

NCA Test Series Final
General Science

Date:

Sun Mon Tue Wed Thu Fri Sat

35.5

Q.3 (a)

Why Do Atoms Form Chemical Bonds?

① Achieving Stable Electron Configuration

→ atoms have a tendency to seek a stable electron arrangement, usually by filling outermost electron shell to maximum capacity (octet rule)

② Lowering Energy

→ bonding lowers energy of system
→ through share/transfer of e^- , resulting molecule has lower potential energy than individual atoms

③ Increasing Stability Through Bond Types

Atoms bond in different ways to achieve stability:

Covalent → share e^- to fill outer shells

Ionic → transfer e^- to form positive and negative ions that attract each other

Metallic → share a sea of e^- that move freely

④ Electronegativity + Charge Distribution

→ atoms will bond in a way that minimizes their potential energy and creates a stable distribution of e^-

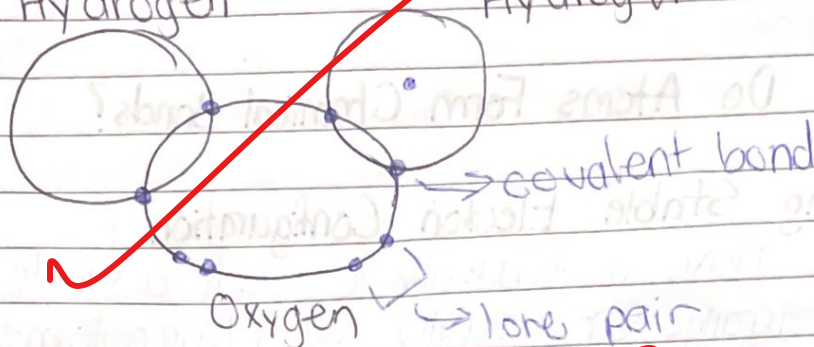
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Covalent Bond in Water Molecule

Hydrogen

Hydrogen



Formation of Covalent Bond

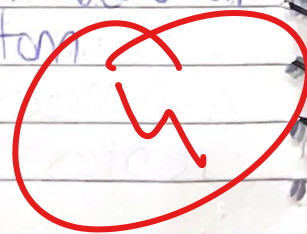
- each H atom shares its single e^- w/ O atom
- in turn, O atom shares one of its e^- w/ each H atom
- sharing creates 2 covalent bonds, one between the O and each H atom

Nature of Bond

- polar covalent bond → O is more electronegative than H, attracts shared e^- more strongly
- shared e^- closer to O atom, creating partial $-ve$ charge on O atom and partial $+ve$ charge on H atom

Bond Angle + Geometry

- bent shape, due to repulsion between lone pairs of e^- on O atom
- bond angle = 104.5°



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Q.3. (b)

What is Doping?

Definition

→ the process of intentionally introducing impurities into a pure material to modify its electrical/optical/mechanical properties

Application

→ commonly applied in semiconductors to enhance their conductivity or in ceramics to tailor their functional properties

In ceramics doping can affect:

- 1) Electrical conductivity
- 2) Mechanical strength
- 3) Thermal stability

Types of Doping

① N-Type Doping

→ adding a small amount of impurity w/ more valence e^- introduces free e^- .

→ These e^- can move and carry electric current, enhancing conductivity

② P-Type Doping

→ adding an impurity with fewer valence e^- creates "holes" in crystal structure

→ these holes can move as neighbouring e^- jump into them, conducting electricity

Types of Ceramics

① Traditional Ceramics

→ made from naturally occurring materials such as clay / quartz / feldspar
E.g. earthenware → porous and opaque

② Advanced (Engineering) Ceramics

→ made from highly refined materials and designed for specific applications, such as electronics / aerospace / medical devices
E.g. oxide ceramics

③ Glass Ceramics

→ formed by controlled crystallization of glass
→ high strength, low thermal expansion, excellent resistance to thermal shock

④ Bioceramics

→ used in medical applications due to their biocompatibility

⑤ Electroceramics

→ exhibit unique electrical properties
E.g. Ferroelectric ceramics

⑥ Refractory Ceramics

→ resistant to high temps, used in furnaces + kilns

Q. 3. (c)

- ① Longer Growing Seasons

→ in colder regions such as Siberia, warmer temps could extend the growing season for crops, yielding increased agricultural production

- ② New Agricultural Opportunities

→ areas that were previously too cold for farming, could become arable, enabling cultivation of new crops

Merits
of

Global

Warming

- ③ Access to Arctic Resources

→ melting ice in Arctic has opened new shipping routes (e.g. Northwest Passage) and made previously inaccessible oil/gas/mineral resources now more accessible

- ④ Enhanced Plant Growth

→ higher levels of atmospheric CO_2 can boost photosynthesis, potentially increasing the growth of plants/forests

- ⑤ Potential Economic Benefits

→ warmer climates could increase tourism in certain regions that were previously too cold, boosting local economies

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- ① Rising Sea Levels

→ melting polar ice caps and thermal expansion of seawater lead to rising sea levels, which threaten low-lying coastal regions (eg. Maldives)

- ② Threat to Biodiversity

→ many species are unable to adapt quickly to changing temperatures, leading to habitat loss, extinction, ecosystem imbalances

Demerits
of

Global
Warming

- ③ Health Risks

→ higher temps can exacerbate health problems, including heatstroke, respiratory issues, and the spread of diseases like malaria and dengue fever

- ④ Extreme Weather Events

→ increased global temps intensify weather events such as hurricanes, floods, droughts, and heatwaves, causing widespread damage and loss of life

- ⑤ Displacement of Populations

→ sea level rise and extreme weather events force millions of people to migrate → social/political tensions

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Q.3. (d)

What is Polio?

