2$ to forty-two.

Following the equating of the groups, two initial tests were given each group: The Ruch-Popenoe General Science Test, form A, and The Dvorak General Science Scale, form T-2.

The IT for $EF_2$ was given ten recitation periods later than for $EF_1$ to compensate for the difference covered in text book material.

The experiment continued for seventy-two recitation periods for $EF_1$, and seventy-one recitation periods for $EF_2$.

The same teacher taught both groups, using the same method of instruction. The interest in the subject appeared approximately equal in the two groups.

All tests were given by the author of this study. No one had access to the material before or after the tests.

The teacher in charge of the groups was informed that his classes were subject to experimentation but was not informed as to the results until the experiment was completed.

At the end of seventy-two recitation periods, $EF_1$ was given FT with Ruch-Popenoe Test form B, and Dvorak Scale form S-2. The $EF_1$ showed such little gain that a multiple choice, objective test, containing ninety items was made up by the author of this study, using the text book as a basis. This test referred to in the tabulations as the "Rule" test showed a self correlation coefficient of .64, $PE_r$ .059, when the odd items were correlated with the even items. Sixty-five days after the $EF_1$ work terminated another test, "Powers Test in General Science" was given, the number in $EF_1$ at the time being 45. This test has not been standardized.

Following seventy-one recitations $EF_2$ was given the same FT in the same sequence together with the Rule test and Powers test.

Summary

Groups equated on basis of Terman IQ.

Disturbing elements equated.

Same teacher and teaching methods for both groups.

Experimental period equal within one day.

Objective tests for IT and FT.

## Chapter III

## Data

Table

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Tables III, IV, V and VI represent the result of the equating of the two groups.

Table V, showing the comparison of the IQ of the two groups should be read: the mean IQ of $EF_1$ is 98.9, the mean IQ of $EF_2$ is 99.40, and so on.

The difference in IQ was the basis for equating the two groups. As indicated, there is .5 of a point difference in the mean IQ of the two groups. $EF_1$ shows 2.07 points difference in their SD which would indicate that the two groups agree within the limits of two pupils for their middle 68.28% of cases. This difference is based on the fact that there were 45 in the $EF_1$. To equate the groups more closely than that offers practical difficulties in the administration of a medium sized school where cases are limited in number.

The two groups were within 2.36 months in chronological age. There is a difference of 6.44 months in their MA as based on the Terman test.

Tables 14 to 17 inclusive indicate the differences in mean scores for both groups in all tests. The Ruch-Popenoe, Rule, and Powers tests indicate a small difference in favor of $EF_1$. Because no IT could be given for the Rule and Powers test, no SDD can be shown. The Dvorak test indicates a slight gain for $EF_2$.

A consideration of the SDD in table XIV, Ruch-Popenoe Test, shows a SDD of 1.18 and an EC of .55. This EC would indicate that the chances are approximately 4.8 to 1 that the $EF_1$ is superior; a ratio which does not admit of any certainty in appreciable amount.

A consideration of SDD in table XV, Dvorak test, shows a SDD of .96 and an EC of .48. This EC would indicate that the chances are approximately 10.9 to 1 that the $EF_2$ is superior. This ratio too, indicates uncertainty.

The Ruch-Popenoe test indicates positive results for $EF_1$, while the Dvorak test indicates positive results for $EF_2$. Neither result indicates strong probability that one method is better than the other. In that, they are consistent.

A study of the D for the Rule and Powers test reveals slight positive differences for $EF_1$. These two tests point to an agreement that neither EF is superior.

Tables XXVI to XXIX inclusive show the relationship between the MA and test scores. There is positive correlation between all test scores and MA. Of the four tests, the Rule test and Powers test show the highest correlation. The same holds true for IQ. There is indicated no correlation between CA and the test scores. This may be due to the fact that there is a tendency for the age of the pupils to be

constant, while their scores are variable.

Tables XXXII to XXXIV inclusive show the relationship between the scores of one test with that of the others. The highest correlation is indicated between the Rule and Powers tests, while the lowest is between that of the Huch-Popenoe and the Dvorak.

Table XXXVII is included to show occupational distribution, and through that, whatever it indicates, the environmental factors. A real attempt was made to distribute the children according to what was known of their home surroundings. This distribution was made on the basis of one year's acquaintance with the children and is not submitted for any purpose other than that of speculation. The data concerning occupations were secured after the experiment was well under way.

The "EC" or experimental coefficient referred to is computed from the formula $\frac{D}{2.78SDD}$, by means of which William A. McCall states probability in terms of chances.

The correlations made in this study employed the Pearson r., product moment formula.

Table I
DAILY GROUP -$EF_1$
Terman Group Test of Mental Ability
Form B

| | MA | CA | IQ |
|---|---|---|---|
| BJ | 214 | 155 | 138 |
| PJI | 175 | 151 | 135 |
| CT | 177 | 150 | 118 |
| AJ | 181 | 154 | 117 |
| MJ | 186 | 159 | 117 |
| SM | 192 | 165 | 116 |
| WE | 172 | 149 | 115 |
| CL | 169 | 146 | 115 |
| HA | 161 | 146 | 110 |
| BM | 169 | 155 | 109 |
| BK | 167 | 154 | 108 |
| HM | 167 | 158 | 105 |
| WC | 177 | 172 | 103 |
| CB | 167 | 160 | 103 |
| CS | 164 | 159 | 103 |
| NL | 161 | 156 | 103 |
| BkM | 161 | 156 | 103 |
| RM | 164 | 163 | 100 |
| RJ | 161 | 160 | 100 |
| LL | 155 | 154 | 100 |
| BW | 161 | 162 | 99 |
| WB | 161 | 169 | 95 |
| TG | 155 | 162 | 95 |
| CR | 153 | 161 | 95 |
| OC | 147 | 157 | 93 |
| BJ | 164 | 177 | 92 |
| TO | 153 | 166 | 92 |
| HP | 150 | 162 | 92 |
| PZ | 147 | 159 | 92 |
| SN | 165 | 170 | 91 |
| SK | 144 | 157 | 91 |
| RK | 164 | 181 | 90 |
| OI | 150 | 166 | 90 |
| McG | 155 | 176 | 88 |
| HW | 144 | 163 | 88 |
| BrJ | 155 | 179 | 86 |
| WM | 155 | 182 | 85 |
| PC | 141 | 166 | 85 |
| NeL | 155 | 183 | 84 |
| WOJ | 144 | 170 | 84 |
| DE | 144 | 171 | 84 |
| IM | 136 | 165 | 83 |
| JM | 138 | 171 | 80 |
| PL | 133 | 169 | 78 |
| SE | 141 | 189 | 74 |
| N..45 M | 165.48 | 163.5 | 98.9 |
| SD dist | 15.30 | 11.55 | 13.92 |
| SDM | 2.28 | 1.72 | 2.07 |

Table II
ALTERNATE GROUP - $EF_2$
Terman Group Test of Mental Ability
Form B

| | MA | CA | IQ |
|---|---|---|---|
| LV | 195 | 151 | 129 |
| BK | 169 | 141 | 120 |
| RT | 189 | 160 | 118 |
| RC | 169 | 149 | 113 |
| DeJ | 167 | 147 | 113 |
| SH | 178 | 159 | 112 |
| MV | 172 | 156 | 110 |
| HG | 175 | 161 | 108 |
| CL | 169 | 156 | 108 |
| PE | 172 | 160 | 107 |
| DE | 167 | 156 | 107 |
| DN | 164 | 154 | 106 |
| WR | 155 | 146 | 106 |
| DD | 167 | 159 | 105 |
| HH | 167 | 160 | 104 |
| BE | 169 | 163 | 103 |
| BL | 167 | 161 | 103 |
| AE | 155 | 153 | 101 |
| SJ | 164 | 163 | 100 |
| FW | 153 | 153 | 100 |
| BJ | 153 | 152 | 100 |
| FV | 158 | 159 | 99 |
| WD | 155 | 156 | 99 |
| GJ | 150 | 152 | 98 |
| BV | 161 | 165 | 97 |
| MM | 155 | 159 | 97 |
| YS | 150 | 158 | 95 |
| RR | 150 | 158 | 95 |
| AC | 150 | 159 | 94 |
| HC | 144 | 154 | 93 |
| BV | 161 | 176 | 91 |
| GJ | 153 | 169 | 90 |
| TG | 150 | 166 | 90 |
| SA | 141 | 158 | 89 |
| RT | 147 | 167 | 88 |
| OA | 144 | 163 | 88 |
| WK | 144 | 167 | 85 |
| DH | 147 | 175 | 84 |
| HE | 150 | 188 | 80 |
| BL | 138 | 174 | 79 |
| SC | 138 | 179 | 77 |
| MF | 138 | 189 | 74 |
| N...42 | | | |
| M | 159.04 | 161.14 | 99.40 |
| SD dist. | 13.05 | 9.54 | 11.85 |
| SDM | .20 | 1.47 | 1.82 |

Table III

SUMMARY
MA based on Terman Group Test of
Mental Ability, expressed in months.

| | M | SD | SDM |
|---|---|---|---|
| $EF_1$ | 165.48 | 15.30 | 2.28 |
| $EF_2$ | 159.04 | 13.05 | .20 |
| D | 6.44 | 2.25 | 2.08 |

Table IV

SUMMARY
Chronological age, expressed in months.

| | M | SD | SDM |
|---|---|---|---|
| $EF_1$ | 163.5 | 11.55 | 1.72 |
| $EF_2$ | 161.14 | 9.54 | 1.47 |
| D | 2.36 | 2.01 | .25 |

Table V

SUMMARY
IQ based on Terman Group Test of
Mental Ability

| | M | SD | SDM |
|---|---|---|---|
| $EF_1$ | 98.9 | 13.92 | 2.07 |
| $EF_2$ | 99.40 | 11.85 | 1.82 |
| D | -.50 | 2.07 | .25 |

Table VI
DAILY GROUP -EF$_1$
Ruch-Popenoe General Science Test
IT Form A. FT Form B

| Pupil | IT | FT | C |
|---|---|---|---|
| PJI | 29.0 | 38.0 | 9.0 |
| AJ | 28.0 | 21.5 | -6.5 |
| WC | 25.0 | 26.5 | 1.5 |
| CT | 25.0 | 39.0 | 14.0 |
| MJ | 24.5 | 40.0 | 15.5 |
| BJ | 23.5 | 34.0 | 10.5 |
| SM | 21.5 | 26.5 | 5.0 |
| BJ | 20.5 | 17.5 | -3.0 |
| TO | 19.5 | 19.0 | -0.5 |
| NL | 19.5 | 31.5 | 12.0 |
| RK | 19.0 | 33.5 | 14.5 |
| BJ | 19.0 | 38.0 | 19.0 |
| HP | 18.5 | 16.5 | -2.0 |
| WE | 18.5 | 16.5 | -2.0 |
| WM | 18.5 | 15.0 | -3.5 |
| PC | 18.0 | 20.5 | 2.5 |
| NL | 17.5 | 22.5 | 5.0 |
| HA | 16.5 | 13.5 | -3.0 |
| DE | 16.0 | 18.0 | 2.0 |
| HM | 16.0 | 22.0 | 6.0 |
| HW | 15.5 | 16.5 | 1.0 |
| RJ | 15.5 | 20.5 | 5.0 |
| TG | 15.5 | 16.0 | 0.5 |
| SN | 14.5 | 19.0 | 4.5 |
| McG | 14.5 | 26.0 | 11.5 |
| WB | 14.5 | 18.0 | 3.5 |
| BW | 14.5 | 15.5 | 1.0 |
| CS | 14.5 | 24.0 | 9.5 |
| OI | 14.0 | 20.0 | 6.0 |
| BM | 14.0 | 18.5 | 4.5 |
| RM | 13.5 | 12.5 | -1.0 |
| BM | 13.0 | 19.5 | 6.5 |
| BK | 13.0 | 20.0 | 7.0 |
| JL | 13.0 | 11.5 | -1.5 |
| PZ | 13.0 | 15.0 | 2.0 |
| CR | 12.5 | 18.5 | 6.0 |
| CL | 12.0 | 12.5 | 0.5 |
| JM | 12.0 | 19.5 | 7.5 |
| IM | 11.5 | 10.5 | -1.0 |
| PL | 10.5 | 15.0 | 4.5 |
| CB | 10.0 | 22.0 | 12.0 |
| SK | 9.5 | 21.5 | 12.0 |
| SE | 9.0 | 3.0 | -6.0 |
| OW | 7.0 | 12.5 | 5.5 |
| WOJ | 4.5 | 20.0 | 15.5 |
| N...45 | | | |
| M | 16.33 | 21.23 | 4.91 |
| SD list. | 5.18 | 8.01 | 6.12 |
| SDM | .77 | 1.19 | .91 |

Table VII
ALTERNATE GROUP--$EF_2$
Ruch-Popenoe General Science Test
IT Form A. FT Form B

| Pupil | IT | FT | C |
|---|---|---|---|
| YS | 24.0 | 30.5 | 6.5 |
| DH | 24.0 | 26.0 | 2.0 |
| LV | 23.5 | 35.0 | 11.5 |
| PE | 22.5 | 22.0 | -0.5 |
| DE | 22.0 | 16.5 | -5.5 |
| BV | 21.5 | 25.5 | 4.0 |
| FV | 21.0 | 14.0 | -7.0 |
| BK | 20.5 | 25.5 | 5.0 |
| RT | 20.0 | 27.5 | 7.5 |
| HG | 19.5 | 23.5 | 4.0 |
| DH | 19.5 | 21.0 | 1.5 |
| GJ | 19.0 | 20.0 | 1.0 |
| OA | 18.5 | 20.5 | 2.0 |
| BV | 18.5 | 20.0 | 1.5 |
| WR | 18.0 | 17.5 | -0.5 |
| RT | 18.0 | 8.5 | -9.5 |
| TG | 17.5 | 24.0 | 6.5 |
| SJ | 17.5 | 16.5 | -1.0 |
| CL | 17.0 | 20.5 | 3.5 |
| DD | 17.0 | 20.0 | 3.0 |
| RC | 16.5 | 30.5 | 14.0 |
| SH | 16.5 | 24.0 | 7.5 |
| WK | 16.0 | 16.0 | 0.0 |
| BL | 16.0 | 11.5 | -4.5 |
| MV | 15.5 | 21.5 | 6.0 |
| BL | 15.5 | 17.5 | 2.0 |
| AE | 15.5 | 17.5 | 2.0 |
| WD | 15.5 | 14.5 | -1.0 |
| GJ | 15.0 | 27.0 | 12.0 |
| HC | 13.5 | 14.5 | 1.0 |
| SA | 13.5 | 11.5 | -2.0 |
| MM | 13.5 | 18.0 | 4.5 |
| HH | 13.5 | 18.5 | 5.0 |
| DeJJ | 13.5 | 19.5 | 6.0 |
| HE | 13.5 | 20.5 | 7.0 |
| BJ | 13.5 | 20.5 | 7.0 |
| RR | 13.0 | 12.5 | -0.5 |
| BE | 12.5 | 21.0 | 8.5 |
| AC | 10.5 | 14.5 | 4.0 |
| MF | 9.5 | 13.5 | 4.0 |
| FW | 9.0 | 16.0 | 7.0 |
| SC | 8.5 | 17.0 | 8.5 |
| N...42 | | | |
| M | 16.71 | 20.05 | 3.42 |
| SD dist. | 4.12 | 5.52 | 4.94 |
| SDM | .63 | .85 | .76 |

