p Block Elements JEE Main PYQ - 1

Total Time: 1 Hour : 15 Minute **Total Marks:** 120

Instructions

Instructions

1. Test will auto submit when the Time is up.
2. The Test comprises of multiple choice questions (MCQ) with one or more correct answers.
3. The clock in the top right corner will display the remaining time available for you to complete the examination.

Navigating & Answering a Question

1. The answer will be saved automatically upon clicking on an option amongst the given choices of answer.
2. To deselect your chosen answer, click on the clear response button.
3. The marking scheme will be displayed for each question on the top right corner of the test window.

p Block Elements

1. For P, the incorrect statement is: **(+4, -1)**

a. P is less reactive than benzyl chloride towards nucleophilic substitution reaction.

b. In P, C-Cl bond has partial double bond character.

c. Cl is an ortho-para directing group towards electrophilic aromatic substitution.

d. P can undergo nucleophilic substitution reaction in normal conditions.

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2. **Two elements of p-block can form following halides XF_3 and YF_3. XF_3 can act as Lewis acid while YF_3 can act as Lewis base. Then hybridization of 'X' and 'Y' in XF_3 and YF_3 is respectively.** **(+4, -1)**

a. sp^2, sp^2

b. sp^3, sp^2

c. sp^3, sp^3

d. sp^2, sp^3

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3. **Statement-I:** An element 'X' of P-block forms a hydride H–X, which has the longest bond length, then element 'X' will have the shortest covalent radius. **(+4, -1)**
Statement-II: An element 'E' of Group 15 forms hydride EH_3, that has least B.P. The maximum covalency of E is 4.

a. Both statements are correct.

b. Statement-I is correct; statement-II is incorrect.

c. Statement-I is incorrect; statement-II is correct.

d. Both statements are incorrect.

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4. **An element of p-block forms a species of type EH_4^+, which when passed through a basic solution of $K_2[HgI_4]$, forms a brown ppt. Select the correct option:** **(+4, -1)**

   a. Element E has maximum covalency equal to 5.

   b. Brown ppt. formed is HgO. $Hg(NH_3)I$.

   c. Element E has maximum electron affinity in its group.

   d. EH_3 is phosphine.

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5. **Given below are two statements.** **(+4, -1)**

   Statement I : The dipole moment of $\overset{4}{CH_3}\text{–}\overset{3}{CH}\text{=}\overset{2}{CH}\text{–}\overset{1}{CH}\text{=O}$ is greater than $\overset{4}{CH_3}\text{–}\overset{3}{CH_2}\text{–}\overset{2}{CH_2}\text{–}\overset{1}{CH}\text{=O}$

   Statement II : C_1–C_2 bond length of $\underset{4}{CH_3}\text{–}\underset{3}{CH}\text{=}\underset{2}{CH}\text{–}\underset{1}{CH}\text{=O}$ is greater than C_1–C_2 bond length of $\underset{4}{CH_3}\text{–}\underset{3}{CH_2}\text{–}\underset{2}{CH_2}\text{–}\underset{1}{CH}\text{=O}$

   In the light of the above statements, choose the correct answer from the options given below:

   a. Statement I is false but Statement II is true

   b. Both Statement I and Statement II are false

   c. Statement I is true but Statement II is false

   d. Both Statement I and Statement II are true

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6. **For compound having the formula $GaCl_3$, the correct option from the following is:** **(+4, -1)**

   a. Ga forms bond with Cl in $GaCl_3$.

   b. Ga is coordinated with Cl in $GaCl_3$.

   c. Ga is more electronegative than Cl and is present as a cationic part of the salt.

   d. Oxidation state of Ga in $GaCl_3$ is +3.

