INFRARED RADITION

INTRODUCTION, HISTORY ,CLASSIFICATIONS AND APPLICATIONS

HISTORY , WHAT IS INFRARED RADITION, CLASSIFICATIONS

HISTORY

- Infrared radiation was discovered in 1800 by Astronomer Sir William Herschel.

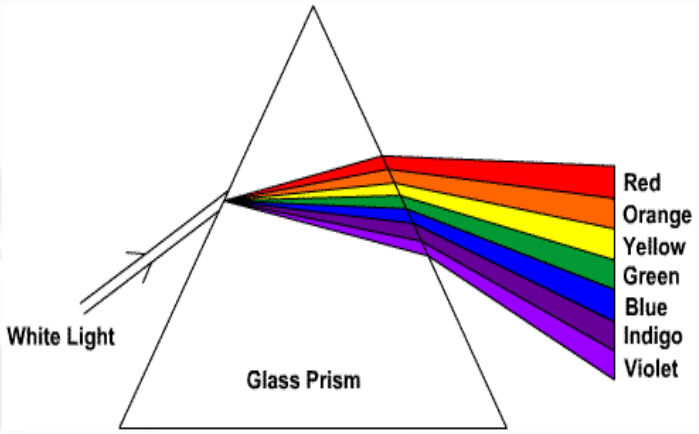
- He knew that sunlight was a mixture of all colors in the rainbow.
- He also knew that a glass prism can spread the sunlight and show all of these colors.

- His experiment was to measure the temperature of each color in the rainbow with a thermometer.

- He used a prism to refract light from sun and detected the infrared beyond the red part of the spectrum through an increase in a temperature recorded on a thermometer.

- He was surprised as the result and called Calorific Rays.
- Today, we called Infrared Radiation.

WILLIAM HERSCHEL



PRISM

WHAT IS INFRARED RADIATION

*Infrared radiation is an electromagnetic radiation with a wave length longer than that of visible light.

*Infrared radiation includes most of the thermal radiation emitted by objects near room temperature.

*Microscopically, IR light is typically emitted or absorbed by molecules when they change their rotational vibrational movements.

*When energy from sun arrives on earth in the form of infrared radiation. Sunlight zenith provides an irradiance of just 1kilo watt per square meter at sea level in which 527 watts is infrared radiation, 445 watts is visible light, and 32 watts is ultraviolet radiation.

*The balance between absorbed and emitted infrared radiation has a critical effects on the earth climate.

TYPES OF INFRARED RADIATIONS

TYPES	WAVELENGTH
a) IRA	760- 1400nm
b) IRB	1400- 3000nm
c) IRC	3000nm- 1mm

Former Classification:-

Near or Short IRR	760-1500nm
Far or Long IRR	1500-15000nm

TYPES OF IR LAMP

- Two types of infrared source are used in physiotherapy practice:-

1.Non luminous generators

2.Luminious generators

❑ NON LUMINOIOUS GENERATORS :-

- Also known as low temperature generator.
- Produces only infrared rays of wavelength 750- 15000nm.
- These generators are heated by passage of electric currents through a bare wire or carbon held in a non conducting materials like porcelein, mounted in center of parabolic reflector.
- Examples:- Hot Pack

NON LUMINIOUS

LUMINIOUS

❑ LUMINIOUS GENERATOR

- It is also known as high temperature generator.
- Emits visible rays, ultraviolet rays, and infrared rays of wavelengths 350-4000nm.
- Luminous generators are in the form of Incandescent bulb – consist of a wire filament enclosed in a glass bulb which may contain inert gas at low temperature.
- Filaments made up of tungsten as it tolerates repeated heating and cooling.
- Human skins absorbs 95% of energy if it is perpendicular to surface.
- Examples :- Tungsten Lamp, Carbon Filament Lamp etc.

SOURCES OF INFRARED RADIATION

Sources of infrared (IR) radiation

1. Nernst glower

- It was used to provide continuous source of IR radiation for use in spectroscopy.

- A cylindrical rod or tube composed of a mixture of certain oxides such as zirconium oxide (ZrO_2), yttrium oxide (Y_2O_3) and erbium oxide (Er_2O_3) at a ratio of 90:7:3 by weight. Pt leads at the ends of the cylinder permit the passage of electricity.