Table VIII
DAILY GROUP - $EF_1$
Dvork General Science Scale

| Pupil | FT | $I^T$ | C |
|---|---|---|---|
| CT | 87.5 | 81.0 | 6.5 |
| BJ | 86.5 | 79.5 | 7.0 |
| BJ | 86.5 | 83.0 | 3.5 |
| PJI | 85.5 | 79.0 | 6.5 |
| MJ | 85.5 | 83.5 | 2.0 |
| SM | 83.0 | 76.0 | 7.0 |
| RK | 82.0 | 73.0 | 9.0 |
| AJ | 81.0 | 80.0 | 1.0 |
| McG | 81.0 | 78.5 | 1.5 |
| DE | 80.5 | 77.5 | 3.0 |
| NL | 80.0 | 78.0 | 2.0 |
| RJ | 79.5 | 78.5 | 1.0 |
| CL | 79.0 | 78.0 | 1.0 |
| WE | 78.0 | 76.5 | 1.5 |
| SC | 78.0 | 80.0 | -2.0 |
| WC | 78.0 | 84.5 | -6.5 |
| CR | 77.5 | 76.5 | 1.0 |
| BK | 77.0 | 70.0 | 7.0 |
| WB | 76.5 | 77.5 | -1.0 |
| SK | 76.5 | 74.5 | 2.0 |
| NL | 76.5 | 73.0 | 3.5 |
| SN | 76.5 | 75.5 | 1.0 |
| HM | 76.0 | 80.5 | -4.5 |
| OI | 75.5 | 71.5 | 4.0 |
| SE | 75.5 | 69.0 | 6.5 |
| HA | 75.0 | 72.5 | 2.5 |
| PL | 74.5 | 69.0 | 5.5 |
| BM | 74.5 | 76.5 | -2.0 |
| CB | 74.5 | 64.5 | 10.0 |
| RM | 74.5 | 73.5 | 1.0 |
| WOJ | 73.5 | 73.5 | 0.0 |
| HP | 73.5 | 69.5 | 4.0 |
| TO | 73.5 | 76.0 | -2.5 |
| PZ | 73.0 | 69.0 | 4.0 |
| WM | 73.0 | 77.5 | -4.5 |
| HW | 72.5 | 76.0 | -3.5 |
| BM | 72.5 | 86.0 | 6.5 |
| IM | 72.0 | 66.0 | 6.0 |
| BJ | 71.0 | 70.0 | 1.0 |
| TG | 70.5 | 67.5 | 2.5 |
| LL | 70.0 | 73.0 | -3.0 |
| BW | 69.5 | 79.0 | -9.5 |
| JM | 69.5 | 72.5 | -3.0 |
| PC | 69.5 | 77.5 | -8.0 |
| OC | 68.0 | 73.5 | -5.5 |
| N...45 | | | |
| M | 76.73 | 75.26 | 1.57 |
| SD dist. | 4.78 | 4.8 | 4.58 |
| SDM | .71 | .71 | .68 |

Table IX
ALTERNATE GROUP-$EF_2$
Dvorak General Science Scale

| Pupil | FT | IT | C |
|---|---|---|---|
| HG | 85.5 | 78.0 | 7.5 |
| LV | 84.0 | 78.0 | 6.0 |
| CL | 84.0 | 76.0 | 8.0 |
| RT | 84.0 | 79.5 | 4.5 |
| SH | 81.5 | 80.5 | 1.0 |
| RC | 81.5 | 75.5 | 6.0 |
| GJ | 80.5 | 80.5 | 0.0 |
| GJ | 79.5 | 77.0 | 2.5 |
| WR | 79.0 | 77.0 | 2.0 |
| PE | 78.5 | 72.5 | 6.0 |
| WK | 78.5 | 75.0 | 3.5 |
| MM | 78.5 | 78.0 | 0.5 |
| BK | 78.0 | 73.0 | 5.0 |
| MV | 78.0 | 73.5 | 4.5 |
| DD | 77.5 | 70.0 | 7.5 |
| YS | 78.0 | 76.0 | 2.0 |
| BE | 76.0 | 62.5 | 13.5 |
| DeJJ | 76.0 | 67.0 | 9.0 |
| BL | 77.0 | 80.0 | -3.0 |
| AE | 75.5 | 76.5 | -1.0 |
| HE | 75.0 | 72.0 | 3.0 |
| DH | 74.0 | 78.5 | -4.5 |
| DH | 74.5 | 76.5 | -2.0 |
| FW | 74.5 | 75.0 | -0.5 |
| BV | 75.0 | 72.0 | 3.0 |
| HH | 74.5 | 69.0 | 5.5 |
| OA | 75.0 | 70.0 | 3.0 |
| TG | 75.0 | 74.0 | 1.0 |
| WD | 74.5 | 68.5 | 6.0 |
| AC | 72.5 | 62.0 | 10.5 |
| FV | 73.5 | 70.0 | 3.5 |
| BV | 73.0 | 75.0 | -2.0 |
| SJ | 75.0 | 65.5 | 7.5 |
| DE | 73.0 | 74.0 | -1.0 |
| BJ | 74.0 | 71.5 | 2.5 |
| BL | 72.5 | 70.5 | 2.0 |
| SC | 71.0 | 75.5 | -4.5 |
| RR | 70.5 | 71.5 | -1.0 |
| RT | 70.0 | 71.5 | -1.5 |
| HC | 70.5 | 71.0 | -0.5 |
| MF | 67.5 | 65.0 | 2.5 |
| SA | 65.0 | 73.0 | -8.0 |
| N...42 | | | |
| M | 76.19 | 73.61 | 2.85 |
| SD dist | 4.48 | 4.64 | 4.44 |
| SDM | .69 | .71 | .68 |

Table X
DAILY GROUP-$EF_1$
Rule General Science Test

| Pupil | Score | Pupil | Score |
|---|---|---|---|
| MJ | 66 | WE | 40 |
| NL | 65 | CS | 40 |
| AJ | 60 | BW | 39 |
| CT | 60 | PZ | 39 |
| SH | 57 | WH | 38 |
| BJ | 56 | TG | 38 |
| PJI | 46 | SK | 37 |
| DE | 46 | HP | 36 |
| BM | 45 | LL | 35 |
| BJ | 44 | CR | 33 |
| HA | 44 | SN | 33 |
| RM | 44 | PC | 32 |
| CB | 44 | WB | 32 |
| RK | 43 | HM | 31 |
| RJ | 43 | TO | 31 |
| HW | 42 | McG | 31 |
| BK | 41 | WOJ | 30 |
| BM | 41 | SE | 30 |
| OI | 41 | OC | 30 |
| WC | 41 | B° | 27 |
| NL | 41 | PL | 23 |
| CL | 41 | JM | 21 |
| | | IM | 21 |

N.....45
M 40.23
SD dist. 10.32
SDM 1.53

Table XI
ALTERNATE GROUP-$EF_2$
Rule General Science Test

| Pupil | Score | Pupil | score |
|---|---|---|---|
| LV | 65 | DE | 38 |
| RT | 64 | BL | 37 |
| PE | 59 | BK | 37 |
| HG | 56 | GJ | 36 |
| RC | 53 | TG | 36 |
| MV | 51 | OA | 35 |
| BE | 51 | HE | 35 |
| DN | 49 | AE | 34 |
| SH | 49 | SC | 32 |
| BJ | 47 | BV | 32 |
| MM | 46 | WD | 31 |
| DH | 46 | FV | 31 |
| YS | 44 | HH | 31 |
| DD | 44 | FW | 29 |
| DEJJ | 44 | HC | 27 |
| GJ | 43 | RR | 26 |
| WK | 43 | SJ | 24 |
| BV | 42 | SA | 21 |
| WR | 41 | MF | 20 |
| BL | 39 | AC | 20 |
| CL | 38 | RT | 13 |

N 42
SD dist. 11.28
SDM 1.74

Table XII
DAILY GROUP -$EF_1$
Powers General Science Test
Given sixty-five days after FT.

| Pupil | Score | Pupil | Score |
|---|---|---|---|
| MJ | 40 | NL | 25 |
| CT | 36 | HA | 24 |
| BJ | 35 | TO | 24 |
| BJ | 35 | McG | 24 |
| RK | 35 | TG | 23 |
| WE | 33 | RM | 22 |
| NL | 32 | PZ | 22 |
| CS | 30 | BK | 21 |
| HP | 30 | SH | 21 |
| WC | 29 | WB | 21 |
| DE | 29 | LL | 20 |
| SM | 28 | SE | 20 |
| OI | 28 | HW | 19 |
| AJ | 27 | IM | 19 |
| CL | 27 | OC | 18 |
| BM | 27 | BJ | 18 |
| SK | 27 | PL | 13 |
| PC | 27 | BM | 17 |
| WOJ | 26 | JM | 17 |
| HM | 26 | CB | 16 |
| PJI | 25 | CR | 14 |
| RE | 25 | BW dropped | |
| | | WH " | |

| | |
|---|---|
| N | 43 |
| M | 25.18 |
| SD dist. | 5.98 |
| $SD_M$ | .91 |

Table XIII
ALTERNATE GROUP-$EF_2$
Powers General Science Test

| Pupil | Score | Pupil | Score |
|---|---|---|---|
| RT | 43 | WD | 23 |
| LV | 34 | DeJJ | 22 |
| YS | 33 | HH | 22 |
| HG | 31 | SJ | 22 |
| GH | 31 | MH | 22 |
| SH | 30 | AC | 22 |
| PE | 30 | BJ | 22 |
| BV | 28 | BL | 21 |
| WR | 27 | TG | 21 |
| DD | 27 | BL | 21 |
| MW | 26 | BE | 20 |
| AE | 26 | PR | 20 |
| FW | 26 | DH | 20 |
| RC | 25 | DN | 19 |
| CL | 25 | MC | 19 |
| GJ | 25 | MP | 19 |
| WK | 25 | FV | 17 |
| HE | 25 | SA | 17 |
| BV | 24 | BK | 16 |
| OA | 24 | MT | 16 |
| DE | 23 | SC | 16 |

| | |
|---|---|
| N | 42 |
| M | 24.42 |
| SD dist. | 5.56 |
| SDM | .82 |

Table XIV
Comparison of Gains (C)
Ruch-Popenoe General Science Test

| | M | SD | SDM |
|---|---|---|---|
| $EF_1$ | 4.91 | 6.12 | .91 |
| $EF_2$ | | | .76 |
| D | 1.49 | 1.18 | .15 |
| SDD | 1.18 | | |
| EC | .35 | | |

Table XV
Comparison of Gains (c)
Dvorak General Science Test

| | M | SD | SDM |
|---|---|---|---|
| $EF_1$ | 1.57 | 4.58 | .68 |
| $EF_2$ | 2.85 | 4.44 | .68 |
| D | -1.28 | .14 | .00 |
| SDD | .96 | | |
| EC | .48 | | |

Table XVI
Comparison of Scores
Rule Test in General Science

| | M | SD | SDM |
|---|---|---|---|
| $EF_1$ | 40.43 | 10.32 | 1.55 |
| $EF_2$ | 39.42 | 11.28 | 1.74 |
| D | 1.01 | -.96 | -.21 |

Table XVII
Comparison of Scores
Powers Test in General Science

| | M | SD | SDM |
|---|---|---|---|
| $EF_1$ | 25.18 | 5.98 | .91 |
| $EF_2$ | 24.42 | 5.36 | .82 |
| D | .76 | .62 | .09 |

Table XVIII

DAILY GROUP - $EF_1$

Correlation between Terman Group Test of Mental Ability MA, CA, IQ and C of Ruch-Popenoe General Science Test.

| Pupil | MA | CA | IQ | C |
|---|---|---|---|---|
| BJ | 214 | 155 | 138 | 19.0 |
| PJI | 175 | 131 | 133 | 9.0 |
| CT | 177 | 150 | 118 | 14.0 |
| AJ | 181 | 154 | 117 | -6.5 |
| MJ | 186 | 159 | 117 | 15.5 |
| SM | 192 | 165 | 116 | 5.0 |
| WE | 172 | 149 | 115 | -2.0 |
| CL | 169 | 146 | 115 | 0.5 |
| HA | 161 | 146 | 110 | -3.0 |
| BM | 169 | 155 | 109 | 4.5 |
| BK | 167 | 154 | 108 | 7.0 |
| HM | 167 | 158 | 105 | 6.0 |
| WC | 177 | 172 | 103 | 1.5 |
| CB | 167 | 160 | 103 | 12.0 |
| CS | 164 | 159 | 103 | 9.5 |
| NL | 161 | 156 | 103 | 12.0 |
| BkM | 161 | 156 | 103 | 6.5 |
| RM | 164 | 163 | 100 | -1.0 |
| RJ | 161 | 160 | 100 | 5.0 |
| LL | 155 | 154 | 100 | -1.5 |
| BH | 161 | 162 | 99 | 1.0 |
| WB | 161 | 169 | 95 | 3.5 |
| TG | 155 | 162 | 95 | 0.5 |
| CR | 153 | 161 | 95 | 6.0 |
| OC | 147 | 157 | 93 | 5.5 |
| BJ | 164 | 177 | 92 | 10.5 |
| TO | 153 | 166 | 92 | -0.5 |
| HP | 150 | 162 | 92 | -2.0 |
| PZ | 147 | 159 | 92 | 2.0 |
| SN | 155 | 170 | 91 | 4.5 |
| SK | 144 | 157 | 91 | 12.0 |
| RK | 164 | 181 | 90 | 14.5 |
| OI | 150 | 166 | 90 | 6.0 |
| McG | 155 | 176 | 88 | 11.5 |
| HW | 144 | 163 | 88 | 1.0 |
| BrJ | 155 | 179 | 86 | -3.0 |
| WM | 155 | 182 | 85 | -3.5 |
| PC | 141 | 166 | 85 | 2.5 |
| NeL | 155 | 183 | 84 | 5.0 |
| WOJ | 144 | 170 | 84 | 15.5 |
| DE | 144 | 171 | 84 | 2.0 |
| IM | 136 | 163 | 83 | -1.0 |
| JM | 138 | 171 | 80 | -1.0 |
| PL | 133 | 169 | 78 | 4.5 |
| SE | 141 | 189 | 74 | -6.0 |
| r | .37 | -.05 | .26 | |
| $PE_r$ | .09 | .15 | .09 | |

Table XIX

ALTERNATE GROUP-$EF_2$

Correlation between Terman Group Test of Mental Ability MA, CA, IQ, and C of Ruch-Popenoe General Science Test.

| Pupil | MA | CA | IQ | C |
|---|---|---|---|---|
| LV | 195 | 151 | 129 | 11.5 |
| BK | 169 | 141 | 120 | 5.0 |
| RT | 189 | 160 | 118 | 7.5 |
| RCJr | 169 | 149 | 113 | 14.0 |
| DeJ | 167 | 147 | 113 | 6.0 |
| SH | 178 | 159 | 112 | 7.5 |
| MV | 172 | 156 | 110 | 6.0 |
| HG | 175 | 161 | 108 | 4.0 |
| CL | 169 | 156 | 108 | 5.5 |
| PE | 172 | 160 | 107 | -0.5 |
| DE | 167 | 156 | 107 | -5.5 |
| DN | 164 | 154 | 106 | 2.0 |
| WR | 155 | 146 | 106 | -0.5 |
| DD | 167 | 159 | 105 | 5.5 |
| HH | 167 | 160 | 104 | 5.0 |
| BE | 169 | 163 | 103 | 8.5 |
| BL | 167 | 161 | 103 | 2.0 |
| AE | 155 | 153 | 101 | 2.0 |
| SJ | 164 | 163 | 100 | -1.0 |
| FW | 153 | 153 | 100 | 7.0 |
| BJ | 153 | 152 | 100 | 7.0 |
| FV | 158 | 159 | 99 | -7.0 |
| WD | 155 | 165 | 99 | -1.0 |
| GJ | 150 | 152 | 98 | 1.0 |
| BV | 161 | 165 | 97 | 1.5 |
| MM | 155 | 159 | 97 | 4.5 |
| YS | 150 | 158 | 95 | 6.5 |
| RR | 150 | 158 | 95 | -0.5 |
| AC | 150 | 159 | 94 | 4.0 |
| HC | 144 | 154 | 93 | 1.0 |
| BuV | 161 | 176 | 91 | 4.0 |
| GoJ | 153 | 169 | 90 | 12.0 |
| TG | 150 | 166 | 90 | 6.5 |
| SA | 141 | 158 | 89 | -2.0 |
| RT | 147 | 167 | 88 | -9.5 |
| OA | 144 | 163 | 88 | 2.0 |
| WK | 144 | 167 | 85 | 0.0 |
| DH | 147 | 175 | 84 | 1.5 |
| HE | 150 | 188 | 80 | 7.0 |
| BL | 138 | 174 | 79 | -4.5 |
| SC | 138 | 179 | 77 | 8.5 |
| MF | 138 | 185 | 74 | 4.0 |
| r..... | .30 | -.0002 | .25 | |
| PEr.... | .09 | .1 | .1 | |

