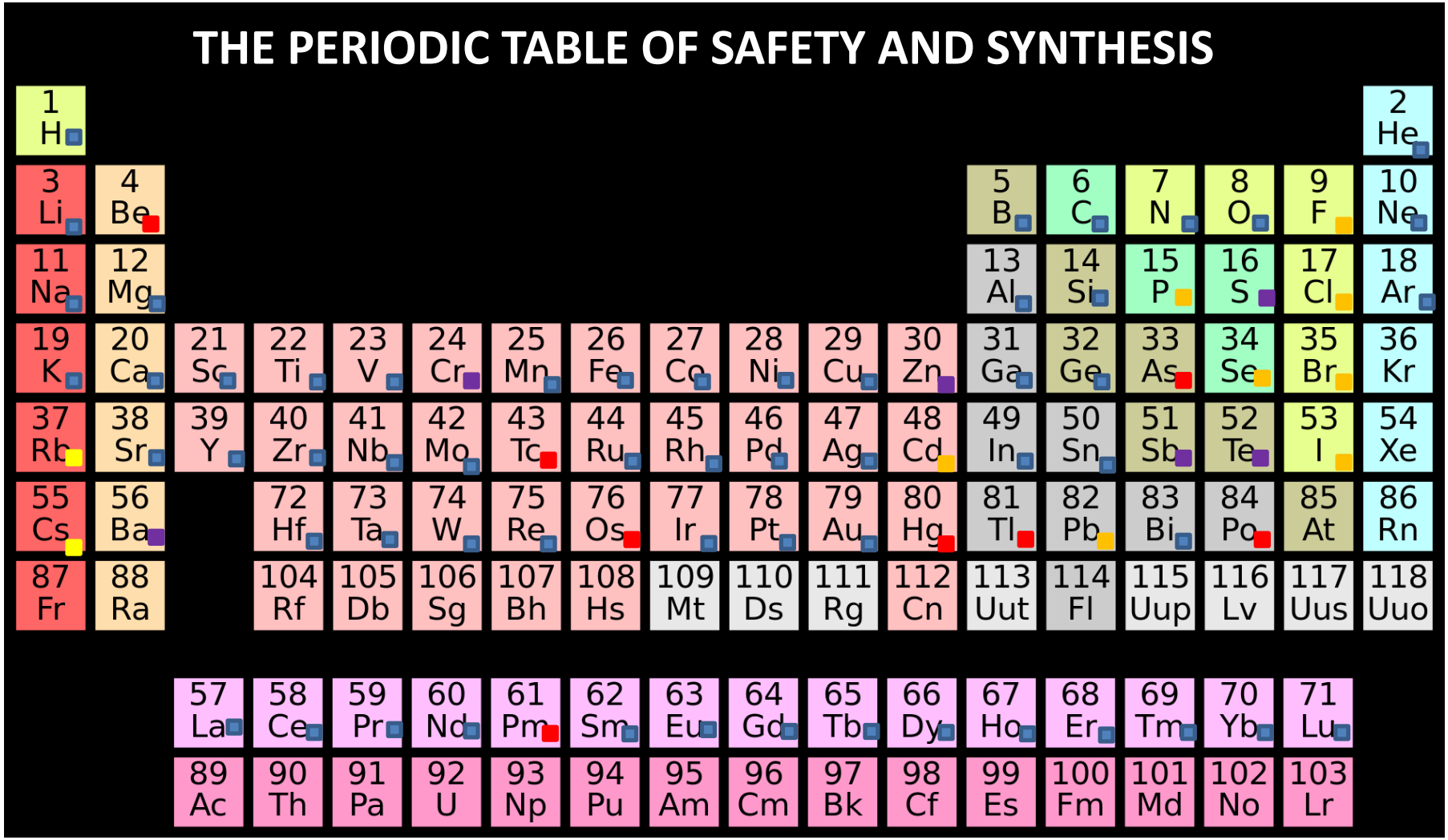
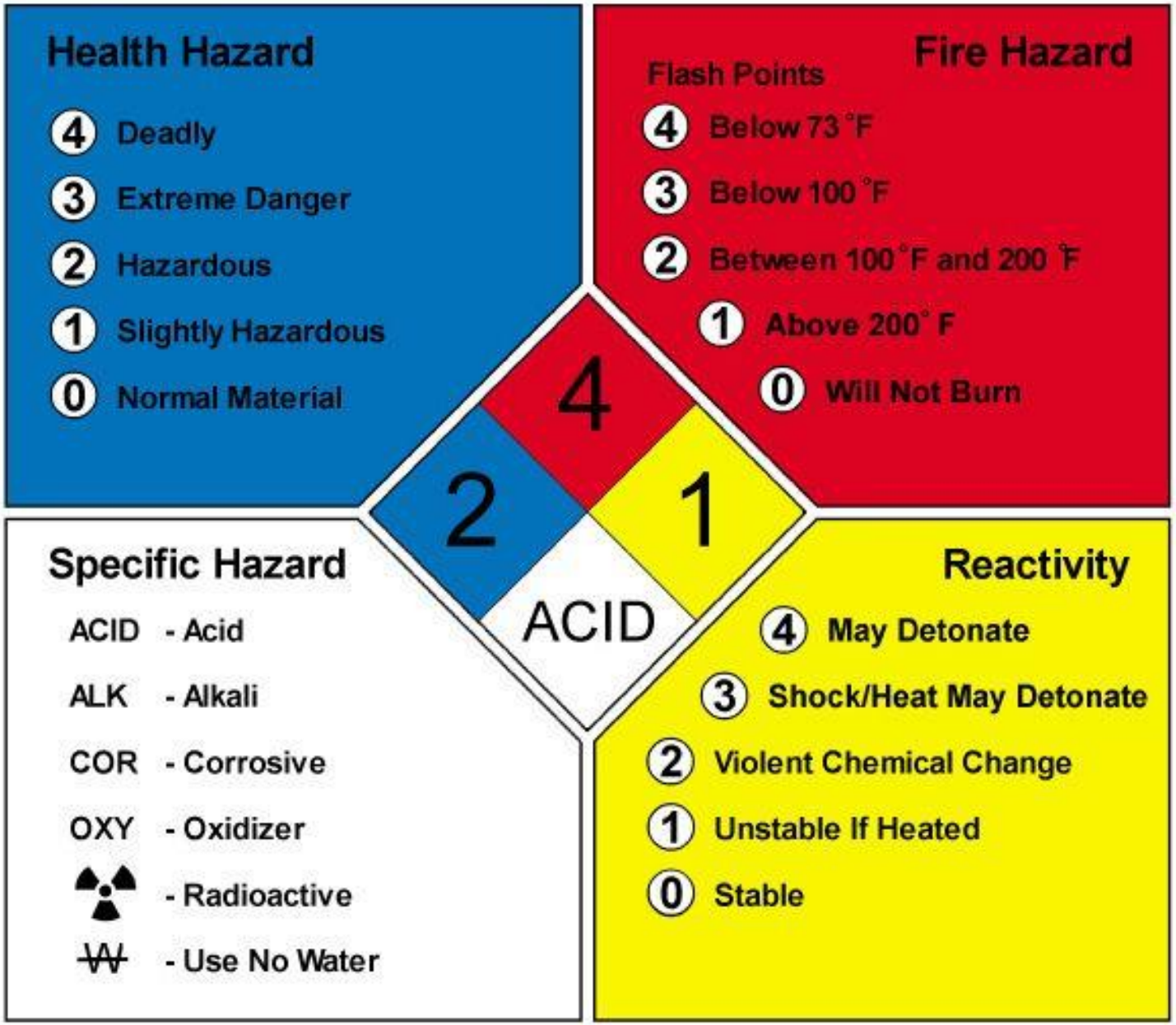
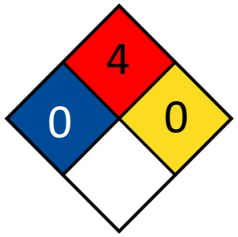
THE PERIODIC TABLE OF SAFETY AND SYNTHESIS



