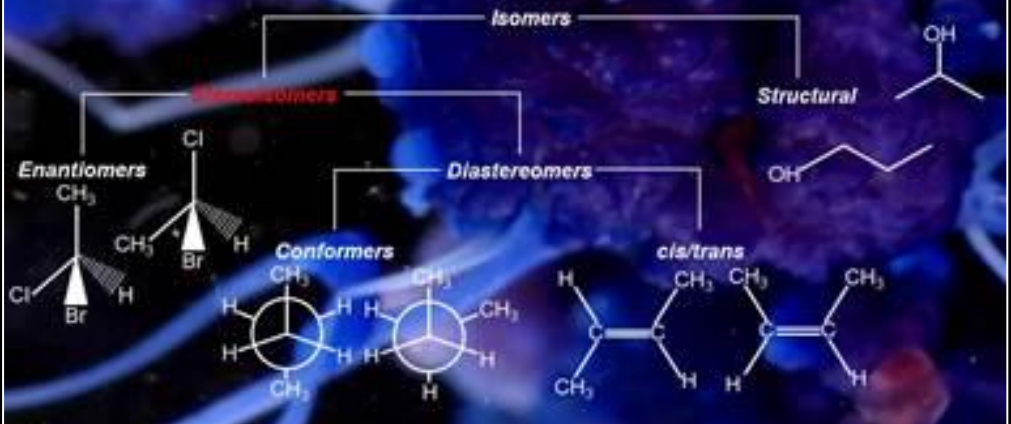
SCIENCE FOR DIPLOMATS

ISOTOPIC LABELS, STEREOISOMERS, & SCHEDULED CHEMICALS

WHY DOES THIS MATTER?
A REVIEW OF THE SAB'S ADVICE

WEDNESDAY 13 JULY 2016
13:30-15:00
OOMS ROOM
LIGHT LUNCH PROVIDED AT 13:00



At SAB-22, The Director-General requested the Scientific Advisory Board (SAB) to:

- make technical recommendations on isotopic labelling of chemicals relevant to Schedule 1, 2 and 3 under the Chemical Weapons Convention – in light of the SAB's previous advice on CAS registry numbers (RC-2/DG.1, dated 28 February 2008, in paragraph 3.5 of the Annex);

- assess whether the chemical properties of a chemical are altered, when subject to isotopic labelling, in a manner that would affect its relevance to the schedules of chemicals under the Chemical Weapons Convention; and

- make technical recommendations on how stereoisomers of chemicals relevant to Schedule 1, 2 and 3 under the Chemical Weapons Convention should be considered in relation to the Convention, taking into account the SAB's previous advice on CAS registry numbers (RC-2/DG.1, dated 28 February 2008, in paragraph 3.5 of the Annex).

OPCW

Scientific Advisory Board

Twenty - Third Session
18 – 22 April 2016

SAB-23/WP.1
28 April 2016
ENGLISH only

RESPONSE TO THE DIRECTOR-GENERAL'S REQUEST TO THE SCIENTIFIC ADVISORY BOARD TO PROVIDE FURTHER ADVICE ON SCHEDULED CHEMICALS

RESPONSE TO THE DIRECTOR-GENERAL'S REQUEST TO THE SCIENTIFIC ADVISORY BOARD TO PROVIDE FURTHER ADVICE ON SCHEDULED CHEMICALS

1. RECCOMENDATIONS

1.1 The Scientific Advisory Board (SAB) has considered isotopically labelled scheduled chemicals and stereoisomers of scheduled compounds relating to the Convention according to the Director-General's requests (see Appendixes 1 and 2).

1.2 **Recommendation 1**. The SAB recommends that the molecular parent structure of a chemical should determine whether it is covered by a schedule entry. This is because:

(a) it is inappropriate to rely solely upon Chemical Abstracts Service (CAS) numbers to define chemicals covered by the schedules. Although relevant as aids to declaration and verification, CAS numbers should not be used as the means to identify a chemical, or to determine whether a chemical is included in, or excluded from, a schedule;

(b) thus, if a chemical is included within a schedule, then all possible isotopically-labelled forms and stereoisomers of that chemical should be included, irrespective of whether or not they have been assigned a CAS number or have CAS numbers different to those shown in the Annex on Chemicals to the Convention. The isotopically labelled compound or stereoisomer related to the parent chemical specified in the schedule should be interpreted as belonging to the same schedule; and

(c) this advice is consistent with previous SAB views on this topic.[1]

1.3 **Recommendation 2.** Inclusion of appropriate analytical data in the OPCW Central Agent Database (OCAD) for isotopically labelled relatives of scheduled compounds where available is recommended.

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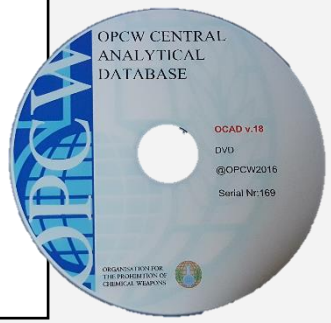
1 RG-2/DG.1, dated 28 February 2008, in paragraph 3.5 of its Annex.



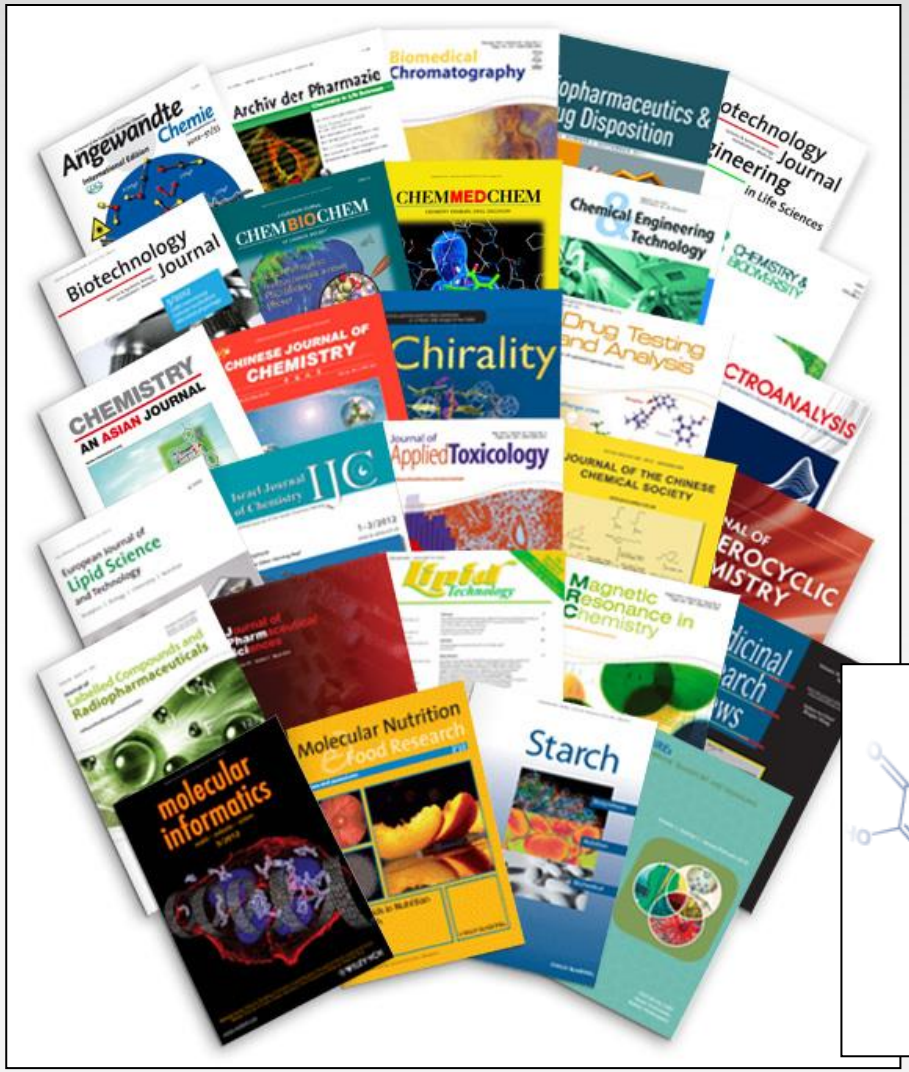
Part 1: Chemical Abstracts Service (CAS) Registry Number?

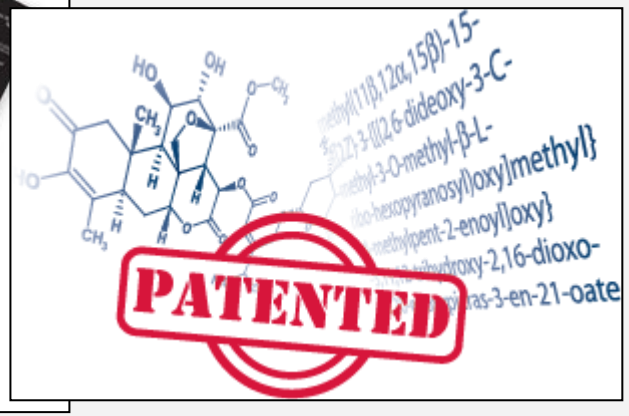
Is a unique numeric identifier

Designates only one substance

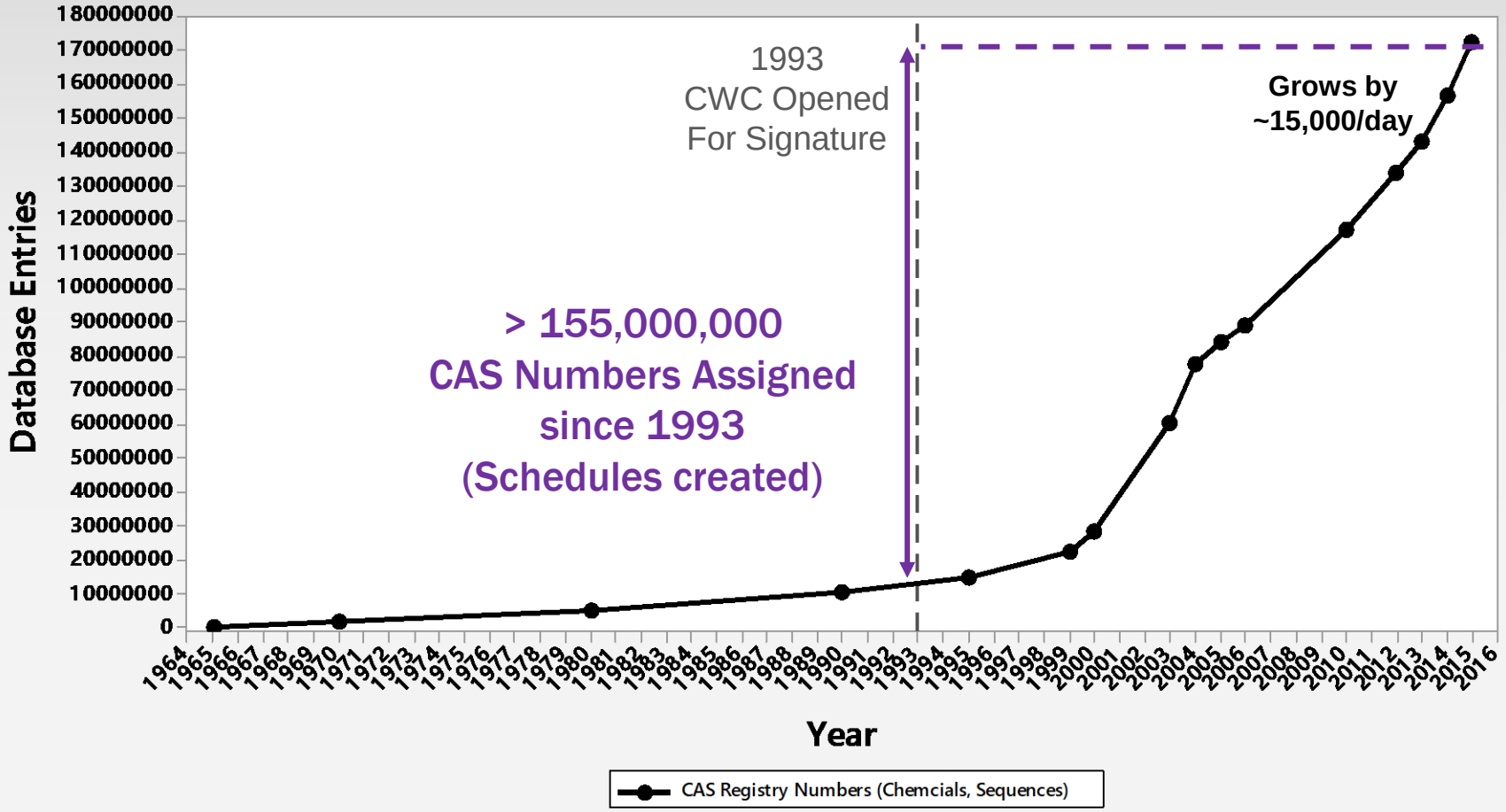
Contains no chemical information, yet is a link to a wealth of information about a specific chemical substance

Part 1: Chemical Abstracts Service (CAS) Registry Number?





How Many CAS Registry Numbers Have Been Assigned?



