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Chemistry in *Finnegans Wake*

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Joyce recorded a number of chemical names and phrases in notebooks VI.B.41, VI.B.45, and VI.B.47 (abbreviated B.41 etc.) which he seems to have taken from *Science Primers. Chemistry*[1]. Many of these notes were crossed out and used in the final stages of composition, from late August to October 1938. It is clear that there are also some additions to *Finnegans Wake* which derive from *Chemistry*, but which have not been found in these notebooks. They are listed under 'Notebook X' below to indicate they are as yet unlocated or missing.

The notebook material is ordered below according to the dates given in *JJDA*[2]. This shows a pattern of notetaking, fairly systematically through *Chemistry*, with a few anomalies. B.45 (Jan-Feb 1938) has entries taken from *Chemistry* pages 30-50 with three from pp. 80-85. The entries in Notebook X fall mainly between those in B.45 and B.41 so they may have been recorded in the missing notebook N55 (VI.X.5) that Joyce compiled between March and August 1938. B.41 (late Aug-mid Oct 1938) has entries from *Chemistry* pages 79-94 and the notetaking was completed in B.47 (Nov-Dec 1938) from *Chemistry* pages 99-108.

Knowledge of Joyce's sources can often illuminate his text. In the present case this is true for only a few of the entries. Most are fairly well known. Another important help that they can sometimes give is in establishing a correct text. B.41.195(a), 196(d) and (h) are three cases where corruption may have occurred. B.41.195(i) and B.47.084(f) would give a licence to amend 'lithargogalenu' to 'lithargogalena' on the added basis that Joyce often didn't close his 'a's'. Notebook X (7) both sheds light on the meaning and indicates a possible textual corruption. The 'word' *mauwe* makes no sense and I believe that the 'w' may have originated from a badly written 'v'. The clear source in this case indicates that the 'mauve' aniline dye (from coal tar) is meant. Interestingly the three flames of the next entry (8) come from the description of the parts of a candle flame.

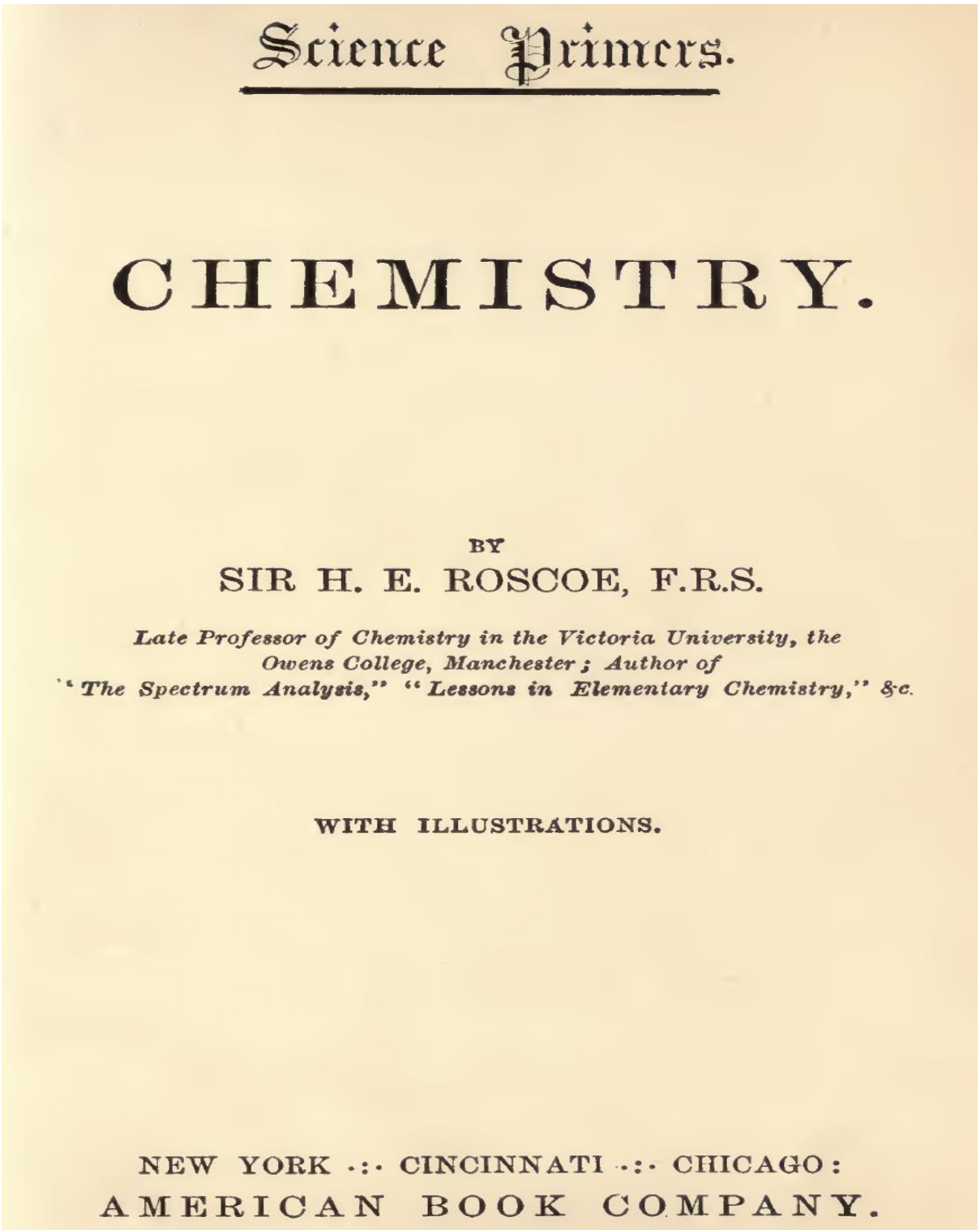
As usual, Joyce distorts and recomposes most of the material he draws from Chemistry. Caustic potash [B.41.195(c)] turns into a strange soup (via French *potage*) which you would not want to drink! The chemical formula for sodium chloride [B.41.195(f)] comes to mean 'brand new' via German *nagelneu*. Chlorine [B.41.195(g)] turns into 'colouring' but its bleaching power is retained. The blue and green vitriols of his source [B.41.195(k)] become the vitrails (stained glass windows) of the village church in the final chapter. Red (Italian *rosso*) oxide of mercury [Notebook X (3)] colours Shem's eyes when he sees a vision of his tart 'white from her garters up' (*FW* 247.19). The well-worn metaphor of magnetic force for human attraction receives a wonderfully fresh expression [Notebook X (4)]. Britannia metal, a tin alloy, becomes amusingly 'Hibernia metal' [B.47.084(d)].