- DON'T
- Extreme caution
- Special handling or other considerations
- No hazards

*Note: All chemicals in powder form are irritating to respiratory system. Some metals may be more flammable in powder form too.

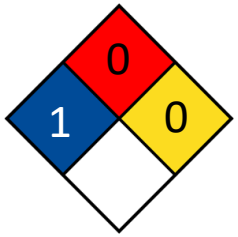

Health Hazard
4 Deadly
3 Extreme Danger
2 Hazardous
1 Slightly Hazardous
0 Normal Material
Fire Hazard
Flash Points
4 Below 73 °F
3 Below 100 °F
2 Between 100 °F and 200 °F
1 Above 200° F
0 Will Not Burn
4
2
1
ACID
Specific Hazard
ACID - Acid
ALK - Alkali
COR - Corrosive
OXY - Oxidizer
- Radioactive
- Use No Water
Reactivity
4 May Detonate
3 Shock/Heat May Detonate
2 Violent Chemical Change
1 Unstable If Heated
0 Stable



H

BACK

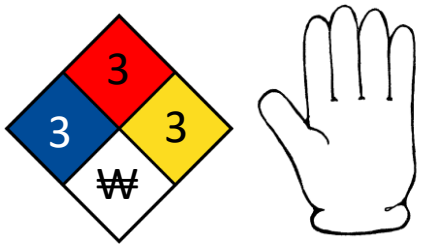
- Think: Hindenburg



BACK

He

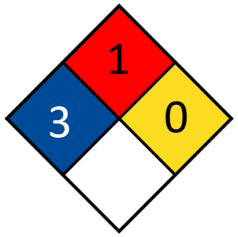
- Nature’s most precious resource. Do not waste.