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7. Which one of the following elements will remain as liquid inside pure boiling water? **(+4, -1)**

   a. Li

   b. Ga

   c. Cs

   d. Br

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8. Identify the correct statements about p-block elements and their compounds. **(+4, -1)**
   (A) Non metals have higher electronegativity than metals.
   (B) Non metals have lower ionisation enthalpy than metals.
   (C) Compounds formed between highly reactive nonmetals and highly reactive metals are generally ionic.
   (D) The non-metal oxides are generally basic in nature.
   (E) The metal oxides are generally acidic or neutral in nature.

   a. (D) and (E) only

   b. (A) and (C) only

   c. (B) and (E) only

   d. (B) and (D) only

9. The number of oxygen atoms present in chemical formula of fuming sulphuric acid is _____. **(+4, -1)**

10. **Choose the correct statements about the hydrides of group 15 elements.** **(+4, -1)**

A. The stability of the hydrides decreases in the order $NH_3 > PH_3 > AsH_3 > SbH_3 > BiH_3$

B. The reducing ability of the hydrides increases in the order $NH_3 < PH_3 < AsH_3 < SbH_3 < BiH_3$

C. Among the hydrides, NH_3 is a strong reducing agent while BiH_3 is a mild reducing agent.

D. The basicity of the hydrides increases in the order $NH_3 < PH_3 < AsH_3 < SbH_3 < BiH_3$

Choose the most appropriate from the option given below:

a. B and C only

b. C and D only

c. A and B only

d. A and D only

11. $Mg(NO_3)_2.XH_2O$ and $Ba(NO_3)_2.YH_2O$, represent formula of the crystalline forms of nitrate salts. Sum of X and Y is _____ . **(+4, -1)**

12. Total number of acidic oxides among $N_2O_3, NO_2, N_2O, Cl_2O_7, SO_2, CO, CaO, Na_2O$ and NO is _____ . **(+4, -1)**

13. When borax is heated with CoO on a platinum loop, blue coloured bead formed is largely due to **(+4, -1)**

a. B_2O_3

b. $CO(BO_2)_2$

c. COB_4O_7

d. $CO[B_4O_5(OH)_4]$

14. Dinitrogen is a robust compound, but reacts at high altitudes to form oxides. The oxide of nitrogen that can damage plant leaves and retard photosynthesis is **(+4, -1)**

a. NO

b. NO_3^-

c. NO_2

d. NO_2^-

15. Which among the following pairs has only herbicides? **(+4, -1)**

a. Aldrin and Dieldrin

b. Sodium chlorate and Aldrin

c. Sodiumarsinate and Dieldrin

d. Sodium chlorate and sodiumarsinite

16. **Reduction potential of ions are given below:** **(+4, -1)**

$$\begin{array}{ccc} \mathrm{ClO_4^-} & \mathrm{IO_4^-} & \mathrm{BrO_4^-} \\ E^\circ = 1.19\,\mathrm{V} & E^\circ = 1.65\,\mathrm{V} & E^\circ = 1.74\,\mathrm{V} \end{array}$$

The correct order of their oxidising power is:

a. $\mathrm{ClO_4^- > IO_4^- > BrO_4^-}$

b. $\mathrm{BrO_4^- > IO_4^- > ClO_4^-}$

c. $\mathrm{BrO_4^- > ClO_4^- > IO_4^-}$

d. $\mathrm{IO_4^- > BrO_4^- > ClO_4^-}$

17. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R) **(+4, -1)**

Assertion (A) : Boron is unable to form BF_6^{3-}

Reason (R) : Size of B is very small

In the light of the above statements, choose the correct answer from the options given below:

a. Both (A) and (R) are true and (R)is the correct explanation of(A)

b. Both (A) and (R) are true but (R) is not the correct explanation of (A)

c. (A) is true but (R) is false

d. (A) is false but (R) is true

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18. Concentrated HNO_3 reacts with Iodine to give **(+4, -1)**

a. $HI, NO_2 \ and \ H_2O$

b. $HIO_2, N_2O \ and \ H_2O$

c. $HIO_3, NO_2 \ and \ H_2O$

d. $HIO_4, N_2O \ and \ H_2O$

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19. White phosphorus reacts with thionyl chloride to give **(+4, -1)**

a. $PCI_5, SO_2 and S_2Cl_2$

b. $PCI_3, SO_2 and S_2Cl_2$

c. $PCI_3, SO_2 and Cl_2$

d. $PCl_5, SO_2 and Cl_2$

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20. Amongst SF_4, XeF_4, CF_4 and H_2O, the number of species with two lone pair of electrons is _____. **(+4, -1)**

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21. Given below are two statements : **(+4, -1)**

Statement I : The pentavalent oxide of group-15 element, E_2O_5, is less acidic than trivalent oxide, E_2O_3, of the same element.