The ethos of the booklet was long-lasting as many who taught or learnt chemistry may remember. The systematic study, backed up by detailed experiments performed by both teacher and pupils, leading to a scientific picture of the world, and above all the primacy of observation for gaining knowledge, offered a lifelong philosophy.

1. *Science Primers. CHEMISTRY*. BY SIR H. E. ROSCOE, F.R.S. Late Professor of Chemistry in the Victoria University, the Owens College, Manchester; Author of "The Spectrum Analysis," "Lessons in Elementary Chemistry," &c. WITH ILLUSTRATIONS. (No publication date is given for the edition illustrated below but a number of editions were published in the 1870's.) It is not known

which edition Joyce used, but the basic text remains the same although the pagination differs.) The edition used below is available online at: https://archive.org/details/ost-chemistry-chemistry00rosciala.

2. The *James Joyce Digital Archive*: http://jjda.ie/main/JJDA/F/FF/fdra/fnbdetails.htm.



Science Primers.

CHEMISTRY.

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Late Professor of Chemistry in the Victoria University, the Owens College, Manchester; Author of "The Spectrum Analysis," "Lessons in Elementary Chemistry," &c.

WITH ILLUSTRATIONS.

NEW YORK ·:· CINCINNATI ·:· CHICAGO:
AMERICAN BOOK COMPANY.

VI.B.45.126

(f) **[g]vivarian**

Note: In the following source quotations all the keywords that H. C. Roscoe marked in another font, are now in bold.

Chemistry 30*:* Here you see that the part played by the animal is exactly the opposite of that played by the plant: the animal renders the air **impure** by constantly breathing out carbonic acid; the plant constantly tends to purify the air again by taking up the carbonic acid, and breathing out (by means of its leaves) oxygen gas. This balance between animal and vegetable life is well illustrated by the Vivaria, now so common, in which small water-animals and water-plants grow in a globe shut off from the air; the carbon contained in the carbonic acid evolved by the animals is set free by the plants, and is just sufficient for their growth, whilst the oxygen at the same time liberated serves for the respiration of the animals.

MS 47476a-242, ScrPrBMA: ^+, as ours is a vivarious where one plant's breaf is a lunger planner's byscent and you may not care for the argon,+^ | *JJA* 49:501 | early 1938 | I.6§1.7/2.4/3.10/4.6 | *FW* 165.10

(g) **[g]argon**

Not found in *Chemistry*.

MS 47476a-242, ScrPrBMA: ^+, as ours is a vivarious where one plant's breaf is a lunger planner's byscent and you may not care for the argon,+^ | *JJA* 49:501 | early 1938 | I.6§1.7/2.4/3.10/4.6 | *FW* 165.11

(h) **[g]pour up H**

Chemistry 38: hydrogen is much lighter than air. For this reason we can pour hydrogen upwards.

MS 47476a-181, ScrPrRMA: ^+We might leave that nitrience of oxagiants to take its free of the air and just analectralyse that very chymirical combination, the gasbag where the warder works. And try to pour somour heiteroscene up the almostfere.+^ | *JJA* 49:383 | early 1938 | I.3§1.10/2.10/3.10 | *FW* 067.09-10

(i) **[g]amalgam**

Chemistry 35: If we press the bit of sodium with a pestle under the surface of the mercury contained in a mortar, the two metals will unite, and we get a mixture of the metals, or an amalgam, as it is called.

