

Date: 17/6/2025

Day: _____

NAME

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BATCH

384

NATIONAL OFFICERS ACADEMY

(Islamabad)

(GENERAL SCIENCE & ABILITY)

Q.i. Define ceramic and nano-ceramic materials. Why the non-ceramics show better properties than their ceramic counterparts? Write the application of ceramic materials.

Ceramic Material

Ceramics are inorganic, non-metallic materials made by shaping and then firing a non-metallic mineral, such as clay, at high temperatures. They are typically hard, brittle, and heat resistant, and can be crystalline or partly crystalline.

Examples

Alumina (Al_2O_3), Zirconia (ZrO_2)
Silicon Carbide (SiC)

General Properties

- i. These are high hardness and strength
- ii. High melting point

- iii) Excellent thermal and electrical insulation
- iv) Corrosion and wear resistance
- v) Brittle in nature.

Non-Ceramic Materials

Non-ceramics are ceramics materials with grain sizes in the nanometer range. These materials retain the basic chemistry of conventional ceramics but exhibit significantly improved properties due to their nanoscale structure.

Examples

Nano-Zirconia, Nano-Alumina
Nano-Titania.

Non-ceramics outperforms conventional ceramics due to several key reasons.

Reasons	Effects
1. Reduced Grain Size.	Smaller grains lead to more grain boundaries, which hinder crack propagation resulting in improving toughness and strength.

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|----------------------------|--|
| 2. Increased Surface Area. | Higher surface area enhance chemical reactivity and sintering ability, improving the material's density and mechanical properties. |
| 3. Enhanced Densification. | Nanoparticles can pack more efficiently during sintering, leading to fewer pores and improved mechanical strength. |
| 4. Quantum Effects. | At the nanoscale, materials may show unique electrical, optical, and magnetic properties not seen in bulk ceramics. |

Applications

- i. These are used mainly in electronics such as capacitors, insulators and electronic circuits.
- ii. It also use in medical profession specially in Dental implants, Bone Grafts
- iii. Thermal barrier Coatings
- iv. wear Resistant parts
- v. Solid oxide fuel cells (SOFCs)

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Q. Write a Note on liver juice 'Bile'?

Bile:

Bile is a digestive fluid produced by the liver and stored in the gallbladder. It plays a crucial role in the digestion and absorption of fats in the small intestine.

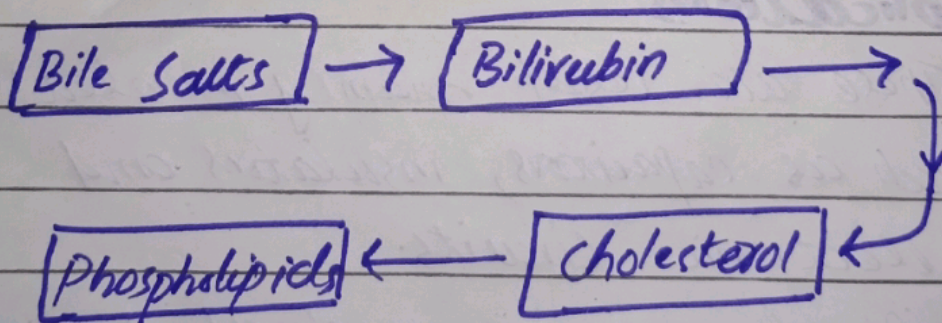
Bile is composed of water, bile salt, bilirubin, cholesterol, and electrolytes.

Functions of Bile.

It performs the following functions.

1. Emulsification of Fats.
2. Absorption of fat-soluble vitamins
3. Excretion of waste products
4. Neutralization of stomach Acid.

Composition Bile



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