Statement II : The acidic character of trivalent oxide of group 15 elements, E_2O_3, decreases down the group.

In light of the above statements, choose most appropriate answer from the options given below:

a. Both Statement I and Statement II are true

b. Both Statement I and Statement II are false

c. Statement I true, but Statement II is false

d. Statement I false, but Statement II is true

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22. Element "E" belongs to the period 4 and group 16 of the periodic table. The valence shell electron configuration of the element, which is just above "E" in the group is **(+4, -1)**

a. $3s^2, 3p^4$

b. $3d^{10}, 4s^2, 4p^4$

c. $4d^{10}, 5s^2, 5p^4$

d. $2s^2, 2p^4$

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23. Borazine, also known as inorganic benzene, can be prepared by the reaction of 3-equivalents of "X" with 6-equivalents of "Y". "X" and "Y", respectively are: **(+4, -1)**

a. $B(OH)_3$ and NH_3

b. B_2H_6 and NH_3

c. B_2H_6 and HN_3

d. NH_3 and B_2O_3

24. The correct order of nucleophilicity is **(+4, -1)**

a. $F^- > OH^-$

b. $H_2O > OH^-$

c. $ROH > RO^-$

d. $NH_2^- > NH_3$

25. The most common oxidation state of Lanthanoid elements is +3. Which of the following is likely to deviate easily from +3 oxidation state? **(+4, -1)**

a. Ce(At. No. 58)

b. La (At. No. 57)

c. Lu (At. No. 71)

d. Gd(At. No. 64)

26. The oxide which contains an odd electron at the nitrogen atom is **(+4, -1)**

a. N_2O

b. NO_2

c. N_2O_3

d. N_2O_5

27. Match List-I with List-II List-I **(+4, -1)**

List-I	List-I i
Reaction	Catalyst
$4NH_3(g) + 5O_2(g) \rightarrow 4NO(g) + 6H_2O(g)$	NO(g)
$N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$	H_2SO_4(l)
$C_{12}H_{22}O_{11}(aq)H_2O(l) \rightarrow$ (Glucose) $+ C_6H_{12}O_6C_6H_{12}O_6$	Pt(s)
$SO_2(g) + O_2(g) \rightarrow 2SO_3(g)$	Fe(s)

Choose the correct answer from the options given below:

a. (A) - (II), (B) - (III), (C) - (I), (D) - (IV)

b. (A) - (III), (B) - (II), (C) - (I), (D) - (IV)

c. (A) - (III), (B) - (IV), (C) - (II), (D) - (I)

d. (A) - (III), (B) - (II), (C) - (IV), (D) - (I)

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28. Which of the following has least tendency toliberate H_2 from mineral acids? **(+4, -1)**

a. Cu

b. Mn

c. Ni

d. Zn

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29. Match List-I with List-II **(+4, -1)**

List-I		List-II	
(A)	$Cd_{(s)}+2Ni(OH)_{3(s)} \rightarrow CdO_{(s)}+2Ni(OH)_{2(s)}+H_2O_{(l)}$	(I)	Primary battery
(B)	$Zn(Hg)+HgO_{(s)} \rightarrow ZnO_{(s)}+Hg_{(l)}$	(II)	Discharging of secondary battery
(C)	$2PbSO_{4(s)}+2H_2O_{(l)} \rightarrow Pb_{(s)}+PbO_{2(s)}+2H_2SO_{4(aq)}$	(III)	Fuel cell
(D)	$2H_{2(g)}+O_{2(g)} \rightarrow 2H_2O_{(l)}$	(IV)	Charging of secondary battery

Choose the correct answer from the options given below:

a. (A) - (I), (B) - (II), (C) - (III), (D) - (IV)

b. (A) - (IV), (B) - (I), (C) - (II), (D) - (III)

c. (A) - (II), (B) - (I), (C) - (IV), (D) - (III)

d. (A) - (II), (B) - (I), (C) - (III), (D) - (IV)

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30. Borazine, also known as inorganic benzene, can be prepared by the reaction of 3-equivalents of "X" with 6-equivalents of "Y". "X" and "Y", respectively are : **(+4, -1)**

a. $B(OH)_3$ and NH_3

b. B_2H_6 and NH_3

c. B_2H_6 and HN_3

d. NH_3 and B_2O_3

Answers

1. **Answer: d**

Explanation:

Step 1: Analyze the reactivity.
- Statement (1) is correct, as benzyl chloride is more reactive than other alkyl chlorides towards nucleophilic substitution. - Statement (2) is correct. The C-Cl bond in P has partial double bond character due to resonance. - Statement (3) is correct. Chlorine is an ortho-para directing group in electrophilic aromatic substitution reactions. - Statement (4) is incorrect. P (which likely refers to a compound like C_6H_5Cl) does not easily undergo nucleophilic substitution under normal conditions. It requires special conditions, such as the presence of a strong nucleophile or elevated temperatures. **Step 2: Conclusion.**
Thus, the incorrect statement is (4). **Final Answer:**

$$\boxed{P \text{ can undergo nucleophilic substitution reaction in normal conditions}}$$

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2. **Answer: c**

Explanation:

Step 1: Understanding the behavior of XF_3 and YF_3.
- XF_3 is a Lewis acid, which means element X must have an incomplete octet or a strong tendency to accept electron pairs. This typically happens when the central atom has a higher oxidation state and can accept electron pairs. This is characteristic of sp^3 hybridized species.
- YF_3 acts as a Lewis base, which means element Y donates electron pairs. This occurs when element Y has lone pairs of electrons available for donation, and such atoms are typically sp^3 hybridized.

Step 2: Analyzing the hybridization of X and Y.
- For XF_3, X needs to have an oxidation state of +3, and its hybridization is sp^3 to accommodate three bonding pairs with fluorine atoms and leave an empty orbital

for accepting electron pairs.
- For YF_3, Y needs to have lone pairs to act as a Lewis base. It will also be sp^3 hybridized as it needs to accommodate three bonding pairs and retain one lone pair, allowing it to donate electrons.

Step 3: Conclusion.
The hybridization of both X and Y in XF_3 and YF_3 is sp^3. Therefore, the correct answer is (3).

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3. Answer: d

Explanation:

Step 1: Understanding the statements.
- Statement-I is incorrect because a longer bond length typically corresponds to a larger atomic size, which is not necessarily related to a shorter covalent radius.
- Statement-II is incorrect because the least boiling point (B.P.) among the Group 15 hydrides is for PH_3 (Phosphine), and the maximum covalency of Phosphorus (P) is 5, not 4.

Step 2: Conclusion.
Both statements are incorrect. The correct answer is (4).

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4. Answer: b

Explanation:

Step 1: Identifying the species and the element.
The given species is EH_4^+, and when passed through a basic solution of $K_2[HgI_4]$, it forms a brown ppt. This reaction is characteristic of ammonia (NH_3), where the species formed is NH_4^+, and a brown ppt of HgO. $Hg(NH_3)I$ is formed.

Step 2: Analyzing the options.
(1) Element E has maximum covalency equal to 5: This is incorrect. The covalency of Nitrogen (N) in NH_4^+ is 4, not 5.
(2) Brown ppt. formed is HgO. Hg(NH$_3$)I: Correct — This is the brown precipitate formed when ammonia reacts with the mercury(I) complex.
(3) Element E has maximum electron affinity in its group: This is incorrect. Nitrogen does not have the maximum electron affinity in its group; it is oxygen.
(4) EH_3 is phosphine: This is incorrect. EH_3 would correspond to ammonia (NH_3), not phosphine (PH_3).

Step 3: Conclusion.
The correct answer is **(2) Brown ppt. formed is HgO. Hg(NH$_3$)I**, as it correctly matches the reaction behavior of ammonia.

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5. Answer: c

Explanation:

1. **Analysis of Statement I:**

- For $CH_3 - CH = CH - CH = O$: $\mu = q \times d$
- Conjugated system creates greater charge separation
- More distance between charges than in saturated compound

Therefore, greater dipole moment

2. **Analysis of Statement II:**

- In $CH_3 - CH = CH - CH = O$, $C_1 - C_2$ has partial double bond character
- Double bond character means shorter bond length
- Compared to pure single bond in \chemfig{CH_3-CH_2-CH_2-CH=O}
  Statement II is FALSE
  (actual bond length is shorter)

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6. Answer: d

Explanation:

- Ga forms bond with Cl: $GaCl_3$ shows ionic bonding, and the bond between Ga and Cl is ionic.
- Ga is coordinated with Cl: Ga in $GaCl_3$ is in the +3 oxidation state, which results in covalent bonding with Cl.
- Ga is more electronegative than Cl: This statement is incorrect as Ga has lower electronegativity than chlorine.
- Oxidation state of Ga: In $GaCl_3$, Ga is in the +3 oxidation state.

