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Paper: Radiology

Question-1

Differentiate between the calcium tungstate screens and rare earth screens?

Answer

Calcium tungstate  
Screen:

Rare earth  
Screen:

1- Calcium tungstate  
screen conversion  
efficiency is 5%.

Rare earth screen  
conversion efficiency  
is 20%.

2- Conversion efficiency  
is lower than  
rare earth screen.

Conversion efficiency  
is higher than  
calcium tungstate screen.

3- lower image.

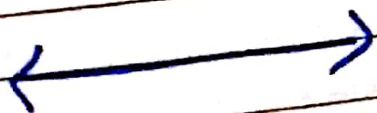
Blue image.

4- white colour.

Blue colour.

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5- higher patient dose.	lower patient dose.
6- Speed 50-200	speed 80-1200.
7- calcium tungstate screen assigned to value of 100.	High speed rare earth screen have speed up to 1200.
8- lower absorption.	Higher absorption.
9- Thicker emission layer.	Thinner emission layer.
10- High atomic No.	low atomic No.
11- Continuous spectrum.	Discrete spectrum.
12- less image noise.	High image noise.
13- violet to blue.	green blue.
14- violet & blue sensitive.	green sensitive film.
15- 20-200 HF	40-400 HF



## Question-2

Explain the latent image formation?

### Answer

### Latent Image :

A latent image is an invisible image produced by the exposure to light of a photosensitive material such as photographic material.

### Formation of the latent image :

The film emulsion is made of silver bromide crystals and silver iodide crystals that is precipitated in gelatin and layered on a thin sheet of transparent base.

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The silver halide crystals are chemically sensitized by the presence of sulphur compounds which cause physical irregularities in the crystal produced by iodide ions and these are called latent image sites.

The function of latent image site is to begin the process of image formation by trapping the electrons generated when the emulsion is irradiated.

When the silver halide crystals are irradiated the electron released changes bromide ion into bromine atoms. This will produce kinetic energy with which it moves in the crystal and strikes the image site imparting a negative charge to that region.

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Free positively charged interstitial silver ions are attached to the negative latent image site and neutralize the image site with the result that an atom of metallic silver is deposited at the site. After exposure of a film to radiation the aggregate of silver atoms at the latent image sites, comprises the latent image. It is the metallic silver at each latent image site that catalyses the development of the halide crystal in which it formed and renders the crystal sensitive to development and image formation.

Silver halide crystals absorb x-radiation during x-ray exposure and store the energy from the radiation.

The stored energy within

The silver halide crystals forms a pattern and creates an invisible image within the emulsion on exposed film.

This pattern of stored energy on the exposed film cannot be seen and is referred to as latent image.

The concentration of electrons at the sensitivity centers produces a region of negative electrification.

As halide atoms are removed from the crystal the positive silver ions are electrostatically attracted to the sensitivity centers.

After migrating to the sensitivity centers the silver ions are neutralized by electrons and are converted to metallic silver.

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In an optimally exposed film most developable silver halide crystals have collected 4 to 10 silver atoms at a sensitivity center.

Consequently this silver deposition is not observable even microscopically.

This group of silver atoms is called latent image center. It is here that visible quantities of silver form during processing to create the radiographic image.

The unobservable information contained in radiation-activated and inactivated silver halide crystals constitutes the latent image.



## Question- 3

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Briefly describe the construction of radiographic film with diagram?

## Answer

### Radiographic film

Radiographic film consist of an emulsion- gelatin containing radiation sensitive silver halide crystals such as silver bromide or silver chloride and a flexible transparent, blue tinted base.

### Construction of radiographic film :

#### Base film :

1- The base is the foundation of radiographic film.



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1- The primary purpose is to provide a rigid structure onto which the emulsion can be coated.

2- The base is flexible and fracture resistant to allow easy handling but is rigid enough to be snapped into a viewbox.

3- The base of radiographic film is 150 to 300  $\mu$ m thick, semirigid, lucent and made of polyester.

4- The base is of uniform lucency and is nearly transparent to light.

5- The original radiographic film base was a glass plate.

6- In the early 1960s a polyester base was introduced.

7- polyester has taken the

place of cellulose + acetate as the film base of choice.

## Emulsion :

- 1- The Emulsion is the heart of the radiographic film.
- 2- It is the material with which x-rays or light photons from radiographic intensifying screens interact.
- 3- The emulsion consists of a homogenous mixture of gelatin and silver.
- 4- It is coated evenly with a layer that is 3 to 5 thick.
- 5- Tabular grains are used in most radiographic film.
- 6- Its principle function is to provide mechanical support for silver halide crystals by holding them uniformly

dispersed in place:-

7. The crystals are made by dissolving metallic silver in nitric acid to form silver nitrate.

8. Radiographic film is manufactured in total darkness, from the moment the emulsion ingredients are brought together until final packaging no light is present.

- Most film has two layers of emulsion so it is referred to as double emulsion film.

- An adhesive layer attaches the emulsion to the base.

- The emulsion is enclosed in a protective layer or overcoat.

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# Diagram:

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