Table XX
DAILY GROUP-$EF_1$
Correlation between Terman Group Test of Mental Ability, MA, CA, IQ and C of Dvoarak General Science Test.

| Pupil | MA | CA | IQ | C |
|---|---|---|---|---|
| BJ | 214 | 155 | 138 | 7.0 |
| PJI | 175 | 131 | 133 | 6.5 |
| CT | 177 | 150 | 118 | 6.5 |
| AJ | 181 | 154 | 117 | 1.0 |
| MJ | 186 | 159 | 117 | 2.0 |
| SM | 192 | 165 | 116 | 7.0 |
| WE | 172 | 149 | 115 | 1.5 |
| CL | 169 | 146 | 115 | 1.0 |
| HA | 161 | 146 | 110 | 2.5 |
| BM | 169 | 155 | 109 | -2.0 |
| BK | 167 | 154 | 108 | 7.0 |
| HM | 167 | 158 | 105 | -4.5 |
| WC | 177 | 172 | 103 | -6.5 |
| CB | 167 | 160 | 103 | 10.0 |
| CS | 164 | 159 | 103 | -2.0 |
| NL | 161 | 156 | 103 | 2.0 |
| BkM | 161 | 156 | 103 | 6.5 |
| RM | 164 | 163 | 100 | 1.0 |
| RJ | 161 | 160 | 100 | 1.0 |
| LL | 155 | 154 | 100 | -3.0 |
| BW | 161 | 162 | 99 | -9.5 |
| WB | 161 | 169 | 95 | -1.0 |
| TG | 155 | 162 | 95 | 2.5 |
| CR | 153 | 161 | 95 | 1.0 |
| OC | 147 | 157 | 93 | -5.5 |
| BJ | 164 | 177 | 92 | 3.5 |
| TO | 153 | 166 | 92 | -2.5 |
| HP | 150 | 162 | 92 | 4.0 |
| PZ | 147 | 159 | 92 | 4.0 |
| SN | 155 | 170 | 91 | 1.0 |
| SK | 144 | 157 | 91 | 2.0 |
| RK | 164 | 181 | 90 | 9.0 |
| OI | 150 | 166 | 90 | 4.0 |
| McG | 155 | 176 | 88 | 1.5 |
| HW | 144 | 163 | 88 | -3.5 |
| BrJ | 155 | 179 | 86 | 1.0 |
| WM | 155 | 182 | 85 | -4.5 |
| PC | 141 | 166 | 85 | -8.0 |
| NeL | 155 | 183 | 84 | 3.5 |
| WOJ | 144 | 170 | 84 | 0.0 |
| DE | 144 | 171 | 84 | 3.0 |
| IM | 136 | 163 | 83 | 6.0 |
| JM | 138 | 171 | 80 | -3.0 |
| PL | 133 | 169 | 78 | 5.5 |
| SE | 141 | 189 | 74 | 6.5 |
| r..... | .17 | .05 | .17 | |
| $PE_r$ | .1 | .1 | .1 | |

Table XXI

ALTERNATE GROUP-$EF_2$

Correlation between Terman Group Test of Mental Ability MA, CA, IQ and C of Dvorak General Science Scale.

| Pupil | MA | CA | IQ | C |
|---|---|---|---|---|
| LV | 195 | 151 | 129 | 6.0 |
| BK | 169 | 141 | 120 | 5.0 |
| RT | 189 | 160 | 118 | 4.5 |
| RCJr | 169 | 149 | 113 | 6.0 |
| DeJ | 167 | 147 | 113 | 9.0 |
| SH | 178 | 159 | 112 | 1.0 |
| MV | 172 | 156 | 110 | 4.5 |
| HG | 175 | 161 | 108 | 7.5 |
| CL | 169 | 156 | 108 | 8.0 |
| PE | 172 | 160 | 107 | 6.0 |
| DE | 167 | 156 | 107 | -1.0 |
| DN | 164 | 154 | 106 | -4.5 |
| WR | 155 | 146 | 106 | 2.0 |
| DD | 167 | 159 | 105 | 7.5 |
| HH | 167 | 160 | 104 | 5.5 |
| BE | 169 | 163 | 103 | 13.5 |
| BL | 167 | 161 | 103 | -3.0 |
| AE | 155 | 153 | 101 | -1.0 |
| SJ | 164 | 163 | 100 | 7.5 |
| FW | 153 | 153 | 100 | -0.5 |
| BJ | 153 | 152 | 100 | 2.5 |
| FV | 158 | 159 | 99 | 3.5 |
| WD | 155 | 156 | 99 | 6.0 |
| GJ | 150 | 152 | 98 | 0.0 |
| BV | 161 | 165 | 97 | -2.0 |
| MM | 155 | 159 | 97 | 0.5 |
| YS | 150 | 158 | 95 | 2.0 |
| RR | 150 | 158 | 95 | -1.0 |
| AC | 150 | 159 | 94 | 10.5 |
| HC | 144 | 154 | 93 | -0.5 |
| BuV | 161 | 176 | 91 | 3.0 |
| GoJ | 153 | 169 | 90 | 2.5 |
| TG | 150 | 166 | 90 | 1.0 |
| SA | 141 | 158 | 89 | -8.0 |
| RT | 147 | 167 | 88 | -1.5 |
| OA | 144 | 163 | 88 | 3.0 |
| WK | 144 | 167 | 85 | 3.5 |
| DH | 147 | 175 | 84 | -2.0 |
| HE | 150 | 188 | 80 | 3.0 |
| BL | 138 | 174 | 79 | 2.0 |
| SC | 138 | 179 | 77 | -4.5 |
| MF | 138 | 185 | 74 | 2.5 |
| r..... | .89 | -.14 | .31 | |
| $PE_r$.... | .09 | .1 | .09 | |

Table XXII

DAILY GROUP - $EF_1$

Correlation between Terman Group Test of Mental Ability MA, CA, IQ, and Scores of Rule test in General Science.

| Pupil | MA | CA | IQ | Scores |
|---|---|---|---|---|
| BJ | 214 | 155 | 136 | 56 |
| PJI | 175 | 131 | 133 | 46 |
| CT | 177 | 150 | 118 | 60 |
| AJ | 181 | 154 | 117 | 60 |
| MJ | 186 | 159 | 117 | 66 |
| SM | 192 | 165 | 116 | 57 |
| WE | 172 | 149 | 115 | 40 |
| CL | 169 | 146 | 115 | 41 |
| HA | 161 | 146 | 110 | 44 |
| BM | 169 | 156 | 109 | 41 |
| BK | 167 | 154 | 108 | 41 |
| HM | 167 | 158 | 105 | 31 |
| WC | 177 | 172 | 103 | 41 |
| CB | 167 | 160 | 103 | 44 |
| CS | 164 | 159 | 103 | 40 |
| NL | 161 | 156 | 103 | 65 |
| BkM | 161 | 156 | 103 | 45 |
| RM | 164 | 163 | 100 | 44 |
| RJ | 161 | 160 | 100 | 43 |
| LL | 155 | 154 | 100 | 35 |
| BW | 161 | 162 | 99 | 39 |
| WB | 161 | 169 | 95 | 32 |
| TG | 155 | 162 | 95 | 38 |
| CR | 153 | 161 | 95 | 33 |
| OC | 147 | 157 | 93 | 30 |
| BJ | 164 | 177 | 92 | 44 |
| TO | 153 | 166 | 92 | 31 |
| HP | 150 | 162 | 92 | 36 |
| PZ | 147 | 159 | 92 | 39 |
| SN | 155 | 170 | 91 | 33 |
| SK | 144 | 157 | 91 | 37 |
| RK | 164 | 181 | 90 | 43 |
| OI | 150 | 166 | 90 | 41 |
| McG | 155 | 176 | 88 | 31 |
| HW | 144 | 163 | 88 | 42 |
| BrJ | 155 | 179 | 86 | 27 |
| WM | 155 | 182 | 85 | 58 |
| PC | 141 | 166 | 85 | 32 |
| NeL | 155 | 183 | 84 | 41 |
| WOJ | 144 | 170 | 84 | 30 |
| BE | 144 | 171 | 84 | 46 |
| IM | 136 | 163 | 83 | 21 |
| JM | 138 | 171 | 80 | 21 |
| PL | 133 | 169 | 78 | 23 |
| SE | 141 | 189 | 74& | 30 |
| r ..... | .72 | -.27 | .60 | |
| $PE_r$ | .04 | .09 | .06 | |

Table XXIII
ALTERNATE GROUP -EF2
Correlation between Terman Group Test of Mental Ability MA, CA, IQ, and Scores of Rule Test in General Science.

| Pupil | MA | CA | IQ | Scores |
|---|---|---|---|---|
| LV | 195 | 151 | 129 | 65 |
| BK | 169 | 141 | 120 | 37 |
| RT | 189 | 160 | 118 | 64 |
| RCJr | 169 | 149 | 113 | 55 |
| DeJ | 167 | 147 | 113 | 44 |
| SH | 178 | 159 | 112 | 49 |
| MV | 172 | 156 | 110 | 51 |
| HG | 175 | 161 | 108 | 56 |
| CL | 169 | 156 | 108 | 38 |
| PE | 172 | 160 | 107 | 59 |
| DE | 167 | 156 | 107 | 38 |
| DN | 164 | 154 | 106 | 49 |
| WR | 155 | 146 | 106 | 41 |
| DD | 167 | 159 | 105 | 44 |
| HH | 167 | 160 | 104 | 31 |
| BE | 169 | 163 | 103 | 51 |
| BL | 167 | 161 | 103 | 39 |
| AE | 155 | 153 | 101 | 34 |
| SJ | 164 | 163 | 100 | 24 |
| FW | 153 | 153 | 100 | 29 |
| BJ | 153 | 152 | 100 | 47 |
| FV | 158 | 159 | 99 | 31 |
| WD | 155 | 156 | 99 | 31 |
| GJ | 150 | 152 | 98 | 56 |
| BV | 161 | 165 | 97 | 42 |
| MM | 155 | 159 | 97 | 46 |
| YS | 150 | 158 | 95 | 44 |
| RR | 150 | 158 | 95 | 26 |
| AC | 150 | 159 | 94 | 20 |
| HC | 144 | 154 | 93 | 27 |
| BuV | 161 | 176 | 91 | 32 |
| GoJ | 153 | 169 | 90 | 43 |
| TG | 150 | 166 | 90 | 36 |
| SA | 161 | 158 | 89 | 21 |
| RT | 147 | 167 | 88 | 18 |
| CA | 144 | 163 | 88 | 35 |
| WK | 144 | 167 | 85 | 43 |
| DH | 147 | 175 | 84 | 46 |
| HE | 150 | 188 | 80 | 35 |
| BL | 138 | 174 | 79 | 37 |
| SC | 138 | 179 | 77 | 32 |
| MF | 138 | 185 | 74 | 20 |
| r ..... | .69 | -.26 | .86 | |
| $PE_r$ | .06 | .1 | .028 | |

Table XXIV

DAILY GROUP - $EF_1$

Correlation between Terman Group Test of Mental Ability MA, CA, IQ, and Scores of Powers Test in General Science.

| Pupil | MA | CA | IQ | Scores |
|---|---|---|---|---|
| BJ | 214 | 155 | 138 | 35 |
| PJI | 175 | 131 | 133 | 25 |
| CT | 177 | 150 | 118 | 36 |
| AJ | 181 | 154 | 117 | 27 |
| MJ | 186 | 159 | 117 | 40 |
| SM | 192 | 165 | 116 | 28 |
| WE | 172 | 149 | 115 | 33 |
| CL | 169 | 146 | 115 | 27 |
| HA | 161 | 146 | 110 | 24 |
| BM | 169 | 155 | 109 | 17 |
| BK | 167 | 154 | 108 | 21 |
| HM | 167 | 158 | 105 | 26 |
| WC | 177 | 172 | 103 | 29 |
| CB | 167 | 160 | 103 | 16 |
| CS | 164 | 159 | 103 | 30 |
| NL | 161 | 156 | 103 | 32 |
| BkM | 161 | 156 | 103 | 27 |
| RM | 164 | 163 | 100 | 22 |
| RJ | 161 | 160 | 100 | 25 |
| LL | 155 | 154 | 100 | 20 |
| BW | 161 | 162 | 99 | dr* |
| WB | 161 | 169 | 95 | 21 |
| TG | 155 | 162 | 95 | 23 |
| CR | 153 | 161 | 95 | 14 |
| OC | 147 | 157 | 93 | 18 |
| BJ | 164 | 177 | 92 | 35 |
| TO | 153 | 166 | 92 | 24 |
| HP | 150 | 162 | 92 | 30 |
| PZ | 147 | 159 | 92 | 22 |
| SN | 155 | 170 | 91 | 21 |
| SK | 144 | 157 | 91 | 27 |
| RK | 164 | 181 | 90 | 35 |
| OI | 150 | 166 | 90 | 28 |
| McG | 155 | 176 | 88 | 24 |
| HW | 144 | 163 | 88 | 19 |
| BrJ | 155 | 179 | 86 | 18 |
| WM | 155 | 182 | 85 | dr* |
| PC | 141 | 166 | 85 | 27 |
| NeL | 155 | 183 | 84 | 25 |
| WOJ | 144 | 180 | 84 | 26 |
| DE | 144 | 171 | 84 | 29 |
| IM | 136 | 163 | 83 | 19 |
| JM | 138 | 171 | 80 | 17 |
| PL | 133 | 169 | 78 | 18 |
| SE | 141 | 189 | 74 | 20 |
| r.... | .52 | -.05 | .4 | |
| $PE_r$ | .08 | .1 | .08 | |

* dropped

Table XXV
ALTERNATE GROUP-$EF_2$
Correlation between Terman Group Test of Mental Ability MA, CA, IQ, and Scores of Powers Test in General Science.

| Pupil | MA | CA | IQ | Scores |
|---|---|---|---|---|
| LV | 195 | 151 | 129 | 34 |
| BK | 169 | 141 | 120 | 16 |
| RT | 169 | 160 | 118 | 43 |
| RCJr | 169 | 149 | 113 | 25 |
| DeJ | 167 | 147 | 113 | 22 |
| SH | 178 | 159 | 112 | 30 |
| MV | 172 | 156 | 110 | 26 |
| HG | 175 | 161 | 108 | 31 |
| CL | 169 | 156 | 108 | 25 |
| PE | 172 | 160 | 107 | 30 |
| DE | 167 | 156 | 107 | 25 |
| DN | 164 | 154 | 106 | 19 |
| WR | 155 | 146 | 106 | 27 |
| DD | 167 | 159 | 105 | 27 |
| HH | 167 | 160 | 104 | 22 |
| BE | 169 | 163 | 103 | 20 |
| BL | 167 | 161 | 103 | 21 |
| AE | 155 | 153 | 101 | 26 |
| SJ | 164 | 163 | 100 | 22 |
| FW | 153 | 153 | 100 | 26 |
| NJ | 153 | 152 | 100 | 22 |
| FV | 158 | 159 | 99 | 17 |
| WD | 155 | 156 | 99 | 23 |
| GJ | 150 | 152 | 98 | 25 |
| BV | 161 | 165 | 97 | 28 |
| MM | 155 | 159 | 97 | 22 |
| YS | 150 | 158 | 95 | 33 |
| RR | 150 | 158 | 95 | 20 |
| AC | 150 | 159 | 94 | 22 |
| HC | 144 | 154 | 93 | 19 |
| BuV | 161 | 176 | 91 | 24 |
| GoJ | 153 | 169 | 90 | 31 |
| TG | 150 | 166 | 90 | 21 |
| SA | 141 | 158 | 89 | 17 |
| RT | 147 | 167 | 88 | 16 |
| OA | 144 | 163 | 88 | 24 |
| WK | 144 | 167 | 85 | 25 |
| DH | 147 | 175 | 84 | 20 |
| HE | 150 | 188 | 80 | 24 |
| BL | 138 | 174 | 79 | 21 |
| SC | 138 | 179 | 77 | 16 |
| MF | 138 | 185 | 74 | 19 |
| r .... | .60 | .09 | .47 | |
| $PE_r$ | .06 | .1 | .08 | |

