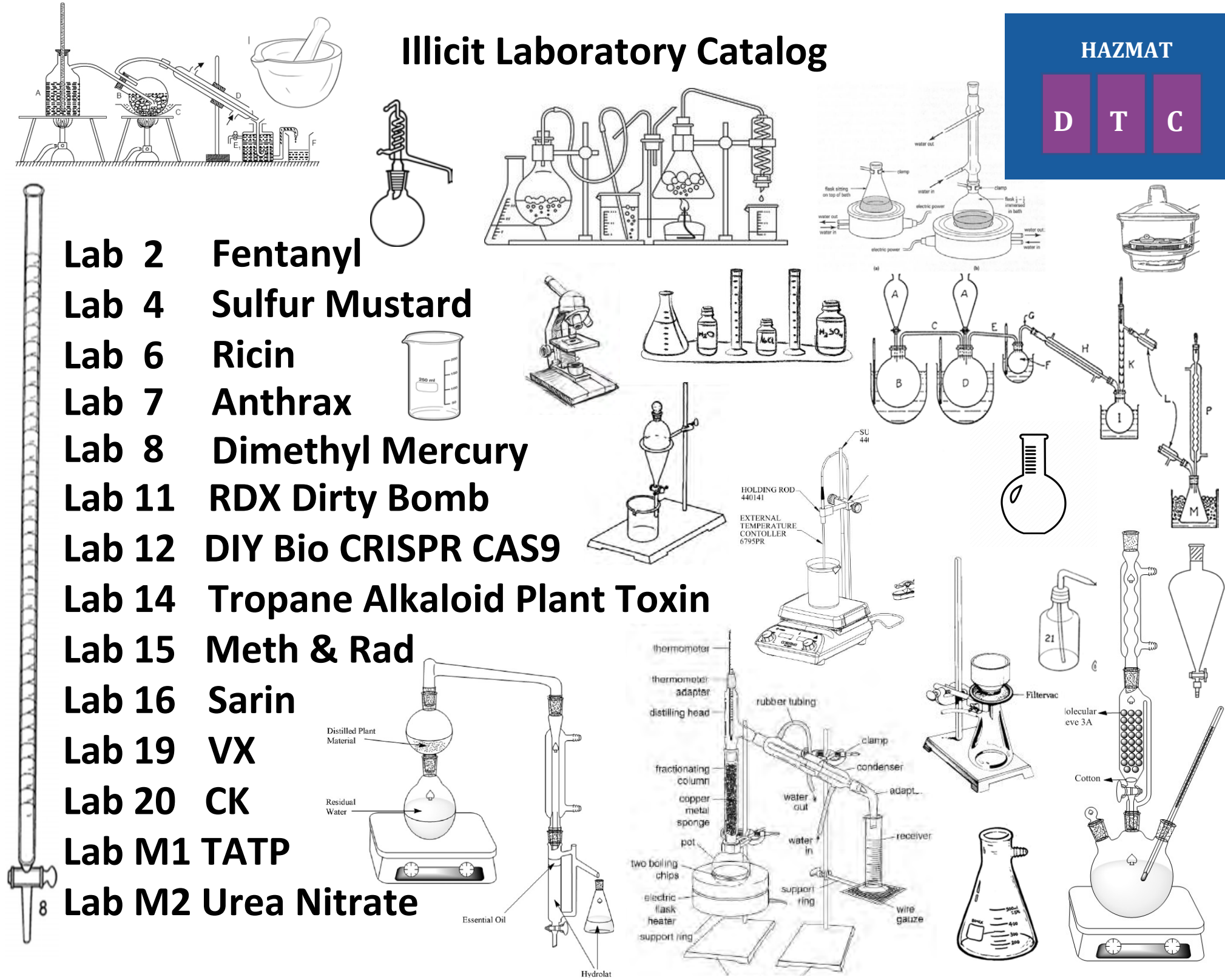


Illicit Laboratory Catalog

HAZMAT

D T C

- Lab 2 Fentanyl
- Lab 4 Sulfur Mustard
- Lab 6 Ricin
- Lab 7 Anthrax
- Lab 8 Dimethyl Mercury
- Lab 11 RDX Dirty Bomb
- Lab 12 DIY Bio CRISPR CAS9
- Lab 14 Tropane Alkaloid Plant Toxin
- Lab 15 Meth & Rad
- Lab 16 Sarin
- Lab 19 VX
- Lab 20 CK
- Lab M1 TATP
- Lab M2 Urea Nitrate



Illicit Laboratory Catalog

Lab 2 Fentanyl

Includes:



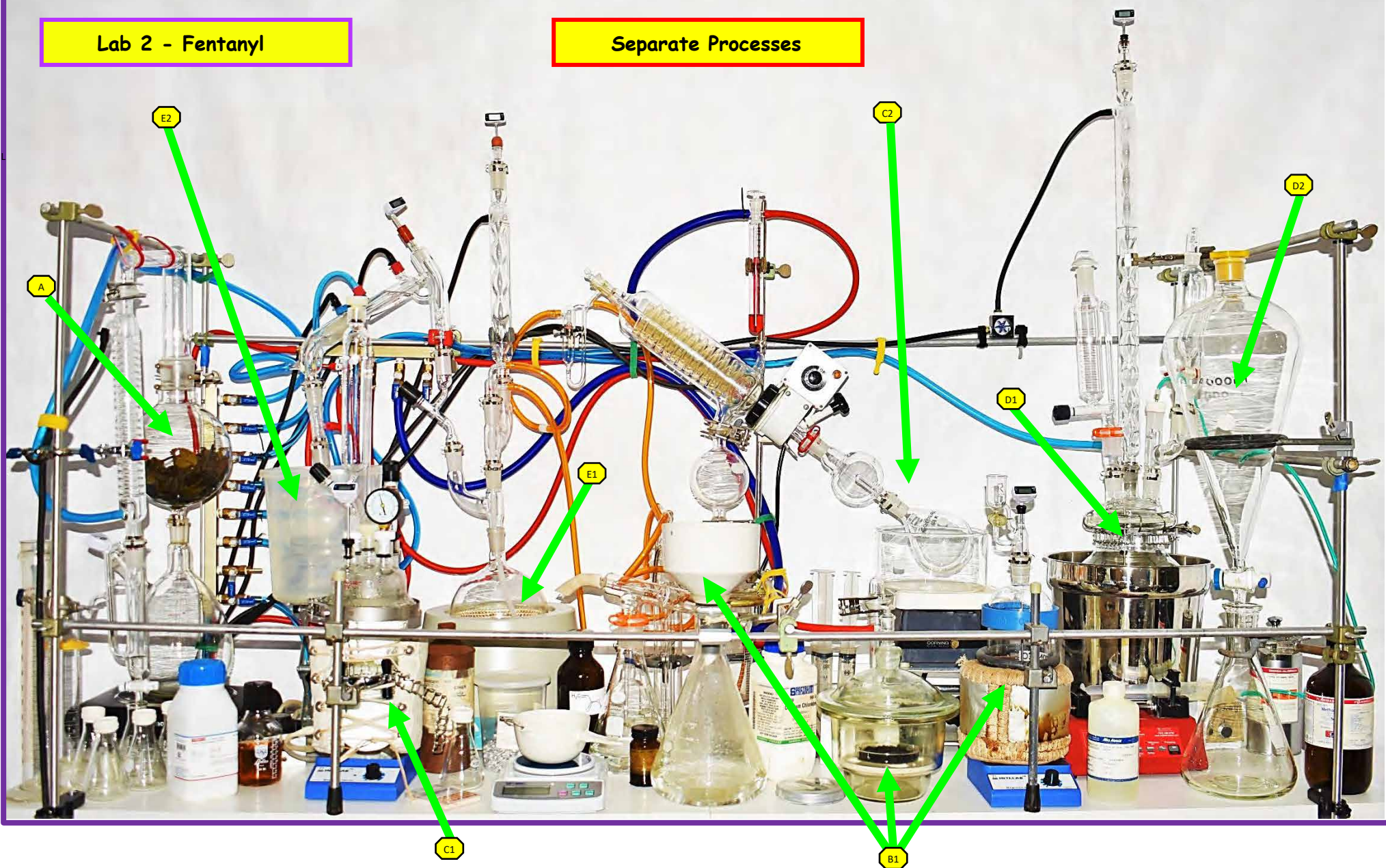
- The Fentanyl/Carfentanyl Lab starts with a steam extraction of plant material to obtain a needed precursor. A Palladium/Carbon catalyst is prepared in a 1Liter reaction vessel. The catalyst and precursor extract are placed into a hydrogenator to make another precursor one step closer to the final product. This substance is then placed into an autoclave with methyl acrylate and cooked for 3 hours. Into another reaction vessel equipped with a reflux/fractional distillation column, under an inert atmosphere, another precursor is synthesized via a Grignard Reaction. This precursor is purified and then added to the first precursor made to create the final product.
- The "finished product" is added to baby food and packed in jars in a glove bag as part of a food poisoning terrorism plot carried out by Chechen Rebels targeting Russian Children in the US. Indicia and labels are in Russian language.