Li

BACK

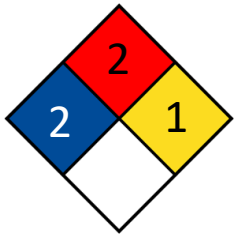
- Li(s) in glovebox – ignites in air
- LiF is hygroscopic
- Skin corrosive
- Incompatible with: water, acids, oxidizing agents



BACK

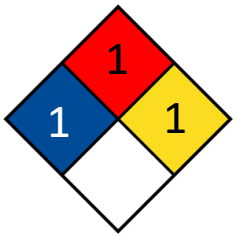
Be

- Stored in glove box
- Toxic if swallowed, fatal if inhaled
- Carcinogenic via inhalation
- Skin/eye/respiratory irritant
- Strong reducing agent
- Incompatible with acids



B

BACK



C

BACK

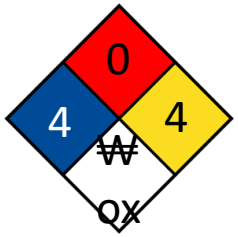
N

BACK

O

BACK

EXTREME CAUTION



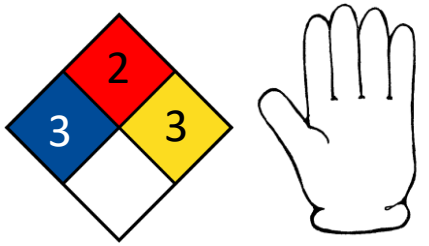
BACK

F

- Fluorides can be toxic
- Fluoride compounds can decompose to produce HF → very dangerous: corrosive, fatal

Ne

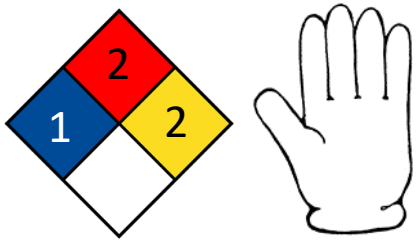
BACK



Na

BACK

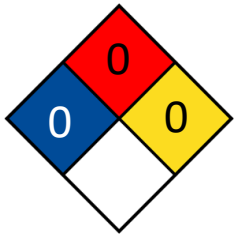
- Na in glovebox – ignites in contact with moisture
- Na_2CO_3 lives in the drying oven because it is hygroscopic
- NaF is hygroscopic
- Incompatible with water, air, acids, ox. agents



Mg

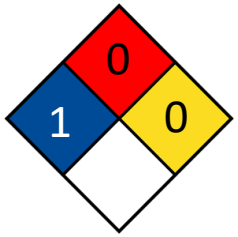
BACK

- MgO (s) should be dried before use
- Flammable solid, self-heating
- Incompatible with air, nitrogen, water



Al

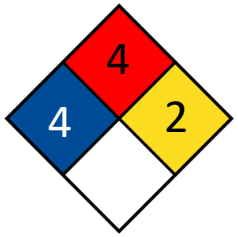
BACK



Si

BACK

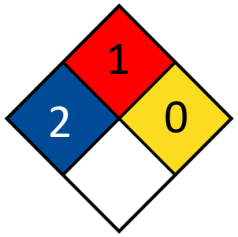
EXTREME CAUTION



BACK

P

- Use caution when heating
- Red phosphorus becomes white phosphorus (above 300 C) which is flammable and can react with moisture to create toxic phosphine gas (PH_3), cardiovascular & respiratory depression
- Do not put phosphorus tubes in furnace with other tubes in the event of tube explosion
- Use hearting rate < 1 C/min
- Open quartz tube in the fume hood
- Potential neurotoxin and gastrointestinal disturbances

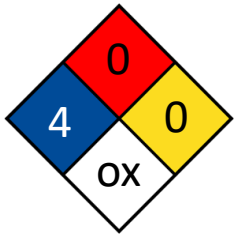


BACK

S

- Use caution when heating in sealed tubes
- Ramp very slowly (50 deg. Increments) until vapor in tube dissipates
- Tubes can often explode – do not put in furnace with other hazards
- Clean by sealing in quartz tube with carbon, heat to 800 C overnight (careful!)