MS 47476a-156, ScrPrLMA: ^+(an amalgam as absorbing as ~~el~~ calzium chloereydes and hydrophobe sponges ~~can~~ ^+could+^ make it)+^ | *JJA* 49:333 | early 1938 | I.2§1.10/2.10/3.10 | *FW* 035.01

(j) **[g]N & O free in air >**

MS 47476a-181, ScrPrRMA: ^+We might leave that nitrience of oxagiants to take its free of the air and just analectralyse that very chymirical combination, the gasbag where the warder works. And try to pour somour heiteroscene up the almostfere.+^ | *JJA* 49:383 | early 1938 | I.3§1.10/2.10/3.10 | *FW* 067.07-8

(k) **[g]H & O ch. comb. in W**

Chemistry 41: oxygen is contained in the air mixed with nitrogen.[…] The oxygen exists in the air in the **free state** as a colourless gas; in water the oxygen is **chemically combined** with hydrogen, and when united together these two gases form liquid water.

MS 47476a-181, ScrPrRMA: ^+We might leave that nitrience of oxagiants to take its free of the air and just analectralyse that very chymirical combination, the gasbag where the warder works. And try to pour somour heiteroscene up the almostfere.+^ | *JJA* 49:383 | early 1938 | I.3§1.10/2.10/3.10 | *FW* 067.07-9

VI.B.45.127

(a) **^{g}calcium chloride eagerly absorbs moisture**

Chemistry 42: white calcium chloride, a substance which eagerly absorbs moisture;[…]
MS 47476a-156, ScrPrLMA: ^+(an amalgam as absorbing as ~~el~~ calzium chloereydes and hydrophobe sponges ~~can~~ ^+could+^ make it)+^ | *JJA* 49:333 | early 1938 | I.2§1.10/2.10/3.10 | *FW* 035.01-2

(b) **^{g}alum >**

MS 47476a-194, ScrPrLMA: ^+like the one chrystalisations of Alum on Even+^ | *JJA* 49:409 | early 1938 | I.4§1.10/2.10 | *FW* 086.04

(c) **^{g}crystallisation**

Chemistry 49: Now mix up half an ounce of powdered alum and half an ounce of powdered sulphate of copper, and having mixed these powders well together with the mortar and pestle, dissolve them in one ounce of hot water, and let the solution cool. Carefully notice what separates out. You will see that the colourless crystals of alum are formed, and side by side with them blue crystals of sulphate of copper appear. The two different salts can thus be separated by crystallization; and if we took time enough, we could pick out all the alum crystals and put them on one side, leaving all the crystals of sulphate of copper. This shows how nature separates out things which are different, and we see that many rocks and minerals are formed in the earth by crystallization.
MS 47476a-194, ScrPrLMA: ^+like the one chrystalisations of Alum on Even+^ | *JJA* 49:409 | early 1938 | I.4§1.10/2.10 | *FW* 086.04 | *FW* 086.02-3

(d) **^{g}fluorspar**

Chemistry 50: Thus we find calc-spar, fluor-spar, heavy-spar, felspar, and quartz, all crystalline minerals which have, in different ways […], been produced in the earth by crystallization.
MS 47476a-194, ScrPrLMA: ^+with all the fluors of sparse+^ | *JJA* 49:409 | early 1938 | I.4§1.10/2.10 | *FW* 086.01

(e) **^{g}acid & alkali = salt (petre) >**

MS 47476a-244, ScrPrRMA: ^+(And, taking off sourstuffs and alkalike matters, I hope we can kill time to reach the salt because there's some forceglass neutric assets bittering in the soldpewter for you to plump your pottage in).+^ | *JJA* 49:505 | early 1938 | I.6§1.8/2.5/3.11/4.7 | *FW* 167.19

(f) **^{g}nitric & potash / solidpewter**

Chemistry 80-1*:* This is nitric acid. It is very sour and corrosive; strong nitric acid will make [80] yellow stains and wounds if it touches the skin. It will turn **blue** litmus solution **red**, because it is an **acid**; and if mixed with an **alkali**, like caustic potash (which has the power of turning **red** litmus **blue**) it loses its acid properties. Take a little **caustic potash** solution and add litmus to it, then gently pour some **nitric acid** in; the blue litmus will soon turn red, because the acid **neutralizes** the alkali. If the water be now boiled away in a small porcelain basin, a white salt will be left which is **nitre** or **saltpetre**, made by the chemical combination of nitric acid and potash, the substance which we originally used to make the nitric acid; and if after heating it strongly you dissolve a little of this salt in water, the solution will neither turn red litmus blue, nor blue litmus red: this shows that the salt is neutral.
MS 47476a-244, ScrPrRMA: ^+(And, taking off sourstuffs and alkalike matters, I hope we can kill time to reach the salt because there's some forceglass neutric assets bittering in the soldpewter for you to plump your pottage in).+^ | *JJA* 49:505 | early 1938 | I.6§1.8/2.5/3.11/4.7 | *FW* 167.21-2

VI.B.45.138

(f) **ʳmanganese**

Chemistry 84-85*:* black manganese oxide [...] [84] […] metallic antimony
MS 47476a-254, ScrPrRMA: ^+antimonian manganese limolitmious+^ | *JJA* 49:527 | early 1938 | I.7§1.11/2.11 | *FW* 184.36

Notebook X—not traced**—**inferred to contain notes and words from *Chemistry* which relate to passages in *Finnegans Wake*.