- There are 13 sample sites for solids and 28 sample sites for liquids. Two unknown atmospheres are also part of the lab.
- Degree of Difficulty: Advanced
Time to Complete: 1.5 to 2 days
Options: Man-Down, Perpetrator Down, Flammable Atmosphere requiring ventilation

Lab 2 - Fentanyl

Separate Processes



A - Extraction of Benzyl Cyanide	C1 - Prep of NPP	E1 - prep of Propionic acid
B1 - Prep of Palladium/Carbon Catalyst	C2 - solvent removal from NPP	E2 - purify propionic acid
B2 - Hydrogenation of benzyl cyanide	D1 - Prep of ANPP	F - synthesis of fentanyl/carfentanyl (not shown)
	D2 - Isolation of ANPP	G - adulteration of food supply (baby food)



Lab 2 - Fentanyl

Separate Processes



Illicit Laboratory Catalog

Lab 4 Sulfur Mustard

Includes:



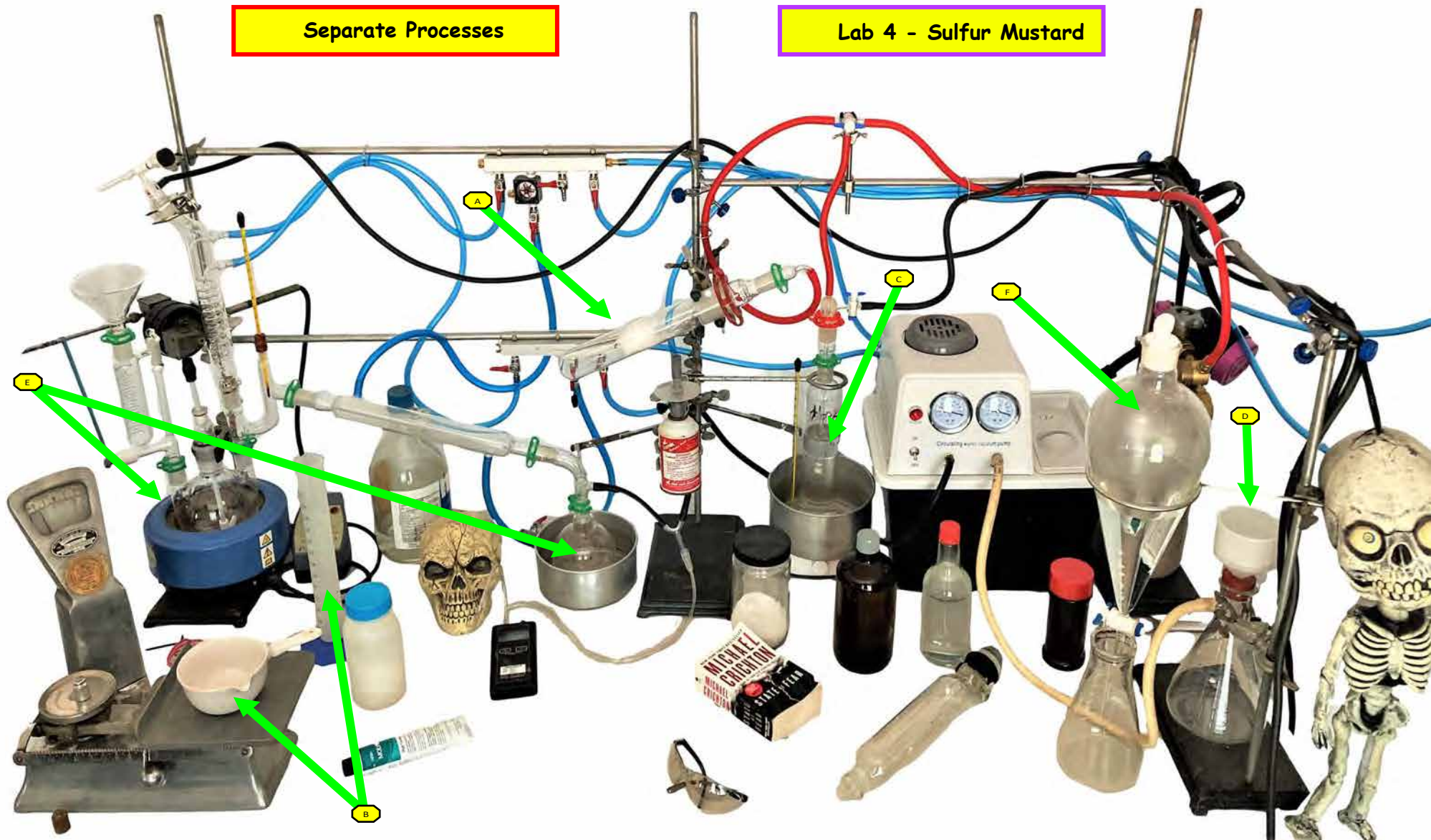
- The Sulfur Mustard Lab starts with a series of reactions aimed at producing the Chemical Weapons Convention Schedule 2 substance Thiodiglycol. This chemical is a direct precursor to the manufacture of Sulfur Mustard and as such is hard to obtain without raising suspicions.
- Ethene gas is first produced by passing ethanol over a heated catalyst. The gas is bubbled into a gas washer vessel filled with a bleach solution. This solution requires vacuum filtration to remove a byproduct solid. The filtrate, a precursor to thiodiglycol, is added to a triple neck flask where a reactive sulfide is then added via a solid addition funnel. This rxn mixture is refluxed and then distilled to remove water. Once the thiodiglycol is produced it is added to a large stainless steel still for the final production of the sulfur mustard chemical warfare agent.
- The crude blister agent is added to a dissemination device fashioned from an over-the counter fan mister operated via bluetooth with a phone app.
- The theme involves an eco-terrorist group based on the Michael Crichton story "State of Fear"
- There are 7 sample sites for solids and 14 sample sites for liquids. Two unknown atmospheres are also part of the lab.
- Degree of Difficulty: Intermediate

Time to Complete: 1 day

Options: Man-Down, Perpetrator Down, Victims, Flammable Atmosphere requiring ventilation

