

JEECUP Group A Chemistry Sample Paper - 21

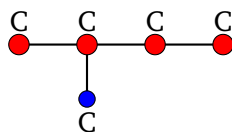
Duration: 45 Minutes

Maximum Marks: 100

Instructions

- This paper contains **25** Multiple Choice Questions (Single Correct).
- Each correct answer carries **+4 marks**. No marks will be deducted for incorrect answers. Unattempted questions carry **0** marks.
- Only **one** option is correct for each question.
- Use of mobile phones, smartwatches, or any electronic gadgets is strictly prohibited.

Q1. The self-linking property of carbon that enables formation of long chains and complex structures is called:



- (A) Allotropy
(B) Isomerism
(C) Catenation
(D) Polymerization
- Q2.** Which element among the following exhibits the maximum electronegativity value in the modern periodic table?
- (A) Chlorine
(B) Fluorine
(C) Bromine
(D) Iodine
- Q3.** For extraction of copper from its ores, the ore is first roasted. The primary purpose of roasting is:

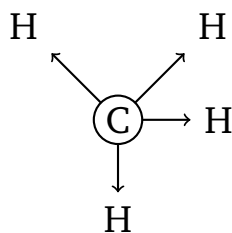


- (A) To convert the ore into soluble form
- (B) To remove carbon dioxide and increase oxide content
- (C) To reduce the metal directly to free state
- (D) To decrease the boiling point of the final product

Q4. An aqueous solution of sodium acetate (CH_3COONa) is:

- (A) Strongly acidic
- (B) Weakly alkaline
- (C) Neutral
- (D) Strongly alkaline

Q5. In methane (CH_4), the carbon atom undergoes which type of hybridization?



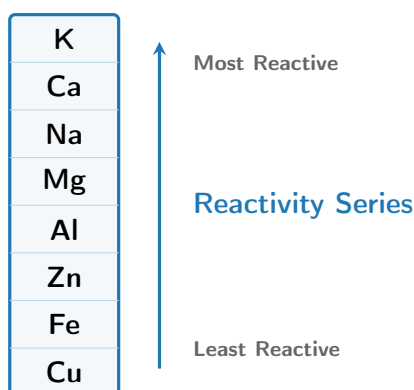
- (A) sp
- (B) sp^2
- (C) sp^3
- (D) dsp^2

Q6. When mercuric oxide is heated, it decomposes into metallic mercury and oxygen gas. This type of reaction is:

- (A) Combination reaction
- (B) Decomposition reaction
- (C) Displacement reaction
- (D) Double decomposition

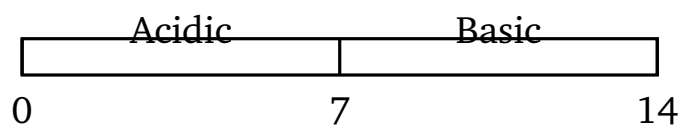


- Q7.** An element has electronic configuration $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^2$. To which group of the periodic table does it belong?
- (A) Group 2
(B) Group 10
(C) Group 12
(D) Group 4
- Q8.** The compounds having the same molecular formula but different structural arrangements are called:
- (A) Allotropes
(B) Isomers
(C) Homologues
(D) Conformers
- Q9.** Based on the reactivity series, which metal will displace copper from its salt solution?



- (A) Copper
(B) Gold
(C) Zinc
(D) Silver
- Q10.** A solution has a concentration of $[H^+] = 10^{-5}$ M. The pH of this solution is:





- (A) 3
- (B) 5
- (C) 7
- (D) 9

Q11. In a coordinate covalent bond, both electrons of the shared pair come from:

- (A) One atom only
- (B) Both atoms equally
- (C) The atmosphere
- (D) Water molecules

Q12. When chlorine gas reacts with sodium hydroxide solution to form chloride and chlorate ions, chlorine undergoes:

- (A) Oxidation only
- (B) Reduction only
- (C) Both oxidation and reduction
- (D) Neither oxidation nor reduction

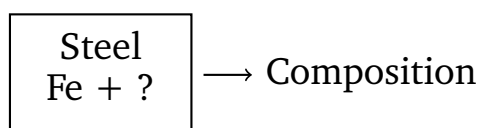
Q13. Which of the following alkanes is gaseous at room temperature and standard pressure?

