

Question (3)(a)

Chemical Bond:

A chemical bond is an attraction between atoms that enables formation of chemical compound.

WHY ATOMS FORM CHEMICAL BOND

Atoms exist in nature in a highly unstable state. They form chemical bond to achieve greater stability. The stability is usually attained by reaching a lower energy state, often by achieving a full outermost shell or valence shell. The driving force behind bond formation is the atom's tendency to follow the octet rule, where atoms seek to have eight electrons in their valence shell, similar to the electron configuration of nearest noble gas. Noble gases are most stable elements in periodic table.

Henceforth, atoms form chemical bond in order to achieve stability by gaining electronic configuration of noble gases

COVALENT BOND IN WATER MOLECULE

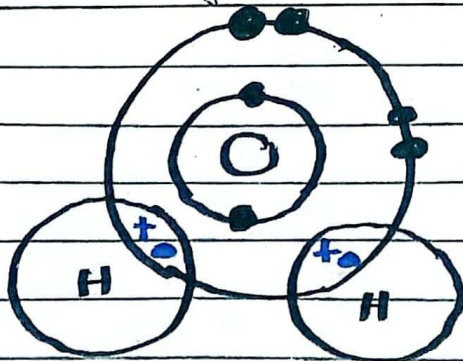
Chemical Formula of water:
 H_2O

ATOMS INVOLVED IN FORMATION OF COVALENT BOND

Hydrogen, $H = 1$
Oxygen, $O = 8$

FORMATION OF BOND

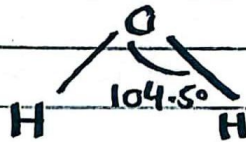
Hydrogen has one electron in its valence shell and needs one more to achieve stability - similarly, oxygen has 6 electrons in its valence shell and requires two electrons to complete its valence shell - As water molecule has two hydrogen atoms so each hydrogen atom will share one electron with oxygen atom - In turn oxygen atom will share one electron with hydrogen - This sharing results in two single covalent bonds.



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MOLECULAR GEOMETRY

The shape of water molecule is bent or V shaped with an angle of about 104.5°



Question 3(b)

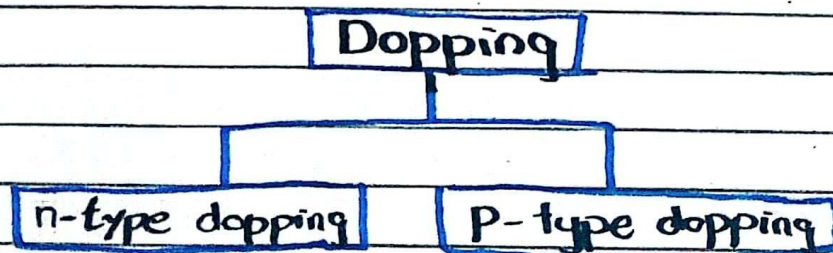
DOPPING

"Dopping refers to intentional introduction of impurities into pure semiconductor to modify its electrical properties"

The process is essential in creation and optimization of electronic devices such as transistors, diodes and integrated circuits - Doping increases number of charge carriers (electron or holes), thereby enhancing conductivity of material.

TYPES OF DOPPING

There are two main types of Dopping.



1- N-TYPE DOPPING

"It is achieved by adding donor impurities, which have more valence electrons than semiconductor"

0-10
15-1

2-82

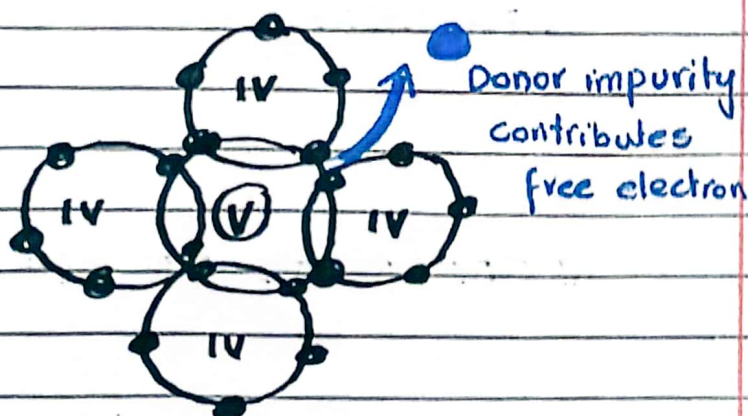
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The member of 4th group in periodic table are used in type doping. e.g Silicon, Germanium

