

Q No 2(a) Define ceramic and Nano-ceramic materials. Why the Nano-ceramics show better properties than their ceramic counterparts? Write the application of ceramic materials.

Ceramic Materials:

Ceramic materials are inorganic materials usually made from metallic or non-metallic compounds such as silicates, carbides, aluminates, oxides and hydroxides. They are generally hard, brittle, and have high melting points. Pottery, tiles, glass and refractory materials are some examples of ceramic materials.

Nano ceramic Materials

Nano ceramics are a type of nanoparticle that is fabricated from ultrafine particles. They are much smaller in size as compared to ceramic materials ranging between 1-100 nm in diameter. They are inorganic, heat resistant and non-metallic and were first discovered in the 1980s.

Why the Nano-ceramics show better properties than their ceramic counterparts?
Over the recent decades, Nano ceramic materials have gained huge significance due to their improved and unique properties compared to traditional ceramic materials. They show unique material and surface characteristics such as super plasticity, bioactivity, strength, toughness, and machinability.

They show better properties primarily due to the fine grain size, and large grain boundaries. The fine grain size leads to higher strength.

and toughness while the large surface boundaries allow particles to easily interact with each other which results in better thermal and mechanical properties.

Applications of ceramic Materials

Nano ceramic materials have a wide variety of application in different fields such as

a. In medical technology Nano ceramics are used for bone repair and developing materials that can enter the human body without any disturbance. Bioactive ceramics closely resemble and properties of bones and can, therefore support bone redevelopment.

b. Floor and walls tiles: ceramic are widely used in the construction industry for covering both indoor and outdoor walls.

c. Electronics They are used in the construction of different electronics such as semiconductors, capacitors, insulators, conductors and magnets.

d. Transportation and communication

They are also used in energy supply, transportation and communication systems.

e. Aerospace: ceramics are used in aerospace for the formation of parts of the space shuttle, rockets, and space station.

(b) What is a "Black hole" How black holes are formed and discovered?

What is a Black Hole

Black holes refer to the region of space where the gravitational pull is so strong that nothing even light cannot escape. The reason behind

the strong gravitational pull is that matter has been compressed into a tiny space. This compression usually occurs at the end of a star's life or as a result of dying stars. As light can't escape, black holes are generally invisible. However, some black holes can be observed with special space telescopes. These telescopes trace the presence of black holes through their impact on nearby materials.

Formation of Black Holes:

Different types of black holes are formed through different processes. Typically, they are created by the collapse of massive stars, many times larger than the sun. Others are thought to have been created since the creation of the universe. The creation of many others is still a mystery. They are not directly observable but their presence can be detected through their impacts on the nearby matter.

Discovery of Black holes

The idea of black hole was first proposed by physicist John Michell in 1786 and later by Pierre-Simon in 1796.

In 1931 astrophysicist Subrahmanyan Chandrasekhar calculated that when the fuel of stars, larger than the mass of the sun, runs out, the force of gravity collapses its core and a black hole is formed. This idea was rejected by many of his contemporaries but he was later awarded a Nobel prize in 1983 for this discovery.

The term black hole was discovered in 1968 by American Scientist John Wheeler.

(c) Write two application of each of the following electromagnetic radiations

Electromagnetic radiations have a wide range of applications in different fields such as

(i) **Ultra violet**

- Ultra violet are used in a variety of industrial process such as creating fluorescent effects
- They are also used in the medical and dental fields for different processes such as killing bacteria, phototherapy, and suntanning.

(ii) **Infra-red**

- Night vision goggles and thermal imaging technology make use of infrared waves
- They are also used in devices such as remote controls and telescopes

(iii) **Microwave**

- Microwaves are used in ovens for cooking food
- They are also used to transfer communication signals across great distance through devices such as satellites and remote sensors.

(iv) **Radio waves**

- Radio waves are widely used in communication devices such as cell phones, wifi networks, and Bluetooth devices
- Radio waves are primarily used in TV and radio broadcasting. TV and radio employ radio waves to transmit video and audio signals over long distance, enabling us to receive TV programming.

(v) **X-rays**

- These are useful in medical diagnosis. X-rays are

used to detect the structure of bones and to detect any breakage or damage in them.

→ X-rays are used in airport security system to scan the luggage of passengers to detect prohibited items such as weapons or explosives. X-ray scanners take the image of items present inside the bags of passengers.

(d) What is Wildfire? Explain its types, causes, spread, and prevention.

What is Wildfire

Wildfire refers to the uncontrolled fire occurring in wildland areas which can devastate large agricultural land and houses. It often begins unnoticed but can spread quickly igniting trees, homes, and bushes.

causes of Wildfire

- Lightning
- Smoking
- Campfires
- Accidents or equipment failure
- Fireworks
- Dry weather
- Burning debris

Types of Wildfire:

There are three types of wildfires.

1. Surface Fire

Burns the forest undergrowth and the surface layer. It can be extinguished more easily compared to other types.

2. Crown Fire

It advances through the top of forest trees or shrubs. Crown fires are extremely dangerous and challenging to control.

3. Ground Fire

Burns the humus layer of the forest floor but does not burn above the surface. It can be challenging to detect and extinguish this type of fire.

Spread of Wildfire

The spread of wildfire is influenced by several factors including

1. Weather

Dry and windy places allow forest fires to spread faster.

2. Fuel

Forest fires spread more quickly in areas where there is more wood or availability of other fuel sources.

3. Topography

Landmarks such as rivers can stop wildfires, however, mountains and hills can help them spread further.

Prevention Against Wildfires

- Creating awareness in citizens regarding the dangerous impact of wildfire so that they can develop a responsible attitude such as proper campfire use and cigarette disposal.
- Trained firefighters are key to fighting forest fires. They must be properly trained and equipped with specialized equipment to ensure an effective response to wildfires.
- Satellites, aircraft, and digital equipment should be used to monitor fires, forecast wind direction and create and effective maps and information to fight fires.