- (A) Hexane
- (B) Pentane
- (C) Propane
- (D) Decane



- Q14.** Ionization energy generally increases along a period from left to right because:
- (A) Nuclear charge increases
 - (B) Atomic size increases
 - (C) Shielding effect increases
 - (D) Number of valence electrons decreases

- Q15.** Steel is primarily an alloy of iron and:

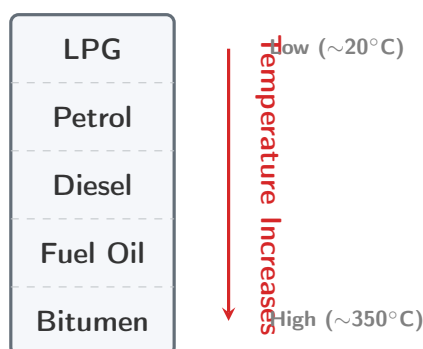


- (A) Copper
 - (B) Aluminum
 - (C) Carbon
 - (D) Zinc
- Q16.** Which of the following compounds is amphoteric in nature?
- (A) $NaOH$
 - (B) HCl
 - (C) Al_2O_3
 - (D) CuO
- Q17.** Which of the following is a physical change?
- (A) Burning of magnesium ribbon
 - (B) Rusting of iron
 - (C) Melting of ice
 - (D) Decomposition of water
- Q18.** A compound formed between two atoms has an electronegativity difference of 1.7. The bond is likely to be:



- (A) Covalent
- (B) Polar covalent
- (C) Ionic
- (D) Metallic

Q19. In the fractional distillation of crude oil, the fraction obtained at the highest temperature is:



- (A) LPG
- (B) Petrol
- (C) Diesel
- (D) Bitumen

Q20. Transition metals belong to which block of the periodic table?

- (A) s-block
- (B) p-block
- (C) d-block
- (D) f-block

Q21. Galvanization is a process used to prevent corrosion of iron by coating it with:

- (A) Aluminum
- (B) Zinc
- (C) Copper



(D) Tin

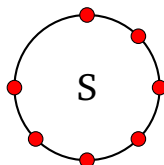
Q22. A salt formed from a strong acid and a weak base will give a solution that is:

- (A) Neutral
- (B) Weakly acidic
- (C) Strongly acidic
- (D) Alkaline

Q23. When ethane gas (C_2H_6) burns completely in oxygen, the products formed are:

- (A) Carbon and water
- (B) Carbon monoxide and water
- (C) Carbon dioxide and water
- (D) Carbon monoxide and hydrogen

Q24. The number of valence electrons in a sulfur atom is:



- (A) 4
- (B) 6
- (C) 8
- (D) 2

Q25. The calorific value of a fuel measures:

- (A) The mass of the fuel
- (B) The heat energy released per unit mass during complete combustion
- (C) The temperature at which it burns
- (D) The color of the flame produced



Detailed Solutions

Q1.

Solution

Concept: Carbon exhibits a unique property of forming stable covalent bonds with other carbon atoms. The carbon-carbon bond is exceptionally strong due to the small size of the carbon atom, allowing electrons to be held tightly between two nuclei. This capability allows carbon to form long chains, branches, and rings, which is fundamental to organic chemistry.

Solution:

Step 1: Identify the property in question. The phenomenon describes the ability of carbon atoms to link together in various structural arrangements.

Step 2: Evaluate the given terms. Allotropy refers to different forms of the same element. Isomerism refers to different structures of the same molecular formula. Polymerization is the linking of monomers.

