

July 2024 - Mock 3

General Science and Ability

Section I

3.a) Atoms form bonds in order to:

→ make their outer electron shells more stable

→ the type of chemical bond maximizes the stability of the atoms that form it

↳ noble gases are very reluctant to form bonds because their outer shells are full

→ octet rule: elements gain or lose electrons to obtain an electron configuration of the nearest noble gas

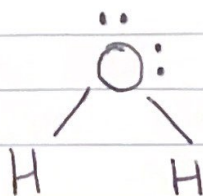
∴ Atoms form bonds in order to attain greater stability

Covalent Bond in a water molecule (H_2O):

Hydrogen Atom → each hydrogen atom has one electron and needs one more to achieve stable configuration

Oxygen Atom → oxygen has six electrons in its outer shell and needs two more to complete the shell

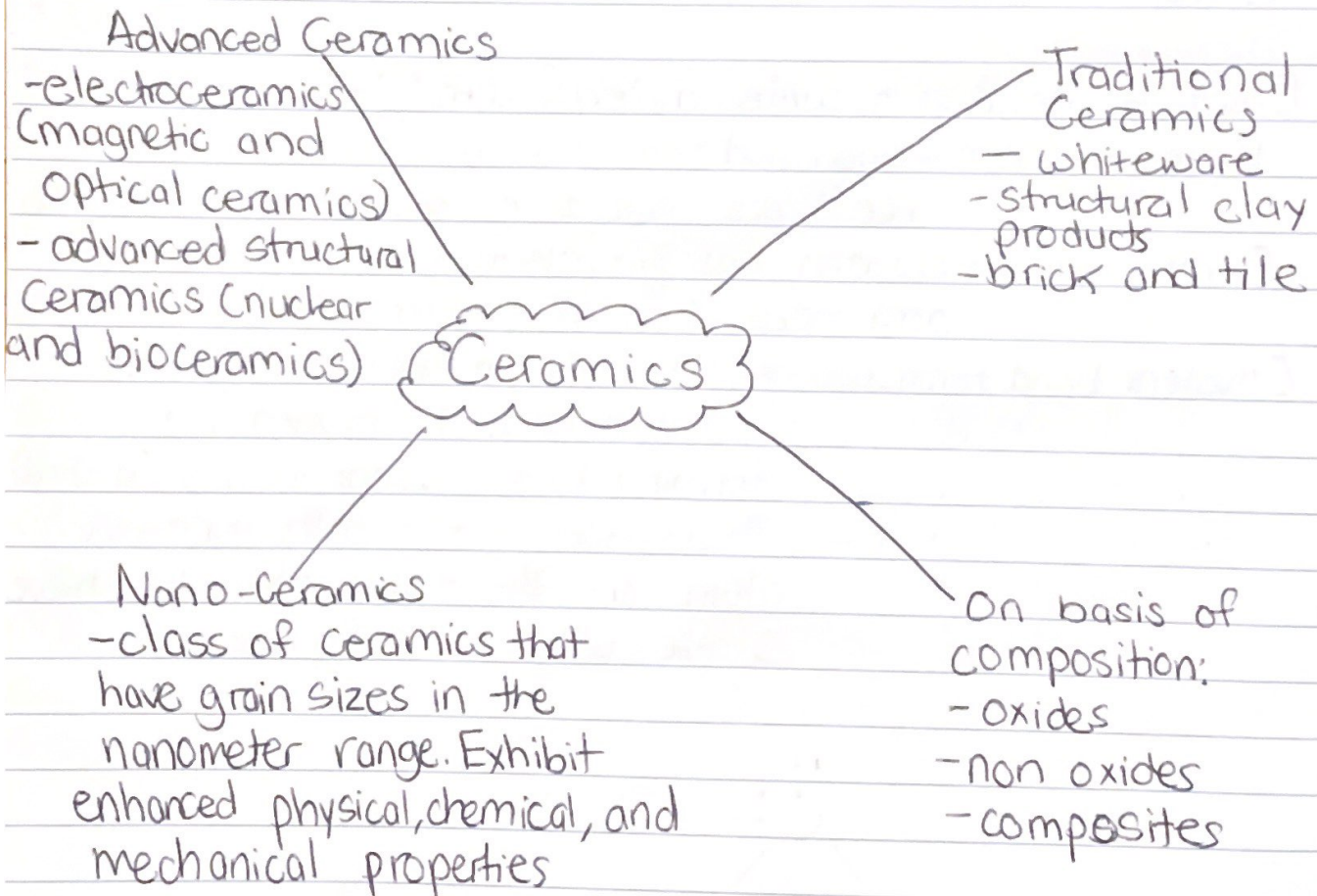
Covalent Bond Formation → each hydrogen atom shares one electron with the oxygen atom, forming two covalent bonds ($H-O-H$). This sharing allows both hydrogen atoms and the oxygen atom to achieve stable electron configuration



3. b) Doping = a key process in the function of semiconductors.
↳ introducing impurities to create n-type (more electrons) and p-type (more holes) in semiconductors.