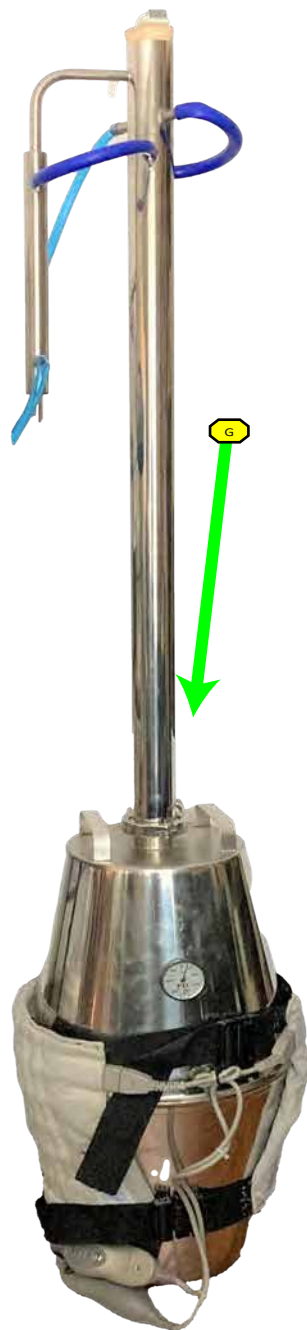
Separate Processes

Lab 4 - Sulfur Mustard



A - preparation of ethene gas from ethanol over hot Al_2O_3 catalyst	E - preparation of thiodiglycol by adding sodium sulfide to 2-chloroethanol
B - making up a 3% hypochlorite solution with $\text{Ca}(\text{ClO})_2$ in water	F - washing thiodiglycol reaction mixture with hot ethanol to remove byproducts
C - prep of 2-chloroethanol by bubbling CO_2 & C_2H_4 gas through bleach solution	G - preparation of sulfur mustard agent by refluxing thiodiglycol with HCl in still
D - filter solution from C to remove calcium carbonate byproduct	H - dissemination of crude sulfur mustard product

Separate Processes



Lab 4 - Sulfur Mustard



G - preparation of sulfur mustard agent by refluxing thiodiglycol with HCl in still

H - dissemination of crude sulfur mustard product

Illicit Laboratory Catalog

Lab 6 Ricin

Ricin is a highly potent, poisonous, cytotoxic ribosome inactivating protein (RIP) - produced in the seeds of the Castor plant. Extraction, Isolation and Purification of proteins from plant material is complex and delicate chemistry because proteins are so easily denatured. In this Lab the perpetrator has researched a dozen different methods of extraction, isolation and purification;

is trying out the various methods, testing the final product on lab animals, and determining which method is giving the best, most potent yields. Preparation of weapon delivery is also present.

Lab Includes: high speed homogenizer, cryo-grinder in liquid nitrogen, caustic soak, oil press, dialysis with a semi-permeable membrane, vacuum filtration, precipitation methods, centrifuges, cation exchange chromatography, electrophoresis

There are 32 liquid sample sites, 18 solid sample sites and more samples in containers with Bi/Tri-Phasic samples, slurries; Dialysis cells, Electrophoresis cells, Cryo-Grinder capsules, Solid Phases in beakers and centrifuge tubes

Options: Man-Down, Perpetrator Down, Flammable or Inert Asphyxiant Atmosphere requiring ventilation





Lab 6 Ricin



Illicit Laboratory Catalog

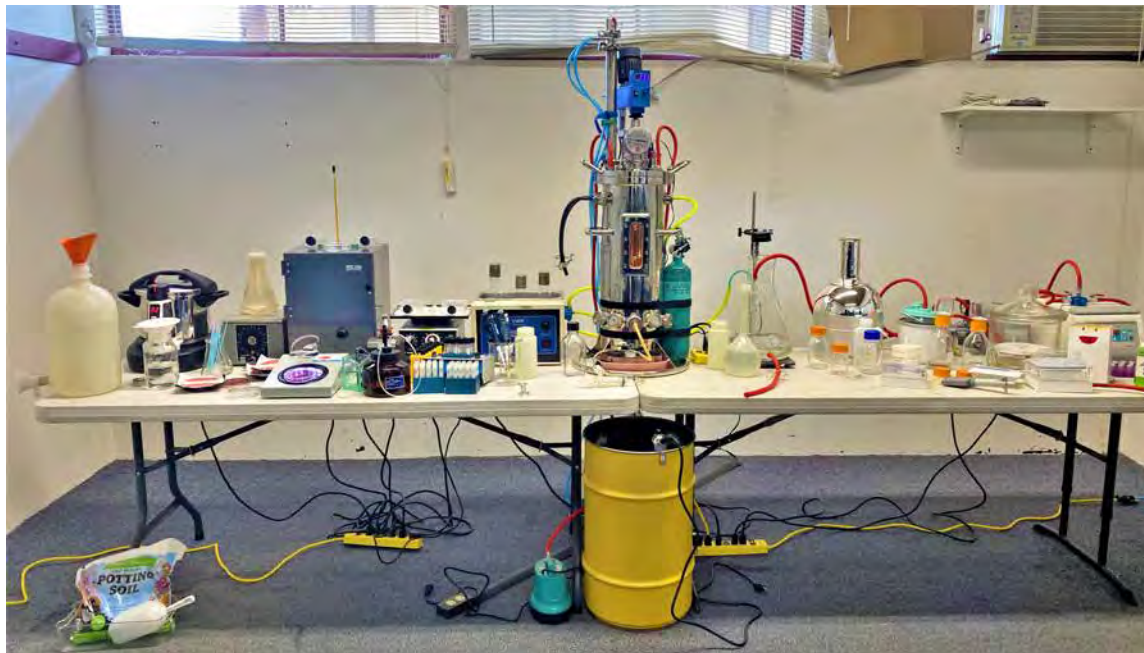
Lab 7 Anthrax

Includes:

