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NOTEBOOKS, 1869-1927
STUDENT, 1869-1875

German Lessons

Chapter 1.

Vowels. Umlauts. Diphthongs.

(a) Alles, Axt, Apfel. (a) Gut. Hut, Mann, Mond. (i.j.) Ist, Kind, Bild, Papier.
(o) Ofen. Lob. Mond. (u) Mutter. Kuh, Mund. (u. w.) Wasser, Wein. (au) Haus. (äu eu) Häuser. Feuer, Leute. (ä. e.) Männer. Leben. Bäcker.
(ö) Ofen, Löwe. (ü) Über. Müssen.

Chapter 2.

Consonants & double Consonants.

(l) Schalt, Leben, Lesen, Leben, Lage, Berlin.
(r) Gabel, gar. Gift. Himmel, wie, Ring.
(j) Ja. (b) Bett. und (p) Bis. Bad. (t) Tisch. Leben. (b) Bis. und Bier. Papier. (d) Dann. Leid. Bis. Finger. (g) Tag. Berg. Finger. (f) Pfeife. Schiff. (v) Brief. Wasser. (s) Haus. Wasser. (ß) Straße. Fuß.

Lection 3.

1. Der Sohn Pia? 2. Ja sehr Sun.
3. Der fort den Ratten? 4. Er fort nor Glas.
5. Der Sohn if. 6 Pia fohn Gla. 7 Sy klau Sa
der Glas? 8 Mann, ey fort der Sohn. 9 Syst
nor Der Ratten? 10. Der in fort der Gla. 11. Syst
if der Sun? 12 Der Pia fohn no. 13. Der fort
der Lehn. 14 der Ratten fort no. 15. Der fort no
Ratten? 16. der Mann fort 4. Syst den Fort-
tan der Glas, nan der Gla. 18. Er fort nor der
nor Ratten.

Lection 4.

1. Syst an Pia der Sun? 2. Ja, if sehr
3 Syst an der Glas? 4. Mann, no fort der Sun.
5. Der fort der Sun? 6. Ja sehr no. 7. Syst ey
der Glas, oder der Gold? 8. Pia fohn der Glas
und der Gold. 9 Syst den Ratten der Sun
der Lehn? 10. Er fort der Sun und der
Lehn. 11 Der fort den Mann? 12 Er fort
der Glas und der Gold. 13. Der fort den Ratten?
14. Er fort der Gold. 15 Der fort der Ratten? 16. Ja sehr no?
17 Syst Pia der Gold? 18. Nein, den Ratten fort no?

Aufgabe 6.

1. Das Pferd kauft das Heu. 2. Das Mädchen kauft das Heu. 3. Das kauft das Heu. 4. Das Heu kauft das Heu und das Stroh. 5. Die Heu und Die Jungen. 6. Die Stroh Pferden. 7. Das Heu Pferden. 8. Das Heu Pferden kauft. 9. Die Pferden kauft. 10. Die und das Pferden Mädchen kauft. 11. Das Mädchen kauft. 12. Die Mädchen. 13. Das kauft. 14. Das Pferd. 15. Das Heu kauft und das kauft. 16. Das kauft das Heu. 17. Das Mädchen und Pferden kauft. 18. Die Jungen Heu. Das Mädchen kauft Stroh und Die Jungen Heu.

Aufgabe 7.

1. Das Mädchen schneidet. 2. Das kauft das Heu? 3. Das Pferd kauft das? 4. Die und das Mädchen. 5. Das Mädchen

Lection 7 (Neu)

Lucifer und Eva, nach der Schöpfung des Adams.
Adam. 2. Die Schöpfung der Eva. 3. Die Hochzeit.
4. Die Versuchung. 5. Der Fall. 6. Die Strafe.
7. Die Vertreibung aus dem Paradies. 8. Die Arbeit.
9. Die Geburt Cains. 10. Die Geburt Abels.
11. Die Opfer Cains und Abels. 12. Die Mörder.
13. Die Strafe Cains. 14. Die Nachkommenschaft
Cains. 15. Die Geburt Seths. 16. Die Nachkommen
Seths. 17. Henoch. 18. Die Geburt Noahs. 19. Die Sündfluth
und Noahs Opfer.

Lection 1.

1. Die Schöpfung. 2. Die Versuchung. 3. Der Fall.
4. Die Strafe. 5. Die Vertreibung aus dem Paradies.
6. Die Geburt Cains. 7. Die Geburt Abels.

Aufgabe 3.

1. Wer ist der Gottsucher? 2. Wer ist
der Sünder? 3. Wer ist der Sünder?
4. Sagt der Heiland? 5. Warum bat er?
6. Wo steht es, und was steht es? 7. Wo
wird Barmherzigkeit von Gott gesucht? 8. Was ist

Aufgabe 4.

1. Wer ist ein Sünder? 2. Wer ist
der Sünder? 3. Wer ist der Sünder?
4. Sagt der Heiland? 5. Warum bat er?
6. Wo steht es, und was steht es? 7. Wo
wird Barmherzigkeit von Gott gesucht? 8. Was ist

Lektion 9

Wer kann das Lernen? 2. Wann fängt man
an Deutsch zu sprechen? 3. Wann fängt man
an Englisch zu reden? 4. Wann fängt man
an Holländisch zu sprechen? 5. Wann fängt
man an Polnisch zu reden? 6. Wann fängt man
an Russisch zu sprechen? 7. Wann fängt man
an Französisch zu reden? 8. Wann fängt man
an Italienisch zu sprechen? 9. Wann fängt
man an Spanisch zu reden? 10. Wann fängt
man an Portugiesisch zu sprechen? 11. Wann
fängt man an Griechisch zu reden? 12. Wann
fängt man an Türkisch zu sprechen? 13. Wann fängt
man an Chinesisch zu reden? 14. Wann fängt man an Arabisch?
15. Wann fängt man an? 16. Wann endigt
man? 17. Wann hört man auf?
18. Wie lange dauert
es? 19. Wie lange
muß man lernen?

Lektion 10.

1. Wessen Buch ist das? 2. Ist das
Ihr Buch? 3. Wessen Feder ist das?
Ist das Ihre Feder? 4. Wessen Bleistift
ist das? Ist das Ihr Bleistift? 5. Wessen
Tinte ist das? 6. Wessen Papier ist das? 7. Ist das
Ihr Papier? 8. Wessen Federmesser ist das? 9. Wessen

Aufgabe 11 (Forts.)

Schlafen Personen? 9. Personen trinken
nur Bier Personen? 10. Personen trinken
nur Cognac Gins? 11. Welche
Personen Bier und Wein Cognac?
12. Einen Bier und Wein Cognac?
13. Wer weder Cognac noch Gin, sondern
Zucker? 14. Niemand Cognac
Wasser Kind? 15. Was Personen Bier und
Schnaps Liter? 16. Warum Cognac
und Portwein? 17. Wer Bier schmeckt
und Portwein. 18.) Niemand?

Aufgabe 12.

1. Liebt wen Lehrer? 2. Wer liebt uns?
3 Schickt wen Herr und Frau? 4. Wann, wo
schmeckt es? 5. Warum Cognac wen
Schmecken und Bett, wer Bier, sondern
wen Wein. 6. Wen singt wen Kind?
7. Trinkt wen Jäger Thee, wen Pferden?

8

Übersetzen 11

8. Warum kriecht der Hund? 9. Wissen Sie warum der Hase
rennt? 10. Warum sagen Sie? 11. Wissen Sie wie lang der Hund ist? 12. Wie hoch ist der
Hund? 13. Kriecht der Hund oder der Hase? 14. Der
Affe ist gestorben, weil er nicht gegessen hat. 15. Wie
lange ist er krank? 16. Warum? 17. Der
Kaufmann sie, der Hund oder der Affe? 18. Ist der
Mensch stark, wie der Affe.

Übersetzen 12

1. Der Hund gibt dem Pferde das Heu. 2. Das Mädchen gibt dem Knaben den Ball.
dem Pferde und gibt es. 3. Der Knabe gibt
dem Hunde Essen, der Hund gibt dem Pferde,
und das Pferd gibt dem Affen. 4. Der
Hund kriecht dem Pferde und frißt. 5. Sagen Sie
dem Hunde und dem Affen. 6. Wem sagen Sie dem
Hunde? Sie sagen dem Hunde
Essen.

7. Was versteht man unter Reibung? 8. Es wird unterschieden zwischen Reib-, und Gleitreibung. 9. Wovon hängt die Reibung ab? 10 Gesetze der Reibung. 11. Was versteht man unter Schmierung? 12. Wozu dient die Schmierung? 13. Welche Schmiermittel kennen Sie? 14. Die Mittel werden unterschieden in feste, flüssige und gasförmige. 15. Was versteht man unter Festigkeit, und wozu dient sie?

Aufgabe 13.

1. Wann spricht man von Betrug und Betrüger? 2. Wer ist der Betrogene und Betrüger? 3. Wann ist man Betrüger und wer ist Betrüger? 4. Wer ist Betrüger und Betrügerin? 5. Wer ist Betrüger und Betrügerin. 6. Was Betrug ist und wie Betrüger und Betrügerin. 7. Wer ist Betrüger und Betrügerin. 8. Wer ist der Betrüger und Betrügerin? 9. Wer ist Betrüger und Betrügerin und wer ist Betrüger? 10. Wer ist der Betrüger und Betrügerin, und wer ist Betrüger und Betrügerin, und wer ist Betrüger, 11. Wer ist Betrüger und Betrügerin, wer ist Betrüger und Betrügerin. 12. Wer kommt als Betrüger und Betrügerin? 13. Wann spricht man von Betrug und Betrügerin, wann ist Betrüger und Betrügerin? 14 Wer ist Betrüger und Betrügerin, wer ist Betrüger und Betrügerin? 15. Wann spricht man von Betrug und Betrügerin

Übung 11

1. Das ist das Tier das Milch gibt. 2. Das ist die Milch der Kuh? 3. Das ist der Schwanz der Katze. 4. Ja, und das Maul der Katze ist klein. 5. Das ist das Ohr des Hundes? 6. Das Ohr ist das Organ des Hörens, und das Auge ist das Organ des Sehens. 7. Das Schwein ist das Tier der Speise der Menschen. 8. Nicht das Pferd ist das Tier der Arbeit? 9. Das Pferd ist das Tier der Arbeit, und der Ochse ist das Tier der Arbeit. 10. Das ist der Schwanz der Kuh. 11. Das ist der Schwanz der Katze. 12. Das ist der Kopf des Pferdes. 13. Das ist der Hals der Gans. 14. Wo ist der Hund des Jägers? 15. Wo ist der Hund des Jägers? 16. Das ist der Hund des Jägers.

Aufgabe 15.

1. Was ist Luft? Nenne Eigenschaften der Luft! 2. Was ist Feuchtigkeit? Nenne Eigenschaften derselben, wie sie sich an deine Person zeigen. 3. Was ist Luft? Nenne Organe der Atmung! 4. Was ist Einatmung und Ausatmung? 5. Was ist Luft? Nenne Unterschiede zwischen Luft und Wasser! 6. Nenne, wo man Luft findet! Nenne Organe der Ernährung. 7. Was ist Luft? Nenne Eigenschaften der Luft! 8. Was ist Luft? Nenne Eigenschaften der Luft, der Erde, und der Luft! 9. Was ist Luft? Nenne die Bestandteile der Atmosphäre! 10. Was ist Luft? Nenne Eigenschaften der Atmosphäre! 11. Was ist Luft? Nenne Eigenschaften der Atmosphäre und der Atmosphäre. 12 Luft ist ein Körper wie ein Wasser! 13. Was ist Luft? Nenne Eigenschaften der Luft!

Lection 16

1. Wieso Müller ist der Vater seines Sohnes
2. Seines Sohnes ist der Vater dieses Sohnes
3. Meines Onkel wohnt meinem Müller
4. Wessen Bücher sind das? 5. Wem dieses Buch ist
dasselbe? 6. Wessen ist dieses? 7. Wessen Bücher
sind diese? 8. Wessen Bücher sind diese? 9. Wessen
Bücher sind diese? 10. Wessen Bücher sind diese
meine? 11. Wessen Bücher sind diese
Bücher? 12. Wessen Federn
sind diese? 13. Wessen
Tinte ist diese? 14. Wessen
Federn sind diese? 15. Wessen ist dieses
Buch, oder meine? 16. Wessen Messer
ist dieses, meines oder seines? Dieses ist
seines. 16. Wessen Bücher sind diese? Diese sind
seine. Wessen Federn sind diese?

Lection 17.

1. Welches Perfect hat diesen Infinitiv?
2. Es hat drei Perfecta gleicher Bildung? 3. Welche hat ein Substantiv hinter sich? 4. Es hat eine Substantiv hinter sich. 5. Welches Substantiv hinter sich hat Mann und Frau? 6. Welches Adjectiv hat Mann und Frau? 7. Ist Haus groß und gut? 8. Ist Haus klein und schön? 9. Welches Substantiv hat Haus hinter sich? 10. Welches Substantiv hat Haus und Dach hinter sich? 11. Hat jeder Mann Geld? 12. Ist Mann und Frau reich? 13. Ist alles Obst faul? 14. Ist alles Obst faul und gut? 15. Gehört dieses Substantiv diesem Adjectiv und jenem Substantiv? 16. Hat das Haus eine Thür und Fenster? 17. Welches Substantiv ist Thür, Haus und Fenster? 18. Was ist Kalk? 19. Was singt? 20. Jeder Kind singt. Ein Knabe und Mädchen? 21. Jeder Knabe ist gut und schön. 22. Jeder Knabe hat Geld.

Aufgabe 15.

1. Womit hat Jürgen wieder einen Streich
vor? 2. Was
schießt er wohl vor? 3. Wann
kommt Pia zum Besuch? 4. Was
sagt das Kleine, wenn es Licht
sieht? 5. Warum ist Peter
Clemens? 6. Was
Kind ist traurig
Clemens, weil er
Durst? 7. Die
Mädchen Obst
Essen? 8. Warum
Vater Brüder? 9. Wo
Pia
Walfischen Clemens
10. Was
sagt
Clemens
11. Ärgert
Pferdes
12. Was
Ärgert
3. Was
Clemens
Essen. 14. Was
sagen Pia
Clemens
15. Was
Wasser
16. Was
Kinder
Clemens
17. Mit

Aufgabe 18. (Lö)

Schriftlich gerundet auf Zehner? 18. Wissen
Sie mit Begründung Schriftlich an gerundet?
19. Warum ist es nicht sinnvoll schriftlich zu runden?
20. Was muss man zuerst tun beim Schriftlich?
21. Erklären Sie Brüche und Teile eines Ganzen,
Ihre Teile? 22. Ich suche einen
Bruch, Teile, Ganze, Brüche mit Bild.
23. Ich suche den Zähler und Nenner
mit dem Begriff des Bruchs? 24. Warum
muss der Nenner ungleich Null sein?
25. Es ist ein Bruch und Bild?
Erklären Sie Teil Ganz? 27.
Zeichnen Sie gegen Bruch mit Bild
Bruch. 28. Ich suche einen Bruch ungleich.
29. Die Brüche sind Sie an Bruch Begriffe
30. Ich suche Brüche Ganz gleich.
31. Wo ist die Brüche? 32. Es ist
ungleich Bruch?

Lection 4.

1. Welches Pferd hat Josef nicht
Lieblich und Schön? 2. Wer sagt
der Knecht von seinem Herrn. 3. Wer
sorgt für Pferde wenn Herr? und wenn
kommt der? Sind wir Herr sorgen.
4. Wenn hat den Pferden wenn Herr Pferde?
5. Wenn Josef für Pferden? 6. Josef
sorgt es wenn Herr? Josef wenn
Pferde wenn Herr? 7. Wenn hat Josef
Pferde wenn Herr? 8. Wenn Josef
für Pferden? 9. Wer
sorgt es wenn Herr? 10. Ist der Herr wenn
Pferde Herr wenn? 11. Fällt den Apfel wenn Herr
Herrn? 12. Wenn Pferden kommt wenn Herr
sorgen wir Pferden, und wir Herr
sorgt wenn Pferden, und wir Pferden
für wenn Herrn? Wenn Sie Herrn Herr?

17. Wie viel Finger hat die Hand? 18. Wie viel Augen hat der Mensch? 19. Wie viel Ohren hat der Mensch? 20. Wie viel Füße hat der Hund? 21. Wie viel Beine hat der Stuhl? 22. Wie viel Beine hat der Tisch? 23. Wie viel Augen hat der Hund?

Übersetzung 20.

1. Mein Bruder hat eine Hand, einen Finger, und einen Kopf in seinem Zimmer. 2. Es steht ein Stuhl und ein Tisch in meinem Zimmer. 3. Haben Sie ein Buch in Ihrem Zimmer? 4. Nein, aber ich habe einen Stuhl in meinem Zimmer. 5. Der Mensch hat zwei Augen und zwei Ohren. 6. Wie viele Finger hat meine Hand? Sie hat fünf. 7. Wie viele Augen hat der Hund? 8. Wie viele Füße hat der Tisch? 9. Haben Sie einen Bruder? 10. Hat der Hund zwei Füße und einen Kopf?

11. Wann sagt Jesus seinen Jüngern seinen Tod?
12. Was [illegible] Petrus? Was ist über diese
Sünde? 13. Was sagt Jesus? 14. Was sagt Jesus
Paulus für Lehre und seinen Beispiele?
15. Lasen Sie die Worte, über die meinen
Leute? 16. Dieses Wunder ist wenn, an Jesu
Leben Gott noch Sonst.

Freitag 27.

1. Sagt Jesus Samuel die seinen Jünger?
2. Wenn, an sagt er seinen Jünger. 3. Wenn
kann Sie einen Jesus die Jünger Sünden
vergeben? 4. Jesus Jesus die Jünger
Bäumen. 5. Sagt seinen Lehrer
Jünger Jesu. 6. Wenn sagt Jesus
seinen Jünger? 7. Ist Jesus Samuel
sein Gewissen? 8. Wenn, an ist sein
Gewissen schwach. 9. Zu Jesus sagt
gläubigen Jesu Sünden und Jesu Jesu. Was
Petrus Bäumen ist über Jesus Bäumen

spiens Blatens. 11 Lyrebon Pin Lone Tüte
in Jhnen Zimmer. 12. Ik forbe Lone Tüte
in meinem Zimmer, wenn ik forbe
Lone Ofen. 13. Ik Bidje den Lönend Jhnen
Lehren Sunden Jhnen Pelt? 14. Nein ik
Stolt den spienen Lyrebon, den Hefft ik den ge-
Lihe. 15. Wessen Lönend, den Wessen Pelt
wessen Hund Hund wessen Lyrebon spien
Gerbten. 16. Den Posen den Lönend Jhnen
Lindorf Hund Jhn Lihen.

Contractions in Multiplication.

Unit of any order plus one. Any order minus one.

$7965 \times 101 = 796500$ $\quad 4834 \times 99 \quad 483400$
$\quad\quad 7965$ $\quad\quad\quad

(continued)

$nt + u$ (2)
$nt + (10-u)$
$(nt)^2 + ntu + nt(10-u) + (10-u)u$
fac. $nt(nt+u+t-u) + (10-u)u$
$nt(nt+t) + (10-u)u$
$nt \times t(n+1) + (10-u)u$

(2) 46 44 2024
(1) 46 43 1478

(1)
$t + u_1$
$t_1 + u_2$
$t^2 + tu_1 + tu_2 + u_1 u_2$
$t(t+u_1+u_2) + u_1 u_2$

Division.

Division is a process of contracted Subtraction. or

It is the processe of ascertaining how many times a given

quantity may be contained in another" or

Of what quantity is contained in another a given

number of times.

Teaching.

Begin with Short Division, gradually working into

Long Division.

(1) (2) (3) (4) (5) (6) (7)
Examples. 2)654 2)148 3)456 6)726 3)849 7)17528

Principles. 1. The dividend is composed of factors of which

the divisor is one, and the quotient the other.

2. Multiplying the dividend or dividing the divisor

Multiplies the Quotient.

3. Dividing the Dividend or Multiplying the Divisor

divides the Quotient.

4. Increasing the Divisor decreases the quotient by

as many units as the new divisor is contained times

in the remainder added multiplied by the first quotient.

5. Decreasing the Divisor increases the quotient by as

many units as the new divisor is contained times in the

remainder added multiplied by the first Quotient.

6. Multiplying both Dividend and Divisor by the same number does not affect the quotient.

7. Dividing both dividend and Divisor by the same number does not affect the Quotient.

6.

7.

Definitions.

1. Any factor of a number is a divisor of that number.

2. Any common factor of two or more numbers is a Common Divisor of those numbers.

3. Any product of the factors of a number is a divisor of that number.

4. Any product of the common factors of two or more numbers is a Common divisor of those numbers.

5. Hence the greatest product of the common factors of two or more numbers is their greatest Common Divisor.

Continued.

Dividing by unit of any order minus one.

94 | 68 — 4683 | 72
1 | 07 — 76 | 53
— 2 | 43
94 | 63 — 4731 | 09

quo. 9 & 63 remainder

Demon. 9468 = 94 00 + 68 or

② 94 × (99 + 1) + 68 =

③ 94 × 99 + 94 + 68 or 94 × 99 + 162

④ 94 × 99 + 1 × (99 + 1) + 62

⑤ 99 × 94 + 1 × 99 + 1 + 62

6. factoring 99(94+1) + 1 + 62

7. dividing gives { 94 + 1 = 95 quo. / 62 + 1 = 63 rem.

Dividing by unit of any order plus one.

quo. 32 | 89 — 13 | 289 — 37643 | 89 — 43 | 27
−32 — −132 — −37643 — −43
57 rem. — 1 21 — −376 43 — −1
quo. 131 | 58 rem. — −3 76 — −3
+3 76
+1 −3
−1
quo 372 | 71 | 18 rem.

quo 42 | 85 rem

Demonstration —

① 3289 = 32 (101 − 1) + 89

② " = (32 × 101) − 32 + 89

③ quotient = 32
remainder = 89 − 32 = 57

① 13289 = 132 × (101 − 1) + 89

② " = 132 × 101 − 132 + 89

③ " = 132 × 101 − (1 × 101 − 1 + 32) + 89

④ " = 132 × 101 − 1 × 101 + 1 − 32 + 89

⑤ " factoring 101 (132 − 1) + 1 − 32 + 89

⑥ $\frac{3289}{101}$ = 131 quo. 58 rem.

① 3764389 = 37643 × (101 − 1) + 89

② " = 37643 × 101 − 37643 + 89

③ " = 37643 × 101 − (376 × 101 − 376 + 43) + 89

④ " = 37643 × 101 − 376 × 101 + 376 − 43 + 89

⑤ " = 37643 × 101 − 376 × 101 + 3 (101 − 1) + 76 − 43 + 89

⑥ " = 37643 × 101 − 376 × 101 + 3 × 101 − 3 + 76 − 43 + 89

⑦ fac. 101 (37643 − 376 + 3) − 3 + 76 − 43 + 89

⑧ " = 101 (37643 − 376 + 3) + 119

⑨ " = 101 (37643 − 376 + 3) + 1 × 101 − 1 + 19

⑩ " = 101 (37643 − 376 + 3 + 1) − 1 + 19

⑪ fac. 101 (37643 − 376 + 3 + 1) − 1 + 19

⑫ $\frac{3764389}{101}$ = (37643 − 376 + 3 + 1) = 37271 quo (19 − 1) = 18 rem.

"It may also be demonstrated a similar analysis dividing algebraically"

We may divide in this way by 98, 97 or 102, 103 etc. by simply multiplying by 2 or 3 & the figures left to the right

Contracted Division of Decimals.

$$\begin{array}{r} 7\frac{1}{2}6.3847\,6\overline{)23771.08}\,(29.85 \\ 15928 \\ 7843 \\ 7168 \\ 675- \\ 638 \\ 37 \\ 31 \\ 39 \end{array}$$

places as in the last of partial dividend required in product " " " in dividend to produce

Contracted Multiplication.

Factoring.

To find all the divisors of a number

$$72 = 2 \times 2 \times 2 \times 3 \times 3$$

Taking all the powers of each factor commencing with zero power we have 1, 2, 4, 8 & 1, 3, 9. By multiplying these as polynomials we have

1, 2, 4, 8
3, 6, 12, 24
9, 18, 36, 72

1, 2, 4, 8
1, 3, 9,
1, 2, 4 8, 3, 6, 12, 24, 9, 18, 36, 72 or in better form

To find all the common Divisors of 2 or more numbers.

62 — 24, 42, 36
2^3 $2 \cdot 3$ $2^2 \cdot 3^2$

Taking all the powers of each common factor we have 1, 2 and 1, 3 multiplying

1, 2
3, 6 or $\frac{1, 2}{1, 3}$
$\frac{3, 6}{1, 2, 3, 6}$

To find the number of divisors. As 972 $= 2 \times 2 \times 3 \times 3 \times 3 \times 3$

1 " 2 " 4
1 " 3 " 9

1 " 2 " 4
3 " 6 " 12
9 " 18 " 36
27 " 54 " 108
81 " 162 " 324
243 " 486 " 972

or

$(1 + 2 + 4)(1 + 3 + 9)(1 + 2 + 3)$

In general, a number whose factors equal $x^a y^b z^c$

$$\left.\begin{array}{l} 1 \text{ " } x \text{ " } x^2 \ldots\ldots x^a \\ y \text{ " } xy \text{ " } x^2y \ldots\ldots x^ay \\ y^2 \text{ " } xy^2 \text{ " } x^2y^2 \ldots\ldots x^ay^2 \\ \vdots \\ y^b \text{ " } xy^b \text{ " } x^2y^b \ldots\ldots x^ay^b \end{array}\right\} = (a+1)(b+1)$$

$$\left.\begin{array}{l} (a+1)(b+1)z \\ (\text{ " } \text{ " })z^2 \\ (\text{ " } \text{ " })z^3 \\ \vdots \\ (\text{ " } \text{ " })z^c \end{array}\right\} = (a+1)(b+1)c$$

$$\text{all} = (a+1)(b+1)c + (a+1)(b+1) = \text{factoring}$$

$$(a+1)(b+1)(c+1)$$

Reduction of Repetends.

Particular Cases:—

Denom.

① $.\dot{5}\dot{2}\dot{3} = \frac{523}{999}$ $\quad 1000 \times .\dot{5}\dot{2}\dot{3} = 523.\dot{5}\dot{2}\dot{3}$

$\quad 1 \times .\dot{5}\dot{2}\dot{3} = \quad .\dot{5}\dot{2}\dot{3}$

$\quad$ dif. $999 \times .\dot{5}\dot{2}\dot{3} = 523$

$\quad .\dot{5}\dot{2}\dot{3} = \frac{523}{999}$ ans.

Denom.—

② $4,8\dot{3} = \frac{4830}{999}$ $\quad 4.8\dot{3} = .4\dot{8}\dot{3} \times 10$

$\quad .4\dot{8}\dot{3} = \frac{483}{999}$ hence $4.8\dot{3} = \frac{483}{999} \times 10 = \frac{483}{99}$

Denom.

③ $7.43\dot{1}\dot{2} = \frac{73569}{9900}$ $\quad 7,43\dot{1}\dot{2} \times 10000 = 74312.\dot{1}\dot{2}$

$\quad$ " $\times$ $100 = 743.\dot{1}\dot{2}$

$\quad$ dif. $= 7.43\dot{1}\dot{2} \times 9900 = 73569$

$\quad$ hence $7.43\dot{1}\dot{2} = \frac{73569}{9900}$

General Cases:—

$.d_1 d_2 \ldots\ldots d_m D_1 D_2 \ldots\ldots D_m$

$10^{m+m} \times b = d_1 \ldots\ldots d_m D_1 \ldots\ldots D_m . D_1 \ldots\ldots D_m$

$10^m \times b = d_1 \ldots\ldots d_m . D_1 \ldots\ldots D_m$

dif. $(10^{m+m} - 10^m) b = d_1 \ldots\ldots d_m D_1 \ldots\ldots D_m . D_1 \ldots\ldots D_m - d_1 \ldots\ldots d_m . D_1 \ldots\ldots D_m$

or subtracting

$(10^{m+m} - 10^m) b = d_1 \ldots\ldots d_m D_1 \ldots\ldots D_m - d_1 \ldots\ldots d_m$

fact. $10^m (10^m - 1) b = d_1 \ldots\ldots d_m D_1 \ldots\ldots D_m - d_1 \ldots\ldots d_m$

$$b = \frac{d_1 \ldots\ldots d_m D_1 \ldots\ldots D_m - d_1 \ldots\ldots d_m}{10^m (10^m - 1)}$$

$10^m - 1 =$ m m. of 9s

Thus belongs to the opposite page. See post. ⁶

d = digit

m = order

$(d_m)^a = d_{2m-1}$ ones

$(d_m)^b = d_{3m-2}$ "

$(d_m)^c = d_{4m-3}$ "

$(d_m)^n = d_{m\,m-(n-1)\,m}$

$\quad = d_{m\,m-n+1\,m}$

$\quad = d_{m(m-1)+1}$

$2m-1 \ldots$ when $m=1$, $2m-1 = 1$. If $m=2$, $2m-1 = 3$. $3-1 =$ 2 digits in Period in ( )

$3m-2 \ldots$ " $m=1$, $3m-2 = 1$. If $m=2$, $3m-2 = 4$. $4-1 =$ 3 digits in Period in ( )

$4m-3 \ldots$ If $m=1$, $4-3 = 1$. If $m=2$, $8-3 = 5-1 =$ 4 digits in Period in ( )

$n(m-1)+1 \ldots$ " $n=1$ $n(m-1)+1 = 1$, " $n=2$, $n(m-1)+1 = m+1-1 = m =$ fig in Period in ( )

Hence the no. of figures in a Period = the no. of nines in the Denom.

Law Relating to Orders.

The order of the Product of the orders multiplied – 1. Then is give units, Tens hundreds, etc.

Representing orders by m, n, p, q.

$m \times n = m+n-1$ if $m = n$. $m+n-1 = 2m-1$

$m \times n \times p = m+n+p-2$. " $m=n=p$. $m+n+p-2 = 3m-2$

$m \times n \times p \times q = m+n+p+q-3$ " $m=n=p=q$. $m+n+p+q-3 = 4m-3$

Then the order of $10^2 = 2 \times 2 - 1 = 3$ or 100

" " " $100^2 = 2 \times 3 - 1 = 5$ " 10,000

" " " $1000^2 = 2 \times 4 - 1 = 7$ " 1,000,000

" " " $10^3 = 3 \times 2 - 2 = 4$ " 1,000

" " " $100^3 = 3 \times 3 - 2 = 7$ " 1,000,000

" " " $1000^3 = 3 \times 4 - 2 = 10$ " 1,000,000,000

$d_m = d_m(000\ldots)$ $m-1$ zeros annexed

$d_n = d_n(000\ldots)$ $n-1$ zeros annexed

$d_m d_n = d_m \times d_n(000\ldots)$ $m+n-2$ zeros annexed

Were d also requires an order we add it to the zeros annexed making $m+n-1$, the order.

If $m = n$, then $m+n-1 = 2m-1$, or the sum of the orders

Theorem 1. If again by d_p then we would likewise add $p-1$ giving the order $m+n-1+p-1 = m+n+p-2$.

$d_m \} \frac{d^{m+n+p-2}}{dx^{m+n+p-2}} \} d^{m+n+p+q-3}$

If m, n, p, q are $=$, then

$m+n = 2m-1$

$m+n+p-2 = 3m-2$

$m+n+p+q-3 = 4m-3$

m-power $m \; m-(m-1)$ or $m \; m-n+1$ m

$m(m-1)+1$ of the last two powers

Square Root.

23
23
2×2 + 2×3
2×3 + 3×3
+2(2×3) + 3²
2×2×3 + 3²
0 0

a+b
a+b
a² + ab
ab + b²
a² + 2ab + b²
2a+b | 2ab + b²
2ab + b²
0 0

$(a+b+c)^2$ By applying formulae the operation.

$(a+b)^2 + 2(a+b)c + c^2 = a^2 + 2ab + b^2 + 2(a+b)c + c^2$ (a+b+c)

a^2

2a+b | 2ab + b²
2ab + b²
2(a+b)+c | 2(a+b)c + c²
2(a+b)c + c²

Perform the same with figures

Use the letters i. e.

Cube Root.

$2+4$
$2+4$

$2^2 + 2\times4$
$2\times4 + 4^2$
$2^2 + 2\times(2\times4) + 4^2$
$2+4$
$2^3 + 2\times(2^2\times4) + 1\times(2\times4^2)$
$1\times(2^2\times4) + 2\times(2\times4^2) + 4^3$
$2^3 + 3\times(2^2\times4) + 3\times(2\times4^2) + 4^3$

$a+b$
$a+b$
$a^2 + ab$
$ab + b^2$
$a^2 + 2ab + b^2$
$a^3 + a^2b + ab^2$
$a^2b + 2ab^2 + b^3$
$a^3 + 3a^2b + 3ab^2 + b^3$

$(a+b+c)^3 = (a+b)^2 + 3(a+b)^2c + 3(a+b)c^2 + c^3 =$
$a^3 + 3a^2b + 3ab^2 + b^3 + 3(a+b)^2c + 3(a+b)c^2 + c^3$ $(a+b+c$
a^3
$3(a^2 + 2ab + b^2)$ $+ 3ab^2 + b^3$
$3a^2b + 3ab^2 + b^3$
$3(a+b)^2c + 3(a+b)c^2 + c^3$
$3(a+b)^2c + 3(a+b)c^2 + c^3$

0 0 0

$(a+b+c)^3$ $a.\ b.\ c.$

Horner's Method

		4436184
3	9	27
6	2700	17361
45	3175	15875
100	367500	1486864
1054	371716	1486864
		0

Cube Root

Sixth Root

2	4	8	16	32	64	128
4	12	32	80	192	448	1088
6	24	88	240	672	1792	4736
8	40	160	560	1792	5376	15872
10	60	280	1120	4032	13440	42240
12	84	456	2016	7776	26208	82368
146	9276	33656	136936	512656	1825936	6318176

Cube Root of a Duodecimal.

1	1	2 " 0' " 2" " 8''' " 9'''' " 0''''' " 8'''''' 1 " 3' " 2
2	3 " 0' " 0"	1
3 " 3'	3 " 9' " 9"	1 " 0' " 2" " 8'''
3 " 6'	4 " 8' " 3" " 0''' " 0''''	" " 5'' " 3'''
3 " 9" " 2"	4 " 8 " 10" " 6''' " 4''''	9" " 5''' " 9'''' " 0''''' " 8''''''
		9" " 5''' " 9'''' " 0''''' " 8'''''

Fourth Root in the Scale of Nine.

			1 8 5 0 7 [07
1	1	1	1
2	3	4 0 0 0	8 8 8 0 7
3	6 0 0	7 5 0 1	
47	1064	12501	8 8 8 0 7
			0 0 0 0 0

Properties of Integral Numbers.

(1) Any simple Number is of the form q:

$23 = 21 + 3. = 2 \times 10 + 3$

$234 = 200 + 30 + 4 = 2 \times 10^2 + 3 \times 10^1 + 4$

$4573 = 4 \times 10^3 + 5 \times 10^2 + 7 \times 10^1 + 3$

If d = any digit, and n = its order, or the highest of the number, then

Any number $= d_n d_{n-1} d_{n-2} \ldots\ldots d_3 d_2 d_1$ and

$d_n d_{n-1} d_{n-2} \ldots d_2 d_1 = d_n \times 10^{n-1} + d_{n-1} \times 10^{n-2} + d_{n-2} \times 10^{n-3} \ldots\ldots d_3 \times 10^2 + d_2 \times 10^1 + d_1$

Some digits known, as $8 \ldots 6532 = 8_n \times 10^{n-1} + 6 \times 10^3 + 5 \times 10^2 + 3 \times 10 + 2$

Each digit is multiplied by that power of the scale = to its order - 1

As in the scale of five, Any number equals $d_n \times 5^{n-1} + d_{n-1} \times 5^{n-2} \ldots\ldots d_3 \times 5^2 + d_2 \times 5 + d_1$

Or a general expression, thus,

Any Number $= d_n \times S^{n-1} + d_{n-1} \times S^{n-2} \ldots\ldots d_3 \times S^2 + d_2 \times S + d$

$2 = 2 \times 1$
$4 = 2 \times 2$
$6 = 2 \times 3$
$10 = 2 \times 5$
} Hence Any even No. $= 2n$

$7 = \begin{cases} 2 \times 3 + 1 \\ 2 \times 4 - 1 \end{cases}$
$9 = \begin{cases} 2 \times 4 + 1 \\ 2 \times 5 - 1 \end{cases}$
$11 = \begin{cases} 2 \times 5 + 1 \\ 2 \times 6 - 1 \end{cases}$
} Any Odd No. $= 2n \pm 1$

$1 = 6 \times 1/2 - 1$ or $6 \times 1/3 + 1$
$2 = 6 \times 1/2 - 1$ "
$3 = 6 \times 2/3 - 1$ " $6 \times 1/3 + 1$
$5 = 6 \times 1 - 1$
$7 = 6 \times 1 + 1$
$11 = 6 \times 2 - 1$
$13 = 6 \times 2 + 1$

If $p_n = n+1$ } If $p_n = n+2$
$p = 6n+0$ } $p = 6n+6 - 1 = 6(n+1) - 1$

Hence Any prime number $= 6n \pm 1$.

