

## UV, Fluorescence & IR

1. The Electromagnetic Spectrum:
  - A. Wavelengths are measured from peak to peak; nm = 1 billionth of a meter.
  - B. UV: <400nm
    - i- Short Wave UV: 200-300nm (UVB= sunburn)(UVC=germicidal)
    - ii- Long Wave UV: 300-400nm
  - C. Visible Light: 400nm to 700nm.
  - D. IR: >700nm
    - i- Near IR: 700-1100nm
    - ii- Thermal: > 1100nm
    - iii- Heat: 2000-12000
  
2. Light Energy:
  - A. Total Reflection: White.
  - B. Total Absorption: Black.
  - C. Partial Reflection/ Absorption:
    - i- Colors
    - ii- Shades of Gray
  - D. Transmission
  - E. Conversion: Luminescence
    - i- Fluorescence: “glowing” while stimulated; without energy, no “glowing.”
    - ii- Phosphorescence: “glowing” continues after the stimulus ceases.
  
3. Colors:
  - A. Primary Colors: (Additive: the addition of these three colors produces white)
    - i- Red
    - ii- Green
    - iii- Blue
    - iv- Red & Green = Yellow
    - v- Red & Blue = Magenta
    - vi- Blue & Green = Cyan
  - B. Primary Colors: (Subtractive, because 1/3 of colored light is missing/ Complimentary Colors, they are the opposite of the color they lack)
    - i- Cyan: blue + green – red
    - ii- Magenta: red & blue - green
    - iii- Yellow: red & green – blue
  - C. Color Filters:
    - i- Red Filter: absorbs Blue & Green
    - ii- Green Filter: absorbs Blue & Red
    - iii- Blue Filter: absorbs Red & Green

4. Reflected UV (where only UV light strikes the film):
  - A. Use an 18A filter:
    - i- To block out visible light, while transmitting UV light
    - ii- Or, turn out the lights
  - B. Use a UV Light Source.
  - C. Use a UV sensitive sensor/film (B&W best) Most film has a UV filter layer, so when doing UV imaging, you have to use a film that does record the UV area.
  - D. For:
    - i- Alterations in documents
    - ii- Deep bruises
  
5. UV Fluorescence (Stimulation in the UV Range, Fluorescence in the Visible Range):
  - A. Use a 1A, 2A or 2B filter to block out UV light.
  - B. Use a UV Light Source.
  - C. Use Conventional Film.
  - D. Traditional Camera Meters are designed to read Reflected Visible Light, so they do not work optimally in this situation. Bracket! Consider an F-5.6 with a SS of 1,2,5,10,20 seconds.
  - E. For:
    - i- Visualizing Non-Blood Body Fluids
    - ii- Fluorescent Fingerprint Powders
  
6. Fluorescence (Stimulation in the Visible Light Range with Fluorescence in the Visible Light Range).
  - A. The Stokes Shift:
    - i- Light of a particular wavelength is projected onto a material
    - ii- The material absorbs the light
    - iii- The material emits light at a higher wavelength, not previously contained in the original light.
    - iv- The Stimulating light is more intense, and overwhelms the fainter fluorescence being emitted.
    - v- In order to visualize the fluorescence, the original stimulating light must be filtered out. Since different materials fluoresce when stimulated with different wavelength lights, searches should be made with various colored stimuli and different filters.
      - Yellow filters absorb UV
      - Orange filters absorb Blue.
      - Red filters absorb Green.
  - B. For:
    - i- Fluorescent Fingerprint Powders.
    - ii- Visualizing Non-Blood Body Fluids
    - iii- Fluorescent Fibers
    - iv- Drug Residues

- v- Cosmetics
  - vi- Ink Separations
7. Reflected IR Photography (IR Stimulation & IR Reflected Light).
- A. Light Sources:
    - i- IR light
    - ii- Daylight- VG
    - iii- Tungsten light- VG
    - iv- Electronic flash- OK
  - B. Sensors:
    - i- IR Film
    - ii- Digital Camera with CCD
  - C. Filter: if using any visible light, an 87 filter (transmits only IR) is needed to block out visible light.
  - D. Focus Shift: IR light focuses at a different point than does visible light.
    - i- First focus without the IR filter in place.
    - ii- Most lenses have an IR correction mark on the lens next to the focus point on the lens.
      - Either a red hash-mark
      - Or, an “R” designation
    - iii- Whichever distance has been focused on, move that distance to the IR correction mark.
  - E. For:
    - i- Surveillance with IR light
    - ii- Alterations/ Forgeries
    - iii- Subcutaneous Veins
    - iv- GSR
    - v- Ink Differences
    - vi- Burned Documents
    - vii- Aerial
8. IR Luminescence:
- A. Use an IR-Free light, like green.
  - B. Use IR film.
  - C. Use an 87 Filter to eliminate the green light.
  - D. Focus Shift
  - E. For:
    - i- Ink Alterations/Additions