(1) *Chemistry* 50: Thus we find calc-spar, fluor-spar, heavy-spar, felspar, and quartz, all crystalline minerals which have, in different ways […], been produced in the earth by crystallization.
MS 47476a-194, ScrPrLMA: ^+quatz+^ | *JJA* 49:409 | early 1938 | I.4§1.10/2.10 | *FW* 086.03

(2) *Chemistry* 59: Let us put a piece of chalk, or limestone, or marble, into the fire
MS 47479-173, ScrPrBMA: ^+(cholk and murble in lonestime)+^ | *JJA* 54:267 | Jan 1938 | II.3§1.6 | *FW* 319.10

(3) *Chemistry* 62: You see why this is called **oxide of mercury—**because it is a chemical compound of oxygen and mercury. Nobody could tell that this red powder contained these two quite different substances[…]

35. Metals become heavier by oxidation.

Almost all the earthy and solid rocks and bodies which we see around us contain oxygen combined with something else, forming oxides. Thus all the **metals**, such as iron, copper, silver, zinc, lead, will combine like mercury with oxygen to form oxides, and the oxide will always be heavier than the metal contained in it, because there is also the oxygen, which has weight.

Chemistry 63: […] **oxide of iron**, which is the same thing as **iron rust**
MS 47477-289, ScrPrLMA: ^+to ross up the spyballs like exude of margary! And how him it heaviered that eyerim rust!+^ | *JJA* 51:429 | Jan 1938 | II.1§1.9/2.7/3.8/4.10/5.8/6.8/7.7 | *FW* 247.21-2
Note: FW 127.26 likely comes from B.44.118(c) oxide of iron and is not definitively from *Chemistry*.

(4) *Chemistry* 62-3: […] take a small horseshoe magnet, and dip the ends of [62] the magnet into fine iron filings, which will stick to the magnet, forming a kind of small brush.
MS 47477-289, ScrPrRMA: ^+The horseshow magnete draws his field and don't the fillyings fly?+^ | *JJA* 51:429 | Jan 1938 | II.1§1.9/2.7/3.8/4.10/5.8/6.8/7.7 | *FW* 246.23

(5) *Chemistry* 64: 'bluestone,' or sulphate of copper;[…]
MS 47476a-194, ScrPrLMA: ^+and all the sulfeit of copperas+^ | *JJA* 49:409 | early 1938 | I.4§1.10/2.10 | *FW* 086.02-3

(6) *Chemistry* 66: Powder a little coal and put it into the bowl of a common long tobacco-pipe; then cover the top well with a stopper of moist clay (made by mixing the powdered Stourbridge clay with a little water), and let the clay dry well. After it is well dried, fasten the bowl of the pipe over the flame of the gas-lamp.
MS 47476a-254, ScrPrRMA: ^+Stourbridge clay+^ | *JJA* 49:527 | early 1938 | I.7§1.11/2.11 | *FW* 184.12

(7) *Chemistry* 68-9: Besides coal gas we can get many other things from coal. Thus we get the **tar** which is used to tar ropes, sails, and fishermen's nets, to prevent them from rotting in the salt water; also **pitch**,

which is used for **asphalting** pavements; and, what is more wonderful, we get from coal those splendid bright violet and [68] crimson colours, mauve and magenta, which you see in the shop windows.
MS 47477-280, ScrPrLMA: ^+And may his tarpitch dilute not give him chromitis! For the mauwe that blinks you blank is mostly Carbo.+^ | *JJA* 51:411 | Jan 1938 | II.1§1.9/2.7/3.8/4.10/5.8/6.8/7.7 | *FW* 232.01-2

(8) *Chemistry* 70-1: The different parts of a common candle flame are well worth study and teach us much. If you carefully look at the flame of a candle burning steadily you will see that the flame consists of three parts:—

1. A blue, scarcely visible outer zone, or mantle, where the combustion is complete.
2. An inner bright or luminous zone, where soot [70] is separated out and the light is given off, and where the combustion is incomplete.
3. A black cone in the inside, consisting of the unburnt gas given off by the wick.