Putting $(n+1) = n$ in any number would have served Any prime $= 6n \pm 1$.

$6 = 2 \times 3$
$12 = 4 \times 3$
$9 = 3^2 \times 1$
} Any composite No. $= p^a \times p^b \times p^c \ldots\ldots p^m$

$6 = 2 \times 3 = 2(2^2 - 1)$
$28 = 4 \times 7 = 2^2(2^3 - 1)$
$496 = 16 \times 31 = 2^4(2^5 - 1)$
$8128 = 64 \times 127 = 2^6(2^7 - 1)$
} Any perfect No. is of the form $2^{n-1}(2^n - 1)$, or twice odd except in the first.

Even & Odd Numbers.

1.) The sum of any number of even numbers is even.

An even number $= 2n$

The sum of even numbers then would be

$2n+2n_1+2n_2+2n_3+ \cdots\cdots 2n_n$ factoring gives,

$2(n+n_1+n_2+n_3+ \cdots\cdots n_n)$, equivalent to the form $2n$, hence even.

---

(2) The difference of two even numbers is even.

$2n-2n_1 = 2(n-n_1)$ equivalent to $2n_2$, hence even

---

3) One product of even numbers even.

$2n \times 2n_1 \times 2n_2 \times 2n_3 \times \cdots\cdots 2n_n$, factoring =

$2^n \times n \times n_1 \times n_2 \times n_3 \times \cdots\cdots n_n$ " again =

$2(2^{n-1} \times n_1 \times n_2 \times n_3 \times \cdots\cdots n_n)$ equivalent to $2n$, hence even

---

4.) $\frac{2n_1}{2n_2} = \frac{n_1}{n_2}$. Let $\frac{n_1}{n_2} = q$. If $\frac{n_1}{\frac{n_2}{2}} = n$, then $\frac{n_1}{n_2} = 2n$ = even number $\frac{2n_1}{2n_2} = 2n$ also

If $\frac{2n_1}{2n_2}$ or $\frac{n_1}{\frac{n_2}{2}} = n \pm \frac{1}{2}$, then $\frac{n_1}{n_2} = 2n \pm 1$ an odd number $\frac{2n_1}{2n_2} = 2n \pm 1$. Hence, $\frac{2n_1}{2n_2} = 2n$ or $2n \pm 1$

---

5) Sum of even number of odd nos. even. $2n_1 \pm 1 + 2n_2 \pm 1 + 2n_3 \pm 1 + \cdots\cdots 2n_n \pm 1$ when n is even =

$2(n_1+n_2+n_3 \cdots\cdots + n_n) \pm 2n$ = even number.
both terms being even.

---

6) Sum of odd number of odd nos. odd. $2n_1 \pm 1 + 2n_2 \pm 1 + 2n_3 \pm 1 + \cdots\cdots 2n_n$ when n is odd =

$2(n_1+n_2+n_3+ \cdots\cdots n_n) \pm (2n \pm 1)$ = odd number
since both terms are odd.

(Continued)

(7.) Difference of odd nos is even.

$(2n_1 \pm 1) - (2n_2 \pm 1) = 2n_1 - 2n_2 = 2(n_1 - n_2)$ equivalent to $2N$, hence even.

(8.) Product of any no. of odd nos is odd. $(2n_1 \pm 1) \times (2n_2 \pm 1) =$

$2^2 n_1 n_2 \pm 2n_2 + 2n_1 \pm 1 = 2(2n_1 n_2 \pm n_2 \pm n_1) \pm 1$ equivalent to $2N \pm 1$

This product being odd, another or the next product would also be; hence the principle.

(9) $\frac{n_1 \pm 1}{n_2 \mp 1} = g$. If g is even, then when we clear the equation of fractions $a_2 n_1 \mp 1 = g(n_2 \mp 1)$ we have an odd number = an even one.

(10) $2n_1 + 2n_2 \pm 1 = 2(n_1 + n_2) \pm 1$ equivalent to $2N \pm 1$, hence odd.

(11) $2n_1 - (2n_2 \mp 1) = 2(n_1 - n_2) \mp 1$, equivalent to $2N \mp 1$ or $2N \pm 1$, odd

(12) $2^2 n_1 \pm 1 \times 2n_2 = 4n_1 n_2 \mp 2n_2 = 2(n_1 n_2 + n_2)$ equiv. to $2N$, even.

(13) $\frac{2n_1}{2n_2 \mp 1} = g \therefore 2n = g(2N \pm 1)$ which is odd if g is, but must be even because equal to $2n$ which is even.

(14) $\frac{2n_1}{2n_2 \mp 1} = g$. if g is even, then $\frac{2n_1}{2n_2 \pm 1}$ as it must be $= 2N$ then $\frac{2n_1}{2(2n_2 \pm 1)} = n$. Since n is a whole number, $\frac{2n}{2(2n_2 \pm 1)}$ must also be, hence $2n$ is divisible by $2(2n_2 \mp 1)$ or twice the odd number.

Terminal figures in the different powers.

	p^{th}	2^{nd}	3^{rd}	4^{th}	5^{th} Power
	0	0	0	0	0
	1	1	1	1	1
	2	4	8	6	2
	3	9	7	1	3
	4	6	4	6	4
	5	5	5	5	5
	6	6	6	6	6
	7	9	3	1	7
	8	4	2	6	8
	9	1	9	1	9

After the fourth power the series are repeated in their regular order.

Demonstration of Tests of Divisibility by a General Expression.

Divisibility by 2.

$$\left(\underbrace{d_n \times 10^{n-1}}_{\text{div. by 2}} + \underbrace{d_{n-1} \times 10^{n-2}}_{\text{div by 2}} + \text{----------} \underbrace{d_3 \times 10^2}_{\text{div by 2}} + \underbrace{d_2 \times 10}_{\text{div by 2}} + d_1\right)$$

The 2nd 3rd, n^{th} and 2^{nd} terms, being multiples of two, are of course divisible by two, hence their sum will likewise be. Thus if the 1st or right hand term or figure is divisible by two, the sum, when taken with the other terms will also be, and the number.

Divisibility by 3.

The General Expression may be written,—

$$d_n \times (9+1)^{n-1} + d_{n-1} \times (9+1)^{n-2} + \text{----------} d_3 \times (9+1)^2 + d_2 \times (9+1) + d_1$$

In raising a number or quantity to any power, (algebraically) all of the terms except the last, are multiples of the first term in the root.

Thus $(9+1)^{n-1}$ would produce a quantity whose terms would all be divisible by nine except the last, (which would become one) and nine being a multiple of three its terms would also be divisible by three.

$d_n (9+1)^{n-1}$ would then all be divisible except the last term $= d_n \times 1^{n-1} = d_n$
$d_{n-1} (9+1)^{n-2}$ " also be " " " " $= d_{n-1} \times 1^{n-2} = d_{n-1}$
$d_3 (9+1)^2$ " " " " " " " $= d_3 \times 1^2 = d_3$
$d_2 (9+1)$ " " " " " " " $= d_2 \times 1 = d_2$
d_1 the last term might not be divisible. $= d_1 \times 1^0 = d_1$

The sum of numbers being divisible, if $d_n + d_{n-1} + d_3 + d_2 + d_1$, the remainder, after, that is the same number as the sum of the digits of the number, hence the Rule:

A number is divisible by three, when the sum of its digits is three divisible

Demonstration of tests. (Continued)

Divisibility by 4.

Any number with its two right hand figures zeros, as 7400, is equivalent to the number multiplied by one hundred, or $n \times 100$.

One hundred is divisible by four, and hence any multiple of 100 is also.

If the form of the number is 7428, where the 2 right hand figures are divisible by four, or $n \times 100 + f \times 4$ (f = factor), then the number is divisible by composed of two parts, each a multiple of four, and hence their sum divisible.

Hence, when the two right hand figures of a number are zeros, or express a number divisible by four, the number itself is thus divisible.

Divisibility by 5.

Any number ending in a cipher is equivalent to $n \times 10$. Since 10 is divisible by 5, any multiple of 10 is also.

When a number ends in five it is equivalent to $n \times 10 + 5$, both terms of which are divisible by 5, consequently their sum.

Hence, any number ending in zero or 5 is divisible by 5.

Divisibility by 6.

Any even number divisible by 3 must also be divisible by 2, since 3 is an odd number; hence it would also be divisible by the product of 2 and 3 or 6.

Hence, any even number divisible by 3 is divisible by 6.

By 1.

The general expression for numbers may be written.

$d_n(7+3)^{n-1} + d_{n-1}(7+3)^{n-2} + \text{- - - -

Variation Proportional.

May consist of either three or four terms.

Of three terms, a. b, c. The 1st is to the 2nd as 1st − 2nd is to 2nd − 3rd or a : c :: a − b : b − c.

If a + b are given and c is to be found, we have a : x :: a − b : b − x = the equation ① ab − ax = ax − bx ② ab = x(2a − b) ③ $x = \frac{ab}{2a-b}$

Of four terms. a. b. c, d.

a : d :: a − b : c − d. If d is to be found ① a : x :: a − b : x − x ② ac − ax = ax − bx. ③ ac = 2ax − bx ④ ac = x(2a − b) ⑤ $x = \frac{ac}{2a-b}$

Similar equations may be deduced if any term is pertinent.

Three proportions are used in music.

1st Base. Used in the Minor Scale. a, b. c. representing the Minor Chord or Triad. If. b = 24, c = 30 then 24 : 30 :: x 24 : 24 + 30, ②

② 24x − 30x = 30x − 720. ③ 720 = 36x ④ x = 20 = ans

2nd " Base. Used in Major Scale. a. b. c, d. representing Common Chord or Major Triad with the octave. If. a = 24, b = 30, & d = 48. Then

24 : 48 :: 24 − 30 : x − 48 ② 24x − 1152 = 1152 − 1440, ③ 24x = 576, ④ x = 36

* The relative value of the tones of the scale in vibrations is

2/3 3/4 5/6 15/16 1 9/8 5/4 4/3 3/2 5/3 15/8 2 9/4 5/2
16 18 20 22½ 24 27 30 32 36 40 45 48 54 60

Alligation Alternate.

A poulterer is to make up one hundred fowls, of chickens @ 25 cts., ducks @ 50 cts, Turkeys at $4.00 ea. each proportions as will make the average worth $1. ea. How many of each.

	25	+75	(1) 4	(2)	(1) x 6 24	(2) x10	24	52	52	
100	50	+50		0		60	60		30	30
	400	-300	1	1	6	10	16	13	5	18
			5	7			100			100

(1)x13 (2)

ans ans

Two sets { 24 chicks, 60 ducks, 16 Turks ; 52 chicks, 30 ducks, 18 Turks

Percentage

10 Cases from b, r, p, a, d.

						(1)	(2)	(3)
(1)	Given	b	&	r	to find	p	a	d
(2)	"	b	"	p	"	"	r	a, d
(3)	"	b	"	a	"	"	r	p, d
(4)	"	b	"	d	"	"	r	p, a
(5)	"	r	"	p	"	"	b	a, d
(6)	"	r	"	a	"	"	b	p, d
(7)	"	r	"	d	"	"	b	p, a
(8)	"	p	"	a	"	"	b	r, d
(9)	"	p	"	d	"	"	b	r, a
(10)	"	a	"	d	"	"	b	r, p

To find these we have 3 Fundamental Formulae, as follows,

① $p = br$

② $a = b + br$ or $a = b(1+r)$ or $a = b + p$

③ $d = b - br$ or $d = b(1-r)$

(1)		The formulae for this Case are the same as the fundamental		
	1	From	(1)	$r = \frac{p}{b}$
2	2	"	1/2	$a = b + p$
	3	"	1/3	$d = b - p$
	1	"	2	$r = \frac{a-b}{b}$
3	2	"	1/2	$p = a - b$
	3	"	2/3	$d = 2b - a$

Percentage (Continued)

	1	From	(3)	$r = \frac{b-d}{b}$	10
4	2	"	$\frac{1}{3}$	$p = b - d$	11
	3	"	$\frac{2}{3}$	$a = 2b - d$	12
	1	"	(1)	$b = p/r$	13
5	2	"	$\frac{1}{2}$	$a = \frac{p(1+r)}{r}$	14
	3	"	$\frac{1}{3}$	$d = \frac{p(1-r)}{r}$	15
	1	"	(2)	$b = \frac{a}{1+r}$	16
6	2	"	$\frac{1}{2}$	$p = \frac{ar}{1+r}$	17
	3	"	$\frac{2}{3}$	$d = \frac{a(1-r)}{1+r}$	18
	1	"	(3)	$b = \frac{d}{1-r}$	19
7	2	"	$\frac{1}{3}$	$p = \frac{dr}{1-r}$	20
	3	"	$\frac{2}{3}$	$a = \frac{d(1+r)}{(1-r)}$	21
	1	"	$\frac{1}{2}$	$b = a - p$	22
8	2	"	$\frac{1}{2}$	$r = \frac{p}{a-p}$	23
	3	"	$\frac{1}{3}$	$d = a - 2p$	24
	1	"	$\frac{1}{3}$	$b = d + p$	25
9	2	"	$\frac{1}{3}$	$r = \frac{p}{d+p}$	26
	3	"	$\frac{1}{3}$	$a = d + 2p$	27
	1	"	$\frac{2}{3}$	$b = \frac{a+b}{2}$	28
10	2	"	$\frac{2}{3}$	$r = \frac{a-b}{a+b}$	29
	3	"	$\frac{2}{3}$	$p = \frac{a-b}{2}$	30

Commissions.

Terms are a, r, c, ec, np.

a = Amt. of sale, collection, or purchase = b Base

r = Rate

c = Commission, Selling, or Buying = p, percentage

ec = Entire Cost = Amount a

np = Net Proceeds = Difference d

Since we would not wish to find both the ec and the np at the same time, one occurring in buying, and the other in selling commission, we never have but 4 terms involved, and hence can have only 6 cases, as follows:

The 3 Formulas in case 1 are fundamental, since the remainder are derived from them by the several modes of Elimination.

		Given	To be found	Formulas	
	1	a, r	c	$c = ar$	1
1	2	"	np	$np = a - ar = a(1-r)$	2
	3	"	ee	$ee = a + ar = a(1+r)$	3
	1	a, c	r	From (1) $r = \frac{c}{a}$	4
2	2	"	np	" 1/3 $np = a - c$	5
	3		ee	" 1/2 $ee = a + c$	6
	1	a, np	r	" (3) $r = \frac{a - np}{a}$	7
3	2	"	c	" 1/3 $c = a - np$	8
	3	a, ee	r	" 1/2 $r = \frac{ee - a}{a}$	9
	4	"	c	" 1/2 $c = \frac{ee\,r}{1+r}$	10
	1	r, c	a	" (1) $a = \frac{c}{r}$	11
4	2	"	np	" 1/3 $np = \frac{c(1-r)}{r}$	12
	3	"	ee	" 1/2 $ee = \frac{c(1+r)}{r}$	13
	1	r, np	a	" (3) $a = \frac{np}{1-r}$	14
5	2	"	c	" 1/3 $c = \frac{npr}{1-r}$	15
	3	r, ee	a	" (2) $a = \frac{ee}{1+r}$	16
	4	"	c	" 1/2 $c = \frac{ee\,r}{1+r}$	17
	1	c, np	a	" 1/3 $a = c + np$	18
6	2	"	r	" 1/3 $r = \frac{c}{np+c}$	19
	3	c, ee	a	" 1/2 $a = ee - c$	20
	4	"	r	" 1/2 $r = \frac{c}{ee-c}$	21

Stock - Jobbing

Terms. - pv., r, r', ±p, b, r.v., c, p'

pv - Par value = base

r = Rate of premium or discount

r' = " " Brokerage

+p - Premium

-p = Discount.

b = Brokerage

rv = Real Value

c - Cost

p' = Proceeds.

By combining these terms in different ways a great number of cases may be produced, some of which are here given.

In these formulas none are considered as fundamental, although the first only are obtained by analysis.

Formulæ

Given, To find, Formulas, Remarks

	1	$P v, 2$	$\pm p$		$\pm P = P 2.2$	1
	2	"	N		$N V = P v \pm P v 2 = P v (1 \pm 2)$ or $P v \pm P$	2
1	3	$P v, v'$	b		$b = P v v'$	3
	4	$P v, 2, v'$	c		$c = P v \pm P v 2 + P v v' = P v (1 \pm 2 + v')$ or $c = N V + b$	4
	5	"	p'		$p' = P v \pm P v 2 - P v v' = P v (1 \pm 2 - v')$ or $p' = N V - b$	5
	1	$P v, \pm p$	2	1	$2 = \frac{\pm P}{P v}$	6
	2	"	$N V$	2	$N V = P v \pm p$	7
2	3	$P v, b$	v'	3	$v' = \frac{b}{P v}$	8
	4	$P v, \pm P, b$	c	2/4	$c = P v \pm p + b$	9
	5	"	p'	2/5	$p' = P v \pm P - b$	10
	1	$c, 2, v'$	$P v$	4	$P v = \frac{c}{1 \pm 2 + v'}$	11
	2	$P, 2, v'$	"	5	$P v = \frac{p'}{1 \pm 2 - v'}$	12
	3	$c, 2, v'$	$\pm p$	1/11	$\pm p = \frac{c 2}{1 \pm 2 + v'}$	13
	4	$p', 2, v'$	"	12	$\pm p = \frac{p' 2}{1 \pm 2 - v'}$	14
3	5	$c, 2, v'$	$N V$	2/11	$N V = \frac{c \pm c 2}{1 \pm 2 + v'} = \frac{c (1 \pm 2)}{1 \pm 2 + v'}$	15
	6	$P', 2, v'$	"	2/12	$N V = \frac{p' \pm P 2'}{12 - 2 - v'} = \frac{p' (1 \pm 2)}{1 \pm 2 - v'}$	16
	7	$c, 2, v'$	b	3/11	$b = \frac{\pm v'}{1 \pm 2 + v'}$	17
	8	$P, 2, v'$	"	3/12	$b = \frac{P' v'}{1 \pm 2 - v'}$	18
	9	$c, 2, v'$	p'	5/11/17	$p' = \frac{c \pm c 2 - c v'}{1 \pm 2 + v'} = \frac{c (1 \pm 2 - v')}{1 \pm 2 + v'}$	19
	10	$P', 2, v'$	c	4/5	$c = \frac{p' \pm P' 2 + P' v'}{1 \pm 2 - v'} = \frac{p' (1 \pm 2 + v)}{1 \pm 2 - v'}$	20

Formulas (Continued)

	1	P_v, w	$\pm p$	2	$\pm p = \pm w \mp P_v$	21
	2	w, c	b	4	$b = c - w$	22
4	3	w, p'	"	5	$b = w - p'$	23
	4	p_v, w	z	$\frac{2}{21}$	$z = \frac{\pm w \mp P_v}{p_v}$	24
	5	P_v, w, c	z'	$\frac{2}{22}$	$z' = \frac{c - zv}{p_v}$	25
	6	P_v, w, p'	"	$\frac{2}{23}$	$z' = \frac{zv - p'}{p_v}$	26
	1	$z, \pm p$	P_v	1	$P_v = \frac{\pm p}{z}$	27
	2	"	w	$\frac{2}{26}$	$w = \frac{\pm p}{z} \pm p$	28
5	3	$z, \pm p, b$	z'	$\frac{3}{26}$	$z' = \frac{b}{\frac{\pm p}{z}} = \frac{bz}{\pm p}$	29
	4	"	c	$\frac{9}{26}$	$c = \frac{\pm p}{z} \pm p + b$	30
	5	"	p'	$\frac{10}{26}$	$p' = \frac{\pm p}{z} \pm p - b$	31
	1	z, w	P_v	2	$P_v = \frac{zv}{1 \pm z}$	32
	2	"	$\pm p$	$\frac{21}{31}$	$\pm p = \pm zv \mp \frac{zv}{1 \pm z}$	33
7	3	z, w, z'	b	$\frac{3}{31}$	$b = \frac{zvz'}{1 \pm z}$	34
	4	"	c	$\frac{9}{31}$ $\frac{}{32}$ $\frac{}{33}$	$c = zv\left(\frac{1}{1 \pm z} \pm 1 \mp \frac{1}{1 \pm z} + \frac{z'}{1 \pm z}\right) = zv\left(1 + \frac{z'}{1 \pm z}\right)$ si premium $= zv\left(\frac{1 \pm z + z'}{1 \pm z}\right)$ et diremit $= zv\left(-1 + \frac{z + z'}{1 - z}\right) = zv\left(\frac{1 - z + z'}{1 - z}\right)$	35
	5	"	p'	$\frac{10}{31}$ $\frac{}{32}$ $\frac{}{33}$	$p' = zv\left(\frac{1}{1 \pm z} \pm 1 \mp \frac{1}{1 \pm z} - \frac{z'}{1 \pm z}\right) = zv\left(1 - \frac{z'}{1 \pm z}\right)$ si premium $= zv\left(\frac{1 \pm z - z'}{1 \pm z}\right)$ et diremit $= zv\left(-1 + \frac{z - z'}{1 - z}\right) = zv\left(\frac{1 - z - z'}{1 - z}\right)$	36
	1	$\pm P, w$	P_v	21	$P_v = zv \mp p$	37
	2	"	z	$\frac{6}{36}$	$z = \frac{\pm p}{zv \mp p}$	38
5	3	$\pm P, b, zv$	z'	$\frac{8}{36}$	$z' = \frac{b}{zv \mp p}$	39
	4	b, zv	c	4	$c = zv + b$	40
	5	"	p'	5	$p' = zv - b$	41

May be multiplied to infinity - ! ?

Geometrical Theorems.

Relations of lines and Angles.

(1)

$adb' + b'dc = 2Ra.$
$adb - b'db = adb'$
$bdc + b'db = b'dc$
$adb - b'db + bdc + b'db = adb' + b'dc$
$adb + bdc = 2Ra.$

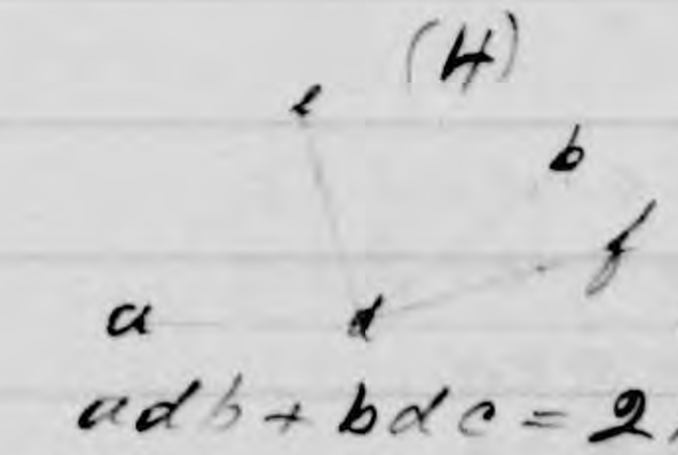
(2)

$bfc + cfd + dfe = bfe$
$bfe + bfa = 2Ra$
$bfa + bfc + cfd + dfe = 2Ra.$

(3)

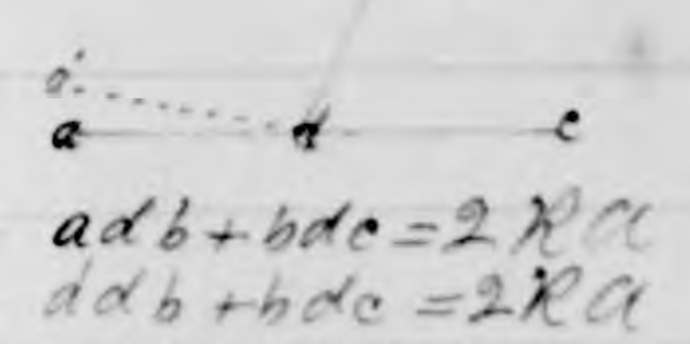
$aob + boc + cod + doe = 2Ra$
$aoh + hog + gof + foe = 2Ra$
$aob + boc + cod + doe + aoh + hog + gof + foe = 4Ra$

(4)



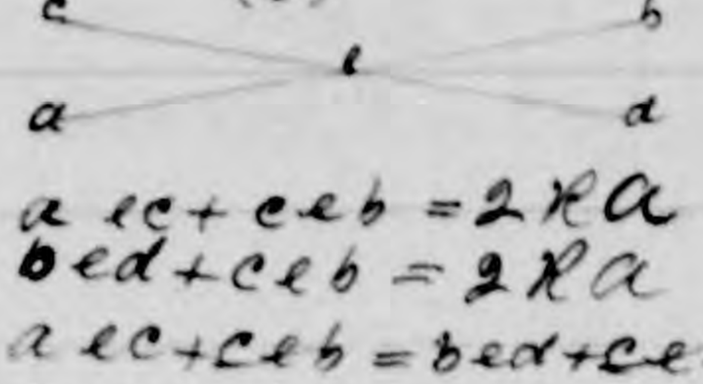
$adb + bdc = 2Ra$
$\frac{adb}{2} + \frac{bdc}{2} = 1Ra$
$\frac{adb}{2} = edb$
$\frac{bdc}{2} = bdf$
$edb + bdf = 1Ra.$

(5)



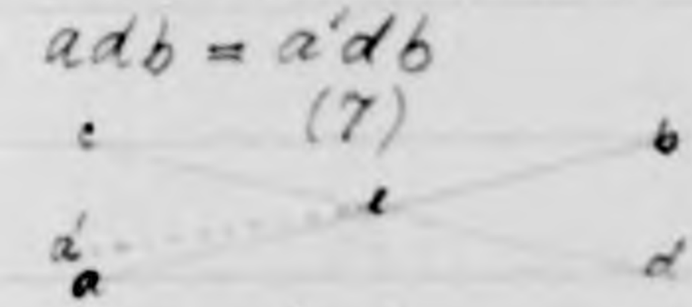
$adb + bdc = 2Ra$
$d'db + bdc = 2Ra$
$adb = a'db$

(6)



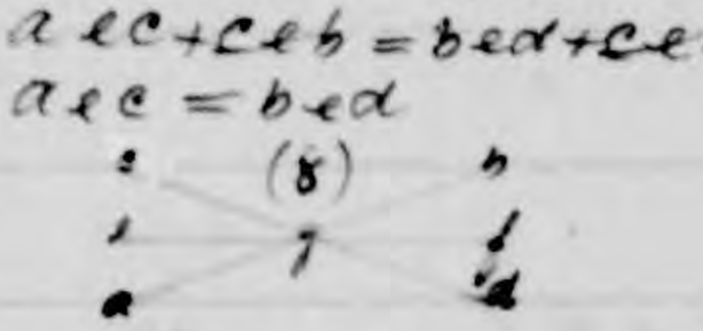
$aec + ceb = 2Ra$
$bed + ceb = 2Ra$
$aec + ceb = bed + ceb$
$aec = bed$

(7)



$aec = bed$
$a'ec = bed$
$a'ec = aec$

(8)

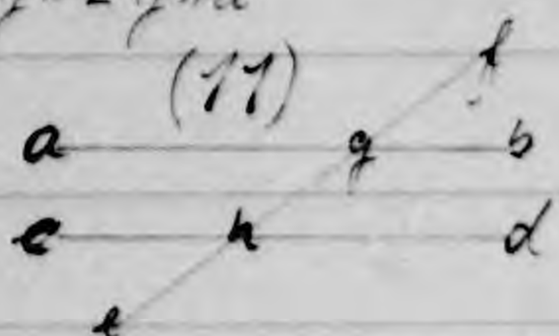


$agc = bgd$
$age = egc$
$agc + egc = agc$
$agd + bgd = bgd$
$agc = bgd$
$agc = bgf$
$fgd = bgf$

(9)

div of ab to fe is same as
" of cd from h; hence
$fgb = ghd$

(11)



$chg + ghd = 2Ra$
$agh + hgb = 2Ra$
$agh = ghd$
$chg = hgb$
$agh + chg = 2Ra$
$ghd + hgb = 2Ra$
or
$egb = ghd +$
$hgb = hgb =$
$fgb + hgb = ghd + hgb$
$egb + hgb = 2Ra$ hence
$ghd + hgb = 2Ra$ ax.

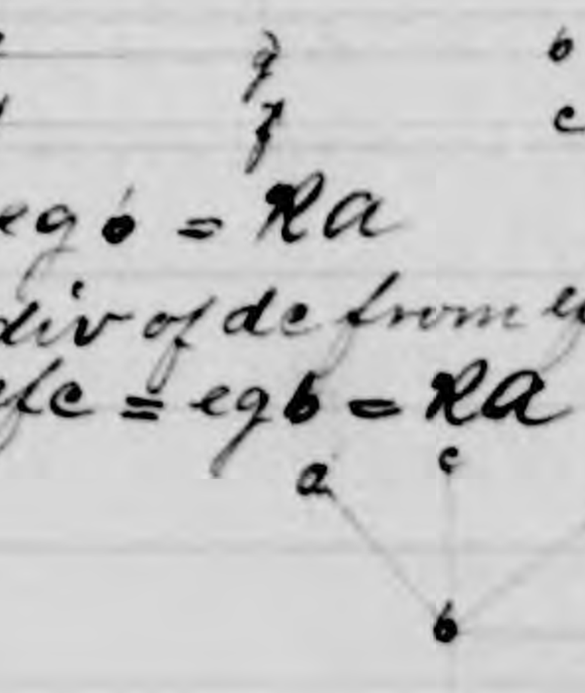
(13)

$abc = a'bc$
$a'b'c' = a'bc$
$abc = a'b'c'$

(10)

$agh = egb$ (6)
$agf = hgb$ (6)
$cfh = ghd$ (6)
$chg = ehd$ (6)
$egb = ghd$ (9) hence
$ghd = agh$ ax.
$chg = agf$ (9) hence
$chg = hgb$ ax. rr
$chg + ghd = 2Ra$
$agh + hgb = 2Ra$
$chg + ghd = agh + hgb$
$chd = agh$
$chg = hgb$

(12)

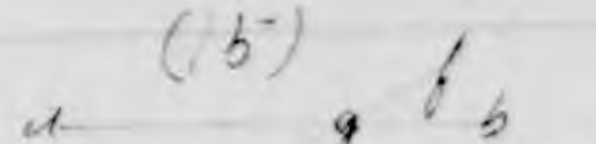


$egb = Ra$
div of dc from e is same as
$efc = egb = Ra$

(14)

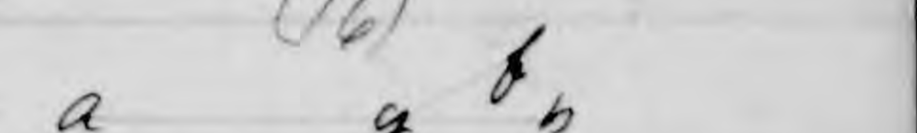
$abc + cba' = Ra$
$a'bc' + cbd' = Ra$
$abc + cba' = a'bc' + cba'$
$abc = a'bc'$
$abc + abd = 2Ra$
$a'bc' + abd = 2Ra$

(15)



$fg\,b = ghd$ hence
dirn of ab and of cd
to it is same: then
their direction is same
and they are parallel

(16)

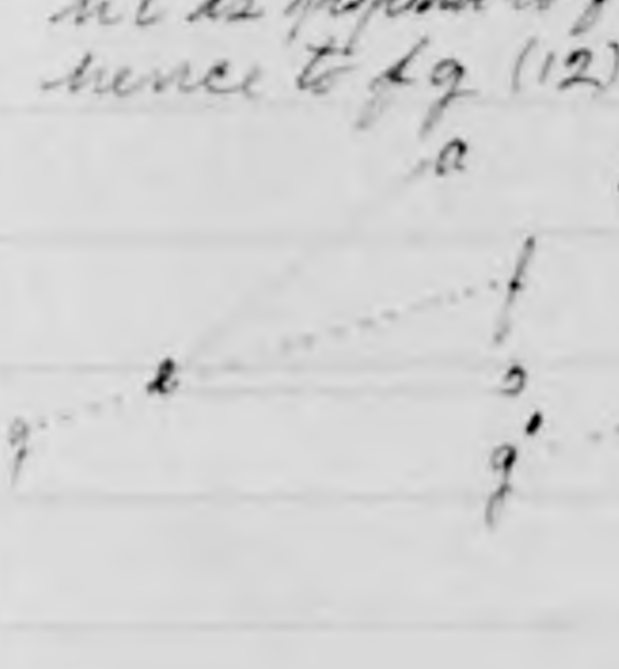


$agh = ghd$
$agh = fgb$
$ghd = fgb$
lines ab and cd pll. (15) or
$hgb + ghd = 2RA$
$hgb + fgb = 2RA$
$ghd = fgb$ lines pll (15)

(17)

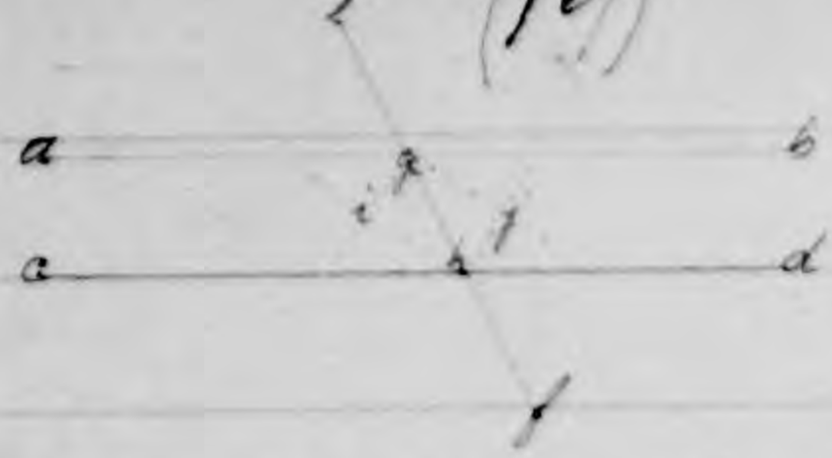
$abc = a'b'c'$
$abg = a'b'g'$
$abg = bcd$
$a'b'g' = b'c'd'$
Hence $\angle g + \angle b'g'$ are pll (16)
$a'b'c' + d'b'c = 2RA.$
$ib'c' + c'b'g' = 1RA$
bi is pll to $f'g'$ and
hence to fg (12)

(18)



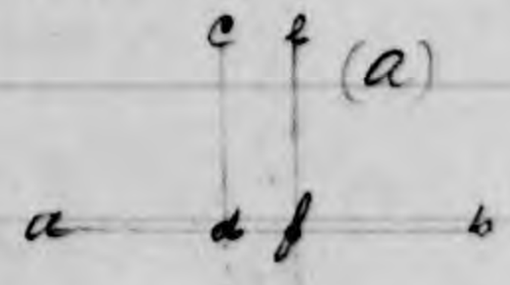
$agc = a'b'c'$
$abf = a'b'f'$
$ab'f = bhb'$
$a'b'f = bhb'$
hence ef is pll to $e'f'$ (16)
$a'b'c' + c'b'd = 2RA$
$f'b'c' + c'b'g = 1RA$
gb' is pll to $e'f'$ hence
to ef (12)
$aeb = a'e'b'$
$a'e'b' = c'e'd$
$c'e'd = aeb$
$a'eb + beic = RA$
$he'b' + ce'f = ae'b'$
$hib' + ceif + bic = RA$
hence hi is pll to gf and
also pll to gf. (12)
$a'e'b' + a'e'j = 2RA$
$a'e'h + a'e'g' = 1RA$
he is pll to ge' and also to $e'f'$
then ge' is in the same straight line
with $e'f'$ and hence pll to gf.