Table XXVI
SUMMARY
Coefficient of correlation between the gains made in Ruch-Popenoe test and the factors involved in Terman Group Test of Mental Ability.

| | MA | ($PE_r$) | CA | ($PE_r$) | IQ | ($PE_r$) |
|---|---|---|---|---|---|---|
| $EF_1$ | .37 | .09 | -.05 | .15 | .26 | .09 |
| $EF_2$ | .30 | .09 | -.002 | .10 | .25 | .1 |
| D | .07 | | .042 | | .01 | |

Table XXVII
SUMMARY
Coefficient of correlation between the gains of Dvorak General Science Scale and factors involved in Terman Test.

| | MA | ($PE_r$) | CA | ($PE_r$) | IQ | ($PE_r$) |
|---|---|---|---|---|---|---|
| $EF_1$ | .17 | .1 | .05 | .1 | .17 | .1 |
| $EF_2$ | .39 | .09 | -.14 | .1 | .31 | .09 |
| D | -.22 | | .19 | | -.14 | |

Table XXVIII
SUMMARY
Coefficient of Correlation between Rule test scores and factors involved in Terman Test.

| | MA | ($PE_r$) | CA | ($PE_r$) | IQ | ($PE_r$) |
|---|---|---|---|---|---|---|
| $EF_1$ | .72 | .04 | -.27 | .09 | .60 | .06 |
| $EF_2$ | .69 | .06 | -.26 | .1 | .86 | .028 |
| D | .03 | | -.01 | | -.26 | |

Table XXIX
SUMMARY
Coefficient of correlation between Powers scores and factors involved in Terman Test

| | MA | ($PE_r$) | CA | ($PE_r$) | IQ | ($PE_r$) |
|---|---|---|---|---|---|---|
| $EF_1$ | .52 | .08 | -.03 | .1 | .4 | .08 |
| $EF_2$ | .60 | .06 | .09 | .1 | .47 | .08 |
| D | -.08 | | -.12 | | -.07 | |

Table XXX

DAILY GROUP - $EF_1$

Correlation between Rule Test Scores, and Powers Test Scores, Ruch-Popenoe C and Dvorak C. Between Powers Test and Ruch-Popenoe C, and Dvorak C. Between Ruch-Popenoe C and Dvorak C.

| Pupil | Rule Score | Powers Score | Ruch-P C | Dvorak C |
|---|---|---|---|---|
| BJ | 56 | 35 | 19.0 | 7.0 |
| PJI | 46 | 25 | 9.0 | 6.5 |
| CT | 60 | 36 | 16.0 | 6.5 |
| AJ | 60 | 27 | -6.5 | 1.0 |
| MJ | 66 | 40 | 15.5 | 2.0 |
| SM | 57 | 28 | 5.0 | 7.0 |
| WE | 40 | 33 | -2.0 | 1.5 |
| CL | 41 | 27 | 0.5 | 1.0 |
| HA | 44 | 24 | -3.0 | 2.5 |
| BM | 41 | 17 | 4.5 | -2.0 |
| BK | 41 | 21 | 7.0 | 7.0 |
| HM | 31 | 26 | 6.0 | -4.5 |
| WC | 41 | 29 | 1.5 | -6.5 |
| CB | 44 | 16 | 12.0 | 10.0 |
| CS | 40 | 30 | 9.5 | -2.0 |
| NL | 65 | 32 | 12.0 | 2.0 |
| BkM | 45 | 27 | 6.5 | 6.5 |
| RM | 44 | 22 | -1.0 | 1.0 |
| RJ | 43 | 25 | 5.0 | 1.0 |
| LL | 35 | 20 | 1.0 | -3.0 |
| BW | 39 | dr* | 3.5 | -9.5 |
| WB | 32 | 21 | 0.5 | -1.0 |
| TG | 38 | 25 | 6.0 | 2.5 |
| CR | 33 | 14 | 5.5 | 1.0 |
| OC | 30 | 18 | 10.5 | -5.5 |
| BJ | 44 | 35 | -0.5 | 3.5 |
| TO | 31 | 24 | -2.0 | -2.5 |
| HP | 36 | 30 | 2.0 | 4.0 |
| PB | 39 | 22 | 4.5 | 4.0 |
| SN | 33 | 21 | 12.0 | 1.0 |
| SK | 37 | 27 | 14.5 | 2.0 |
| RK | 43 | 35 | 6.0 | 9.0 |
| OI | 41 | 28 | 11.5 | 4.0 |
| McG | 31 | 24 | 1.0 | 1.5 |
| HW | 42 | 19 | -3.0 | -3.5 |
| BrJ | 27 | 18 | -3.5 | 1.0 |
| WM | 38 | dr* | 2.5 | -4.5 |
| PC | 32 | 27 | 2.5 | -8.0 |
| NeL | 41 | 25 | 5.0 | 3.5 |
| WOJ | 30 | 26 | 15.5 | 0.0 |
| DE | 46 | 29 | 2.0 | 3.0 |
| IM | 21 | 19 | -1.0 | 6.0 |
| JM | 21 | 17 | -1.0 | -3.0 |
| PL | 23 | 18 | 4.5 | -3.0 |
| SE | 30 | 20 | -6.0 | 6.5 |
| r Rule..... | | .71 | .41 | .30 |
| PEr..... | | .052 | .089 | .092 |
| r Powers..... | | | .35 | .18 |
| $PE_r$..... | | | .09 | .1 |
| r Ruch-Popenoe | | | | .29 |
| PEr ..... | | | | .093 |

Table XXXI

ALTERNATE GROUP-$EF_2$

Correlation between Rule Test Scores, and Powers Test Scores, Ruch-Popenoe C and Dvorak C; between Powers Test and Ruch-Popenoe C, and Dvorak C; between Ruch-Popenoe C and Dvorak C.

| Pupil | Rule Score | Powers Score | Ruch-P C | Dvorak C |
|---|---|---|---|---|
| LV | 65 | 34 | 11.5 | 6.0 |
| BK | 37 | 16 | 3.0 | 5.0 |
| RT | 64 | 43 | 7.5 | 4.5 |
| RCJr | 53 | 25 | 14.0 | 6.0 |
| DeJ | 44 | 22 | 6.0 | 9.0 |
| SH | 49 | 30 | 7.5 | 1.0 |
| MV | 51 | 26 | 6.0 | 4.5 |
| HG | 56 | 31 | 4.0 | 7.5 |
| CL | 38 | 25 | 3.5 | 8.0 |
| PE | 59 | 30 | -0.5 | 6.0 |
| DE | 38 | 23 | -5.5 | -1.0 |
| DN | 49 | 19 | 2.0 | 4.5 |
| WR | 41 | 27 | -0.5 | 2.0 |
| DD | 44 | 27 | 3.5 | 7.5 |
| HH | 51 | 22 | 5.0 | 5.5 |
| BE | 51 | 20 | 8.5 | 13.5 |
| BL | 39 | 21 | 2.0 | -3.0 |
| AE | 34 | 26 | 2.0 | -1.0 |
| SJ | 24 | 22 | -1.0 | 7.5 |
| FW | 29 | 26 | 7.0 | -0.5 |
| BJ | 47 | 22 | 7.0 | 2.5 |
| FV | 31 | 17 | -7.0 | 3.5 |
| WD | 31 | 23 | -1.0 | 6.0 |
| GJ | 36 | 25 | 1.0 | 0.0 |
| BV | 42 | 28 | 1.5 | -2.0 |
| MMM | 46 | 22 | 4.5 | 0.5 |
| YS | 44 | 33 | 6.5 | 2.0 |
| RR | 26 | 20 | -0.5 | -1.0 |
| AC | 20 | 22 | 4.0 | 10.5 |
| HC | 27 | 19 | 1.0 | -0.5 |
| BuV | 32 | 24 | 4.0 | 3.0 |
| GoJ | 43 | 31 | 12.0 | 2.5 |
| TG | 36 | 21 | 6.5 | 1.0 |
| SA | 21 | 17 | -2.0 | -8.0 |
| RT | 18 | 16 | -9.5 | - 1.5 |
| OA | 35 | 24 | 2.0 | 3.0 |
| WK | 43 | 25 | 0.0 | 3.5 |
| DH | 46 | 20 | 1.5 | -2.0 |
| HE | 35 | 24 | 7.0 | 3.0 |
| BL | 37 | 21 | -4.5 | 2.0 |
| SC | 32 | 16 | 0.5 | -4.5 |
| MF | 20 | 19 | 4.0 | 2.5 |
| r Rule..... | | .47 | .39 | .25 |
| $PE_r$..... | | .082 | .09 | .099 |
| r Powers ... | | | .40 | .309 |
| $PE_r$..... | | | .089 | .097 |
| r Ruch-Popenoe.. | | | | .26 |
| $PE_r$..... | | | | .099 |

Table XXXII
SUMMARY

Coefficient of correlation between Rule test scores, and gains in Powers, Ruch-Popenoe, and Dvorak scores.

| | Powers | | Ruch-P | | Dvorak | |
|---|---|---|---|---|---|---|
| | | ($PE_r$) | | (PE) | | (PE) |
| $EF_1$ | .71 | .05 | .41 | .089 | .30 | .09 |
| $EF_2$ | .47 | .08 | .39 | .09 | .25 | .09 |
| D | .24 | | .02 | | .05 | |

Table XXXIII
SUMMARY

Coefficient of correlation between Powers test scores and gains in Ruch-Popenoe and Dvorak tests.

| | Ruch-P | | Dvorak | |
|---|---|---|---|---|
| | | (PE) | | (PE) |
| $EF_1$ | .35 | .09 | .18 | .10 |
| $EF_2$ | .40 | .089 | .309 | .097 |
| D | -.05 | | -.129 | |

Table XXXIV
SUMMARY

Coefficient of correlation between Ruch-Popenoe scores and Dvorak gains.

| | Dvorak | |
|---|---|---|
| | | ($PE_r$) |
| $EF_1$ | .29 | .09 |
| $EF_2$ | .26 | .09 |
| D | .03 | |

Table XXXV
DAILY GROUP - $EF_1$
Attendance based on 72 recitations

| Pupils | Attendance | Pupils | Attendance |
|---|---|---|---|
| BJ | 66 | CR | 70 |
| PJI | 72 | CGC | 69 |
| CT | 69 | EJ | 70 |
| AJ | 68 | TO | 67 |
| MJ | 71 | HP | 72 |
| SM | 68 | PZ | 70 |
| WE | 71 | SW | 72 |
| CL | 72 | SK | 72 |
| HA | 68 | RK | 67 |
| BM | 69 | OI | 71 |
| BK | 68 | LcG | 72 |
| HM | 72 | HW | 69 |
| WC | 69 | BJ | 70 |
| CB | 60 | WM | 72 |
| CS | 72 | PC | 71 |
| NL | 65 | NL | 67 |
| BM | 62 | WOJ | 51 |
| RM | 69 | DE | 70 |
| RJ | 71 | IM | 71 |
| LL | 72 | JM | 50 |
| BW | 61 | PL | 66 |
| WB | 67 | SE | 64 |
| TG | 51 | | |

N..... 45
M ..... 67.6

Table XXXVI
ALTERNATE GROUP - $EF_2$
Attendance based on 71 recitations

| Pupil | Attendance | Pupil | Attendance |
|---|---|---|---|
| LV | 69 | FV | 68 |
| BK | 70 | WD | 62 |
| RT | 71 | GJ | 62 |
| RCJr | 68 | BV | 64 |
| DeJ | 67 | MM | 70 |
| SH | 67 | YS | 69 |
| MV | 70 | RR | 64 |
| HG | 65 | AC | 60 |
| CL | 71 | HC | 68 |
| PE | 62 | BV | 59 |
| DE | 62 | GJ | 68 |
| DD | 69 | TG | 71 |
| HH | 70 | SA | 69 |
| BE | 68 | RT | 66 |
| BL | 68 | OA | 70 |
| AE | 67 | WK | 70 |
| SJ | 67 | DH | 69 |
| FW | 61 | HE | 70 |
| BJ | 65 | BL | 70 |
| | | SC | 66 |
| | | MF | 70 |

N.....42
M.....66.9

Table XXXVII

Self-correlation of items in the Rule test in General Science. The tablualted scores are errors. r is the relationship between the errors made in the even items compared with the errors made in the odd items.

| Even | Odd |
|---|---|
| 32 | 37 |
| 34 | 35 |
| 32 | 35 |
| 24 | 35 |
| 24 | 35 |
| 34 | 33 |
| 35 | 32 |
| 26 | 32 |
| 32 | 31 |
| 28 | 31 |
| 26 | 31 |
| 30 | 30 |
| 30 | 30 |
| 30 | 30 |
| 28 | 30 |
| 26 | 30 |
| 24 | 30 |
| 23 | 29 |
| 21 | 29 |
| 29 | 28 |
| 27 | 28 |
| 19 | 28 |
| 18 | 28 |
| 26 | 27 |
| 24 | 27 |
| 22 | 27 |
| 22 | 27 |
| 28 | 26 |
| 25 | 26 |
| 23 | 26 |
| 22 | 26 |
| 19 | 26 |
| 25 | 25 |
| 22 | 25 |
| 19 | 25 |
| 25 | 24 |
| 23 | 23 |
| 31 | 21 |
| 23 | 21 |
| 14 | 19 |
| 14 | 16 |
| 9 | 16 |
| 19 | 15 |
| 16 | 15 |
| 12 | 12 |
| M... 24.91 | 27.4 |
| SD 5.62 | 5.72 |
| SDM .83 | .85 |
| r .64 | $PE_r$ .059 |

Table XXXVIII

Environmental factors as indicated
by occupations of parents

| Occupation | No. in $EF_1$ | No. in $EF_2$ |
|---|---|---|
| Agent RR | | 1 |
| Auditor | 1 | |
| Beauty Shop | | 1 |
| Blacksmith | 2 | 1 |
| Boilermaker | | 1 |
| Brakeman | 2 | 3 |
| Butcher | | 1 |
| Carpenter | | 2 |
| Claim Agent | | 1 |
| Clerk RR Office | 3 | |
| Conductor | | 2 |
| Cook | | 1 |
| Coppersmith | | 1 |
| Crane operator | | 1 |
| Dairy | 1 | |
| Dentist | | 1 |
| Drayman | | 1 |
| Editor | | 1 |
| Engineer | 3 | 3 |
| Farmer | 1 | 2 |
| Flagman | | 1 |
| Florist | 2 | |
| Foreman | 1 | 1 |
| Gas Co. employees | 3 | 1 |
| Grocery | 1 | 2 |
| Horticulturist | | 1 |
| Inspector RR yard | | 1 |
| Insurance | 2 | 1 |
| Mchinist | 4 | 1 |
| Mail Carrier | | 1 |
| Merchant | 1 | 1 |
| Messenger Train | | 1 |
| Pavement finisher | 1 | |
| Physician | 1 | |
| Plumber | | 1 |
| Salesman | 3 | 4 |
| Tailor | 2 | |
| Truck driver | 1 | 1 |
| Teacher music | | 1 |
| Welder | 1 | |
| Retired | | 3 |
| Unclassified | 2 | 2 |

# CHAPTER IV

## Conclusion.

Data secured from this experiment do not seem to point definitely toward any gain by the use of either method. The low EC obtained shows that neither EF used indicates sufficient superiority to warrant the conclusion that the true difference, if known, would continue to favor the same EF.

# BIBLIOGRAPHY

Ebbinghaus, H. : Ueber das Gedächtniss.

Jost, A.: Zeitschrift für Psychologie, Vol. 14, pp. 436-472.

McCall, William A.: How to Experiment in Education.

# GENERAL SCIENCE

Basic text: "Science for Boys and Girls." - Nichols.

Note: Part one of "Science for Boys and Girls" is largely Nature Study material and is covered in the work of the seventh grade.

The outline below makes provision for seventy-six assignments. Therefore it is fourteen lessons short of ninety, a full semester, or a full year if classes are held every other day. This allows some latitude in giving assignments, allowing for variability of different sections, affording an opportunity to make use of outside material whenever that is pertinent.