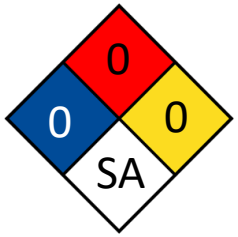
EXTREME CAUTION



BACK

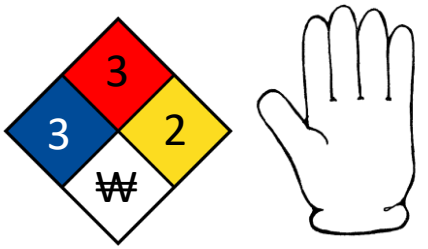
Cl

- Open chlorides in the fume hood
- Immediate reaction with water produces HCl
- Do not inhale



Ar

BACK



K

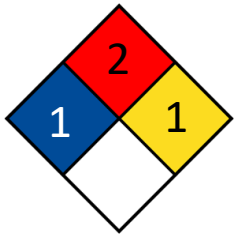
BACK

- K(s) stored in glovebox – ignites in contact with moisture
- K_2CO_3 lives in the drying oven because it absorbs moisture

BACK

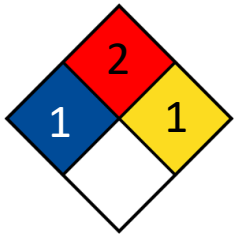
Ca

- $CaCO_3$ lives in the drying oven because it absorbs moisture
- CaO can be made by thermal decomposition of CaCO3. Should be stored in glovebox or desiccator



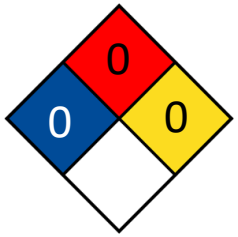
Sc

BACK



Ti

BACK



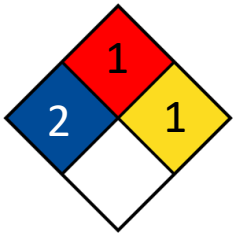
BACK

V

- V(s) is very reactive. Powder must be cleaned (5% HCl/H2O soak; decant and repeat until solution no longer blue; filter and dry in drying oven). Vanadium chunk can be cleaned by 5%HCl/water in a few minutes
- VO_2 is unstable
- V2O3 made from V2O5 by heating under Ar for a few nights
- V2O5 can be made by heating any oxide in air
- V2O5 is toxic, beware!
- V2O3 + V2O5 = VO2 . Heat at 600 C for a few nights

SPECIAL HANDLING OR OTHER CONSIDERATIONS

BACK



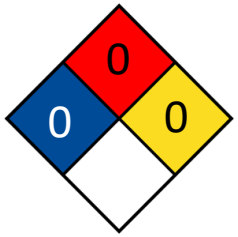
Cr

- Cr (s) is mildly toxic
- Chromates in solution are highly toxic
- Chromate dust can cause respiratory damage (chromic)

BACK

Mn

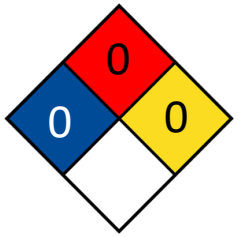
- Metal may need purification. Wrap in quartz wool and seal in quartz tube with broken glass pieces. Heat to 1000 C overnight.



BACK

Fe

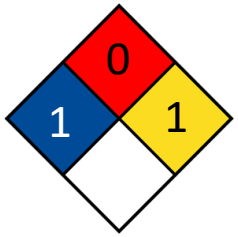
- Metal may need purification. Wrap in quartz wool and seal in quartz tube with broken glass pieces. Heat to 1000 C overnight.
- Incompatible with oxidizing agents



BACK

Co

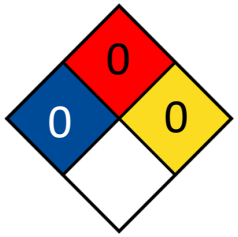
- CoF_2 is toxic
- Co chunk can be purified by arc-melting if needed
- May cause respiratory issue if inhaled
- Incompatible with acids



BACK

Ni

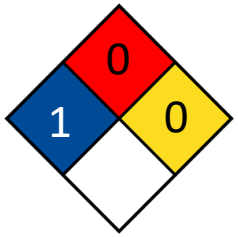
- Don’t trust high oxidation state oxides
- NiF_2 is toxic
- Nickel metal is carcinogenic, avoid inhalation



BACK

Cu

- Metal may need purification. Can tell by color of the metal. (Can’t tell by x-ray)
- Heat under 5%H2/95%Ar @ 350 C overnight