(19)



The lines gj and hj are ppnd by Pr. Th.; hence the ang. j is R.
So with the line hi. and gi.; hence the ang i. is R.A
By Pr. Th. the angs h and g are R.A's, hence the figure is rectangle

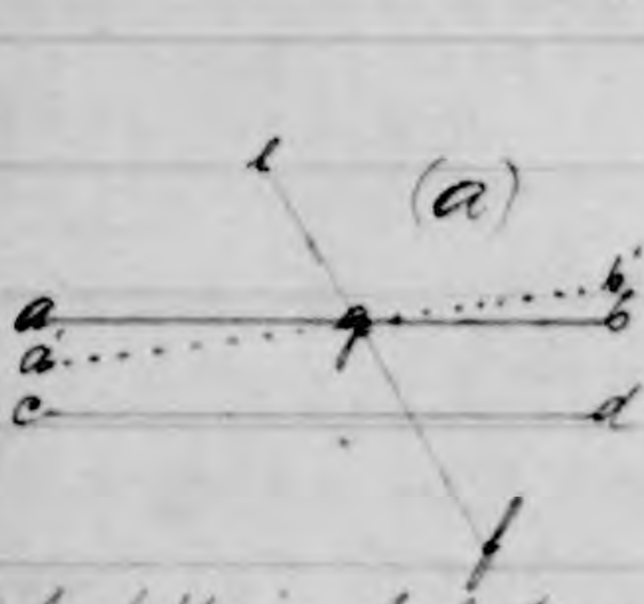
(20)



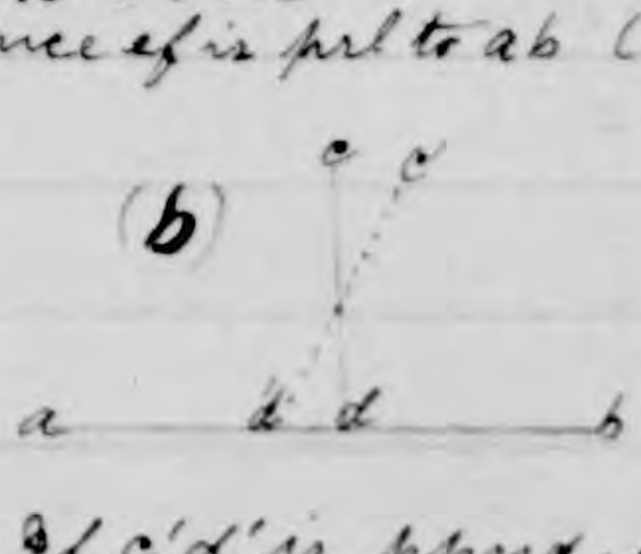
The ang d is R.A., also the ang f.
Then their sum is 2 R.A.
Hence the lines cd & ef are prl (Pr. Th)

$\angle i = \angle j$.
$\angle i = \angle k$
$\angle k = \angle i$
hence ef is prl to ab (Pr. Th.)

(21)



If a'b' is prl. to cd, then
$\angle a'gc = \angle a'gc$
Then would a g and a'g coincide and hence become the same straight line.



If c'd' is ppnd. to ab then is it prl. to cd.
By Pr. Th. two prl. lines cannot be drawn through the same point.

*(25)

Ang b > $\angle$c when ac > ab Proof.
Let dc - bc, then bd = a + abd hence bc'c > a
but abc > d. hence abc > a

Properties of Triangles
(general)

Angles

(22)

$abd + abc + cbe = 2RA$

$abd = bac$

$cbe = acb$

Then $bac + acb + abc = 2RA$.

or

$dbf + fbg + gbe = 2RA$.

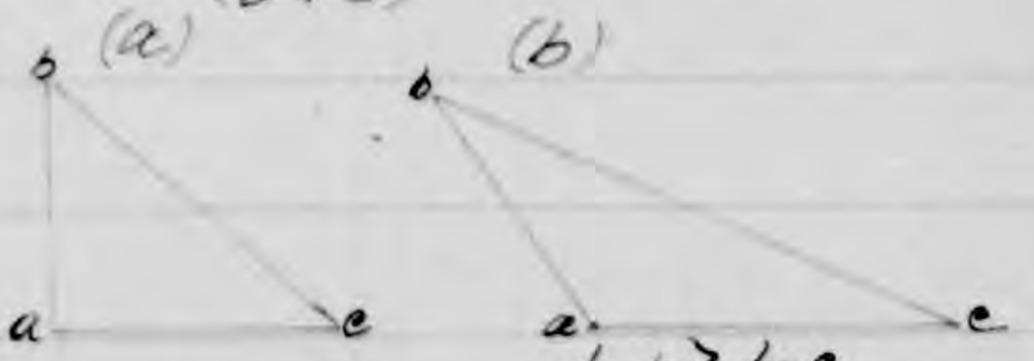
$gbe = bac$

$fbf = acb$

$fgb = abc$

Then $bac + acb + abc = 2RA$

(23)



$\angle a > \angle c$ or b

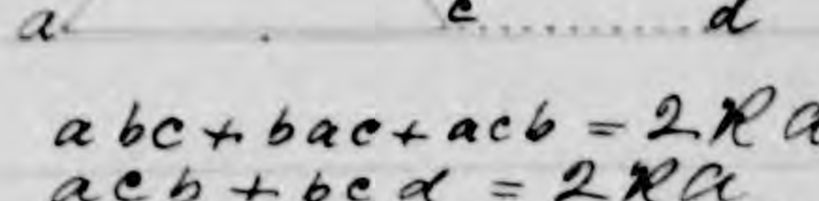
then if c or b is Ra a must be obtuse; but a is Ra. Hence the theorem If the triangle contains two Ra & then the two opposite sides would be perl. and hence two obtuse angles could never. It contains a $\angle$ they would constantly diverge and hence never meet.

$\angle b > \angle c$

$\angle a > c$ or b

then if c is obtuse or right, b must be more obtuse and a still more which cannot be.

(24)



$abc + bac + acb = 2Ra$

$acb + bcd = 2RA$

$abc + bac + \underline{acb} = \underline{acb} + bcd$

$abc + bac = bcd$

(25)

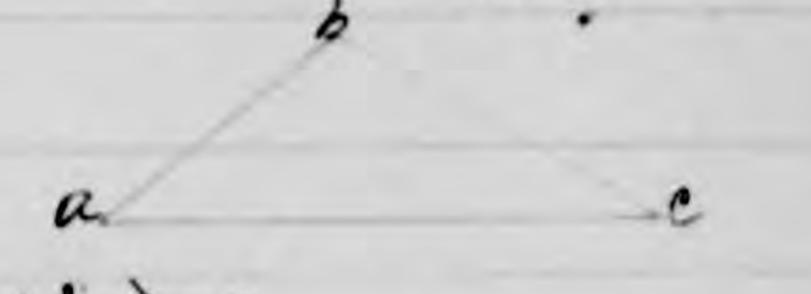
*See previous page at bottom.

An ang is diverg. between two lines

This diverg is measured by the third side of the triangle

Then the greater this line the greater will be the divergence and hence, the angle.

(26)



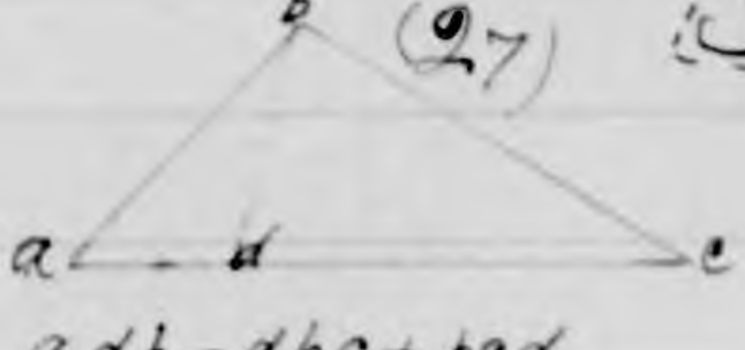
$b > a$.

$a > c$; hence none are equal

If a or c were R or obtuse, b would be more obtuse which would be impos

Sides

(27)



$adb = dbc + bcd$

$abc = bdc$ hence

$adb > bdc$

$dab + abd = bdc$; hence

$dab > dab + abd$

Then the line ab opposite the angle adb must be the longest side of the triangle abd and hence longer than cd the dif. between $\underline{bc}$ and $\underline{ac}$

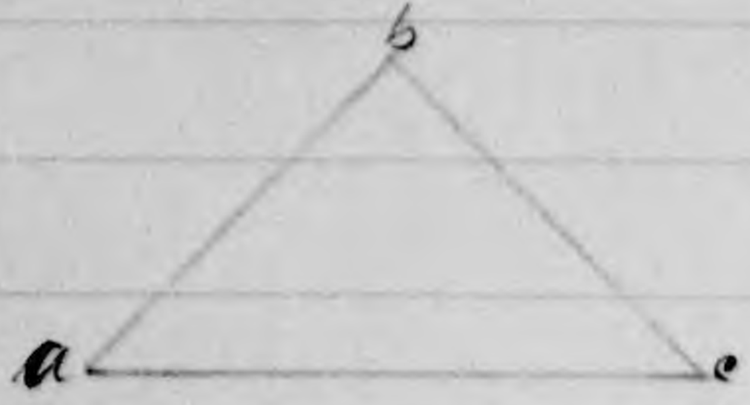
So with any sides

Again, $ab + bc > ac$

$cd = bc$

2nd Dim. $ab > ac - bc$

(28) (Sides)

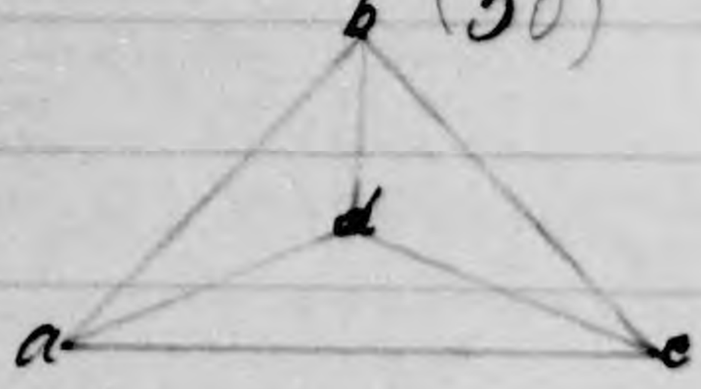


$ab + bc > ac$
$ab + bc + ac > 2ac$

(29)

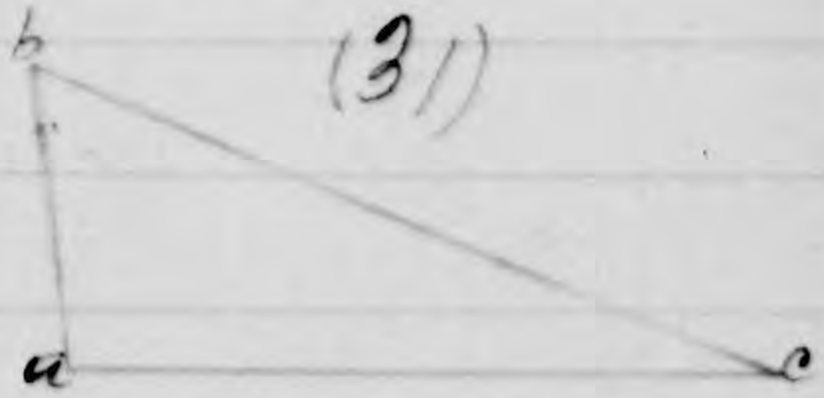
$ab > ad$
$bc > dc$
$ab + bc > ad + dc$

(30)



$ab > ad$.
$ab > bd$
$ac > ad$
$ac > dc$
$bc > bd$
$bc > dc$
$2ab + 2ac + 2bc > 2ad + 2bd + 2dc$
$ab + ac + bc > ad + bd + dc$

(31)



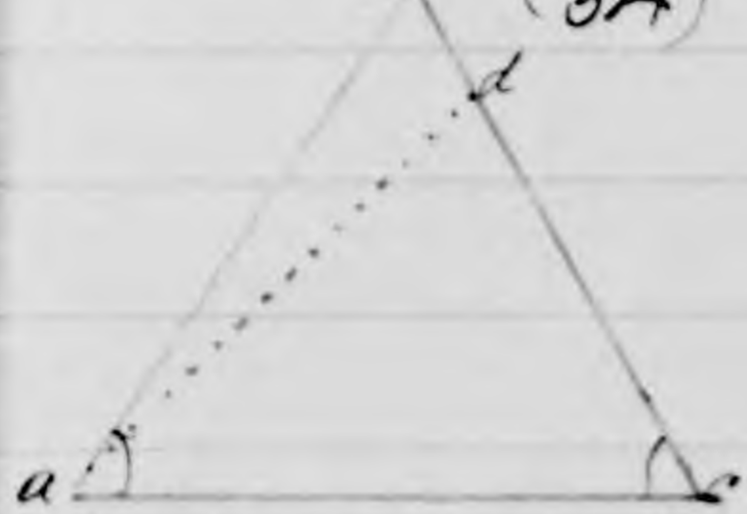
The greater angle is the one between those lines having the greatest divergence. The lines having the greatest divergence would require the longest lines to connect that is hence the theorem.

Properties of Triangles.

(Special)

(32) Sides ---- and Angles.

If one were larger than the other then one side would be longer and hence they would not be equal.



Suppose $bc > ab$

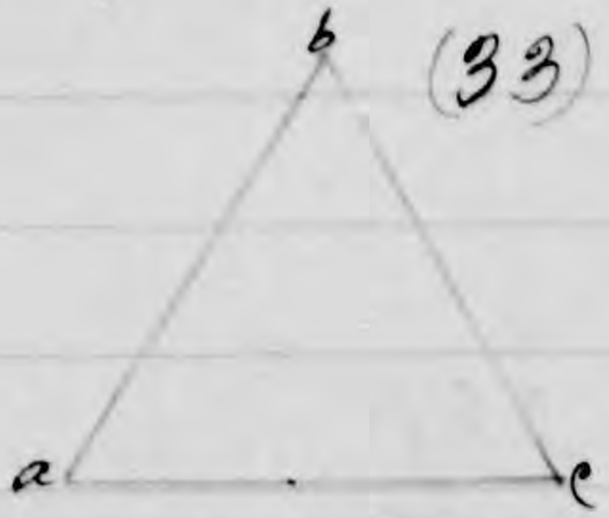
Let $dc = ab$

Then adc is an isosceles triangle, and the angle adc will equal abc which is absurd.

$dac = dca$

hence $ad = dc$ making the triangle isosceles.

(33)



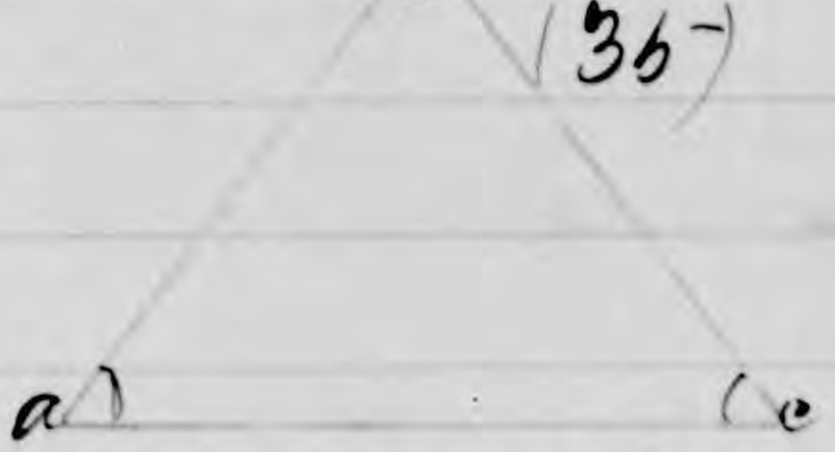
$ab = bc$ then

$a = c$

$ac = bc$ then $a = b$ hence

$c = b$; hence the theorem.

(35)

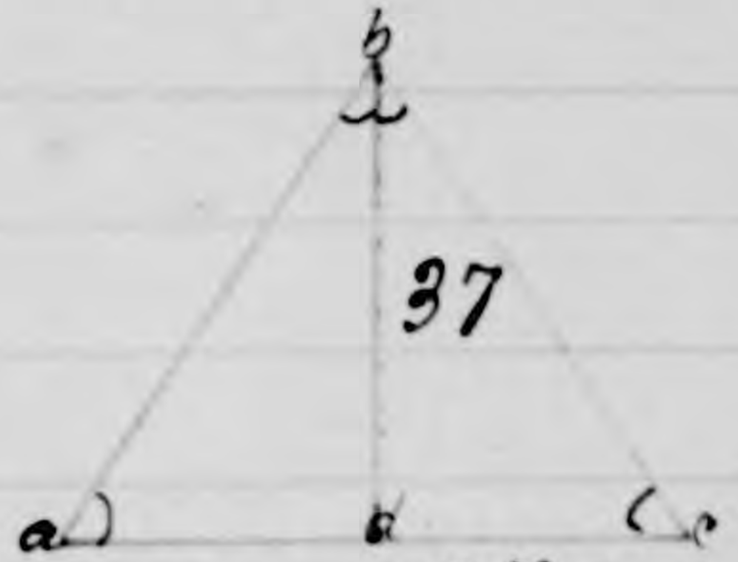


If $a = c$, then $bc = ab$

" $a = b$ " $bc = ac$ hence

$ac = ab$; Hence the theorem

37



$bad + adb + abd = 2Ra$

$dbc + bcd + cdb = 2Ra$

$adb + bdc = 2Ra$

$bad + abd = dbc + bcd$

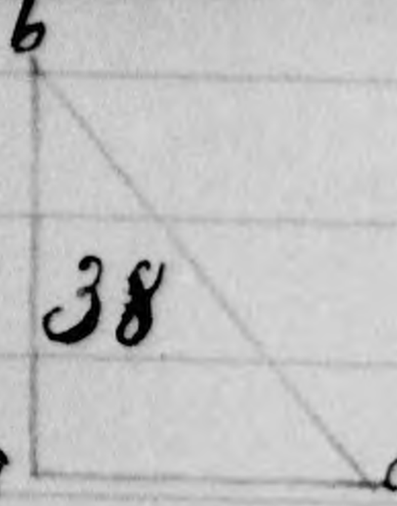
$bad + adb + abd = dbc + bcd + cdb$

$bad + abd = dbc + bcd$

$adb = cdb$

$adb = 1Ra$ since bd is $\perp$ to ac.

$bcd = 1Ra$.

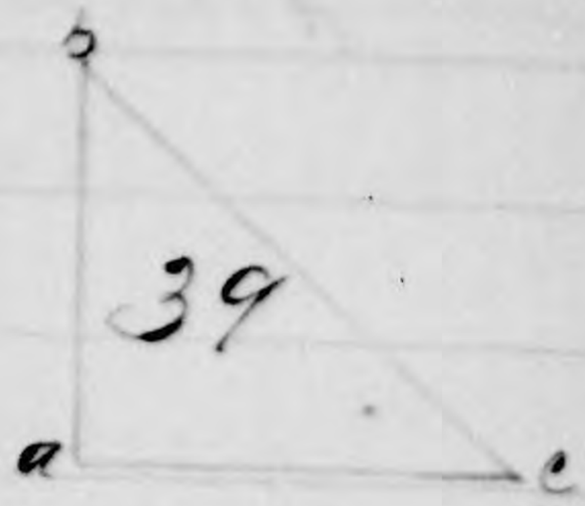


38

$a+b+c=2Ra$

$a=1Ra$ hence

$b+c=1Ra$



39

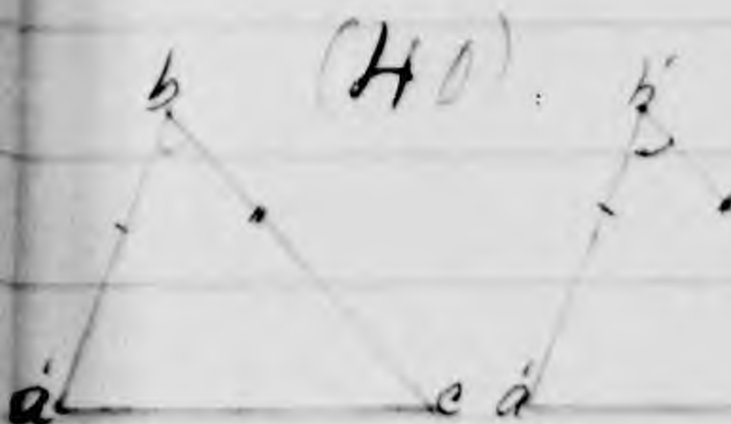
$\angle a > b$ or c hence

$bc > ba$ or ac.

Relation of Triangles.

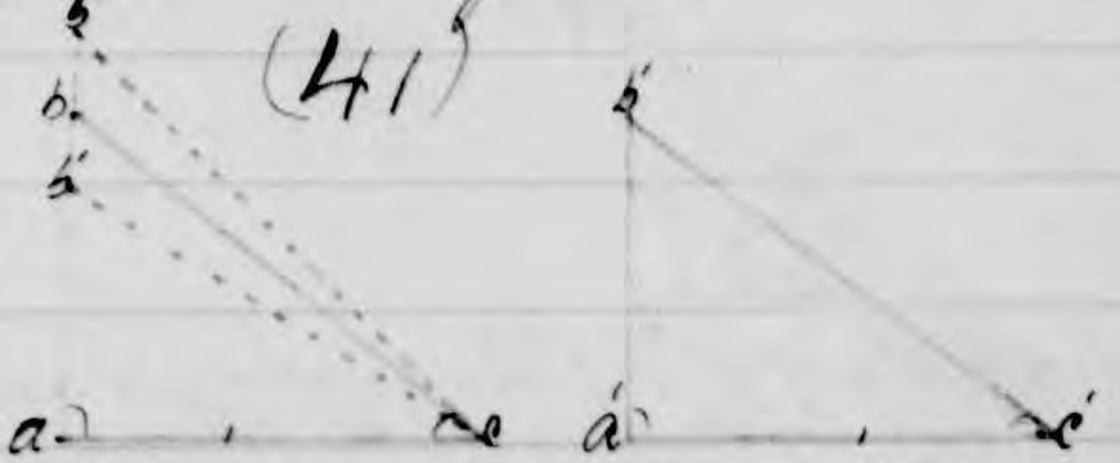
(Equality.

(40)



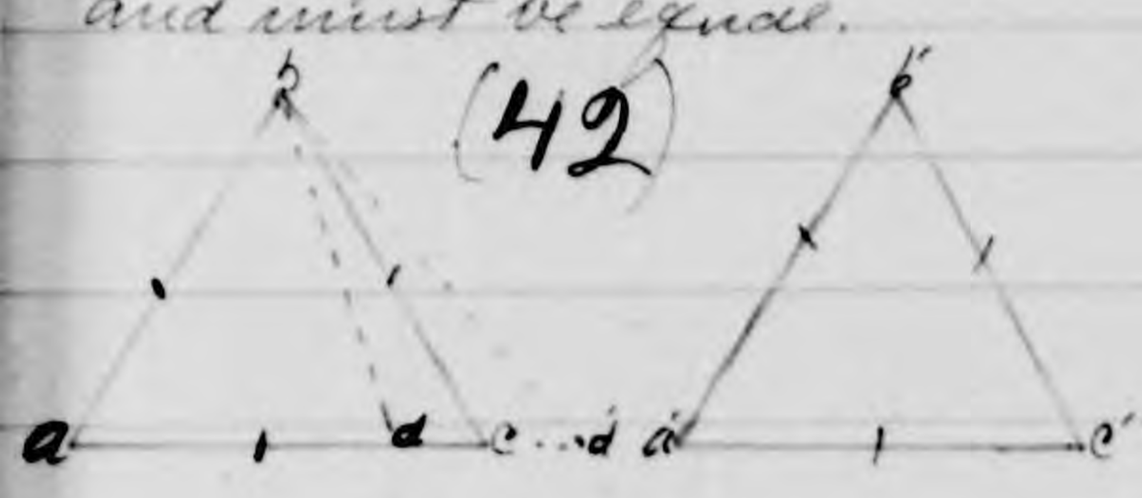
The points a, b, c and d, b', c' must coincide; hence the lines ac and dc'; and hence the triangles must coincide and must be equal.

(41)



a'c' will coincide with ac
∠a' " " " ∠a
∠c' " " " ∠c
Suppose b' falls at b'' within the line bc
Then the angle ac b' = acb; which is absurd
If b' falls without the line
Then acb = acb' which is absurd
hence it must fall at b where the triangles will coincide.

(42)



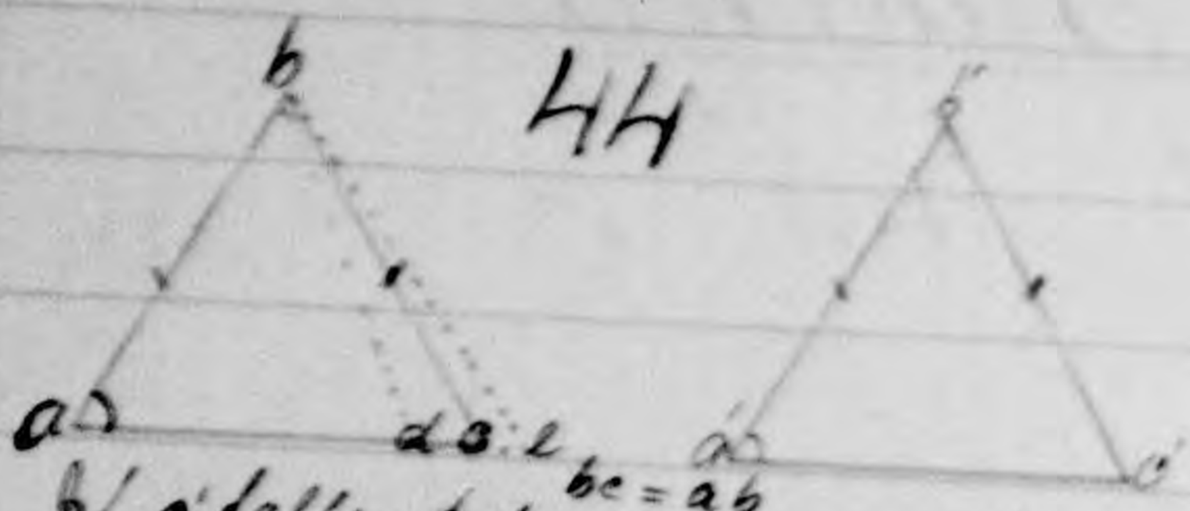
(43)

2nd Demonstration

bc = cd hence ∠ bdc = ∠ cbd
ab = ad " ∠ abd = ∠ adb

since ∠ abd + ∠ cbd = ∠ bdc + ∠ adb

then, ∠ adc = ∠ abc and since
ad and dc = ab and bc respectively
the triangles are equal



If c' falls at d upon making a' and b' coincide with a and b, then we have the isosceles triangle abc
bdc = bad + abd; bdc = dcb by supposition
acb = bac; hence
bdc > dcb and c' cannot fall within bc
In like manner we can prove that it cannot fall without.
Also if bc > ab the same.

Library of Greek Words.

A

ἄγκῡρα, anchor

ἀϊτοῖ, of eagle

ἀϊτοῦ, of himself

ἀϊχμῆς, unarmedly.

ἄκμῆς, acme.

Zweites Beispiel

Beispiel 1.

Von Wasser und Luft. Wasser, Luft
Feuer und Erde. Erde, Wasser und
Luft, Feuer und Erde. Erde, Wasser und
Luft, Feuer und Erde.

Beispiel 2

Blauer Tisch. Blauer Tisch und
Stuhl. Der Stuhl ist nicht blau. Ist
der Stuhl nicht blau? Der Stuhl
ist blau und der Tisch ist blau.
Ist der Tisch blau? Der Tisch ist
nicht blau. Ist der Stuhl blau?
Der Stuhl ist nicht blau.

βασιλεύς, έως, ὁ

βάλλω, to throw

ἔλεγχος, proof

ἐλέγχω.

ἐρευνάω search

Jesus, Lord.

Rapida. courage.

εἶναι, to exist

ἐᾶναι, to go.

ἵππος, horse

ὁ ἱππός, the horse

Chart of the English Verb.

- Verbal
  - Definition.
  - Use
    - Forms
    - Intransitive
    - Transitive
  - Classification
    - Structure
      - Regular
      - Irregular
      - Defective
      - Redundant.
  - Time & Properties.
    - Number
      - Person
    - Voice
      - Active
      - Passive
  - Laws & Formulas
    - Definition
    - Mode
      - Classification
        - Inflection
          - Standard
          - Subjunctive
          - ~~Imperative~~
          - Infinitive
        - Framing
          - 1st Indicative
          - 2d Subjunctive
          - 3d Potential
          - 4th Imperative
          - 5th Infinitive
      - Formation
        - 1.
        - 2.
        - 3.
        - 4.
        - 5.
    - Tense
      - Definition
      - Classification
        - Inflection
          - Present
          - Past.
        - Framing
          - Time
            - Present
            - Past
            - Future
          - Time & Mode
            - Present P.
            - Past. P.
            - Future P.
      - Formation
        - 1.
        - 2.
        - 3.
        - 4.
        - 5.
        - 6.
        - Structure
          - Simple
            - Present
            - Past
            - Fut.
          - Compound
            - Past
            - Present
            - Past P.
            - Fut. P.

K

- Definition
- Form
  - Infinitive
    - Present — Int. / Trans.
    - Perfect — Pass.
  - Participle
    - State
      - Imperfect — 1.
      - Perfect — 2. / 3.
    - Time
      - Present — 1.
      - Past — 2. / 3.
    - Structure
      - Simple — 1.
      - Compound — 2. / 3.
- Classification
- Verbal
- Properties
  - Voice ?
  - Case
- Uses
  - Nominal
    - Sub.
    - Obj.
    - Comp.
    - Gen. Ob.
  - Adnominal
  - Adverbial
- Rules.
  - Class.
  - Deriv.
  - Use
  - Rule.

ξένος, stranger,

πατήρ factor,

πλείστα several.

φέρ. 6 γ' ἔαρ.

ἐκ Δηλ., ληθαῖος

Difficult Sentences.

1) The farm was taken possession of. (by me)

2) He is too obnoxious to be shaken hands with. (by me)

3) The matter has been attended to already

4) Check this accts.

5) Pick the orange and (the) did not think of his being.

6) He is a worse (than) person now is braver

7) The rascal was given a good (and) whipping

8) He was thought to be (the) person who was loitering

9) One mistake of the rascal be a knave, provided that the razors shave.

Katharine Fisher (now) H
Mable Boardman / Rectress

Olivia Fuller
Martha Koehne Vice
Thelma Seibe Sec
Peter Barr Brig

Gundar Oliver Boslow Secy
Katherine Thoma Michael Recap
Trea

Diet & Diabetes

Dr. Elizabeth Patterson

Dr. Patterson is a registered dietitian and nutritionist

1st Patient appointment

Must be on hemodialysis

Need to be on peritoneal dialysis

Specific medical diet

Need Patient to be on renal diet

How to teach this unit!
Give patient a problem
or hypothesis list
early*
Need reach metric system
docs to follow drs
exactly, until used to
them* Pt teaching
&
.5 gms ostmeal bread
1 " bread
1.5 gms bacon
1 egg
Moon - 300 gr 5 1/2 lbs!
60 - meal

1 egg yolk = 15 grams cream
bacon

40 cream - 10 g butter
30 flour - 30 oatmeal

1½ bread 3085 [illegible]
= bread [illegible]

[illegible]

[illegible]

[illegible]

100 grams of peaches

16 peaches

100 of blackberries

150 watermelon

85

65 - blueberries.

Shepard Deer

C 64 PS-2758

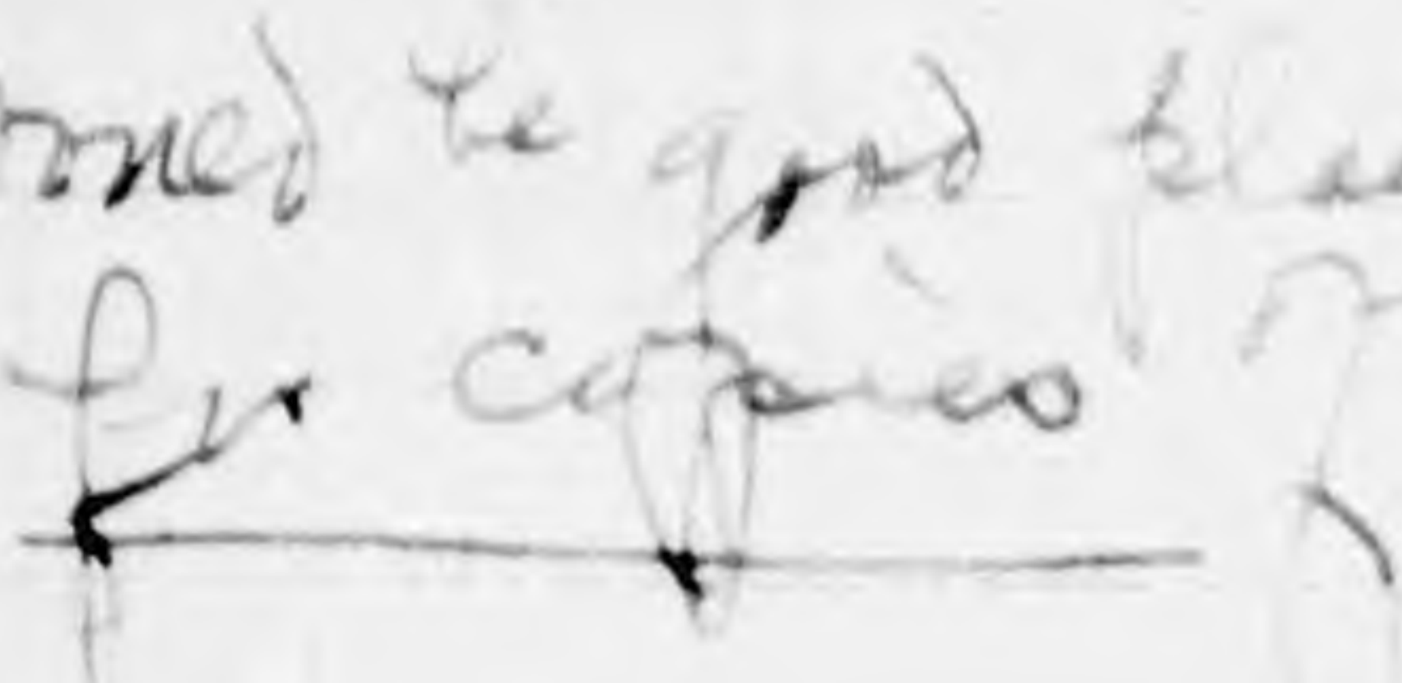
2 eggs
2 tbl Cream
6 oz Steak
Juice 2 oz

Lunch

2 eggs
4 oz Steak
2 Beans

Sq Insts re

(Name) the good [illegible] of [illegible]



Patient (shown) be

[illegible] Regarding [illegible]

[illegible]

Instruct patient [illegible]

Medications [illegible]

[illegible]

Refer [illegible]

3 [illegible]

[illegible]

[illegible]

Refill [illegible]

Often vomits black
material

100 or 150
cubic cc of pt's blood
can take
24 hrs
6 to 8 glucose drinks
per day

Fluid & electrolyte imbalance
Best Rx hyperdermoclysis
3 or 4 x in 24 hrs -
Dehydration or Shock
Clear broth 6
normal -
4 drops of cortin and
in 1 drop D & glycerin

Please fill machine to take care of carboxyhemoglobin levels.

2 cond in pers. after must be notified

Admission

Patient led up to
ward bed by (2) of
personal Physician

In emerg. Operation
must have machine
ext & carbo
machine - Pt. to
care ward for feed
asap -

Method must be
simple enough
for students.

No instructions or diagrams
when you ask a
student to
break down $\int \cot^4 x \, dx$
using $\cot^2 x = \csc^2 x - 1$

Dr Wm Clarke

Diet in the Disorders of the Gastro Intestinal Tract

Treat 52

People come to us saying they have stomach trouble - Maybe early tuberculosis - Reflex from - Complete Rest history up -

Cannot look out upon cereal or milk

barium

as long as he stuffed cat

All right but if he pulled cat, stuffed cat would only

get in dog's dish plus pound

1.11 - 3 hours

Dis
Peritonitis
Peritonitis secondary
to large ulcer perforation
Symptoms -
Stretch Pain with
muscular rigidity
pressure.
Some times vomiting
Diagnosis based on
Test -
Blood culture
Alcohol - = acute gastritis
No do not use vinegar
Chronic gastritis
We have Duodenal
Ulcer but

Friday Breakfast
10 o'clock - Preaching
between Meals -

Elders. Ordained elders
Sermon
Brethren pray. Local preachers.
first - Deacons Trustees:
Quarterly Conference Superintendent
Presiding Elder
Class Leaders
Stewards
Sunday School
Singing -

Black pants (brown)
Diet mixers (Pepsi)

3 meals + possible bedtime

Keep patient warm + quiet

Put cream under R eye

barley water to take p.o.

work-

with hemorr-

hage food 24-48 hrs

Observe hemorr-

hage —

morphine sulphate

nothing by mouth

& if vomiting after 4 hours.

1-2 drops milk of bismuth

Pylonic Obstruction

mod. degrees often due to adhesions. (swelling)

Gall Bladder -

Old cases - Flatulence

Pain after meals

Vomiting

Acute cases - Attacks of pain

Pain in back.

Often jaundice - Rigors and high temp.

Patients - Gall stones

No Gall bladder

Chronic cases

Jaundice - Rigors

Pain in right hypochondrium

Liable to recur

Kelp (I) as near normal as possible

Entero Coliti
Enteritis e Diee
Cyanosis
Yellow Fever
Laryngismus
Alternative Coliti

Appendicitis
Bad teeth are liable to cause
Septic Poisoning
Pneumonia Influenza

Gall. Int. Crud. with
marked prostration
Quite rare. Infection
Fairly watery stools
Bluish-black color
Typhoid in Pneumonia
Measles Mumps.

Under Instruction

Dr. Kerr F.
Chief Surgical Technician
Mt. Pearl Police Department
Medical Division
Police Surgeon
Police Medical Examiner
Mt. Pearl Police Department
Forensic Pathologist
Dr. Kerr F.
Chief Surgical Technician
Mt. Pearl Police Department
Medical Division
Police Surgeon
Police Medical Examiner
Mt. Pearl Police Department
Forensic Pathologist

Ned McCulloch

Hospital admissions
a free people.