No attempt is made to teach any one science as a science. However, an attempt is made to give pupils an idea of what scientific study really means. As nearly as possible within the limits of the minds of pupils of eighth grade, general science students are brought to realize that a scientific study implies careful organization of material: that there are basic, underlying truths of Nature; that these truths, or laws when discovered, have significance for each individual; that a study of their relationship constitutes "scientific study."

Note books are required. Each individual pupil is expected to contribute to the work of his class.

The intent and purpose of the course is to acquaint the pupil with various branches of science; to give him enough constructive work to make him respect it; to avoid giving him so little that he will hold "science" in contempt; and finally, to send him out at the end of the course with a healthy desire to "know more."

GENERAL SCIENCE

First six weeks.

Text - Science for Boys and Girls - Nichols.

Part II. Everyday Happenings.

Note: Part I is very workable in Nature Study so it is not included in this part of outline.

A. Chapter XXX. The Value of Science.

Lesson. Pages 308-313.

1. Why we need to know science.

a. Why boys and girls go to school.

b. Learn to live wisely and well.

c. Apply what you have learned.

d. Learn to know your environment.

e. Adaptation of organisms to different environment.

2. Why we need to know science. (con.) P. 313-318.

f. Manners of adaptation.

g. Man's artificial environment and its control.

h. Science and control of environment.

B. Chapter XVI. Metric System.

3. Questions and problems. P. 169.

a. Linear and square measure
(1) comparison of meter, yard, etc.

b. Cubic measure.

4. Questions and problems P. 170.

a. Weights

b. Balances

c. Thermometers

Lessons.

5. Readings of text and discussions P. 171-176.

a. Linear measure.

b. Square measure.

c. Cubic measure.

d. Measure of weight.

e. Scales of balances.

f. Metric system is a decimal system.

g. Thermometers.

h. Questions.

C. Chapter XVII. Behavior of water and some of its uses.

6. Experiments on water - P. 177.

a. What substances will water dissolve?

b. How can substances be made to dissolve more rapidly?

c. How much sugar and how much salt will 20 c.c. of $H_2O$ dissolve?

7. Experiments with water - P. 177-178.

d. What happens when dye dissolves in water?

e. What is effect of heat on water?

f. When liquids evaporate how is the temperature affected?

g. How are crystals formed?

8. Experiments with water - P. 179.

h. Can water vaper be changed to a liquid?

i. Is there water in air?

j. How can water be made more pure?

k. Will a solution pass through a membrane?

(Note: This experiment may be started at the beginning of the ninth lesson).

9. Reading of text and discussion - P. 181-184.

a. Solution

(1) Solvent, solute.
(2) Soluble, insoluble.
(3) Saturated, dilute, strong solution.

b. Diffusion and Osmosis

10. Reading of text and discussion. P. 184-192.

c. Crystallization.

d. Evaporation and condensation.

e. Conditions aiding evaporation.

f. Humidity.

g. Distillation.
(1) Residue, distillate.

h. Filtration.
(1) Residue, filtrate.

D. Chapter XVIII. Making atmosphere work.

11. Experiments on atmosphere. P. 194-195.

a. Is a tumbler ever empty?

b. Has air weight?

c. Does air exert pressure?

d. Siphon.

12. Experiments on atmosphere. P. 196.

e. Bicycle pump.

f. Compressed air.

g. Vacuum cleaner.

h. Pin wheel

13. Reading of text and discussion. P. 197-202.

a. Is a tumbler ever empty?

b. Pressure of atmosphere.

c. The Siphon.

d. Raising a weight by atmospheric pressure

e. Compressed air.

f. Questions.

Second six weeks.

E. Chapter XIX. Making work easier.

14. Experiments on work - pp. 203-205.

a. What are levers and how do they work?

b. Application of lever.

15. Experiments on work - pp. 205-206.

d. Do pulleys save work?

d. Does inclined plane save work?

e. Screws.

16. Reading and discussion - pp. 207-213.

a. Meaning of work
(1) Motion produced.
(2) Resistance overcome.
(3) Energy expended.

b. The see-saw.

c. Other levers.

17. Reading and discussion - pp. 213-219.

d. Pulleys
(1) Fixed
(2) Movable

e. Inclined plane

f. Screws

g. Wedge

h. Friction

F. Chapter XX. Heat and some of its uses.

18. Experiments on heat. P. 220.

a. & b. are questions on previous work.

c. Are solids good conductors of heat?

d. Is water a good conductor of heat?

e. What happens when water is heated from below?

19. Experiments on heat. pp. 221-222

f. What happens when air is heated?

g. What makes a draft upward?

h. What makes a draft downward?

i. What happens when a solid is heated?

20. Reading and discussion - pp. 223-229.

a. Conduction.

b. Convection.

c. Effect of heat on water.

d. Convection defined.

e. Effect of heat on solids.

f. Management of kitchen stove.

21. Reading and discussion - pp. 230-236.

g. Fireless cooker.

h. Refrigerator.

i. Thermos bottle.

j. Hot air heating.

k. Hot water heating.

l. Steam heating.

m. Humidity of air in building.

n. Winds, currents, and climate.

22. Supplement - General Science by Snyder.

On winds - pp. 275-278.

a. Circulation of air.

b. Doldrums.

c. Trade winds.

d. Effect of earth's rotation on winds.

e. Horse latitudes.

f. Prevailing westerlies.

g. Anti-trade winds.

Lessons:

23. Supplement - General Science by Snyder - pp. 278-285.

a. Wind and weather.
   (1) Relation of westerlies to our weather.
   (2) Charting.
   (3) How weather maps are made.
   (4) Storm area.

24. Supplement - General Science by Snyder - pp. 285-293.

a. Weather and climate.

b. Thunderstorms.

c. Tornadoes.

25. Supplement - General Science by Snyder - pp. 293-300.

a. Effect of mountains.

b. Effect of ocean currents.

c. Effect of large bodies of water.

d. Day and night effects along a shore.

f. Summer and winter effects along a shore.

26. Summary and questions on what is taken from General Science by Snyder.

27. Supplement - General Science by Snyder pp. 177-187.

a. Pressure of atmosphere.
   (1) Atmosphere exerts pressure equally in all directions.
   (2) Why water rises in a lift pump.
   (3) Measuring atmospheric pressure.
   (4) Barometer and uses.
   (5) Why balloons and airships ascend.
   (6) Helium for U. S. airships.

28. Supplement - General Science by Snyder —. 187-196.

a. Machines that make use of air pressure.
   (1) Siphon.
   (2) Vacuum cleaner.
   (3) Compressed air.
   (4) Force pump.
   (5) Heat produced by compression and colling.
   (6) Liquid air.
   (7) Pressure and the boiling point.
   (8) Pressure cooker.

29. Supplement - General Science by Snyder. pp. 197-207.

a. Water.
   (1) Water is essential to our existence.
   (2) Composition of water.
   (3) Water as a carrier of heat.
   (4) Force of freezing water.

b. Water as a sculptor
   (1) What becomes of the rain.
   (2) Work of running water.
   (3) Carrying power of water.
   (4) Rivers as destroyers.
   (5) Rivers as builders.
   (6) Waves as destroyers.
   (7) Waves as builders.

30. Supplement - General Science by Snyder. pp. 207-217.

a. Checking the floods; Forestry; Reclamation.

   (1) Protecting upland soils from erosion.
   (2) Damage caused by removal of forests.
   (3) Reckless waste.
   (4) Necessity of scientific forestry.
   (5) Reclaiming the lowlands.

31. Supplement - General Science by Snyder - P. 217-228.

a. Rain that soaks into the ground.
   (1) Evaporation.
   (2) How ground water returns to surface.
   (3) Earths crust like a giant sponge.
   (4) Water-table.
   (5) Wells and springs.
   (6) Hot springs.
   (7) Artesian wells.
   (8) Why under ground waters are clear.

b. Water as a solvent.
   (1) Greatest of all solvents.
   (2) How water is purified (distillation).
   (3) Salt water and fresh water.
   (4) Water dissolves air and other gasses.
   (5) How water hollows under ground caverns out of rock.
   (6) How hard water builds columns of rock.

C. Chapter XXI. Making a fire.

32. Experiments on fire. P. 222.

a. What happens when a match is struck?

b. Does air help things to burn?

c. What keeps the fire burning in the range or furnace?

33. Reading and discussion. P. 237-244.

a. Burning of a match
   (1) Heat and oxygen.

b. Laying the fire.

c. Products of burning.

d. Oxygen necessary for burning.

e. Putting out a fire.

f. Preventing fires.

g. Questions.

H. Chapter XXII. How things burn in air.

54. Divided into two parts on how things burn in air. P. 246-250.

a. Experiments.
(1) How does sulphur burn?
(2) How does phosphorous burn?
(3) Of what is air composed?

b. Reading and discussion.
(1) Physical and chemical changes.
(2) Oxides and oxidation.
(3) Spontaneous combustion.
(4) Nitrogen
(5) Oxidation in human body
(6) Questions.

I. Chapter XXIII. Making mortar.

55. Experiments on mortar. P. 252.

a. How is mortar made?

b. What is effect of adding more water?

56. Reading and discussion. P. 253 - 255.

a. Lime, unslaked and slaked.

b. Unslaked lime an oxide.

c. Slaked lime a hydroxide.

d. Is calcium hydroxide soluble in water?

e. Uses of unslaked lime.

f. Questions.

Third six weeks.

J. Chapter XXIV. Acid, Alkaline and Neutral substance.

57. Experiments on acid, alkaline and neutral substances.

a. How does the substance affect litmus?

b. What is effect of an alkaline substance on an acid?

K. Chapter XXV. Making of soap.

39. Experiments on soap. P. 260.

a. Will oil and vinegar mix?

b. Will oil and soda lye mix?

c. Will lime water make suds?

40. Reading and discussion. P. 261-265.

a. Home-made soap.

b. Emulsion produced by physical change.

c. Soap produced by chemical change.

d. Soap suds.

e. Hard and soft water.

f. Questions.

L. Chapter XXVI. Metals and Non-Metals.

41. Observations, Reading, and discussion. P. 264-269.

a. Elements and compounds.

b. Iron and steel.

c. Characteristics of metals.

d. Characteristics of non-metals.

e. Forms of carbon.

f. Questions.

M. Chapter XXVII. Making a light.

42. Experiments on light and flames. P. 270.

a. Observations on Bunsen burner.

b. Why does flame sometimes give more heat and sometimes more light?

c. Why is the flame that vies light not all the same color?

d. What makes the flame of a candle?

e. Is light always caused by a flame?

43. Experiments on light and flame. 271-272.

f. What kind of substances reflect light best?

g. What kind of an image does a mirror make?

h. What happens to light when it passes from water to air?

i. What happens to light when it passes through a magnifying glass?

j. Will a magnifying glass make an image?

44. Reading and discussion. 273-279.

a. Lighting a candle.

b. Candle flame.

c. Other ways of making a light.

d. Reflection.

e. Diffusion of light.

f. Transmission of light.

45. Reading and discussion. 279-286.

g. Absorption of light.

h. Indirect lighting.

i. Proper position for reading.

j. Refraction.

k. Lens and focus.

l. Eye.

M. Questions.

N. Chapter XXVIII. Magnets and electricity.

46. Experiments on magnets. p. 287.

a. What does the magnet attract?

b. Effect of heat on magnet?

c. Show law of magnets.

d. Magnetic field around poles of magnet.

47. Experiments on electricity, pp. 287-288.

a. Rub sealing wax on hard rubber with wool.

b. Rub glass rod with silk.

c. Prove law of like and unlike charges of electricity.

48. Reading and discussion, pp. 289-292.

a. Lode stone.

b. Power of magnets.

c. Magnetic field.

d. Law of magnetic attraction.

e. Compass.

f. Production of electric charges.

Fourth six weeks.

49. Reading and discussion - pp. 292-295.

g. Positive and negative charges.

h. Electric discharge.

i. Questions and review.

50. Supplement - General Science by Snyder, pp. 543-552.

a. Electricity as first known.
   (1) Electricity by friction.

b. Serviceable electrical energy.
   (1) Current electricity.
   (2) Force of an electric current.
   (3) Dangers and safe guards in an electric circuit.

51. Supplement - General Science by Snyder, pp. 552-559.

b. of above mentioned.
   (4) Electric lighting.
   (5) Other devices that make use of heat of resistance.
   (6) Measuring the electric current and computing cost.
   (7) Electroplating.

52. Supplement - General Science by Snyder, pp. 559-560.

c. Magnetism and electricity yoked, for service.
(1) Magnetism.
(2) Permanent magnets.
(3) Magnetic field of force.
(4) Electromagnets.
(5) Electric bell.
(6) Electric telegraph.
(7) Telegraphic communication.
(8) Greatest electrical discovery.
(9) Telephone.

53. Supplement Gen. Sci. by Snyder, pp. 569-575.
(10) Dynamo.
(11) Electric motor.
(12) Theory of electricity.
(13) All forms of energy are related.
(14) Review.

54. Supplement making the electromagnet and simple telegraph.

55. Review of electricity.

O. Chapter XXIX. Noise and music.

56. Experiments on sound - p. 296.

a. How is sound produced?

b. What makes difference in pitch of sounds?

c. Can sound be carried through different substances?

57. Reading and discussion, pp. 297-301.

a. Production of sound.

b. Loudness and pitch.

c. Conduction of sound.

58. Reading and discussion, pp. 302-306.

d. Noise and music.

e. Echoes.

f. Concentration

g. Reinforcement.

h. Characteristics of sound.

i. Human voice.

59. Questions and review of sound.

Fifth six weeks.

60. Supplement General Science by Snyder, pp. 1-11.

a. Groupings and apparent movements of stars.
(1) Star groups.
(2) Apparent movement of stars.
(3) North pole of heavens.

61. Supplement General Science by Snyder, pp. 11-19.

b. Our solar family.
(1) Wanderers.
(2) Size and appearance of planets.
(3) Sun.
(a) Size.
(b) Surface.
(c) Gift of heat and light.

62. Supplement General Science by Snyder, pp. 19-24.

c. Distant suns.
(1) Stars are distant suns.
(2) Light from stars and planets.
(3) Review.

63. Supplement General Science by Snyder, pp. 24-30.

a. Movements of Heavenly bodies.
(1) Day and nights on planets.
(2) Years on the planets.
(3) Why planets are not perfect spheres.
(4) Grandchildren of sun.

64. Supplement General Science by Snyder, pp. 30-36
(5) Phases of our moon.
(6) Surface of our moon.
(7) Eclipse of sun and moon.
(8) Meteors and comets.

65. Supplement General Science by Snyder, pp. 36-44.

(9) Movements of sun and stars.

b. Why solar family keeps together.
(1) Gravitation.
(2) Meaning of inertia.
(3) Why planets move in curved paths.
(4) Mapping courses of planets.

66. Supplement General Science by Snyder, pp. 44-54.
(5) Causes of ocean tides.

c. Determining location and measuring time.
(1) Direction.
(2) Location.
(3) Measurement of time.
(4) Standard time.
(5) International date line.

67. Supplement General Science by Snyder, pp. 267-273.

a. Changing days and seasons.
(1) Inclination of earth's axis.
(2) Days and nights of varying length.
(3) Daylight saving.
(4) Causes of seasons.

68. Supplement General Science by Snyder, pp. 302-314.

Story of rocks and soils.

a. Tearing down forces.
(1) Water.
(2) Wind.
(3) Decay.

b. Story of rocks.
(1) How different kind of rocks were formed.
(a) Sedimentary.
(b) Igneous.
(c) Metamorphic.
(2) Origin of coal and oil.

69. Supplement General Science by Snyder, pp. 314-325.
(3) Story of ancient life found in rocks.

c. Transportation of soils.
(1) Local and transported soils.
(2) Water as a carrier.
(3) Wind-borne soils.
(4) Ice as a builder of soils.
(5) How ice does its work.
(6) Continental ice mates.
(7) What the ancient glaciers did in North America.

