p Block Elements JEE Main PYQ - 2

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. Which one among the following metals is the weakest reducing agent? **(+4, -1)**

a. Rb

b. Na

c. Li

d. K

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2. Ba+2 cannot be precipitated as? **(+4, -1)**

a. BaCO3

b. Ba(OH)2

c. BaCrO4

d. BaSO4

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3. **Given below are two statements:** **(+4, -1)**
Statement I: SO_2 and H_2O both possess V-shaped structures.
Statement II: The bond angle of SO_2 is less than that of H_2O. In the light of the above statements, choose the most appropriate answer from the options given below:

a. Both Statements I and Statement II are incorrect

b. Both Statement I and Statement II are correct

c. Statement I is correct but Statement II is incorrect

d. Statement I is incorrect but Statement II is correct

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4. The oxide of a metal has 32% oxygen. Its equivalent weight would be: **(+4, -1)**

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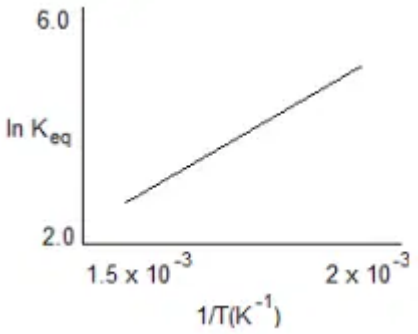
5. A schematic plot of ln Keq versus inverse of temperature for a reaction is shown below: **(+4, -1)**



The reaction must be:

a. (A) Highly spontaneous at ordinary temperature

b. (B) One with negligible enthalpy change

c. (C) Endothermic

d. (D) Exothermic

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6. When photons of energy 4.25 eV strike the surface of a metal A the ejected photo electrons have a maximum kinetic energy EA eV and de Broglie wavelength . The maximum kinetic energy of photo electrons liberated from another metal B by photons of energy 4.70 eV is = (– ?) eV. If the de Broglie wavelength of these photo electrons is = 2 , then: **(+4, -1)**

2.25eV, 4.20eV

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7. Boiling point of water at 750 mmHg is 99.63 C. How much sucrose is to be added to 500 g of water such that it boils at 100 C. Molal elevation constant for water is 0.52 K kg mol^{-1} **(+4, -1)**

a. (A) 131.67 g

b. (B) 141.67 g

c. (C) 151.67 g

d. (D) 121.67 g

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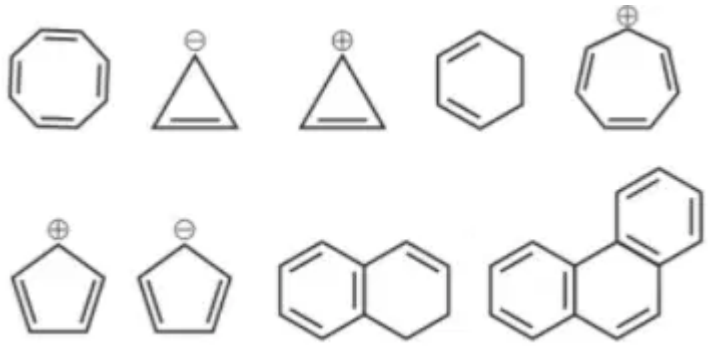
8. Among the following the number of aromatic compound(s) is/are: **(+4, -1)**



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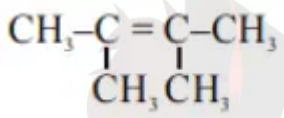
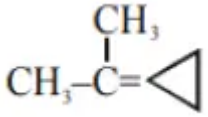
9. An unsaturated hydrocarbon X on ozonolysis gives A. Compound A when warmed with ammonical silver nitrate forms a bright silver mirror along the sides of the test tube. The unsaturated hydrocarbon X is: **(+4, -1)**

a. (A)



b. (B)



c. (C) HC C – CH_2 – CH_3

d. (D) CH_3 – C C – CH_3

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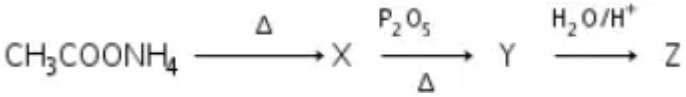
10. What is the number of carbon atoms in compound Z in the given reaction sequence: **(+4, -1)**



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11. At equilibrium the concentrations of $N_2 = 3.0 \times 10^{-3}$ M, $O_2 = 4.2 \times 10^{-3}$ M and $NO = 2.8 \times 10^{-3}$ M in a sealed vessel at 800 K. What will be K_C for the reaction $N_{2(g)} + O_{2(g)} \quad 2NO_{(g)}$? **(+4, -1)**

a. (A) 0.622

b. (B) 0.722

c. (C) 0.822

d. (D) 0.922

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12. In good quality cement ratio of lime total oxides of Si(SiO_2), Aluminium(Al_2O_3) and Iron(Fe_2O_3) should be as close as possible to _____ . **(+4, -1)**

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13. How many of the following have five radial nodes ? **(+4, -1)**
5s, 6s, 7s, 6p and 4p

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14. If the formula of borax is $Na_2B_4Ox(OH)y.zH_2O$, Find the value of x + y + z. **(+4, -1)**

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15. Incorrect statement about Borazine is: **(+4, -1)**

a. It has banana shape bonds

b. It has electron delocalisation

c. It reacts with water

d. Cyclic in nature

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16. **XeF_4 reacts with SbF_5 to form:** **(+4, -1)**

$$[XeF_m]^{n+}[SbF_y]^{z-}$$

What is $m + n + y + z$?