Well Give
Dr Brown
Hope dur Goodness
I- Drink Hot Soup
Salad
Peaches
Sweet meats
Cakes &c
2 Sub (a) Drinks that
Includes
Tea
(b) Stimulants &
Meals
Coffee
Salts

11. Explain the term of
contract

5. Explain the term Sleep
Walker or Somnambulism

10. Explain the term
Entrepreneurship

Break Even

Differentiate
between Pure —
(b) Business Partnership
and Agency

Apply Knowledge about
the principles of
Carpentry Plumbing &
Cabinet - Making & Tool
Making Supplies &
Sharpening
In the growth
(Life Graph) Emphasis
placed
Individual Needs
Annual Free Leaf
Period Free —
Growth

Sect rec
Los acres

Sect
all cuts, 07
une - Feb 5

Sect. 6 Food dep.
for
Deborah Ewald
Meals
Meals 4 /
dep on need
patient -
Reduce
overweight

Fat bowels secretion
Mucus
Reabsorb
Stomach
Pancreas
Liver
Gallbladder
Intestine
Rectum
Pleura
6-8 hrs
Stomach empties
Small 2-3 hrs

Lemon Juice
Sweet Potato
Potatoes
Egg
Shortening
Cake Flour
Milk
Salt
Cream of Tartar
Soda
Vanilla
Sugar
Eggs
Flour
Salt
Baking Powder

Roasted Pork Steak
Mashed Taters and
Creamed Cabbage
Fresh Peas
Sweet Meats
Pickles
Fresh Fruit
Rock Cake Pudding
Salads
Tea
Coffee

Justice of the Peace
Circle — Power to
Issue Writs of
Certiorari to Justices
of the Peace —
Appeal — Appeal
Bond — Sureties
on Appeal Bond
Not Necessary
to be Filed
Within Time
Allowed by
Statute

2 Tbsp Semolina
225 Ml Hot Water
Add a pinch of salt
1 Tbsp Butter
Heat Gently until
Lukewarm - Sprinkle
Yeast & Sugar on top
Stir
Cover
Leave to rise
Until Double
Knock back
Knead
Shape
Cover
Leave to prove
Until Double
Bake

Treatment
Best defense for
Cure of Ulcer Stop
on Pressure of
Cancer of Stomach

Best cure for
all forms of Cancer
Because we go
to the cause of
the disease by Diet

Cancel Reason for Cancellation

Cancel Reason for Cancellation

Cancel Reason for Cancellation

Cancel Reason for Cancellation

Cancel Reason for Cancellation

Pat Oppenheimer

Incidental disturbance
Remedies Allen
Peterson
Water appro-
priation Colorado
Ground Water Code
Irrigation Ditches
Reservoirs
Flow Measurement
Diversion Quota
Rule Water Court
Priority Decree)

Flex Products Enterprises
Accepted Petitioned
Motion Temporary
Cases Direct
Storage Counties
Func. Def. Rel.

In Beef Veal
Stomach cured
No food test
In pea or bean
cure settled from
the
Nucleus Fat
Meal (No Chloride
Test
No Food)
Choose Centrifugal
Test Food
Fat Test Paraffin
Fat Tests
Guaranteed refer
to Farmers

1 Atomé - langs
- valves - shafts

11 Shaded
(Treated Ends)

Treats comes in
Atomé
Retains
Takes from shaft
end shaft -

Roll - Stimulates
(often over)
Acts

Laurie Eaton

D Brent Bailey

Patricia Bailey

Ed Kelleher

Peggy Kelleher

Spastic — Magnetism

The Nature Cure

Free Radicals

Free Electrons

Free Energy

Earth Gladden

Prisoner —

Release —

Release of

Thought Forms

Infection — Spread

L. Chapin
Ala Mae Reinhardt
U.S.N.R.
Meriden Conn
Louise Ellen Fisher
3205 Bath Road

Blanche Gardner Hanson
Kenton Hall School
Mar.

Marie B. Rose
Beaumont Place
Nesbit Randolph
U.S. Red Cross
Base Hospital

Chronic Conjestion
Can produce
Respiratory Conflicts
Bad Breath
Dental Problems
Ear Aches
Eye Aches
Head Aches
Pressure Headaches
Ear -
Pain all Over
Headaches
Neck Pain

Helen B. Reed
U. S. Dep. Mint
Salem N. C

Isaac L. Brasher
Jewish Brotherhood
Bro. Rep. N. C.
Chas. E. McClenahan
Secretary
Jewish Brotherhood
New Orleans La.

Geo. Hoffheimer
Gen. Rep.
Jewish Brotherhood

In all cases after
Deaths of Parents
Executor
Clerk Sheriff
Jeeet
Deet plaeo thee
Free Delivered
Freeholder
Deep Blue
White Magnolia
Bacon's
Franklin
Colden
Fords Corona
(Very Good)

Sara K Kendrick
Avery Keep
Chemo
Dec 1 Scarf
Med Oncl. of Dr
Beckham and Dr
Norton Hem
Palliative Should
Pt Needs Chemo
Pt Is
Anna M Lacey
Fcs Str Card
Pt Is
Marjorie Roberts
US - Mammogram -
Results

Mrs. Hall Brown

Frederick Matter
Miss Cordelia Hoff-
Phillips

Marietta Lorine Berry
Cofer Hoffield

Therein Dolgerson
Allen Bonner Bell
Otterbein Ray

Lynn Johnston-
Reed Hoff-
Spartanburg S.C.

Margaret P Brown
Catherine Sims
Lindemann

Dr Richardson
Has made Such
Reasonable
Requests of
Me that I do
not feel
Justified in refusing
to Do
what he asks
of me
Dr Richardson is the
Surgeon
who has been
attending
Mrs Bailey
and
Mrs Bailey
Consents
to
what
he asks
of
me

Elizabeth Hayward
Ca Gl Freeh Groves &c.
Les Angeles

Eloise McCleery
St. Helena Napa
Calistoga Healdsburg
Santa Rosa

Jeanette Gonzalez
Gilroy Castroville
Berkeley Napa

Phyllis Lee
Belvedere-Tiburon Napa
Dr. Corrales

Pauline Mendenhall
Los Gatos

Upon Nineteenth
of December Eighteen
Hundred & Ninety-Four
Nurses Keeps in An
Perfect
Accord
Develop an Attractive
Habits
Habits Display

Nurses
Whom shall We
Where will We Begin
To Study What we
Must while

Patient refuses but
release form and
answers questions

Procedure explanation
Associations

This patient's
normal presentation
(unresponsive
abdominal
Upon Dr [illegible] the
[illegible]

Often me
Sometimes helps health
us to do well.

Mr Rowe's list of
duties as Monitor
Pupils duties
with regard to Library

Monitors, please go
round the Library
& see that all
Pupils are behaving
properly

Children eat tea
up because shes
Enjoys like food
Speech
Father has spoke him
Darkness safe to
+ Music. Animals Dogs
+ Reading on
+ Speech Time central
Loud Normal
Music Quiet Noise
a Advert
Silence
Quiet
Silence

Plastrée
Dermoplastie
Synthèse

Les Swallowers -
et Gourmands -
Thomas Adès - Study
on Leaves Book 2 to 12 -

Late of Hartford
Deceased
(Testate)

Notice is hereby given that
the Hon. Thomas Swift
Judge of the Court of
Probate for the District
of Hartford
has appointed the undersigned
Executrix of the Estate
of said deceased
and has limited
the time for the creditors
of said deceased
to bring in their claims
against said Estate
to the undersigned
at the office of
Edward Steiner
in Hartford
in said District
within six months
from the date of
said appointment.

Dated at Hartford
this 15th day of
March A.D. 1916

Mary Steiner
Executrix

Linda Lou

Psychology Test

Thirty Possible

Complete Set of Pattern

What is a complete set of the

Components of a Pattern

Two Letters of today

Represented in Symbols

Ten Pictures

Next Week Is planned by

Two Members of Four

Pairs —

I believe we get credit
partly from Somacha up-
peasup Khan for Political
Factors - Problem
Administration
Revenue Works
Defence Services
Principles of
Revision Mark
(Sept 01) -
Book appreciation (Autumn)
like how it feels
the purpose read
was has words
13 - 14 examples -
Pure Mixture Letter
true ask Diary
Bridal number -

We are concerned because
so many schools may close
later work -

Byrds do not become
[illegible] during incubation -

Alternating [illegible] through
[illegible] plumage
[illegible] but [illegible] by
[illegible] [illegible]
[illegible]

Lettuce
Jan 3 yrs
Mrs 1 1/2 lbs
Per carton
Much used for
Garnish
Nutrients = Can be
Made more attractive
if cut just before
Serving (not more than 30 mins)
Oranges 3 a lb Sm
Must be kept in a cool place
Do not put in water
Main
Carbohydrate
Sodium Potassium
Chlorine Sulphur

You must be
well born to be
a Gentleman of the
Sens. 5

Must have pleasing
manners of address
personality

No [illegible]
Where [illegible]
[illegible]
[illegible]
Always [illegible]
poise —

Ability to [illegible]
Absolute [illegible]
Decision [illegible]

Color - Match to dress
Wear Red to bring
my wedding
Jewelry - Pearls
Formal Hair -
Pull back with pearls
1 Garter
1 "
Wear Veil (Red)
The people you are
celebrating with
Breakfast following
Outdoor Ceremony
Formal Ceremony
Lock

Art. Supp. 2.

Old Mill Bench 5.25

Mills 2 5.25

L. McIntyre 30.00

69 m 5-00

40.50

38.70

11.50

50 20

Cove Chevrolet 25
Mama Assembly 10
Altima Nursery 30
Dall Assembly 4
Ford 7ths 30
Ground Nut - 250
Mac Brides CB 150
Burnished Castings 150
Methodist Church 150
Bemis Welded Seam 175
Vital Veg 200
Salads Ground 175
Memorial Dead 100
McCasters Bend 1,20
38,40
Community Center
Stone Economic 1 to
Ground H & 300
Young Auto Body 300
Hospital 11,5

Work	
Lunch (?)	1,10
Registration	2,00
Meal tickets	9,00
Jazz class	1,30
Dinner	1,50

Hall

Hall 7+W 2.25

Supe .50

Burpee 2.5 " .65

Dunbar 2.6" .55

Hotel R. Jeff 2.00

Apples .10

Breakfast (2) .59

Dinner (2) .84

Supper (2) .75

Fresh (2) .10

Hotel Breakfast

Supper Chop 6.15

Hotel Fr Breakfast 2.10

Hotel Fr Breakfast 6.50

Dinner Breakfast 1.65

Breakfast (2) .85

HPY4l - 1111 Sand 1½ ÷
5 Sand 7.5
Reg Ice
2p - Meal Strip 9
Pepper Steak 1.75

Reading at BC

1/1-20

25 Gas oil 1.50

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8 gal gas 1.60

20.20

Sum — 5 qts

1.15

Hash — .85

Hash — 2 qts — .95

Kabobs — .50

Salad 1 qt — 1.30

Relish tray — .75

Vegetables — 1.05

2.05

Dressing extra — .50

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J. H. KELLOGG, M. D.

No...... *Price.*.....

1869

Dr. K's shorthand practice
article proof.

Cementing Metal to Glass

Take two parts finely powd[illegible] litharge, and one part dry [illegible]ad, mix intimately, and work [illegible]oiled linseed oil and lac copal t[illegible]n dough. One part of copal is take[illegible] three parts boiled oil, and enough li[illegible]ge and white lead added to make a dough similar to putty. The underside of the metal is filled with the cement, and then pressed upon the glass, the excess of cement being scraped off with any sort of instrument. It dries quickly and holds firmly.

A Superior Glue.

Dissolve 3 parts of india rubber in 34 parts of naphtha. Heat and agitation will be required to readily effect the solution. When the rubber is completely dissolved, add 64 parts of finely-powdered shellac, which must be heated in the mixture until all is dissolved. This mixture may be obtained in sheets like glue, by pouring it, when hot, upon plates of metal, where it will harden. When required for use, it may be simply heated in a pot till soft. Two pieces of wood or leather joined together, with this glue can scarcely be sundered without a fraction or tearing of the parts.

Rubber Cement.

As rubber plates and rings are now-a-days used almost exclusively for making connections between steam and other pipes and apparatus, much annoyance is often experienced by the impossibility or imperfection of an air-tight connection. This is obviated entirely by employing a cement which fastens alike well to the rubber and to the metal or wood. Such cement is prepared by a solution of shellac in ammonia. This is best made by soaking pulverized gum shellac in ten times its weight of strong ammonia, when a slimy mass is obtained, which in three to four weeks will become liquid without the use of hot water. This softens the rubber and becomes, after volatilization of the ammonia, hard and impregnable to gases and fluids.

Detonating Mixture for Chemical Experiments.—Mix equal quantities of nitrate of potassa and acetate of soda, both in powder, and gradually heat the mixture on a shovel or iron plate.

To Extract Grease Spots from Books or Paper.

Gently warm the greased or spotted part of the book or paper, and then press upon it pieces of blotting paper, one after another, so as to absorb as much of the grease as possible. Have ready some fine, clear essential oil of turpentine, heated almost to a boiling state; warm the greased leaf a little, and then with a soft, clean brush wet with the heated turpentine both sides of the spotted part. By repeating this application the grease will be extracted. Lastly, with another brush dipped in rectified spirits of wine, go over the place, and the grease will no longer appear, neither will the paper be discolored.

Green Pigment, dark.—Heat to redness a mixture composed of 5 parts of oxide of zinc and one part of sulphate of cobalt. For grass green, 10 parts of the oxide of zinc and one part of the cobalt, and proceed as above. For light green, 20 parts of zinc.

Anhydrous, or Absolute Alcohol.—Boil strong alcohol with quicklime for one hour in a vessel with an inverted condenser, and then distill.

Parchment Paper.—Dip the paper for a few seconds into a mixture of equal parts of sulphuric acid and water, and immediately wash off the acid, first with pure water, and then with dilute aqua ammonia, and dry.

Metallic Soap for Canvas.

The following is highly recommended as a cheap and simple process for coating canvas for wagon tops, tents, awnings, &c. It renders it impermeable to moisture, without making it stiff and liable to break. Soft soap is to be dissolved in hot water, and a solution of sulphate of iron added. The sulphuric acid combines with the potash of the soap, and the oxide of iron is precipitated with the fatty acid as insoluble iron soap. This is washed and dried, and mixed with linseed oil. The addition of dissolved india rubber to the oil greatly improves the paint.

Monday Nov. 29. 1869.

FASTENING MEDALS ON GLASS.

When it becomes necessary to attach medals to glass, as has frequently been the case with exhibitors at the Vienna Exhibition, the following cement, invented by R. Franke, will be found very useful: Take two parts finely powdered white litharge and one part dry white lead, mix intimately, and work up with boiled linseed oil and lac copal to a stiff dough. One part of copal is taken to three parts boiled oil, and enough litharge and white lead added to make a dough, similar to putty. The underside of the medal is filled with the cement, and then pressed upon the glass, the excess of cement being scraped off with any sort of instrument. It dries quickly and holds firmly, and has been much used for the purpose above described.

A TEST FOR ARSENIC IN PRESENCE OF ANTIMONY.

Gatehouse publishes the following modification of Fleetmann's test for arsenic in the presence of antimony: Place the solution in a long test tube, and drop in a small piece of caustic soda about the size of a pea, also a piece of aluminum about a quarter of an inch in length by one-eighth of an inch in breadth, and cover the tube with a piece of filtering paper which has been moistened with solution nitrate of silver. If the soda has not already commenced to act with some energy on the aluminum, warm gently and set aside for a short time. The nitrate of silver will be blackened if arsenic be present, but not if antimony alone be present. The 75-1000 of a grain of arsenious acid will give this reaction.

SPONGY PLATINUM.

Prof. Phin recommends the following plan for preparing spongy platinum in a less fragile form than ordinary. A cylinder of pumice stone is first formed, three-eighths of an inch in diameter, and then cut into disks about the twentieth of an inch thick by means of a fine saw. These disks are soaked for some time in a strong solution of bichloride of platinum in alcohol, and afterward for an equal period in an alcoholic solution of sal ammoniac. After being ignited these disks inflame a jet of hydrogen readily, and are found to retain their power quite as well as the more delicate forms in common use.

Pollacci finds that when nitre is mixed with 2 or 3 parts of iron filings, and exposed to the action of heat in an iron vessel, the action spreads rapidly, and the whole mass becomes incandescent. As soon as it is cool the product is treated with water, and the clear solution, when decanted and evaporated, furnishes pure caustic potassa. Caustic soda may be prepared in the same manner from sodium nitrate.

W. Skey recommends the use of galena and zinc for generating sulphuretted hydrogen. Fragments of galena and granulated zinc, equal parts of each, are put in the ordinary evolution flask, and hydrochloric acid, diluted with 20 parts water, poured upon them. Sulphuretted hydrogen is instantly given off, and is evolved energetically, regularly and continuously for a long time. A little hydrogen and traces of hydrochloric acid are also given off, but the latter may be removed by passing it through a little carbonate of lime before using.

Tuesday, Dec. 30th 1879

SEPARATION OF THE MERCURY IN THERMOMETER TUBES.

When thermometers are overturned or shaken by accident it frequently happens that a portion of the mercury in the instrument is separated from the main column and hangs in the upper part of the tube. It is generally easy to unite this portion of the mercury with that in the bulb by holding the thermometer vertically two or three inches above a piece of card and letting it fall vertically upon the card, or, while firmly holding it in the right hand, strike with the arm smartly against the palm of the left hand, or, further, the thermometer may be fastened to a piece of string and swung around, as with a sling, but with caution, and not too rapidly. In many cases the detached particle of mercury is so small that its weight is not sufficient to overcome the adhesion to the side of the glass tube; the following plan of procedure is then recommended:

The instrument is inclined at an angle of twenty to forty degrees, so that the bulb stands higher than the tube, and a blow with a flat piece of wood is given in the direction of the thermometer stem. The mercury in the stem is thus jerked forward, and, uniting with the detached portion, fills the entire tube. If the thermometer be now slowly and cautiously brought into such a position that the mercury begins to flow back toward the bulb, the united column may generally be returned to its proper place. In the place where the separation has occurred a small air bubble is generally found, but by following the above directions this difficulty may be almost always overcome.

A STRONG ADHESIVE PASTE.

According to Fr. Sieburger, an excellent paste may be prepared as follows: Four parts, by weight, of glue are soaked for several hours in 15 parts of water, and then slowly warmed until a perfectly clear solution is formed. This solution is then diluted with 65 parts boiling water and thoroughly stirred. In the meantime, 30 parts of starch are stirred into 200 parts of cold water, so as to form a thin, milky liquid, free from lumps. Into this is poured the solution of glue, stirring continuously and heating. When cold, 10 drops of carbolic acid are added. The paste made in this way is said to possess extraordinary adhesive power, joining leather, paper, pasteboard, &c. By keeping it in closed vessels, so that the water cannot evaporate, it may be preserved for years. Where no great strength is desired, ordinary flour or starch paste is used, a little carbolic acid being added to prevent souring.

PREPARATION OF GUN COTTON FOR COLLODION.

A perfectly white cotton, which is completely soluble in ether and in mixtures of ether and alcohol, is obtained, according to Mitchell, in the following manner: Two parts of cotton are boiled for two hours in an alkaline solution containing one part carbonate of potash in 100 parts of water, more water being added occasionally to replace that which evaporates. The cotton is then washed and dried. Seven parts of the purified cotton is immersed in four parts by weight of nitric acid, spec. grav. 1.42, and saturated with nitrous fumes, mixed with four parts of sulphuric acid, spec. grav. 1.84, after the mixture has cooled to 27° C. The cotton remains in a cool place for four days in this mixture, and is then well washed and dried.

Wednesday, Dec 31st 1879.

CAUSE OF THE DECOMPOSITION OF EGGS.

The question of the decomposition and decay of eggs has been the object of numerous experiments, some of which seemed to lead to opposite conclusions. A committee of the French Academy have arrived at the following conclusions:

1. Eggs that have not been shaken can be preserved quietly without fermenting or decaying.

2. Shaken and broken eggs decompose in less than a month.

3. In no stage of decay is the slightest trace of an organism, either animal or vegetable, to be found in the egg.

The decomposition of eggs, with all signs of decay, and without the presence of any microscopic organisms, is contrary to Pasteur's theory, according to which every destruction of organic matter, and its conversion into its inorganic elements, is due to the development and increase of small organisms. U. Gayon has made some new experiments on this subject, the results of which are given in *Comptes Rendus*, vol. 76, p. 282.

By exposing unshaken eggs to the atmospheric air, at a mean temperature of 77° F., he found that one portion of the egg underwent decay, the other did not.

On making the same experiment with shaken and broken eggs, some decayed, others did not, even for several months.

In all cases where the eggs remained sound it was impossible to discover the slightest trace of an organism; on the contrary, in all those which decayed there were numerous microscopic organisms from the species of vibriones and mushrooms.

These facts contradict the previous suppositions. Without anticipating any decision which may be obtained by further experiment, Gayon inclines to the opinion that the germs of organisms are originally present in those eggs which decay.

ENAMEL FOR COPPER COOKING UTENSILS.

A preparation for coating copper vessels used in cooking, especially for cooking acid fruits which attack the copper, forming so-called verdigris, may be made as follows: 12 parts white fluorspar, 12 parts unburned gypsum, 1 part powdered borax, all intimately mixed and fused in a crucible. The fused mass is then poured out, and after cooling triturated with water to a doughy paint. The copper vessel is painted inside and put in a warm place, so that the mass dries uniformly throughout. When thoroughly dried the vessels are baked, if small, in a muffel, if large, in an oven, until the mass is fused. On cooling it forms a white, opaque enamel, which adheres very strongly to the copper, and is not removed by ordinary blows or percussion, and protects the vessels from the action of vegetable acids. Vessels thus coated may be used for preparing pickles, sauer-kraut, &c., without danger of copper poison.

ELASTIC VARNISH FOR LEATHER. — Take two parts by weight of resin, and one of india rubber, and heat them in an earthenware vessel till they are fused together; after which they should be stirred till they are quite cold; a little boiled linseed oil may be added while the materials are hot.

TO IMPROVE GILDING. — Mix a gill of water with two ounces of purified nitre, one ounce of alum, one ounce of common salt; lay this over gilt articles with a brush, and the color will be much improved.

FINE GREEN BRONZE. — First boil the work in a strong solution of potash to get off all the old lacquer and grease; next wash in clear water; after that let the work stand a day or two in a weak solution of nitric acid, then take out, wash, and dry; then coat the article with some good black lead. Polish until you have a good black, glossy surface; then put on yellow lacquer, which, upon a black surface, gives a green bronze.

SYMPATHETIC INKS.

All writings or drawings executed with sympathetic inks are illegible until, by heat or by the action of some chemical agent upon a peculiar acid or substance which forms the base of the ink, a change is effected, and a color produced from that which was before colorless.

YELLOW SYMPATHETIC INK.

If a letter or drawing be executed with a solution of lead nitrate ($Pb'',O_2,(NO_2)_2$), the work executed will be invisible, but if it is washed over when perfectly dry with a solution of potassium iodide (KI), the writing or drawing will be developed to a beautiful yellow color; the change which takes place is represented by the following formula: $Pb'',O_2,(NO_2)_2 + 2KI = PbI_2 + 2(K,O,NO_2)$.

BLUE SYMPATHETIC INK.

If the writing or drawing be executed with a weak solution of ferrous sulphate (Fe'',O_2,SO_2) it will be invisible, but if when dry it is washed over with a solution of potassium ferrocyanide ($K_4,FeCy_6$), the writing or drawing becomes developed to a beautiful light blue color; the reaction is shown by the following formula: $3(Fe'',O_2,SO_2) + 2(K_4,FeCy_6) = Fe_3K_2Cy_{12} + 3(K_2,O_2,SO_2)$.

If in the last case the writing is washed over when dry with a solution of potassium ferricyanide ($K_3,FeCy_6$), a deeper blue color would be formed, called Turnbull's blue; the change would be represented $3(Fe'',O_2,SO_2) + 2(K_3,FeCy_6) = Fe_3Cy_{12} + 3(K_2,O_2,SO_2)$.

PURPLE SYMPATHETIC INK.

Write with a solution of chloride of gold and the writing will be invisible; wash it over with a solution of tin and a beautiful purple color will be formed (purple of Cassius), as shown by the following formula: $2AuCl_3 + 3SnCl_2 + SnCl_4 + 6H_2O = Sn^{IV},O_2,Au_2,O_2,(SnO)_2, + SnCl_4 + 12HCl$.

BLACK SYMPATHETIC INK.

Write with a solution of ferrous sulphate (Fe'',O_2,SO_2), and, as before stated, it will be colorless, but if a brush which has been dipped in a solution of galls be passed over it, it will turn black.

GREEN SYMPATHETIC INK.

The most curious of all kinds of sympathetic inks is that procured from cobalt. It is a very singular phenomenon peculiar to this ink that the characters or figures traced out with it may be made to appear or to disappear at pleasure; all other kinds of sympathetic inks are at first invisible until some fluid has been applied to cause their reappearance, but when once they are developed they remain permanent.

If the writing be done with chloride of cobalt ($CoCl_2$)—a weak solution—the characters will be invisible when cold, but if heated become blue, and again fade as the hygroscopic moisture of the paper is restored from the air; the color of this ink may be varied at pleasure; the addition of a small proportion of a ferric salt renders it green; zinc produces red, and copper a yellow tint. If the paper is overheated the writing will not disappear.

YELLOWISH GREEN SYMPATHETIC INK.

Write with a dilute solution of chloride of copper ($CuCl_2$), and the writing will be invisible when dry, but on being held to the fire the writing will appear yellowish green.

HENRY A. MOTT, JR.

JOINING RUBBER.—Rubber is easily joined and made as strong as an original fabric, by softening before a fire and laying the edges carefully together, without dust, dirt, or moisture between. The edges so joined must be freshly cut in the beginning. Tubing can be united by joining the edges around a glass cylinder, which has previously been rolled with paper. After the glass is withdrawn the paper is easily removed. Sift flour or ashes through the tube to prevent the sides from adhering from accidental contact.

To Make Goods Uninflammable.—Carteron & Rimmel have taken out a patent in England for rendering fabrics uninflammable by immersing them in a solution consisting of acetate of lime, 1 lb; chloride of calcium, 1 lb; boiling water, 2 lbs.

OXYGEN WITHOUT HEAT.

Oxygen gas has been prepared by M. Kirkpatrick by the action of the hydrated oxide, or a hydrated salt, or other hydrated compound of nickel or cobalt, or both, on a soluble hypochlorite, such as hypochlorite of lime, potash, soda, baryta, or magnesia. The metallic compounds coming in contact with the hypochlorite are decomposed and a black precipitate of the oxide in the hydrated form is thrown down. This precipitate acting on the hypochlorite sets free the oxygen. The oxygen gas is given off under these circumstances with effervescence, and may be collected in the same manner as hydrogen or carbonic acid gas and put in a gasometer. The hypochlorite preferred for making oxygen in this way is the ordinary bleaching powder. It may be taken in a liquid form, or that found in commerce may be used, made into a milk, and mixed with hot or cold water; for making the milk from the commercial chloride, five lbs of water are taken to one of chloride of lime. After this has been introduced into a convenient generator, the hydrated compound of nickel or cobalt is introduced either in solution or suspended in water. The reaction begins at once, i. e., the oxygen gas is disengaged with effervescence. It has been proposed to use this method for the oxyhydrogen light.

A RAPID AND PRACTICAL METHOD FOR SEPARATING COPPER AND SILVER.

In the preparation of nitrate of silver from silver coin, which contains several per cent. of copper, R. Palm uses the following method, dependent on the insolubility of nitrate of silver in concentrated nitric acid:

The coin is dissolved in nitric acid, and the solution evaporated to the consistency of oil, and then concentrated nitric acid, free from hydrochloric, is added; the silver salt crystallizes out while the copper remains in solution. The precipitated salt is then washed two or three times with concentrated nitric acid to remove any adhering copper salt, which gives it a bluish shade. On drying, any acid attached to it is evaporated. It is essential that the solution be evaporated only to the consistency of oil, for if evaporated to dryness, the copper salt adheres so firmly to the silver that it can with difficulty be removed. The more concentrated the acid, the more completely the silver will be precipitated, but an acid with a spec. gr. of 1.25 may be used for completely separating the two metals. Three or four parts of concentrated acid are required for one part of the concentrated metallic solution.

Contractions and examples in applications.

B. Objects.

Examples in Mental Exercises.

CEMENTS.

A good rubber cement may be prepared by dissolving one part india rubber in two parts linseed oil, and adding to the solution a sufficient quantity of bole, say about three parts.

For amber and tortoiseshell, a cement is made by mixing together equal parts of mastic and linseed oil, and warming gently. This cement should be used warm.

To unite wood to wood, a thick solution of shellac in alcohol may be used. It is well to put a piece of fine gauze or crape between the broken surfaces of wood, and then press them tightly together until the cement becomes perfectly firm. Another good, durable cement for woodwork is made by fusing together shellac, mastic and common turpentine, and adding some broken isinglass.

For attaching small objects to anything turned, a mixture of colophonium, turpentine and yellow wax, with the addition of a little pulverized sealing wax, answers nicely. The cement sets quickly and holds well.

To fasten knives and forks in silver handles, we may use a mixture of 2 parts of melted black pitch and 1 part of fine brick dust. It must be used warm.

A varnish or cement to protect wood from the action of mineral acids, alkalies and corrosive gases like chlorine, is made from 6 parts of colophonium and 3 parts of wood tar by heating together in an iron kettle on a furnace in the open air, and then stirring in 4 parts of fine brick dust. The varnish is applied with a brush while warm.

An excellent cement for glass is made by dissolving 1 part india rubber in 60 parts of chloroform, then adding 34 of mastic, and letting it digest for a week at a gentle heat. This cement is also applied with a brush, and is especially distinguished by its transparency.

Another cement for glass and porcelain is made by digesting small pieces of isinglass in 16 times their weight of water for 24 hours. The solution is evaporated to one-half, strained, and, while still hot, 8 parts of alcohol is added, and at the same time a solution of 1 part mastic in 6 parts warm alcohol. One-half part of finely-powdered gum ammoniac is triturated in the warm solution until the whole mass is homogeneous. When used, both the cement and the object to be mended are warmed. This cement is highly recommended for its adhesive qualities.

GLUE AND GUM CEMENTS.

These are very tender and well adapted to mending ornaments. They resist the action of water and atmosphere. There are various kinds of these cements for bone, ivory, whalebone, mother of pearl and precious stones.

One of these is made by dissolving 2 parts isinglass and 4 parts colorless glue in 60 parts water, evaporating to half its volume, then adding 1-15 part mastic dissolved in 1 part alcohol, and stirring in 2 parts zinc white. The surfaces are warmed when the cement is applied to them. This cement holds well, dries easily and may be kept a long time in tightly-corked bottles.

For bone, ivory, whalebone, mother of pearl, etc., a cement with a beautiful gloss may be prepared as follows: Soak common cabinet-makers' glue in hot water, warm the jelly formed, add enough pulverulent slaked lime to give it consistency. Warm the object to be cemented, clean the surfaces carefully, apply the cement and tie the parts firmly together. It a few days it gets very hard. Even common glue, with pulverized chalk stirred in, makes an excellent cement for wood and metals.

For fastening leather to metal, the metal should be coated with a hot solution of glue, and the leather with a hot extract of nutgalls. Allow them to dry quietly, and they adhere well.

For porcelain, the well-known white-of-egg cement is best. To prepare this it is only necessary to stir the white of eggs into quite a stiff solution of glue, and then apply to the fracture.

A cement of gum for porcelain is made by pulverizing 4 parts of oyster shells and mixing intimately with 2 parts pulverized gum arabic. The powder is kept in a well-stoppered bottle, and when needed for use is rubbed up with white of egg, or warm water, to a thick dough, applied to the object and dried by a gentle heat. Another cement for glass and porcelain is made from 8 parts well-burnt pulverized alabaster gypsum and 2 parts fine gum arabic, mixed with water to a thick paste, and 40 to 50 drops of oil of turpentine added to an ounce of the cement.

CEMENTS FROM CASEINE.

For glass, porcelain, stone and wood, the very best cement is made of a suitable quantity of old cheese rubbed fine and mixed with water to a thick magma, and a fourth part of pulverized lime added.

A still stronger cement for the same purpose is made by slaking 1 pound of quick lime in water, and mixing with ½ pound pulverized lime or sandstone and 1 pound pulverized cheese. Before using it is well to moisten the fracture or edges with warm water.

A so called caseine water glass is made as follows: The caseine of skimmed milk is separated from it by the addition of acetic acid, filtered, and the acid washed out with water. The pure caseine thus

obtained is mixed with six times its volume of concentrated water glass. This cement is thoroughly commendable, and well repays the trouble taken to make it.

An excellent cement for artificial meerschaum, and one that may be used to give consistency to silk goods or to coat artificial flowers and court-plaster, to give more adhesiveness and firmness, is made by rubbing two to four parts of the above caseine with cold borax solution till a thick liquid is obtained that becomes clear on standing. This also renders goods waterproof.

WATERGLASS CEMENTS.

For glass, earthenware, porcelain, and all kinds of stoneware, these cements are excellent. A cement for glass and marble is prepared by rubbing together one part of fine pulverized glass and two parts of pulverized fluorspar, and then adding enough waterglass solution to give it the consistency necessary in a cement.

Waterglass mixed with hydraulic cement to a thick dough makes a good cement for the edges and joints of stone and marble slabs. It is well to mix but little at a time, as it hardens very quickly.

LIME, GYPSUM, CLAY AND CEMENT, MIXED WITH WATER, OIL OR BLOOD.

For cementing stone and for filling crevices in buildings, before they are painted, the masons use a cement made of fresh blood, slaked lime, brick dust, broken up coal ashes, hammerslag and sand in all proportions. This excellent cement hardens quickly and offers great resistance to the action of the weather.

A lime cement for connecting water pipes, bathing tubs, etc.; a mixture of two-thirds fine brick dust, two-thirds unslaked lime, and two-thirds hammerslag, is made and stirred up with lye or hot oil to a stiff dough.

Another cement, intended to render Hessian clay retorts impenetrable, is obtained by rubbing freshly slaked lime into a concentrated solution of borax. The solution is applied with a stiff brush and allowed to dry, after which it is heated until the glazing begins to fuze.

Clay mixed with water and fresh warm blood, containing some unslaked lime, is used in Germany to close the joints in their stoves. The cement is applied while the stove is hot. Wood ashes, fire clay and salt mixed with water is used for the same purpose. Fat and burnt clay, in equal proportions, molded with water into a dough, is also used.

Plaster of Paris mixed with water and a cold solution of alum is an excellent cement for stoneware. It sets slowly but becomes as hard as stone.

IRON CEMENTS.

Their essential constituents are iron filings or borings. By the addition of some common salt or sal ammoniac they are rapidly oxidized, and the escape of carbonic acid increases the volume of the cement and completely fills the crevices where it is put. An excellent luting or cement for the joints and crevices in iron surfaces, and for rendering tight cast iron steam and water pipes and water tanks, is made of filings of cast iron. The filings are sifted to obtain those of the size of a grain of rice, and then rubbed with horse urine and one-half part sal ammoniac, well worked together, and an equal quantity of flowers of sulphur added. The mass is hammered until it gets warm, and then cold, and, finally, it begins to be brittle. In this condition it is put in the joints, and soon hardens. The surfaces where it is applied must be free from rust. Greasy and oily substances are most readily removed by rubbing with cotton dipped in benzine. The cement keeps best under water.

Another good iron cement is made by stiring 5 parts clay, 1 part salt and 15 parts iron filings together with vinegar to a magma. It will stand heat, and is used for bellows and air pipes.

OIL CEMENTS.

An excellent oil cement for porcelain and for luting of retorts, flasks and porcelain evaporating dishes is obtained when ordinary brick dust is powdered, sifted and mixed with an equal quantity of red lead, and then rubbed, under great pressure, into old boiled linseed oil to a thick paste, which is mixed with coarse sand to the stiffness of cement. When a dish is to be covered with it, the paste is applied before the sand is put in, and the sand then strewn upon it. The dish is afterward exposed to a steady heat for a long time.

For larger vessels take 6 parts litharge, 4 parts fresh-burnt pulverized lime and 2 parts white bole, and mix with cold linseed oil.

A Chemical Barometer.