Two Types of Doping:

- 1) N-Type Doping = adding a small amount of impurity with more valence electrons introduces free electrons. These electrons can move and carry electric current, enhancing the conductivity
- 2) P-Type Doping = adding an impurity with fewer valence electrons, creates "holes" in the crystal structure. These holes can move as neighbouring electrons jump into them, also allowing the material to conduct electricity



3.c) Demerits of Global Warming:

- increased frequency and intensity of heatwaves can compromise human health (lead to illness or death)
- changes in temperature, precipitation, and increased CO_2 levels can ~~also~~ affect crop productivity, and food security
- water availability → some regions are experiencing droughts
- ecosystems and biodiversity → habitat loss; species are forced to migrate

Merits of Global Warming:

- areas with freezing temperatures (Antarctica) become more habitable

3.d) Polio = highly infectious disease (viral) which mainly affects young children

- there are 3 strains of poliovirus, none can survive outside of human body for a long time
- Symptoms = invades nervous system, fever, fatigue, headache, vomiting, can cause total paralysis in hours
- Causes = spreads in human feces, contaminated water + food
- Prevention = there is no cure, can only be prevented
- Vaccine = inactivated polio vaccine (IPV) and oral polio vaccine. Children should be vaccinated starting at 2 months

Challenges in eradication of polio in Pakistan:

- Sanitation and hygiene are poor
- improper sewage disposal in rural areas
- lack of education amongst new mothers

4.a) Bile = chemical substance that breaks down fats and makes them more digestible

- produced by the liver
- aids in digestion of proteins, fats, and carbohydrates
- emulsifies fats, making them easier to digest
- stored and concentrated in gallbladder. Gallbladder releases bile into small intestine to aid in fat digestion

4.b) Function of kidneys:

- regulates blood pressure and the level of vital salts in blood
- nephrons filter, reabsorb, and secrete glutamate, carbs, and solutes
- Loop of Henle concentrates the salts which are added to the urine to aid in excretion

4.c) Methods of Solid Waste Management:

- 1) Generation → waste is produced and begins to increase in volume
- 2) Collection → waste is picked up from the location (e.g. municipal, industrial, biomedical, agricultural)
- 3) Transfer → system is designed to carry waste towards collect facility
- 4) Treatment → waste is managed using a variety of methods such as incineration, recycling, landfill (buried underground), transferred across sites

4.d)

- i) Anaemia = condition of having low iron in the blood
- ii) Appendicitis = condition in which appendix becomes inflamed, requires removal of appendix
- iii) Spleen = site of concentration for lymphocytes
- iv) Myopia = condition of nearsightedness (person can only see when going near), corrected by concave lens

Section II

6.a) A : B : C : D

Difference between A and C : 1

↓

~~Let~~

4 : 7 : 3 : 1

Let increment of 1 = 50 blocks

$$\therefore A = 4 \times 50 = 200 \text{ blocks}$$

$$\therefore B \text{ has } 350 \text{ blocks}$$

$$B = 7 \times 50 = 350 \text{ blocks}$$

$$C = 3 \times 50 = 150 \text{ blocks}$$

$$D = 1 \times 50 = 50 \text{ blocks}$$

6.b) Original cost = \$80

$$15\% \text{ discount} = 0.15 \times 80 \Rightarrow \begin{matrix} 15 \\ \times 8 \\ \hline \end{matrix} \Rightarrow 15 \times 80 = \$200$$

$$\Rightarrow 0.15 \times 80 = \cancel{20} = 12$$

$$\text{Price is now } 80 - 12 = \$68$$

$$10\% \text{ sale tax} = 0.1 \times 68 = 6.8$$

$$\text{Final price} = 68 + 6.8 = \boxed{\$74.80}$$

6.c) Travels 36 km/h

First Hour \rightarrow travels 36 km (6 km left) = 5 pm

Second Hour \rightarrow travels 6 km ($\frac{1}{6}$ of the hour)
= 10 min

\therefore Train arrives at 5:10 pm

6.d) i) Superintendent

ii) white

7.b) Average age = 15 years

Sum of ages = $15 \times 3 = 45$

3:5:7

$\downarrow \times 3$

9:15:21

\therefore Age of youngest boy is
9 years old

c) i)

8, 19, 52, 151, 447

$\underbrace{\quad} \times 3 - 5$ $\underbrace{\quad} \times 3 - 5$ $\underbrace{\quad} \times 3 - 5$ $\underbrace{\quad} \times 3 - 5$

\rightarrow next number = $(448 \times 3) - 5$
= 1339

\therefore 447 is the wrong number because its supposed to be 448

ii)

11, 13, 17, 19, 23

$\underbrace{\quad} \times 1 + 2$ $\underbrace{\quad} \times 1 + 4$ $\underbrace{\quad} \times 1 + 2$ $\underbrace{\quad} \times 1 + 4$ $\underbrace{\quad} \times 1 + 2$

= 25