In silicon (which has four valence electrons), common n-type dopant include phosphorus (five valence electrons) and arsenic. These extra electrons increase the number of free electrons in semiconductor making it more conductive



2-

P-TYPE DOPPING

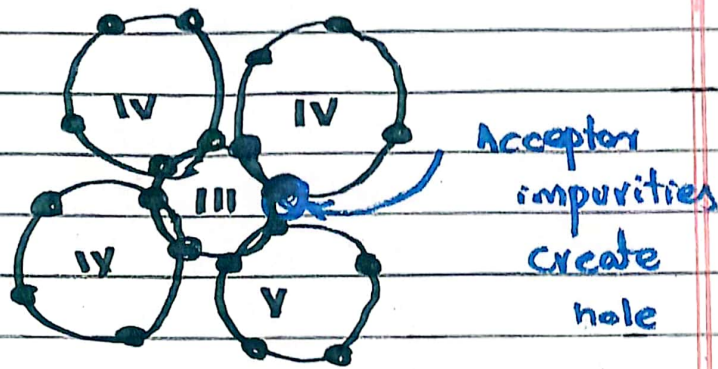
Achieved by adding acceptor impurities which have fewer valence electrons than semiconductor.

In silicon, common p-type dopant include Boron (three valence electron) and gallium

These dopant create holes (positive charge carriers) by accepting electron from silicon atom

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DIFFERENT TYPES OF CERAMICS

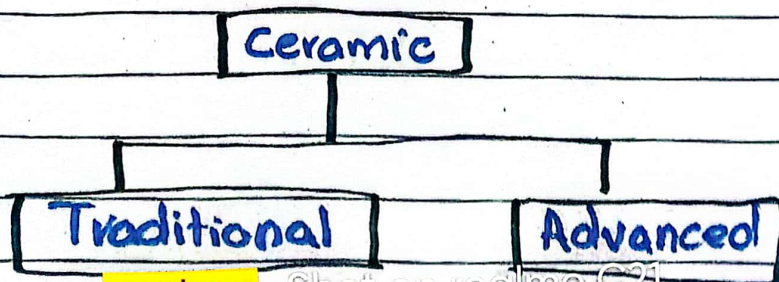
CERAMICS

Ceramics are inorganic, non-metallic materials made through specialized manufacturing processes.

PROPERTIES OF CERAMICS

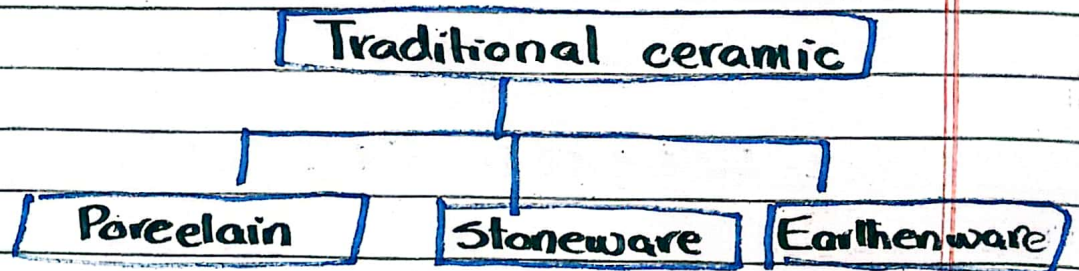
1. Harder and more brittle than metal
2. Refractory
3. nonmagnetic
4. oxidation resistance
5. chemically stable.

TYPES OF CERAMIC



1- TRADITIONAL CERAMICS

These are made from natural materials like quartz, clay. Their structure depends on the composition of clay which makes them more imperfect compared to uniform microstructure of advanced ceramics. They are manufactured by wet moulding.