In our issue of May 15th, we made a reprint of the following interesting item from the Boston *Journal of Chemistry*, but by some oversight it was incorrectly reproduced. We now repeat it again for the benefit of those of our readers who have been essaying the experiment according to our recent version and failed, as they might:

The common camphor-bottle makes a very cheap index of atmospheric weight and weather changes, on which the following is an improvement. Dissolve 21-2 drachms of camphor in 11 fluid drachms of alcohol. Put 20 grains of nitrate of potash (saltpetre), and 20 grains of muriate of ammonia (sal ammoniac), into 5 fluid drachms of water; when all are perfectly dissolved, mix the two solutions. Shake them well in a two-ounce or four-ounce white glass vial, cork very loosely, or, better, tie over the mouth a piece of linen or cotton cloth, and place the instrument in a good light out of the sunshine, where it can be observed without handling. When the weather is fine and clear, the fluid is clear; but on the least change, the chemicals, which lie as a sediment, rise in beautiful frond-like crystals properly, and again duly subside. By watching these changes one soon becomes able to predict the changes of weather probable for a few hours to come, in any locality. This instrument is also a pretty philosophical toy, showing how sensitive some chemical solutions are to atmospheric influences. We saw barometers of this kind for sale in Boston several years ago, but do not recollect meeting with them in this country, except the home-made ones prepared according to the above directions, which have been several times published, but may be new to some of our readers.

Friday. Dec. 6th 1867.

Addition of fraction.

① 48.294. 84968. 93876. 45963.

234. 98765. 89749. 64398. 85057

92. 5463. 8765. 9276. 5472. 4167

98. 7688. 8764. 9286. 6402. 115.62

rations in the first four

tude and Sense.

tion and Numeration

Algebra.

Mental Exercises.

A Perfect Water-Proof.

A writer in an English paper says: By the way, speaking of water-proofs, I think I can give travelers a valuable hint or two. For many years I have worn India rubber water-proofs, but will buy no more, for I have learned that good Scottish tweed can be made entirely impervious to rain, and, moreover, I have learned how to make it so; and for the benefit of readers I will give the recipe.

In a bucket of soft water put half a pound of sugar of lead, and half a pound of powdered alum; stir this at intervals, until it becomes clear, then pour it off into another bucket, and put the garment therein, and let it be in for twenty-four hours, and then hang it up to dry without wringing it. Two of my party—a lady and gentleman—have worn garments thus treated in the wildest storms of wind and rain, without getting wet. The rain hangs upon the cloth in globules. In short they were really water-proof. The gentleman, a fortnight ago, walked nine miles in a storm of rain and wind, such as you rarely see in the South; and when he slipped off his overcoat, his under-clothes were as dry as when he put them on. This is, I think, a secret worth knowing; for cloth, if it can be made to keep out wet, is, in every way, better than what we know as water-proofs.—*The Household.*

Student, Jeffersonville, N. Y.—What is the best Cement for mending Glass?—Here are two very good ones: No. 1. Soak 2 dr. of cut isinglass in 2 ozs of water for 24 hours; evaporate on a water bath to 1 oz; add 1 oz. dilute alcohol, and strain through linen. Mix this, while hot, with a solution of 1 dr. gum mastic in 1 oz alcohol and triturate with one-half dr. powdered gum ammoniac. Warm before applying. No. 2. Take 1 oz pure white lead in oil, add to 10 grains very finely powdered acetate of lead and mix thororoughly; the cement must be applied as soon as made and the article allowed to dry two weeks before being used No. 1 is almost transparent, and is not affected by alcohol, but does not stand hot water. No. 2 is not transparent, but stands hot water when perfectly dry, and is only affected by strong alcohol or ethers.

H. B. asks: How can I make sailors' clothing waterproof? Answer: There are various processes for waterproofing cloth: 1. Moisten the cloth on the wrong side, first with a weak solution of isinglass, and when dry with an infusion of nut galls. 2. Moisten with a solution of soap, and another of alum. 3. A simple method of rendering cloth waterproof without being airproof is to spread it on a smooth surface and to rub the wrong side with a lump of beeswax (pure and free from grease) until it presents a slight, but even, white or grayish appearance. A hot iron is then passed over it; and the cloth being brushed while warm, the process is complete.

CEMENT FOR MARBLE AND ALABASTER.

According to Ransome, the following mixture affords an admirable cement for marble and alabaster:

Stir up to a thick paste, by means of a solution of soda water glass, 12 parts Portland cement, 6 parts prepared chalk, 6 parts fine sand, 1 part of infusorial earth. An irregular piece of coarse-grained marble was broken off by means of a hammer, and the surface coated by a brush with the above paste, and the fragment inserted in its place. After 24 hours it was found to be firmly set, and it was difficult to recognize the place of fracture. It is not necessary to apply heat.

—To cover pictures, maps, etc., with a beautiful and protecting coat, soak gutta percha in ether until it swells up, and then apply it rapidly with a fine brush; dirt settled upon the coat can be washed off with a rag or sponge moistened in water.

A Lie

A rather astonishing bit of chemical news appears in a Paris letter [illegible] *Field and Farm*. It describes the discovery related at a secret session of the Paris Academy of Science, June 13. The discovery is that hydrogen, hitherto considered an element, is in reality a combination of two elements, one of which is nine times as light as hydrogen, and twenty-five time as light as ordinary illuminating gas. The new element is called abaron, meaning weightless. It will not burn, extinguishes flame, is without odor, taste or color. The discoverer is Mr. Lebarre, a well known French chemist, and his discovery was not an accident, but the result of a series of successful experiments. The influence o the discovery, should it be substantiated, upon ballooning will be manifest. The tremendous lifting power of abaron will render possible the employment of metalic balloons, [illegible] resisting all strains and shocks, and [illegible] preventing the escape of [illegible] by

[illegible] of the [illegible] business w[illegible]

C. B. asks: Will you please tell me how many grains of coal it will require, burned in an ordinary locomotive boiler, to melt one pound of snow or ice? It is proposed to melt the snow in streets by superheated steam to be discharged upon the snow. I want to make approximate estimate of the cost of the fuel necessary to do the work. A. This question can only be determined theoretically. The latent heat of liquefaction of ice is about 144° Fah.; and one pound of coal, burned in an ordinary boiler, will develope about 10,657 units of heat. Hence, if the steam acts with perfect efficiency, to melt one pound of ice will require the consumption of about 98 grains of coal.

C. C. F. asks: How can I make variously colored fires? A. Red fire: Sulphur 1 part, sulphuret of antimony 1 part, niter 1 part, dried nitrate of strontia 5 parts. Blue fire: Tersulphuret of antimony (orpiment) 1 part, sulphur 2 parts, dry niter 6 parts. This is the Bengal blue light. Green fire: Boracic acid 10 parts, sulphur 17 parts, chlorate of potash 73 parts. Yellow fire: Sulphur 16 parts, dry carbonate of soda 23 parts, chlorate of potash 61 parts. Violet fire: Charcoal 8 parts, sulphur 10 parts, metallic copper 15 parts, chlorate of potash 30 parts. Orange fire: Sulphur 14 parts, chalk 34 parts, chlorate of potash 52 parts. Purple fire: Lampblack, realgar and niter, of each 1 part, sulphur 2 parts, chlorate of potash 5 parts, fused nitrate of strontia 16 parts. By parts are meant equivalent proportions, ounces, pounds, etc. The different ingredients are to be separately reduced to powder, sifted through lawn, and kept in well corked wide mouthed bottles until used. Care must be exercised in handling, especially the chlorate of potash, when in contact with combustible materials. The materials must be carefully mixed on a sheet of paper with a wooden stirrer with a light hand, avoiding excessive friction. They should not be mixed long before using, as they are apt to deteriorate by long keeping and even to inflame spontaneously. The nitrate of strontia, alum, saltpeter and carbonate of soda, before being weighed, should be heated until their water of crystallization is driven off and they fail to powder.

Bending Glass Tubes.

A. H. Gallatin has communicated to the *Journal of the Franklin Institute* the following directions for bending glass tubes: "If the glass tube you desire to bend be filled with sand, and each end stopped to prevent its escape, on heating over a Bunsen burner it will be found that the tube may be quite doubled, if desired, a perfect curve being produced. In this way accurate bends of any desired size may be produced in tubes of any bore, without any previous skill in glass working. Obviously, the principle depends on a uniform distribution by the sand of the pressure exerted. A similar plan is resorted to by metal brokers in heading up tubes of lead."

Practical Recipes.

Substitute for Bottle Wax.—Take 400 grams plaster of Paris, 600 grams white English cement, 300 grams chalk, 200 grams dextrine, 5 liters alcohol varnish, and a sufficient quantity of ochre or other coloring material to produce the color desired. The necks of the bottles are dipped into this mixture and allowed to dry.

Cold Cream.—Take pure white wax and spermaceti ointment, of each, 1 ounce; oil of almonds, ½ pint; melt together, then pour them into a large warm mortar, and add orange flower water, 1 fluid ounce; rose water, 4 fluid ounces. Stir until nearly cold, then put into porcelain pots for use.

French Polish for Leather.—Dissolve 18 grams of shellac in 5 grams turpentine and 40 grams alcohol, and add to it one gram of extract of logwood and some chromate of potash and sulphate of indigo.

Removal of Ink Spots.—When these are of long standing it is difficult to get them out, since the iron has become thoroughly peroxidized and must be reduced. The following is recommended: Water, 1 liter; hydrochloric acid, 100 grams; tin salt, 100 grams. Moisten the spot with this solution, keeping it moist until the color disappears, and rinse with water.

How to Clean Bones.—Soda ash, 1 lb; lime (burned), ½ lb; hot water, 3 quarts. Mix, and soak the bones for 24 hours in the liquid; wash them thoroughly and bleach them.

Frank's Ointment for Freckles, &c.—Take of flour of mustard 3 ounces; lemon juice to make a stiff paste, q. s.; oil of almonds, ½ fl. ounce.

Practical Recipes.

Cement for Attaching Labels to Metals.—Take 10 parts tragacanth mucilage, 10 parts honey and 1 part flour. The flour appears to hasten the drying and renders it less susceptible to damp. Another cement that will resist the damp still better, but will not adhere if the surface is greasy, is made by boiling together 2 parts shellac, 1 part borax and 16 parts water. Flour paste, to which a certain proportion of sulphuric acid has been added, makes a lasting cement, but the acid often acts upon the metals.

New Antidote to Strychnia.—It is asserted by a correspondent of an Australian paper that salad oil promptly applied is an antidote to strychnia. The remedy has not been tried on man, but on dogs a half pint of oil is said to be sufficient to prevent fatal results.

An Alcoholic Varnish that will Adhere to Metal.—In order to make alcoholic varnish adhere more firmly to polished metallic surfaces, A. Morell adds one part of pure crystallized boracic acid to 200 parts of the varnish. Thus prepared it adheres so firmly to the metal that it cannot be scratched off with the finger nail; it appears, in fact, like a glaze. If more boracic acid is added than above recommended the varnish loses its intensity of color.

Kalsomining Fluid.—The following is recommended as a good kalsomining fluid for walls: white glue, 1 pound; white zinc, 10 pounds; Paris white, 5 pounds; water, sufficient. Soak the glue over night in three quarts of water, then add as much water again, and heat on a water bath till the glue is dissolved. In another pail put the two powders, and pour on hot water, stirring all the time, until the liquid appears like thick milk. Mingle the two liquids together, stir thoroughly, and apply to the wall with a whitewash brush.

Cement for Iron.

A correspondent of the *English Mechanic* says that he has used the following recipe with the greatest success for the cementing of iron railing tops, iron gratings to stoves, &c., and with such effect as to resist the blows of the sledge hammer. Take equal parts of sulphur and white lead with about a sixth of borax, incorporate them so as to form one homogeneous mass. When going to apply it wet it with strong sulphuric acid and place a thin layer of it between the two pieces of iron, which should then be pressed together. In five days it will be perfectly dry, all traces of the cement having vanished, and the iron will have the appearance of having been welded together.

A CHEAP AND ACCURATE THERMOMETER.

A. Jaksch, of Kreibitz, in Bohemia, has devised a convenient form of air thermometer, in which the liquid employed is glycerin. The air thermometer has long been known and regarded as more accurate than any other form of thermometer, as air, like other gases, expands equally for equal increments of temperature. When water is employed in the air thermometer, it cannot be employed for low temperatures; with glycerin this disadvantage is overcome, while glycerin does not evaporate so readily as alcohol.

The glycerin thermometer is thus described by Jaksch: An ounce bottle is two-thirds filled with glycerin of any desired color, and the bottle placed in a freezing mixture of sal ammoniac, saltpetre and water, so as to cool the liquid to 32° F. A glass tube 12 to 15 inches long is passed through a good-fitting cork, so as to dip nearly an inch into the glycerin. The cork is inserted in the neck of the bottle and rendered air tight with sealing wax or a cement of varnish and chalk, and the thermometer is then ready to be graduated. On inserting the cork, the liquid rises in the tube a few inches.

The bottle is placed in melting ice, and the level of the liquid marked 32°, if the scale is to be Fahrenheit's. It is next placed in warm water, say at 132°, and this point marked. The space between these points is divided into 100 equal parts, and this division carried down to the [illegible] zero, and upward to the top of the tube. This method of graduation is necessary, as the thermometer cannot be exposed to the temperature of boiling water like other thermometers. This thermometer is exceedingly delicate and [illegible], but cannot be employed for high temperatures, owing to the great length of the tube that would be required. It can be so easily and cheaply constructed that every family can afford to have one in each room, as well as in cellars, stables, gardens, conservatories and other places where it is desirable to know or regulate the temperature.

Fermentation.

Some experiments upon the behavior of alcoholic yeast in media free from oxygen gas have been made by Moritz Traube with the following results: 1. Yeast germs do not develop themselves without free oxygen, even in media favorable to their growth, such as grape juice. 2. Developed yeast, on the other hand, as Pasteur correctly maintains, can increase in suitable media, in the absence of every trace of oxygen. 3. Pasteur's statement that yeast, if air is excluded, can obtain the oxygen necessary to its growth from sugar is incorrect, for the increase ceases while the greater part of the sugar is still undecomposed. The accompanying albuminoid bodies are used for its growth by yeast secluded from air. 4. In a solution of pure sugar, yeast occasions alcoholic fermentation in the absence of every trace of oxygen, and without increasing. The assertion of Pasteur that the fermentation of sugar is connected with the process of organization of the yeast is incorrect. 5. While grapes, on seclusion from the air, produce alcohol from their sugar, even if much bruised, this property is no longer possessed by the expressed juice. 6. It does not hence necessarily follow that alcoholic fermentation is a vital process, depending on the activity of the living cell.

dark, a light appearance is perceived at the moment of explosion, filling the tube and extending a little beyond at the two openings. The same pipette may be used to explode a mixture of sulphide of carbon vapor and oxygen. The internal surface is first moistened with a few drops of the former substance, oxygen is passed through from a gasometer, the pipette is quickly removed, and the point of it, directed slightly downwards, brought immediately into contact with a flame. A pretty strong explosion follows, but one that is also without danger.

Frost Crystals for Windows.—All that is necessary to produce a frosted appearance upon window panes, is to dissolve any kind of salt in hot water, producing a saturated solution, and apply it hot with a brush to the glass. As the water cools the salt crystalises upon the surface of the window pane, and it becomes beautifully frosted.

For this purpose the following may be used:

Chloride of ammonium (sal-ammoniac).
Sulphate soda (Glauber's salt).
Sulphate of magnesia (Epsom salt).
Sulphate of copper.
Nitrate of potassium.

Salts which are liable to deliquesce should not be used for this purpose.

CHEMICAL EXPERIMENTS.

CURIOUS CHANGES OF COLOR.—Place five glasses in a row; pour into the first a solution of caustic potassa, into the second a solution of corrosive sublimate, into the third a small quantity of iodide of potassium and some oxalate of ammonium, into the fourth a solution of chloride of calcium, and into the fifth some sulphide of ammonium. Now pour the contents of the first glass into the second, and a scarlet color will be obtained; next pour the second into the third, and the mixture will be colorless; again pour the third into the fourth, and the contents will be white; finally pour the fourth into the fifth, and the mass will be a dense black. Then you will have had two glasses colorless, one scarlet, one white, and one [illegible].—*Phar-*

IMITATION CORAL GROWTH.—Make a solution of [illegible]ide of potassium in water, using about 250 grains to the pint. Place the solution in a tall jar and in this solution suspend a hard lump of corrosive sublimate, the latter being securely tied by a piece of fine thread. The jar should be ten or twelve inches in length, and the corrosive sublimate should be suspended at the upper part of the solution. At once a number of peculiar yellowish colored streams seem to flow from the lower part of the suspended lump, which as they descend lose their color; after a short time brilliant scarlet tubes several inches in length attach themselves to the lump and the colored liquid passes out through these tubes. This goes on for several days, during which time if the jar is not disturbed the growth ot these tubes continues and presents an appearance of coral. These tubes consist of biniodide of mercury produced by the action of the iodide of potassium upon the solution of corrosive sublimate, which gradually dissolves. The experiment is analagous to the previous one, but much prettier, on account of the brilliant color of the crystals produced.

IMITATION FROST CRYSTALS.—A very pretty winter ornament for a parlor table can be prepared as follows: Dissolve 456 grains of nitrate of lead in six fluid ounces of water. If the solution is turbid, filter through paper. Place the solution on the table where it is intended to remain, and drop into it 200 grains of sal-ammoniac in long fibrous crystals. Small crystals of chloride of lead form and ascend through the denser liquid, presenting the appearance of an *ascending* snow-storm. When the lead is all precipitated, the crystals of chloride of lead begin to descend as a genuine miniature snow-storm, forming grotesque masses resembling a winter's landscape. If the vessel containing the crystals be not disturbed, it often preserves its beauty for a week or two.—*Journal of Chemistry.*

A [illegible] for preventing dry rot, [illegible] which [illegible] in a solution [illegible] of sulphate per cent. of copper, two per cent. of corrosive sublimate per cent. of nitre, two per cent. of white lead, two per cent. of pitch, two per cent. of resin, and four per cent. of spirits of turpentine. The sulphur is melted in one vessel, and the coal tar, gutta percha, bitumen, white lead, pitch, and resin, all [illegible] in another; but before adding the latter ingredients to the sulphur, it is absolved in about an equal quantity of the spirits of turpentine. When all these ingredients have melted, the solution is poured in [illegible] from the separate vessels, the whole is then thoroughly mixed, and the composition applied hot by the aid of a brush, or the article to be coated is dipped into it.

New Way of Making Magic Lanterns.—At a meeting of the Franklin Institute, a method [illegible] of preparing magic-lantern [illegible] in a new way, thus: Get a sheet of gelatine such as is used by engravers for tracing purposes; fix it over the engraving or drawing which is to be shown in the lantern, and with a style or steel point trace the lines of the picture pretty deeply on the transparent substance. Then rub in black lead or crayon dust lightly with the finger, and the slide is ready for use. Any one acquainted with the magic-lantern will know how to frame or mount it for use. In this way any number of pictures may be easily prepared, which, when shown in the lantern, have a satisfactory effect.

An Excellent Tooth-wash.

11. R. A. says: An excellent tooth-wash, very much resembling *Sozodont*, is made as follows:

Carbonate of Potassa	½	ounce.
Honey	4	ounces.
Alcohol	2	"
Water	10	"
Oil Wintergreen, Oil Rose	q. s.	

Tuesday. Dec. 14th 1869.

cone is poured into the funnel, and the wire is worked up and down till the operation is completed. In most cases the composition should not be rammed down too tightly, otherwise it will burn irregularly. The ordinary weight of the hand, without exerting much extra strength, will be quite sufficient.

The following compositions for lances have stood the test of long experience, and will be found to answer their purpose admirably.

No. 1. Green.

[illegible]	12 parts.
[illegible]	7 "
[illegible] of Antimony	4 "
[illegible] Lead	1 "

No. 2. Green.

[illegible]	16 parts.
[illegible]	6 "
[illegible] of Antimony	3 "

No. 3. Pink Fire.

[illegible] of Potash	10 parts.
[illegible] of Strontia	3 "
[illegible]	20 "

This is a very beautiful composition, but is hardly so brilliant as the following. It is of course less troublesome to make.

No. 4. Pink Fire.

[illegible] of Potash	9 parts.
[illegible] of Strontia	14 "
[illegible]	4 "
[illegible] of Copper	1 "
[illegible]	4 "

This should only be made a day or two before using, and not removed too hard into the cone. The nitrate of strontia should be perfectly dry, or the color will be injured.

No. 5. Rose.

[illegible] of Potash	8 parts.
[illegible]	2 "
[illegible]	3 "
[illegible]	1 "

A very delicate color, forming a lovely contrast with the following when burnt side by side.

No. 6. Green.

[illegible] of Baryta	6 parts.
[illegible] of Lead	2 "
[illegible]	1 "

This mixture is somewhat expensive, owing to the large amount of chlorate of baryta contained in it. It is of a most lively emerald green, and should be burnt simultaneously with the last named composition.

No. 7. Green.

Chlorate of Potash	20 parts.
[illegible] of Baryta	45 "
[illegible]	5 "
[illegible]	15 "

This is not so brilliant as the preceding, but when economy is desirable, it may be used with advantage.

No. 8. Rose.

Chlorate of Potash	20 parts.
[illegible] of Copper	12 "
Chloride of Lead	2 "
[illegible] of Lead	2 "
[illegible]	6 "
[illegible]	1 "

(43) L. & G. M. Co. ask: What preparation can be applied, with a pen, to mark numbers on the surface of tin plate? A. Squeeze the juice of a lemon into a cup, and put in a bit of copper, of the size of a cent. Let it stand for a day or two, then use it with a quill pen.

(34) E. S. H. asks: How can I make colored fires? A. Try the following: For light blue 61 per cent of chlorate of potash, 16 of sulphur, 23 of strongly calcined alum. For dark blue, 60 per cent of chlorate of potash, 16 of sulphur, 22 of carbonate of copper, 12 of alum. For deep blue, use 54 per cent of chlorate of potash, 13·5 of charcoal, and 27·5 of ammoniacal sulphate of copper. It is hardly necessary to mention that great care is required in mixing these materials, and that each ingredient should be pulverized separately. For red fire use 29·7 parts chlorate of potash, sulphur 17·9, charcoal 1·7, nitrate of strontia 45·7, black sulphuret of antimony 5·7. For green, chlorate of potash 28·7, sulphur 9·8, charcoal 5·2, nitrate of baryta 51·3. For yellow, sulphur 29·6, charcoal 3·8, nitrate of soda 9·8, saltpeter 57·8.

Spirit Photographs.

3. M. S. A. says: The so-called Spirit Photographs, or shadow pictures, may be successfully produced by taking the pains to sketch the desired spectre upon the background with some colorless fluorescent material, as for example, a solution of sulphate of quinine.

Insoluble Glue.

2. A. D. asks: How can I render glue insoluble?

A. Bichromate of potassa added to the water in which the glue is to be dissolved, in the proportion of 1 part of the bichromate to 50 parts of the glue, will render it insoluble. The Japanese make their umbrellas of a paper coated with a glue or gelatine, prepared in this manner.

GLYCONIN. — The formula for the preparation of glyconin in the last number of the JOURNAL (page 108) was given as it appeared in the *Druggists' Circular*; but it would be better to state the proportions of glycerine and yolk of egg as five parts by weight of the former to four parts by weight of the latter. Glyconin is used in the French hospitals in burns, erysipelas, etc, and in diet:

Collodion in Treatment of Carious Teeth.

Dr. Lardier advises, in *L' Union Medicale*, the use of collodion in the treatment of carious teeth, by dropping the collodion into the cavity, after the latter has been cleaned and dried. The ether evaporates and narcotizes the nervous twigs. By solidifying, the collodion protects the tooth from the contact of the air.

Dr. Lardier states that he has thus succeeded in relieving many patients.

To Cure Nail-Biting. — Children often get into the bad habit of biting their nails, and it is not wholly unknown among those of larger growth. A correspondent of the *British Medical Journal* having asked for a cure for this habit, a reply was given, suggesting the application of styptic colloid (tannin in collodion) in a thin line at the end of each nail. It dries quickly, forming a film, the bitter taste of which acts as a reminder. It must be reapplied whenever the hands have been washed.

Tooth Wash. — We find the following in the London *Chemist and Druggist*: —

Potass. carb.	½ oz.
Mellis	4 ozs.
Spt. rect.	2 ozs.
Aqua	10 ozs.

Flavor to suit.

Remedy for Toothache. — The following formula, says *The Practitioner*, seems likely to be serviceable, as the creasote will have an anæsthetic action, while the ammonia will act in the same way as bicarbonate of sodium, by neutralizing any acid present in the tooth. "Take equal parts of creasote, strong solution of ammonia, and tincture of myrrh. A very *small* piece of cotton wool to be soaked in the mixture and put in the hollow of the aching tooth."—*Med. Times.*

Strong Solution of Salicylic Acid. — A writer in *New Remedies* remarks that various solvents for this substance have from time to time been proposed, such as phosphate of soda, phosphate of ammonia, and borax; but none of these yield a very strong solution. "The demand for such a solution (aqueous) having arisen, we were compelled to search for another substance — neutral, and itself not irritating — which might take up a large quantity. We finally succeeded by the use of acetate of lime. Introduce 31.1 grams (3 i.) each of salicylic acid and acetate of lime into a half-pint bottle, add about 118 cc. (3 iv.) of water, and shake well until the salicylic acid has been thoroughly incorporated with the water. Then add 29.5 cc. (fl. 3 i.) of glycerine, and finally enough water to make up the bulk to 236.2 cc. (Oss). Immerse the bottle to the neck in boiling water, and remove it from time to time to agitate the contents. In the course of about fifteen minutes solution will have taken place, and it remains permanent on cooling. In order to prevent water from being spattered into the bottle from the outside, we are in the habit of slipping a perforated rubber nipple over the neck, which allows the vapor from inside to escape, and the orifice of which is too small to allow access of any liquid from without."

Depilatory Powder.—The following formula is a good one:—

Orpiment	1 oz.
Quicklime	10 "
Starch	14 "

To be made into a paste with warm water just before use. Redwood recommends a strong solution of sulphide of barium, made into a paste with powdered starch, as the best and safest depilatory.

—*Chemist and Druggist.*

Freckle Lotion.

Take Sulpho-carbolate of zinc	2 parts.
Glycerine	
Rose water, of each	25 parts.
Cologne water	5 "

Pimple Wash.

Take Corrosive sublimate	2 grains.
Iodide of potassium	20 "
Bicarbonate of soda	30 "
Aromatic spirits of ammonia	½ fl. drachm.
Cologne	4 " "
Camphor water	3 " ounces.

—*H. M. Wilder, in the Druggists' Circular.*

GRAINS AND GRAMMES.

THE following table for reducing apothecarie weights to those of the metric system we hav prepared for the convenience of the readers c the JOURNAL, and they will find it exact enoug for all practical purposes:—

Apothecaries' Weights.	Grammes	Apothecaries' Weights.	Grammes
Grain 1/10	0.006	Grains 80	5.18
" 1/8	0.008	" 90	5.83
" 1/6	0.011	" 96	6.22
" 1/5	0.012	" 100	6.48
" 1/4	0.016	" 120 (℥ij)	7.77
" 1/3	0.021	" 150	9.72
" 1/2	0.032	" 160	10.37
" 2/3	0.042	" 180 (℥iij)	11.66
" 3/4	0.048	" 200	12.96
" 1	0.065	" 240 (℥ss)	15.55
Grains 2	0.13	Drachms 5	19.44
" 3	0.194	" 5½	21.38
" 4	0.259	" 6	23.33
" 5	0.324	" 7	27.21
" 6	0.389	" 8 (℥j)	31.1
" 7	0.453	" 9	34.99
" 8	0.518	" 10	38.88
" 9	0.583	" 12	46.66
" 10	0.648	" 14	54.35
" 12	0.777	" 16 (℥ij)	62.2
" 14	0.907	" 18	69.99
" 15	0.972	" 20	77.76
" 16	1.037	" 24 (℥iij)	93.31
" 18	1.166	Ounces 2½	108.81
" 20 (℥j)	1.296	" 4	124.41
" 24	1.555	" 4½	139.91
" 30	1.944	" 5	155.51
" 32	2.074	" 5½	171.
" 36	2.333	" 6	186.62
" 40 (℥ij)	2.592	" 6½	202.12
" 48	3.11	" 7	217.72
" 50	3.24	" 8	248.82
" 60 (℥j)	3.89	" 9	279.92
" 72	4.66	" 10	311.02

Depilatory. Egyptians
: the bath, a depilat
sulphide of arsenic (or pin
into an unguent & pa
To Remove Grease—

VORTEX RINGS.

Any one who has ever witnessed a cannonade on a still day can hardly have failed to remark the great rings of smoke, which often arise from the cloud belched forth by the guns, and float aloft for a considerable period before becoming dissipated. The same rings are produced on a small scale by smokers of tobacco, by a sudden expulsion of air from the mouth, the lips being placed in a peculiar position. There is also an easy way of making them for purposes of examination, which consists in providing a box having a round aperture at one end, and its opposite extremity covered only with cloth. The bottom is sprinkled with a strong solution of ammonia, and a dish of common salt and sulphuric acid is inserted. The gases arising from the salts and acid combine in the shape of smoke, and the latter may be expelled in beautiful rings through the aperture by striking suddenly on the cloth back.

When the behavior of these rings is critically investigated, it appears that they have peculiar properties. When two impinge, they act as if made of solid elastic material, and vibrate independently after the shock; or vibrations may be produced in them by ejecting them through a square instead of a circular hole. The circle is the position of equilibrium, and the irregularly-shaped ring vibrates about that form. Another curious result is that, if the two rings are moving in the same direction, with their centers in the same line and their planes perpendicular to that line, the pursuer contracts and moves faster, while the pursued expands and moves more slowly, so that they alternately pass through one another. If they are moving in opposite directions, under like circumstances, both expand indefinitely, and more slowly and slowly, never reaching one another.

Now each ring or vortex contains not merely the matter in fine division forming smoke, but a certain definite proportion of smoky air, which, in virtue of the vortex motion, has become a different substance from the surrounding air, and moves through it very like a solid body. If there were no such thing as fluid friction in the atmosphere, the ring would go on moving for ever; and not only this, but the portion of the fluid containing the smoke and marked thereby would remain precisely the same set of particles of the fluid as it moved through the rest. Consequently those thus marked by the smoke would be, by the fact of their rotation, differentiated from the surrounding atmosphere, and could not by any process short of an act of creative power be made to unite with the latter.

Helmholtz has shown that the properties of every vortex ring are, first, that every part of its core is essentially rotating. As a ring approaches the observer, every portion of the inner side is moving forward, and every portion of the outer side is moving backward; and if the face be placed in the path of a large ring, a sudden blast of air will be felt flowing through the center of it. Thus the vortex ring, no

only involves in itself rotating elements, distinguished fro other elements of the fluid, but it also is associated necessa rily with other movements through the non-differentiate air, and especially a forward rapid current of air, passing through its center in the direction in which it is going. Helmholtz has further shown that such a ring is indivisible. The sharpest knife will not cut it. It wriggles around the blade and moves away. It is not that it cannot be cut, but you cannot so much as get at it so as to try to cut it.

Again, vortex filaments existing in a continuous medium of any kind must either be endless, or else the ends must be in the free surface of the liquid. The last condition any one can realize by drawing his teaspoon over a cup of tea and lifting it from the surface. There will be a couple of little whirlpools going round in the tea, rotating in opposite directions, the two moving forward (as do their sides which are nearest one another) in the direction in which the teaspoon was drawn. These two little eddies are simply the ends of a half vortex ring, and they are on the free surface of a liquid.

We are now in a position to understand Sir William Thomson's recent theory of vortex atoms, which Professor Tait explains in his "Recent Advances in Physical Science," from which we have freely drawn for the foregoing. We have shown that, given a perfect fluid, nothing but creative agency could produce a vortex ring in it, or destroy one already there. No process at our command could enable us to do either; because in order to do it, fluid friction is essentially requisite. Now, by the very definition of a perfect fluid, friction does not exist in it. Sir William Thomson suggests that the Universe is filled with something which we have no right to call ordinary matter (though it must possess inertia) but which we may call a perfect fluid. In this vortex, motion once produced by creative act remains until the same power removes it. Thus, he argues, this property of rotation may be the basis of all that to our senses appears as matter. All atoms of matter are vortex rings; and in a perfect fluid filling all space and having no surface, there can be no ends. All vortex atom rings, therefore, must be endless, that is to say, must have their ends united together after any number of convolutions. Lastly, the indivisibility of a ring shows that, in that sense, at least, it is literally an atom.

This idea enables us to explain a great many properties of matter, but it carries with it a host of mathematical difficulties. The theory has but passed its first trials, and, being admitted as a possibility, it is left to time and the mathematicians to settle whether really it will account for everything experimentally found. If it does so, and if it, in addition, enables us to predict other phenomena, which in their turn shall be found to be experimentally verified, it will have a positive claim on our belief that any physical theory can ever have.

THE NEW METAL—GALLIUM.

This new metal, to whose discovery we referred some months ago, has been obtained in a pure state by M. Lecoq, and although the quantity he isolated was only a grain and a half, it was sufficient to enable him to ascertain its leading properties. The most curious of these is its melting point, which is lower than that of any known metal; mercury, which is liquid at all ordinary temperatures, being of course excepted. Gallium melts at 85.1° F., so that it cannot be held in the hand without liquefying. In a solid state it is hard, and to a slight degree malleable. When fused it adheres to glass, forming a mirror whiter and more beautiful than that made with mercury. It oxidizes only on the surface when heated to redness in the air, and does not volatilize. Its density at 59° F. is 4.7, that of water being taken as unity.

Gallium is actually more fusible than tallow, which melts at 92° F. The melting point of tin, the most fusible of the familiar metals, is about 450°. Even the "fusible alloys," which are among the curiosities of the laboratory and the lecture-room, are refractory substances in comparison with gallium. An alloy of 3 parts of cadmium, 15 of bismuth, 8 of lead, and 4 of tin, melts at 140° F., and is the most fusible compound of the kind that has been discovered. One which is easier to make consists of 2 parts of bismuth, and 1 each of lead and tin. This melts between 200° and 201° F., or below the temperature of boiling water. Teaspoons have sometimes been made of it, for the sport of the thing, and persons using them have been amazed at seeing them melt away when put into a cup of hot tea.

A Gas Shadow. — A striking and curious experiment, showing the superior weight of carbonic acid over air, may be made by projecting the shadow of the gas, as it is poured from its containing vessel, upon a screen. The latter should be of white paper, and bright sunlight should fall upon the stream of gas, which should be poured from the spout of a pitcher held within ten inches of the screen. The curious result of a shadow produced by apparently nothing will be seen, the former resembling descending smoke, quite black at the sides of the vessel, but brightly illuminated whenever the sunlight is concentrated by passing through the gas.

Powder for Producing Ozone.

In order to produce artificial ozone, Mr. Leuder makes use of equal parts of peroxide of manganese, permanganate of potash, and oxalic acid. When this mixture is placed in contact with water, ozone is quickly generated. For a room of medium size two spoonfuls of this powder, placed on a dish and occasionally diluted with water, would be sufficient. The ozone developes itself; it disinfects the surrounding air without producing cough

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A SOLUTION of iodide of potassium is slowly decomposed by the action of light; but when some cane sugar is added, it turns yellow, owing to the liberation of iodine. If starch is present, a blue color is produced. If a sheet of starched paper is soaked in a solution of iodide of potassium and sugar in the dark, and then exposed under a photographic negative to light, a fine positive print is obtained, which is fixed by washing in water.

If the barometer, after having been high, descends, a change of wind will probably occur twelve hours afterwards. This change will be without rain or with very little rain. When the barometer stops in its falling without descending lower before rising again, rain will come twelve hours after the stoppage. If the mercury remains low, the rain will persist, and fine weather will not come again until ten or twelve hours after the column commences regularly to rise. Sometimes this interval extends to sixteen or eighteen hours, but this is rare.

If, while low, the mercury oscillates slightly up and down, bad weather will persist, with, however, occasional clearing. These alternations of rain and shine will be more pronounced as the oscillations are greater, and will follow the movements of the barometric column at shorter intervals than those noted in the law above given.

Finally, if, as often happens, the mercury, after reaching its lowest point, immediately ascends in a continuous and regular manner, rain will come inside of twelve hours after the mercury touches the minimum: but it will last but a short time, and will soon give place to fine weather.

A FALLACIOUS TEST FOR L

An item has been widely circulated, in which it was stated that the presen easily be detected by putting a drop clean surface of tin plate, heating g tack the metal and evaporate the excess the white spot with a five per cent so tassium; if lead were present, the sp or less yellow from the formation of Puerkhauer calls attention to the fa lead, will also yield a yellow spot dently due to the liberation of iodine acid; for nitric acid cannot be compl even when the tin is heated to its me easily proved that the yellow spot, f free from lead, is due to the liberatio the spot with starch paste. The ab can be made reliable by touching t nitric acid with very dilute caustic the iodide of potassium, when a yell fail to indicate lead.