Step 3: Recognize the self-linking ability. The property of an element forming long chains with itself is specifically called catenation, derived from the Latin word "catena" meaning chain.

Step 4: Verify with examples. Carbon exhibits catenation by forming alkanes (C_nH_{2n+2}), alkenes, alkynes, and cyclic compounds, each with different carbon chain arrangements.

Step 5: Confirm the correct term. This property is exclusive among elements and is the foundation of organic chemistry, where millions of compounds exist due to carbon's ability to catenate.

Final Answer:

Answer: (C)

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Q2.

Solution

Concept: Electronegativity is the tendency of an atom in a chemical compound to attract a shared pair of electrons. This property depends on the effective nuclear charge and atomic radius. As we move across a period, the nuclear charge increases while the atomic radius decreases, leading to higher electronegativity.

Solution:

Step 1: Analyze the periodic trends. Electronegativity increases across a period and decreases down a group.

Step 2: Compare the given elements. All options are non-metals in the p-block: Chlorine (Group 17, Period 3), Fluorine (Group 17, Period 2), Bromine (Group 17, Period 4), and Iodine (Group 17, Period 5).

Step 3: Apply the trend rule. Since all elements are in the same group, electronegativity decreases as we go down: Fluorine > Chlorine > Bromine > Iodine.

Step 4: Identify the maximum value. Fluorine, being the smallest and highest in the group, has the maximum electronegativity value (approximately 4.0 on the Pauling scale).

Step 5: Verify this is the highest in the entire periodic table. Fluorine is the most electronegative element in the entire periodic table.

Final Answer: Fluorine

Answer: (B)

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Q3.

Solution

Concept: Roasting is a metallurgical process where ore is heated in the presence of air (oxygen) at a temperature below its melting point. This process converts sulfide or carbonate ores into oxides, which are more amenable to reduction using carbon or carbon monoxide.

Solution:

Step 1: Identify the ore composition. Copper ores typically contain copper sulfides (like CuFeS_2 , chalcopyrite) or copper carbonates.

Step 2: Understand the roasting process. When heated in air:



Step 3: Analyze the primary purpose. Roasting oxidizes sulfide ores to oxides, removing sulfur as SO_2 gas.

Step 4: Evaluate the options. The process doesn't directly reduce metal, decrease boiling points, or make it immediately soluble. It increases the oxide content by removing sulfur.

Step 5: Conclude. The primary purpose is to remove volatile elements (like sulfur) and increase the oxide content for subsequent reduction.

Final Answer:

Answer: (B)

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Q4.

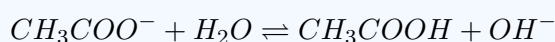
Solution

Concept: Salt hydrolysis is the reaction of a salt with water where the ions interact with water molecules to disturb the balance of H^+ and OH^- ions. Sodium acetate is formed from a weak acid (acetic acid) and a strong base (NaOH), so it undergoes anion hydrolysis.

Solution:

Step 1: Identify the parent acid and base. Sodium acetate comes from acetic acid (weak) and sodium hydroxide (strong).

Step 2: Write the hydrolysis reaction. The acetate ion reacts with water:



Step 3: Analyze the effect on pH. The hydrolysis produces OH^- ions, making the solution basic.

Step 4: Determine the strength. Since acetate is the conjugate base of a weak acid, the hydrolysis is appreciable but not complete, giving a weakly basic solution.

Step 5: Verify with solution pH. The pH will be greater than 7 but not extremely high, confirming a weakly alkaline solution.

Final Answer:

Answer: (B)

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Q5.

Solution

Concept: Hybridization is the mixing of atomic orbitals to form new hybrid orbitals suitable for bonding. The type of hybridization depends on the number of electron groups (bonding and non-bonding) around the central atom. Methane has a tetrahedral geometry with four C-H bonds.

Solution:

Step 1: Determine the electron configuration of carbon. Carbon has 6 electrons: $1s^2 2s^2 2p^2$.