- Operates at wavelength range of 2 to 4 microns.

- Has a large negative temperature coefficient of electrical resistance and preheating to about 2000o C was necessary

2. Globar

- Used as thermal light source for infrared spectroscopy.
- It is a silicon carbide rod of 5 to 10 mm width and 20 to 50 mm length which is electrically heated up to 1000 to 1650 °C .
- When combined with a downstream variable interference filter, it emits radiation from 4 to 15 micro-metres wavelength.
- Globars are used as thermal light sources for **infrared** spectroscopy because their spectral behaviour corresponds approximately to that of a Planck radiator (i.e. a black body).

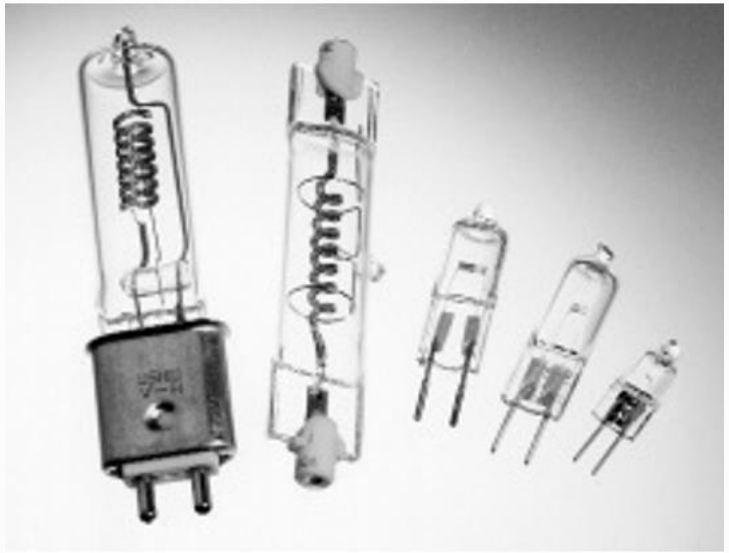
3. Quartz tungsten Halogen (QTH) lamps

- It is a popular near infrared (NIR) source.

- These use a doped tungsten filaments inside a quartz envelope filled with rare gas and a small amount of halogen.

- Current flowing through the filament heats tungsten to around 3000 K.

- The combination of the halogen gas and the tungsten filament produces a halogen cycle chemical reaction which redeposit evaporated tungsten back onto the filament, increasing its life and maintaining the clarity of the envelope.



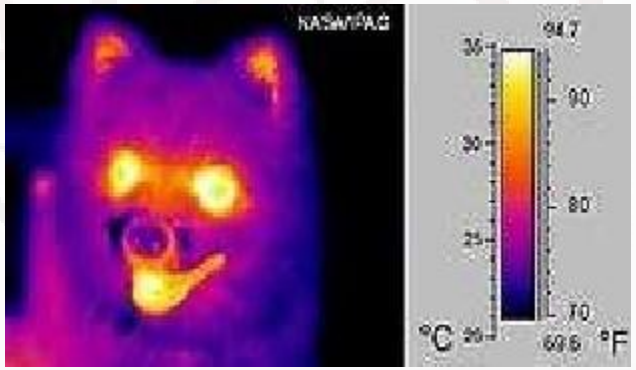
APPLICATION OF INFRARED RADIATION

THERMOGRAPHY :

*This is a branch deals with acquring and analyzing thermal informations from thermal imaging devices

*Infrared radiation can be used to remotely determine the temperature of objects

*This works on the principle that infrared radiation is emmitted by the bodies and these radiation are detected by thermography cameras



MEDICAL APPLICATIONS :

*Digital infrared thermal imaging (DITI) is a technique that is used for diagonosis in the medical feild .

