Drug =

Drug abuse =

Addiction =

Poison =

Classification of drugs:
• DEA:

<table>
<thead>
<tr>
<th>Schedule</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Schedule I</td>
<td>no accepted medicinal use, legally possessed for research purposes only</td>
</tr>
<tr>
<td>Schedule II</td>
<td>Currently accepted for medicinal use with high potential for abuse</td>
</tr>
<tr>
<td>Schedule III</td>
<td>Currently accepted for medicinal use with low potential for abuse</td>
</tr>
<tr>
<td>Schedule IV</td>
<td>Currently accepted for medicinal use with low potential for abuse</td>
</tr>
<tr>
<td>Schedule V</td>
<td>Currently accepted for medicinal use with low potential for abuse and may lead only to limited dependence</td>
</tr>
</tbody>
</table>

B) According to physiological effects in the human body

• Narcotics = produces narcosis = stuporous state resembling sleep and characterized by loss of sensation. Analgesics.

Term commonly used for a drug socially unacceptable.
• **Stimulants** = affects the sympathetic nervous system →

• **Hallucinogens** = produce psychotic reactions →

• **Depressants** = depressant action on central nervous system.

• **Anabolic Steroids** =

1) **Opiates** → Substances with morphine-like effects.

<table>
<thead>
<tr>
<th>Substance</th>
<th>Source</th>
<th>Components / Form</th>
<th>Ingestion / Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Opium</td>
<td></td>
<td>Alkaloids = 10% morphine 0.5% codeine</td>
<td>Smoking in long-stemmed pipes</td>
</tr>
<tr>
<td>Morphine</td>
<td></td>
<td>Form of water-soluble salts, i.e. morphine sulfate and morphine HCl</td>
<td>Hypodermic needles (analgesia, drowsiness, changes in mood, inability to concentrate)</td>
</tr>
<tr>
<td>Heroin = diacetyl-morphine</td>
<td></td>
<td>Form of water-soluble salts, i.e. Heroin HCl Common diluents: quinine, lactose, starch, mannitol, mannitol, procaine, &amp; powdered milk.</td>
<td>Intravenous injection → rapidly metabolized to morphine 3X more potent and more rapid onset of action than morphine</td>
</tr>
<tr>
<td>Codeine</td>
<td></td>
<td>Codeine sulfate and codeine phosphate</td>
<td>Orally 1/6 of the potency of morphine</td>
</tr>
<tr>
<td>Meperidine (Demerol) Methadone (Dolophine)</td>
<td></td>
<td></td>
<td>Tablets or aqueous soln's intended for injection</td>
</tr>
<tr>
<td>Hydro-morphine (Dilaudid) Oxycodone (Percodan)</td>
<td></td>
<td></td>
<td>Tablets</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substance</th>
<th>Source</th>
<th>Components / Form</th>
<th>Ingestion / Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Morphine</td>
<td></td>
<td>Form of water-soluble salts, i.e. morphine sulfate and morphine HCl</td>
<td>Hypodermic needles (analgesia, drowsiness, changes in mood, inability to concentrate)</td>
</tr>
<tr>
<td>Heroin = diacetyl-morphine</td>
<td></td>
<td></td>
<td>Intravenous injection → rapidly metabolized to morphine 3X more potent and more rapid onset of action than morphine</td>
</tr>
<tr>
<td>Codeine</td>
<td></td>
<td>Codeine sulfate and codeine phosphate</td>
<td>Orally 1/6 of the potency of morphine</td>
</tr>
<tr>
<td>Meperidine (Demerol) Methadone (Dolophine)</td>
<td></td>
<td></td>
<td>Tablets or aqueous soln's intended for injection</td>
</tr>
<tr>
<td>Hydro-morphine (Dilaudid) Oxycodone (Percodan)</td>
<td></td>
<td></td>
<td>Tablets</td>
</tr>
</tbody>
</table>
II) **Stimulants**
Stimulates the CNS.
Major effects include excitement, loss of fatigue, decreased appetite, increased wakefulness, blood pressure, respiratory rate and nervousness. Excessive use induces psychotic behavior, hallucinations, muscular tremor, convulsions.