Scheduled Chemicals under the Chemical Weapons Convention (CWC)

Schedule 1

Guidelines for Schedule 1

The following criteria shall be taken into account in considering whether a toxic chemical or precursor should be included in Schedule 1:

(a) It has been developed, produced, stockpiled or used as a chemical weapon as defined in Article II;

(b) It poses otherwise a high risk to the object and purpose of this Convention by virtue of its high potential for use in activities prohibited under this Convention because one or more of the following conditions are met:

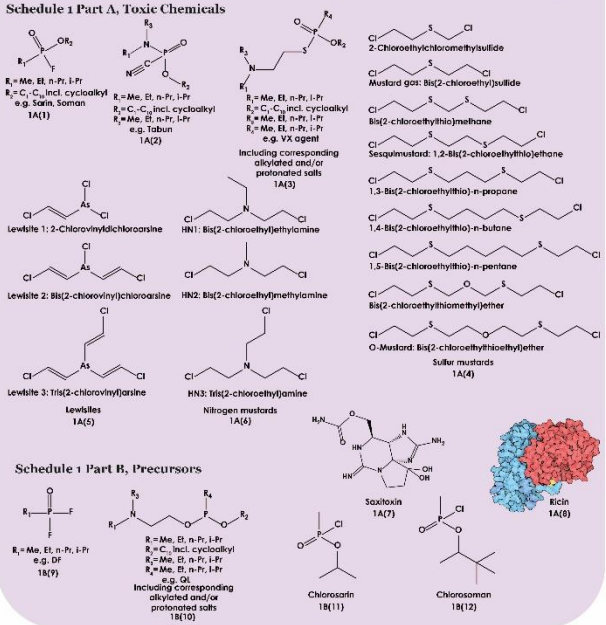
(i) It possesses a chemical structure closely related to that of other toxic chemicals listed in Schedule 1, and has, or can be expected to have, comparable properties;

(ii) It possesses such lethal or incapacitating toxicity as well as other properties that would enable it to be used as a chemical weapon;

(iii) It may be used as a precursor in the final single technological stage of production of a toxic chemical listed in Schedule 1, regardless of whether this stage takes place in facilities, in munitions or elsewhere;

(c) It has little or no use for purposes not prohibited under this Convention.

Schedule 1 Part A, Toxic Chemicals



Schedule 1 Part B, Precursors

Schedule 2

Guidelines for Schedule 2

The following criteria shall be taken into account in considering whether a toxic chemical not listed in Schedule 1 or a precursor to a Schedule 1 chemical or to a chemical listed in Schedule 2, part A, should be included in Schedule 2:

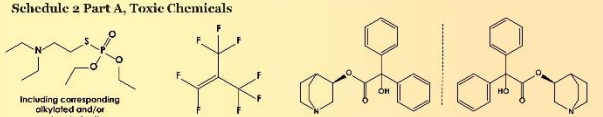
(a) It poses a significant risk to the object and purpose of this Convention because it possesses such lethal or incapacitating toxicity as well as other properties that could enable it to be used as a chemical weapon;

(b) It may be used as a precursor in one of the chemical reactions at the final stage of formation of a chemical listed in Schedule 1 or Schedule 2, part A;

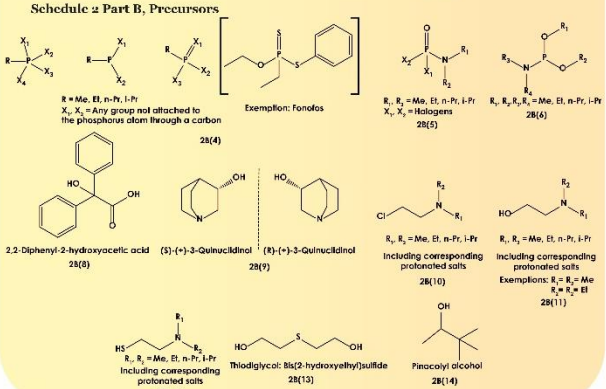
(c) It poses a significant risk to the object and purpose of this Convention by virtue of its importance in the production of a chemical listed in Schedule 1 or Schedule 2, part A;

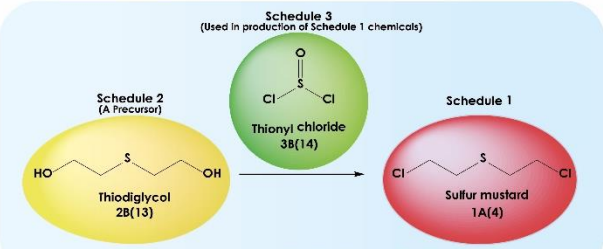
(d) It is not produced in large commercial quantities for purposes not prohibited under this Convention.

Schedule 2 Part A, Toxic Chemicals



Schedule 2 Part B, Precursors





Relationship between Schedules, illustrated with sulfur mustard.

Schedule 3

Guidelines for Schedule 3

The following criteria shall be taken into account in considering whether a toxic chemical or precursor, not listed in other Schedules, should be included in Schedule 3:

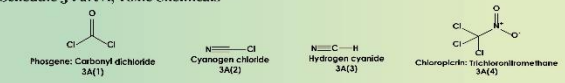
(a) It has been produced, stockpiled or used as a chemical weapon;

(b) It poses otherwise a risk to the object and purpose of this Convention because it possesses such lethal or incapacitating toxicity as well as other properties that might enable it to be used as a chemical weapon;

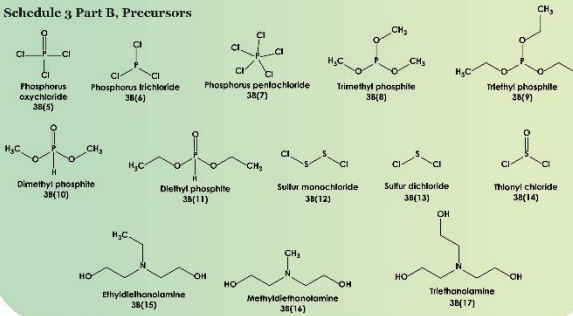
(c) It poses a risk to the object and purpose of this Convention by virtue of its importance in the production of one or more chemicals listed in Schedule 1 or Schedule 2, part B;

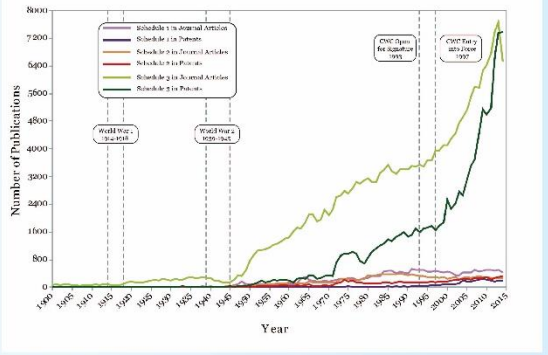
(d) It may be produced in large commercial quantities for purposes not prohibited under this Convention.

Schedule 3 Part A, Toxic Chemicals



Schedule 3 Part B, Precursors





Scheduled chemicals are both scientifically and economically important as illustrated by the number of yearly publications that refer to them.

ORGANISATION FOR THE PROHIBITION OF CHEMICAL WEAPONS

Working Together for a World Free of Chemical Weapons

@opcw @opcw_st /opcwonline /opcwonline /company/opcw /opcw

Scheduled Chemicals under the Chemical Weapons Convention (CWC)

Schedule 1

Guidelines for Schedule 1

The following criteria shall be taken into account in considering whether a toxic chemical or precursor should be included in Schedule 1:

(a) It has been developed, produced, stockpiled or used as a chemical weapon as defined in Article II;

(b) It poses otherwise a high risk to the object and purpose of this Convention by virtue of its high potential for use in activities prohibited under this Convention because one or more of the following conditions are met:

(i) It possesses a chemical structure closely related to that of other toxic chemicals listed in Schedule 1, and has, or can be expected to have, comparable properties;

(ii) It possesses such lethal or incapacitating toxicity as well as other properties that would enable it to be used as a chemical weapon;

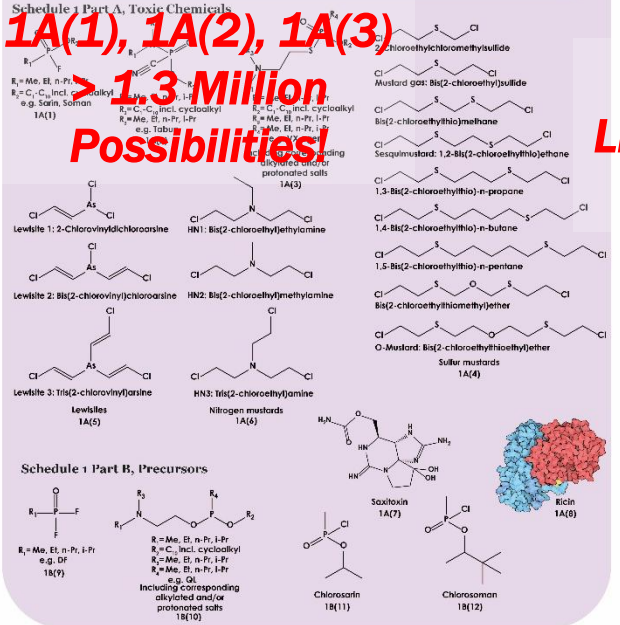
(iii) It may be used as a precursor in the final single technological stage of production of a toxic chemical listed in Schedule 1, regardless of whether this stage takes place in facilities, in munitions or elsewhere;

(c) It has little or no use for purposes not prohibited under this Convention.

Schedule 1 Part A, Toxic Chemicals

1A(1), 1A(2), 1A(3)

> 1.3 Million Possibilities!



Schedule 1 Part B, Precursors

Schedule 2

Guidelines for Schedule 2

The following criteria shall be taken into account in considering whether a toxic chemical not listed in Schedule 1 or a precursor to a Schedule 1 chemical or to a chemical listed in Schedule 2, part A, should be included in Schedule 2:

(a) It poses a significant risk to the object and purpose of this Convention because it possesses such lethal or incapacitating toxicity as well as other properties that could enable it to be used as a chemical weapon;

(b) It may be used as a precursor in one of the chemical reactions at the final stage of formation of a chemical listed in Schedule 1 or Schedule 2, part A;

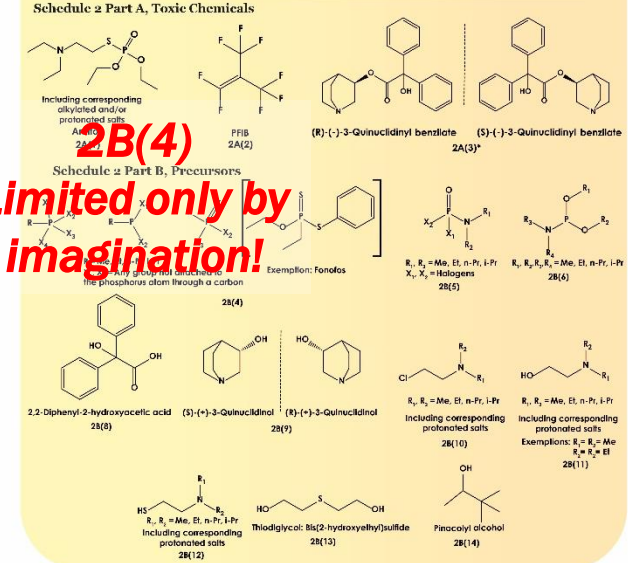
(c) It poses a significant risk to the object and purpose of this Convention by virtue of its importance in the production of a chemical listed in Schedule 1 or Schedule 2, part A;

(d) It is not produced in large commercial quantities for purposes not prohibited under this Convention.

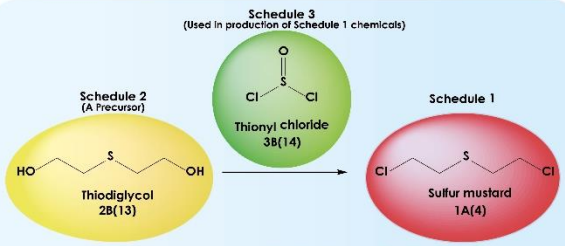
Schedule 2 Part A, Toxic Chemicals

2A(1), 2A(2), 2A(3)*, 2B(4)

Limited only by imagination!



Schedule 2 Part B, Precursors



Relationship between Schedules, illustrated with sulfur mustard.

Schedule 3

Guidelines for Schedule 3

The following criteria shall be taken into account in considering whether a toxic chemical or precursor, not listed in other Schedules, should be included in Schedule 3:

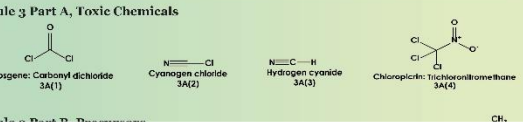
(a) It has been produced, stockpiled or used as a chemical weapon;

(b) It poses otherwise a risk to the object and purpose of this Convention because it possesses such lethal or incapacitating toxicity as well as other properties that might enable it to be used as a chemical weapon;

(c) It poses a risk to the object and purpose of this Convention by virtue of its importance in the production of one or more chemicals listed in Schedule 1 or Schedule 2, part B;

(d) It may be produced in large commercial quantities for purposes not prohibited under this Convention.