Therefore, the correct answer is the oxidation state of Ga in $GaCl_3$ is +3.

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7. **Answer: b**

Explanation:

Element State at Boiling Water Temperature Analysis

Boiling water has a temperature of $100^\circ C$. We need to find an element that has a melting point below $100^\circ C$ and a boiling point above $100^\circ C$ to remain liquid at this temperature.

- Li and Cs: Alkali metals (Li and Cs) react vigorously with water.
- Br_2: Bromine (Br_2) has a boiling point of $58.8^\circ C$, so it would be a gas at $100^\circ C$.
- Ga: Gallium (Ga) has a melting point of $29.8^\circ C$ and a boiling point of $2400^\circ C$. Thus, gallium will remain liquid inside boiling water.

Conclusion:

Gallium will remain liquid inside boiling water.

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8. **Answer: b**

Explanation:

To determine the correct statements about p-block elements and their compounds, we need to evaluate each statement based on our understanding of chemistry:

1. **(A) Non-metals have higher electronegativity than metals.**
   Electronegativity $is\ a\ measure\ of\ an\ atom's\ ability\ to\ attract\ and\ bond\ with\ electrons.$ In

general, non-metals have higher electronegativity because they tend to gain electrons to form anions. This statement is correct.

2. **(B) Non-metals have lower ionisation enthalpy than metals.**
   Ionisation enthalpy is the energy required to remove an electron from an atom. Non-metals, which tend to hold onto their electrons more tightly than metals, generally have higher ionisation enthalpy. Therefore, this statement is incorrect.
3. **(C) Compounds formed between highly reactive nonmetals and highly reactive metals are generally ionic.**
   Compounds such as sodium chloride (NaCl) form when a highly reactive metal (like sodium) transfers an electron to a highly reactive non-metal (like chlorine), resulting in an ionic bond. This statement is correct.
4. **(D) The non-metal oxides are generally basic in nature.**
   Non-metal oxides, like CO_2, SO_2, are generally acidic or neutral, not basic. This statement is incorrect.
5. **(E) The metal oxides are generally acidic or neutral in nature.**
   Metal oxides, such as CaO or $\mathrm{Na_2O}$, are typically basic, not acidic or neutral (with a few exceptions). Therefore, this statement is incorrect.

Thus, the correct statements are (A) and (C). Hence, the correct answer is the option:

(A) and (C) only

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9. Answer: 7 - 7

Explanation:

To determine the number of oxygen atoms in fuming sulfuric acid, first recognize its chemical formula. Fuming sulfuric acid is also known as oleum and is a combination of sulfuric acid (H_2SO_4) and sulfur trioxide (SO_3). A common representation is $H_2S_2O_7$, which can be viewed as $H_2SO_4 + SO_3$.

Counting the oxygen atoms, H_2SO_4 contains 4 oxygen atoms and SO_3 contains 3 oxygen atoms, summing up as:

- 4 (from H_2SO_4)
- + 3 (from SO_3)

Total = 7 oxygen atoms.

We verify that the result, 7, falls within the provided range [7,7]. Thus, the number of oxygen atoms in fuming sulphuric acid is **7**.

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10. Answer: c

Explanation:

Evaluate the given statements (A, B, C, D) regarding the properties of Group 15 hydrides to identify the correct ones.

Concept Used:

Key trends for Group 15 hydrides (EH_3):

- **Stability:** Decreases down the group due to decrease in E–H bond dissociation enthalpy.
- **Reducing Character:** Increases down the group as the E–H bond becomes weaker and easier to break.
- **Basicity:** Decreases down the group due to decreased availability of the lone pair on the central atom (increase in size, decrease in electronegativity).

Step-by-Step Solution:

Step 1: Analyze Statement A: "The stability of the hydrides decreases in the order NH_3 > PH_3 > AsH_3 > SbH_3 > BiH_3." This is correct. The E–H bond strength decreases down the group due to the increasing size of the central atom and poorer orbital overlap with hydrogen.