70. Review of previous lessons from Snyder.

71. Supplement General Science by Shyder, pp. 456-466.

Animal life.

a. Lowest forms of life.
   (1) Protozoa.
   (2) Worms.

b. Work of insects.
   (1) Insects
   (2) Friendly and unfriendly insects.
   (3) Productive insects.

72. Supplement General Science by Snyder, pp. 466-481.
   (4) Insects that spread disease.

c. Higher forms of life.
   (1) Vertebrates.
   (2) Lowest forms of vertebrates.
   (3) Birds.
   (4) Mammals.
   (5) Man's war against predatory mammals.

73. Supplement General Science by Snyder, pp. 150-155.

Heat and earth's crust.

a. A theory of earth's beginnings.

b. A molten sphere.

c. Interchange of sea and land.

d. Within earth's crust.

74. Supplement General Science by Snyder, pp. 155-161.

e. Mountain building.

f. Earthquakes and volcanoes.

g. Tidal waves.

75. Supplement General Science by Snyder, pp. 532-536.

Steam engine, gas engine, and the auto.

a. Man's most important energy transformers.

b. Steam engine.

c. Steam turbine.

76. Supplement General Science by Snydor, pp. 536-542.

d. Gas engine.

e. Automobile engine.

f. Transmission of power in automobile.

g. Lubrication and cooling.

This outline is 14 lessons short of 90 lessons, but the remaining lessons can very profitably be taken up by outside paper clippings, or other other problems outside.

# RUCH-POPENOE GENERAL SCIENCE TEST

By GILES M. RUCH, PH.D.
Assistant Professor of Psychology, University of Iowa
and HERBERT F. POPENOE, A.B.
Stanford University

## EXAMINATION: FORM A

Primarily for Grades 8 and 9

---

*Do not open this paper*, or turn it over, until you are told to do so. Fill these blanks, giving your name, age, birthday, etc. Write plainly.

Name .....
(First name, initial, and last name)

Age last birthday ..... years. Birthday .....
(Month and day)

Grade ..... Teacher .....

School ..... City .....

Date of examination .....

| PART | SCORE |
|---|---|
| I | |
| II | |
| TOTAL | |

Published by World Book Company, Yonkers-on-Hudson, New York, and 2126 Prairie Avenue, Chicago

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# PART I

DIRECTIONS. Draw a line under the one word or phrase that makes the truest answer to the question, as shown in the sample.

SAMPLE. An example of a liquid is iron glass air <u>water</u> lead zinc oxygen

---

Begin here.

1 Pneumonia is a disease of the heart liver lungs brain stomach muscles kidneys 1

2 Volcanoes are most likely to be found in
deserts valleys coastal plains mountains deltas interiors islands..... 2

3 Distance above sea level is called
longitude rotation altitude latitude declination revolution inclination..... 3

4 The earth rotates on its axis once in
12 hours 24 hours 7 days 31 days 3 months 365¼ days 4 years..... 4

5 An example of a rock which weathers rapidly is
granite marble slate schist augite obsidian limestone..... 5

6 Radium was discovered by
Edison Marconi Burbank Davy Curie Metchnikoff Einstein..... 6

7 An example of oxidation is the
rusting of iron electrolysis of water melting of ice dissolving of salt
action of acid on marble heating potassium chlorate boiling of water..... 7

8 "Shooting stars" are properly called
planets suns nebulæ asteroids moons comets meteors..... 8

9 The capacity to do work is termed
energy inertia momentum efficiency mechanical advantage mass velocity.. 9

10 When a liquid contains all the dissolved substance possible, the condition is termed
osmosis permeability fusion neutralization reduction transpiration saturation 10

11 The handle of a skillet becomes hot as the result of
convection resistance conduction expansion friction radiation latent heat.. 11

12 The best "all-round" fertilizer is probably
lime bone meal dried blood Chile saltpeter manure ammonium nitrate
calcium phosphate..... 12

13 Poisonous products secreted by bacteria are called
enzymes anti-bodies toxins vaccines ferments hormones legumes..... 13

14 The law of gravitation was discovered by
Archimedes Galileo Priestley Copernicus Aristotle Newton Marconi..... 14

15 An organism which reproduces by means of spores is the
maple amœba bread mold sponge earthworm minnow cedar..... 15

16 Sunlight can be broken up into the spectrum by means of a
telescope mirror burning glass lens prism microscope color-mixer..... 16

17 The act of transfer of pollen from anther to stigma is called
pollination reproduction fertilization transpiration mitosis adaptation filtration 17

18 Images are formed by the passage of light through a
prism helix ampere lens diaphragm mirage spectrum..... 18

19 The propelling mechanism of a machine is termed the
chassis piston motor differential carburetor governor fly-wheel..... 19

20 The separation of liquids and solids by evaporation and condensation is called
solution distillation diffusion fusion transpiration reduction pasteurization 20

21 A mirage is a kind of
swamp rainbow body of water optical illusion vision desert warfare..... 21

22 Decaying vegetable matter in the soil is termed
fungus nitrates mineral phosphates lichens potash humus..... 22

23 The smallest of the planets is Mercury Venus Mars Jupiter Saturn Uranus Neptune 23

24 The length of a meter in inches is about **12 19 24 2 39 47 144** ..... 24

25 A general term for any living thing is a
**plant cell larva animal organism mammal nucleus** ..... 25

26 A violent circular windstorm of small area is a
**cyclone tornado monsoon trade wind norther blizzard equinox** ..... 26

27 A collection of similar cells is called an
**organism tissue organ gland muscle sense-organ function** ..... 27

28 The watt is the unit of measurement of
**resistance current velocity power potential inductance friction** ..... 28

29 The unborn young of an animal is termed the
**larva embryo pupa adult chrysalis ovum sperm** ..... 29

30 An example of a chemical element is
**water glass mercury carbon dioxide ammonia nitric acid sugar** ..... 30

31 All space is believed to be filled with **air oxygen nitrogen ether hydrogen heat moisture** 31

32 Electrolysis of water liberates hydrogen and
**chlorine nitrogen carbon dioxide ammonia acetylene oxygen bromine** ..... 32

33 Pollen is produced in the **ovary calyx corolla stamen receptacle stigma pistil** .... 33

34 Pasteurization of milk is produced by
**boiling evaporation chemical agents moderate heating freezing cooling** ..... 34

35 The mercurial barometer reads at sea level about
**10 inches 18 inches 30 centimeters 30 inches 100 inches 980 inches 1 meter** 35

36 Heat can pass through a vacuum only by means of
**fusion convection conduction capillarity radiation gravitation combustion** .. 36

37 The process of food manufacture in green plants is called
**respiration transpiration digestion mitosis pollination photosynthesis pasteurization** 37

38 The greatest vertical height to which water can be siphoned is about
**30 inches 10 feet 30 feet 40 feet 100 yards 1 mile 5½ miles** ..... 38

39 The anther is a part of the **calyx corolla receptacle ovary pistil stamen petiole** 39

40 A small calorie is the amount of heat necessary to raise the temperature of one gram of water
**1° C. 2.4° C. 32° F. 100° C. 212° F. 212° C. 1000° F.** ..... 40

41 An example of a leguminous plant is the **willow clover toadstool pansy lilac moss maple** 41

42 An example of an alkali is
**aluminum lead oxide sodium hydroxide table salt mercury potassium chlorate glucose** ..... 42

43 The distinguishing feature of the mammals is the possession of
**backbones hair two pairs of legs warm blood milk glands nervous systems teeth** 43

44 The one of these substances having the highest specific heat is
**water iron glass lead copper soil rubber** ..... 44

45 "Hypo" is used in photography as a
**developer fixing bath intensifier reducing agent bleaching agent sepia-toner hardening bath** ..... 45

46 Glucose is found in large quantities in
**eggs grapes olive oil beefsteak onions rice tapioca** ..... 46

47 The calyx is made up of the **petals stamens petioles leaves pistils sepals stipules** 47

48 Fusion means the same as
**evaporation melting boiling freezing dissolving distilling burning** ..... 48

49 A metal which can be drawn into fine threads is said to be
**elastic ductile flexible malleable amorphous magnetic viscous** ..... 49

50 The attraction between molecules of a body is called
**capillarity adhesion magnetism inertia buoyancy cohesion convection** ..... 50

*Score in Part I*_____

# PART II

DIRECTIONS. On this page and the following pages there are 20 diagrams and several statements about each diagram. Part of each statement is left blank. You are to fill each blank so as to make a true statement. Make the statements as complete and definite as possible. In most cases you will need to write but ONE WORD in each blank. You will be given 25 minutes to do this part of the test

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**Begin here.**

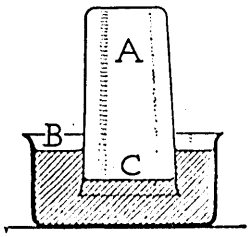



FIGURE 1

*a* The water does not rise to fill the tumbler completely because of the .....of the air in the tumbler. *a*

*b* The fact that the water has risen a short distance into the tumbler as shown at C shows that air is slightly.....under pressure. *b*

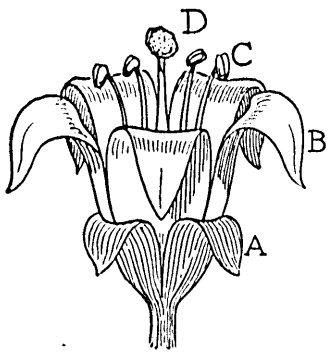



FIGURE 2

In this diagram of a typical flower:

*a* The petals (the corolla) are marked by the letter..... *a*

*b* The stamens are marked by the letter ..... *b*

*c* The sepals (the calyx) are marked by the letter ..... *c*

*d* The pistil is marked by the letter ..... *d*

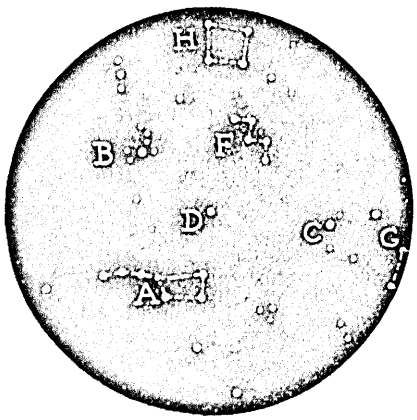



FIGURE 3

*a* The North Star (Polaris) is marked by the letter..... *a*

*b* The Big Dipper is marked by the letter ..... *b*

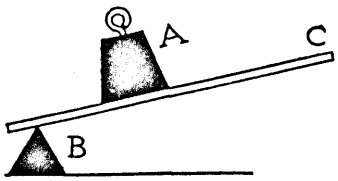
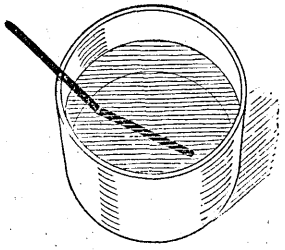



FIGURE 4

*a* In this lever the power or force is applied at ..... *a*

*b* The fulcrum is placed at the point marked ..... *b*

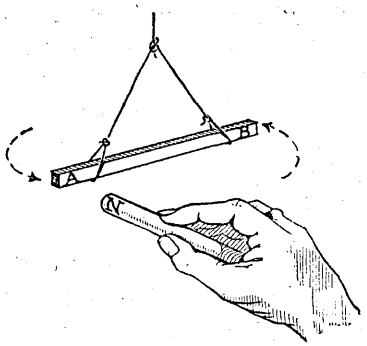
*c* The mechanical advantage of a lever of this class is always .....than 1. *c*



## Figure 5

*a* This diagram illustrates the facts of the.....of light. *a*

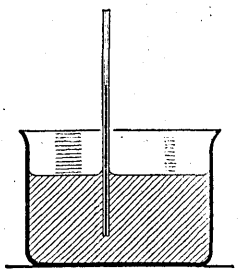
*b* The amount of apparent bending of the stick depends upon the .....of the liquid. *b*




## Figure 6

*a* In the bar magnet suspended by the strings, the north pole is the one marked..... *a*

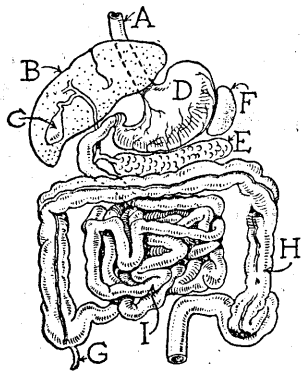
*b* The law of magnets states that.....poles .....each other and that.....poles .....each other. *b*



## Figure 7

*a* This diagram illustrates the facts of ..... *a*

*b* The rise of liquids in small tubes is ..... proportional to the.....of the tubes. *b*




## Figure 8

In this diagram of the digestive tract:

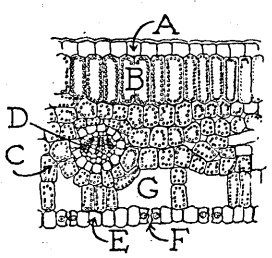
*a* The small intestine is lettered..... *a*

*b* The œsophagus is lettered ..... *b*

*c* The liver is lettered ..... *c*

*d* The stomach is lettered ..... *d*

*e* The pancreas is lettered ..... *e*




## Figure 9

*a* This is a drawing of a cross section of a ..... *a*

*b* The palisade layer is marked by the letter ..... *b*

*c* A vein is marked by the letter ..... *c*

*d* The mesophyll layer is marked by the letter..... *d*

*e* A stoma is marked by the letter ..... *e*

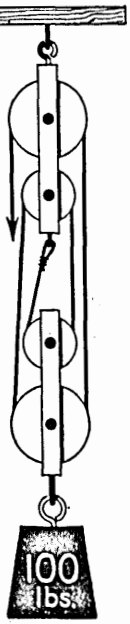



FIGURE 10

*a* The mechanical advantage of this pulley system is..... *a*

*b* The rule for the mechanical advantage of any pulley system is that the mechanical advantage is equal to the number of times the cord passes to and from the.....pulley. *b*

*c* Disregarding friction, the force needed to lift the 100-pound weight shown is.....pounds. *c*

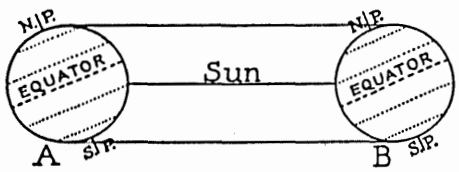



FIGURE 11

*a* In the northern hemisphere the season is..... when the earth is in the position marked A, and it is..... *a* when the earth is in the position marked B.

*b* In the northern hemisphere the season is..... *b* when the sun's rays fall directly upon the Tropic of Cancer.

*c* The season is.....when the sun's rays fall *c* directly upon the equator.

*d* The season is.....when the sun's rays fall *d* directly upon the Tropic of Capricorn.

*e* The earth's axis is inclined at an angle of about..... *e* degrees to the plane of its orbit.

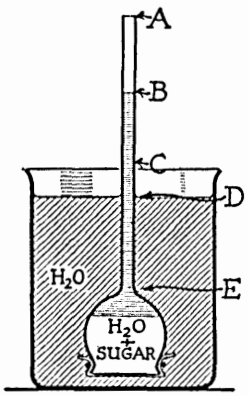



FIGURE 12

The thistle tube shown in the drawing has been filled with a colored solution of sugar. A piece of parchment membrane was then tied over the mouth of the thistle tube and the tube was then inverted in a jar of water.

*a* This apparatus illustrates the facts of..... *a*

*b* The final level of the liquid in the tube will be nearest the point marked..... *b*

*c* A similar principle is involved in the exchange of..... .....and.....in the lungs of animals. *c*

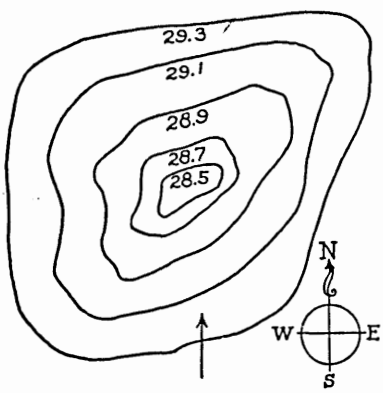



FIGURE 13

*a* In the barometric map shown at the left, the region shown is termed a..... *a*

*b* The more or less circular curved lines are called ..... *b*

*c* A wind blowing from the south, as shown by the arrow, in the northern hemisphere will be turned to the....., due to the.....of the earth. *c*

*d* It is most likely to rain in the.....half of this *d* area.