MS 47477-280, ScrPrLMA: ^+Where the ~~inflammable~~ ^+inflammabilis+^ might pursuive his comburenda with a pure flame and a true flame and a flame all toogasser. Soot.+^ | *JJA* 51:411 | Jan 1938 | II.1§1.9/2.7/3.8/4.10/5.8/6.8/7.7 | *FW* 232.03-5

(9) *Chemistry* 75-6: […] we divide the elements themselves into two classes; those which are **metals**, [75] such as **iron**, **copper**, **gold**, **silver**; and those which are **non-metals,** such as **oxygen, sulphur, carbon.**
MS 47477-293, ScrPrTMA: ^+, Metellus and Ametallikos,+^ | *JJA* 51:437 | Jan 1938 | II.1§1.9/2.7/3.8/4.10/5.8/6.8/7.7 | *FW* 252.15

(10) *Chemistry* 77: **Oxygen** is a colourless, invisible, tasteless gas. It exists in the **free state** in the air, mixed with about four times its bulk of nitrogen gas.[…] Oxygen is contained in all rocks, sand, soil, and minerals. More than half the weight of our whole earth consists of oxygen.
MS 47478-340, ScrPrBMA: ^+That's how our oxyggent has gotten ahold of half their world. Moving about in the free of the air and mixing with the ruck.+^ | *JJA* 53:319 | Feb 1938 | II.2§1.13/2.11/3.13/5.3-6.5/7.4/8.14/9.12 | *FW* 281.24-6

(11) *Chemistry* 80-1*:* This is nitric acid. It is very sour and corrosive; strong nitric acid will make [80] yellow stains and wounds if it touches the skin. It will turn **blue** litmus solution **red**, because it is an **acid**; and if mixed with an **alkali**, like caustic potash (which has the power of turning **red** litmus **blue**) it loses its acid properties.
MS 47476a-254, ScrPrRMA: ^+antimonian manganese limolitmious+^ | *JJA* 49:527 | early 1938 | I.7§1.11/2.11 | *FW* 184.36

(12) *Chemistry* 82: **Carbon**.—This is a solid element; we know it in the free state as charcoal, coke, or coal. Carbon also exists free as two other quite different sorts of bodies, viz.: the colourless hard gem called **diamond**, and the soft body, used for making pencils, called **blacklead** or **graphite**.
MS 47480-218v, ScrTsLPA: ^+, ^+as+^ coked, diamoned or penceloid,+^ | *JJA* 55:420 | 1938 | II.3§6.5+ | *FW* 359.09-10

(13) *Chemistry* 85: Chemistry 85: if we throw a little powdered metallic antimony into the bottle containing the chlorine gas, we see sparks of fire, and a white cloud of antimony chloride is formed.
MS 47476a-254, ScrPrRMA: ^+antimonian manganese limolitmious+^ | *JJA* 49:527 | early 1938 | I.7§1.11/2.11 | *FW* 184.36

(14) *Chemistry* 103*:* Lead ore […] is called **Galena**, and is lead sulphide.[…] There are several very useful compounds of lead.[…] Litharge.[…] Yellow lead oxide.
MS 47476a-254, ScrPrRMA: ^+lithargogalenu+^ | *JJA* 49:527 | early 1938 | I.7§1.11/2.11 | *FW* 184.13

VI.B.41.195

(a) **^{b}*[m]*itrogene in free*[r]* / state on the air >**

MS 47488-80v, ScrTsLPA: ^+nitrogenerand in the free state on the air,+^ | *JJA* 63:138 | Mid 1938 | IV§1.5/2.8 | *FW* 604.23-4

(b) **^{b}saltpetre**

Chemistry 79-80: **Nitrogen** is likewise a colourless, invisible, tasteless gas. It exists in the **free state** in the air. We can separate the oxygen in the air from the nitrogen by burning a piece of phosphorus […]. Nitrogen also is found in many compounds, [79] in **nitric acid**, and **nitre** or **saltpetre**, and in **ammonia** or **spirits of hartshorn**.

MS 47481-126v, ScrTsLPA: ^+, soldpowder and all,+^ | *JJA* 56:196 | late Aug 1938 | II.4§2.8/3.10 | *FW* 393.22

(c) **^{b}caustic potash**

Chemistry 80-1: strong nitric acid will make [80] yellow stains and wounds if it touches the skin. It will turn **blue** litmus solution **red**, because it is an **acid**; and if mixed with an **alkali**, like caustic potash (which has the power of turning **red** litmus **blue**) it loses its acid properties. Take a little **caustic potash** solution and add litmus to it, then gently pour some **nitric acid** in; the blue litmus will soon turn red, because the acid **neutralizes** the alkali.

MS 47481-125v, ScrTsLPA: ^+like an acoustic pottish+^ | *JJA* 56:194 | late Aug 1938 | II.4§2.8/3.10 | *FW* 393.11-2

(d) **^{b}acid + alkali / = salt**

Chemistry 81: **Acids, Alkalis, and Salts**.