2- ADVANCED CERAMICS

These use synthetic powders such as aluminium oxide, silicon carbide, and silicon nitride. They are designed and engineered to have specific properties for high-performance application. Each of these ceramics is known for its ability to use in magnetism, insulation and conductivity.

MERITS OF GLOBAL WARMING

Some benefits of global warming are:

1- LONGER GROWING SEASONS

In certain regions, warmer temperatures can lead to longer growing seasons potentially increasing agricultural yields and enabling multiple harvests per year.

2- REDUCED HEAT COSTS

Warmer winters can lead to lower heating costs for homes and businesses in colder regions, reducing energy consumption and expenses.

3- NAVIGATING ARCTIC ROUTES

Melting polar ice opens new shipping routes in the Arctic, reducing travel distance and time between major global ports.

DEMERITS OF GLOBAL WARMING

1- SEA LEVEL RISE

Melting ice caps and glaciers contribute to rising sea levels, leading to coastal erosion, increased flooding and displacement of communities.

2- EXTREME WEATHER EVENT

Increased frequency and intensity of extreme weather events such as hurricanes, drought, heatwaves and heavy rainfall causing widespread damage and loss of life.

3- LOSS OF BIODIVERSITY

Changes in temperature and habitat loss threaten many species leading to reduced biodiversity and extinction of vulnerable species.

Question 3(d)

POLIO (POLIOMYELITIS)

It is highly infectious viral disease caused by poliovirus. It primarily affects young children and can lead to paralysis primarily of legs.

CAUSES OF POLIO -

Polio is caused by poliovirus - It mainly targets nerve cells in spinal cord and brain stem that control muscle movement - Nerve cells controlling sensation are not affected.

COMMON SYMPTOMS

- o Meningitis
- o Flaccid paralysis
- o Loss of reflexes
- o paresthesia (tingling feeling in legs)
- o Severe muscle aches
- o paralysis

CHALLENGES IN ERADICATION OF POLIO IN PAKISTAN

Pakistan, along with Afghanistan and Nigeria, are the last countries struggling to eradicate poliovirus transmission.

Several challenges persist in eradicating polio in Pakistan.

- 1- SECURITY CONCERNS
- 2- MISCONCEPTION AND MYTHS
- 3- Health Infrastructure challenges
- 4- Population Mobility and Migration
- 5- Resistance from Local Leaders
- 6- Vaccine access and cold chain management

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Section II

QUESTION 6(a)

The ratio of Blocks : A : B : C : D
4 : 7 : 3 : 1

Let, denote toy blocks with
alphabet A, B, C, D as
 $4x$, $7x$, $3x$ and x respectively.

A block is 50 more than
C block

$$A = C + 50$$

$$4x = 3x + 50$$

$$4x - 3x = 50$$

$$x = 50$$

No. of B block = $7x$

$$B = 7 \times 50$$

$$B = 350$$

$$\boxed{B = 350}$$

Question 6(B)

Data:

$$\begin{aligned} \text{Original Cost} &= 80 \$ \\ \text{Discount} &= 15\% \\ \text{Sale tax} &= 10\% \end{aligned}$$

To Find:

$$\text{Final Price} = ?$$

Solution:

$$\begin{aligned} \text{Discount price} &= 80 \$ \times 15\% \\ &= 12 \$ \end{aligned}$$

$$\text{Discount price} = 12 \$$$

$$\begin{aligned} \text{Sale tax} &= 80 \$ \times 10\% \\ &= 8 \$ \end{aligned}$$

$$\text{Sale tax} = 8 \$$$

$$\begin{aligned} \text{Total} &= 12 + 8 \\ &= 20 \$ \end{aligned}$$

$$\text{Final Price} = \text{Total price} - \text{Discount}$$

$$= 80 - 20$$

$$= 60 \$$$

$$\text{Final Price} = 60 \$$$

Question 6 (c)