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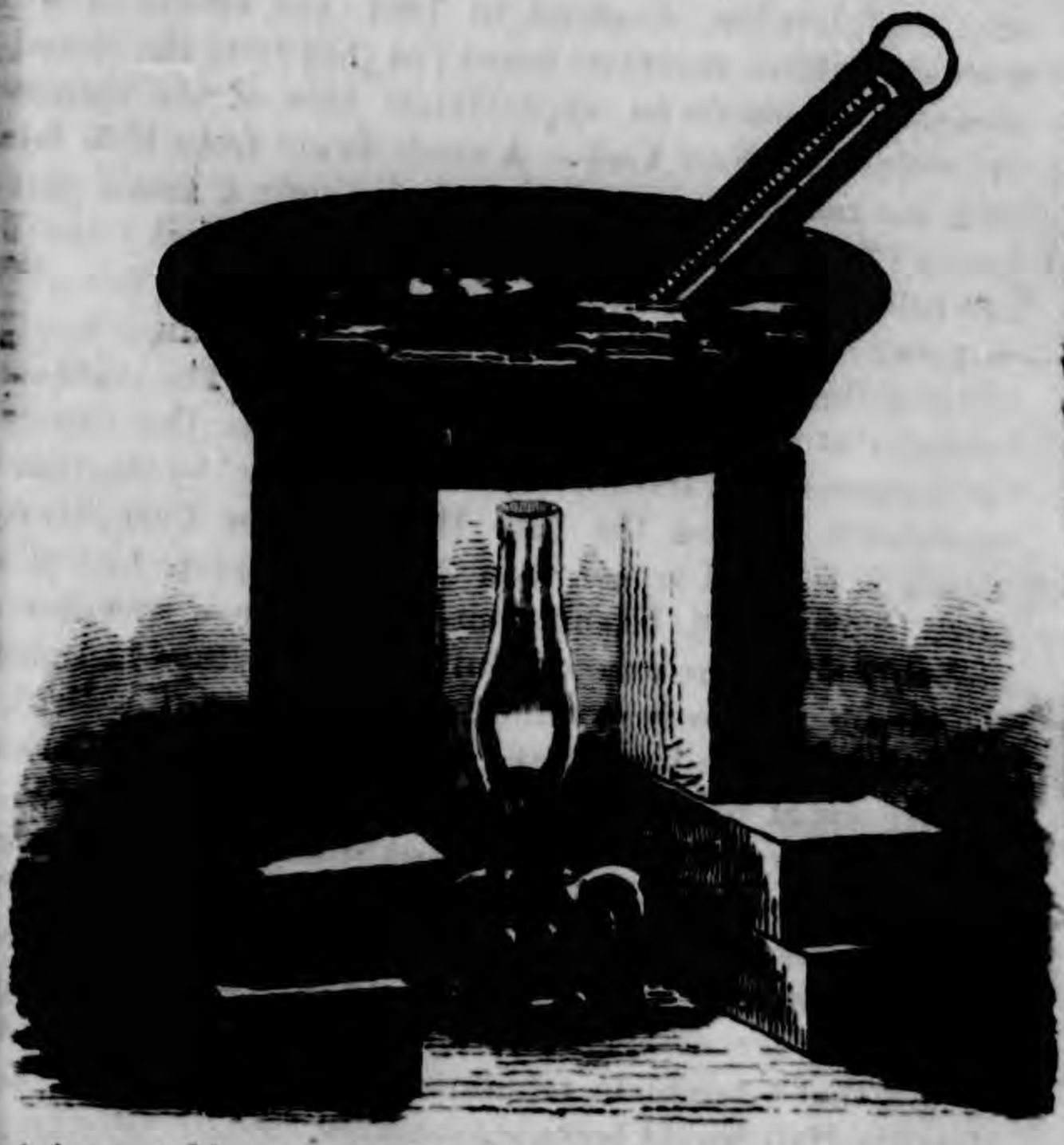
Cap and pronunciation of the following words. Ebb. wreck. oasis. lisle. buffalo. indict. Manlath's. Robinson's Algebra. oasis. emphasis. elysis. parenthesis. Ly. Gay lay. Gay Lussac. Gay Lussac's Gay Lussac's wife. Gay Lussac's wife's. Gay Lussac's wife's wharf. Gay Lussac's wife's wharf's. York. Yorkshire. Yorkshire's. crisis.

A SIMPLE KEROSENE-TESTING DEVICE.

Mr. H. E. Mead, of New York city, contributes the annexed illustration of a simple method, devised by himself, for testing kerosene oil with such ordinary appliances as are sure to exist in or about every dwelling. The extensive use of kerosene makes it important that people should understand how to avoid the numerous dangerous compounds sold as illuminating oils under high-sounding names.

This apparatus consists of a common tin pan of water, set upon bricks at a sufficient hight to allow of a lighted lamp being inserted beneath. In the pan is floated a patty pan con-



taining a tablespoonful or two of the oil to be tested. A thermometer is also placed in the water. The indications of this instrument are noted as the water becomes gradually heated by the lamp, and from time to time an ignited match is applied to the oil. It is safe to advise the prompt throwing of the entire supply of oil into the sink in case a flash occurs below 100°. It is as dangerous as gunpowder. It is also a safe rule not to purchase oil which flashes below 110°; and it should be further understood that the greater the heat the material will endure without flashing, above 110°, the greater is the proportional increase in its safety.

drawn. With the other end of the thread (which may be of any length, say 100 yards or more) do likewise with the other cylinder, and the telegraph is complete. By keeping the thread tightly drawn, in order that the vibration may be perfect, a person speaking or even whispering in one cylinder can be distinctly heard by another holding the other cylinder to the ear.

A Thread Telegraph.

To the Editor of the Scientific American:

A cheap telegraph, useful for certain purposes, can be made in this way: Take two tin cylinders about the size of a small dice box, say 3 inches long by 1½ inches diameter;

over one end of each with parchment or bladder, forming a drumhead. Pierce the center with a pin and insert a strong thread, and make a knot to prevent its being with-

Dr. Fleury, after examining an immense number of human encephala, asserts that the left anterior lobe is a little larger than the right one. Again he shows that, by examining a large number of people, there is an unequal supply of blood to the two sides of the body. The brachio-cephalic trunk, which only exists on the right of the arch of the aorta, produces, by a difference in termination, an inequality in the waves of red blood which travel from right to left. Moreover, the diameters of the subclavian arteries on each side are different, that on the right being noticeably larger.

The left lobe of the brain, therefore, being more richly hematosed than the right, becomes stronger; and as, by the intersection of the nervous fiber, it commands the right side of the body, it is obvious that that side will be more readily controlled. This furnishes one reason for the natural preference for the right hand, and another is found in the increased supply of blood from the subclavian artery. The augmentation of blood we have already seen suggested above; but the reason for it is here ascribed to the relative size of the artery, and not to any directness of path from the heart. Dr. Fleury has carried his investigations through the whole series of mammifers; and he finds that the right-handed peculiarity exists in all that have arteries arranged similar to those of man. At the same time, such animals, notably the chimpanzee, the seals, and the beavers, are notably the most adroit and intelligent.

New Discovery in Agriculture.

The curious discovery is announced by Professor P. B. Wilson, of Washington University, Baltimore, that minutely pulverized silica is taken up in a free state by plants from the soil, and that such silica is assimilated without chemical or other change. The experiment, of which we give a more full account in our SUPPLEMENT of this week, consisted in fertilizing a field of wheat with the infusorial earth found near Richmond, Va. This earth, it is well known, consists of the shells of microscopic marine insects, known as diatoms, which under strong magnifying powers reveal many beautiful forms that have been resolved, classified, and named. After the wheat was grown Professor Wilson treated the straw with nitric acid, subjected the remains to microscopic test, and found therein the same kinds of shells or diatoms that are present in the Richmond earth, except that the larger sized shells were absent: showing that only silica particles below a certain degree of fineness can ascend the sap pores of the plant. This discovery opens up a new line of research in agricultural investigation from which important results and much additional knowledge may accrue.

Tuesday. Dec. 23?

A. Algebra. Equation. (Con.) — Problems.

Q. Arith. Ex. in Subtraction.

B. Arith. Least Common Multiple.

A. Arith. Complex Fractions.

B. Grammar. Is it used as Ex. Ch. of Pro.

A. Grammar. Parse Double personal and relative pronouns.

Left Upper & Lower Double Pronouns.

Left Upper Double Pronouns

Monday Sept 27th

A. Algebra. Problems (Con.)

1. Add. ① 7846 − 5975. ② 24638 − 28542 = 65696
③ 9468 − 7337 − 2111. ④ 2463 + 2687 − 2467 = 2533
⑤ 79048 − 48356 + 69843 − 100735

2. Subt. Applications in Long Division.

① Subtr. Find Greatest Common Divisor of 42468 +
5974, 26474 + 3692. ② 3497 + 7774, 071 ④ 22,923 + 75578
+ 641.27 ⑤ 12,138 + 16796 + 18189.

3. Subtr. Equivalence Duodecimals.

4. Subtr. The lady came from where the seed stood
at midnight. Silver is of Scot. Ex. Ex.

5. Factors. Outline for

Phonography

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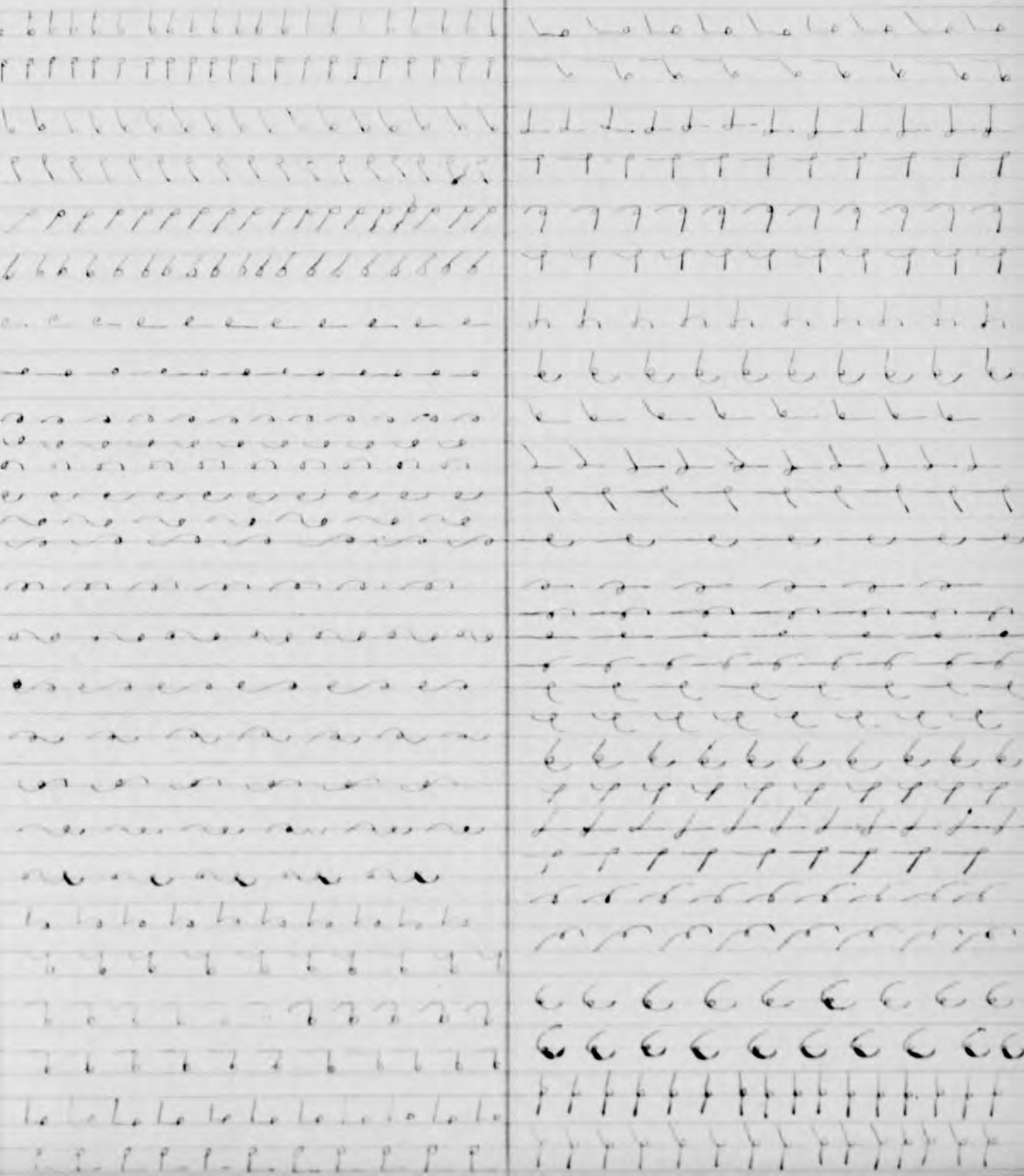
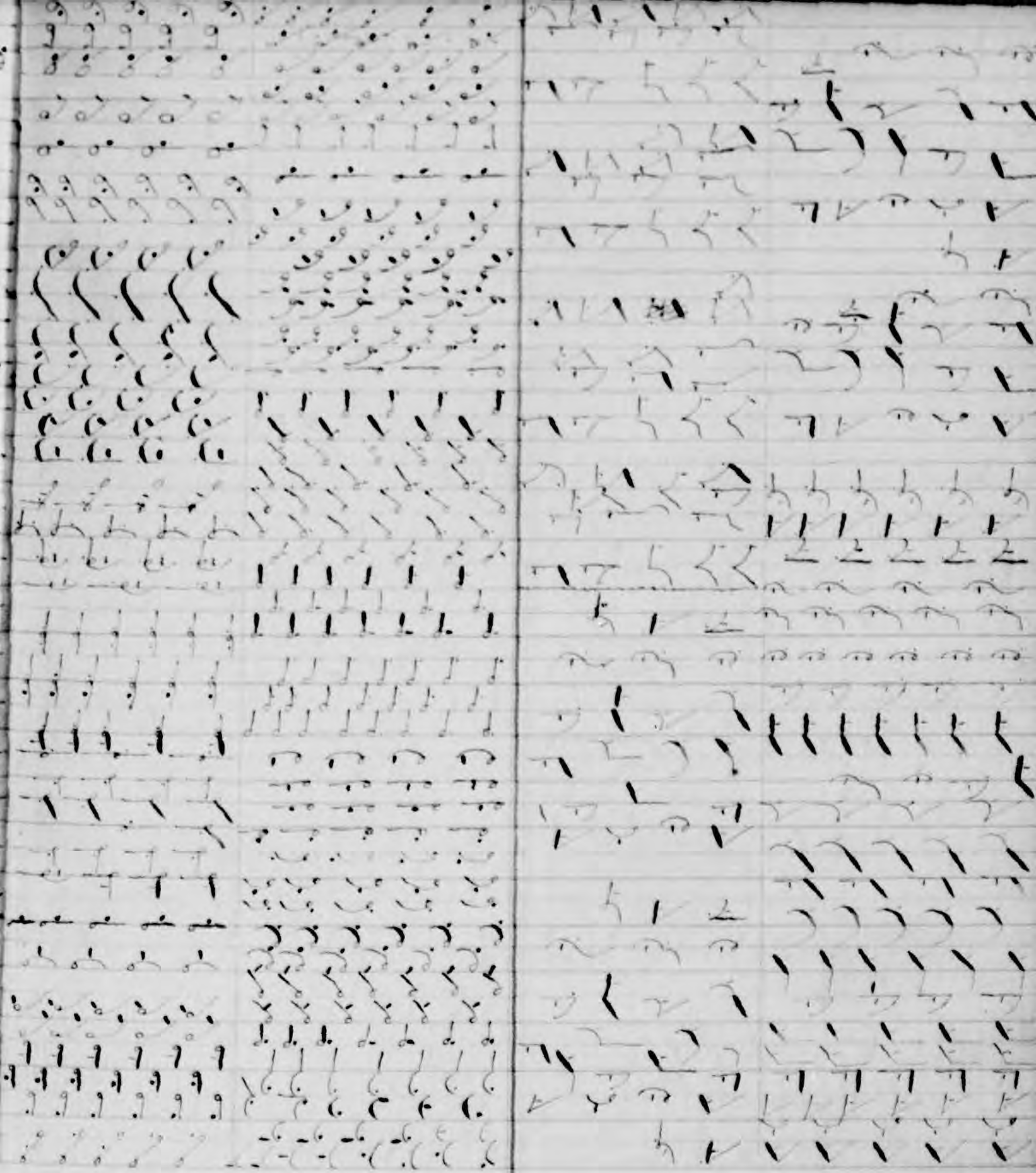
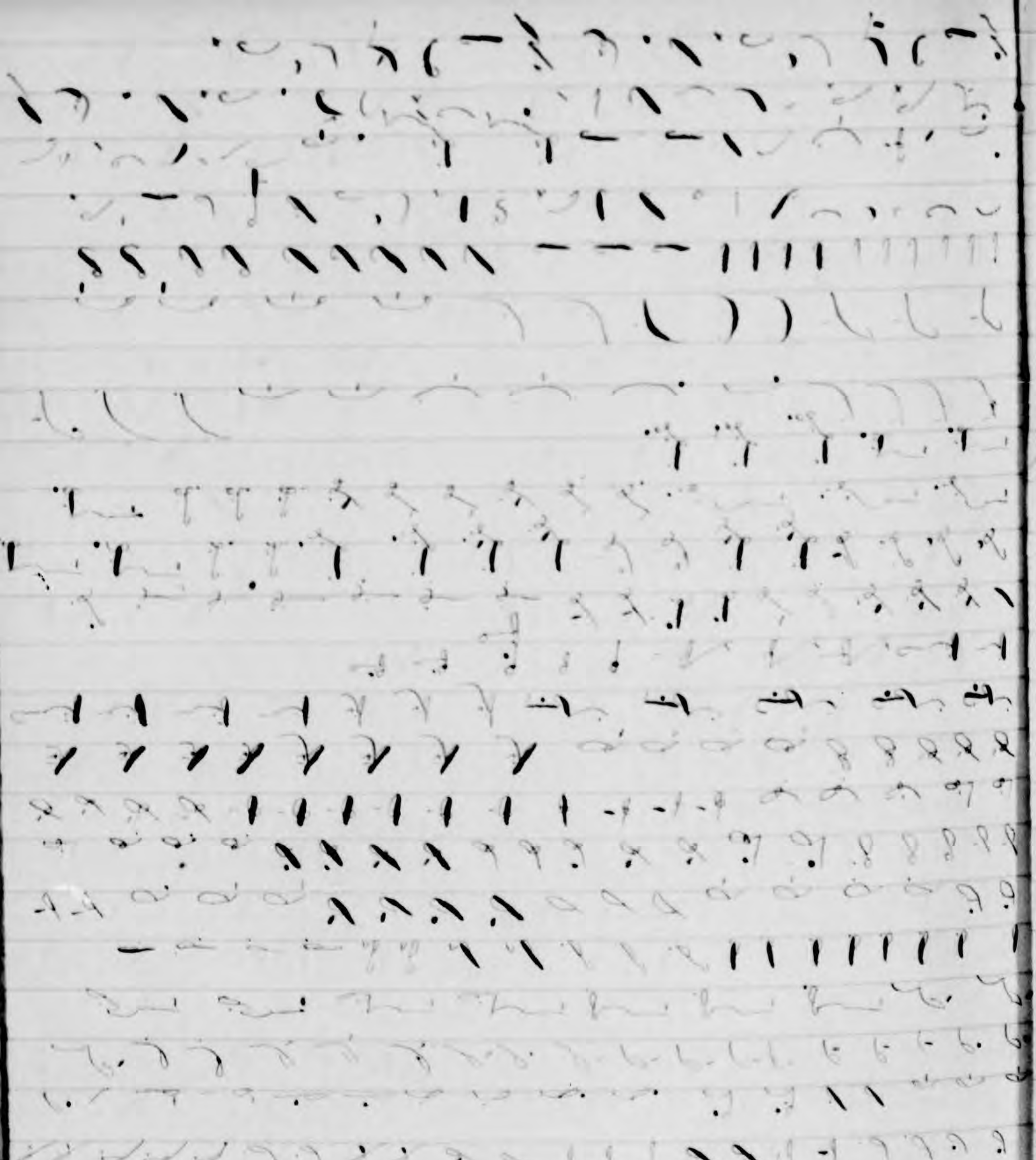




EXERCISE VI



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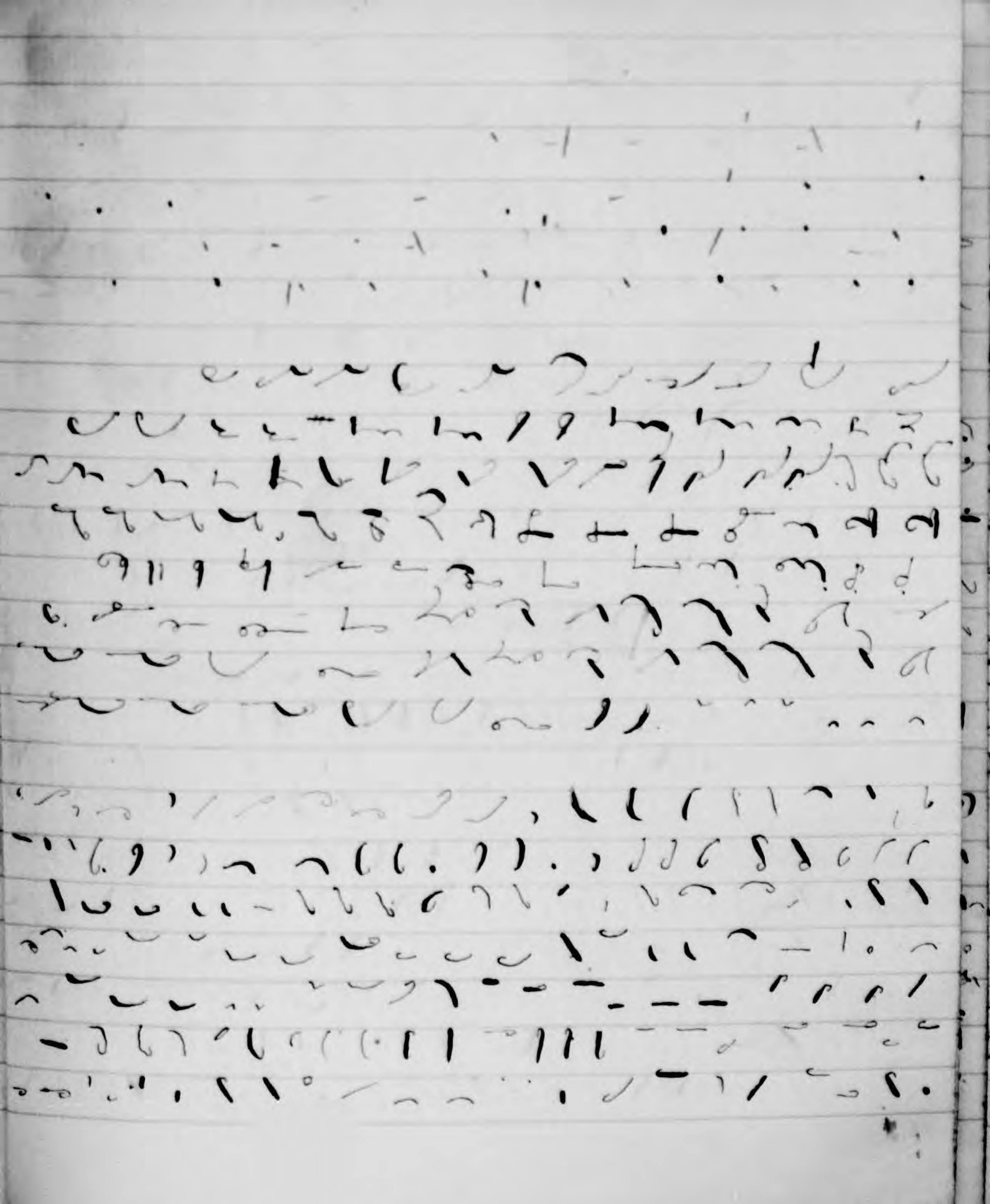
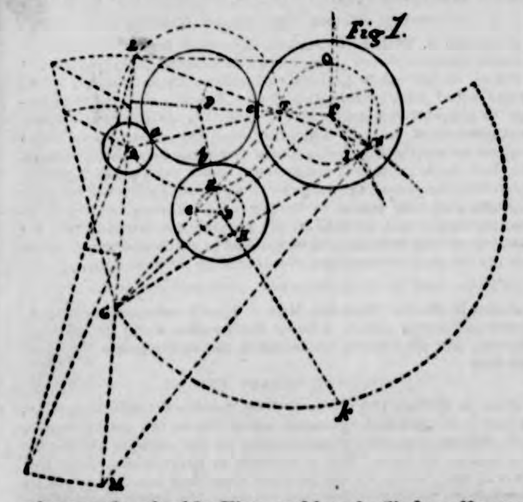


AN OLD PROBLEM.

In a recent letter a correspondent asked for an explanation of the method of drawing a circle tangent to any three given circles. Intending to refer him to some good treatise on practical geometry, we examined the principal ones, and found that they contained no mention of this question. On making further investigation, we ascertained that it was a celebrated problem among the ancient geometers, and was



subsequently solved by Vieta, and later by Sir Isaac Newton. It is contained in some foreign works on geometry, and a solution is given in Hutton's "Mathematical Recreations," which seems, however, to be incorrect. It is probable, therefore, that the solution is not generally accessible; and as the problem is unusually interesting and instructive, we lay it before our readers, in as simple a form as possible. The problem itself may be of little importance, but the principles upon which its solution depends are of general utility in geometrical constructions.

The construction in question is one of a class in which the solution is best obtained by indirect methods, changing the nature of the problem by successive steps in order to simplify it. As it is not at once evident what those steps should be, it will be advantageous to make the supposition that the problem has been solved, and see if some conditions can be obtained which may be fulfilled by construction. If such conditions can be discovered, it will, of course, be easy to make the required construction. It may be added that this method is of general application to all intricate geometrical problems.

Referring to Fig. 1, the three given circles have their centers at A, B, C, with radii, Aa, Bb, Cc. Suppose that D, the center of the required tangent circle, to happen to be evident

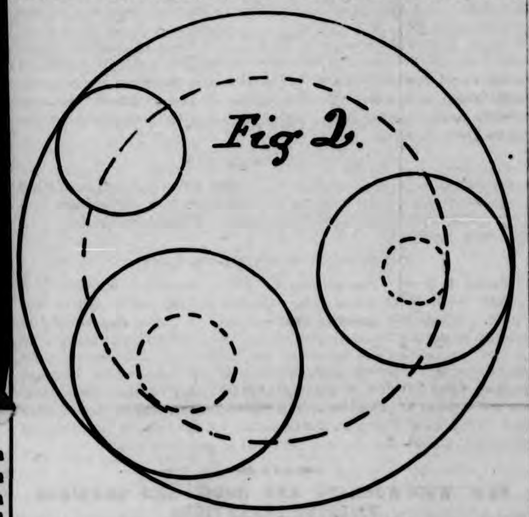
lem can be changed into another, in which it is required to draw a circle through a given point, and tangent to two given circles. Suppose this to be done, and draw the line, GHN, tangent to the two auxiliary circles; draw also the line, CBG, through the centers of the auxiliary circles, the line, GEF, through the points of tangency of these circles with the required circle, the line, GAL, through the center of the small circle, and the radius, Be. Then, from the principles of geometry, we obtain the relations:

$$\frac{GC}{GB}=\frac{GF}{Ge}=\frac{GF\times GE}{Ge\times GE}=\frac{GL\times GA}{(GH)^2}$$

From these conditions we can find a point, L, in the circumference of the required circle, so that, if the circle is drawn through the points, L and A, and tangent to one of the auxiliary circles, it will also be tangent to the other; hence the original problem can be reduced to the case in which it is required to draw a circle through two given points, and tangent to a given circle. Suppose the circle with radius, CF, is the given circle, and that the required construction is made. Through the point of contact, F, draw the straight lines, LFN and AF; at N, draw a tangent, NM, to the given circle, produce the line, LA, to its intersection with the tangent at M; and from L, draw the tangent, LO, to the given circle. Then we will have the relations:

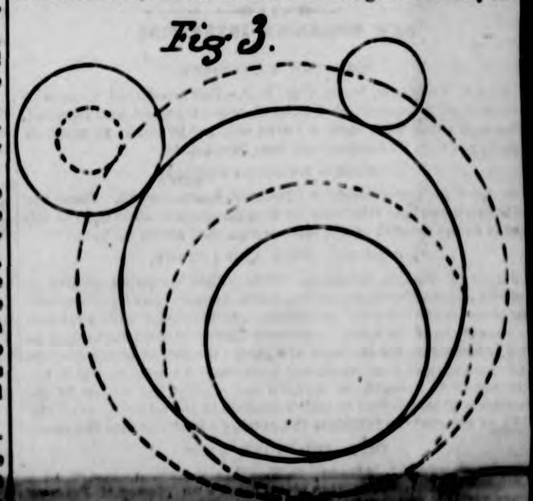
$$\frac{LA}{LF}=\frac{LN}{LM}, \text{ or } LA\times LM=LF\times LN=(LO)^2$$

From these conditions, we can find the point of intersection,

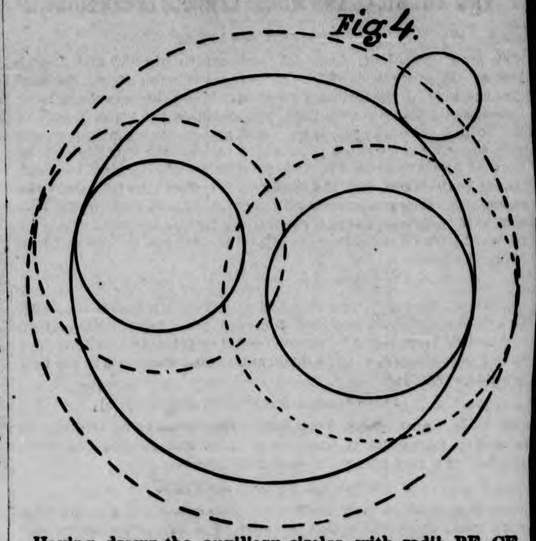


M, the point of tangency, N, and the point of contact, F, so that the original problem is finally reduced to the simple one of finding the center of a circle which shall pass through three given points, A, L, F. The reader may find it profitable to verify the geometrical principles which have been stated above. We now pass to the method of making the construction, having shown the principles involved. All the auxiliary constructions are given in the figure, except such a simple one as the bisection of a line; but it has not been thought necessary to explain the methods of making them, as they will be found in an elementary text book. The reader will find it instructive to make the constructions as they are detailed below.

We have given the three circles in full lines, with centers at A, B, and C. It is evident that the problem admits of several solutions, as the tangent circle may touch the given circles externally, internally, or some of them internally and some externally. Several of these cases are illustrated in Figs. 2, 3, and 4. In any case, the first thing to do is to draw two auxiliary circles, whose centers are coincident with the centers of the two larger circles, and whose radii are such that a circle drawn from the same center as the required tangent circle, and passing through the center of the smallest of the given circles, will be tangent to the auxiliary circles. In Fig. 1, where the given circles touch the tangent circle externally, the radii of the auxiliary circles are the radii of the larger circles, each diminished by the radius of the smallest; and the method of drawing the auxiliary cir-



struction is the same for all cases; so that, in the remainder of the explanation, reference is made to Fig. 1.



Having drawn the auxiliary circles, with radii BE, CF, draw IH, tangent to both circles, and produce this tangent to its intersection with a line, CBG, drawn through the centers of the auxiliary circles. From G, the point of intersection, draw a straight line through A, the smallest of the given circles, and prolong it indefinitely. Next find the length of HK, the side of a square whose area is to the area of the square constructed upon GH as the line, GI, is to the line, GH. Then, considering GA to be one side of a rectangle whose area is equal to the square constructed upon HK, find the other side, GL; and the point, L, so determined, will be a point of the circle whose center we wish to find. We have now reached that part of the problem in which it is required to draw a circle through the points, L and A, and tangent to the circle whose radius is CF. Produce the line, LG, indefinitely; and from L, draw a tangent, LO, to the given circle. Find LM, the second side of a rectangle of which LA is the other side, and whose area is equal to the square constructed upon LO. From M, so determined, draw a tangent, MN, to the given circle, and connect the point of tangency, N, with the point, L. F, the point in which this last line cuts the given circle, is the point of contact of the given and required circles; so that it only remains to find D, the center of a circle passing through the points, A, L, and F.

We have been greatly interested in bringing the above problem to its present shape, in which it can be readily illustrated by a single figure, and many of our readers may be equally interested in repeating the construction. It will be necessary to use great care in all the steps, in order to secure satisfactory results. As it is not improbable that there are other solutions known to some of our readers, we may add that we will be glad to hear from any of them who think they can improve upon the method explained above.

WORKING AND HOUSE AND CARRIAGE BUILDING INVENTIONS.

VED DEVICE FOR GREASING AXLES.

tin, Ottawa, Ill.—This invention relates to an im- tion of devices for lubricating the skein of vehicle sists in a filling tube and a plunger fitting therein, are employed for charging a longitudinal reser- with grease, the said reservoir running the entire in and opening through a slot upon the surface of ans of which construction the axle is rendered til the reservoir is exhausted. The latter may be aking off the wheel.

ROVED FOUR-WHEELED VEHICLE.

eridge, Port Huron, Mich.—This invention is an the class of four-wheeled vehicles provided with a facilitate turning within narrow limits. The front re connected by a jointed reach without the aid of ary device, and the body of the wagon is pivoted , and supported on the rear axle by means of fric- int it moves freely thereon whenever the wagon is ght or left.

OVED ARCH BAR FOR FIRE PLACES.

n Wickersham, Harrodsburg, Ky.—The ordinary brick arch of chimney fire places is a flat iron bar, aight or slightly curved. The chief objection to the total lack of ornamental design or configura- ility of obstruction to the passage of smoke by rea- ness of the brick arch or wall resting on the bar. objection, and also secure certain other advan- tor employs an arch bar formed of a vertical front horizontal top flange to support the brick wall, plate, projecting upward and inward from the e front plate, at an angle of about 45°, for the pur- g the smoke.

NEW HOUSEHOLD INVENTIONS.

IMPROVED WASHBOARD.

ers, Jersey City, N. J.—This consists of a series of und which a strip of wood is passed and fastened. bent upon a curve will not be liable to break or will not cut nor tear the clothes.

IMPROVED HANGING SHELVES.

ger Brodrick Chimnery, Kankakee, Ill.—These are hat they may be lengthened and shortened to ad- width of the place where they are to be hung.

MPROVED CHAIR AND LOUNGE.

son, Navasota, Texas.—This invention relates to ments in invalid chairs, designed more particularly ted with pulmonary affections and with weakness the spine. It consists mainly in the attachments to

Miner H. Paddock, East Clarkson, N. Y.—The calend attachment, is arranged for the days, weeks, and monti dicating hands for each, and, while being practically au also perpetual: that is to say, the mechanism is such as t sate for the irregular number of days occurring in th months, by a system of skipping, whereby a single day v subdivisions is made to indicate, successively and in pr the different number of days (28, 30, or 31) as they occur cessive months of the year.

IMPROVED WATER COIL STEAM GENERATOR

Benjamin S. Benson, Baltimore, Md.—This invention a novel construction of steam generator adapted to be a a boiler. It belongs to that class of generators in whic drical coil of pipes is employed above a furnace or heat ber, to generate the steam; and it consists in the constru arrangement of the coils, which are made to project at beyond the containing shell, and are provided, upon the the shell, with peculiarly constructed elbow joints, whi the ready removal of the deflector or worn-out sections and also give easy access to the pipes for cleaning out The invention also consists in the peculiar constructio rangement with the coils of a thermostat or automatic re ber for the surplus water not evaporated by the generat

SPRING POWER AND TREADLE FOR SEWING MAC

James H. Morley, Holyoke, Mass.—This is a combinatio power and spring power. One of the treadles works th directly, and the other is connected to the spring power ing it up.

IMPROVED ROTARY ENGINE.

John R. Peters, Dover, N. J.—This consists of plain f tached to the hub and extending out as far as the pisto with stationary packing rings pressing on the edges of th and against the case. This is claimed to prevent the r wear of the pistons by the packing rings and the loss through the necessary clearance between the inside edg circumference of the flanges and the case. The inven consists of compound pistons, consisting of two or more each groove in the hub, the ends and tops of which ma formed as to prevent serrated edges, and constitute w densed steam what is called water packing.

IMPROVED ROLLER GAGE FOR SAWMILLS.

Aaron Reppard, Savannah, Ga.—An adjustable roller employed, on the side of which the boards are cut, with lever and a scale for setting it for boards of any thickn roller is located just in advance of the saw, so that, by log against it, every board will be gaged exactly alike ac ness. The roller gage is mounted in a bracket, which sli bed piece, and the lever is connected to it by a link, and to piece by a bracket.

IMPROVED TYPE WRITER.

Philander Deming, Albany, N. Y.—The object of this inve to so improve the type writer that it may be made available fective manner for short hand reporting, and that the spee same in copying common writing may be considerably in The invention consists of a double escapement in combi

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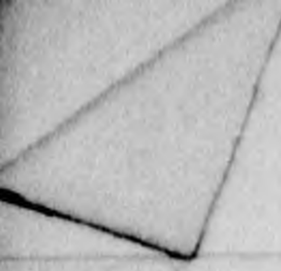

Spelling Classes.