<table>
<thead>
<tr>
<th>Source</th>
<th>Amphetamine</th>
<th>Cocaine (coke, snow, or free base)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Synthetic (meta-) Phenethylamines</td>
<td>Synthetic AND Alkaloid from the leaves of a South American shrub (Erythroxylon coca)</td>
</tr>
<tr>
<td>Distribution</td>
<td>Tablets or capsules illegally produced as liquids or powders</td>
<td>Cocaine HCl = Free base =</td>
</tr>
<tr>
<td>Effects</td>
<td>Appetite suppressants, treatment of narcolepsy and hyperactivity. Strong psychological dependence.</td>
<td>Local anesthetic (blocks nerve conduction) and stimulant (CNS)</td>
</tr>
</tbody>
</table>

III) **Hallucinogens**

1) **LSD (Lysergic Acid Diethylamine)**
-- first synthesized in 1938 from lysergic acid
-- naturally occurring substance found in the ergot fungus which infects rye and wheat grains.
-- Other indoleamines: psilocyn, psilocybin (both from the mushroom Psilocybe mexicana), DMT (seeds of the plant Piptadenia peregrinea), DET (synthetic).

2) **Mescaline = 3,4,5-Trimethoxyphenylethylamine**
-- from the peyote cactus plant or synthetically produced. -- Structurally related to amphetamines like: MDA, DOM (STP), MMDA, MDMA (Ecstasy).
3) Phencyclidine (Sernyl)
   -- street names:
   -- Use legitimately as veterinary anesthetic.

4) Marijuana
   -- from the flower, leaves, seeds, stem, and roots of the Cannabis plant.
   -- Street names:
   -- Cystolithic hairs
   -- THC (tetrahydrocannabinol)
   --- Hashish
   -- Hashish oil
   -- Sinsemilla

IV) Depressants
1) Ethanol - CNS depressant.
   Enters bloodstream unchanged.
   Metabolized by liver enzymes to acetaldehyde and acetate.
2) Sedative and Hypnotic drugs - CNS depressants
   a) Barbiturates =
      Street names:
      Phenobarbital, secobarbital, pentobarbital, amobarbital

   b) nonbarbiturate sedative-hypnotic
      Quaalude, equanil, methaqualone

   c) benzodiazepines = tranquilizers
      Valium (diazepam), Librium (chlordiazepoxide), Ativan.

   d) “Sniffers”
      airplane glue, model cement, freons, toluene, gasoline, trichloroethylene, methyl ethyl ketone
Anabolic Steroids
Derivatives of testosterone.
Androgenic and anabolic effects modified.
1991 \(\rightarrow\) classified as controlled substance.

POISONS
Usually analyzed by a forensic toxicologist.

Inorganic
- Heavy-metals:
- Soluble salts of:
- Nonmetallic:

Organic -
- Acidic
- Neutral or basic
- Alkaloids and barbiturates are the most common (favored by suicide).
- Glycosides
- Pesticides coumarin derivatives, organophosphates esters.
- Volatile poisons

Laboratory Examination
1) Isolation and Separation techniques

2) Qualitative identification procedures

3) Quantitative determinations
1) Isolation and Separation techniques

--Questionable purity and limited quantities.

--Solvent extraction (distillations, evaporation, recrystallization, chromatography, centrifugation).
Ex: Steam distillation for alcohols or phenols.

--Extractions from aqueous solutions
Drugs may be acidic, basic, or neutral.

Extraction scheme

Acidic drug in aqueous solution
(basic drug in aqueous solution)

\[ + \]

HCl or CH₃CO₂H
(NaOH or NH₄OH)

\[ + \]

CHCl₃ and ether

Separation of phases

--Extractions from body fluids or organs.
Tissues or organs must be grounded, macerated or chemically digested first followed by filtering or centrifuging to remove debris prior to extraction.