Step 2: Count electron groups around carbon in CH_4 . Carbon forms four single bonds with four hydrogen atoms, resulting in four bonding electron groups.

Step 3: Apply the hybridization rule. With four electron groups, the atom requires four hybrid orbitals. The number of hybrid orbitals equals the number of atomic orbitals mixed.

Step 4: Identify the orbitals involved. One s orbital and three p orbitals mix to form four sp^3 hybrid orbitals.

Step 5: Verify the geometry. sp^3 hybridization produces tetrahedral geometry with 109.5° bond angles, consistent with methane's structure.

Final Answer: sp^3

Answer: (C)

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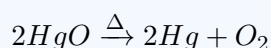
Q6.

Solution

Concept: Chemical reactions are classified based on the rearrangement of atoms and bonds. Decomposition reactions involve a single reactant breaking down into two or more products.

Solution:

Step 1: Write the chemical equation. Mercuric oxide decomposes when heated:



Step 2: Analyze the reaction pattern. A single compound (HgO) breaks down into two products: metallic mercury and oxygen gas.

Step 3: Identify the reaction type. Since one reactant produces multiple products, this is a decomposition reaction.

Step 4: Distinguish from other types. Combination reactions merge reactants. Displacement reactions involve element substitution. Double decomposition involves two compounds exchanging ions.

Step 5: Confirm the classification. This is historically called the decomposition of mercuric oxide, a classic example in chemistry.

Final Answer:

Answer: (B)

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Q7.

Solution

Concept: The position of an element in the periodic table can be determined from its electronic configuration. The last electron's orbital determines the group (for main group elements and transition metals).

Solution:

Step 1: Count total electrons. Configuration: $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^2$ sums to 30 electrons, making this Zinc (Zn).

Step 2: Identify the period. The highest principal quantum number is 4, so it's in Period 4.

Step 3: Determine the block. Since the last electron enters a d orbital ($3d^{10}$), it's a d-block element (transition metal).

Step 4: Find the group number. For transition metals: Group number = (number of d electrons) + (number of s electrons) in the highest shell = $10 + 2 = 12$.

Step 5: Verify. Zinc (Zn) is indeed in Group 12, Period 4 of the modern periodic table.

Final Answer:

Answer: (C)

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Q8.

Solution

Concept: Isomers are compounds with the same molecular formula but different structural arrangements. This structural difference leads to variations in physical and chemical properties.

Solution:

Step 1: Define structural isomerism. When compounds have identical molecular formulas but different arrangements of atoms in their structures, they are called isomers.

Step 2: Provide examples. Butane (C_4H_{10}) has two isomers: n-butane (linear chain) and isobutane (branched chain).

Step 3: Distinguish from related terms. Allotropes are different forms of the same element. Homologues differ by CH_2 units. Conformers differ by rotation around single bonds.

Step 4: Explain the consequences. Isomers have the same molecular formula but different physical properties (boiling point, density) due to structural differences.

Step 5: Confirm the terminology. The term "isomers" comes from Greek words meaning "equal parts," referring to the equal distribution of elements in different arrangements.

Final Answer:

Answer: (B)

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Q9.

Solution

Concept: The reactivity series (or activity series) is an empirical arrangement of metals based on their tendency to lose electrons and form cations. A metal higher in the series can displace a metal lower in the series from its salt solution.

Solution:

Step 1: Understand the displacement principle. For metal A to displace metal B from its salt, A must be higher in the reactivity series than B.

Step 2: Locate copper in the series. Copper is relatively low in the reactivity series.

Step 3: Identify which metals can displace copper. From the provided diagram, metals above copper (K, Ca, Na, Mg, Al, Zn, Fe) can displace it.

Step 4: Evaluate the options. Copper cannot displace itself. Gold is below copper and cannot displace it. Zinc is above copper and can displace it. Silver is below copper and cannot displace it.

Step 5: Select the correct answer. Zinc is the only option that can displace copper from its salt solution.

