

Basic tools needed for forensic documents examination:-

▶ Ultraviolet Photography:-

All standard photographic papers and photographic films are sensitive to UV. They are not, however sensitive to UV. They are not, however sensitive to infrared specialized film, sensitized to infrared radiation, is required for infrared photography. This infrared film is also sensitive to blue-violet and to ultraviolet.

- Infrared and ultraviolet photography are both non-destructive techniques.

LONG-WAVE ULTRAVIOLET:

Practical photographic purposes this is used.

- 320-400 nm (range)
- This band is transmitted by regular optical glass, of which most photographic lenses are made and, therefore, is of most practical value in ultraviolet photography.

MIDDLE ULTRAVIOLET:

- 280 - 320 nm
- Middle UV radiation are not transmitted by regular photographic lenses.
- A lens made of quartz, however will transmit middle and long wave ultraviolet and could therefore produce an image using them.

SHORT WAVE ULTRAVIOLET:

- 200-280 nm
- It is mutable for its germicidal effects but will also cause 'sunburn' of unprotected eyes and skin.

COMMON SOURCES OF UV RADIATION:

- Long wave UV (320nm - 400nm) are emitted from the following sources: = electronic flash units, fluorescent tubes (F15/T8BLB), sunlight, mercury vapour lamps.

APPLICATION:

- Blood situations where it's color blends with surrounding; document erasures, ink and typewriter ribbons.
- Pigments vary in the absorption and reflection of UV invisible stains of various body secretions such as: urine, semen, pus, perspiration, etc. as they often emit a particular fluorescence.
- Fingerprints on multicolored background; shiny or concave object, organic matter (all using fluorescent fingerprint powders).
- In secret marking of object - powders, pastes, inks, pencils.

► INFRARED PHOTOGRAPHY: =

- An active infrared can be used for photography with ordinary camera lens.
 - Actinic IR ranges from 700nm - 900nm.
 - Actinic IR photography can be defined as the technique of using a camera lens to focus and expose an IR image on an emulsion sensitized to IR radiations.
- For a subject to be photographed in this manner it must:
- reflect or transmit IR radiation.
- or,
- the subject must luminance in the IR region.
 - luminescence of a suitable subject occurs when it is illuminated with the shorter wavelength of visible light or UV radiation.

COMMON SOURCES OF IR radiation:

- Electrical flash units, tungsten lamps, white fluorescent tubes, sunlight.

APPLICATION:

- Gunshot wounds to illustrate powder burns.
- Cloth, hair and fiber examinations may show differences among like subjects by differences in reflection or luminescence capabilities.
- In secret writings will sometimes reveal contents in sealed envelopes.
- In charred document, we can decipher writings with the help of IR photography.
- Documents alteration (where original script has been tampered with) inks visualizing differences seemingly identical to the naked eyes.
- Dyes and other pigments luminance when exposed to IR stimulation (sometimes they may be identified by their degree of luminescence).
- We can reveal the writing in case of chemical erasures.

▶ PHOTOMICROGRAPHY:

It is to capture photograph of objects under a microscope i.e. capturing of an object enlarged under a microscope.

Microscope lens:

has 2 lenses → OBJECTIVE
 ↳ EYEPEICE

- Objective lens has the specimen/subject.
 - The eyepeice lens has the camera attached with a software.
- The area of interest is enlarged and captured.

APPLICATION:

QUESTIONED DOCUMENT APPLICATION:

- Tremours
- Retouching/Repatching
- Pen lifts
- Ink variation/Ink change
- Miniature writing (currency notes, passport, visa etc.)
- Micropointing → ↑
- Sequence of strokes (continuous, non-continuous)
- Thickness of strokes (Overlapping) → which stroke is bolder.
- Digital printouts → yellow dots are present in each printouts, the distribution of dots are even and

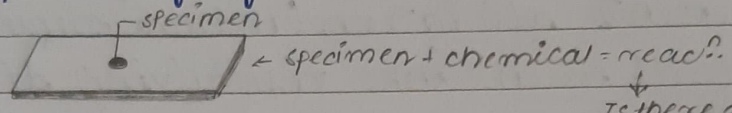
unique to each printer.

Since, microscope has a small space we can locate these dots and then switch to more sophisticated instrument i.e. VSC.

FORENSIC APPLICATION:

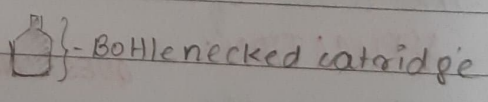
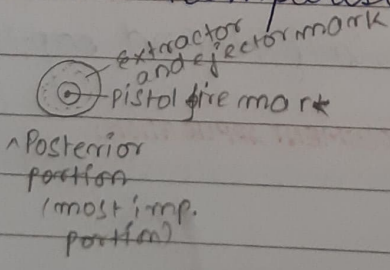
- Presence of semen → sperm (has head or tail or how old it is)
- Confirm the Presence of blood: ^{it is a} human origin blood (grouping is done)

Confirmatory crystal test:

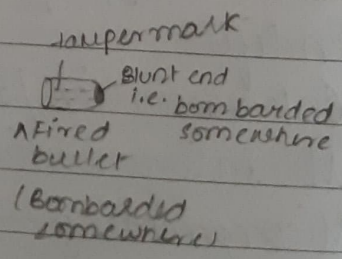
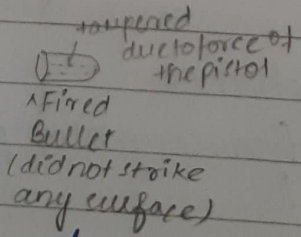
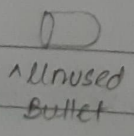


↓
Is there a crystal formation or not
↓
• shape test
• color test

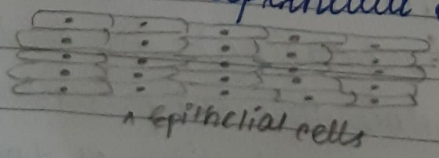
- Crystal test is also done in case of drugs
- Detection of pollen grains
- Hair sample analysis (Hair origin → animal/human)
- GSR (Gun Shot Residue)
- Soil sample - (size of granules)
- Paint sample - (layer/pigment)
- Any presence of foreign materials
- Fingerprint - (ridge details)
- Lip print - (details of grooves and ridges and pattern of identification)
- Cartridge case - (comparison)



Bullet



Vaginal secretion - (epithelial cell examination)



• Toolmark analysis

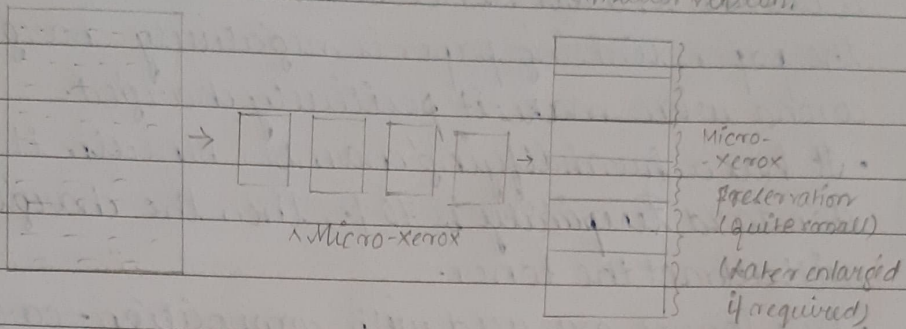
▶ MICRO PHOTOGRAPHY :=

Photography, particularly of papers, arranged to create small images which will not be studied without enlargement. A small microscopic photograph in which images are minified.

When any document is in a macroscale and needs to be shrunken to a microscopic scale for further preservation, microphotography method is used.

Large Document:

Smaller version:



Micro-photography procedure

APPLICATION:

- Documentation of large blood spatter on wall.
- Footwear impressions.
- Overall crime scene photography.
- Large area maps found as an evidence.
- Innumerable small objects on the ground.

▶ VISIBLE SPECTRAL COMPARATOR: [VSC]

• New version → VSC-6000 (latest model)

• This machine utilizes many functions and different light sources to examine documents, and is usually used as a forensic tool to check the validity of valuable documents. It is a very sophisticated instrument. This machine is a comparator, and it is also used to compare one set of images or spectra up against another. As the name suggests VSC is a type of comparator, which works by enhancing a document from different angle and using different light sources.

APPLICATION:

- Enhancement of documents from different angles.
- Analysis of inks and paper.
- Examination of deteriorating documents.
- Examination of indentation.

▶ Electrostatic Detection Apparatus := [ESDA]

- It is a non-destructive technique.
- Also known as Electrostatic Detection Device [ESDD]
- When a sample with indented writing is found a miller sheet is put over it. [A miller sheet is a transparent sheet that protects the documents from getting destroyed like any external mark which might manipulate the evidence]. A corona device with a corona wire charges the paper. Writing paper is negatively charged - the corona wire makes it positively charged.
- It has a humidifying chamber beneath it as the standard humidity is 70%, then the charged paper will attract the toner.
- Dry toners are used with composition - carbon black, lamp black, charcoal. Dry toner is used as it can be brushed out later without any excess which therefore would become a destructive technique.
- The indentations are positively charged.
- ESDA can visualize indentations upto 7-10 pages.
- The miller sheet is put over or sometimes adhesive transparent tapes without air bubbles are used to preserve the document.
- The principle of ESDA is electro-static charge.
- Photography is done as soon as it becomes visible.

APPLICATION:

- Cheque book signatures
- Forged forgery
- Ransom notes (kidnapping case notes or letters)
- Anonymous letters
- Indented writing
- Threaten letters
- * TLC and LCMS is also used.
 - TLC is used for ink analysis
 - ↳ Principle - Adsorption Retention Factor is calculate
i.e. either equal to or less than 1.
 - LCMS is an automatic technique and is used where TLC

isn't accurate and as TLC is a manual method.

* LCMS - Liquid Chromatography Mass Spectroscopy.

Criteria before Preliminary Examinations :
considered

- Size of the paper
- Presence of margin
- Trimmed or cut ends and tool used.
- Number of times the paper was folded and its sequence.
- Indentation marks or embossed strokes
- Artificial ageing.
- Written, printed or typed document
- Ink used (same or different ink)
- Dimension

Proceeding Protocol:

- Natural light
- Oblique light - 45°
- Transmitted light - of different wavelength
- UV
- IR
- Stereomicroscope
- Comparison microscope (if comparison is required)
- Shading
- TLC
- LCMS
- ESDA
- VSC