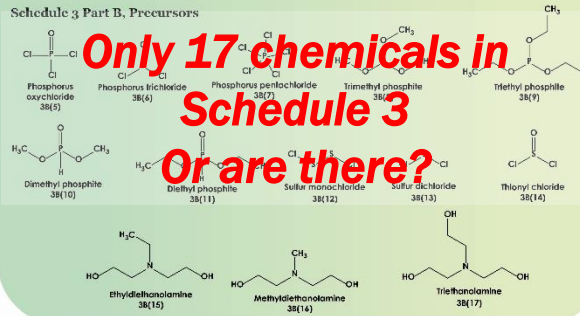
Schedule 3 Part A, Toxic Chemicals

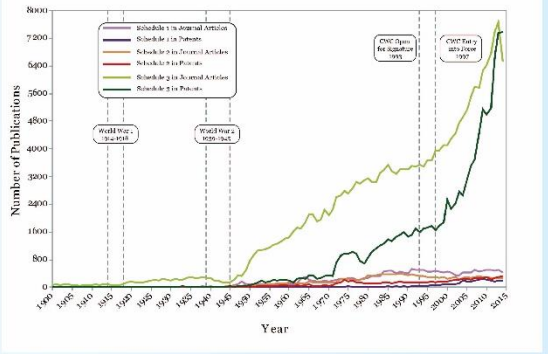


Schedule 3 Part B, Precursors

Only 17 chemicals in Schedule 3

Or are there?





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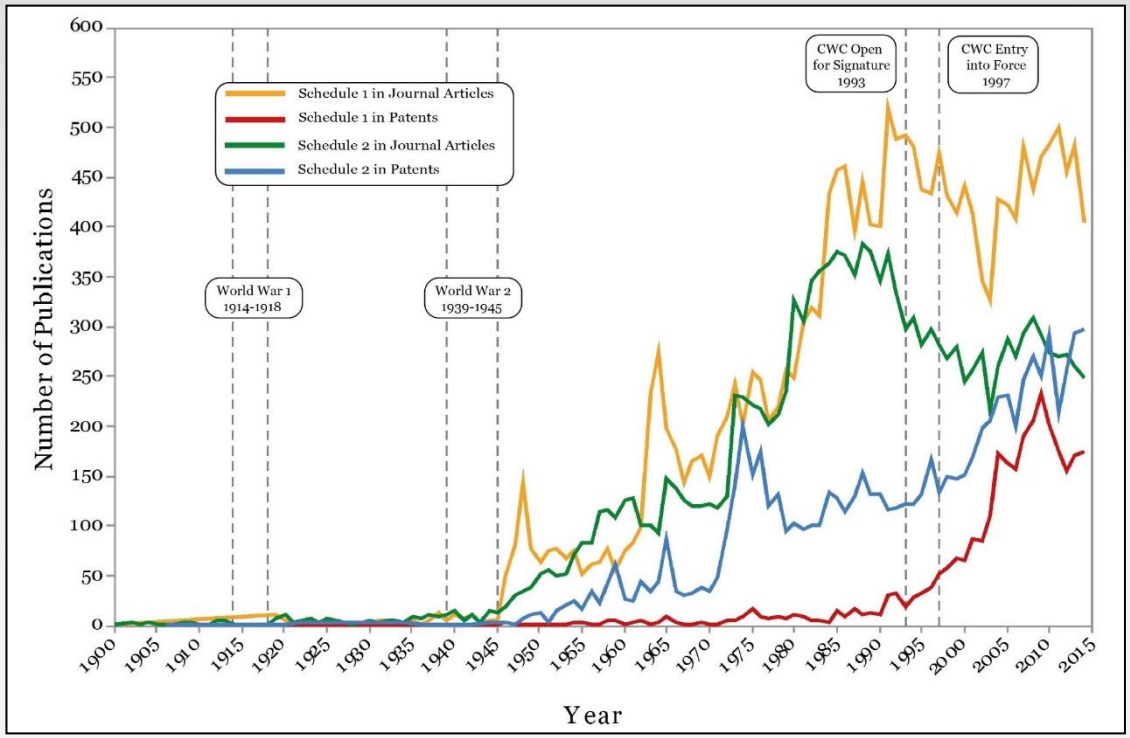
Schedule 1 in Journal Articles
Schedule 1 in Patents
Schedule 2 in Journal Articles
Schedule 2 in Patents
World War 1
1914-1918
World War 2
1939-1945
CWC Open
for Signature
1993
CWC Entry
into Force
1997
Number of Publications
Year
600
550
500
450
400
350
300
250
200
150
100
50
0
1900
1905
1910
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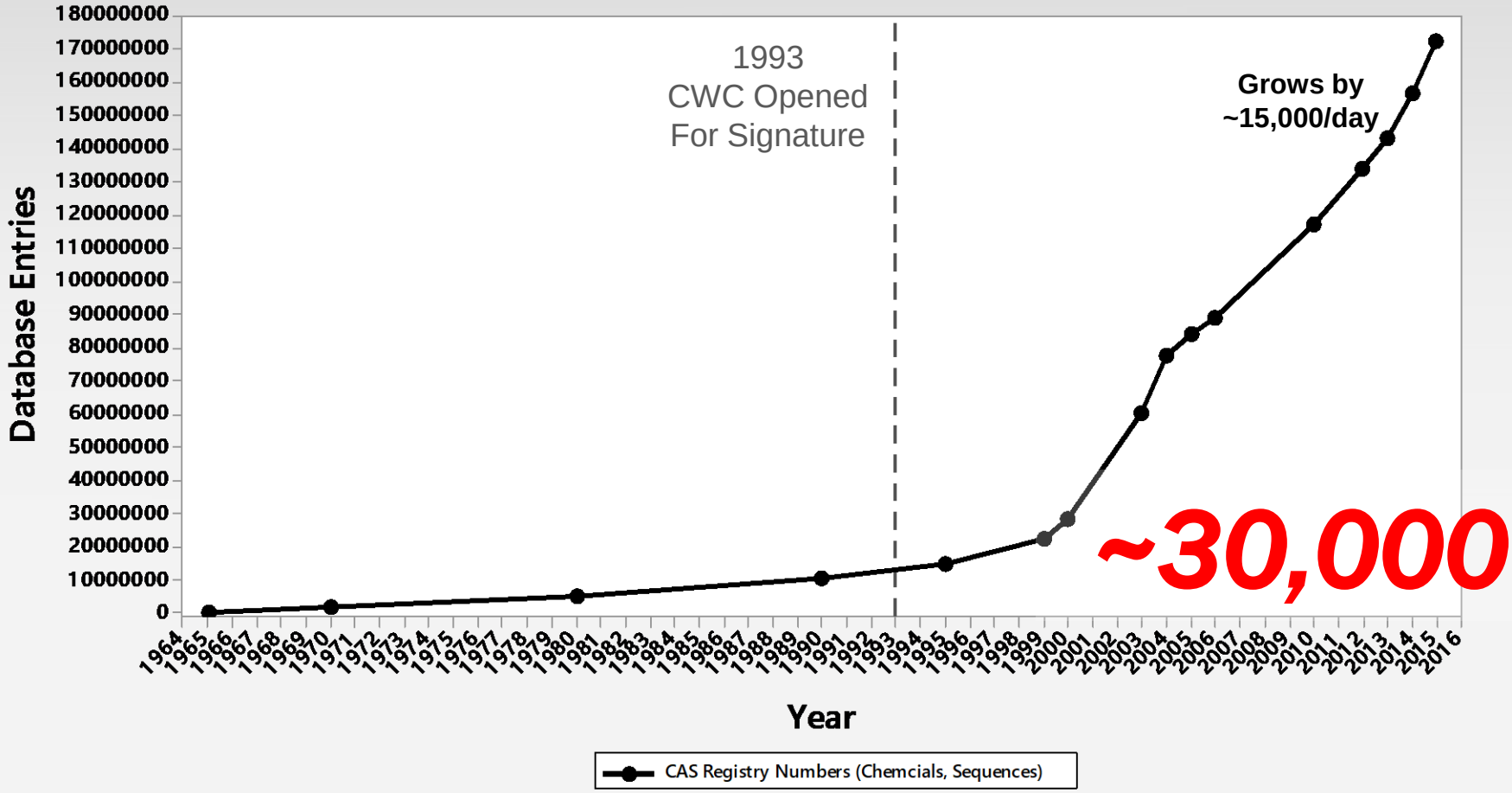
How Many Scheduled Chemicals Have CAS Registry Numbers?



How Many Scheduled Chemicals Have CAS Registry Numbers?

Schedule 1 (CAS registry number)

A. Toxic chemicals:

(1) O-Alkyl ($\leq C_{10}$, incl. cycloalkyl) alkyl (Me, Et, n-Pr or i-Pr)-phosphonofluoridates

e.g. Sarin:	O-Isopropyl methylphosphonofluoridate	(107-44-8)
Soman:	O-Pinacolyl methylphosphonofluoridate	(96-64-0)

(2) O-Alkyl ($\leq C_{10}$, incl. cycloalkyl) N,N-dialkyl (Me, Et, n-Pr or i-Pr) phosphoramidocyanidates

e.g. Tabun:	O-Ethyl N,N-dimethyl phosphoramidocyanidate	(77-81-6)

(3) O-Alkyl (H or $\leq C_{10}$, incl. cycloalkyl) S-2-dialkyl (Me, Et, n-Pr or i-Pr)-aminoethyl alkyl (Me, Et, n-Pr or i-Pr) phosphonothiolates and corresponding alkylated or protonated salts

e.g. VX:	O-Ethyl S-2-diisopropylaminoethyl methyl phosphonothiolate	(50782-69-9)

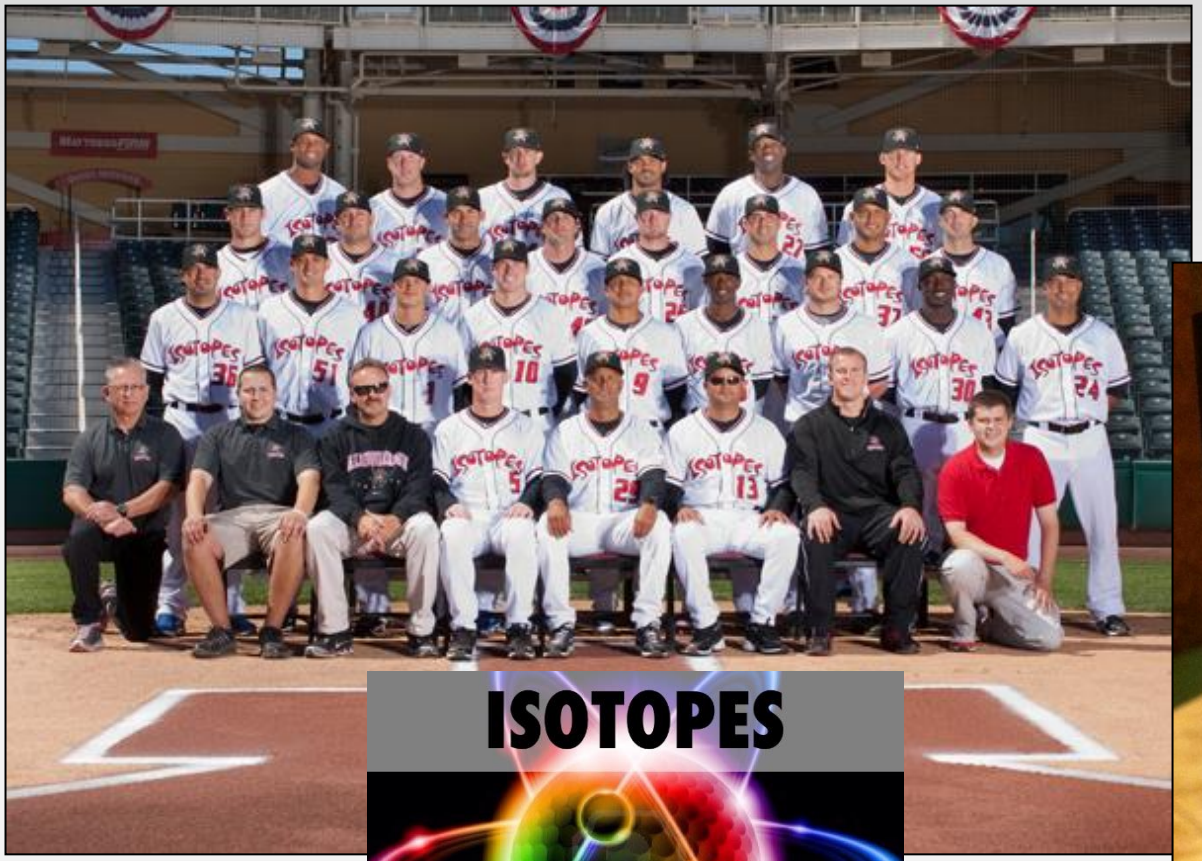
(4) Sulfur mustards:

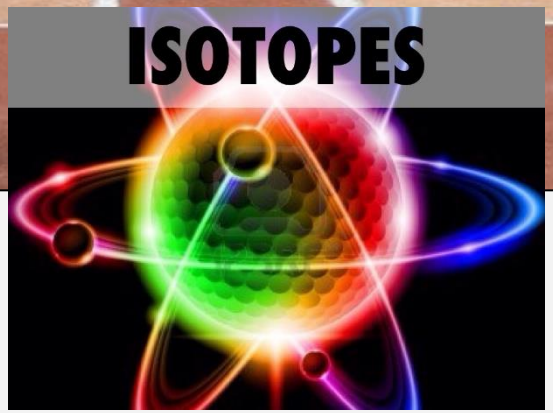
2-Chloroethylchloromethylsulfide	(2625-76-5)
Mustard gas: Bis(2-chloroethyl)sulfide	(505-60-2)
Bis(2-chloroethylthio)methane	(63869-13-6)
Sesquimustard: 1,2-Bis(2-chloroethylthio)ethane	(3563-36-8)
1,3-Bis(2-chloroethylthio)-n-propane	(63905-10-2)
1,4-Bis(2-chloroethylthio)-n-butane	(142868-93-7)
1,5-Bis(2-chloroethylthio)-n-pentane	(142868-94-8)
Bis(2-chloroethylthiomethyl)ether	(63918-90-1)
O-Mustard: Bis(2-chloroethylthioethyl)ether	(63918-89-8)