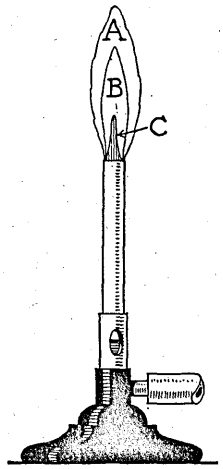



FIGURE 14

In this diagram of the main parts of a flame:

*a* The burning zone is marked by the letter ..... *a*

*b* The region of unburned gas is marked ..... *b*

*c* The region made up of the products of combustion is marked ..... *c*

*d* The chief products of combustion (burning) besides heat are:

1. .....

2. ..... *d*

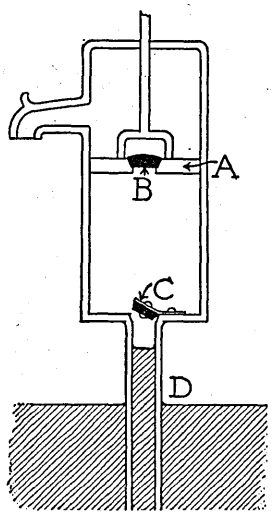



FIGURE 15

*a* This is a drawing of a..... ..... *a*

*b* The piston is lettered ..... *b*

*c* The valve which opens on the upstroke is lettered..... *c*

*d* The greatest distance that valve C can be placed above the level of the water at D, if the instrument is to work successfully, is about .....feet. *d*

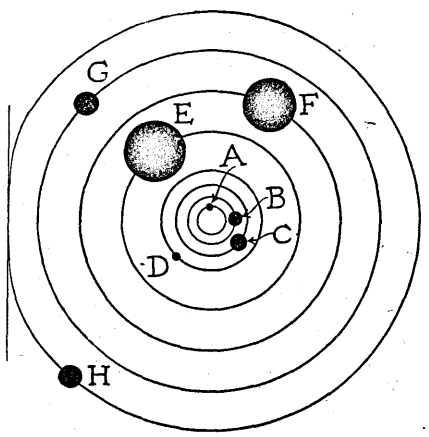



FIGURE 16

In this diagram the earth is the planet marked C.

*a* Mars is the planet marked ..... *a*

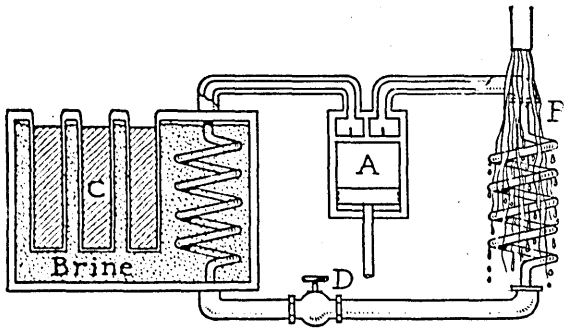
*b* Jupiter is the planet marked ..... *b*

*c* Mercury is the planet marked..... *c*

*d* Saturn is the planet marked ..... *d*

*e* Uranus is the planet marked ..... *e*

FIGURE 17




In this drawing of an artificial ice plant:

*a* The freezing vats are located at ..... *a*

*b* The condensing pump is located at..... *b*

*c* The principle involved in the manufacture of artificial ice by ..... is that the liquid turns into a..... when the pressure is removed and, in so doing, it takes up ..... from the brine, which in turn..... the temperature of the..... in the freezing vats. *c*

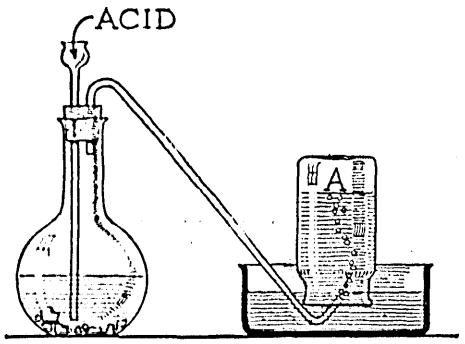
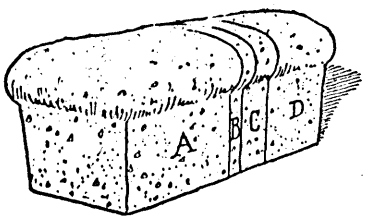



FIGURE 18

*a* In the apparatus shown, some hydrochloric acid has just been poured into the thistle tube so as to act on the bits of marble (limestone) in the flask. The gas which is being collected at A is ..... *a*

*b* If this gas is passed into ....., a.....will be formed. *b*

FIGURE 19



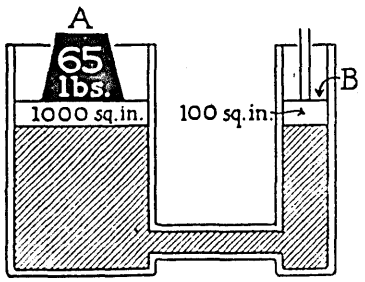

In this loaf of bread the food materials which are contained in bread are shown in rough proportions by the parts A, B, C, and D.

*a* The fat content is the section marked by the letter..... *a*

*b* The carbohydrate content is the section marked ..... *b*

*c* The water content is the section marked ..... *c*

FIGURE 20




This diagram represents a hydraulic press.

*a* If the small piston B has an area of 100 square inches, and the large piston A has an area of 1000 square inches, a force of..... pounds must be applied at B to lift the 65-pound weight. *a*

*b* Complete this statement: "A force applied at one point in a liquid is transmitted.....in all....." *b*

*Number of blanks correctly filled* _____ ÷ 2 = *Score in Part II* _____

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Form T-2

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| | Number items incorrect | | Errors | Scores Corrected (See direction—booklet, page 5) |
|---|---|---|---|---|
| Group III | ..... | ÷2 | ..... | (Key A) Uncorrected Score ..... |
| Group II | ..... | ÷2 | ..... | Total Errors, Groups I & II ..... |
| Group I | ..... | ÷2 | ..... | First Corrected Score ..... |

Number Errors, Group I (Key B) .....

Final Score .....

# GENERAL SCIENCE SCALE

**Arranged by AUGUST DVORAK**

Name .....
(i.e., last name; first name; middle name)

Age: .....years.....months. Grade.....
(i.e., 7th, 8th, 9th, 10th, 11th, 12th)

Sex..... Date.....
(Girl or boy)

School .....

City..... State.....

Room..... Teacher.....

## DIRECTIONS

On the following pages are statements, such as—

"A fly is an animal, a fish, an insect, a reptile, a building."

You can make each of these a **true statement** by underlining the correct one of the five parts printed in large, black type. For instance, in the statement above it is plain that a fly can not be all of the five things printed in large, black type. A fly is an insect. So if you underline "an insect," the statement will read—

"A fly is an animal, a fish, an insect, a reptile, a building."

By underlining "an insect" you have shown that you know which of the five parts is correct.

In the statement—"The heart pumps blood, water, oil, air, sand." "Blood" should be underlined.

---

**Underline the one of the five parts in each of the statements on the following pages which will make the statement most true.**

**Work rapidly and carefully.**

No. incorrect.....

## GROUP I. FORM T-2 (Average value 71.5)

1. House flies lay their eggs
in wood, on the water, in animal and vegetable waste, in nests, in the sand.

2. Distillation is a means of purifying water, securing air pressure, pumping water, transmitting water, securing heat.

3. The earth rotates on its axis once in
12 hours, 24 hours, 7 days, 3 months, 365¼ days.

4. Wounds should be allowed to bleed
a little, not at all, until they stop naturally, a great deal, quantities.

5. The yellow dust on a flower is
chlorophyll, ovules, protoplasm, pollen, dirt.

6. All our food comes directly or indirectly from
rock, animals, plants, air, mines.

7. A dynamo is a machine for generating
heat, light, electric current, sound, music.

8. Ice cracks rock because it is cold, water expands when it freezes, it melts when it gets warm, it is heavy, it is brittle.

9. When the child's first permanent teeth appear he is
6 or 7 years old, 12 years old, 18 years old, 20 years old, 30 years old.

10. The kidneys digest food, clean blood of wastes, build up new blood cells, support the backbone, are useless.

11. The path of a heavenly body is called its
orbit, radius, equator, latitude, declination.

12. Mosquitoes lay eggs on salt water, on stagnant water, on fresh water, on the ground, in garbage.

13. The following gas is found in impure air:
calcium, gold, carbon-dioxide, carbon, sodium.

14. The purpose of flowers on a plant is to develop
roots, seeds, leaves, perfume, branches.

15. An eclipse of the sun is due to the position of the
stars, planets, moon, constellations, milky way.

16. Black smoke from muffler indicates
too much air, too much gas, too little gas, engine too hot, broken clutch.

17. Images are formed by the passage of light through a
prism, helix, lens, diaphragm, spectrum.

18. The teeth should be examined by a dentist every
year, half year, two years, month, ten years.

19. The purpose of the roots of plants is to take in oxygen, manufacture starch, give off $CO_2$, take in soil water, give off waste matter.

20. The best temperature for a living room is
60 F., 68 F., 75 F., 78 F., 80 F.

No. incorrect.....

GROUP II. FORM T-2. (Average value 81.5)

21. On a curve, the tracks are higher in the inside than outside, higher outside than in, same height, wider, narrower.

22. Water freezes at 0 F., 32 F., 42 F., 98.6 F., 100 F.

23. "Shooting stars" are properly called suns, asteroids, moons, comets, meteors.

24. An illustration of capillarity is found in the ink blotter, thermometer, barometer, force pump, excretion of urea.

25. When a liquid contains all the dissolved substance possible, the condition is termed osmosis, permeability, fusion, reduction, saturation.

26. The separation of liquids and solids by evaporation and condensation is called solution, distillation, diffusion, fusion, transpiration.

27. An example of oxidation is the rusting of iron, electrolysis of water, melting of ice, action of acid on zinc, heating potassium chlorate.

28. The corolla is made up of the petals, pistils, sepals, stamens, ovaries.

29. The ampere is a measure of air pressure, humidity, resistance, current, potential.

30. Ventilation is best secured with stoves, hot air furnaces, steam heating, hot water heating, electric heat.

31. Rain is water vapor distilled, evaporated, condensed, filtered, concentrated.

32. Isobars are used in temperature, air pressure, humidity, winds, gravitation.

33. Water cannot be siphoned out of a boat because of unequal air pressure, of unequal amounts of water, water in boat is too low, of suction, of attraction of water particles for each other.

34. The object to be photographed must be in the sun to absorb the light, reflect the light, be seen, cast a shadow, transmit the light.

35. The hottest flame is blue, green, white, yellow, red.

36. Cheese is rich in fats, proteins, oils, carbohydrates, water.

37. A collection of similar cells is called an organism, tissue, gland, muscle, function.

38. Heat is carried horizontally through air by conduction, convection, radiation, erosion, transmigration.

39. A lifting crane gains power in doing work, by the use of the wheel and axle, the lever, the pulley, the inclined plane, an engine.

40. The largest of the planets is Venus, Saturn, Mars, Jupiter, Earth.

No. incorrect.....

GROUP III. FORM T-2. (Average value 91.5)

41. A chimney on a lamp is for ornamentation, to make the light more intense, to create a draft, to make the flame burn, to save oil.

42. An example of a lever of the first class is found in the nut cracker, scissors, wheel barrow, inclined plane, biceps muscle.

43. The density of a solid is usually compared with that of air, hydrogen, water, lead, wood.

44. Pollen is produced in the ovary, calyx, stamen, stigma, pistil.

45. The ratio of the number of units of force applied to a machine to the number of units of force delivered by a machine is called efficiency, out-put, available energy, mechanical advantage, waste.

46. An example of a chemical element is water, carbon-dioxide, mercury, ammonia, nitric acid.

47. The cheapest food on the basis of calorific value is wheat flour, butter, meat, milk, celery.

48. The foot-pound is a unit of energy, work, distance, weight, capacity.

49. The resistance a body offers to being set in motion is called momentum, friction, cohesion, erosion, inertia.

50. The best illumination or light for working or reading is direct, reflected, indirect, white, blue.

51. Refraction is studied in connection with sound, gravity, falling bodies, light, electricity.

52. Gases enter and leave the leaves of plants through organs called stipules, root-hairs, stomata, micropyles, chloroplasts.

53. The nucleus is believed to play a prominent part in digestion, respiration, heredity, storage of food, nerve-conduction.

54. The general direction of the wind in front of a low pressure area is east, west, north, south, northeast.

55. Petroleum is a chemical compound, a chemical element, a mixture, a pure substance, an impure substance.

56. The vaccine used to prevent typhoid fever consists of bacterial cells, horse blood serum, anti-toxin, a chemical preparation, acids.

57. The part of the eye that regulates the entrance of light is the pupil, iris, retina, eye-lid, lens.

58. The distinguishing features of the mammals is the possession of backbones, hair, two pairs of legs, milk glands, nervous systems.

59. The attraction between molecules of a body is called capillarity, adhesion, magnetism, cohesion, convection.

60. Water rises in a suction pump because it is pulled up, pushed up, attracted, repelled, sucked up.

# POWERS GENERAL SCIENCE TEST

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FORM A

Name ..... Boy or Girl ..... Grade .....

Age last birthday ..... Date of birthday .....

Name of school ..... Name of city .....

Name of teacher ..... Date .....

If you have studied any of the following subjects, indicate in the blanks the length of time:

General Science ..... Months ..... Periods per week

General Biology ..... Months ..... Periods per week

..... Months ..... Periods per week

This is a test of information in science. The directions for each of the three parts of the test, and the test items are arranged below and on the following pages. You will probably not be able to make a perfect score on the test, but work carefully and complete as much of it as you can. Begin with Part I. When you have finished as much of one part as you can, go on to the next.

## PART I

In Part I you are to underline the one word (or group of words) which most satisfactorily completes the statement.

ILLUSTRATION: Paper is made from

leather straw leaves metal wool silk

In the illustration *straw* is underlined because straw is the only thing named from which paper is made. Complete as many of the following sentences as you can.

1. Water rises in a lift pump because of
   cohesion buoyancy inertia air pressure diffusion capillary attraction 1.

2. The substance from the air which takes part in the chemical change known as burning is
   nitrogen oxygen water vapor carbon dioxide argon hydrogen 2.

3. A magnet will attract
   silver copper glass wood gold iron 3.

4. A gas which is present in pure air in very small amounts, but which is present in larger amounts in air as it comes from the lungs is
   nitrogen oxygen carbon dioxide helium hydrogen argon 4.

5. Disease bacteria which are frequently carried by water are
   typhoid tuberculosis syphilis diphtheria smallpox malaria 5.

6. The electric light bulb was invented by
   Watt Volta Henry De Forest Marconi Edison 6.

7. The path of the earth about the sun is called its
   equator zodiac circumference inclination orbit perimeter 7.



10L.9.26.II

8. Vitamins are contained in
good water some foods pure air some salts coffee some minerals 8.

9. Moisture enters the air by a process called
osmosis filtration condensation evaporation fusion dissolving 9.

10. The earth receives heat from the sun by
convection condensation cohesion refraction radiation conduction 10.

11. Water flows through a siphon because of
the pull of the water the size of the tube suction momentum air pressure capillarity 11.

12. An example of a good conductor of heat is
glass wood wax water air iron 12.

13. Milk which has been pasteurized has been
chilled frozen boiled heated to a temperature above boiling
carefully protected from contamination heated to a relatively high temperature but not boiled 13.

14. Air pressure at sea level in pounds per square inch is about
12 15 62.5 2.2 27 40 14.

15. The pulse rate per minute of an adult man in normal health is about
44 50 64 72 90 98 15.

16. Water is separated from dissolved minerals by a process called
distillation filtration sedimentation displacement coagulation precipitation 16.

17. Coke is manufactured from
charcoal lignite peat wood hard coal soft coal 17.

18. A piece of material has a density of 0.8, a sample of gasoline has a density of 0.7, and water has a density of 1.0. The material will
float in gasoline and sink in water
float in both gasoline and water
float in neither gasoline nor water
float in water and sink in gasoline 18.