Definition

→ highly infectious disease caused by the poliovirus, which primarily affects children under the age of 5

Causes

Virus = poliovirus, member of Enterovirus genus
Transmission = fecal-oral route: ingesting food or water contaminated w/ feces from an infected person OR direct contact w/ respiratory droplets / saliva

Symptoms

→ most cases (70-90%) are asymptomatic

Mild Polio Symptoms = fever, fatigue, sore throat, headache, nausea, vomiting

Paralytic Polio Symptoms = stiffness in neck and back, pain in limbs

Prevention

① Oral-Polio Vaccine

→ contains weakened live virus

② Inactivated Polio Vaccine

→ injected

→ contains inactivated (killed) virus

② Misinformation

+ Mistrust

→ widespread misinformation about polio vaccines, particularly in rural areas

→ some ppl believe vaccine is part of a foreign conspiracy

① Security Concerns

→ in conflict-prone areas such as Balochistan, safety of health workers is an issue

→ polio vaccination teams are often attacked, and face threats from militant groups

Challenges in Eradicating Polio in Pakistan

④ Political Will + Governance Issues

→ inconsistencies in political leadership and coordination at the provincial and federal levels, affecting the effectiveness of the national polio eradication program

③ Weak Healthcare Infrastructure

→ in some parts of the country, infrastructure is inadequate, limiting the ability to reach every child with the polio virus

3.5

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Section II = 5/10/15 = x

Q. 6. (a)

Use Archimedes Principle = buoyant force acting on a submerged object is equal to the weight of the fluid displaced by the object

① Volume of Water Displaced

When boat sinks by 1 cm (0.01 m), additional volume of water displaced is:

$$\begin{aligned}\text{Volume Displaced} &= \text{length} \times \text{breadth} \times \text{depth} \\ &= 3 \text{ m} \times 2 \text{ m} \times 0.01 \text{ m} \\ &= 0.06 \text{ m}^3\end{aligned}$$

② Mass of Water Displaced

$$\begin{aligned}\text{Mass of water displaced} &= \text{Volume displaced} \\ &\quad \times \text{density of water} \\ &= 0.06 \text{ m}^3 \times 1000 \text{ kg/m}^3 \\ &= 60 \text{ kg}\end{aligned}$$

∴ Mass of man is 60 kg

Q. 6. (b)

Cost price of one ball = x

Total cost price of 17 balls = 17x

Loss = cost price of 5 balls = 5x

Selling Price = Cost Price - Loss

$$720 = 17x - 5x$$

$$720 = 12x$$

$$x = 720 / 12 = 60$$

∴ Cost price of one ball is Rs. 60

Q. 6 (c)

(Present)

Age of man = a

present

Age of son = b

$$a = b + 24 \quad (24 \text{ years older than his son})$$

$$a + 2 = 2b \quad (\text{in } 2 \text{ years, age is twice the age of his son})$$

$$\Rightarrow a = 2b - 2$$

Substitute into first equation:

$$a = b + 24$$

$$2b - 2 = b + 24$$

$$b = 26$$

$$\therefore \text{present age of son} = 26 \text{ years}$$

$$\text{present age of dad} = 26 + 24 = 50 \text{ years}$$

Q. 6 (c)

$$\text{Son's current age} = x$$

$$\text{Father's current age} = x + 24 \quad (24 \text{ years older than son})$$

In 2 years:

$$\text{Son} \rightarrow x + 2$$

$$\text{Father} \rightarrow x + 24 + 2 = x + 26$$

Father's age will be twice = son's age

$$x + 26 = 2(x + 2)$$

$$x + 26 = 2x + 4$$

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$$26 = x + 4$$

$$x = 22$$

∴ Present age of son is 22 years old

Q.6.(d)

Rashid's Typing Rate:

$$= \frac{32}{6} = \frac{16}{3} \text{ pages per hour}$$

Kamran's Typing Rate:

$$= 40/5 = 8 \text{ pages per hour}$$

Combined Rate (Kamran + Rashid):

$$= 16/3 + 8 = 16/3 + 24/3 = 40/3 \text{ pages per hour}$$

Time to type 110 pages:

$$\text{Time} = \frac{\text{Total Pages}}{\text{Combined Rate}} = \frac{110}{40/3} = \frac{110}{1} \times \frac{3}{40}$$

$$= \frac{330}{40} = 8.25 \text{ hours}$$

$$\Rightarrow 8 \text{ hours } 15 \text{ minutes}$$

∴ It will take Rashid and Kamran 8 hours and 15 minutes to type 110 pages together

Work on Paper presentation.