From this experiment you learn—

1. That a substance is called an **acid** when it is sour and corrosive, and when it turns blue litmus solution red.
2. That an **alkali** is a substance which turns red litmus solution blue, and has the power of neutralizing acids.
3. That a **salt** is the substance formed when an acid combines with an alkali and forms a neutral body.

MS 47481-125v, ScrTsLPA: ^+, acid and alkolic, signs on the salt,+^ | *JJA* 56:194 | late Aug 1938 | II.4§2.8/3.10 | *FW* 393.01-2

(e) **graphite / soft body**

Chemistry 82: **Carbon**.—This is a solid element; we know it in the free state as charcoal, coke, or coal. Carbon also exists free as two other quite different sorts of bodies, viz.: the colourless hard gem called **diamond**, and the soft body, used for making pencils, called **blacklead** or **graphite**.

Note: See also Notebook X (12).

(f) **sodium chloride / ^{b}Nacl**

Chemistry 84: Chlorine is not found in the free state in nature, but we can get it from a useful compound which contains it—viz. **common salt**. This body, which we use to flavour our food, and which gives the saltness to sea water, is made up of chlorine and the metal sodium, and common salt is therefore called **chloride of sodium**, or **sodium chloride**.

MS 47480-218v, ScrTsLPA: ^+and bleaching him naclenude from all cohlorine matter, down to a boneash bittstoff,+^ | *JJA* 55:420 | 1938 | II.3§6.5+ | *FW* 359.10

(g) **^{b}chlorine >**

MS 47480-218v, ScrTsLPA: ^+and bleaching him naclenude from all cohlorine matter, down to a boneash bittstoff,+^ | *JJA* 55:420 | 1938 | II.3§6.5+ | *FW* 359.10

(h) **[b]bleaching**

Chemistry 85: Chlorine also has a strong **bleaching** power, and it is largely used for taking the colour out of cotton and linen cloth. This you can easily prove by throwing in a bit of wet coloured cotton rag into a bottle of the yellow gas after a few minutes' shaking the rag will have lost its colour.

MS 47480-218v, ScrTsLPA: ^+and bleaching him naclenude from all cohlorine matter, down to a boneash bittstoff,+^ | *JJA* 55:420 | 1938 | II.3§6.5+ | *FW* 359.10

(i) **galena >**

(j) **[b]<suf> sulphide of lead / ore >**

MS 47480-218v, ScrTsLPA: ^+, the orenode ~~as~~ under the selfhide of his bessermettle,+^ | *JJA* 55:420 | 1938 | II.3§6.5+ | *FW* 359.03

(k) **[b]green & blue / vitroils**

Chemistry 86-7: Free sulphur is found in the earth in volcanic districts, and comes chiefly from the island of Sicily. Sulphur is found also in combination chiefly with metals, forming **sulphides** of the metals. These sulphides are generally the **ores** of the metals, that is, the substances from which the metals are obtained. Thus the ore of lead, a mineral called **galena**, is [86] sulphide of lead. Sulphur also combines with oxygen and hydrogen to form **sulphuric acid**, a very important chemical compound. This acid is a heavy oily liquid, and is commonly called **oil of vitriol**, and it is made in enormous quantities (many thousand tons every week), and used for a great number of processes—for making alkali, for soap-making, and dyeing, and calico printing and bleaching, and for the preparation of almost every other acid. Sulphuric acid unites with metals to form **sulphates—**thus we have **sodium sulphate**, or Glauber salts**; iron sulphate**, or green vitriol; **copper sulphate**, or blue vitriol; and many others.

MS 47488-80v, ScrTsLPA: ^+The novened iconostase of his blueygreyned vitroils but begins in feint to ~~show his story~~ light his legend. Let ~~phosphoron~~ ^+Phosphoron+^ proclaim!+^ | *JJA* 63:138 | Mid 1938 | IV§1.5/2.8 | *FW* 603.35

VI.B.41.196

(a) **[b]boneash >**

MS 47480-218v, ScrTsLPA: ^+and bleaching him naclenude from all cohlorine matter, down to a boneash bittstoff,+^ | *JJA* 55:420 | 1938 | II.3§6.5+ | *FW* 359.11

(b) **[b]phosphor**

Chemistry 87: When a bone is burnt, a white porous mass is left called bone-ash, and from this phosphorus can be prepared.

Phosphorus, like carbon, exists in two different forms: one is known as yellow or common phosphorus; the other as red phosphorus. These two sorts of phosphorus differ very much in their properties.

MS 47488-80v, ScrTsLPA: ^+The novened iconostase of his blueygreyned vitriols but begins in feint to ~~show his story~~ light his legend. Let ~~phosphoron~~ ^+Phosphoron+^ proclaim!+^ | *JJA* 63:138 | Mid 1938 | IV§1.5/2.8 | *FW* 603.36

(c) **silicon >**

(d) **[b]quartz**

Chemistry 89: 52. **Silicon** is an element which (like phosphorus) we do not meet with in the free state in nature, although it is contained in enormous quantities in combination with oxygen. Silicon oxide, or **silica**, is known as **quartz** or **rock crystal**, and it is found in almost all rocks.