Step 2: Analyze Statement B: "The reducing ability of the hydrides increases in the order NH_3 < PH_3 < AsH_3 < SbH_3 < BiH_3." This is correct. Reducing ability depends on the ease of E–H bond cleavage. As the bond becomes weaker down the group, the hydride can more readily donate H^- (or H•), making it a stronger reducing agent.

Step 3: Analyze Statement C: "Among the hydrides, NH_3 is a strong reducing agent while BiH_3 is a mild reducing agent." This is incorrect. The trend is the opposite. NH_3 is a very weak reducing agent (stable), while BiH_3 is the strongest reducing agent in the group (very unstable and decomposes easily).

Step 4: Analyze Statement D: "The basicity of the hydrides increases in the order NH_3 < PH_3 < AsH_3 < SbH_3 < BiH_3." This is incorrect. Basicity decreases down the group: NH_3 > PH_3 > AsH_3 > SbH_3 > BiH_3. The lone pair on nitrogen in NH_3 is most available for donation due to its small size and high electronegativity.

Thus, the correct statements are **A and B** only.

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11. Answer: 6 - 6

Explanation:

- The given formulas represent hydrated magnesium nitrate and hydrated barium nitrate.
- The formulas are as follows:
  - **Magnesium nitrate hexahydrate:** $\mathrm{Mg(NO_3)_2 \cdot 6H_2O}$
  - **Barium nitrate (anhydrous):** $\mathrm{Ba(NO_3)_2}$
- Here:
  - $X = 6$ (number of water molecules in magnesium nitrate hexahydrate).
  - $Y = 0$ (number of water molecules in anhydrous barium nitrate).

Calculation:

The sum of X and Y is:

$$X + Y = 6 + 0 = 6$$

Final Answer:

The sum of X and Y is 6.

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12. Answer: 4 - 4

Explanation:

Acidic oxides react with water to form acids. Among the given oxides: - Acidic oxides: $\mathrm{N_2O_3}$, $\mathrm{Cl_2O_7}$, $\mathrm{SO_2}$, $\mathrm{NO_2}$ - Neutral oxides: NO, $\mathrm{N_2O}$, CO - Basic oxides: CaO, $\mathrm{Na_2O}$
Thus, there are 4 acidic oxides.

Concepts:

1. P-Block Elements:

- P block elements are those in which the last electron enters any of the three p-orbitals of their respective shells. Since a p-subshell has three degenerate p-orbitals each of which can accommodate two electrons, therefore in all there are six groups of p-block elements.
- P block elements are shiny and usually a good conductor of electricity and heat as they have a tendency to lose an electron. You will find some amazing properties of elements in a P-block element like gallium. It's a metal that can melt in the palm of your hand. Silicon is also one of the most important metalloids of the p-block group as it is an important component of glass.

P block elements consist of:

- Group 13 Elements: Boron family
- Group 14 Elements: Carbon family
- Group 15 Elements: Nitrogen family
- Group 16 Elements: Oxygen family
- Group 17 Elements: Fluorine family
- Group 18 Elements: Neon family

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13. Answer: b

Explanation:

The question involves the borax bead test, a qualitative analysis technique used to identify certain metal ions based on the color of the bead formed when a metal compound is fused with borax in a flame. Let's go through the process to identify why the blue-colored bead is formed when borax is heated with cobalt oxide (CoO).

When borax $(Na_2B_4O_7 \cdot 10H_2O)$ is heated, it loses water and forms sodium metaborate $(NaBO_2)$ and boric oxide (B_2O_3):

$$Na_2B_4O_7 \cdot 10H_2O \rightarrow 2NaBO_2 + B_2O_3 + 10H_2O$$

The boric oxide (B_2O_3) then reacts with the cobalt oxide (CoO) present on the platinum loop to form cobalt metaborate $(Co(BO_2)_2)$. This compound is responsible for the distinctive blue color of the bead:

$$CoO + B_2O_3 \rightarrow Co(BO_2)_2$$

Now, let's analyze why the correct answer is $Co(BO_2)_2$:

1. **Formation of the compound:** During the fusion in the flame, the formed cobalt metaborate $Co(BO_2)_2$ imparts a blue color to the glassy bead as it is integrated into the structure of the glass matrix.
2. **Ionic influence:** The presence of cobalt ion Co^{2+} specifically imparts the deep blue coloration which is typical in cobalt-containing glass and glazes.
3. **Elimination of other options:**
   - B_2O_3: Boric oxide itself does not contribute to any specific coloration; it acts as a basic constituent enabling the formation of metaborate structures.
   - CoB_4O_7 and $Co[B_4O_5(OH)_4]$: These structures do not typically form or exist in the bead under the heated conditions from borax bead preparation.