51 Schedules of Chemicals

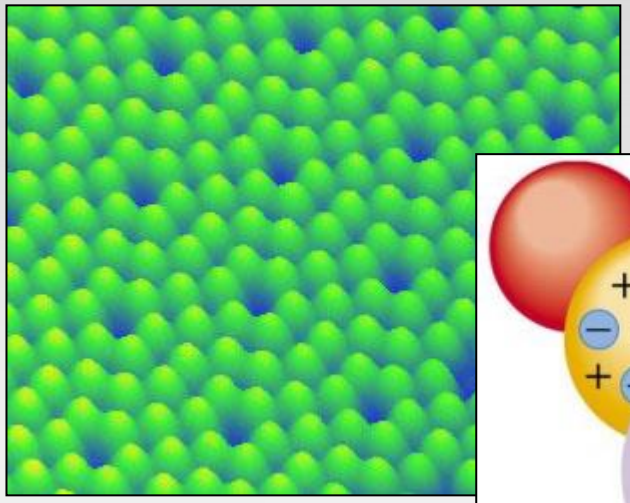
55 in Annex on Chemicals (3 are not Scheduled)

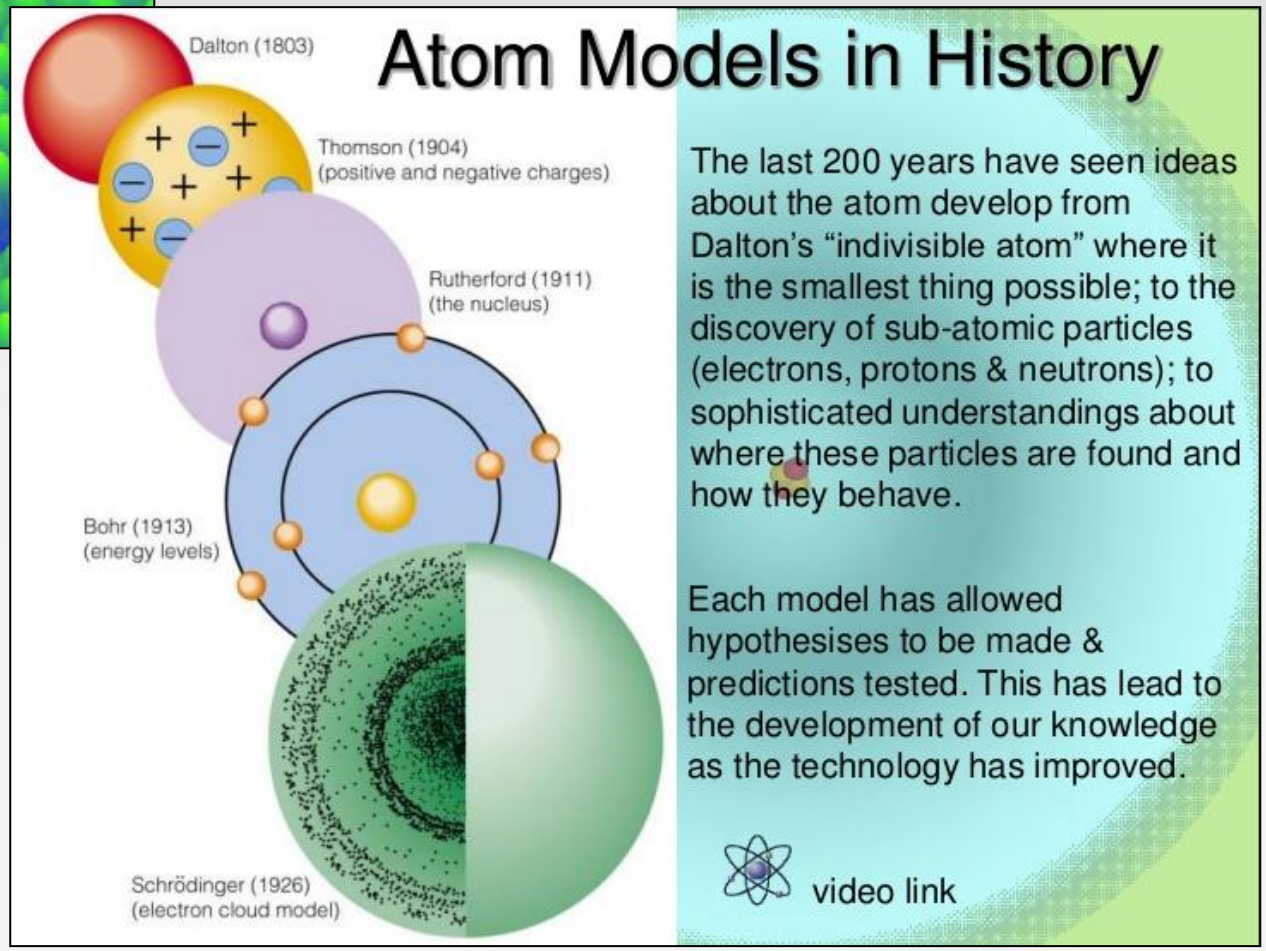
Part 2: Isotopes



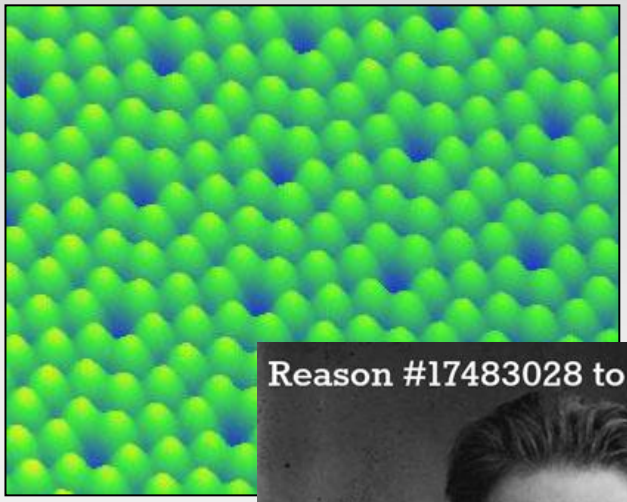


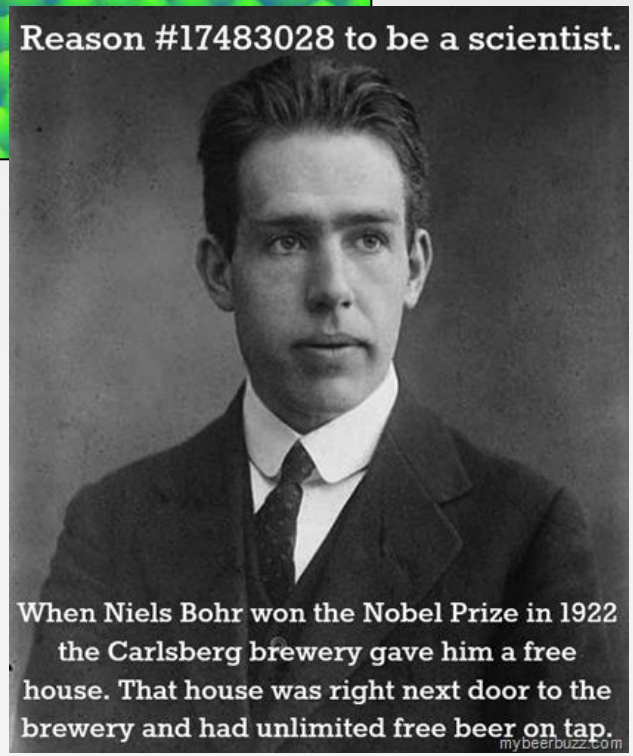
But First Atoms...

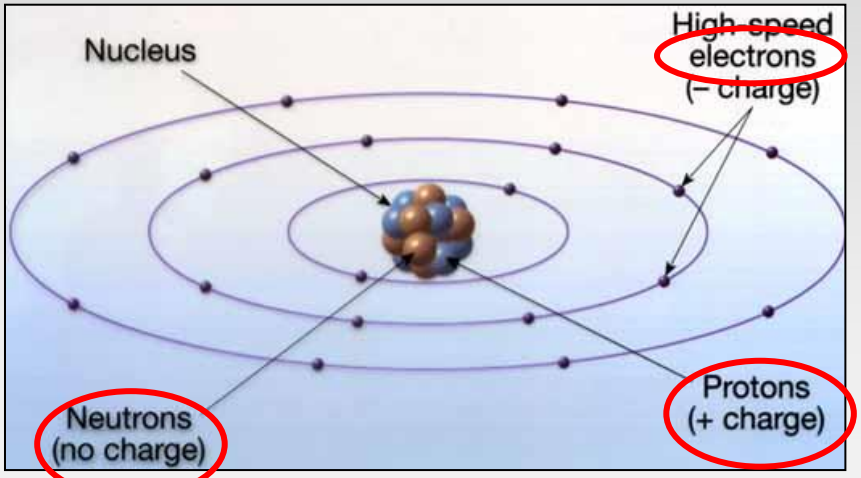




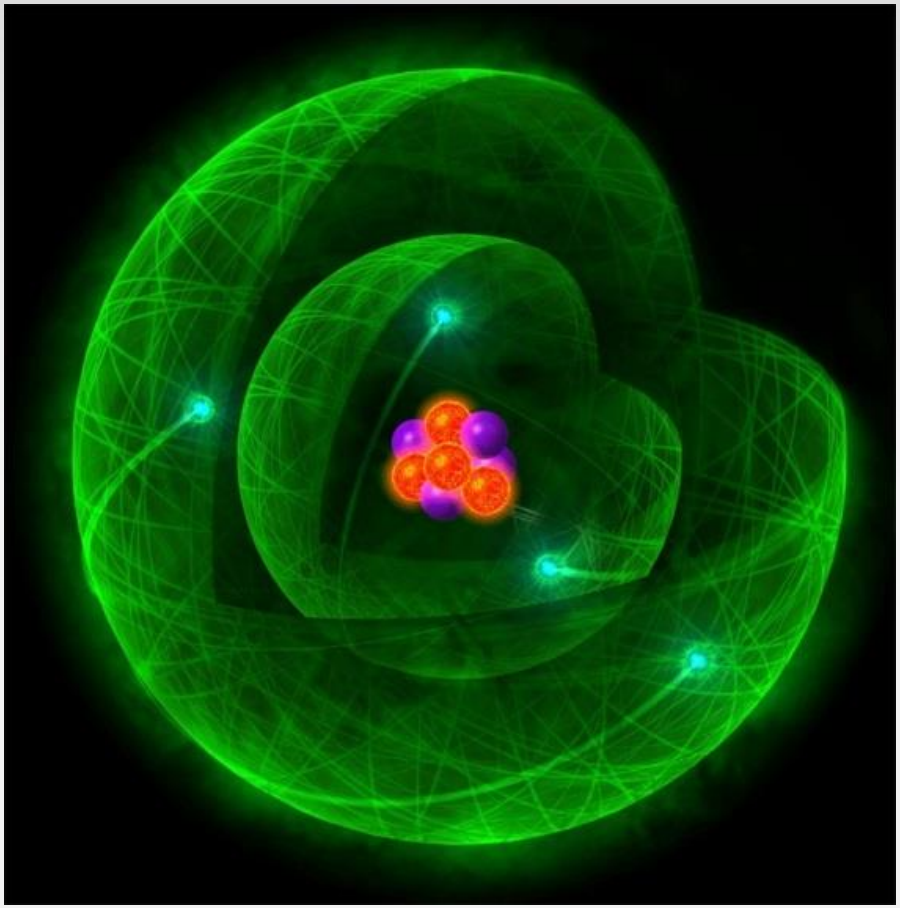
But First Atoms...







But First Atoms...



And Elements...