19. The white-capped clouds which frequently form on hot summer days are called
cirrus stratus nimbus conical cumulus cirro-stratus 19.

20. A gradual drop in the barometer reading indicates the approach of
clear weather cloudy weather strong winds light winds cooler weather thunder storms 20.

21. The plates of the storage battery used in automobiles are made of
lead copper zinc aluminum acid carbon 21.

22. A temporary magnet is made of
soft steel tool steel cast iron soft iron copper and iron alloy iron and nickel alloy 22.

23. The vaccine used to develop immunity from smallpox is obtained from
sheep horses rabbits cows guinea pigs white rats 23.

24. Water rises through the soil on account of
osmosis diffusion capillarity transfusion evaporation convection 24.

25. The mixing of gas molecules is called
osmosis transpiration evaporation transfusion diffusion effusion 25.

26. In transplanting plants it is important to protect from the air the
leaves stems branches twigs buds root hairs 26.

27. Peach trees are in *most* danger from damage by late frosts which grow
on hill sides on level plains close to bodies of water in small orchards in valleys on hill tops 27.

28. The alternating current of a dynamo may be converted into a direct current by means of a
commutator armature magneto transformer switch field magnet 28.

29. When the carburetor is working properly, the principal products of the chemical change which causes the explosion within the cylinder of a gasoline engine are
carbon dioxide and nitrogen carbon dioxide and water vapor carbon monoxide and nitrogen
nitrogen and water vapor oxygen and water vapor carbon monoxide and carbon dioxide 29.

30. Gasoline is used instead of kerosene for automobiles because of differences in
color energy value composition boiling point purity odor 30.

Go right on with Part II.

## PART II

The items of Part II are like the illustration below. You are to underline the one word (or group of words) from the six on the right whose meaning is most closely related to that of the word on the left.

ILLUSTRATION: dog insect stone <u>animal</u> flower tree star

In the illustration the word *animal* is underlined because a dog is an animal.

Complete as many of these items as you can.

| | | |
|---|---|---|
| 1. boiling temperature | 32° F. 72° F. 110° F. 180° F. 212° F. 300° F. | 1. |
| 2. enamel | skin nails hair pigment nerve cells bones teeth | 2. |
| 3. combustion | burning quenching breathing breaking blowing decomposing | 3. |
| 4. organism | rock animal musical instrument battery simple machine engine | 4. |
| 5. centigrade | thermometer road building insect fruit fuel ice machine | 5. |
| 6. astronomy | plants animals soils stars rocks rivers | 6. |
| 7. humidity | water vapor oxygen carbon dioxide temperature purity odor | 7. |
| 8. nitrogen | water gasoline salt oxygen air sugar | 8. |
| 9. larva | plant bird medicine radio insect star | 9. |
| 10. electron | heat light sound electricity machines element | 10. |
| 11. year | revolution rotation inclination navigation evolution calculation | 11. |
| 12. pistil | circulation excretion respiration digestion absorption reproduction | 12. |
| 13. pupa | snakes mice flies bacteria flowering plants domestic animals | 13. |
| 14. starch test | acid Fehling's solution ammonia chlorine iodine sugar | 14. |
| 15. carbohydrate | butter meat egg milk vitamin potato | 15. |
| 16. retina | ear nose mouth eye hair skin | 16. |
| 17. mesophyll | root stem leaf flower fruit seed | 17. |
| 18. ptomaine | mold tin air bacteria dirt yeast | 18. |
| 19. first-magnitude | meteors satellites planets comets constellations stars | 19 |
| 20. culex | fly ant bee mosquito spider bacteria | 20. |
| 21. star | earth Mars comet meteor satellite sun | 21. |
| 22. differential | universal joint clutch gear shift front axle muffler rear axle | 22. |

23. saphrophyte corn smut mushroom clover barberry mistletoe poison ivy 23.

24. equinox January March June August November December 24.

25. albumen fat sugar starch protein vitamin salt 25.

Go right on with Part III.

## PART III

The items of Part III are like the illustration below. Underline two words to complete sentence.

ILLUSTRATION: Two domesticated animals are
bears racoons dogs lions horses minks

The words *dogs* and *horses* are underlined, for these are the only words given which are names of domestic animals.

Complete as many of the statements below as you can.

1. Two planets are
Vega Iris Saturn Jupiter Polaris Orion 1.

2. Two foods which contain considerable quantities of sugar are
honey eggs cheese beans potatoes grapes 2.

3. Two products derived from petroleum are
coal tar alcohol dyes gasoline kerosene ammonia 3.

4. Two materials in which house flies may breed are
garbage grass manure dry leaves mud water 4.

5. Two disease germs which may be carried by milk are
malaria rheumatism typhoid fever yellow fever cancer tuberculosis 5.

6. Two things contained in green leaves are
chlorophyll cambium endosperm cotyledons palisade cells ovules 6.

7. Two necessary processes in distillation are
convection evaporation conduction condensation transpiration diffusion 7.

8. Two essential parts in a telephone receiver are
magneto carbon particles electromagnet spark gap diaphragm bell 8.

9. Two parts which are essential to a steam engine but not to a gasoline engine are
slide valve carburetor piston timer fly wheel steam chest 9.

10. Two products from a burning candle are
nitrogen carbon monoxide water carbon dioxide oxygen hydrogen 10.

11. Two heavenly bodies which are visible by reflected light are
sun moon stars planets constellations meteors 11.

12. Two thing essential for alcoholic fermentation are
sugar mold salt yeast fat hops 12.

13. Two liquids which are heavier than pure water are
gasoline lubricating oil alcohol ether skimmed milk sea water 13.

14. The two substances present in bread in largest quantities are
proteins fats starch salt yeast water 14.

15. Two kinds of cloth which are the poorest conductors of heat are
cotton wool natural silk linen artificial silk calico 15.

# RULE TEST IN GENERAL SCIENCE.

Read over each statement carefully. After you have read the statement, underline the word or words which make the statement most nearly true. Read the statements as many times as you like. You will be given forty minutes to do them all.

1. The thermometer is used to measure
   the amount of heat, air pressure, convection, dilution, viscosity, current.

2. A meter is, in inches
   29.37 , 36 , 47.25 , 39.37 , 48 .

3. A solution is a
   mixture, chemical combination, paste, suspension, distillate.

4. Water can be freed from suspended particles by
   boiling, freezing, stirring, filtration, agitation.

5. A good example of oxidation is
   rusting of iron, expansion of water, thawing of ice, refrigeration, melting of lard.

6. Draw a line under the name of the substance listed which is the best conductor of heat
   iron, copper, clay, aluminum, glass.

7. If phosphorus is burned under a bell jar which is placed with its mouth in water, the water will rise the following proportion of the jar into the jar
   1/2, 3/4, 1/5, 2/3, 1/10.

8. Litmus paper is used to
   filter water, test for acidity, determine temperature, show oxidation.

9. Salt is
   a hydroxide, an alkali, an acid, a neutral substance.

10. The best way to describe the product when oil and vinegar are shaken up together is
    emulsion, mixture, combination, distillation, suspension.

11. The most heat comes from a gas flame when its color is
    yellow, red, blue, pale.

12. Objects which give forth light are given the general term
phosphorescent, brilliant, opaque, translucent, luminous.

13. In the eye, the image is formed by the
retina, crystalline lens, iris, pupil, ciliary muscles.

14. The principle of the magnet is used in the
barometer, anemometer, thermostat, compass, x-ray.

15. Soap is produced by
a physical change, mechanical mixture, a suspension, chemical change, emulsion.

16. Metals that can be hammered into shape are said to be
vitreous, ductile, malleable, amorphous, fragile, brittle.

17. The boiling point of a Fahrenheit thermometer is
100, 98, 39.37, 121, 180, 212, 72.

18. When oil and eggs are beaten up together the product is best described as
an emulsion, a suspension, combination, mixture.

19. Distilled water is
hard, a solution, soft, a mixture, alkaline.

20. Metals that can be drawn into wires are said to be
malleable, amorphous, brittle, vitreous, ductile.

21. The boiling point on a centigrade thermometer is
98, 212, 72, 100, 180.

22. Water is necessary for the body because it is
good to drink, always plentiful, a good solvant, inexpensive, pure.

23. A saturated solution is one that
contains no solute, will not contain any more solute, a damp substance, a syrup, a weak acid.

24. At the surface of the earth the weight of the air exerts a pressure, in pounds per square inch, of
37.39 , 98 , 1728 , 72 , 15 , 29 .

25. A boy and a girl are on a see-saw. The boy weighs 100 lbs., and the girl weighs 75 pounds. The boy is 6 feet from the fulcrum. Underline the correct number of feet that the girl is distant from the fulcrum when the see-saw is balanced.
4.5, 12 , 16 , 8 , 6 .

26. Oxidation in the body causes it to throw off
moisture, to not catch cold, to be immune, to throw off carbon dioxide.

27. The process of the transfer of heat through a substance is called
convection, conduction, radiation, expansion, lines of force.

28. Spaces are left at the end of railroad rails to allow for
proper fit, expansion in summer, ease of installation, differences in length, the curvature of the earth.

29. Winds are the result of
convection currents, conduction currents, storms, radiation of earth energy, sunny and dark days.

30. The change which takes place when water is added to unslaked lime is
physical, chemical, mechanical, neutral.

31. If acid were dropped on a coat which of the following should be put on the spot to prevent damage?
charcoal, vinegar, milk, soda, turpentine.

32. A megaphone is sometimes used by speakers because it is
ornamental, changes the pitch, concentrates sound waves, absorbs sound waves.

33. The hottest portion of a candle flame is
at the wick, on the side, at the top.

34. The angle of reflection is equal to the angle of
refraction, distortion, retraction, incidence.

35. According to the Law of Magnetic Attraction, like poles
attack, attract, refract, reflect, repel.

36. An example of a non-metal is
iron, tin aluminum, magnesium, carbon.

37. The difference in degrees between boiling and freezing points on a Centigrade scale is
32, 100, 313, 180, 39.37, 144.

38. When a solute is placed in water, the water finally becomes uniformly dilute. This action is known as
convection, conduction, evaporation, diffusion, osmosis, radiation.

39. An example of an element is
nitrous oxide, calcium carbonate, hydrogen peroxide, nitrogen, ferrous sulphate.

40. Water can dissolve more air when the water is
warm, cold, tepid, frozen, boiling.

41. Underline the four planets which are the farthest from the sun
Venus, Neptune, Mercury, Mars, Uranus, Saturn, Jupiter,
Earth.

42. The Centigrade thermometer is most generally used by
candy makers, farmers, egg hatcheries, scientists, bakers.

43. If a weak and strong solution are separated by a membrane the two solutions will adjust their dilution by the process of
radiation, cohesion, evaporation, diffusion, osmosis.

44. An example of a chemical compound is
sodium bicarbonate, chlorine, oxygen, sulphur, helium.

45. The crystal form of carbon is known as
carbon dioxide, carbonic acid, diamond, graphite,
lead, carborundum.

46. A flame mixture used for lighting purposes should have
lots of air, little air, no air.

47. Substances which allow most of the light rays to pass are said to be
translucent, opalescent, opaque, diffused, transparent.

48. If iron filings are dusted on a paper under which a magnet is held, they will arrange themselves
in the order they fall, along lines of force, in
series of fours, at the extreme end of the magnet in
a lump.

49. If breath from the lungs is blown into clear lime water, it immediately becomes
warm, full of bubbles, cloudy, thick.

50. An acid may be neutralized by means of
oxygen, sulphur, a sulphate, a chloride, a hydroxide.

51. Soap is made by the action between fat and acid, a neutral
substance, water, a hydroxide, salt.

52. Sound is caused by
reflection, echoes, vibration, illumination, absorption.

53. Underline three characteristics of sound
brilliance, loudness, rapidity, clarity, resonance, pitch,
tremolo, quality, persistance, beauty.

54. Handles of kitchen utensils are frequently made of wood because
they look better, it is cheaper, wood can be kept from rusting, it is a non-conductor, it will not scar the utensil.

55. Ice on one side of a refrigerator cools food on the other side by means of
absorption, melting, radiation, conduction, convection.

56. A fireless cooker cooks well when
it is non-conducting, there is good convection, there is no absorption, it has food in it, it radiates well.

57. Underline the gas which supports combustion
neon, helium, argon, nitrogen, oxygen, hydrogen.

58. A substance which gets soft when heated is called
fusible, ductile, amorphous, vitreous, refractive.

59. A draft in a chimney is caused by
radiation of heat, conduction currents, an approaching storm, air pressure, convection.

60. A stone floor feels colder than wood to the feet because
it is a better conductor, it is harder, it is smoother, it is a mineral, wood burns.

61. The air consists of the following part oxygen
1/5, 1/3, 2/5, 3/5, 3/4.

62. The loss of water by heat is called
boiling, condensation, evaporation, solution, distillation.

63. Humidity is
the amount of moisture in the air, the leafy substance in soil, the amount of water in a solution, the action of water on solutes, rise of temperature.

64. Water can be sucked through a straw because of
the pressure of the air on the surface of the water, the suction in the straw, capillarity, osmosis.

65. A barometer measures
humidity, temperature, air pressure, air currents, volts.

66. John weighs 120 pounds and is 12 feet from the fulcrum of a see-saw. Fred is 16 feet from the fulcrum while they balance. Fred weighs, in pounds,
100, 160, 90, 110.5, 150.

67. Most cheap thermometers are filled with
mercury, alcohol, sugar water, pink water, glycerine.

68. If a Centigrade and Fahrenheit thermometer are both in a moderately heated room the Centigrade thermometer will show
a higher reading, a lower reading, an equal reading.

69. Roots of plants absorb food by means of
capillarity, cohesion, osmosis, air pressure, suction.

70. Crystallization takes place most readily in the following kind of solution
warm, cold, saturated, weak, acid.

71. A substance which will not crystallize is known as
hematite, amorphous, coagulate, glutin, quartz.

72. The color of a large number of metals is
gray, red, blue, brown, green, black.

73. When a substance will allow no rays of light to pass it is said to be
translucent, refractive, transparent, opaque, diffused.

74. Pitch of sound is regulated by
temperature, pressure of air, amount of reflection, rate of travel through the air, rapidity of vibration, force.

75. A thermos bottle keeps an even temperature for a long time because it is so constructed that
it has good radiation, it is a good conductor, it is a poor conductor, it is painted green, it is simple to operate.

76. An example of physical change is
burning of wood, dissolving of sugar in water, burning of sulphur, eating of metal by acid.

77. Drops of water formed on the outside of a pitcher of ice water are caused by the action called
evaporation, conduction, distillation, condensation, crystallization.

78. Water can be purified from solutes by
boiling, freezing, distilling, shaking, settling.

79. Motion produced, resistance overcome, energy expended, are three things included in the meaning of the word
exercise, work, process, toil, manufacture.

80. A man pulls on a rope which is threaded through one fixed pulley, one movable pulley and then to the ceiling so that the movable pulley may carry the load. If 190 pounds is attached to the movable pulley, the number of pounds that the man must pull on the rope to move the load is
95, 100, 380, 243.5, 26, 47.5.

81. The best system of lighting is
by reflection, direct, indirect, by refraction.

82. The lead in a lead pencil is made of
charcoal, graphite, the metal lead, lead oxide.

83. When a candle burns, the flame continues because of the process of
osmosis, convection , capillarity, adhesion.

84. The process by means of which a kettle of water is heated on a stove is called
conduction, radiation, convection, absorption, boiling.

85. A refrigerator remains cool a long time if
it is a poor conductor, its convection currents are small, it is of metal, it is kept indoors, it does not absorb moisture.

86. An example of chemical change is
burning of sulphur, melting of sugar, melting of sulphur, dissolving of salt, filtering of water, freezing of ice.

87. Evaporation requires
agitation, concentration, heat, sunlight, radiation.

88. The process of evaporation followed by condensation is called
crystallization, convection, radiation, adherence, distillation.

89. Evaporation may be hastened by
stirring, cooling, sunlight, catalysis, fanning.

90. Refraction is best illustrated by
the reflection of sunlight by a mirror, a glowing match, the apparent bending of a stick thrust in water, air currents, an arc light.