Final Answer:

Answer: (C)

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Q10.

Solution

Concept: The pH scale logarithmically measures the hydrogen ion concentration. pH is defined as the negative logarithm of $[H^+]$ concentration: $pH = -\log[H^+]$.

Solution:

Step 1: Apply the pH formula. Given $[H^+] = 10^{-5}$ M:

$$pH = -\log(10^{-5}) = -(-5) = 5$$

Step 2: Verify using logarithm rules. $\log(10^{-5})$ equals -5 , so the negative of this is positive 5.

Step 3: Interpret the pH value. Since $pH = 5$ (which is less than 7), this solution is acidic.

Step 4: Confirm the option validity. Option A ($pH = 3$) would require $[H^+] = 10^{-3}$ M. Option C ($pH = 7$) would require $[H^+] = 10^{-7}$ M. Option D ($pH = 9$) would require $[H^+] = 10^{-9}$ M.

Step 5: Select the correct answer. $pH = 5$ matches a hydrogen ion concentration of 10^{-5} M.

Final Answer:

Answer: (B)

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Q11.

Solution

Concept: A coordinate covalent bond (or dative bond) is a special type of covalent bond where both electrons of the shared pair originate from the same atom. One atom acts as the electron donor (nucleophile) and the other as the electron acceptor (electrophile).

Solution:

Step 1: Define the standard covalent bond. In a typical covalent bond, each atom contributes one electron to the shared pair.

Step 2: Distinguish coordinate bonding. In a coordinate covalent bond, one atom provides both electrons while the other atom provides the empty orbital.

Step 3: Provide an example. In the ammonia-boron trifluoride complex ($NH_3 \rightarrow BF_3$), nitrogen donates both electrons of the shared pair to the empty orbital of boron.

Step 4: Identify the characteristics. After formation, the coordinate bond is indistinguishable from a regular covalent bond in terms of bond strength and properties.

Step 5: Confirm the source. Both electrons originate from one atom only, making it a coordinate covalent bond.

Final Answer:

Answer: (A)

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Q12.

Solution

Concept: A disproportionation reaction is a special type of redox reaction where a single element undergoes both oxidation and reduction simultaneously, producing products with different oxidation states of that element.

Solution:

Step 1: Write the balanced equation. When chlorine reacts with dilute NaOH:



Step 2: Determine oxidation states. In Cl_2 , chlorine has oxidation state 0. In Cl^- (chloride), it's -1 . In ClO^- (chlorate), it's $+1$.

Step 3: Identify oxidation. One chlorine atom goes from 0 to $+1$ (loses electrons), so it's oxidized.

Step 4: Identify reduction. Another chlorine atom goes from 0 to -1 (gains electrons), so it's reduced.

Step 5: Classify the reaction. Since the same element both loses and gains electrons, chlorine undergoes both oxidation and reduction in this disproportionation reaction.

Final Answer: Both oxidation and reduction

Answer: (C)

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Q13.

Solution

Concept: Alkanes are saturated hydrocarbons with only single C-C and C-H bonds. Their physical state depends on the number of carbon atoms. Generally, alkanes with fewer than five carbon atoms are gaseous at room temperature.

Solution:

Step 1: List the alkanes. Hexane (C_6), Pentane (C_5), Propane (C_3), and Decane (C_{10}).

Step 2: Apply the boiling point trend. As molecular weight increases, intermolecular forces increase, raising boiling points.

Step 3: Determine boiling points: - Propane (C_3H_8): -42°C (gaseous at RTP) - Pentane (C_5H_{12}): 36°C (liquid at RTP) - Hexane (C_6H_{14}): 69°C (liquid at RTP) - Decane ($\text{C}_{10}\text{H}_{22}$): 174°C (liquid at RTP)

Step 4: Identify the gaseous alkane. Propane is the only gaseous alkane among the options at room temperature and standard pressure.