IUPAC Periodic Table of the Elements

1 = Atomic Number = Number of Protons

Protons = Electrons (neutral atom)

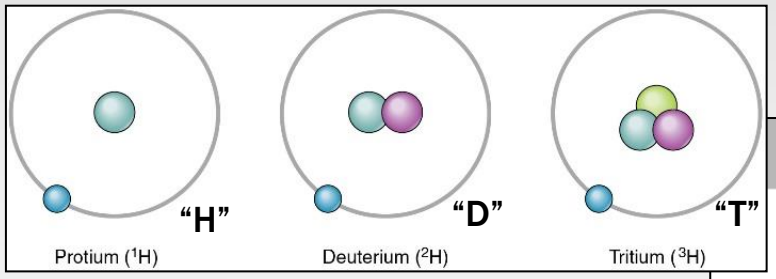
1																	18
1 **H** hydrogen [1.007, 1.009]	2		Key: atomic number **Symbol** name standard atomic weight									13	14	15	16	17	2 **He** helium 4.003
3 **Li** lithium [6.938, 6.997]	4 **Be** beryllium 9.012											5 **B** boron [10.80, 10.83]	6 **C** carbon [12.00, 12.02]	7 **N** nitrogen [14.00, 14.01]	8 **O** oxygen [15.99, 16.00]	9 **F** fluorine 19.00	10 **Ne** neon 20.18
11 **Na** sodium 22.99	12 **Mg** magnesium [24.30, 24.31]	3	4	5	6	7	8	9	10	11	12	13 **Al** aluminium 26.98	14 **Si** silicon [28.08, 28.09]	15 **P** phosphorus 30.97	16 **S** sulfur [32.05, 32.08]	17 **Cl** chlorine [35.44, 35.46]	18 **Ar** argon 39.95
19 **K** potassium 39.10	20 **Ca** calcium 40.08	21 **Sc** scandium 44.96	22 **Ti** titanium 47.87	23 **V** vanadium 50.94	24 **Cr** chromium 52.00	25 **Mn** manganese 54.94	26 **Fe** iron 55.85	27 **Co** cobalt 58.93	28 **Ni** nickel 58.69	29 **Cu** copper 63.55	30 **Zn** zinc 65.38(2)	31 **Ga** gallium 69.72	32 **Ge** germanium 72.63	33 **As** arsenic 74.92	34 **Se** selenium 78.97	35 **Br** bromine [79.90, 79.91]	36 **Kr** krypton 83.80
37 **Rb** rubidium 85.47	38 **Sr** strontium 87.62	39 **Y** yttrium 88.91	40 **Zr** zirconium 91.22	41 **Nb** niobium 92.91	42 **Mo** molybdenum 95.95	43 **Tc** technetium	44 **Ru** ruthenium 101.1	45 **Rh** rhodium 102.9	46 **Pd** palladium 106.4	47 **Ag** silver 107.9	48 **Cd** cadmium 112.4	49 **In** indium 114.8	50 **Sn** tin 118.7	51 **Sb** antimony 121.8	52 **Te** tellurium 127.6	53 **I** iodine 126.9	54 **Xe** xenon 131.3
55 **Cs** caesium 132.9	56 **Ba** barium 137.3	57-71 lanthanoids	72 **Hf** hafnium 178.5	73 **Ta** tantalum 180.9	74 **W** tungsten 183.8	75 **Re** rhenium 186.2	76 **Os** osmium 190.2	77 **Ir** iridium 192.2	78 **Pt** platinum 195.1	79 **Au** gold 197.0	80 **Hg** mercury 200.6	81 **Tl** thallium [204.3, 204.4]	82 **Pb** lead 207.2	83 **Bi** bismuth 209.0	84 **Po** polonium	85 **At** astatine	86 **Rn** radon
87 **Fr** francium	88 **Ra** radium	89-103 actinoids	104 **Rf** rutherfordium	105 **Db** dubnium	106 **Sg** seaborgium	107 **Bh** bohrium	108 **Hs** hassium	109 **Mt** meitnerium	110 **Ds** darmstadtium	111 **Rg** roentgenium	112 **Cn** copernicium	113 **Uut** ununtrium	114 **Fl** flerovium	115 **Uup** ununpentium	116 **Lv** livermorium	117 **Uus** ununseptium	118 **Uuo** ununoctium

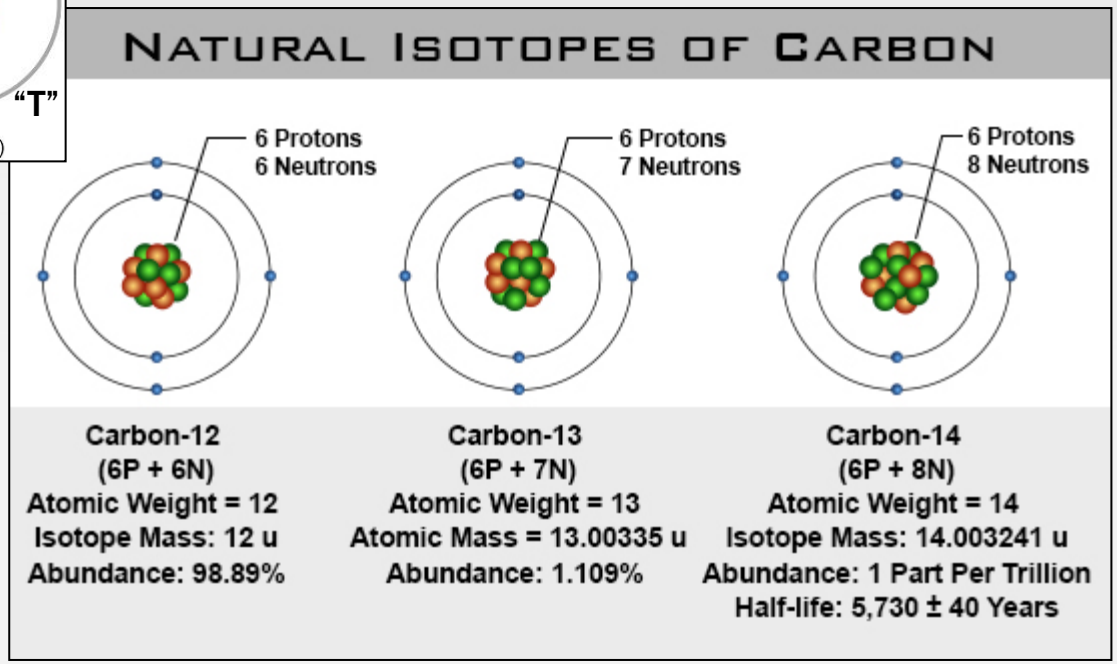
57 **La** lanthanum 138.9	58 **Ce** cerium 140.1	59 **Pr** praseodymium 140.9	60 **Nd** neodymium 144.2	61 **Pm** promethium	62 **Sm** samarium 150.4	63 **Eu** europium 152.0	64 **Gd** gadolinium 157.3	65 **Tb** terbium 158.9	66 **Dy** dysprosium 162.5	67 **Ho** holmium 164.9	68 **Er** erbium 167.3	69 **Tm** thulium 168.9	70 **Yb** ytterbium 173.0	71 **Lu** lutetium 175.0
89 **Ac** actinium	90 **Th** thorium 232.0	91 **Pa** protactinium 231.0	92 **U** uranium 238.0	93 **Np** neptunium	94 **Pu** plutonium	95 **Am** americium	96 **Cm** curium	97 **Bk** berkelium	98 **Cf** californium	99 **Es** einsteinium	100 **Fm** fermium	101 **Md** mendelevium	102 **No** nobelium	103 **Lr** lawrencium

INTERNATIONAL UNION OF PURE AND APPLIED CHEMISTRY

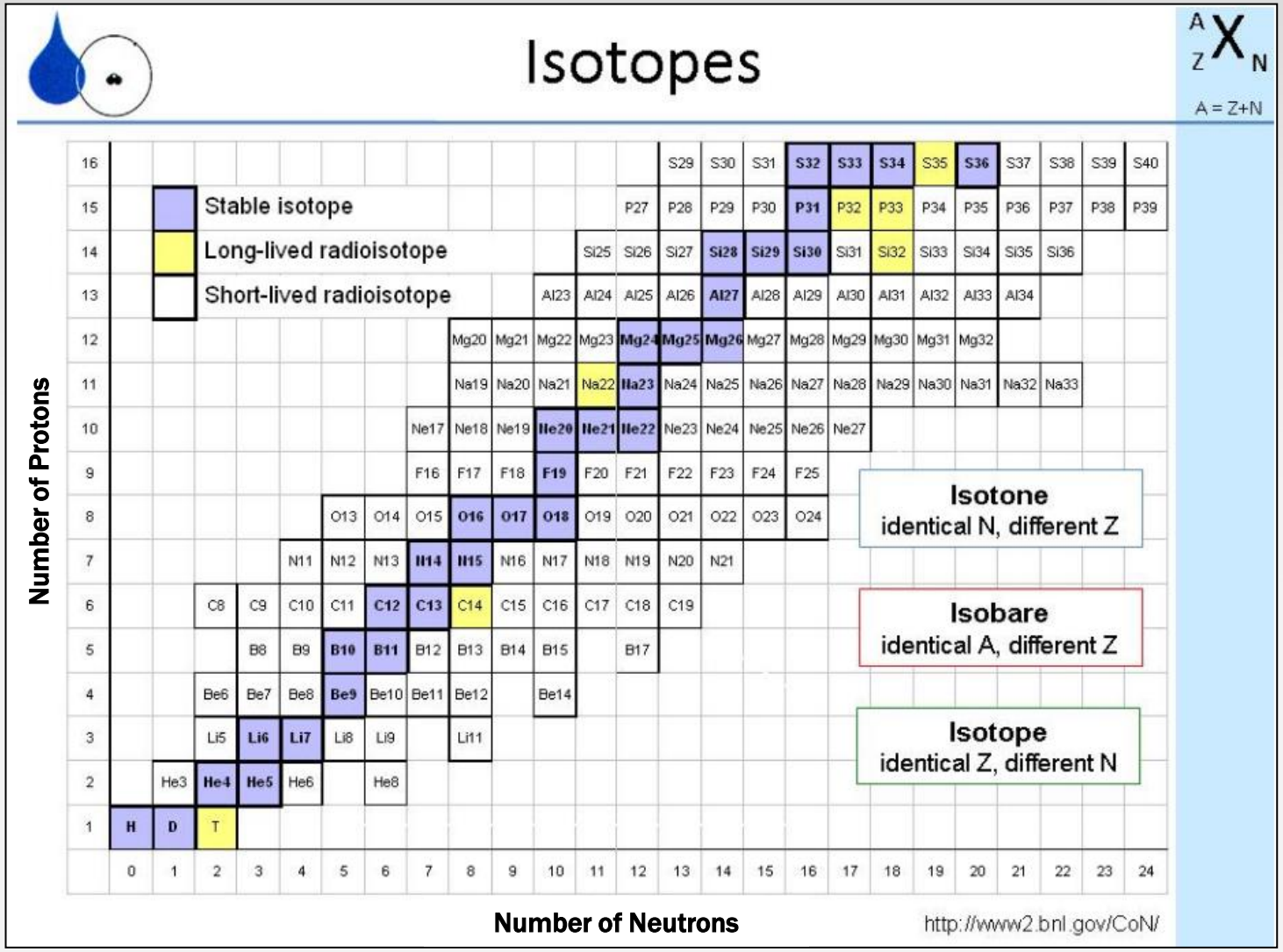
For notes and updates to this table, see www.iupac.org. This version is dated 8 January 2016.

And Elements...

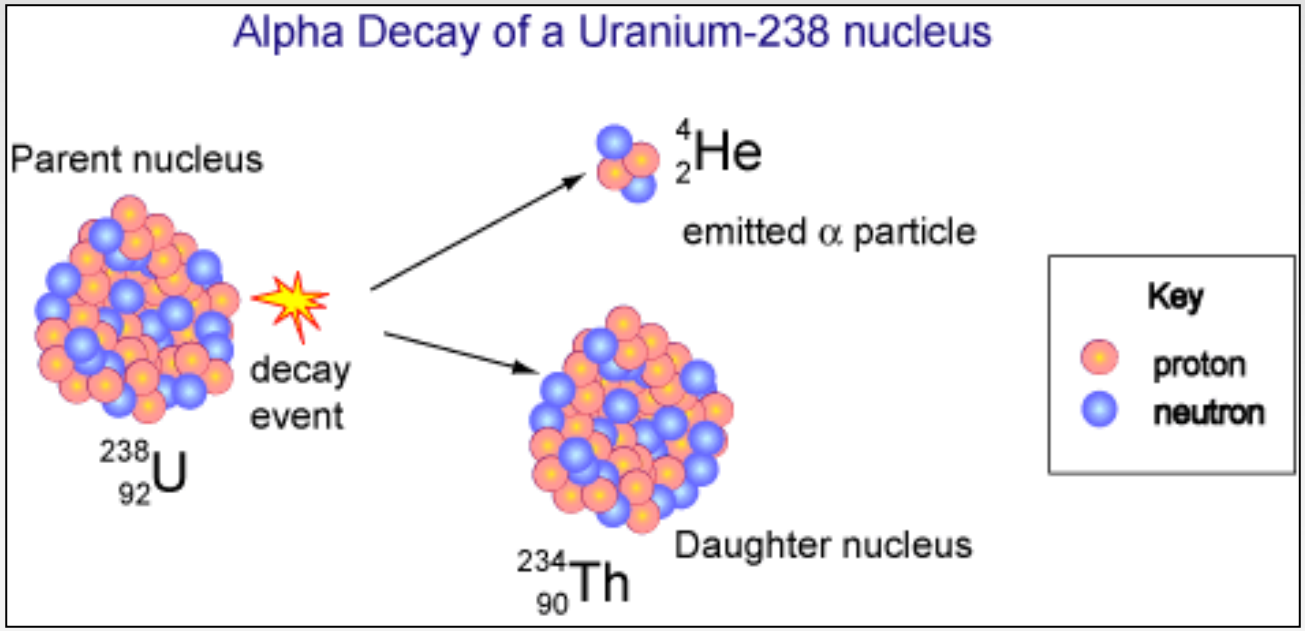




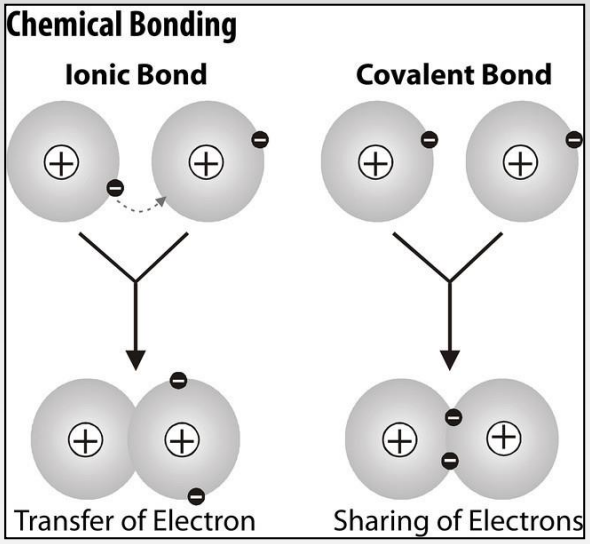
Stable and Unstable Isotopes



Stable and Unstable Isotopes

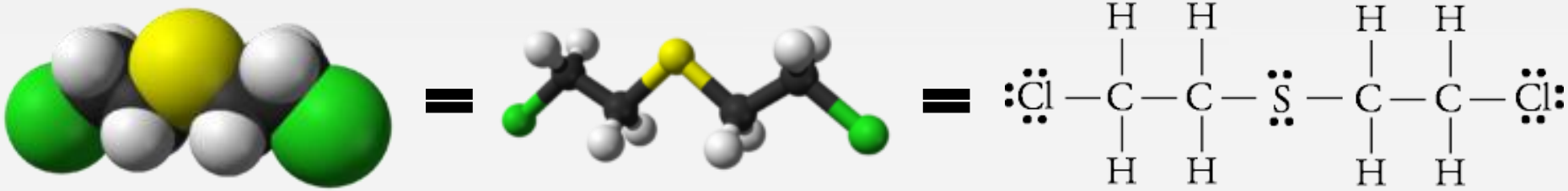


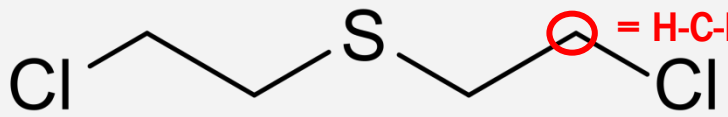
And Back to Atoms... and Molecules



Chemical bonding is all about electrons!