2) Qualitative identification procedures

a) macroscopic examination
b) chemical color tests \( \rightarrow \) presumptive in nature

1. Marquis reagent - usually turns violet in the presence of the opium alkaloids such as heroin, morphine, and codeine. The amphetamines or "uppers", such as dextroamphetamine and methamphetamine, turns Marquis reagent red-brown. **Prep:** 10 drops of 40% formaldehyde solution to 10 mL of conc. H₂SO₄.

2. Cobalt thiocyanate or Modified Scott test - for the coca alkaloids, cocaine in particular; a blue, flaky precipitate is formed. **Prep:** dissolve 6.8 g cobalt chloride and 4.3 g of ammonium thiocyanate in 50 mL of water containing a few drops of glycerin. Add 0.5 mL to 1 pinch of sample.
3. **P-Dimethylaninobenzaldehyde (p-DMAB) or Modified Ehrlich test** - forms a blue to purple color with LSD. **Prep:** 2 g p-DMAB added to 50 ml 95% ethanol and 50 ml HCl conc.

4. **Duquenois test** - forms a purple color with marijuana. **Prep:** 12 drops of acetaldehyde and 1 g of vanillin in 50 mL of 95% ethanol. Add 2 mL of this reagent and 1 mL of conc. HCl to sample with shaking. Add 2 mL of chloroform as purple color develops.

5. **Dille-Koppanyi test** - cobalt acetate and isopropylamine for the barbituates. A red-violet color is formed by barbituric acid or its derivatives. These are the "downers". Examples are phenobarbital, secobarbital, amobarbital, and pentobarbital. **Prep:** dissolve 0.1 g of cobalt(II) acetate in 100 mL of methanol and add 0.2 g of glacial acetic acid. Add 1 drop to sample, then add 1 drop of 5% isopropylamine in methanol.

6. **Mecke’s reagent** - selenous acid in sulfuric acid; an alternative test for the opium alkaloids that gives a distinct color change for each alkaloid, such as green for codeine. **Prep:** dissolve 0.125 g of selenous acid in 25 mL of conc. H2SO4.

7. **Mandelin reagent** – screening test for codeine (olive color), cocaine (orange color), and heroin (brown color). **Prep:** 1 g ammonium vanadate dissolved in 100 ml H2SO4 conc.

8. **HNO3** - concentrated HNO3 reacts with codeine, doxepin, heroin, LSD, and some others to give a yellow to orange color.

**The Narcotics Identification System (NIK®)**

Test kits for presumptive identification of controlled substances:

- **Test A** - Marquis Reagent: heroin, opium alkaloids, and amphetamine-type compounds
- **Test B** - Nitric Acid Reagent: heroin, morphine, and codeine
- **Test C** - Dille-Koppanyi Reagent System: barbituates
- **Test D** - Modified Ehrlich test (p-DMAB): LSD Reagent
- **Test E** - Duquenois-Levine Reagent System: marijuana, hash, THC
- **Test G** - Cobalt thiocyanate or Modified Scott test: cocaine HCl and free base
c) microchemical crystal tests → test reagent produces a specific crystal that are highly characteristic of certain drugs.

d) Reinsch test → screens for heavy-metal poisons =

e) Specific antigen-antibody reactions

3) Quantitative determinations

--TLC, GC, and HPLC →

--TLC →

--GC →

--UV/VIS →

--IR and MS →

**ALCOHOL Analysis**

1939-1967  Drunkometer
1967- Testing devices based on blood-breath ratio of 2100:1 ratio.

Breathalyzer -Extent of color change is measured by photometric absorbance.

$$2K_2Cr_2O_7 + 3C_2H_5OH + 8H_2SO_4 \rightarrow 2Cr_2(SO_4)_3 + 2K_2SO_4 + 3CH_3COOH + 11H_2O$$

Alcohol in blood:
[Blood-alcohol] > 0.1% are taken as *prima facie*

Major methods: GC, microdiffusion, and enzymatic
GC →
Microdiffusion →

Alcohol dehydrogenase (ADH) →