MS 47480-218v, ScrTsLPA: ^+, regarding to prussyattes or quarzyverzing+^ | *JJA* 55:420 | 1938 | II.3§6.5+ | *FW* 359.07

(e) **clay silicate >**

(f) **[b]limon soda >**

Note: Fr. *Limon*. Lime**.**

MS 47488-80v, ScrTsLPA: ^+And ~~matutinal~~ ^+primilibatory+^ silicates of limon sodias will be absorbable.+^ | *JJA* 63:138 | Mid 1938 | IV§1.5/2.8 | *FW* 604.09

(g) **[b]silica = glass**

Chemistry 90: **Clay** is a silicate so therefore are bricks, pottery, and china, which are made from clay. **Glass** is also a silicate; it is made by heating together in a hot fire or furnace a mixture of white sand (silica), lime, and soda, or of sand, oxide of lead, and potash.

The first mixture forms what we know as **plate-glass** or **window-glass**; the second produces **flint-glass**.

?MS 47488-107, ScrTsTMA: ^+, as staneglass on stonegloss,+^ | *JJA* 63:173 | Mid 1938 | IV§3.4+ | *FW* 609.15

Note: At the time of the addition ‘windows’ (*FW* 609.14) was already present in the text.

(h) **[b]hematite**

Chemistry 91: One most useful ore of iron is red iron oxide, called **hæmatite** iron ore.

MS 47480-221v, ScrTsLPA: ^+Whet the bee as to deflowret greendy grassies yellowhorse. Hematitis, cele our erdours!+^ | *JJA* 55:386 | 1938 | II.3§6.5 | *FW* 360.30

(i) **[b]puddling**

Chemistry 92: **Cast-iron** is not pure iron, but **contains carbon**, which it gets from the coal; we can burn the carbon away (by a process called puddling), and we thus can get wrought-iron from cast-iron.

Not located in MS/*FW*.

(j) **[b]rust on the / oxide of iron**

Chemistry 92: If we burn iron in the air […] or in oxygen, we get oxide of iron. The same thing is formed when any piece of bright iron is left exposed to air and wet; it becomes **rusty**, and at last will all change to **rust**. Iron-mould on linen is also oxide of iron, or rust.

MS 47481-125v, ScrTsLPA: ^+, and taking his rust in the oxsight of Iren,+^ | *JJA* 56:194 | late Aug 1938 | II.4§2.8/3.10 | *FW* 392.27

(k) **[b]prussiate / of**

Chemistry 93: We can tell that iron is present if we add a little of this solution mixed with a few drops of nitric acid to a pint of water, by pouring in a few drops of the bottle labelled “Potassium Ferro-cyanide,” or yellow prussiate of potash, when a dark blue colour (or Prussian blue) will be formed.

MS 47480-218v, ScrTsLPA: ^+, regarding to prussyattes or quarzyverzing+^ | *JJA* 55:420 | 1938 | II.3§6.5+ | *FW* 359.07

(l) **[b]alum &**

Chemistry 94: we might use the bright metal aluminium for very many purposes. It costs too much to make the metal, although clay is so cheap and common. When this bright metal is strongly heated in the air, it burns and forms an oxide called **alumina**, the earth of clay.

The white crystals of **alum** contain this metal.

MS 47481-126v, ScrTsLPA: ^+from alum and oves+^ | *JJA* 56:196 | late Aug 1938 | II.4§2.8/3.10 | *FW* 393.24

(m) **[b]precipitate**

Chemistry 94-5: This is a **salt** called calcium chloride.[…] it takes up moisture with great ease. Let a little of the dry powder remain exposed to the air for a few hours; you will then find that it has become liquid, because it has absorbed, or taken up, the moisture which is always present in the air.

If you add some of the clear solution labelled [94] "Sodium Carbonate," to a little bit of the dry powder of calcium chloride, which you have dissolved in some water in a test-tube, you will see that the two clear liquids at once become milky or turbid. This is because calcium carbonate, or chalk, is produced, and this chalk is insoluble, or does not dissolve in water as the calcium chloride does, and it is therefore thrown down, or precipitated.

MS 47488-80v, ScrTsLPA: ^+to precipitate after night's combustion.+^ | *JJA* 63:138 | Mid 1938 | IV§1.5/2.8 | *FW* 604.18

(n) **[b](absorb**

Note: For the source see *(m)* above.

MS 47488-80v, ScrTsLPA: ^+And ~~matutinal~~ ^+primilibatory+^ silicates of limon sodias will be absorbable.+^ | *JJA* 63:138 | Mid 1938 | IV§1.5/2.8 | *FW* 604.09

VI.B.41.197

(a) **[b]combustion of / night**

Chemistry 95-6: If you hold the end of a bit of magnesium ribbon about six or eight inches long in [95] the flame, the metal will take fire, and burn with a dazzling white light, and a white powder will fall on the ground. This white powder is **magnesia**, the oxide of the metal. Black as well as white fumes will be seen whilst the magnesium is burning. The black fume is not soot, for there is no carbon present; it consists of some of the metal, which is not burnt but is sent off as a cloud having a black colour; the white fume is the solid oxide magnesia going off in fine dust.