(isotopes do not differ by electrons : chemistry of isotopes of the same element is for practical purposes the same)





= H-C-H (a "C" with 4 "bonds", H's are not shown)

What About Scheduled Chemicals?

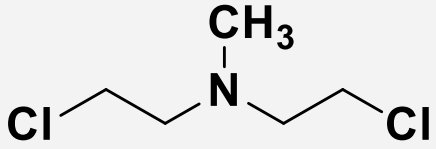
Schedule 1 (CAS registry number)

A. Toxic chemicals:

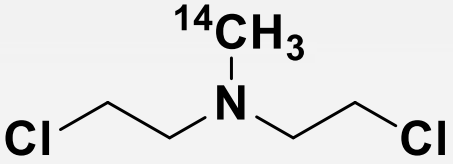
(6) Nitrogen mustards:

Is it still Schedule 1?

HN1: Bis(2-chloroethyl)ethylamine	(538-07-8)
HN2: Bis(2-chloroethyl)methylamine	(51-75-2)
HN3: Tris(2-chloroethyl)amine	(555-77-1)



Bis(2-chloroethyl)methylamine

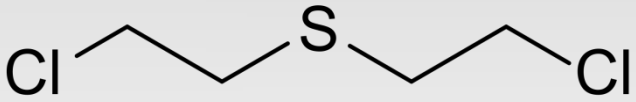


Bis(2-chloroethyl)methyl-[14C]-amine

No Assigned CAS Registry Number

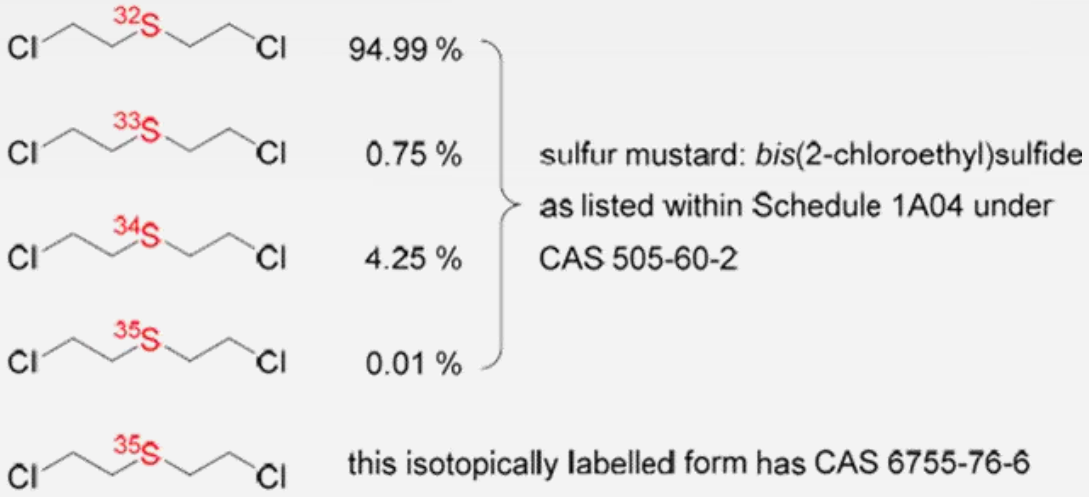
Natural Abundance of Stable Isotopes

Mustard gas: Bis(2-chloroethyl)sulfide (505-60-2)

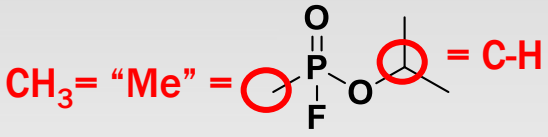


No isotopes indicated

for practical purposes, we assume a sample indicated by this structure contains all isotopes of each element in their natural abundance

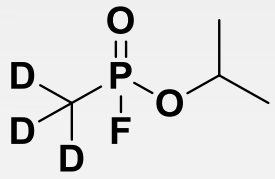


What Schedule Is It?



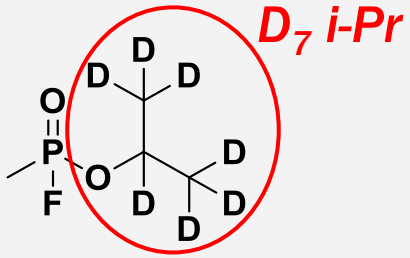
Isopropyl methylphosphonofluoridate

Schedule 1		(CAS registry number)
A.	Toxic chemicals:	
(1)	O-Alkyl (≤C_{10}, incl. cycloalkyl) alkyl (Me, Et, n-Pr or i-Pr)-phosphonofluoridates	
	e.g. Sarin: O-Isopropyl methylphosphonofluoridate	(107-44-8)
	Soman: O-Pinacolyl methylphosphonofluoridate	(96-64-0)



Isopropyl methyl-d3-phosphonofluoridate

If CD_3 is considered "not Me", this is unscheduled



Isopropyl-d7 methylphosphonofluoridate

Schedule 2

B. Precursors:

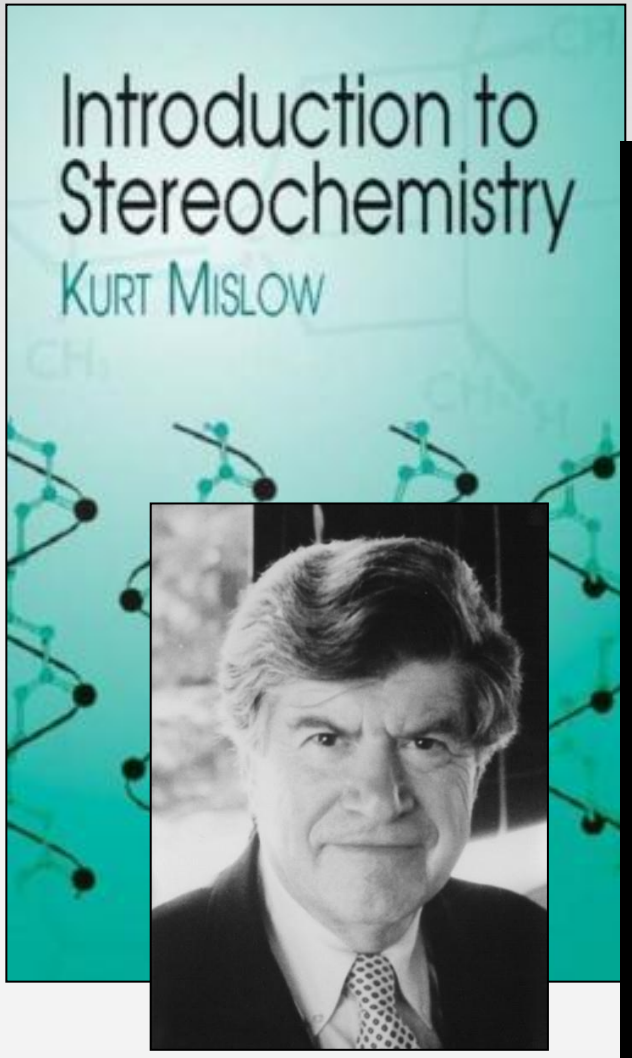
Schedule 1A(1) or 2B(4)

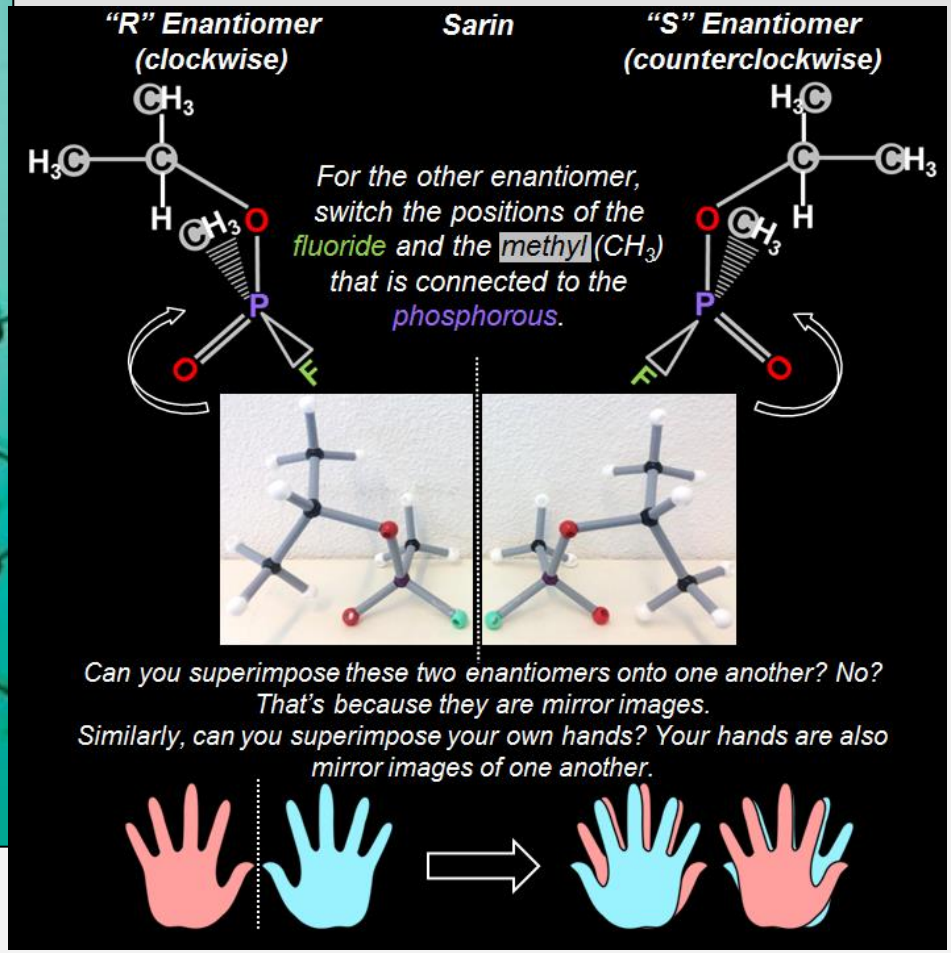
(4) Chemicals, except for those listed in Schedule 1, containing a phosphorus atom to which is bonded one methyl, ethyl or propyl (normal or iso) group but not further carbon atoms,

e.g. Methylphosphonyl dichloride (676-97-1)
Dimethyl methylphosphonate (756-79-6)

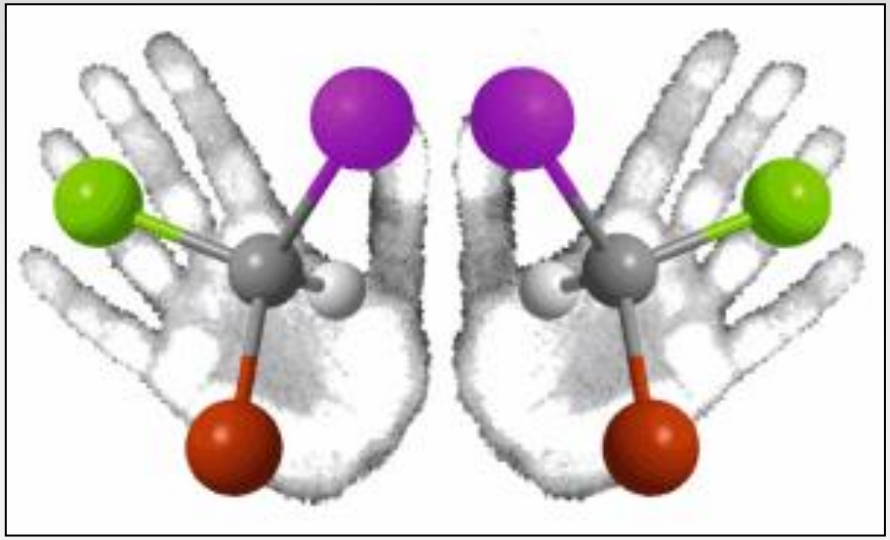
Exemption: Fonofos: O-Ethyl S-phenyl ethylphosphonothiolothionate (944-22-9)