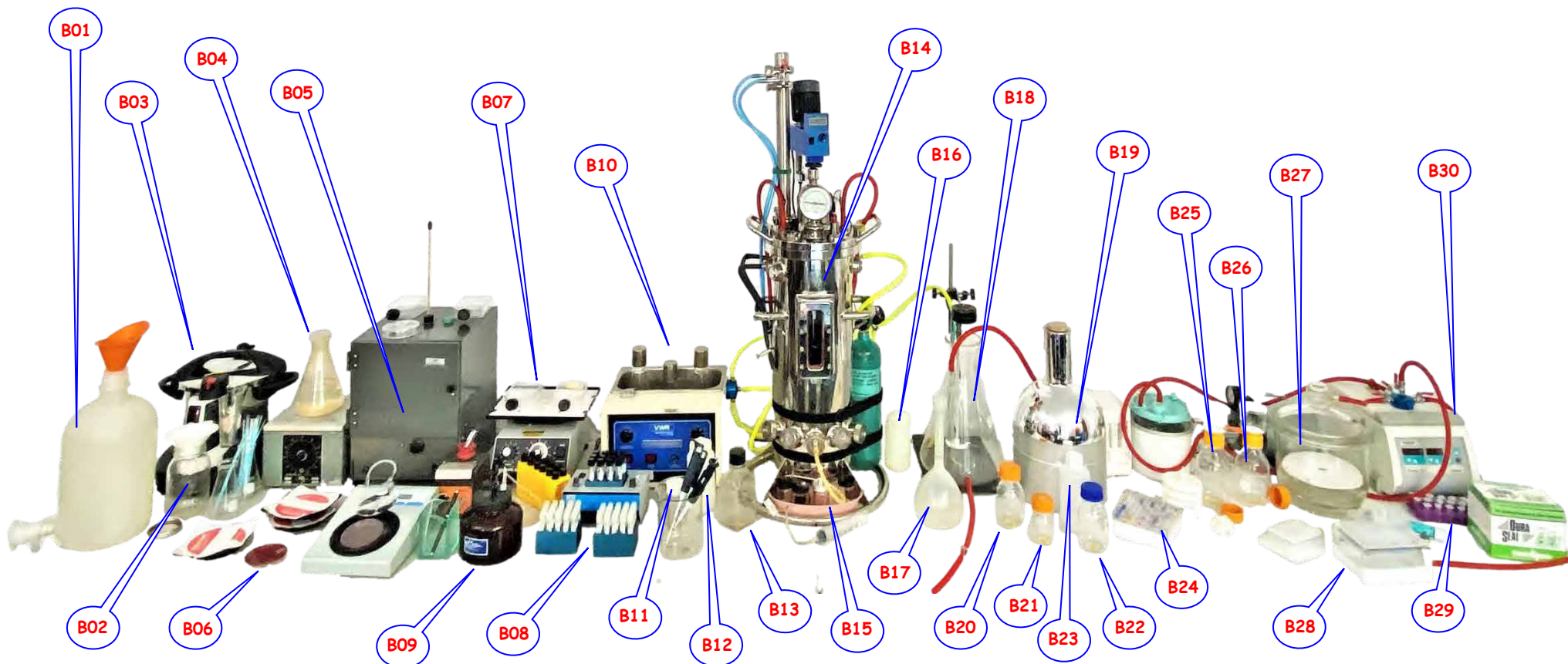
The Anthrax BWA Lab starts with soil extraction of various vegetative bacillus species. An extraction solution is prepared and autoclaved. The soil extract is centrifuged (transferred to Eppendorf tubes and spun). This is followed by EtOH purification to eliminate any vegetative bacteria. The anthrax is then separated from other Bacillus by culturing on PLET Petri Dishes incubated for 10hrs @ 98 °F. A good set of anthracis colonies are found with a microscope. The colonies are replicated onto blood agar & incubated in an oven with high CO₂. The cultures are scaled up using Culture Tubes in a Heater Block in a specially formulated Cultue Medium. Next step the process is scaled up into T-Flasks on a plate shaker and then scaled up to a subculture in 1L baffled erlenmeyer flasks. This final seed culture is added to a 20 Liter Bioreactor maintained at 520 rpm, with sparged air/oxygen, suspended in Sporulation Broth #10 and pH adjusted to 7 with 10M NaOH. After the BioReactor run is finished the culture is suspended in a freeze drying medium. Using Liquid N₂ the medium containing spores is frozen. Lyophilization is achieved using a vacuum desiccator.



- There are 30 sample sites. Two unknown atmospheres are also part of the lab.
- Degree of Difficulty: Advanced
- Time to Complete: 1.5 to 2 days
- Options: Man-Down, Perpetrator Down, Flammable Atmosphere requiring ventilation



Lab 7 Sample Opportunities



Sample Opportunities:

B01 - 4L white plastic jug	B09 - desktop dispenser	B17 - plastic 2,000ml volumetric	B25 - 500ml filter jar
B02 - mason jar under filter	B10 - baffled erlenmeyers in bath	B18 - large glass Erlenmeyer	B26 - 500ml filter jar
B03 - mason jars in autoclave	B11 - small square plastic bottle	B19 - liquid N ₂ dewer	B27 - jars inside desiccator
B04 - 1,000ml Erlenmeyer stirrer	B12 - round plastic white bottle	B20 - 500ml glass bottle orange lid	B28 - filter robot basin
B05 - petri dish	B13 - clear plastic square bottle	B21 - 250ml glass bottle orange lid	B29 - centrifuge tubes purple rack
B06 - petri dish	B14 - 20 Liter Bioreactor	B22 - 500ml glass bottle blue lid	B30 - tubes inside centrifuge
B07 - T flask on shaker	B15 - sample jars near syringe	B23 - plastic wash bottle	
B08 - culture tubes in heat blocks	B16 - round plastic white bottle	B24 - cryogenic Eppendorf tubes	

Illicit Laboratory Catalog

Lab 8 Dimethyl Mercury

Includes:



- Dimethylmercury ($(\text{CH}_3)_2\text{Hg}$) is an extremely toxic organomercury compound. A highly volatile, reactive, flammable, and colorless liquid, dimethylmercury is one of the strongest known neurotoxins, with a quantity of less than 0.1 mL capable of inducing severe mercury poisoning resulting in death. It is rapidly absorbed through the skin. Dimethylmercury is capable of permeating many materials, including plastic and rubber compounds. It has a slightly sweet odor. This particular lab has some confusing precursors. It can look like a meth lab with the Red P, Iodine and Drano (NaOH), it can also look like a TATP lab with the acetone, hydrogen peroxide and sulfuric acid. Adding to the confusion is the presence of potassium iodide tablets which are used to protect the thyroid from radioactive iodine exposure. This might lead one to believe the lab has something to do with radiation dispersal. The presence of magnesium metal may lead one to believe this lab has something to do with explosives manufacture. In order to effectively and efficiently determine which CWA the perpetrator is attempting to produce –the Recon team needs to be particularly thorough.
- This lab stretches the analytical abilities of the team - Metal Chemical Warfare Agents are a fairly recent addition to the Nerve-Blister-Blood-Choking-Incapacitating categories of CWA's.
- The theme involves a poison plot from North Korean agents against US politicians. Indicia and labels are in Korean.
- There are 10 sample sites for solids and 26 sample sites for liquids. Two unknown atmospheres are also part of the lab.
- Degree of Difficulty: Advanced