MS 47488-80v, ScrTsLPA: ^+to precipitate after night's combustion.+^ | *JJA* 63:138 | Mid 1938 | IV§1.5/2.8 | *FW* 604.18

(b) **[b]nobody is present / which was not / there before a / different *[*arranged*]***

Chemistry 95: But you must take care not to fancy that any substance is afterwards present which was not there before; we have here to do only with a **difference of arrangement**. An exchange takes place by which the chalk is formed, but the materials of the chalk were present in the original substances.

MS 47488-113v, ScrTsEM: ^+Yet is no body present ^+here+^ which was not there before. Only is ~~the~~ order othered. Nought is nulled. Fuitfiat!+^ | *JJA* 63:172 | Mid 1938 | IV§3.4 ├ | *FW* 613.13-4

(c) **[b]Meganesia.**

Note: For the source see *(a)* above.

MS 47488-80v, ScrTsLPA: ^+, Meganesia,+^ | *JJA* 63:138 | Mid 1938 | IV§1.5/2.8 | *FW* 604.25

(d) **calcium**

Chemistry 94: **Calcium** too is a metal which is very difficult to get in the pure state, although its compounds are very common. Quicklime is calcium oxide; chalk and marble and limestone and coral are all calcium carbonate; gypsum is calcium sulphate; and bone earth is calcium phosphate. So you see that there is plenty of this metal in the earth.

VI.B.47.084

(b) **[g]ashpot**

Chemistry 99: Potash salts are found in many places in the earth, and also in the ashes of plants; and this alkali derives its name because it can be got by boiling out wood **ashes in pots**.[…] Chlorate of potash

MS 47488-214v, ScrPrLPA: ^+Sugars of lead for the chloras ashpots!+^ | *JJA* 63:312 | Dec 1938 | IV§1.6/2.9/3.5/4.3/5.7 | *FW* 616.12

(c) **[g]native copper**

Chemistry 100*:* Metallic copper is sometimes met with in nature; it is then called **native copper**; it is, however, more commonly got from **copper ores**, of which there are several kinds.
MS 47488-216, ScrPrBMA: ^+with native copper locks+^ | *JJA* 63:315 | Dec 1938 | IV§1.6/2.9/3.5/4.3/5.7 | *FW* 617.34

(d) **[g]Hibernia metal**

Chemistry 102*:* Tin is also used for making several useful alloys, such as pewter, Britannia metal, plumber's solder.
MS 47488-215, ScrPrTMA: ^+or a slug of Hibernia metal+^ | *JJA* 63:313 | Dec 1938 | IV§1.6/2.9/3.5/4.3/5.7 | *FW* 616.05

(e) **tinstone**

Chemistry 102*:* The most important ore of tin is an **oxide of tin**, known as **Tin Stone**, and is found in Cornwall.

(f) **[g]galena**

Chemistry 103*:* Lead ore […] is called **Galena**, and is lead sulphide.[…] There are several very useful compounds of lead.[…] Litharge.[…] Yellow lead oxide.
Note: 'Galena' is uncrossed in VI.B.41.
Not located in MS/*FW*. The entry at *FW* 184.13 is too early for VI.B.47. See Notebook X (14).

(g) **[g]sugar of lead**

Chemistry 103: [in table] Sugar of lead. | Lead acetate.
MS 47488-214v, ScrPrLPA: ^+Sugars of lead for the chloras ashpots!+^ | *JJA* 63:312 | Dec 1938 | IV§1.6/2.9/3.5/4.3/5.7 | *FW* 616.12

(h) **[g]valency**

Note: This word is not used in *Chemistry*! However the last sections of this little booklet describe valency in all but name, dealing with the combining ratios of the elements.
MS 47488-215, ScrPrTMA: ^+of highest valency+^ | *JJA* 63:313 | Dec 1938 | IV§1.6/2.9/3.5/4.3/5.7 | *FW* 616.13

VI.B.47.085

(a) **by weight of water**

Chemistry 107-8: We found that—

Sixteen parts by weight of oxygen	16
and Two parts by weight of hydrogen.	2
	–
make up eighteen parts by weight of water	18

and I told you that water always contains its [107] elements in these fixed proportions.

(b) **[g]constancy of chemical combination**

Chemistry 108: This great fact of the **constancy of chemical combination** runs through all the changes we have noticed.
Note: Addition not in Joyce's writing. The end of 'combination' is smudged with no clear 's'.
MS 47488-215, ScrPrLMA: ^+in contravention to the constancy of chemical combination+^ | *JJA* 63:313 | Dec 1938 | IV§1.6/2.9/3.5/4.3/5.7 | *FW* 616.08