Thus, the blue-colored bead is indeed due to the formation of cobalt metaborate, $Co(BO_2)_2$.

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P block elements consist of:

- Group 13 Elements: Boron family

- Group 14 Elements: Carbon family
- Group 15 Elements: Nitrogen family
- Group 16 Elements: Oxygen family
- Group 17 Elements: Fluorine family
- Group 18 Elements: Neon family

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14. Answer: c

Explanation:

The question pertains to understanding which oxide of nitrogen can be harmful to plant leaves and can hinder photosynthesis. Let us evaluate each option:

1. **NO (Nitric Oxide):** Nitric oxide is generally not stable in the atmosphere and does not directly damage plant leaves. It usually oxidizes to form nitrogen dioxide (NO_2).
2. **NO_3^- (Nitrate Ion):** This is a stable ion that is often a part of fertilizers. It does not damage plant leaves directly.
3. **NO_2 (Nitrogen Dioxide):** This is a significant air pollutant known to cause damage to plants. It can penetrate leaves, causing chlorophyll destruction and thus retarding the process of photosynthesis. This is the correct answer.
4. **NO_2^- (Nitrite Ion):** Similar to the nitrate ion, this ion does not directly cause damage to plants.

Given these evaluations, NO_2 is the oxide of nitrogen that can damage plant leaves and retard photosynthesis. Therefore, the correct answer is:

NO_2

Concepts:

1. P-Block Elements:

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---

15. Answer: a

Explanation:

To determine which pair exclusively consists of herbicides, we must analyze each option based on the properties and uses of the chemicals listed.

1. **Aldrin and Dieldrin:** Aldrin and Dieldrin are well-known pesticides primarily used as insecticides, not herbicides. Therefore, this pair is incorrect.
2. **Sodium Chlorate and Aldrin:**
   - Sodium Chlorate: This compound is a chemical commonly used as a herbicide for weed control.
   - Aldrin: As mentioned earlier, Aldrin is an insecticide.

   Therefore, this pair is not exclusively herbicides.
3. **Sodiumarsinate and Dieldrin:**
   - Sodiumarsinate: This is used as a herbicide.
   - Dieldrin: Is primarily an insecticide.

   This combination includes one herbicide and one insecticide, making it inappropriate for the question.
4. **Sodium Chlorate and Sodiumarsinite:**
   - Sodium Chlorate: This is a herbicide used commonly for eradicating vegetation.
   - Sodiumarsinite: Used as a herbicide for controlling unwanted plants.

Both chemicals in this pair serve as herbicides, satisfying the question's requirement.

Thus, the correct answer is: **Sodium chlorate and sodiumarsinite**, as both chemicals are herbicides.

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16. Answer: b

Explanation:

Solution: The standard reduction potentials (SRP) provide insight into the tendency of each ion to undergo reduction:
Understanding Standard Reduction Potential: The higher the value of the standard reduction potential, the greater the tendency to gain electrons (undergo reduction). Hence, ions with higher reduction potentials act as better oxidizing agents.

Comparative Analysis: From the given data: BrO_4^- has the highest E^o value (1.74 V). IO_4^- follows with 1.65 V. ClO_4^- has the lowest at 1.19 V. Thus, the correct order of oxidizing power based on SRP is:

$$BrO_4^- > IO_4^- > ClO_4^-.$$

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17. Answer: b

Explanation:

The correct answer is (B): Both (A) and (R) are true but (R) is not the correct explanation of (A).
The outer most shell of Boron is 2 and its maximum covalency is 4.
Therefore, boron cannot form BF_6^{3-}.

Hence Assertion is correct.
Boron is the first element of group-13 of modern periodic table. It is very small in size. But it does not provide correct explanation of Assertion.