Step 5: Confirm the classification. Alkanes with 1-4 carbon atoms are gases; those with 5+ are liquids or solids under normal conditions.

Final Answer: Propane

Answer: (C)

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Q14.

Solution

Concept: Ionization energy is the energy required to remove an electron from a neutral atom. It depends on the effective nuclear charge and atomic radius. As we move across a period, atomic number increases and atomic size decreases.

Solution:

Step 1: Analyze the periodic trend. Moving left to right across a period, the number of protons increases.

Step 2: Examine atomic radius change. Atomic radius decreases from left to right because all electrons are added to the same valence shell.

Step 3: Evaluate shielding effect. Electrons in the same shell provide minimal shielding for each other against the nuclear charge.

Step 4: Calculate effective nuclear charge. As protons increase and shielding remains relatively constant, the effective nuclear charge pulling on valence electrons increases.

Step 5: Relate to ionization energy. Stronger nuclear attraction makes it harder to remove electrons, so ionization energy increases across a period.

Final Answer: Nuclear charge increases

Answer: (A)

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Q15.

Solution

Concept: Steel is one of the most important alloys in industry. It is formed by combining iron with other elements to improve its mechanical properties. The primary element added to iron to make steel is carbon.

Solution:

Step 1: Identify the base metal. Steel has iron as its principal constituent metal.

Step 2: Determine the alloying element. Carbon is added to iron in controlled amounts (typically 0.2-2

Step 3: Understand the mechanism. Carbon atoms fit into interstitial spaces between iron atoms in the crystal lattice, creating a harder, stronger material.

Step 4: Compare with other alloys. Copper with iron forms copper alloys. Aluminum creates aluminum alloys. Zinc with copper makes brass.

Step 5: Verify the composition. Steel is fundamentally an iron-carbon alloy, and carbon is the primary alloying element that determines steel's properties.

Final Answer: Carbon

Answer: (C)

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Q16.

Solution

Concept: An amphoteric compound is one that can react with both acids and bases, exhibiting characteristics of both acidic and basic substances. This is common for oxides and hydroxides of elements near the boundary between metals and non-metals.

Solution:

Step 1: Analyze NaOH. Sodium hydroxide is a strong base; it accepts protons but cannot donate them (not amphoteric).

Step 2: Analyze HCl. Hydrochloric acid is a strong acid; it donates protons but cannot accept them (not amphoteric).

Step 3: Analyze Al_2O_3 . Aluminum oxide reacts with both acids and bases: - With acid: $Al_2O_3 + 6HCl \rightarrow 2AlCl_3 + 3H_2O$ - With base: $Al_2O_3 + 2NaOH + 3H_2O \rightarrow 2Na[Al(OH)_4]$

Step 4: Analyze CuO. Copper oxide reacts primarily with acids, not bases (not amphoteric).

Step 5: Confirm the amphoteric nature. Al_2O_3 exhibits both acidic and basic properties, making it amphoteric.

Final Answer: Al_2O_3

Answer: (C)

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Q17.

Solution

Concept: Physical changes alter the physical properties of matter (such as shape, size, or state) without changing its chemical composition. The substance remains chemically the same before and after the change.

Solution:

Step 1: Analyze burning of magnesium. This produces magnesium oxide, a new chemical compound. This is a chemical change.

Step 2: Analyze rusting of iron. Iron reacts with oxygen to form iron oxide, creating a new substance. This is a chemical change.

Step 3: Analyze melting of ice. Ice (solid water) converts to liquid water. The molecular composition remains H_2O ; only the physical state changes.

Step 4: Analyze decomposition of water. Water breaks down into hydrogen and oxygen gases, forming new substances. This is a chemical change.

Step 5: Identify the physical change. Melting of ice is a phase transition where the substance remains water throughout the process, making it a physical change.

Final Answer: Melting of ice

Answer: (C)

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Q18.

Solution

Concept: The type of chemical bond formed between two atoms depends on the electronegativity difference. Different ranges of electronegativity difference correspond to different bond types.