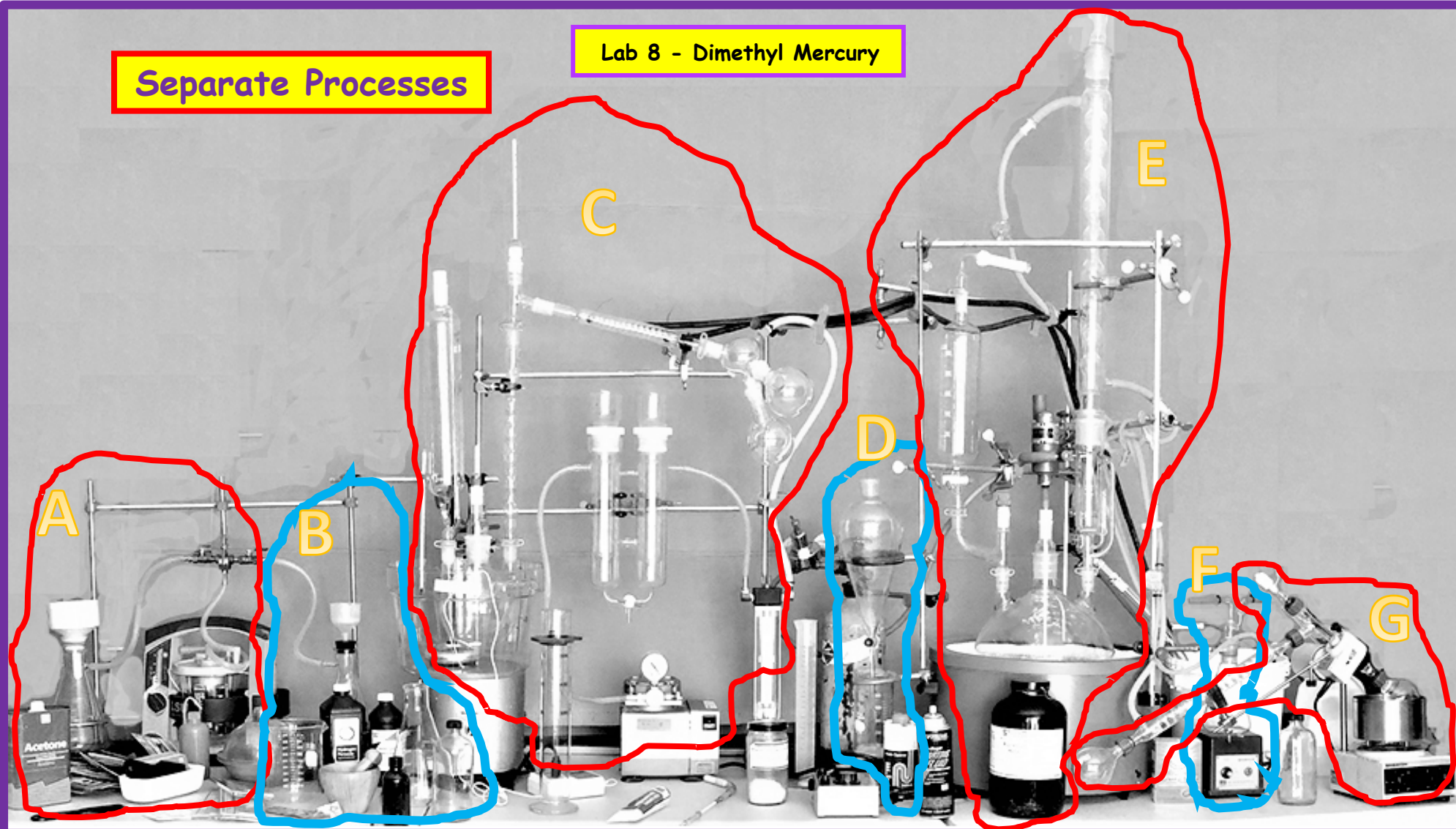
Time to Complete: 1.5 to 2 days

Options: Man-Down, Perpetrator Down, Flammable Atmosphere requiring ventilation



Separate Processes

Lab 8 - Dimethyl Mercury



Identify seven separate processes:

- Extraction of red phosphorous from matchbook striker plates using methanol or acetone – vacuum filtration, drying in a desiccator
- Extraction of iodine from potassium iodide tablets. Dissolve tablets in HCl, add H_2O_2 , I_2 ppt separates out then vacuum filter, collect I_2 in bottle
- Synthesis of methyl iodide – reaction vessel contains red P, I_2 , MeOH. Warmed by bath with immersion heater, vacuum distill after reaction
- Separation of methyl iodide from I_2 , MeOH – using sodium hydroxide solution. Separatory funnel over beaker, bottom layer is CH_3I
- Synthesis dimethyl mercury using Grignard Reagent – methylmagnesium chloride – Soxhlet extractor thimble holds mercuric chloride/ ether solvent
- Synthesis of mercuric chloride using metallic mercury and sulfuric acid
- Purification of methyl iodide using a roto evap – separate from methanol.. CH_3I is in the Receiver – has lower BP

Illicit Laboratory Catalog

Lab 11 Dirty Bomb - RDX - RAD - IED

- The RDX Explosives Lab takes over-the-counter precursors (hexamine fuel tablets) through the process to make the finished product 1,3,5-Trinitroperhydro-1,3,5-triazine also known as cyclonite. RDX is a white crystalline solid that can be used alone for detonators or mixed with other explosives such as TNT and is mixed with plasticizers to make C4.
- In addition to the operating lab apparatus and various glassware (distillation, reflux with solid addition funnel, vacuum filtration, etc.), this lab includes rad sources, an IED and other bomb making materials and precursor chemicals.
- The theme for this lab is a Lone Wolf Domestic Terrorist who idolizes Theodore John Kaczynski the Unabomber.
- There are 11 sample sites for solids and 17 sample sites for liquids. Two unknown atmospheres are also part of the lab.
- Degree of Difficulty: Intermediate
Time to Complete: 1 day
Options: Man-Down, Perpetrator Down, Flammable Atmosphere above
Turn-Back Criteria



Lab 11 - Dirty Bomb RDX + RAD + IED

Render Stable Ops

The A, B, C's of Render Stable Ops: Document, Shut-Off, Maintain.

Document all temperatures & pressures, dial positions, add funnel drip rates

Shut down all heat, stirring, mixing, shaking, vacuum, additions, reactive gases

Maintain cooling water flow, add ice to ice baths, maintain inert gas flow, maintain ventilation

Render Stable Ops are a job for the Recon Team !

This gives glassware time to cool down before sampling operations occur.....



A - Document: ○	B - Shut off: ⬡	C - Maintain: ⬢
Temperatures (thermometers, IR non-contact)	All sources of heat	Cooling (add ice/dry ice)
Pressures (gauges , manometers)	All sources of stirring, shaking, mixing	Condenser column cooling water flow (add ice)
Dial positions, Valve positions	Addition funnels, syringe pumps, reactive gases	Flow of inert atmospheres (nitrogen)
Addition funnel drip rates, syringe pump rates	Vacuum pumps, aspirators	Ventilation (if it exhausts to safe place)

Illicit Laboratory Catalog

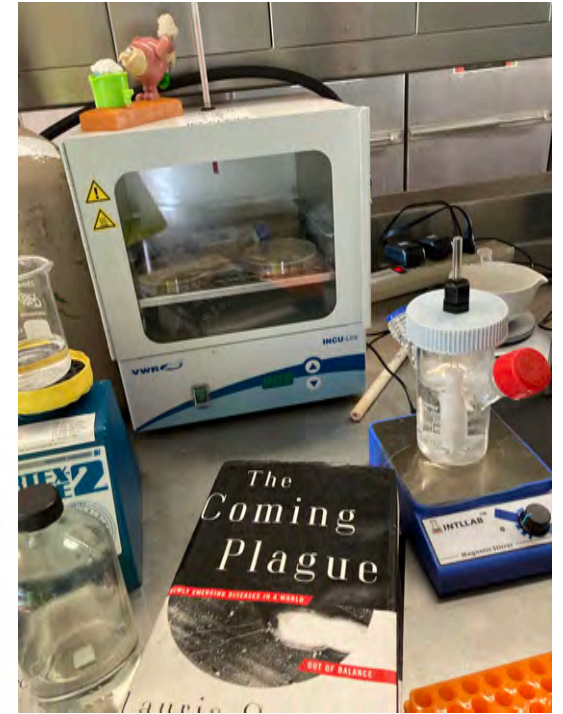
Lab 12 DIY Bio CRISPR CAS9 Genetic Engineering



The DIY Bio Lab uses Genetic Engineering aimed at modifying an organism's DNA to deliberately change the characteristics of organisms to enhance their toxic effect and survivability. Part of this process is conducted in a PCR machine using the CRISPR Cas9 system to modify the genomic DNA of a strain of E. coli so that it can grow and survive in conditions it normally would not be able to. In this lab the Survey Team will encounter active cultures growing on agar plates in an incubator, sample storage in a liquid nitrogen dewar, centrifuges, dialysis purification, protein separation by column chromatography, virus propagation in embryonated chicken eggs, growth mediums, microscopic examination of bacteria, indicia pointing toward attempts to synthesize infectious prions and all the common tools of a DIY Bio lab - innoculating loops, glove box, syringes, culture tubes, etc..