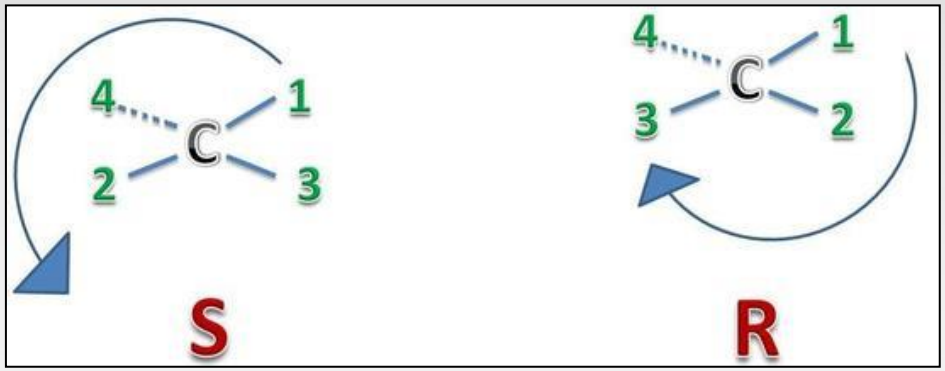
Part 3: Stereoisomers





Three Dimensional Molecular Structure





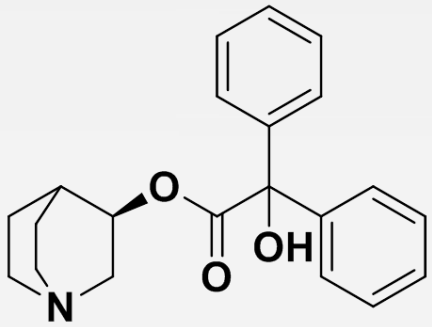
- **Enantiomers:**
  - "Mirror image" chemical structures
  - Atom with 4 different substituents = "Chiral Center"
  - Chemical properties are the same for each enantiomer
  - Enantiomers are designated "R" and "S"

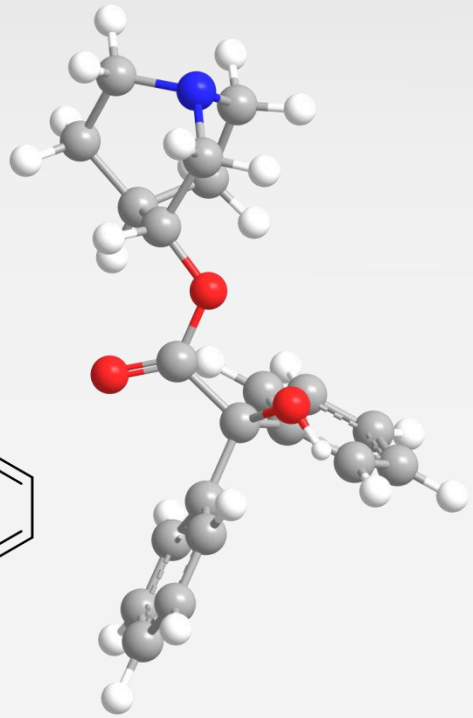
CAS Registry Numbers and Stereoisomers

Schedule 2

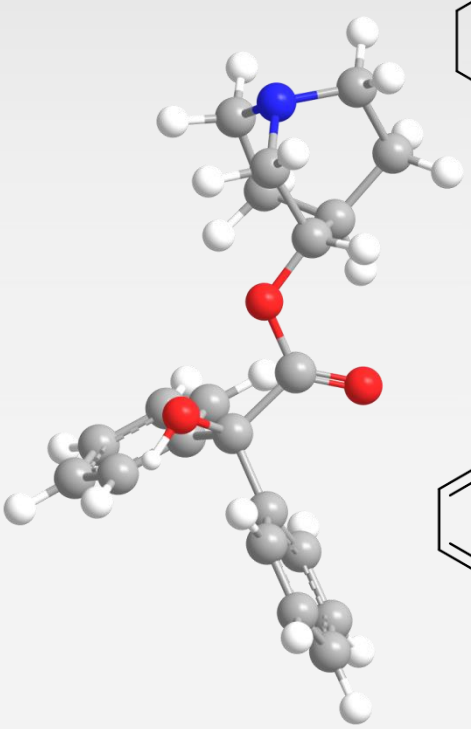
A. Toxic chemicals:

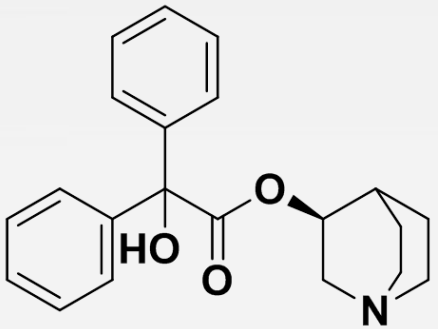
(3) BZ: 3-Quinuclidinyl benzilate (*) (6581-06-2)





(*R*)-3-Quinuclidinyl benzilate
CAS Number 62869-69-6



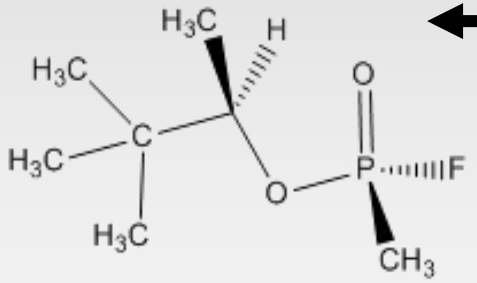


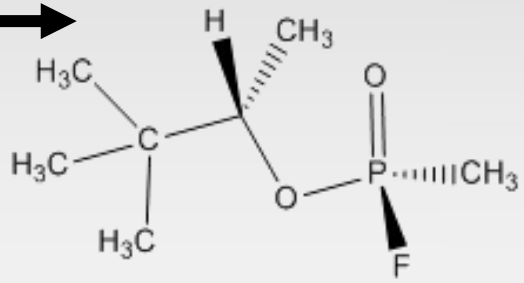
(*S*)-3-Quinuclidinyl benzilate
CAS Number 62869-68-5

What if There is More than One Chiral Center?

Enantiomers

C(*R*)P(*R*)
LD_{50} > 5000 µg/kg





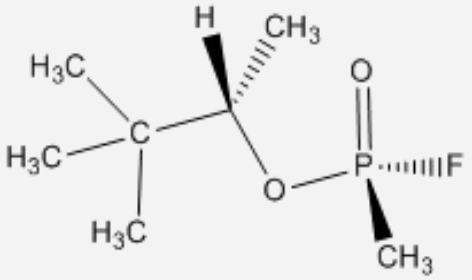
C(*S*)P(*S*)
LD_{50} 38 µg/kg

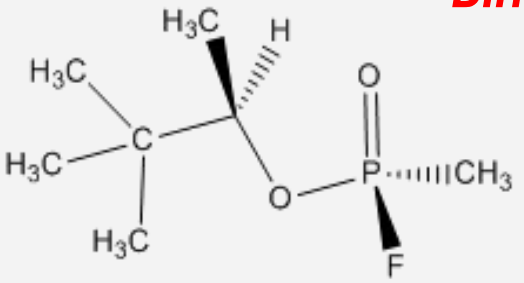
Not Enantiomers

Not Enantiomers

Diastereomers
Different Properties!

C(*S*)P(*R*)
LD_{50} > 2000 µg/kg

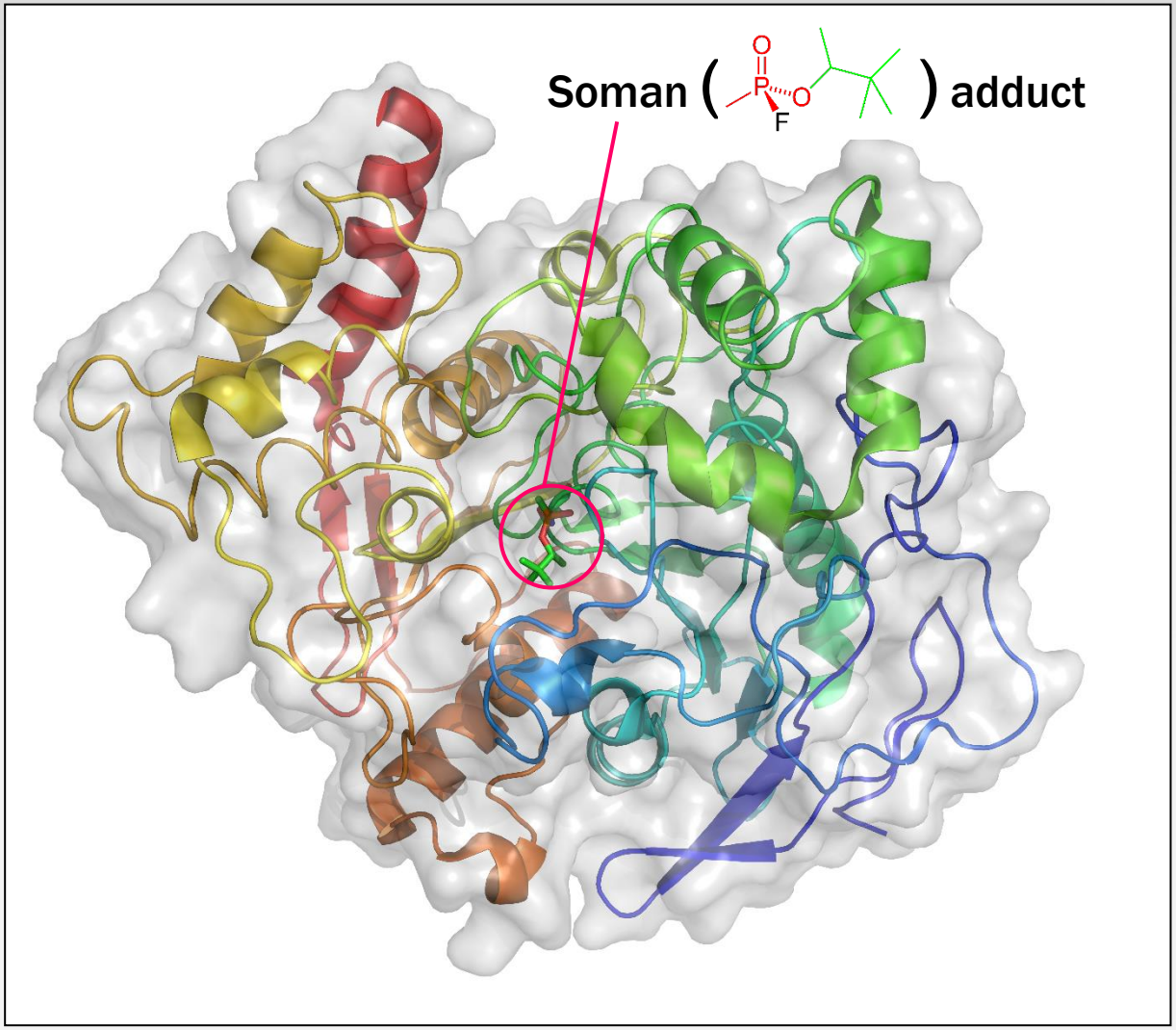




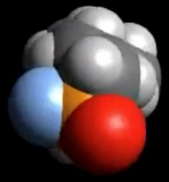
C(*R*)P(*S*)
LD_{50} 99 µg/kg

Enantiomers

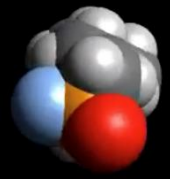
Stereochemistry and Life Processes



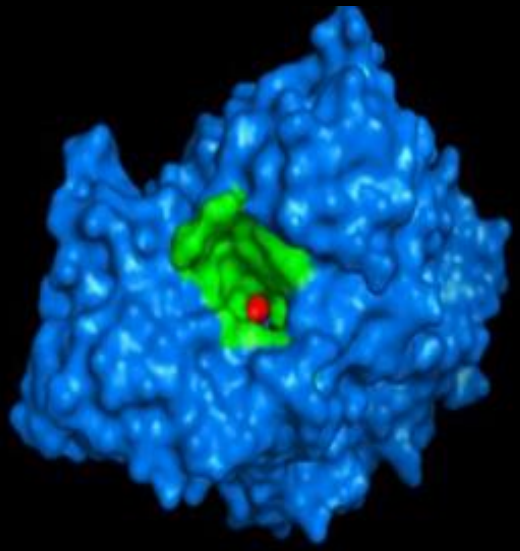
Stereochemistry and Life Processes



C(*R*)P(*R*)
LD_{50} > 5000 μg/kg

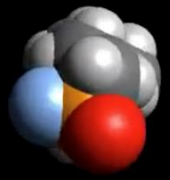


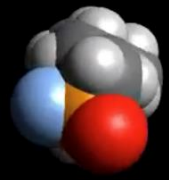
C(*R*)P(*S*)
LD_{50} 99 μg/kg



C(*S*)P(*R*)
LD_{50} > 2000 μg/kg

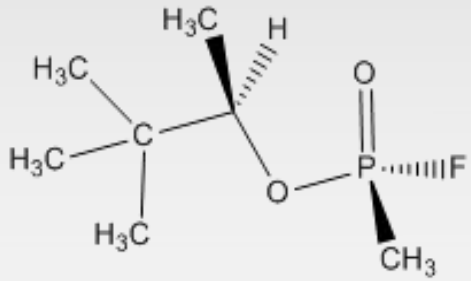
C(*S*)P(*S*)
LD_{50} 38 μg/kg



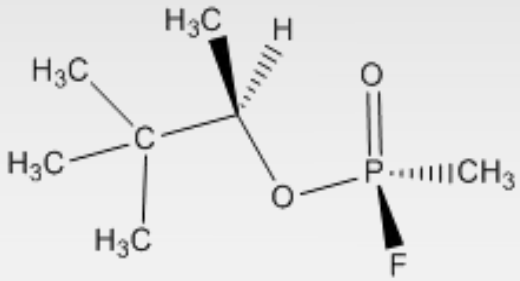


Less Toxic Forms of Soman?