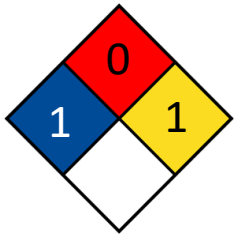


SPECIAL HANDLING OR OTHER CONSIDERATIONS

BACK

Zn

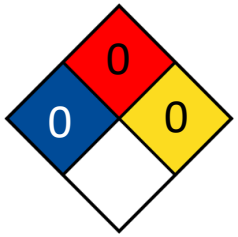
- Zn(s) is mildly toxic



BACK

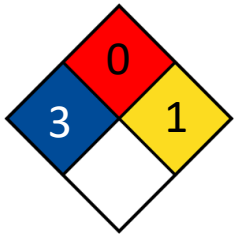
Ga

- Ga2O3 should be dried at 800 C before use



Ge

BACK



BACK

As

- Toxic if swallowed/inhaled
- Arsenic oxides are very toxic
- Acute poisoning includes gastrointestinal and neurological symptoms
- Carcinogenic

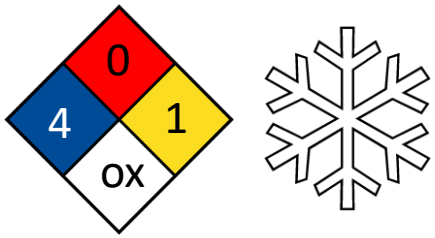
EXTREME CAUTION

BACK

Se

- Use extreme caution when sealing Se in tubes
- Heat slowly, let it stay at around 600 C and check the tube to make sure it is clear before heating further, high vapor pressure results in explosion
- Se vapor reacts in air to make H_2Se which is highly toxic
- Clean by sealing in quartz tube with carbon, heat to 800 C overnight (careful!), typically not required
- Toxic if swallowed/inhaled

EXTREME CAUTION



BACK

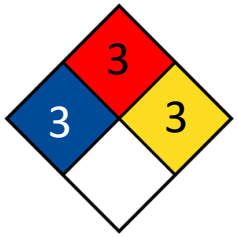
Br

- Br(l) is a very strong oxidizer
- Do not mix with organics, keep away from organic solvent like acetone
- Do not inhale vapor; handle in fume hood
- Stored in refrigerator
- Corrosive; skin burns and eye damage

Kr

BACK

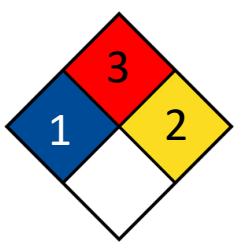
EXTREME CAUTION



BACK

Rb

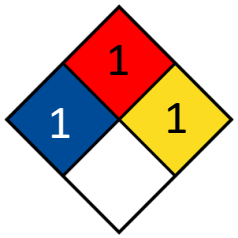
- Flammable on exposure to air
- Most explosive alkali on contact with water!



Sr

BACK

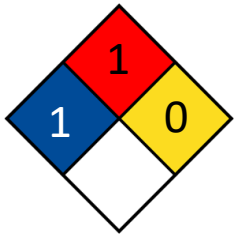
- Sr (s) in glovebox, reacts with moisture vigorously



Y

BACK

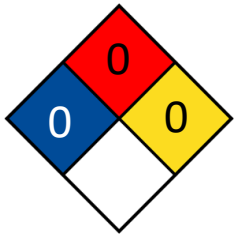
- Y_2O_3 should be dried (800 C) before use
- Clean by arc-melting
- Store in desiccator



BACK

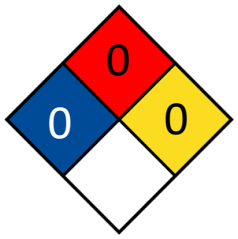
Zr

- Clean by putting in ethanol for a day, then move to drying oven. (ZrH2 and ZrH form on surface)
- Incompatible with oxidizing agents, air, moisture



Nb

BACK

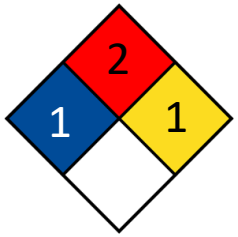


Mo

BACK

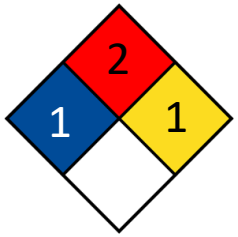
BACK

Tc



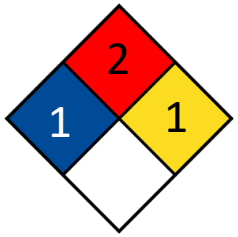
Ru

BACK



Rh

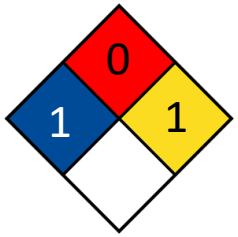
BACK



BACK

Pd

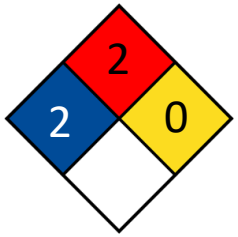
- PdO should be dried at 800 C overnight
- Flammable solid
- Incompatible with oxidizing agents