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18. Answer: c

Explanation:

$$I_2 + 10HNO_3 \rightarrow 2HIO_3 + 10NO_2 + 4H_2O$$

Concepts:

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19. Answer: b

Explanation:

$$P_4 + 8SOCl_2 \rightarrow 4PCl_3 + 4SO_2 + 2S_2Cl_2$$

Concepts:

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20. Answer: 2 - 2

Explanation:

The correct answer is 2

Fig. Molecular Structures

XeF_4 and H_2O have 2 lone pairs.

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21. Answer: d

Explanation:

The correct answer is (D) : Statement I false, but Statement II is true.
Statement I is false, as E_2O_5 is more acidic than E_2O_3
Statement II is correct.
As +ve oxidation state increases, EN of element increases hence acidic character increases. Down the group, non-metallic character decreases, acidic character decreases.
Acidic character : E2O5 > E2O3 Down the group, acidic character of E2O3 decreases

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---

22. Answer: a

Explanation:

The correct answer is (A) : $3s^2, 3p^4$
Element E is Selenium
The element which is just above 'E' in periodic table is sulphur, its electronic configuration is $1s^2, 2s^2, 2p^6, 3s^2, 3p^4$.
$E \Rightarrow [Ar]^3d^10^4s^24p^4$
Element above $E \Rightarrow [Ne]3s^23p^4$

Concepts:

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23. Answer: b

Explanation:

$3B_2H_6 + 6NH_3 \rightarrow 2B_3N_3H_6$
(Borazine)

So, the correct option is (B): B_2H_6 and NH_3.

Concepts:

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---

24. Answer: d

Explanation:

The correct answer is (D) : $\mathrm{NH_2^-} > NH_3$

$NH_3 \rightarrow \mathrm{NH_2^-} + H^+$

Acid Conjugate base

Conjugate base of acid is always a stronger nucleophile.

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---

25. Answer: a

Explanation:

The correct answer is (A): Ce(At. No. 58)

Explanation:

$Ce \rightarrow [Xe]4f^1\ 5d^1\ 6s^2$
$Ce^{+4} \rightarrow [xe]\ 4f^o\ 5d^o\ 6s^o$
Cerium in +4 oxidation state acquires inert gas configuration.

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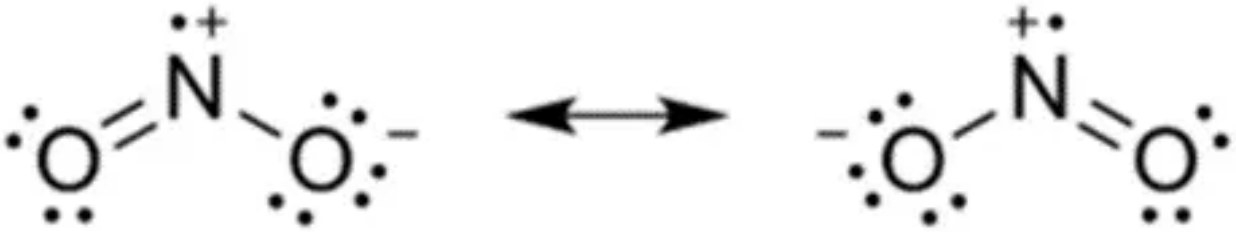
26. Answer: b

Explanation:

The correct answer is (B): NO_2

Explanation:

The oxide of nitrogen which contains odd electrons is NO_2



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27. Answer: a

Explanation:

The correct option is(A): (A) - (II), (B) - (III), (C) - (I), (D) - (IV).

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28. Answer: a

Explanation:

The tendency to liberate hydrogen gas from mineral acids generally depends on the reactivity of the metal.

- Copper (Cu) has a low reactivity and thus has a relatively low tendency to liberate hydrogen gas from mineral acids.
- Manganese (Mn) and nickel (Ni) have higher reactivities compared to copper, so they have a higher tendency to liberate hydrogen gas.
- Zinc (Zn) is more reactive than copper and has a higher tendency to liberate hydrogen gas from mineral acids.

So, the correct option is (A): Cu

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29. Answer: c

Explanation:

From the given options the correct answer is option (C): (A) - (II), (B) - (I), (C) - (IV), (D) - (III)

Concepts:

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30. Answer: b

Explanation:

The correct option is (B): B_2H_6 and NH_3.

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