- This lab includes a booby trap that shoots a injector syringe dart containing a plant toxin "through" the Level A suit of a Survey Team member. This lab also includes an alarm system and "surveillance cameras" used by the "perpetrator".
- The theme for this lab: a brilliant teenager immersed in dystopian literature, follower of ODIN the Bio Hacker Company and avid fan of the TV Series - Utopia, has decided it is time to reduce the worlds' population.
- There are 6 sample sites for solids and 12 sample sites for liquids and 5 live agent samples. Two unknown atmospheres are also part of the lab.
- Degree of Difficulty: Intermediate
Time to Complete: 1 day
Options: Man-Down, Perpetrator Down, Flammable Atmosphere requiring ventilation





Illicit Laboratory Catalog

Lab 14 Tropane Alkaloid Plant Toxin

Includes:



- Plants such as jimsonweed, deadly nightshade, belladonna, and Saint Ignatious Bean Tree contain alkaloid toxins such as atropine, scopolamine, hyoscyamine, strychnine, and curare.



- This lab includes a homogenizer to prepare the plant material, a buchner funnel, a large defatting/extraction column and recovery tank (same type as is used in a butane honey oil marijuana lab), a vacuum distillation rotoevap with a dry ice condenser, a separatory for extraction of plant alkaloids, a reflux/fractional distillation apparatus with addition funnel, etc..



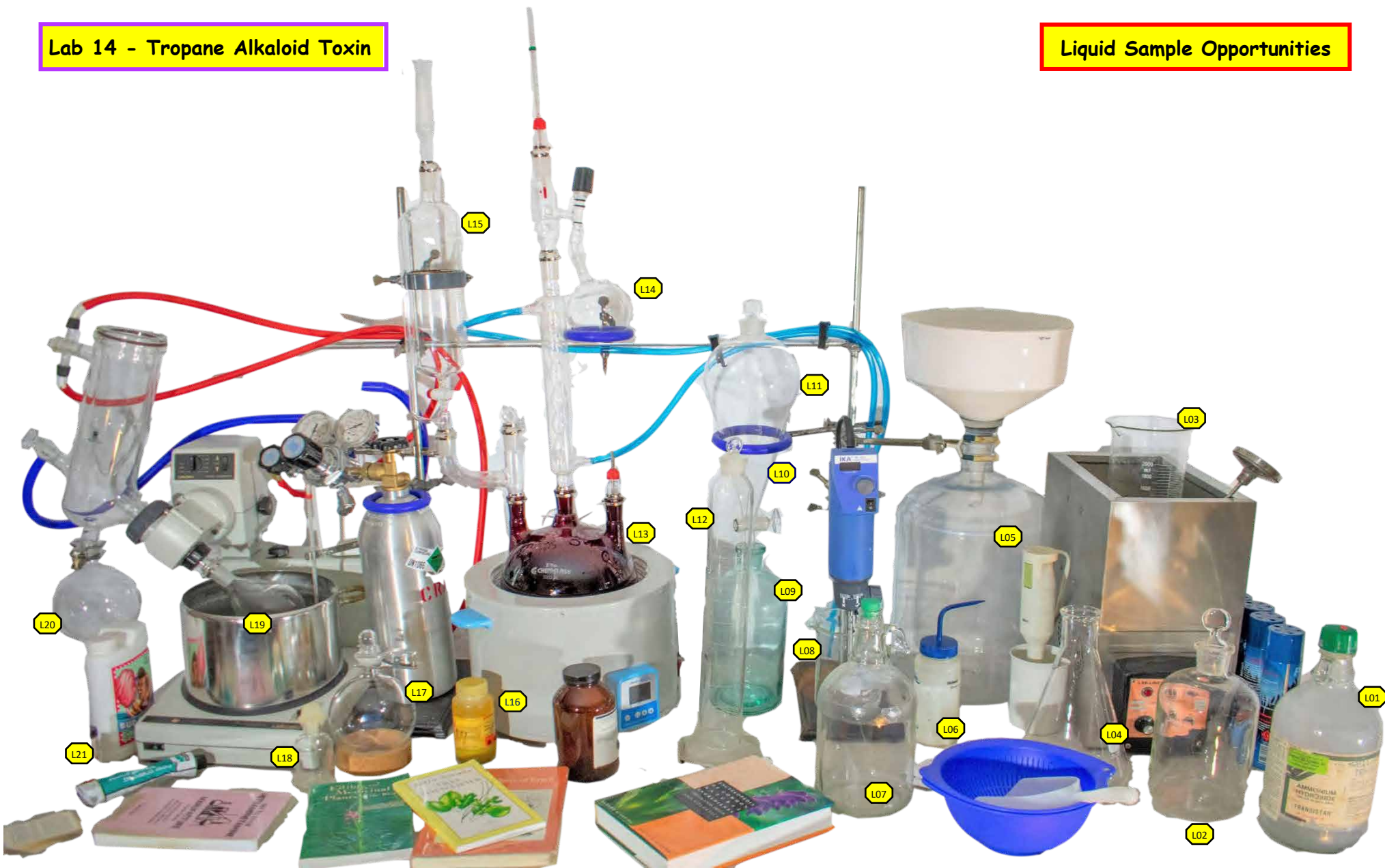
- There are 6 sample sites for solids and 24 sample sites for liquids. Two unknown atmospheres are also part of the lab.
- The Theme for this lab involves a disgruntled employee who wishes to poison co-workers.
- Degree of Difficulty: Advanced