Ag

BACK

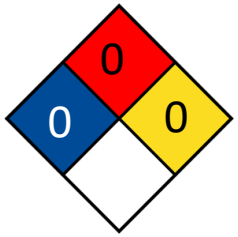
- Powder goes to glove box



BACK

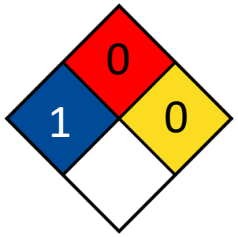
Cd

- Use extreme caution when handling Cd
- Must be cleared with Fazel
- Fatal if inhaled
- Suspected carcinogen via oral exposure
- Do not allow even small amounts into water systems



In

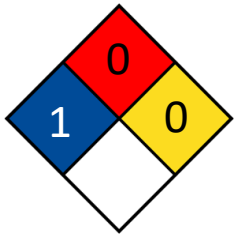
BACK



Sn

BACK

SPECIAL HANDLING OR OTHER CONSIDERATIONS

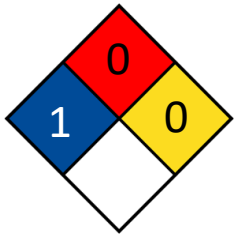


BACK

Sb

- To purify, seal in quartz tube with carbon and heat to 800 c overnight
- Sb powder better in the glove box

SPECIAL HANDLING OR OTHER CONSIDERATIONS



BACK

Te

- Use caution when sealing Te in tubes due to vapor pressure
- Te (s) is mildly toxic
- Clean by sealing in quartz tube with carbon, heat to 800 C overnight (careful!)

EXTREME CAUTION

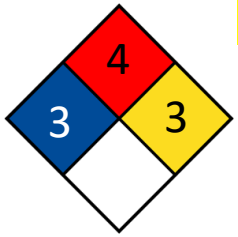
BACK

I

- Use caution when handling
- High vapor pressure, heat slowly , 1 C/min
- Use ice/water when sealing quartz tube for vapor transport
- Highly volatile

Xe

BACK

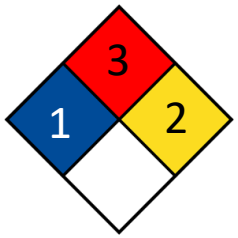


EXTREME CAUTION

BACK

Cs

- Bursts into flame on contact with air

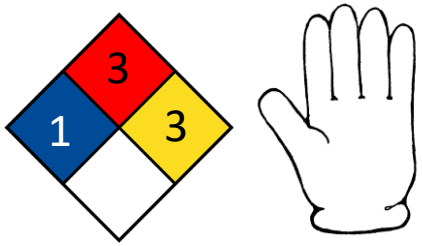


SPECIAL HANDLING OR OTHER CONSIDERATIONS

BACK

Ba

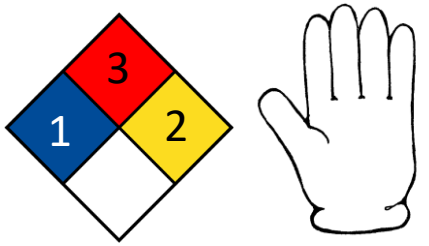
- Mildly toxic
- Ba in glovebox



La

BACK

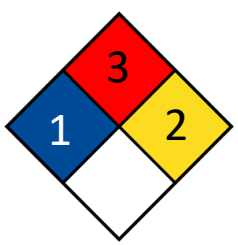
- Oxide should be dried (800 C) before use
- Metal rapidly oxidizes (< 10 min) outside of glovebox
- Purify metal by arc-melting and sanding
- Shave and make turnings for better reactions
- Incompatible with air, moisture, oxidizing agents, acids, acid chlorides, halogens



BACK

Ce

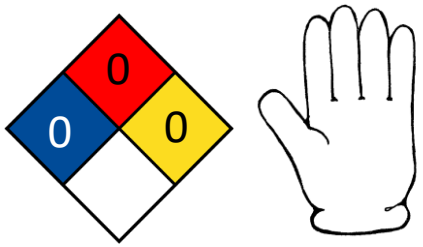
- Metal rapidly oxidizes (< 10 min) outside of glovebox
- Compounds with high Ce content will spark and can be flammable
- Oxide should be dried (800 C) before use
- Purify metal by arc-melting and sanding
- Wait after arc-melting, sparks if too hot
- Sparks when hammered



Pr

BACK

- Metal rapidly oxidizes (< 10 min) outside of glovebox
- Oxide should be dried (800 C) before use
- Purify metal by arc-melting and sanding