Solution:

Step 1: Establish the electronegativity difference scale: - $\Delta EN < 0.4$: Pure covalent - $0.4 \leq \Delta EN < 1.7$: Polar covalent - $\Delta EN \geq 1.7$: Ionic

Step 2: Evaluate the given difference. The electronegativity difference is 1.7, which falls at the boundary between polar covalent and ionic.

Step 3: Apply the classification rule. A difference of exactly 1.7 or greater indicates an ionic bond.

Step 4: Verify with examples. NaCl has $\Delta EN \approx 2.1$ (ionic). CO has $\Delta EN \approx 1.0$ (polar covalent).

Step 5: Conclude. An electronegativity difference of 1.7 indicates the formation of an ionic bond with significant ionic character.

Final Answer:

Answer: (C)

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Q19.

Solution

Concept: Fractional distillation of crude oil separates it into fractions based on boiling points. Fractions with longer hydrocarbon chains have higher boiling points and are collected at higher temperatures in the distillation column.

Solution:

Step 1: Understand the distillation column. The column has a temperature gradient: hottest at the bottom, coolest at the top.

Step 2: Review the fractions from top to bottom: - LPG and petrol (lighter fractions) condense at the top (lower temperatures) - Diesel condenses in the middle - Fuel oil condenses near the bottom - Bitumen (residue) remains at the very bottom

Step 3: Identify the highest temperature fraction. The fraction obtained at the highest temperature is the one remaining longest in the hottest region.

Step 4: Recognize bitumen's properties. Bitumen has the longest hydrocarbon chains, highest boiling point, and is collected at the highest temperature ($>350^\circ\text{C}$).

Step 5: Verify the ranking. Bitumen is used for road construction and waterproofing, confirming it's the heaviest fraction collected at the highest temperature.

Final Answer:

Answer: (D)

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Q20.

Solution

Concept: The periodic table is divided into four blocks (s, p, d, f) based on which orbitals the valence electrons occupy. Transition metals are defined by electrons entering d orbitals.

Solution:

Step 1: Define the blocks. Elements are classified based on the subshell receiving the last electron: - s-block: last electron in s orbital - p-block: last electron in p orbital - d-block: last electron in d orbital - f-block: last electron in f orbital

Step 2: Identify transition metals. Transition metals have partially filled d orbitals (or can easily form cations with partially filled d orbitals).

Step 3: Locate them in the periodic table. Transition metals occupy Groups 3-12 (or 3-11 depending on classification) in Periods 4, 5, 6, and 7.

Step 4: Provide examples. Iron, copper, zinc, chromium, and manganese are transition metals in the d-block.

Step 5: Confirm the classification. The d-block is the location of all transition metals in the modern periodic table.

Final Answer:

Answer: (C)

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Q21.

Solution

Concept: Galvanization is an electrochemical process that protects steel and iron from corrosion by coating them with a thin layer of zinc. The zinc layer acts as both a physical barrier and a sacrificial anode.

Solution:

Step 1: Define galvanization. Galvanization involves applying a protective coating to steel or iron objects to prevent rusting.

Step 2: Identify the coating material. The most common coating material is zinc (Zn), applied through hot-dip galvanizing, electroplating, or sherardizing.

Step 3: Understand the protection mechanism. Zinc coating provides: - Physical barrier: Separates steel from oxygen and moisture - Sacrificial protection: Zinc is more reactive than iron, so it oxidizes preferentially

Step 4: Evaluate alternative options. Aluminum coating (aluminizing) and copper coating exist but are less common. Tin coating (tinplate) is used for tin cans.

Step 5: Confirm the coating material. Zinc is the most widely used and effective coating for protecting iron from corrosion.

Final Answer:

Answer: (B)

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Q22.

Solution

Concept: The pH of a salt solution depends on the strengths of the parent acid and base. When a strong acid reacts with a weak base to form a salt, the resulting solution is acidic due to salt hydrolysis.