Time to Complete: 1.5 days

Options: Man-Down, Perpetrator Down, Flammable Atmosphere requiring ventilation

Lab 14 - Tropane Alkaloid Toxin

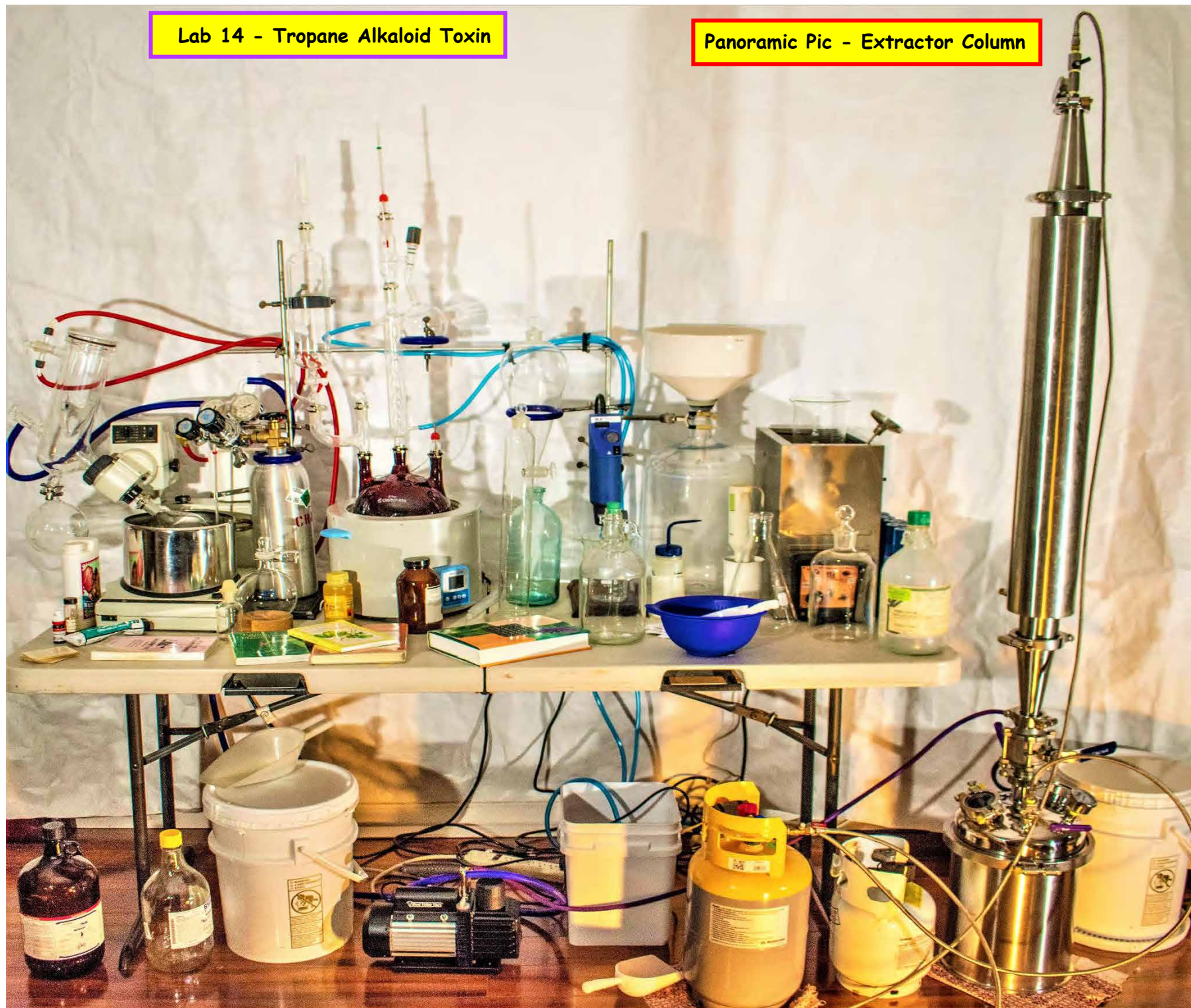
Liquid Sample Opportunities



L01 – Reagent Bottle green cap	L02 – Glass bottle with glass stopper	L03 – 2000ml beaker in bath
L04 – erlenmeyer flask	L05 – 5 gal plastic bottle	L06 – wash bottle
L07 – clear glass reagent bottle	L08 – 1000ml beaker below homogenizer	L09 – green bottle
L10 – separatory funnel bottom layer	L11 – separatory funnel top layer	L12 – graduated cylinder
L13 – red 3-neck flask	L14 – fraction roundbottom receiver	L15 – addition funnel
L16 – picric acid bottle	L17 – roundbottom receiver on cork ring	L18 – small 100 ml glass bottle with stopper
L19 – pear shaped evap flask in roto-evap	L20 – roundbottom receiver flask for roto-evap	L21 – bud candy bottle

Lab 14 - Tropane Alkaloid Toxin

Panoramic Pic - Extractor Column



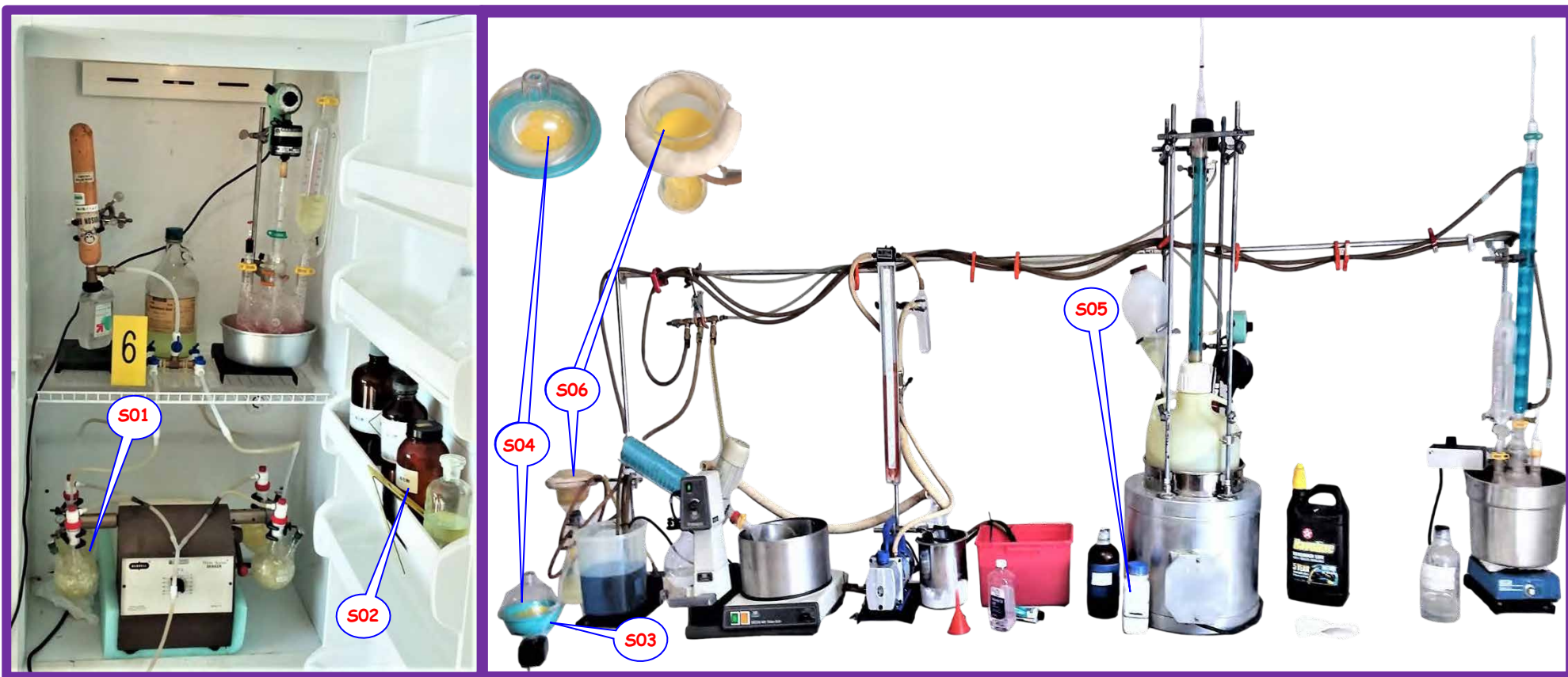
Illicit Laboratory Catalog

Lab 16 Sarin

Includes:



- The Sarin Lab is a complex lab that starts out with reactions taking place at 0°C in a full size upright freezer. Inside the freezer is a reflux apparatus and a large wrist action shaker with gas addition from a chilled cylinder of anhydrous methyl chloride. This lab also has a reflux apparatus with an overhead stirrer and addition funnel, a large teflon reaction vessel with a tall reflux column and an addition funnel and a reflux apparatus in a bath with an immersion heater, etc..
 - The finished product (simulated) is added to facial misters to poison unsuspecting targeted victims.
 - The Theme for this lab involves a couple of surviving members of Aleph, formerly Aum Shinrikyo, the Japanese doomsday cult and terrorist organization founded by Shoko Asahara. Indicia, labels are in Japanese language.
 - There are 5 sample sites for solids and 19 sample sites for liquids. Two unknown atmospheres are also part of the lab.
 - Degree of Difficulty: Advanced
- Time to Complete: 1.5 to 2 days
- Options: Man-Down, Perpetrator Down, Flammable Atmosphere requiring ventilation



Solid Sample Opportunities:

S01 - 500 ml roundbottoms on shaker in freezer	
S02 - amber reagent bottle in freezer (3 rd from left) Japanese label	
S03 - bottom of dessicator left side of table, white solid	
S04 - petri dish in dessicator	
S05 - white plastic jar on table labeled in japanese	
S06 - filter funnel	

Illicit Laboratory Catalog

Lab 19 VX Nerve Agent

Includes:



- The VX Lab starts at a triple neck reaction vessel with drop-wise addition, magnetic stirring, and temp control via an antifreeze bath under an inert atmosphere that passes through a gas bubbler. Suction filtration takes place next with a buchner funnel and vacuum pump. Simple atmospheric distillation takes place next in a triple neck reaction vessel fitted with an addition funnel, magnetic stirring, and heating via a glass mantle under an inert atmosphere. This is followed by vacuum distillation (with the vacuum monitored through a manometer), with magnetic stirring and heating via an immersion heater in an ethylene glycol bath. The last process takes place in a reaction vessel fitted with a solid addition funnel, overhead stirring, and temperature control via a water bath under an inert atmosphere. At first glance the lab looks very complex but a systematic approach to rendering the lab stable, conducting screening and sampling works well.