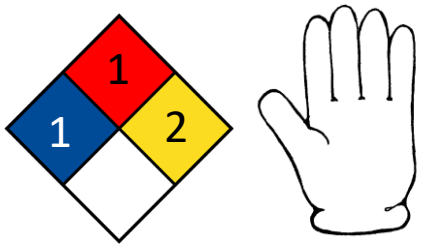
Nd

BACK

- Metal rapidly oxidizes (< 10 min) outside of glovebox
- Oxide should be dried (800 C) before use
- Purify metal by arc-melting and sanding

BACK

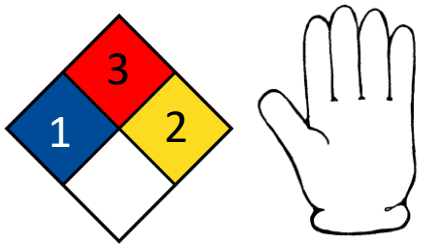
Pm



Sm

BACK

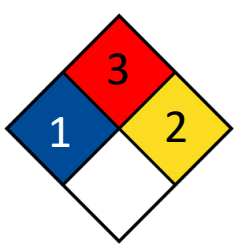
- Metal rapidly oxidizes (< 10 min) outside of glovebox
- Oxide should be dried (800 C) before use
- Purify metal by arc-melting and sanding
- Gradually evaporates during arc-melting
- Incompatible with acids, air, water, ox. agents



BACK

Eu

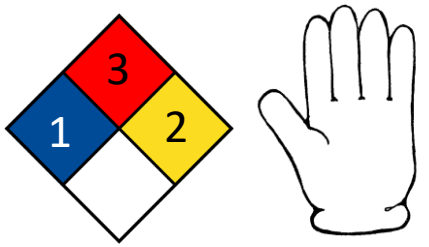
- Metal rapidly oxidizes (< 10 sec) outside of glovebox
- Oxide should be dried (800 C) before use
- Purify metal by arc-melting and sanding
- Gradually evaporates during arc-melting
- Incompatible with acids, air, oxidizing agents, halogens, acid chlorides, moisture



Gd

BACK

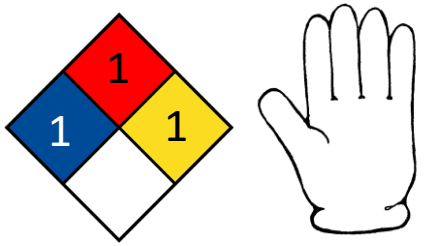
- Metal rapidly oxidizes (< 10 min) outside of glovebox
- Oxide should be dried (800 C) before use
- Purify metal by arc-melting and sanding



Tb

BACK

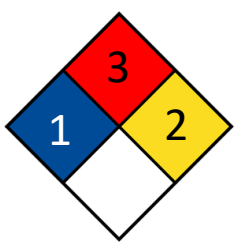
- Metal rapidly oxidizes (< 10 min) outside of glovebox
- Oxide should be dried (800 C) before use
- Purify metal by arc-melting and sanding
- Gradually evaporates during arc-melting
- incompatible with oxidizing agents, moisture



Dy

BACK

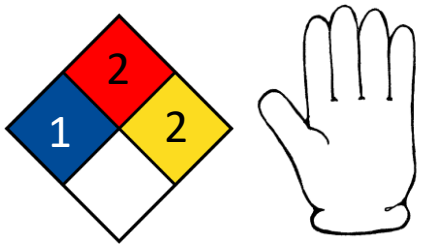
- Metal rapidly oxidizes (< 10 min) outside of glovebox
- Oxide should be dried (800 C) before use
- Purify metal by arc-melting and sanding



Ho

BACK

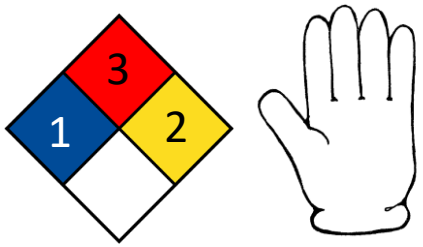
- Metal rapidly oxidizes (< 10 min) outside of glovebox
- Oxide should be dried (800 C) before use
- Purify metal by arc-melting and sanding
- Gradually evaporates during arc-melting
- Incompatible with oxidizing agents, moisture



Er

BACK

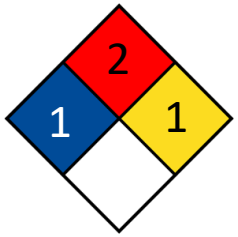
- Metal rapidly oxidizes (< 10 min) outside of glovebox
- Oxide should be dried (800 C) before use
- Purify metal by arc-melting and sanding
- Gradually evaporates during arc-melting
- Incompatible with acids, oxidizing agents, moisture