Solution:

Step 1: Identify the salt components. Consider a generic salt from a strong acid and weak base.

Step 2: Write the hydrolysis reaction. The cation (from weak base) undergoes hydrolysis:



Step 3: Analyze the effect on pH. The hydrolysis produces H^+ ions, which increase hydrogen ion concentration.

Step 4: Determine the resulting pH. Since H^+ concentration increases, the solution becomes acidic ($pH < 7$).

Step 5: Classify the acidity level. The acidity is weak because the hydrolysis of weak base cations is not complete.

Example: NH_4Cl is formed from strong HCl and weak $NH_3 \cdot H_2O$. The NH_4^+ ion hydrolyzes to produce H^+ , making the solution weakly acidic.

Final Answer: Weakly acidic

Answer: (B)

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Q23.

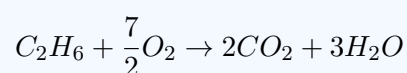
Solution

Concept: Complete combustion of a hydrocarbon (containing only C, H, and O) in excess oxygen produces only carbon dioxide and water as products. The combustion reaction is highly exothermic.

Solution:

Step 1: Identify the hydrocarbon. Ethane (C_2H_6) contains only carbon and hydrogen atoms.

Step 2: Write the balanced equation. Complete combustion requires excess oxygen:



Or in whole numbers:



Step 3: Count the products. The only products are carbon dioxide (CO_2) and water (H_2O).

Step 4: Verify completeness. All carbon atoms form CO_2 (not CO), and all hydrogen atoms form H_2O , confirming complete combustion.

Step 5: Confirm from the options. Carbon and water would indicate incomplete combustion. CO and water would indicate incomplete combustion. Only CO_2 and water indicate complete combustion.

Final Answer: Carbon dioxide and water

Answer: (C)

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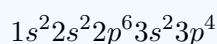
Q24.

Solution

Concept: Valence electrons are the electrons in the outermost shell of an atom that participate in chemical bonding. For main group elements, the number of valence electrons equals the group number.

Solution:

Step 1: Write the electron configuration of sulfur. Sulfur (atomic number 16):



Step 2: Identify the valence shell. The outermost shell is the third shell (M shell), containing electrons in 3s and 3p orbitals.

Step 3: Count valence electrons. In the third shell: 3s² has 2 electrons, and 3p⁴ has 4 electrons.

Step 4: Calculate the total. Total valence electrons = 2 + 4 = 6.

Step 5: Verify with group number. Sulfur is in Group 16, and for main group elements, valence electrons = group number - 10 = 16 - 10 = 6.

Final Answer:

Answer: (B)

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Q25.

Solution

Concept: The calorific value (or heating value) of a fuel is a measure of the amount of chemical energy that can be released as heat when the fuel undergoes complete combustion in oxygen under standard conditions.

Solution:

Step 1: Define calorific value. It is the total heat energy released per unit mass (or per mole) of fuel during complete combustion.

Step 2: Explain the measurement. Typically expressed in units of kJ/g or kJ/kg, the calorific value is determined experimentally using a bomb calorimeter.

Step 3: Evaluate the options. Mass is a quantity, not what calorific value measures. Temperature is a property, not the result. Color indicates combustion but doesn't define calorific value.

Step 4: Identify the correct definition. Calorific value specifically measures the heat energy released per unit mass during complete combustion.

Step 5: Provide context. Different fuels have different calorific values: hydrogen (150 MJ/kg), coal (30 MJ/kg), methane (55 MJ/kg).

Final Answer:

Answer: (B)

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Answer Key

Q	Ans	Q	Ans	Q	Ans	Q	Ans	Q	Ans
1	C	2	B	3	B	4	B	5	C
6	B	7	C	8	B	9	C	10	B
11	A	12	C	13	C	14	A	15	C
16	C	17	C	18	C	19	D	20	C
21	B	22	B	23	C	24	B	25	B