* This process makes use of thermal imaging cameras that are called DITI cameras that record thermograms depending on the infrared radiation emmitted by the body

*Infrared radiation is used in thermotherapy which finds wide application in the treatment of high blood pressure, arthitis ,heart failure ,chronic fatigue ,stress,toxicity,insomnia ,pain .etc ;

*It is also used in physiotherapy and treatment of cancer

*Dentists utilize: infrared light to treat many types of wounds and ulcerations in the oral cavity

*Rheumatologists have used infrared lights to therapy to reduce the pain and inflammation

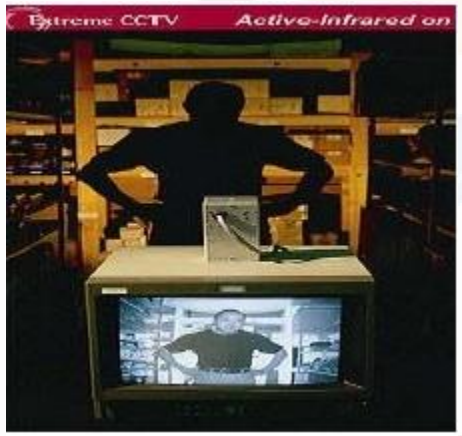
*Dermatologists also use light therapy to manage patients with burns ,skin lessons, edema, ulcers.

NIGHT VISION :

*Infrared is used in night vision equipment when there is insufficient visible lights to see

*The use of infrared light and night vision devices should not be confused with thermal imaging which creates images based

on differences in surface temperature by detecting infrared radiation (heat) that emanates from the object and their surrounding environment



HEATING :

*infrared radiation can be used as a delibrate heating sources

*infrared radiation is also becoming more popular in industrial manufacturing process eg; curing of caoatings , forming of plastics , annealing , plastic welding , print drying .

*in these application the infrared heaters replace convection oven and contact heating

COMMUNICATION :

*In infrared transmission beaming is the communication of data between wireless devices using a beam of infrared light .

*this beams is invisible to human and used in many familiar devices such as television remote control and garage

FORENSIC APPLICATION

* **Infrared radiation** can be used in many **forensic applications**, such as the identification of various inks, sweat prints, hair, and other fibers, and toxic industrial materials and chemicals

ADVANTAGES,DISADVANTAGES, PHYSIOLOGICAL EFFECTS, DANGERS AND INDICATIONS OF INFRARED RADIATIONS

Advantages :

Low power requirements : therefore idea for laptop, telephones, personal digital assistants

Low circuitry costs : $2 - $5 for the entire coding/decoding circuitry

Simple circuitry : no special or proprietary hardware is required , can be incorporated into the integrated circuit of a product

Higher security : directionality of a beam helps ensure that isn’t leaked or spelled to nearby device as it transmitted portable

Disadvantages ;

Light of sight : transmitters and receivers must be almost directly aligned (i.e. able to see each other) to communicate

Blocked by common materials : people, walls, plants etc. can block transmission

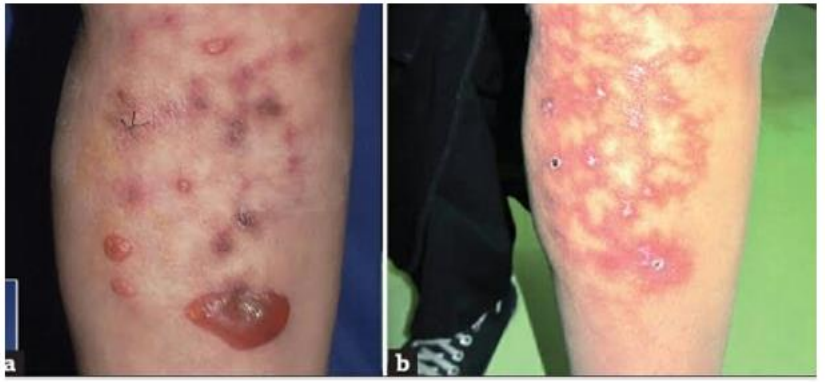
short range: performance drops off with longer distances

Light, weather sensitive : direct sunlight ,rain, fog, dust, pollution can affect transmission

Physiological Effects:

Pigmentation and Erythema

Repeated exposure with infrared rays can cause pigmentation of the skin because of the destruction of blood corpuscles



Effects on metabolism

*Metabolic rate increase.
According to vant's Hoff Law, for every 10 increase in temperature
There is 2-3 fold increase rate of cellular oxidation.

*Sweating

*Cutaneous vasodilatation

*Stimulation of thermal heat receptors.

Dangers:

*Burns

*Electric Shock

*Faintness and giddiness

*Injury to eyes

*Gangrene

*Headache

*Dehydration

Indications

*Pain and muscle spasm

*Chronic inflammatory stage – oedema

*Joint stiffness – Acute and chronic stage

References

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THANK YOU