- This lab has an al-Qaeda terrorist theme. Indicia and labels are in the Farci language.

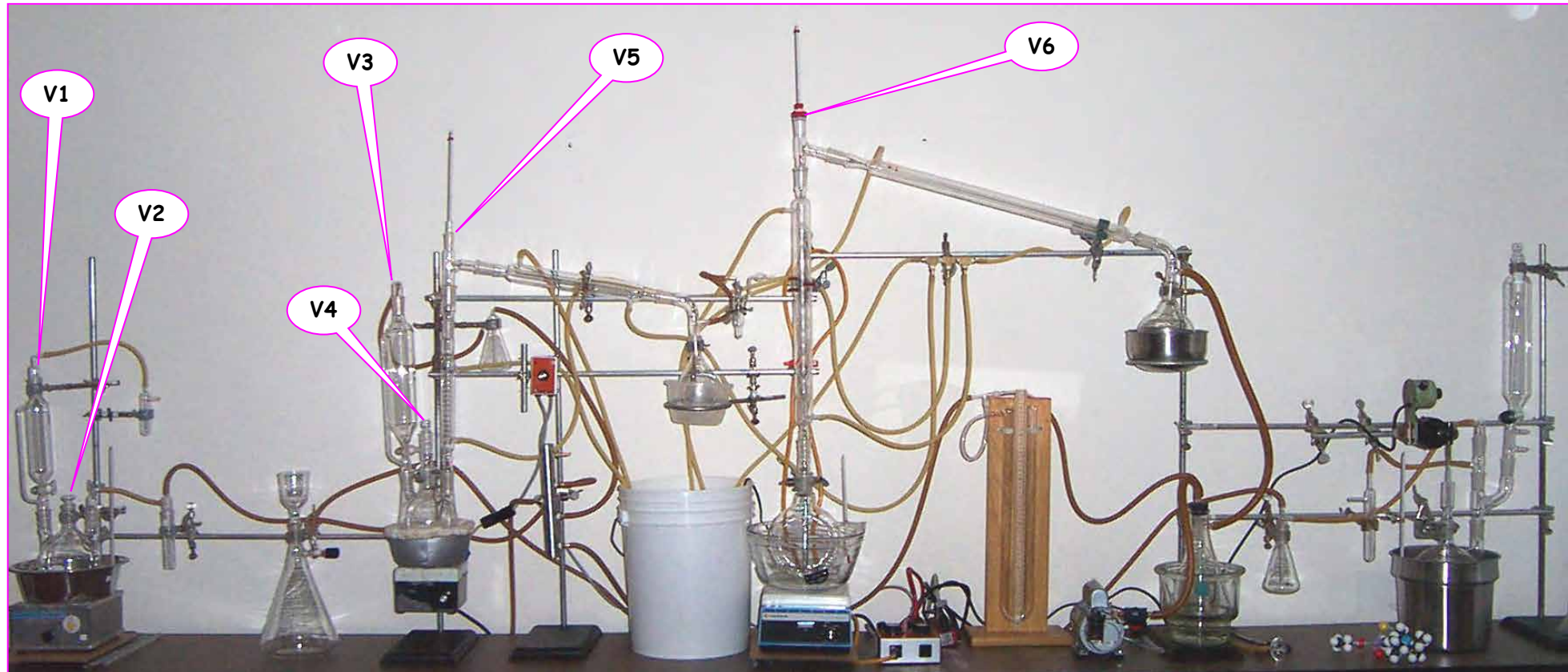


- There are 3 sample sites for solids and 10 sample sites for liquids. Two unknown atmospheres are also part of the lab.
- Degree of Difficulty: Advanced

Time to Complete: 1 day

Options: Man-Down, Perpetrator Down, Flammable Atmosphere requiring ventilation

Analyzed with pH in air, mass spec, & ICAM



V1 Addition funnel process #1

V2 Reaction vessel process #1

V3 Addition funnel process #3

V4 Reaction vessel process #3

V5 Still head from process #3

V6 Still head from process #4

Vapor samples can be analyzed from the headspace of vessels that are easy to access (i.e., remove stopper), and from the top of the still heads by removing the thermometer

Illicit Laboratory Catalog

Cyanogen Chloride CK Lab #20



- The Cyanogen Chloride Lab starts with the preparation of a precursor; made by adding liquid mercury metal to concentrated nitric acid. This precursor is then converted into mercuric cyanide by refluxing with prussian blue solution. This poisonous compound is then reacted with chlorine gas in the dark (in flasks wrapped with black foil to keep out the light). Mercury contamination plays a big role in this lab and invites collaboration with EPA's detection capabilities for Hg and its compounds.
- This lab includes: reflux with several addition funnels in a heat bath with an overhead stirrer, distillation with a roto-evap, vacuum filtration, vacuum drying in a desiccator, reaction vessel in a heating mantle/magnetic stirrer with distillation separation of the products of the reaction, a chlorine gas generator, etc.
- There are 10 sample sites for solids and 30 sample sites for liquids.
Two unknown atmospheres are also part of the lab.
- Degree of Difficulty: Medium to Advanced
Time to Complete: 1 day
Options: Man-Down, Perpetrator Down, Toxic Oxidizing Atmosphere requiring ventilation

Lab #20 - Unknown Samples - Answer Key

Solids	
S01	small clear glass jar with ground glass lid = mercuric cyanide
S02	white porcelain bowl on scale with white solid = sodium hydroxide
S03	plastic container labeled sodium hydroxide = sodium hydroxide
S04	clear glass jar with white crystalline solid = sodium chloride
S05	plastic white jar = Prussian blue
S06	short white plastic wide mouth jar = sodium sulfide
S07	black solid on bottom below clear liquid in flask = mercuric sulfide
S08	dark solid on filter paper = rust - ferric oxide
S09	orange solid in dishes inside vacuum desiccator = mercuric oxide
S10	White solid in bottom of desiccator = silica
Liquids	
L01	plastic bleach bottle = sodium hypochlorite solution
L02	black foil covered shaker Erlenmeyer flasks = water + mercuric cyanide
L03	250 ml flask on cork ring = hydrochloric acid + sodium hypochlorite solution
L04	glass reagent bottle = hydrochloric acid
L05	volumetric flask near scale = sodium hydroxide solution
L06	100 ml graduated cylinder = sodium chloride solution
L07	Triple Neck reaction vessel = nitric acid + mercuric nitrate
L08	500 ml addition funnel = sodium hydroxide solution
L09	250 ml addition funnel closest to center = concentrated nitric acid
L10	250 ml addition funnel closer to right = sodium chloride solution
L11	125 ml addition funnel angled outward = mercury metal
L12	glass nitric acid bottle = nitric acid
L13	glass jar with silver looking liquid = liquid mercury
L14	2000 ml RB in heating mantle = Prussian blue + water + mercuric oxide + mercuric cyanide
L15	500 ml receiver flask in ice bath = water
L16	Erlenmeyer flask in plastic jar = cyanogen chloride (potassium cyanate solution as simulant)
L17	Roto-evap 250ml round bottom flask in oil bath = mercuric cyanide + water
L18	flask with black liquid or clear above black solid = sodium sulfide solution
L19	large vacuum flask below buchner funnel = H ₂ O + mercuric nitrate + nitric acid
L20	wash bottle with green spout = distilled water



HAZMAT

D T C

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