Joseph Van Arman. 1
Rodney Owen. 1 2 12 -6
Frank Hoes. 1 2 11 13 -9
Emma " 1
Joseph Dowd. 1
Julia " 1 11
Susannah Matthews. 1 2
Alice Owen 12 -3
Emily Rising 1 2 2 -11
Lewis " 2 6 3 3 2 5 31 -30
Belle Williams 1

James Spencer 1 2 11 -7
Libbie Rising 2 1 1 1 1 43 -17
Charles " 1 4 1 2 3 1 3 5 44 -23
David Smith 1 2
Emily Matthews 2 5 5 2 1 3 3 11 2 -25
Celia Young 1 1 1 2 -5
John " 1 1 1 2 1 1 -9
Julia Small 1 6 3 3 3 2 1 1 9 2 6 -35
Alice Armentier 2 1 2 1 1 -7
Allie Staff. 1 1 1 5 5 -15
Ned Stiles 1 1 8 -9

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Alfred	"			
Alice	"			
Joseph	Dowd			
Julia	"			
Virir	"			
Joseph	VanAlman	X		
George	"	X	X	
Belle	"			
Ruth	"			
Myles	Rising		X	
Charles	"	X	X	X
Emily	"			
George	"			
Belle	Williams			
Eva	Ross			
Emily	Matthews			
Susannah	"			
Levi	"			
Dora	"			
David	Smith	X		
Mary	"			
Julia	"			
John	"			

LIGHT AND AIR VERSUS DRUGS.

Mrs. Rogers lay in her bed,
Bandaged and blistered from foot to head,
Blistered and bandaged from head to toe,
Mrs. Rogers was very low.
Bottle and saucer, spoon and cup,
On the table stood bravely up;
Physics of high and low degree—
Calomel, catnip, boneset tea;
Everything a body could hear,
Excepting light and water and air.
I opened the blinds; the day was bright,
And God gave Mrs. Rogers some light.
I opened the window; the day was fair,
And God gave Mrs. Rogers some air.
Bottles and blisters, powders and pills,
Quinine, benzoin, syrups and squills;
Drugs and medicines, high and low.
I threw them as far as I could throw.
"What are you doing?" my patient cried.
"Fulgutoming death," I coolly replied.
"You are crazy!" a visitor said;
I flung a bottle at his head.

Deacon Rogers he came to me;
"Wife is a-getting her health," said he.
"I really think she will worry through;
She scolds me just as she used to do.
All the people have peeked and stirred;
All the neighbors have had their word;
'Twere better to perish, some of 'em say,
Than be cured in such an irregular way."
—*Science of Health.*

"for every fact of consciousness, whether in the domain of sense, of *thought*, or of *emotion*, a definite molecular condition of motion or structure is set up in the brain." — Tyndall

| | | |

EXERCISES

Deut. 1st Chapter.

Evening Bells.

Thos. Hood.

Those evening bells, those evening bells,
How many a tale their music tells,
Of Life, and home, and those sweet times
When last I heard their merry chimes.

Those joyous hours have past away.
And many a heart that then was gay,
Within the tomb now darkly dwells.
And hears no more those evening bells.

And so to Erin when I am gone
Your tuneful peal will still ring on;
While other bards shall walk those dells.
And sing your praise sweet evening bells.

The Blue and The Gray.

By the flow of the inland river.
Whence the fleets of iron have fled.
Where the flades of grave grass quiver:
Asleep are the ranks of the dead.
Under the sod and the dew.
Waiting the judgment day.
Under the one the Blue
Under the other the, Gray.

These in the sorking of glory.
Those in the gloom of defeat.
All with the battle blood gory:
In the dusk of eternity meet.
Under the sod and the dew:
Waiting the judgment day
Under the laurel. the Blue.
Under the willow. the Gray.

From the silence of sorrowful hours,
The declate recurrence go.
Loving by laden with flowers;
Alike for the friend and the foe.
Under the sod and the dew,
Waiting the judgment day;
Under the roses, the Blue
Under the lillies, the Gray.

So, with an equal splendor,
The morning sun rays fall;
With a touch impartially tender,
On the blossom blooming for all.
Under the sod and the dew.
Waiting the judgment day;
Broidered with gold, the Blue,
Mellowed with gold, the Gray.

Or. when the summer calleth,
On forest and field of grain;
With an equal murmur falleth,
The cooling drop of the rain.
Under the sod and the dew,
Waiting the judgment day;
Wet with the rain, the Blue,
Wet with the rain, the Gray.

Sadly, but not with upbraiding,
The generous deed was done;
In the storm of the years that are fading
No. trace can be won.
Under the sod and the dew,
Waiting the judgment day;
Under the blossoms, the Blue
Under the garlands, the Gray.

No more shall the Lark cry aloud,
Or the winding rivers be red;
They Lanish mr anger forever,
When the Laural the graves of mr dead.
Conder the sod and the dew.
Waiting the judgment day;
Love and tears for the Blue
Tears and love for the Gray.

F. M. Finch

Alexander Pope. - Writings are generally
admired, he was a man of acute intellect, on
account of poor health he was deprived of
the privileges of school. Was a clever critic
One thing he introduced was the rimed
Couplet.

Joseph Addison - Was a miscellaneous
writer, mostly short essays. He was a very
careful writer being careful not let on me.
His contributions to the Tatler and other
papers are worthy of. The Test book was
called Evidences of the Christian Religion.

Jonathan Swift. Was a man of powerful
intellect. Had quick insight, exposed the
faiers played in fashionable circles.
He depended upon ridicule to cure the
faults of society. He did not shun Leigh
in his writings.

Dr North Indiana Parker is a native
Bridgeport County of Fairfield Ct. His
father is a descendant of English Puritans.
Was early very fond
of Books and Study, and a generous disposition,
displayed a love for Truth. Called the
Valley, wrote a number of plays. was
a humorist, a Artist, a Writer and a
story teller.

Dr Isaac Watts, - Was born in Southampton
Wrote treatise on Logic and On the improvement
of the Mind. Wrote many beautiful hymns
Jonathan Edwards Was a eminent
Theological writer, was born in Conn.
Wrote worthy for Christians. He was
a faithful Minister

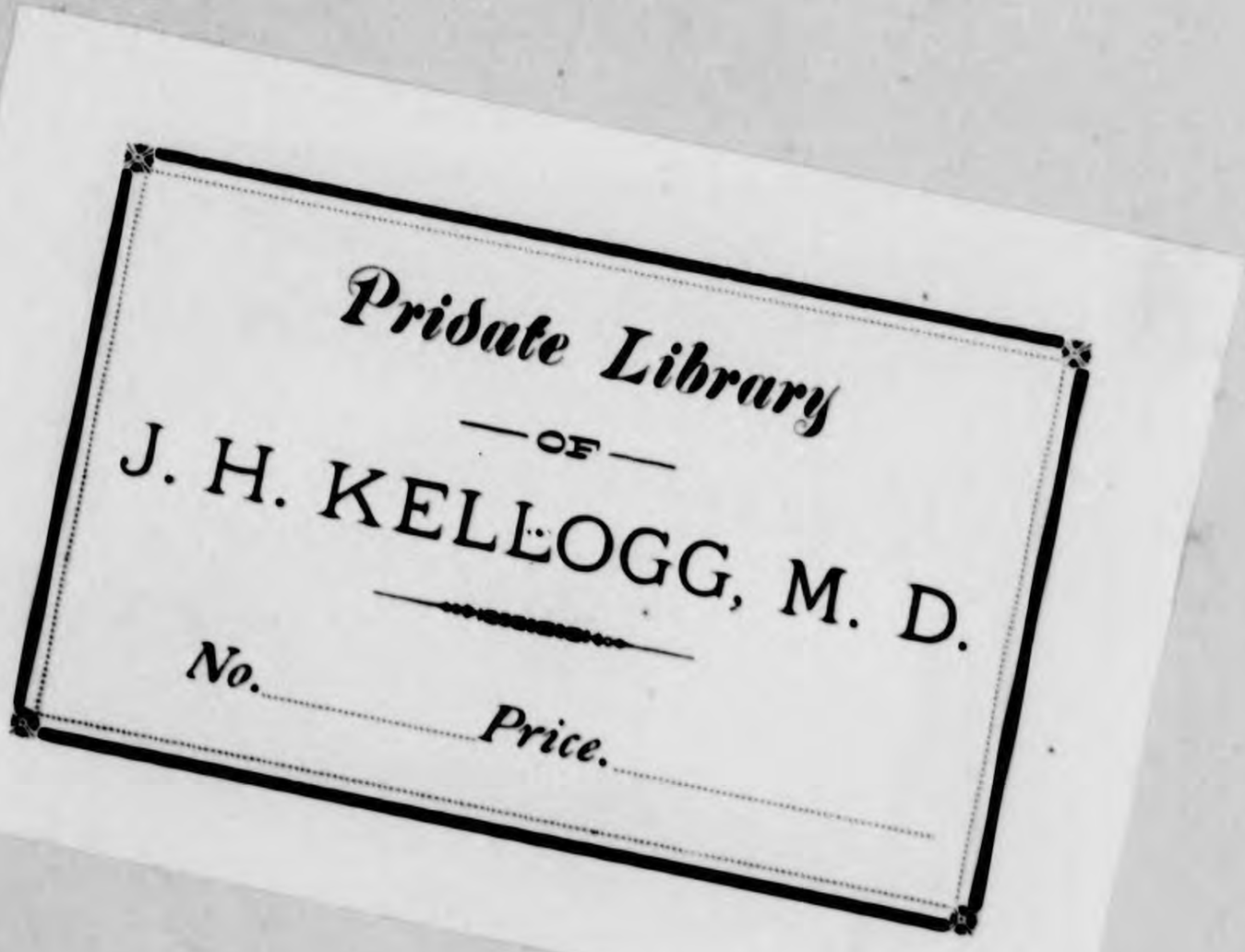
Benjamin Franklin An American, from
Was a printer devil, a statesman a
minister to foreign countries. wrote but
little, more to aid his fellow men, his
Poor Richards Almanac was his best
work. discovered that lightning are
electricity were same.

Samuel Johnson Exercised a powerful
influence over the language of his
age. Was the finder of the English Lexicon
he gave eight years to making a dictionary
Wrote, Lives of the Poets. and his travels in Hebrides
Was by in a Stiff but circumstantial manner
the politeness. was very partial in his
writings.

David Hume. Was a voluminous writer
but his writings are full of skepticism and
infidelity. Love expression better than accuracy

Edward Sitton, — Was Second
Son of the Roman Empire. He replied
the Teachings in the Bible, and Thinks
the Apostles Inspired.

Whitefield and Wesley. — Founders
of Methodism in America and England.
Whitefield was a great preacher. He visited
America seven times, died in Mass.
Wesley was a great organizer. Traveled
300 000 miles, and preached 40,000 sermons
founded the Church of Enfield Conn
Presidentship of N. 20 yrs & 18,000,000
Edmund Burk. was England's greatest
orator, was from Dublin. was a
Politician and Statesman, was for-
seeing. Born for Westminster from
nature.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J. H. KELLOGG, M. D.
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Price.

P. O. Kellogg.

Battle Creek

Mich.

Qualitative Analysis

Studied in the

Chemical Laboratory

of the

University of Michigan

May 19, June

1877.

Solution 1st — Ba Cl2

Reaction Neutral.

Sol + HCl = 0

Sol + HCl + H_2S = 0

Sol + $(NH_4)Cl$ + $(NH_4)_2S$ = 0

Sol + NH_4Cl + NH_4NO_3 + $(NH_4)_2CO_3$ = Pr 1st

Pr 1st + wash + $HC_2H_3O_2$ = Sol 2nd

Sol 2nd + K_2CrO_4 = Pr 2nd

Pr 2nd + HCl = Sol 3rd

Sol 3rd + K_2SO_4 = Pr 3rd

Hence, Base equals Barium.

Confirmation.

Barium Precipitated by Carbonates

Sol + $(NH_4)_2CO_3$ = Pr (w)

Sol + K_2CO_3 = Pr (w)

Sol + Na_2CO_3 = Pr (w)

Barium Precipitated by Sulphates

Sol + $CaSO_4$ = Pr (w)

Sol + $MgSO_4$ = Pr (w)

Sol + $FeSO_4$ = Pr (w) (yellow when heated)

Sol + $(NH_4)_2SO_4$ = Pr (w)

Ba. Precip. by Sulphites

Sol + Na_2SO_3 = Pr (w)

Ba. Precip by Phosphates

Sol + Na_2HPO_4 = Pr (w)

Ba Precip by Borates

Sol + $Na_2B_4O_7$ = Pr (w)

Ba Precip by Arsenites

Sol + $(NH_4)_2AsO_4$ = Pr (w)

Sol + KBO_2 = Pr (w)

$BaCl_2 + NH_4Cl + NH_4NO + (NH_4)_2CO_3 = \underline{BaCO_3} + (NH_4Cl)_2 + NH_4NO$

$BaCO_3 + (HC_2H_3O_2)_2 = Ba(C_2H_3O_2)_2 + H_2CO_3$

$Ba(C_2H_3O_2)_2 + K_2Cr_2O_7 = (HC_2H_3O_2)_2 + \underline{BaCrO_4} + CrO_3$

$BaCrO_4 + (HCl)_2 = H_2CrO_4 + BaCl_2.$

$BaCl_2 + H_2SO_4 = (HCl)_2 + BaSO_4$

Confirmation.

$BaCl_2 + (NH_4)_2CO_3 = (NH_4Cl)_2 + BaCO_3$

$BaCl_2 + K_2CO_3 = (KCl)_2 + BaCO_3$

$BaCl_2 + Na_2CO_3 = (NaCl)_2 + BaCO_3$

$BaCl_2 + CaSO_4 = CaCl_2 + BaSO_4$

$BaCl_2 + MgSO_4 = MgCl_2 + BaSO_4$

$BaCl_2 + ZnSO_4 = ZnCl_2 + BaSO_4$

$BaCl_2 + (NH_4)_2SO_4 = (NH_4Cl)_2 + BaSO_4$

$BaCl_2 + Na_2SO_3 = (NaCl)_2 + BaSO_3$

$BaCl_2 + Na_2HPO_4 = (NaCl)_2 + BaHPO_4$

$BaCl_2 + Na_2B_4O_7 = (NaCl)_2 + BaB_4O_7$

$BaCl_2 + (NH_4)_2CrO_4 = (NH_4Cl)_2 + BaCrO_4$

$BaCl_2 + (KIO_3)_2 = (KCl)_2 + Ba(IO_3)_2$

Solution 1st & 2nd $BaCl_2$ (combined)

Hydrochloric Acid - HCl.

(Table 10)

Evaporated to solid form.

Residue + H_2SO_4 + heat = Effervescence, gas with odor

Gas + Solution of $AgNO_3$ in glass rod = Pr (white)

$Pr + HNO_3$ (dilute) = 0

$Pr + (NH_4)HO$ = Sol

Gas + NH_3 (vapor) = white fumes.

Distilled with H_2SO_4 & $K_2Cr_2O_7$ = Brown fumes.

Sol + $AgNO_3$ = Pr (w)

Sol + $Hg(NO_3)_2$ = Pr (w)

Sol + $Pb(C_2H_3O_2)_2$ = Pr (w)

Chlorides are precipitated by silver, mercurous and lead salts.

(Table 11)

Reaction Neutral

Sol + $AgNO_3$ = Pr (w)

Pr + HNO_3 digested = 0

Pr + HNO_3 + $(NH_4)HO$ (in excess) = Sol 2nd

Sol 2nd + HNO_3 = Sol 3rd

Evaporated and distilled solid residue with chloric acid and bichromate of potash SO_4 and $K_2Cr_2O_7$. Produced red-brown fumes.

$BaCl_2 + H_2SO_4 = BaSO_4 + (HCl)_2$

$HCl + AgNO_3 = HNO_3 + AgCl.$

$(AgCl)_2 + (NH_4HO)_3 = (H_2O)_3 + (NH_3)_3(AgCl)_2$

$HCl + NH_3 = NH_4Cl$

$(BaCl_2)_2 + (H_2SO_4)_3 + K_2Cr_2O_7 = (CrO_2Cl_2)_2 + (BaSO_4)_2 + K_2SO_4 + (H_2O)_3$

$BaCl_2 + (AgNO_3)_2 = Ba(NO_3)_2 + (AgCl)_2$

$BaCl_2 + (AgNO_3)_2 = Ba(NO_3)_2 + \underline{(AgCl)_2}$

$BaCl_2 + Pb(C_2H_3O_2)_2 = Ba(C_2H_3O_2)_2 + PbCl_2$

$BaCl_2 + (AgNO_3)_2 = Ba(NO_3)_2 + \underline{(AgCl)_2}$

$\underline{(AgCl)_2} + (HNO_3)_2 + (NH_4HO)_3 \xrightarrow{\text{(in excess)}} (NH_4NO_3)_2 + (NH_4)_3(AgCl)_2 + (H_2O)_3 + NH_4NO_3$

$NH_4HO + (NH_4)_3(AgCl)_2 + HNO_3\ \text{(in excess)} = (NH_4)NO_3 + HNO_3 + \underline{AgCl}.$

Solution 2nd Sn Gr 2

Reaction Neutral.

Sol + HCl = 0

Sol + HCl + H_2S = 0

Sol + NH_4Cl + $(NH_4)_2S$ = 0

Sol + NH_4OH + $(NH_4)Cl$ + $(NH_4)_2CO_3$ = Pr (w) 1st

Pr 1st + wash + HCl H_2O_2 = Sol 2nd

Sol 2nd + $K_2Cr_2O_7$ = 0

Sol 2nd + NH_4OH + $(NH_4)_2CO_3$ + $K_2Cr_2O_7$ = Pr 2nd (w)

Pr 2nd + wash + HCl = Sol 3rd

Sol 3rd + evaporation + water = Sol 4 neutral.

Sol 4th + $BaSO_4$ = Pr 3rd (w)

Hence base equals Sr.

Confirmation.

Carbonates Precipitate Sr salts { Sol + $(NH_4)_2CO_3$ = Pr (w)
Sol + H_2CO_3 = Pr (w)

Sulphates precipitate Sr. salts. { Sol + $FeSO_4$ = Pr (w)

Sulphites precipitate Sr. salts. { Sol + Na_2SO_3 = Pr (w)

Phosphates precipitate Sr salts. { Sol + Na_2HPO_4 = Pr (w)

Tested for HCl as in 1st solution.

$Sr(ClO_3)_2 + (NH_4)_2CO_3 + NH_4Cl + (NH_4)_2CrO_4 = (NH_4)_2CO_3 + (NH_4Cl)_3 + \underline{SrCrO_4}$
$SrCrO_4 + (HC_2H_3O_2)_2 = H_2CrO_4 + Sr(C_2H_3O_2)_2$

$Sr(C_2H_3O_2)_2 + (NH_4)_2CO_3 + (NH_4)_2CrO_4 + K_2Cr_2O_7 =$
$K_2Cr_2O_7 + (NH_4)_2CO_3 + (NH_4 \cdot C_2H_3O_2)_2 + \underline{SrCrO_4}$
$SrCrO_4 + (HCl)_2 = H_2CrO_4 + SrCl_2$

$SrCl_2 + BaSO_4 = BaCl_2 + \underline{SrSO_4}$

$SrCl_2 + (NH_4)_2CrO_4 = (NH_4Cl)_2 + SrCrO_4$
$SrCl_2 + K_2CrO_4 = (KCl)_2 + SrCrO_4$

$SrCl_2 + Fe_2(SO_4)_3 = FeCl_2 + SrSO_4$

$SrCl_2 + Na_2SO_3 = (NaCl)_2 SrSO_3$

$SrCl_2 + Na_2HPO_4 = (NaCl)_2 + SrHPO_4$

Solution 3rd Group

Reaction Neutral

Sol + H Cl = 0

Sol + H Cl + H_2S = 0

Sol + NH_4 Cl + $(NH_4)_2S$ = 0

Sol + NH_4OH + NH_4 Cl + $(NH_4)_2CO_3$ = Pr 1st (w)

Pr 1st + wash + H $Cl_2H_3O_2$ = Sol 2nd

Sol 2nd + NH_4OH + $(NH_4)_2CO_3$ = Pr 3rd

Pr 2nd + wash + H Cl = Sol 3rd

Sol 3rd + Evaporation + H_2O water = Sol 4th

1st Portion.

Sol + Na SO_4 = 0

2nd Portion.

Sol + H_2SO_4 = Pr (w) (partially precipitated)

Sol + filter = filtrate

Filtrate + NH_4OH + $(NH_4)_2CO_3$ = Pr 2nd (w)

Hence base equals Na.

Confirmation

Pr 2nd + H $Cl_2H_3O_2$ = 0

Pr 2nd + H Cl = Sol

Sol 1st + K_2CrO_3 = Pr (w)

Sol + K_2SO_4 = Pr (w)

Sol + $ZnSO_4$ = Pr (w)

Sol + $MgSO_4$ = Pr (w)

Sol + $Na_2S_2O_3$ = Pr (w)

Sol + Na_2HPO_4 = Pr (w)

Sol + Na_2HCrO_3 = Pr (w)

Sol + NH_4 Clefy = Pr (w)

$CaCl_2 + NH_4NO_3 + NH_4Cl + (NH_4)_2CO_3 = NH_4NO_3 + (NH_4Cl)_3 + \underline{CaCO_3}$

$CaCO_3 + (CH_3COO)_2Ni = NiCO_3 + Ca(CH_3COO)_2$ [$\underline{CaCO_3}$

$Ca(CH_3COO)_2$ $NH_4NO_3 + (NH_4)_2CO_3 = NH_4NO_3 + (NH_4CH_3COO)_3 +$

$CaCO_3 + (CH_3)_2CHOH = CH_3COCH_3 + CaCl_2$

$CaCl_2 + K_2SO_4 = (KCl)_2 + \underline{CaSO_4}$ partly soluble

$CaSO_4 + NH_4NO_3 + (NH_4)_2CO_3 = NH_4NO_3 + (NH_4)_2SO_4 + \underline{CaCO_3}$

$CaCl_2 + (CH_3COO)_2Ba = Ba(CH_3COO)_2 + \underline{CaCl_2}$ (soluble)

$CaCl_2 + K_2CrO_4 = (KCl)_2 + \underline{CaCrO_4}$

$CaCl_2 + K_2SO_4 = (KCl)_2 + \underline{CaSO_4}$

$CaCl_2 + Zn(NO_3)_2 = Zn(NO_3)_2 + \underline{CaSO_4}$

$CaCl_2 + MgSO_4 = MgCl_2 + \underline{CaSO_4}$

$CaCl_2 + Na_2SO_3 = (NaCl)_2 + \underline{CaSO_3}$

$CaCl_2 + Na_2HPO_4 = (NaCl_2), \underline{CaHPO_4}$

$CaCl_2 + Na_2HAsO_3 = (NaCl)_2 + \underline{CaHAsO_3}$

$CaCl_2 + KH_2CoFy = (KCl)_2 + \underline{K_2CaCoFy}$.

Solution H^{th}_{II} ($Ba\,Cl_2$ + $Sr\,Cl_2$ + $Ca\,Cl_2$)

Neutral Reaction.

$Sol + NCl = 0$

$Sol + NCl + N_2S = 0$

$Sol + NH_4Cl + (NH_4)_2S = 0$

$Sol + NH_4NO_3 + NH_4Cl + (NH_4)_2CO_3 =$ Pr (w) 1^{st}_{II}

$Pr\,1^{st}_{II}$ + wash + $NaC_2H_3O_2$ = $Sol\,2^{nd}_{II}$

$Sol\,2^{nd}_{II} + K_2CrO_4 = Pr\,2^{nd}_{II}$

Precipitate

$Pr + NaCl = Sol$

$Sol + H_2SO_4 =$ Pr (w)

Nitric base = Ba.

Confirmation

$Pr + H_2SO_4 = 0$

$Sol + K_2CrO_3 =$ Pr (w)

$Sol + FeSO_4 =$ Pr (w)

$Sol + (NH_4)_2CaO_4 =$ Pr (w)

Solution.

$Sol + NH_4NO_3 + (NH_4)_2CO_3 = Pr\,1^{st}_{II}$

$Pr\,1^{st}_{II}$ + wash + HCl = $Sol\,2^{nd}_{II}$

$Sol\,2^{nd}_{II}$ + evaporation + water = $Sol\,3^{rd}_{II}$ (neutral)

1^{st}_{II} Portion.

$Sol\,3^{rd}_{II} + CaSO_4 =$ Pr (w)

Nitric base = Sr

Confirmation

$Sol + K_2CrO_3 =$ Pr (w)

$Sol + Na_2SO_3 =$ Pr (w)

$Sol + Na_2HPO_4 =$ Pr (w)

$$\left.\begin{matrix}BaCrCl_2\\SrCrCl_2\\CuCrCl_2\end{matrix}\right\} + 2NH_4NO + 2NH_4Cl + (2NH_4)_2CrO_3 = 2NH_4NO + (2NH_4Cl)_2 + \left\{\begin{matrix}\underline{BaCrO_3}\\\underline{SrCrO_3}\\\underline{CuCrO_3}\end{matrix}\right.$$

$$\left.\begin{matrix}BaCrO_3\\SrCrO_3\\CuCrO_3\end{matrix}\right\} + (KCr(NH_3O_2)_2)_6 = (K_2CrO_3)_3 + \left\{\begin{matrix}Ba(Cr(NH_3O_2)_2)_2\\Sr(Cr(NH_3O_2)_2)_2\\Cu(Cu(NH_3O_2)_2)_2\end{matrix}\right.$$

$$\left.\begin{matrix}Ba(Cr(NH_3O_2)_2)_2\\Sr(Cr(NH_3O_2)_2)_2\\Cu(Cu(NH_3O_2)_2)_2\end{matrix}\right\} + K_2CrCrO_7 = (KCr(NH_3O_2)_2)_2 + \underline{BaCrO_4} + CrO_3 + \left\{\begin{matrix}Sr(Cr(NH_3O_2)_2)_2\\Cu(Cu(NH_3O_2)_2)_2\end{matrix}\right.$$

$$BaCrCrO_4 + KCl_2 = K_2CrCrO_4 + BaCl_2$$

$$BaCl_2 + K_2SO_4 = (KCl)_2 + \underline{BaSO_4}$$

$$BaCl_2 + K_2CrO_3 = (KCl)_2 + \underline{BaCrO_3}$$

$$BaCl_2 + FeSO_4 = FeCl_2 + \underline{BaSO_4}$$

$$BaCl_2 + (NH_4)_2CrO_4 = (2NH_4Cl)_2 + \underline{BaCrO_4}$$

$$\left.\begin{matrix}SrCu(CrO_4)_2\\CuCu(CrO_4)_2\end{matrix}\right\} + 2NH_4NO + (2NH_4)_2CrO_3 = 2NH_4NO + (2NH_4Cu(CrO_4)_2)_4 + \left\{\begin{matrix}\underline{SrCrO_3}\\\underline{CuCrO_3}\end{matrix}\right.$$

$$\left.\begin{matrix}SrCrO_3\\CuCrO_3\end{matrix}\right\} + (KCl)_4 = (K_2CrO_3)_2 + \left\{\begin{matrix}SrCl_2\\CuCl_2\end{matrix}\right.$$

$$\left.\begin{matrix}SrCrO_3\\CuCrO_3\end{matrix}\right\} + (CuSO_4) = (CuCrO_3)_2 + \underline{SrSO_4}$$

$$SrCl_2 + K_2CrO_3 = (KCl)_2SrCrO_3$$

$$SrCl_2 + Na_2SO_3 = (NaCl)_2 + SrBO_3$$

$$SrCl_2 + Na_2HPO_4 = (NaCl)_2 + SrHPO_4$$

Solution 4th (continued)

2nd Portion

Sol + K_2SO_4 = Pr (w)

Filtrate + NH_4NO_3 + $(NH_4)_2C_2O_4$ = Pr (w)

Hence base = Ca

Confirm

Sol + K_4 $Fe(CN)_6$ = Pr (w)

Sol + Na_2HAsO_3 = Pr (w)

Solution 5th ($MgSO_4$)

Sol + HCl = 0

Sol + HCl + K_2S = 0

Sol + NH_4Cl + $(NH_4)_2S$ = 0

Sol + NH_4OH + NH_4Cl + $(NH_4)_2CO_3$ = 0

Sol + evaporation = Solid residues

Solid Residue + ignition = 0

Sol + NH_4NO_3 = Pr (w) 1st

Filt NH_4Cl = Sol 2nd

Sol 2nd + Na_2HPO_4 = Pr (w)

Hence base = Mg.

Confirmation:

Sol + KI = Pr (w)

Sol + NH_4IO = Pr (w)

Sol + Na_2CO_3 = Pr (w)

Sol + Na_2HPO_4 = Pr (w)

$$\left.\begin{matrix} Sr\,CrO_3 \\ Ca\,CrO_3 \end{matrix}\right\} + (K_2\,SO_4)_2 = (K_2\,CrO_3)_2 + \left\{\begin{matrix} Sr\,SO_4 \\ Ca\,SO_4 \end{matrix}\right.$$

$$Ca\,SO_4 + 2NH_4NO + (NH_4)_2\,Cr_2\,O_4 = 2NH_4NO + (NH_4)_2\,SO_4 + \underline{Ca\,Cr_2\,O_4}$$

$$Ca\,CrCl_2 + KH\,CrFy = K_2\,Ca\,CrFy + (K\,Cl)_2$$

$$Ca\,CrCl_2 + 2Na_2\,HAsO_3 = (2Na\,Cl)_2 + Ca\,HAsO_3$$

$$(2Mg\,SO_4)_2 + (2NH_4HO)_2 = (NH_4)_2\,SO_4 . 2Mg\,SO_4 + \underline{2Mg\,H_2\,O_2}$$

$$2Mg\,H_2\,O_2 + (2NH_4\,Cl)_2 = (2NH_4HO)_2 + 2Mg\,Cl_2 .$$

$$2Mg\,Cl_2 + 2Na_2\,HAsO_4 + 2NH_4HO = (2Na\,Cl)_2 + \underline{2Mg\,NH_4\,AsO_4} + H_2O .$$

$$2Mg\,SO_4 + (KHO)_2 = K_2SO_4 + \underline{2Mg\,H_2\,O_2} .$$

$$(2Mg\,SO_4)_2 + (2NH_4HO)_2 = (NH_4)_2SO_4 . 2Mg\,SO_4 + \underline{2Mg\,H_2\,O_2}$$

$$(2Mg\,SO_4)_4 + (2Na_2CO_3)_4 + (H_2O) = (2Na_2\,SO_4)_4 + (\underline{2Mg\,CrO_3})_3\,\underline{2Mg\,H_2\,O_2} + CrO_2\,(?)$$

$$2Mg\,SO_4 + 2Na_2\,HPO_4 = 2Na_2SO_4 + \underline{2Mg\,HPO_4} .$$

Solution 5 (continued)
(H_2SO_4)

Sol + $BaCl_2$ + $CaCl_2$ = Pr (w)

Pr + HCl + Heat = 0

Hence acid = H_2SO_4

Confirmation.

Pr + H_2SO_4 + Heat = 0

Sol + $Pb(C_2H_3O_2)_2$ = Pr (w)

Solution 6 $\left\{\begin{matrix} BaCl_2 \\ CaCl_2 \\ SrCl_2 \\ MgCl_2 \end{matrix}\right\}$

Sol + HCl = 0

Sol + HCl + H_2S = 0

Sol + NH_4HO + $(NH_4)_2S$ = 0

Sol + NH_4HO + NH_4Cl + $(NH_4)_2CO_3$ = Pr (w)

Filtrate.

Sol + evaporation = Solid Residue

Residue + ignition. = 0

Solution + NH_4HO = Pr (w)

Pr 1^{st}_{II} + NH_4Cl = Sol 2^{nd}_{II}

Sol 2^{nd}_{II} + Na_2HPO_4 = Pr (w)

Hence base = Mg.

Confirmation

Sol + KHO = Pr (w)

$(MgSO_4)_2 + BaCl_2 + CaCl_2 = (MgCl_2)_2 + \underline{BaSO_4} + \underline{CaSO_4}$

$MgSO_4 + Pb(C_2H_3O_2)_2 = Mg(C_2H_3O_2) + \underline{PbSO_4}$

$MgCO_3 \cdot (NH_4)_2CO_3$

$\left.\begin{matrix} BaCl_2 \\ SrCl_2 \\ CaCl_2 \\ (MgCl_2) \end{matrix}\right\} + NH_4HO + NH_4Cl + (NH_4)_2CO_3 = NH_4HO + (NH_4Cl)_2 + \left\{\begin{matrix} \underline{BaCO_3} \\ \underline{SrCO_3} + \\ \underline{CaCO_3} \end{matrix}\right.$

$(MgCl_2)_2 + (NH_4HO)_2 = MgCl_2 \cdot (NH_4Cl)_2 + \underline{MgH_2O_2}$ (?)

$MgH_2O_2 + (NH_4Cl)_2 = (NH_4HO)_2 + MgCl_2$

$MgCl_2 + Na_2HPO_4 = (NaCl)_2 + MgHPO_4$

$MgCl_2 + (KHO)_2 = (KCl)_2 + MgH_2O_2$

Solution 6 (continued)

Precipitate.

$Pr + wash + HCl_2H_3O_2 = Sol\ 1^{st}_{II}$

$Sol\ 1^{st}_{II} + K_2Cr_2O_7 = Pr\ 2^{nd}_{II}$

Precipitate

$Pr\ 2^{nd}_{II} + wash + HCl = Sol\ 2^{nd}_{II}$

$Sol\ 2^{nd}_{II} + H_2SO_4 = Pr(w)$

Proof.

$Pr + H_2SO_4 + Heat = 0$

$Sol + (NH_4)_2CrO_4 = Pr(w)$

Filtrate

$Sol + NH_4HO + (NH_4)_2CO_3 = Pr(w)$

$Pr + wash + HCl = Sol\ 2^{nd}$

$Sol\ 2^{nd}_{II} + evaporation + water = Sol\ 3^{rd}_{II}$

1^{st}_{II} Portion

1^{st}_{II} Portion

$Sol\ 3^{rd}_{II} + CaSO_4 = Pr(w)$

Hence, Base = Sr.

Proof.

$Sol + K_2CrO_3 = Pr(w)$

2^{nd}_{II} Portion

$Sol + K_2SO_4 = Pr(w)$

$Filtrate + NH_4NO + (NH_4)_2C_2O_4 = Pr(w)$

Hence base = Ca

Proof.

$Sol + Na_2HAsO_3 = Pr(w)$

$$\left.\begin{matrix}BaCl_2\\SrCl_2\\CaCl_2\end{matrix}\right\} + (HC_2H_3O_2)_6 = (HCl)6 + \left\{\begin{matrix}Ba(C_2H_3O_2)_2\\Sr(C_2H_3O_2)_2\\Ca(C_2H_3O_2)_2\end{matrix}\right.$$

$$\left.\begin{matrix}Ba(C_2H_3O_2)_2\\Sr(C_2H_3O_2)_2\\Ca(C_2H_3O_2)_2\end{matrix}\right\} + K_2Cr_2O_7 = (KC_2H_3O_2)_2 + \underline{BaCrO_4} + CrCl_3 + \left\{\begin{matrix}Sr(C_2H_3O_2)_2\\Ca(C_2H_3O_2)_2\end{matrix}\right.$$

$$BaCrO_4 + (HCl)_2 = H_2CrO_4 + BaCl_2$$

$$BaCl_2 + H_2SO_4 = (HCl)_2 + \underline{BaSO_4}$$

$$BaCl_2 + (NH_4)_2C_2O_4 = (NH_4Cl)_2 + \underline{BaC_2O_4}$$

$$\left.\begin{matrix}Sr(C_2H_3O_2)_2\\Ca(C_2H_3O_2)_2\end{matrix}\right\} + NH_4NO + [(NH_4)_2CO_3]_2 = NH_4NO + NH_4C_2H_3O_2)_4 + \left\{\begin{matrix}\underline{SrCO_3}\\CaCO_3\end{matrix}\right.$$

$$\left.\begin{matrix}SrCO_3\\CaCO_3\end{matrix}\right\} + (HCl)_4 = (H_2CO_3)_2 + \left\{\begin{matrix}SrCl_2\\CaCl_2\end{matrix}\right.$$

$$\left.\begin{matrix}SrCl_2\\CaCl_2\end{matrix}\right\} + CaSO_4 = (CaCl_2)_2 + \underline{SrSO_4}$$

$$SrCl_2 + K_2CrO_3 = (KCl)_2 + SrCrO_3$$

$$\left.\begin{matrix}SrCl_2\\CaCl_2\end{matrix}\right\} + (K_2SO_4)_2 = (KCl)_4 + \left\{\begin{matrix}\underline{SrSO_4}\\CaSO_4\end{matrix}\right.$$

$$CaSO_4 + NH_4NO + (NH_4)_2C_2O_4 = NH_4NO + (NH_4)_2SO_4 + \underline{CaC_2O_4}.$$

$$CaCl_2 + Na_2HAsO_3 = (NaCl)_2 + CaHAsO_3.$$

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Solution 7 ($Fe(NO_3)_2$)

Reaction

Acid.