C(*R*)P(*R*)
LD_{50} > 5000 mg/kg

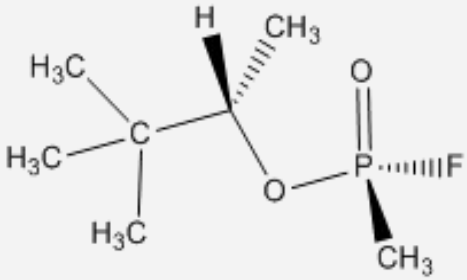


C(*R*)P(*S*)
LD_{50} 99 mg/kg

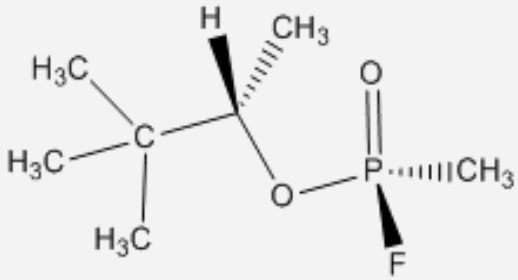


H_2O ⇌

C(*S*)P(*R*)
LD_{50} > 2000 mg/kg



C(*S*)P(*S*)
LD_{50} 38 mg/kg



H_2O ⇌

Enantiomers

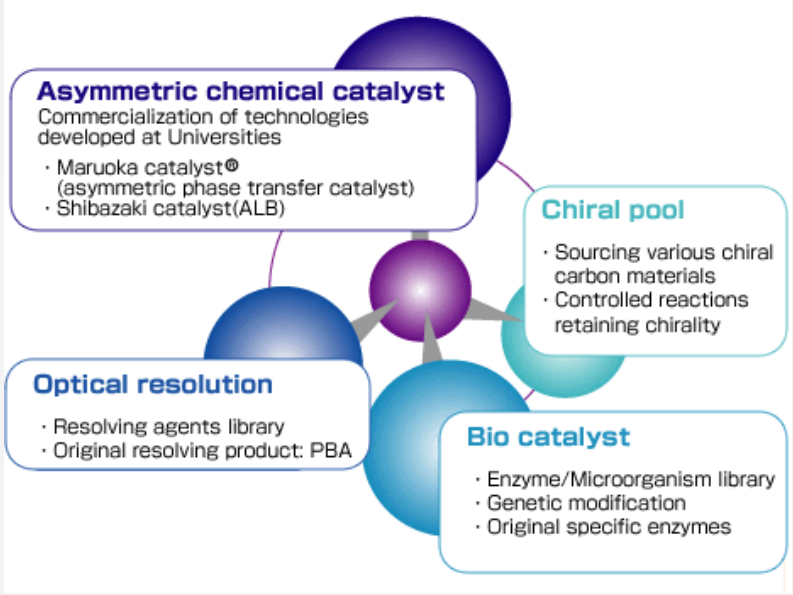
Things to Know About Stereoisomers

- **Not all stereoisomers will interconvert**
- **Under "Achiral" Conditions**
  - Chemical synthesis produces racemic mixtures
  - Chemical analysis does not distinguish between enantiomers

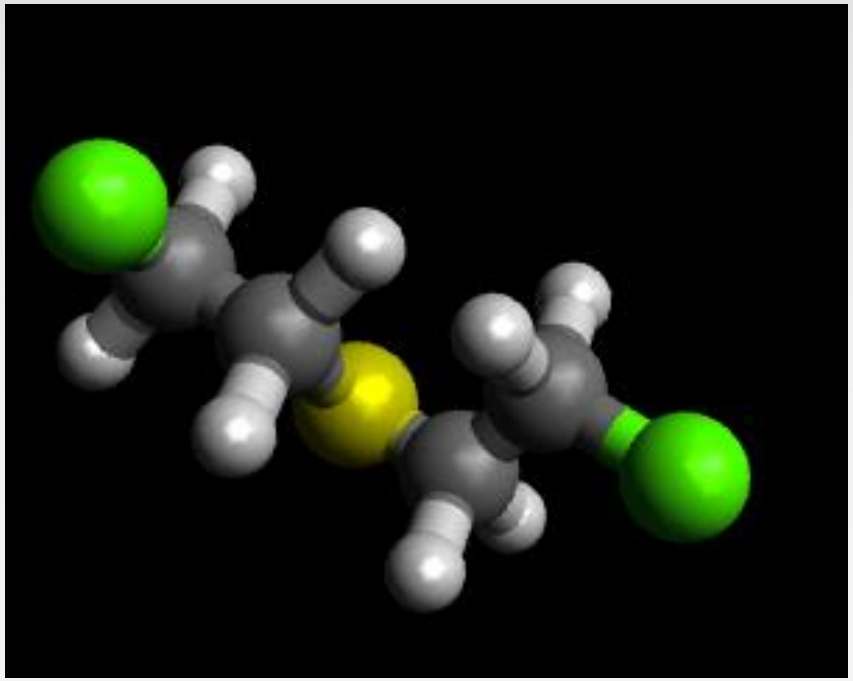
Presence of one might indicate presence of the other

- **Preparation and isolation of enantiomers**
  - Chiral synthesis conditions
  - Biomediated processes
  - Chiral separation conditions

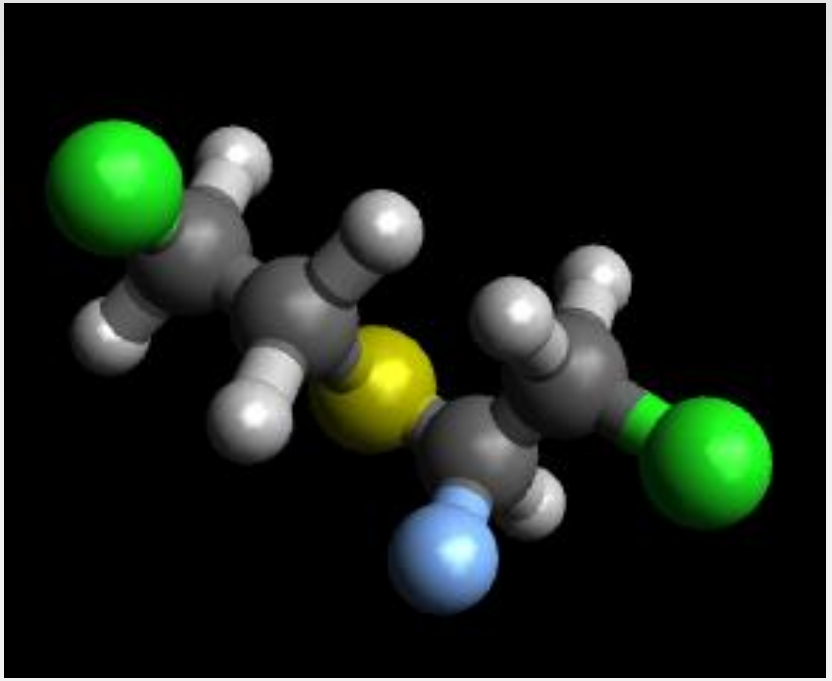
Sampling and analysis is possible with appropriate methods and equipment



Isotopic Labelling and Stereoisomers
(That's right, they are not unrelated!)



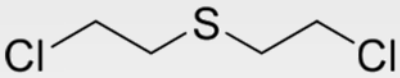
Sulfur Mustard



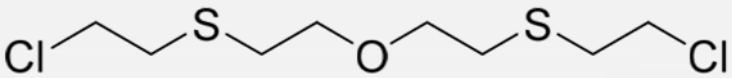
Replace "H" with "D" on Carbon 2

R or S?

Some Additional Complications: Mixtures!

HD 

Schedule 1A04 CAS 505-60-2

T 

Schedule 1A04 CAS 63918-89-8

sulfur mustard 60%

O-mustard 40%

"HT"

mixture has

CAS 172672-28-5

This CAS number is not in the Schedules

RESPONSE TO THE DIRECTOR-GENERAL'S REQUEST TO THE SCIENTIFIC ADVISORY BOARD TO PROVIDE FURTHER ADVICE ON SCHEDULED CHEMICALS

1. RECCOMENDATIONS

1.1 The Scientific Advisory Board (SAB) has considered isotopically labelled scheduled chemicals and stereoisomers of scheduled compounds relating to the Convention according to the Director-General's requests (see Appendixes 1 and 2).

1.2 **Recommendation 1**. The SAB recommends that the molecular parent structure of a chemical should determine whether it is covered by a schedule entry. This is because:

(a) it is inappropriate to rely solely upon Chemical Abstracts Service (CAS) numbers to define chemicals covered by the schedules. Although relevant as aids to declaration and verification, CAS numbers should not be used as the means to identify a chemical, or to determine whether a chemical is included in, or excluded from, a schedule;

(b) thus, if a chemical is included within a schedule, then all possible isotopically-labelled forms and stereoisomers of that chemical should be included, irrespective of whether or not they have been assigned a CAS number or have CAS numbers different to those shown in the Annex on Chemicals to the Convention. The isotopically labelled compound or stereoisomer related to the parent chemical specified in the schedule should be interpreted as belonging to the same schedule; and

(c) this advice is consistent with previous SAB views on this topic.[1]

1.3 **Recommendation 2.** Inclusion of appropriate analytical data in the OPCW Central Agent Database (OCAD) for isotopically labelled relatives of scheduled compounds where available is recommended.

---

1 RG-2/DG.1, dated 28 February 2008, in paragraph 3.5 of its Annex.

How Does This Report Relate to the CWC?

- Each State Party shall adopt the necessary measures to ensure that toxic chemicals and their precursors are only developed, produced, otherwise acquired, retained, transferred, or used within its territory or in any other place under its jurisdiction or control for purposes not prohibited under this Convention. To this end, and in order to verify that activities are in accordance with obligations under this Convention, **each State Party shall subject toxic chemicals and their precursors listed in Schedules 1, 2 and 3 of the Annex on Chemicals, facilities related to such chemicals, and other facilities as specified in the Verification Annex**, that are located on its territory or in any other place under its jurisdiction or control, **to verification measures as provided in the Verification Annex**

CWC Article VI, paragraph 2

Meeting Obligations

- To meet these obligations, and to ensure complete and accurate declarations by CWC States Parties to the OPCW, **chemicals that fall under Schedules 1, 2, and 3 of the Convention must be clearly identifiable**

  Parts VI, VII and VIII to the Convention's Annex on Implementation and Verification set out the relevant requirements

Consistent with Previous Advice from the SAB

- One issue that the SAB noted in the context of its previous recommendations on salts is the role of the Chemical Abstracts Service (CAS) Registry Numbers indicated in the schedules of chemicals. The SAB has come to the view that, while the CAS Registry Numbers are a useful aid to identification, they were intended as specific identifiers of scheduled chemicals. There appears to be a question among States Parties about whether these numbers have a regulatory value. The SAB would like to caution against such a view, because **there is not necessarily a one-to-one relationship between CAS Registry Numbers and chemical structures**. While these numbers are useful in the identification of chemical compounds, this usefulness should not lead to the assumption that they should have any regulatory power within the context of the Convention. At the same time, **it could be helpful if the OPCW Declaration Handbook were to provide references to the various CAS numbers that are related to an entry in the schedules (for example, for different isomers of a scheduled chemical and for mixtures containing a scheduled chemical)**.

RC-2/DG.1, dated 28 February 2008, in paragraph 3.5 of the Annex

Declarations Handbook does provide references and examples as suggested

Handbook on Chemicals

Chemical name: Cyclohexyl methyl-d3-phosphonofluoridate

Schedule: 1A01

CAS RN: HS code: 2845.90

Key: (108-93-0)-M1A1(D3)

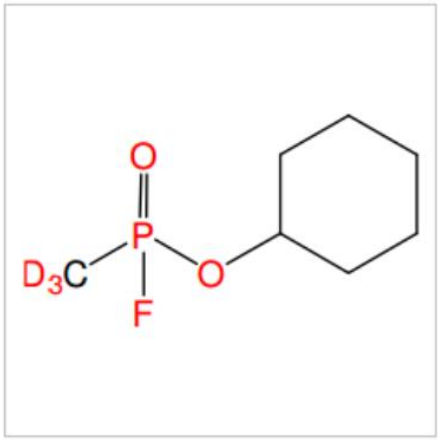
Molecular formula: $C_7H_{11}D_3FO_2P$

CAS Index Name: Phosphonofluoridic acid, methyl-d3-, cyclohexyl ester

IUPAC name: Cyclohexyl methyl-d3-phosphonofluoridoate

Synonyms: O-Cyclohexyl trideuteriomethylphosphonofluoridate

O-Cyclohexyl methyl-d3-phosphonofluoridate



https://www.opcw.org/our-work/non-proliferation/declarations-adviser/handbook-on-chemicals/

Moving Forward

- Encourage sharing of this SAB advice with National Authorities
- Continue current practices in regard to declarations handbook and OCAD

More to Come on Isotopes and Chemical Weapons

SAB Workshop #1: Chemical Forensics 20 – 22 June 2016, Helsinki, Finland (report forthcoming)