Tm

BACK

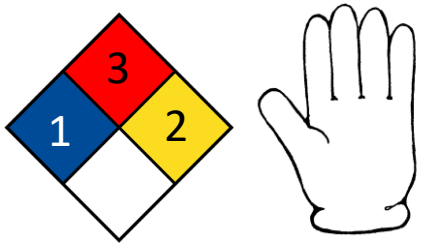
- Metal rapidly oxidizes (< 10 min) outside of glovebox
- Oxide should be dried (800 C) before use
- Purify metal by arc-melting and sanding
- Gradually evaporates during arc-melting
- Incompatible with oxidizing agents, water/moisture



BACK

Yb

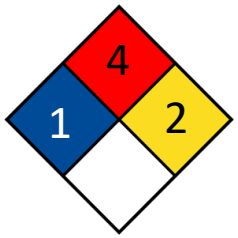
- Oxide should be dried (800 C) before use
- Purify metal by arc-melting and sanding
- Gradually evaporates during arc-melting
- Powder in the glovebox



Lu

BACK

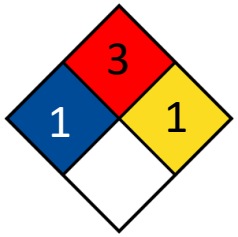
- Metal rapidly oxidizes (< 5 min) outside of glovebox
- Oxide should be dried (800 C) before use
- Purify metal by arc-melting and sanding
- incompatible with oxidizing agents, moisture



Hf

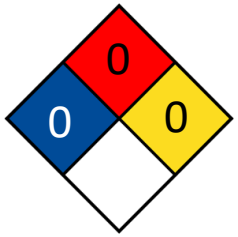
BACK

- Powder oxidizes slowly, keep in glovebox



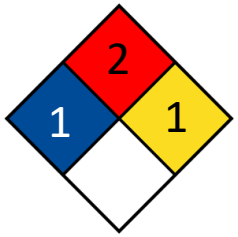
Ta

BACK



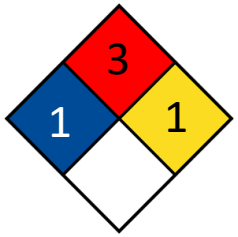
W

BACK



Re

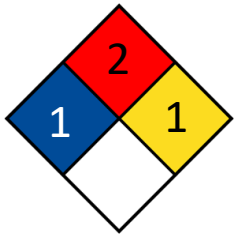
BACK



BACK

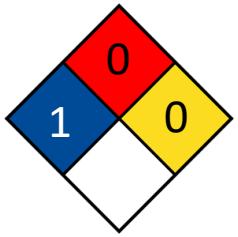
Os

- OsO_4 is incredibly toxic; severe skin and eye burns, respiratory damage



Ir

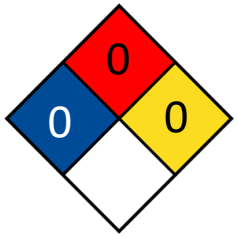
BACK



BACK

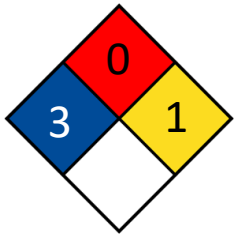
Pt

- PtO is unstable and should not be trusted
- PtO2 should be dried at 550 C under flowing oxygen
- Incompatible with organics



Au

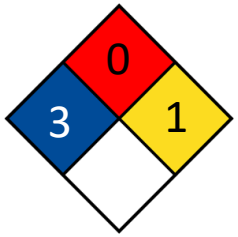
BACK



BACK

Hg

- Damage to central nervous system through prolonged/repeated exposure



BACK

Tl

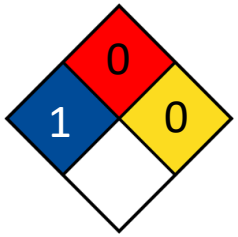
- Readily absorbed through skin
- Main symptoms of poisoning are peripheral neuropathy and hair loss, can include gastrointestinal effects
- Suspected carcinogen
- All thallium compounds, especially oxides, are highly toxic

EXTREME CAUTION

BACK

Pb

- PbO and PbO_2 are both toxic
- Use caution when in contact with acid
- Pb chunk can be cleaned in 5% HCl in water for a few minutes. USE CAUTION. Oxidizes after a few days
- Damage to reproductive, brain, blood, and endocrine systems via inhalation and oral exposure
- Do not allow even small amounts into water systems
- Incompatible with oxidizing agents



Bi

- Bi metal should be purified prior to use
- Seal in quartz tube with carbon and heat to 800 C overnight

BACK

Po