Sol + Hcl = 0

Sol + Hcl + H_2S = 0

Sol + NH_4Cl + $(NH_4)_2S$ = Pr (black)

Pr 1st + H cl (hot) = Sol 2nd

Sol 2nd + KHO + heat = Pr 2nd (w)

Pr 2nd + w-ash + H cl = Sol 3rd

Sol + concentration + K4 Fefy = Pr (blue)

Hence base = Fe

Proofs

Sol + KHO = Pr.

Sol + $(NH_4)_2CO_3$ = Pr (brown)

Sol + $(NH_4)_2S$ = Pr (black)

Acid. (HNO_3)

Sol + evaporation = Solid residue

Solid residue + H_2SO_4 + Cu + heat = red brown fumes

Sol + H_2SO_4 + $FeSO_4$ = Sol 2nd (brown)

Sol 2nd + heat = red fumes.

Hence Acid = HNO_3

$Fe(NO_3)_2 + NH_4Cl + (NH_4)_2S = NH_4Cl + (NH_4NO_3)_2 + \underline{FeS}$.

$FeS + (HCl)_2 = H_2S + FeCl_2$

$FeCl_2 + (KHO)_2 = \underline{FeH_2O_2} + (KCl)_2$

$FeH_2O_2 + (HCl)_2 = (H_2O)_2 + FeCl_2$

$FeCl_2 + K_4Cl_6 = (KCl) + K_2FeCl_3$.

$Fe(NO_3)_2 + (KHO)_2 = (KNO_3)_2 + \underline{FeH_2O_2}$

$Fe(NO_3)_2 + (NH_4)_2CO_3 = (NH_4NO_3)_2 + \underline{FeCO_3}$

$Fe(NO_3)_2 + (NH_4)_2S = (NH_4NO_3)_2 + \underline{FeS}$

$Fe(NO_3)_2 + (H_2SO_4)_4 + Cu_3 = FeSO_4 + \underline{(CuSO_4)_3} + (H_2O)_4 + (NO)_2$

$(NO)_2 + O = N_2O_3$

$(NO)_2 + O_2 = N_2O_4$

$Fe(NO_3)_2 + (H_2SO_4)_5 + (FeSO_4)_{10} = (Fe_2(SO_4)_3)_{11} + (H_2O)_4 + [(FeSO_4)_2NO]_2 + H_2$

$((FeSO_4)_2NO)_2 + O = (FeSO_4)_4 + N_2O_3$

Solution 8.

$Fe_2Cl_6 + BaCl_2 + MgCl_2$

Sol + HCl = 0

Sol + HCl + H_2S = 0

Sol + NH_4Cl + $(NH_4)_2S$ = Pr (black)

Filtrate.

Filtrate + NH_4Cl + NH_4HO + $(NH_4)_2CO_3$ = Pr (w)

Precipitate —

Pr + wash + $HC_2H_3O_2$ = Sol

Sol + $K_2Cr_2O_7$ = Pr (yellow)

Pr 1st + HCl = Sol 2nd

Sol 2nd + H_2SO_4 = Pr 2nd (w)

Hence base = Ba

Proof

Sol + $(NH_4)_2CO_3$ = Pr (w)

Filtrate —

Sol + evaporation on pt. foil = solid residue

Solid residue + ignition = 0

Sol + NH_4HO + $(NH_4)_2S$ = Pr (w)

Pr + NH_4Cl = Sol 2nd

Sol + Na_2HPO_4 = Pr (w)

Hence base = Mg

Proof

Sol + KHO = Pr (w)

$$\left.\begin{matrix} Fe_2Cl_6 \\ BaCl_2 \\ MgCl_2 \end{matrix}\right\} + NH_4Cl + (NH_4)_2S = (NH_4Cl)_3 + S + \left\{\begin{matrix} BaCl_2 \\ MgCl_2 \end{matrix}\right\} + (FeS)_2$$

$$\left.\begin{matrix} BaCl_2 \\ MgCl_2 \end{matrix}\right\} + NH_4HO + NH_4Cl + (NH_4)_2CO_3 = NH_4HO + (NH_4Cl)_3 + MgCl_2 + \underline{BaCO_3}$$

$$BaCO_3 + (HC_2H_3O_2)_2 = H_2O + CO_2 + Ba(C_2H_3O_2)_2$$

$$Ba(C_2H_3O_2)_2 + K_2Cr_2O_7 = (KC_2H_3O_2)_2 + C_4O_3 + \underline{BaCrO_4}$$

$$BaCrO_4 + (HCl)_2 = H_2O + CrO_3 + BaCl_2$$

$$BaCl_2 + H_2SO_4 = (HCl)_2 + \underline{BaSO_4}$$

$$BaCl_2 + (NH_4)_2CO_3 = (NH_4Cl)_2 + \underline{BaCO_3}$$

$$(MgCl_2)_2 + (NH_4HO)_2 = MgCl_2(NH_4Cl)_2 + \underline{MgH_2O_2}$$

$$MgH_2O_2 + (NH_4Cl)_2 = (NH_4HO)_2 + MgCl_2$$

$$MgCl_2 + Na_2HPO_4 = (NaCl)_2 + \underline{MgHPO_4}$$

$$MgCl_2 + (KHO)_2 = (KCl)_2 + \underline{MgH_2O_2}$$

Solution 8 (continued)

Precipitate

Pr + wash + HCl (hot) = Sol

Sol + concentration + KHO (in excess) = Pr

Pr + Wash + HCl (hot) = Sol 2nd

Sol 2nd + K4 Fefy = Pr (blue)

Hence base = Fe

Proof

Sol + KHO = Pr(w)

Sol + $(NH_4)_2CO_3$ = Pr (brown)

Sol + $(NH_4)_2S$ = Pr (black)

Solution 9 ($ZnSO_4$)

Reaction Acid – Sol + HCl = 0

Sol + HCl + H_2S = 0

Sol + NH_4Cl + $(NH_4)_2S$ = Pr (w)

Pr + wash + HCl (hot) = Sol 2nd

Sol 2nd + KHO = Pr (w) 2nd

Pr 2nd + KHO = Sol 3rd

Sol 3rd + $(NH_4)_2S$ = Pr (w)

Hence base = Zn

Proof – Sol + KHO = Pr(w)

Sol + K_2CO_3 = Pr(w)

Acid (H_2SO_4)

Sol + $BaCl_2$ + $CaCl_2$ = Pr (w)

Pr + HCl + heat = 0

Hence Acid = H_2SO_4

$FeS + (HCl)_2 = FeCl_2 + H_2S$.

$FeCl_2 + (KHO)_2 = (KCl)_2 + \underline{FeH_2O_2}$

$FeH_2O_2 + (HCl)_2 = (H_2O)_2 + FeCl_2$

$FeCl_2 + K_4Cfy = (KCl)_2 + \underline{K_2FeCfy}$.

$Fe_2Cl_6 + (KHO)_6 = (KCl)_6 + \underline{Fe_2H_6O_6}$

$Fe_2Cl_6 + ((NH_4)_2CO_3)_3 \xrightarrow{+(H_2O)_3} (NH_4Cl)_6 + \underline{Fe_2H_6O_6} + (CO_2)_3$

$Fe_2Cl_6 + ((NH_4)_2S)_3 = (NH_4Cl)_6 + S + \underline{(FeS)_2}$

$ZnSO_4 + NH_4Cl + (NH_4)_2S = NH_4Cl + (NH_4)_2SO_4 + \underline{ZnS}$

$ZnS + (HCl)_2 = H_2S + ZnCl_2$

$ZnCl_2 + (KHO)_2 = (KCl)_2 + \underline{ZnH_2O_2}$

$ZnH_2O_2 + (KHO)_2 = (H_2O)_2 + K_2O.ZnO$

$K_2O.ZnO + (NH_4)_2S + (H_2O)_2 = (KHO)_2 + (NH_4HO)_2 + \underline{ZnS}$

$ZnSO_4 + (KHO)_2 = K_2SO_4 + \underline{ZnH_2O_2}$

$(ZnSO_4)_5 + (K_2CO_3)_5 + (H_2O)_3 = (K_2SO_4)_5 + (CO_2)_3 + \underline{(ZnCO_3)_2(K_2ZnO_2)_3}$

$(ZnSO_4)_2 + BaCl_2 + CaCl_2 = (ZnCl_2)_2 + \underline{BaSO_4} + \underline{CaSO_4}$

Solution 10

(K_2SO_4)

Sol + HCl = 0

Sol + HCl + H_2S = 0

Sol + NH_4Cl + $(NH_4)_2S$ = 0

Sol + NH_4HO + $(NH_4)Cl$ + $(NH_4)_2CO_3$ = 0

Sol + evaporation = Solid residue

Solid residue + ignition = 0

Solid residue in non-luminous flame = violet flame
which is not obscured by blue cobalt glass.

Hence base = K

Solution 11 ($Cr_2(SO_4)_3 + K_2SO_4$)

Sol + HCl = 0

Sol + HCl + H_2S = 0

Sol + NH_4Cl + $(NH_4)_2S$ = Pr (green)

Precipitate –

Pr + wash + HCl (hot) = Sol

Sol + HKO (excess) = Pr (green)

Pr + wash + fusion with KNO_3 and Na_2CO_3 + water + filter = Sol 2 nd gp

Sol + $Pb(C_2H_3O_2)_2$ = Pr (yellow)

Sol + $AgNO_3$ = Pr (deep red)

Hence base = C_2

Filtrate – Sol + NH_4HO + NH_4Cl + $(NH_4)_2CO_3$ = 0

Sol + evaporation on pt foil = solid residue

Solid residue + ignition = 0

Solid residue in non luminous flame = violet flame
not obscured by blue cobalt glass

Hence base = K.

Acid tested as before

$$\left.\begin{matrix} Cr_2(SO_4)_3 \\ K_2SO_4 \end{matrix}\right\} + NH_4Cl + ((NH_4)_2S)_3 + (H_2O)_6 = NH_4Cl + K_2SO_4 + ((NH_4)_2SO_4)_3 + (H_2S)_3 + \underline{Cr_2H_6O_6}$$

$$Cr_2H_6O_6 + (HCl)_6 = (H_2O)_6 + Cr_2Cl_6$$

$$Cr_2Cl_6 + (KHO)_6 = (KCl)_6 + \underline{Cr_2H_6O_6}$$

$$Cr_2H_6O_6 + (KNO_3)_2 + Na_2BiO_3 = K_2CrO_4 + Na_2BiO_4 + (NO_2 + BiO_2 + (H_2O)_3$$

$$\left.\begin{matrix} K_2C_2Br_4 \\ Na_2C_2O_4 \end{matrix}\right\} + (Pb(C_2H_3O_2)_2)_2 = (KC_2H_3O_2)_2 + Na(C_2H_3O_2)_2 + \underline{(PbC_2O_4)_2}$$

$$\left.\begin{matrix} K_2C_2O_4 \\ Na_2C_2O_4 \end{matrix}\right\} + (AgNO_3)_4 = (KNO_3)_2 + (NaNO_3)_2 + \underline{(Ag_2C_2O_4)_2}$$

Solution 12.

($K_2 Cr_2 O_7$)

Reaction Acid.

Sol + HCl = 0

Sol + HCl + H_2S = Pr (yellow) Filtrate green.

Filtrate + NH_4Cl + $(NH_4)_2S$ = Pr (green) 2nd II

Filtrate

Filtrate + NH_4HO + NH_4Cl + $(NH_4)_2CO_3$ = 0

Sol + evaporation on Pt foil = Solid residue.

Solid residue + ignition = 0

Sol + evaporation = Solid residue

Solid residue in non-luminous flame on Pt wire =

violet flame not observed by cobalt glass.

Hence base = K

Acid. (CrO_3)

Pr 2nd II + wash + HCl (hot) = Sol

Sol + evaporation + KHO (in excess) + heat = Pr 3rd (green)

Pr 3rd II + fusion with KNO_3 and Na_2CO_3 + water + filter = Sol 2nd II

Sol 2nd II + $Pb(C_2H_3O_2)_2$ = Pr (yellow)

Sol 2nd II + $AgNO_3$ = Pr (deep red)

Hence Acid = CrO_3

$$K_2Cr_2O_7 + (HCl)_8 + (H_2S)_3 = Cr_2Cl_6 + (KCl)_2 + (H_2O)_7$$

$$KCl + Cr_2Cl_6 + NH_4Cl + ((NH_4)_2S)_3 + (H_2O)_6 = \underline{Cr_2H_6O_6} + (NH_4Cl)_7 + (H_2S)_3 + KCl$$

$$Cr_2H_6O_6 + (HCl)_6 = Cr_2Cl_6 + (H_2O)_6$$

$$Cr_2Cl_6 + (KHO)_6 = (KCl)_6 + Cr_2H_6O_6$$

$$Cr_2H_6O_6 + (KNO_3)_2 + Na_2CO_3 = K_2Cr_2O_4 + Na_2CrO_4 + (NO)_2 + CO_2 + (H_2O)_3$$

$$\left.\begin{matrix} K_2CrO_4 \\ Na_2CrO_4 \end{matrix}\right\} + (Pb(C_2H_3O_2)_2 = (KC_2H_3O_2)_2 + (NaC_2H_3O_2)_2 + (PbCrO_4)_2$$

$$\left.\begin{matrix} K_2CrO_4 \\ Na_2CrO_4 \end{matrix}\right\} + (AgNO_3)_4 = (KNO_3)_2 + (NaNO_3)_2 + (Ag_2CrO_4)_2$$

Solution 14.

$Al_2(SO_4)_3$

Sol + HCl = 0

Sol + HCl + H_2S = 0

Sol + NH_4Cl + $(NH_4)_2S$ = Pr (W)

Pr + wash + HCl (hot) = Sol 2nd

Sol 2nd + KHO = 0 (Reaction)

Sol 2nd + HCl = 0 (Reaction

Sol 2nd + ~~HCl~~ + NH_4HO = Pr (W)

Hence base = Al

Acid (H_2SO_4)

Sol + heat + $BaCl_2$ + $CaCl_2$ = Pr (W)

Pr + HCl + heat = 0

Hence acid = H_2SO_4

Solution 15

$FeSO_4$

Sol + HCl = Pr (yellow) sulphur

Filtrate + HCl + H_2S = 0

Sol + NH_4Cl + $(NH_4)_2S$ = Pr (B)

Pr 1st + wash + HCl (hot) = Sol 2nd

Sol 2nd + KHO + heat = Pr (black, blue)

Pr + wash + HCl = Sol 3rd

Sol 3rd + K_4 Fefy = Pr (blue)

Hence base = Fe

Acid as before.

$Al_2(SO_4)_3 + NH_4Cl + ((NH_4)_2S)_3 + (H_2O)_6 = Al_2H_6O_6 + NH_4Cl + ((NH_4)_2SO_4)_3 + (H_2S)_3$

$Al_2H_6O_6 + (HCl)_6 = Al_2Cl_6 + (H_2O)_6$

$Al_2Cl_6 + (KHO)_{12} = (KCl)_6 + (K_2O)_3 . Al_2O_3 + (H_2O)_6$

$(K_2O)_3 . Al_2O_3 + (HCl)_{12} = (KCl)_6 + Al_2Cl_6 + (H_2O)_6$

$Al_2Cl_6 + (NH_4HO)_6 = (NH_4Cl)_6 + \underline{Al_2H_6O_6}$

$Al_2(SO_4)_3 + (BaCl_2)_2 + CaCl_2 = Al_2Cl_6 + \underline{(BaSO_4)_2} + \underline{CaSO_4}$

$FeSO_4 + NH_4Cl + (NH_4)_2S = NH_4Cl + (NH_4)_2SO_4 + \underline{FeS}$

$FeS + (HCl)_2 = H_2S + FeCl_2$

$FeCl_2 + (KHO)_2 = (KCl)_2 + \underline{Fe H_2O_2}$

$FeH_2O_2 + (HCl)_2 = (H_2O)_2 + FeCl_2$

$FeCl_2 + K_4Cfy = (KCl)_2 + \underline{K_2FeCfy}$

Solution 16 $\begin{cases} Al_2(SO_4)_3 \\ Fe_2(SO_4)_3 \end{cases}$

Sol + HCl = 0

Sol + HCl + H_2S = 0

Sol + NH_4Cl + $(NH_4)_2S$ = Pr (black)

Pr + wash + HCl (hot) = Sol 2nd

Sol 2nd + KHO + heat = Pr (brown)

Filtrate Sol + HCl = 0 (Reaction)

Sol + ~~HCl~~ + NH_4HO = Pr (w)

Hence base = Al

Precipitate

Pr + wash + HCl = Sol

Sol + K_4Cfy = Pr (blue)

Hence base = Fe

Proofs – Sol + KHO = Pr (green)

Sol + K_2CO_3 = Pr (white to green)

Solution 17.

$MnSO_4$

Sol + HCl = 0

Sol + HCl + H_2S = 0

Sol + NH_4Cl + $(NH_4)_2S$ = P_2 (w)

P_2 ppt + wash + HCl = Sol 2nd

Sol 2nd + KHO = Pr (brown)

Pr + wash + fusion with KNO_3 & Na_2CO_3 = bright green mass

Hence base = Mn

Acid as previously described

$$\left.\begin{matrix}Al_2(SO_4)_3\\Fe_2(SO_4)_3\end{matrix}\right\} + NH_4Cl + (NH_4)_2S + (H_2O)_6 = \underline{Al_2H_6O_6} + FeS + NH_4Cl + (NH_4)_2SO_4 + (H_2S)_3 + S$$

$$\left.\begin{matrix}Al_2H_6O_6\\FeS\end{matrix}\right\} + (HCl)_8 = AlCl_6 + FeCl_2 + (H_2O)_6 + H_2S$$

$$\left.\begin{matrix}Al_2Cl_6\\FeCl_2\end{matrix}\right\} + (KHO)_{24} = (K_2O)_3 \cdot Al_2O_3 + \underline{FeH_2O_2} + (KCl)_8 + (H_2O)_6$$

$$(K_2O)_3 \cdot Al_2O_3 + (HCl)_{12} = (KCl)_6 + Al_2Cl_6 + (H_2O)_6$$

$$Al_2Cl_6 + HCl + (NH_4HO)_6 = HCl + (NH_4Cl)_6 + \underline{Al_2H_6O_6}$$

$$FeH_2O_2 + (HCl)_2 = FeCl_2 + (H_2O)_2$$

$$FeCl_2 + K_4Cfy = (KCl)_2 + \underline{K_2FeCfy}$$

$$Fe_2Cl_6 + (KHO)_6 = Fe_2H_6O_6 + (KCl)_6$$

$$Fe_2Cl_6 + (K_2CO_3)_3 + (H_2O)_3 = (HCl)_6 + (CO_2)_3 + \underline{Fe_2H_6O_6}$$

$$MnSO_4 + NH_4Cl + (NH_4)_2S = NH_4Cl + (NH_4)_2SO_4 + \underline{MnS}$$

$$MnS + (HCl)_2 = H_2S + MnCl_2$$

$$MnCl_2 + (KHO)_2 = (KCl)_2 + \underline{MnH_2O_2}$$

$$(MnH_2O_2)_3 + (KNO_3)_4 + Na_2CO_3 = (K_2MnO_4)_2 + Na_2MnO_4 + (NO)_4 + CO_2 + (H_2O)_3$$

Solution 18

{Fe_2Cl_6}
{$MnSO_4$}

Sol + HCl = 0

Sol + HCl + H_2S = 0

Sol + NH_4Cl + $(NH_4)_2S$ = Pt (black)

Pt + wash + HCl (hot) = Sol 2nd

Sol 2nd + KHO = Pt (black)

1st Portion — Pt + wash + HCl = Sol

Sol + K_4CFy = Pt (blue)

Hence base = Fe

2nd Portion — Pt + wash + fusion with KNO_3 and Na_2CO_3 = green mass

Hence base = Mn.

Proof — Sol + KHO = Pt (w)

Acids as before described.

Solution 19

{$Fe_2(NO_3)_6$
$Sr(NO_3)_2$
KNO_3}

Sol + HCl = 0

Sol + HCl + H_2S = 0

Sol + NH_4Cl + $(NH_4)_2S$ = Pt (black

Precipitate.

Pt + wash + HCl (hot) = Sol

Sol + KHO + heat = Pt (brown)

Pt 2nd + wash + HCl = Sol 2nd

Sol 2nd + K_4CFy = Pt (blue)

Filtrate

Sol + NH_4HO + NH_4Cl + $(NH_4)_2CO_3$ = Pt (w)

Precipitate 2nd

Pt + wash + $HC_2H_3O_2$ = Sol

Sol + $K_2Cr_2O_7$ = 0

$\left.\begin{matrix} Fe_2Cl_6 \\ MnSO_4 \end{matrix}\right\} + NH_4Cl + ((NH_4)_2S)_4 = (FeS)_2 + MnS + (NH_4Cl)_6 + NH_4SO_4 + S$

$FeS + MnS + (HCl)_4 = FeCl_2 + MnCl_2 + (H_2S)_2$

$FeCl_2 + MnCl_2 + (KHO)_4 = (KCl)_4 + \underline{FeH_2O_2} + \underline{MnH_2O_2}$

$FeH_2O_2 + MnH_2O_2 + (HCl)_4 = FeCl_2 + MnCl_2 + (H_2O)_4$

$FeCl_2 + MnCl_2 + K_4Cfy = (KCl)_2 + MnCl_2 + \underline{K_2FeCfy}$

$(MnH_2O_2)_3 + (KNO_3)_4 + Na_2CO_3 =$

$(K_2MnO_4)_2 + Na_2MnO_4 + (NO)_4 + CO_2 + (H_2O)_3$

$\left.\begin{matrix} MnSO_4 \\ Fe_2Cl_6 \end{matrix}\right\} + (KHO)_2 = K_2SO_4 + Fe_2Cl_6 + \underline{MnH_2O_2}$

$\left.\begin{matrix} Fe_2(NO_3)_6 \\ Sr(NO_3)_2 \\ KNO_3 \end{matrix}\right\} + NH_4Cl + ((NH_4)_2S)_3 = \left\{\begin{matrix} Sr(NO_3)_2 \\ KNO_3 \end{matrix}\right\} + NH_4Cl + (NH_4NO_3)_6 + S_4(FeS)_2$

$FeS + (HCl)_2 = H_2S + FeCl_2$

$FeCl_2 + (KHO)_2 = (KCl)_2 + \underline{FeH_2O_2}$

$FeH_2O_2 + (HCl)_2 = (H_2O)_2 + FeCl_2$

$FeCl_2 + K_4Cfy = (KCl)_2 + \underline{K_2FeCfy}.$

$\left.\begin{matrix} Sr(NO_3)_2 \\ KNO_3 \end{matrix}\right\} + NH_4HO + NH_4Cl + (NH_4)_2CO_3 =$

$NH_4HO + NH_4Cl + (NH_4NO_3)_2 + KNO_3 + \underline{SrCO_3}$

$SrCO_3 + (HC_2H_3O_2)_2 = H_2O + CO_2 + Sr(C_2H_3O_2)_2$

Solution 19. (continued)

Sol + NH_4HO + $(NH_4)_2CO_3$ = Pt (w)
Pt + HCl + evaporation + water = Sol 2nd
Sol 2nd + $CaSO_4$ = Pt (w)
Hence Base = ba

Filtrate 2nd

Sol + evaporation = solid residue
solid residue in non-luminous flame gives violet flame not obstructed by blue glass
Hence base = k

Solution 20. (Hg_2Cl)

Sol + HCl = 0
Sol + HCl + H_2S = Pt (black)
Pt + wash + $(NH_4)_2S$ = 0
Pt + wash + HCl + HNO_3 = Sol 2nd
Sol + $SnCl_2$ = Pt (gray)
Hence base = Hg_2Cl

Proof

Sol + KHO = Pt (orange)
Sol + NH_4HO = Pt (w)
Sol + KHO = Pt (brown)

$Sr((C_2H_3O_2)_2 + NH_4HO - (NH_4)_2CO_3 = NH_4HO + (NH_4C_2H_3O_2)_2 + \underline{SrCO_3}$

$SrCO_3 + (HCl)_2 = H_2O + CO_2 + SrCl_2$

$SrCl_2 + CaSO_4 = CaCl_2 + \underline{SrSO_4}$

$(HgCl)_2 + HCl + H_2S = (HCl)_3 + HgS + Hg$

$HgS + ((HCl)_3 + HNO_3)_2 = (NOCl_2)_2 + HgCl_2 + (H_2O)_4 + S$

$(HgCl_2)_2 + SnCl_2 = \underline{(HgCl)_2} + SnCl_4$

$(HgCl)_2 + SnCl_2 = SnCl_4 + \underline{Hg_2}$

Solution 21.
($CuSO_4$)

Sol + HCl = 0
Sol + HCl + H_2S = Pr (brown)
Pr + wash + $(NH_4)_2S$ + heat = 0
Pr + wash + HNO_3 = Sol 2nd
Sol 2nd + H_2SO_4 = 0
Sol 2nd + HCl = 0
Sol 2nd + NH_4HO = Sol 3rd (blue)
Hence base = Cu

Proof –

Sol + KHO = Pr (blue)
Sol + K_2CO_3 = Pr (blue)
Sol + $(NH_4)_2S$ = Pr (black)
Sol + Na_2HPO_4 = Pr (bluish white)
Sol + K_4Cfy = Pr (brown)

Solution 22. ($Bi(NO_3)_3$)

Sol + HCl = 0
Sol + HCl + H_2S = Pr (brown)
Pr + wash + $(NH_4)_2S$ = 0
Pr + wash + HNO_3 (hot) = Sol 2nd
Sol 2nd + H_2SO_4 = 0
Sol 2nd + HCl = 0
Sol 2nd + NH_4HO = Pr (w)
Hence base = Bi.

Proof

Sol + KHO = Pr (w)
Sol + $(NH_4)_2CO_3$ = Pr (w)
Sol + $K_2Cr_2O_7$ = Pr (yellow)

$CuSO_4 + HCl + H_2S = HCl + H_2SO_4 + \underline{CuS}$

$(CuS)_3(HNO_3)_8 = (Cu(NO_3)_2)_3 + S_3 + (H_2O)_4 + (NO)_2$

$Cu(NO_3)_2 + (NH_4HO)_4 = Cu(NO_3)_2 \cdot (NH_3)_4 + (H_2O)_4$

$CuSO_4 + (KHO)_2 = K_2SO_4 + \underline{CuH_2O_2}$

$(CuSO_4)_2 + (K_2CO_3)_2 + H_2O = (K_2SO_4)_2 + CuH_2O_2 \cdot CuCO_3$

$CuSO_4 + (NH_4)_2S = (NH_4)_2SO_4 + \underline{CuS}$

$CuSO_4 + Na_2HPO_4 = Na_2SO_4 + \underline{CuHPO_4}$

$(CuSO_4)_2 + K_4Cfy = (K_2SO_4)_2 + \underline{Cu_2Cfy}.$

$(Bi(NO_3)_3)_2 + HCl + (H_2S)_3 = HCl + (HNO_3)_6 + \underline{Bi_2S_3}$

$Bi_2S_3 + (HNO_3)_6 = (H_2S)_3 + (Bi(NO_3)_3)_2$

$Bi(NO_3)_3 + (NH_4HO)_3 = NH_4NO_3 + \underline{BiH_3O_3}$

$Bi(NO_3)_3 + (KHO)_3 = (KNO_3)_3 + \underline{BiH_3O_3}$

$(Bi(NO_3)_3)_2 + ((NH_4)_2CO_3)_3 = (NH_4NO_3)_6 + \underline{(BiO)_2CO_3} + (CO_2)_2$

$(Bi(NO_3)_3)_2 + (K_2Cr_2O_7)_3 + (H_2O)_4 = (KNO_3)_6 + (H_2C_2O_4)_4 + \underline{Bi_2O(CrO_4)_2}$

Solution 23
$\{Cu(NO_3)_2\}$
$\{Bi(NO_3)_3\}$

Sol + HCl = 0
Sol + HCl + H_2S = Pr (brown)
Pr + wash + NH_4HS = 0
Pr + HNO$_3$ (hot) = Sol 2nd
Sol 2nd + H_2SO_4 = 0
Sol 2nd + HCl = 0
Sol 2nd + NH_4HO = Pr (w) with blue filtrate

Hence Pr base = Bi
" base of filtrate = Cu

Solution 25
($SnCl_2$)

Sol + HCl = 0
Sol + HCl + H_2S = Pr (yellow)
Pr + $(NH_4)_2S$ = Sol 2nd
Sol 2nd + HCl = Pr (brown) 2nd
Pr 2nd $(NH_4)_2CO_3$ = 0
Pr 2nd + HCl (hot) = Sol 3rd
Sol 3rd + $HgCl_2$ = Pr (white to gray)

Hence base = Sn

Proof

Sol + H_2S = Pr (yellow)

$$\left.\begin{matrix} Cu(NO_3)_2 \\ (Bi(NO_3)_3)_2 \end{matrix}\right\} + HCl + (H_2S)_4 = HCl + (HNO_3)_8 + \underline{\left.\begin{matrix} CuS \\ Bi_2S_3 \end{matrix}\right\}}$$

$$\left.\begin{matrix} CuS \\ Bi_2S_3 \end{matrix}\right\} + (HNO_3)_8 = (H_2S)_4 + \left\{\begin{matrix} Cu(NO_3)_2 \\ (Bi(NO_3)_3)_2 \end{matrix}\right.$$

$$\left.\begin{matrix} Cu(NO_3)_2 \\ Bi(NO_3)_3 \end{matrix}\right\} + (NH_4HO)_7 = Cu(NO_3)_2 \cdot (NH_3)_4 + (NH_4NO_3)_3 + (H_2O)_4 + \underline{BiH_3O_3}$$

$$SnCl_2 + HCl + (H_2S) = (HCl)_3 + \cancel{X} + \underline{SnS}$$

$$SnS + ((NH_4)_2S)_2 = (NH_4)_2SnS_3 + (NH_3)_2 + H_2 \quad (?)$$

$$(NH_4)_2SnS_3 + (HCl)_2 = (NH_4Cl)_2 + H_2S + \underline{SnS_2}$$

$$SnS_2 + (HCl)_4 = (H_2S)_2 + SnCl_4 \quad | \quad SnCl_4 + Zn_2 + (HCl)_2 = SnCl_2 + \overset{H_2}{Zn(Cl)_2}$$

$$SnCl_2 + HgCl_2 = SnCl_4 + \underline{Hg}$$

Solution 32.

$(Pb(NO_3)_2)$

$Sol + HCl = Pr(w)$

$Pr + wash + hot\ water = Sol\ 2^{nd}$

$Sol\ 2^{nd} + H_2SO_4 = Pr(w)$

Hence base = **Pb**

Proof

$Sol + H_2S = Pr(black)$

$Sol + KHO = Pr(black)$

$Sol + KI = Pr(yellow)$

Acid

~~Sol + H~~ (HNO_3)

Test previously described

Solution

$(NaHS)$

$Sol + HCl = 0$

$Sol + HCl + H_2S = 0$

$Sol + NH_4Cl + (NH_4)_2S = 0$

$Sol + NH_4HO + NH_4Cl + (NH_4)_2CO_3 = 0$

Sol + evaporation = solid residue

Solid residue + ignition = 0

Solid residue in non-luminous flame = yellow flame

observed by blue glass.

Acid

Solid residue + H_2SO_4 = gas with odor, reddens litmus paper,

and turns $Pb(C_2H_3O_2)_2$ paper black.

Hence acid = H_2S.

$Pb(NO_3)_2 + (HCl)_2 = (HNO_3)_2 + \underline{PbCl_2}$

$PbCl_2 + H_2SO_4 = (HCl)_2 + \underline{PbSO_4}$

$Pb(NO_3)_2 + H_2S = (HNO_3)_2 + \underline{PbS}$

$Pb(NO_3)_2 + (KHO)_2 = (KNO_3)_2 + \underline{PbH_2O_2}$

$Pb(NO_3)_2 + (KI)_2 = (KNO_3)_2 + \underline{PbI_2}$

$(NaHS)_2 + H_2SO_4 = Na_2SO_4 + (H_2S)_2$

Solution 34
($AgNO_3$)

Sol + HCl = Pr(w)
Pr + wash + hot water + NH_4HO = Sol 2nd
Sol 2nd + boiling + HNO_3 = Pr(w)
Hence base = Ag.

Proof -
Sol + KHO = Pr(brown)
Sol + K_4Cfy = Pr(yellow white)

Solution 39
($(NH_4)_2SO_4$)

Sol + HCl = 0
Sol + HCl + H_2S = 0
Sol + NH_4Cl + $(NH_4)_2S$ = 0
Sol + NH_4HO + NH_4Cl + $(NH_4)_2CO_3$ = 0
Sol + evaporation = solid residue.
solid residue + ignition = vapor
Sol + KHO + heat = gas changes red litmus paper blue and fumes with HCl
Hence base = NH_4
Proof - Sol + HgCl = Pr(w)

Solution 40
(Na_2CO_3)

Base = Na. tested as before described.

Acid.

Solid residue + H_2SO_4 = rapid effervescence no color or odor reduce litmus

Hence acid = H_2CO_3

$AgNO_3 + HCl = HNO_3 + \underline{AgCl}$

$(AgCl)_2 + (NH_4HO)_3 = (NH_3)_3(AgCl)_2 + (H_2O)_3$

$(NH_3)_3(AgCl)_2 + (HNO_3)_3 = (NH_4NO_3)_3 + (AgCl)_2$

$(AgNO_3)_2 + (KHO)_2 = (KNO_3)_2 + H_2O + \underline{Ag_2O}$

$(AgNO_3)_4 + K_4Cfy = (KNO_3)_4 + \underline{Ag_4Cfy}$

$NH_3 + HCl = NH_4Cl$

$(NH_4)_2SO_4 + HgCl = H_2SO_4 + \underline{NH_2HgCl}$

$Na_2CO_3 + H_2SO_4 = Na_2SO_4 + H_2O + CO_2$

Solution 41

(KI)

Not pr by I, II, III, or IV.

Sol + evaporation = residue, - non volatile

Sol residue in non luminous flame = violet flame.

Hence base = K

Acid

Solid residue + H_2SO_4 = gas with color

sol + $C_6(H_2O)_4$ solution = blue solution.

Hence acid = HI

Solution 42

(KBr)

Base = K test previously described

Solid residue + H_2SO_4 = gas brown - pungent odor

$C_6(H_2O)_5$ + gas = Sol-yellow

Hence acid = HBr

Proof - Sol + $AgNO_3$ = Pr (yellow)

Solution 44

($Na_2C_2O_4$)

Base = Na, tested as before

solid residue + H_2SO_4 = gas colorless, odorless, reduces test papers

Acid = $H_2C_2O_4$

Proof - Sol + $AgNO_3$ = Pr(w)

$(KF)_2 + H_2SO_4 = K_2SO_4 + (HF)_2$

$(KBr)_2 + H_2SO_4 = K_2SO_4 + (HBr)_2$

$KBr + AgNO_3 = KNO_3 + \underline{AgBr}$

$Na_2C_2O_4 + H_2SO_4 = Na_2SO_4 + H_2O + CO_2 + CO$

$Na_2C_2O_4 + (AgNO_3)_2 = (NaNO_3)_2 + \underline{Ag_2C_2O_4}$

Solution 48

($NaC_2H_3O_2$)

Base = Na. tested as before.

Acid

Solid residue + H_2SO_4 = odor of vinegar

solid " + H_2SO_4 + C_2H_6O = odor of acetic ether

Proof — Sol + Fe_2Cl_6 = Pr (red)

Hence acid = $HC_2H_3O_2$

(Na_2HPO_4)

Base tested as before described.

acid

Sol + heat + $BaCl_2$ + $CaCl_2$ = Pr (w)

Pr + HCl + heat = Sol 2nd

Sol 2nd + NH_4HO = Pr (w)

Pr + $HC_2H_3O_2$ = Sol 3rd

Sol + NH_4HO = Pr (w)

~~Pr +~~ Hence acid = H_3PO_4

$(Na\,C_2H_3O_2)_2 + H_2SO_4 = Na_2SO_4 + (H\,C_2H_3O_4)_2$

$H\,C_2H_3O_2 + C_2H_6O = C_2H_5\,C_2H_3O_2 + H_2O$

$(Na_2\,HPO_4)_2 + BaCl_2 + CaCl_2 = (NaCl)_4 + \left\{\begin{matrix}BaHPO_4\\CaHPO_4\end{matrix}\right\}$

$\left\{\begin{matrix}BaHPO_4\\CaHPO_4\end{matrix}\right\} + (HCl)_4 = \left\{\begin{matrix}BaCl_2\\CaCl_2\end{matrix}\right\} + (H_3PO_4)_2$

$\left\{\begin{matrix}BaCl_2\\CaCl_2\end{matrix}\right\} + (H_3PO_4)_2 + (NH_4HO)_4 = \left\{\begin{matrix}BaHPO_4\\CaHPO_4\end{matrix}\right\} + (NH_4Cl)_4 + (H_2O)_4$

$(CaHPO_4)_2 + (HC_2H_3O_2)_2 = Ca(C_2H_3O_2)_2 + CaH_4(PO_4)_2$

$CaH_4(PO_4)_2 + (NH_4HO)_2 = (NH_4)_2HPO_4 + (H_2O)_2 + \underline{CaHPO_4}$