IMAGE CHARACTERISTICS. N. Serman. Aug, 2000
W&P pages 75 -81.

Radiographic Density - the overall amount / degree of darkening on a radiograph. In routine radiography, the useful range of density varies from 0.3 to 2.0 density. The density below 0.3 is due to the density produced by the base and by some fog on the film (base plus fog). Density is primarily determined by mA - Board question.

Latitude - is described as the measure of the range of exposures that may be recorded as a series of usefully distinguishable densities on a film. The **wider the latitude** of a film, the **greater the range of object densities** visualized. Films with wide latitude show relatively low contrast [long gray scale], because many densities between totally black and totally clear are recorded. Such films are useful when both osseous and soft tissue must be viewed.

Influencing factors -

kVp. HIGH kVp will result in images with WIDE latitude. Different films have different latitudes

H and D Curve.

As the curve increases, the density increases. The **sharper** the angulation of the curve, the **less** the latitude of the film and the **greater** the contrast. The **flatter** the angulation, the greater / **wider** the latitude of the film and the **less** the contrast. Above a density of 3.00 the curve flattens out as this is the maximum density that can be perceived.

Influencing factors.

1. mAs - density; quantity; numbers
2. kVp - penetrating power; wave length; gray scale.
3. Distance - inverse square rule.
4. Object density - as the density of the object increases so the kVp must be increased to compensate for penetrating power - Board question. i.e. for a patient that has large / thick bones the kVp must be increased.

RADIOGRAPHIC CONTRAST.

Radiographic contrast is defined as the **differences in densities** between various regions on a radiograph. A film that shows very light and very dark areas has **high contrast** or a **short gray scale** as there are few shades of gray from one extreme to the other. A radiograph that has many shades of gray is referred to as one with **low contrast** or **long gray scale.** [wide latitude]

Influencing factors

1. **Subject contrast** - as the thickness of the anatomic structure, the density and the atomic number of the subject increases, so the radiopacity of the part increases.

2. **Film contrast** - film contrast describes the ability films to display differences in subject contrast. A **high contrast** film will reveal **small differences** in subject contrast more clearly. The slope of the **characteristic curve** is a measure of contrast; the greater the slope of the curve, the greater the film contrast. Properly exposed intra oral films have more contrast than under exposed films which lacks density. Does not apply to intra oral film.

3. **Beam energy / intensity.**
   If the film is excessively light or dark, contrast is reduced. As kVp is increased, object contrast is decreased.

4. **Fog** and **Scatter** - radiographic density will be increased by **fog** and **scatter** but the contrast will be **reduced**. Scatter results mainly from Compton interactions and can be reduced by -
   i. decreasing kVp
   ii collimation of the beam - wider beam; more scatter.
   iii. use of grids in extra oral radiology.

Common causes of film fog are improper safe-light conditions, storage of film at excessive temperature, processing at excessive temperatures, or for long periods of time, using film after the expiration date, or exposed to chemicals [chemical fog].

5. **Radiographic mottle / noise**

Is the uneven density [darker spots] on an exposed radiograph; often called graininess. This is seen with **high temperature processing** and when **intensifying screens** are used caused by a fluctuation in the number of photons [quanta] per unit of the beam are absorbed by the intensifying screen. Longer exposures required by slower film-screen combinations average out the beam pattern and reduce the mottle.

Film Speed. - Is the amount of radiation required to produce a radiograph of standard density. A **faster film** will require a **shorter exposure** time to produce the same density resulting in less exposure to the patient.

Image sharpness / detail - the **clarity** of the edge or the **outline** of a structure. A small focal spot is required for good detail.

Causes of loss of sharpness.

1. Focal spot size - the larger the focal spot the larger the penumbra which **detracts** from the detail.

2. Motion - movement of the **film**, patient or **radiation source** during the exposure. The shorter the exposure time the less likely the patient will move. The head of the X-ray machine must not move when an exposure is made. The head of the patient must be supported at the same time.

3. Image receptor
   i) the larger the silver grains the poorer the outline of the image.

   ii) intensifying screens have an **adverse** affect on sharpness. X-ray photons are converted to light photons which spread out beyond the point of origin and expose a larger area of the film causing blurring of detail.

   iii) double image receptors - because of the error of parallax. Dental film has a double coating of emulsion but **unimportant**.

Resolution - The ability to record separate structures that are close together. Measured in the number of line pairs per millimeter than can be read. It is said that one can determine 14 line pairs per millimeter. The best digital images give about 10 line pairs per millimeter. Even 10 lines pairs per millimeter can not be seen with the naked eye.