Data:

$$\begin{aligned} \text{Distance, } s &= 42 \text{ km} \\ &= 42000 \text{ m} \end{aligned}$$

$$\begin{aligned} \text{Speed, } v &= 36 \text{ km/hr} \\ &= \frac{36000 \text{ m}}{3600 \text{ sec}} \\ &= 10 \text{ m/sec} \end{aligned}$$

$$\text{Departure time} = 4 \text{ pm}$$

$$\text{Arrival time} = ?$$

Solution:

$$\text{Speed, } v = \frac{\text{Distance (s)}}{\text{Time (t)}}$$

$$\begin{aligned} \text{Time (t)} &= \frac{s}{v} \\ &= \frac{42000}{10} \end{aligned}$$

$$\begin{aligned} \text{Time} &= 4200 \text{ sec} \\ &= 70 \text{ min} \\ &= 1 \text{ hr } 10 \text{ m} \end{aligned}$$

$$\text{Arrival time} = 4 \text{ pm} + 1 \text{ hr } 10 \text{ m}$$

$$\text{Arrival time} = 5 \text{ pm } 10 \text{ m}$$

Question 6(d)

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2- hweti
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Question 7 (a)

Data:

$$\text{Radius, } r = 30 \text{ cm}$$

$$\text{Height, } h = 1 \text{ m}$$

To Find:

$$\text{Volume of Cylinder, } v = ?$$

Formula:

$$v = \pi r^2 h$$

Solution:

$$v = \pi r^2 h$$

$$= 3.14 (30)^2 (1 \text{ m})$$

$$= 3.14 (900)$$

$$v = 2826 \text{ m}^3$$

Date: ___/___/20__

Question 7(b)

Average age of three boys = 15 yrs

Ratio of ages = 3:5:7

Let, ages are denoted in
a way $3x$, $5x$ and $7x$

Average age = $\frac{\text{Sum of Ages}}{\text{total number}}$

$$15 = \frac{3x + 5x + 7x}{3}$$

$$15 \times 3 = 15x$$

$$45 = 15x$$

$$x = 45/15$$

$$x = 3$$

Age of youngest boy =

$$\text{Age of youngest} = 3x$$

$$= 3(3)$$

$$= 9 \text{ yr}$$

Age of youngest boy = 9 yrs

Date: ___/___/20

Question 7(c)

$$i - 8, 19, 52, 151, 447, \dots$$

$\underbrace{\quad}_{11} \quad \underbrace{\quad}_{33} \quad \underbrace{\quad}_{99} \quad \underbrace{\quad}_{297}$

Hence the number '447' is wrong in series, it must be '448'.

The resultant series is as follows:

$$8, 19, 52, 151, 448.$$

$$ii - 11, 13, 17, 19, 23, \dots$$

$$11, 13, 17, 19, 23, 29$$

As it is series of prime number

Question 7 (d)

Given sides -

$$a = 5 \text{ cm}$$

$$b = 4 \text{ cm}$$

$$c = 6 \text{ cm}$$

For angle Law of Cosines is used

$$c^2 = a^2 + b^2 - 2ab \cdot \cos(C)$$

C = angle opposite to c

1- Angle C opposite side $c = 6 \text{ cm}$

$$\cos(C) = \frac{a^2 + b^2 - c^2}{2ab}$$

$$= \frac{5^2 + 4^2 - 6^2}{2(5)(4)}$$

$$\cos(C) = 0.125$$

$$C = \cos^{-1} 0.125$$

2- Angle A opposite side $a = 5 \text{ cm}$

$$\cos(A) = \frac{b^2 + c^2 - a^2}{2bc}$$

$$= \frac{4^2 + 6^2 - 5^2}{2(4)(6)}$$

$$\cos(A) = 0.56$$

$$A = \cos^{-1}(0.56)$$

Date: / / 20

3. Angle B opposite side $b = 4\text{cm}$

$$\cos(B) = \frac{a^2 + c^2 - b^2}{2ac}$$

$$= \frac{5^2 + 6^2 - 4^2}{2(5)(6)}$$

$$\cos B = 0.75$$

$$B = \cos^{-1}(0.75)$$

$$\text{Hence, } C = 82.82^\circ$$

$$A = 55.77^\circ$$

$$B = 41.41^\circ$$