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

LIST I Elements		LIST II Colour imparted to the flame	
A	K	1	Brick Red
B	Ca	2	Violet
C	Sr	3	Apple Green
D	Ba	4	Crimson Red

Choose the correct answer from the options given below:

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

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

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

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

---

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

LIST I		LIST II	
A	XeF_4	I	See-saw
B	SF_4	II	Square planar
C	NH_4^+	III	Bent T-shaped
D	BrF_3	IV	Tetrahedral

Choose the correct answer from the options given below :

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

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

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

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

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19. The total number of acidic oxides from the following list is: **(+4, -1)**
$NO, N_2O, B_2O_3, N_2O_5, CO, SO_3, P_4O_{10}$

a. 3

b. 4

c. 5

d. 6

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20. Given below are two statements, one is labelled as Assertion A and the other is labelled as Reason R **(+4, -1)**
Assertion A: Beryllium has less negative value of reduction potential compared to the other alkaline earth metals
Reason R: Beryllium has large hydration energy due to small size of Be^{2+} but relatively large value of atomization enthalpy
In the light of the above statements, choose the most appropriate answer from the options given below

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

b. A is not correct but R is correct

c. Both A and R are correct but R is NOT the correct explanation of A

d. A is correct but R is not correct

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21. Sum of π-bonds present in peroxodisulphuric acid and pyrosulphuric acid is_____ **(+4, -1)**

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22. Compound A reacts with NH_4Cl and forms a compound B. **(+4, -1)**

Compound B reacts with H_2O and excess of CO_2 to form compound C which on passing through or reaction with saturated $NaCl$ solution forms sodium hydrogen carbonate Compound A, B and C, are respectively.

a. $CaCl_2, NH_4^+, (NH_4)_2\,CO_3$

b. $CaCl_2, NH_3, NH_4HCO_3$

c. $Ca(OH)_2, NH_3, NH_4HCO_3$

d. $Ca(OH)_2, NH_4^+, (NH_4)_2\,CO_3$

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23. Which one among the following metals is the weakest reducing agent? **(+4, -1)**

a. Rb

b. Na

c. Li

d. K

---

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

Assertion A : The alkali metals and their salts impart characteristic colour to reducing flame

Reason R : Alkali metals can be detected using flame tests

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

a. A is not correct but R is correct

b. Both A and R are correct but R is NOT the correct explanation of A

c. Both A and R are correct and R is the correct explanation of A

d. A is correct but R is not correct

---

25. Compound A reacts with NH_4Cl and forms a compound B Compound B reacts with H_2O and excess of CO_2 to form compound C which on passing through or reaction with saturated $NaCl$ solution forms sodium hydrogen carbonate Compound A, B and C, are respectively **(+4, -1)**

a. $CaCl_2, NH_4^+, (NH_4)_2\,CO_3$

b. $CaCl_2, NH_3, NH_4HCO_3$

c. $Ca(OH)_2, NH_3, NH_4HCO_3$

d. $Ca(OH)_2, NH_4^+, (NH_4)_2\,CO_3$

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

LIST I		LIST II	
A	Chlorophyll	1	Na_2CO_3
B	Soda ash	2	$CaSO_4$
C	Dentistry, Ornamental work	3	Mg^{2+}
D	Used in white washing	4	$Ca(OH)_2$

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

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

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

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

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27. Which of the following represents the correct order of metallic character of the given elements? **(+4, -1)**

a. $Be < Si < Mg < K$

b. $K < Mg < Be < Si$

c. $Be < Si < K < Mg$

d. $Si < Be < Mg < K$

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

LIST–I (molecules/ions)	LIST–II (No. of lone pairs of e^- on central atom)
$(A)\ IF_7$	I. Three
$(B)\ ICl_4^-$	II. One
$(C)\ XeF_6$	III. Two
$(D)\ XeF_2$	IV. Zero

Choose the correct answer from the options given below:

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

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

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

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

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29. **The Lewis acid character of boron tri halides follows the order :** **(+4, -1)**

a. $BCl_3 > BF_3 > BBr_3 > BI_3$

b. $BI_3 > BBr_3 > BCl_3 > BF_3$

c. $BBr_3 > BI_3 > BCl_3 > BF_3$

d. $BF_3 > BCl_3 > BBr_3 > BI_3$

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30. Bond dissociation energy of , $_2$, and $_2$ (all diatomic molecules) are in the ratio of 1: 1: 0.5 and Δ of is −100 $^{-1}$. The bond dissociation energy of $_2$ is 100 . The value of is **(+4, -1)**

Answers

1. **Answer: b**

Explanation:

Among the given metals, **sodium (Na) has the highest oxidation potential** in the alkali metal group. The oxidation potential is a measure of an element's tendency to lose electrons and undergo oxidation. In alkali metals, the higher the oxidation potential, the weaker the reducing agent the metal is. Sodium, having the highest oxidation potential in this group, is therefore the weakest reducing agent. This is because a higher oxidation potential means that sodium is less inclined to lose electrons compared to other alkali metals.

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

2. **Answer: b**

Explanation:

Ba+2 cannot be precipitated as **Ba(OH)2**.

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3. **Answer: c**

Explanation:

1. Statement I: Both SO_2 and H_2O possess V-shaped (bent) structures due to the presence of lone pairs on the central atom. - SO_2: The central sulfur atom forms two double bonds with oxygen and has one lone pair of electrons. - H_2O: The central oxygen atom forms two single bonds with hydrogen and has two lone pairs of electrons. Thus, this statement is correct.

2. Statement II: The bond angle of SO_2 is approximately 119.5° (sp^2 hybridization), while the bond angle of H_2O is 104.5° (sp^3 hybridization). - The larger bond angle in SO_2 is due to the greater repulsion caused by the double bonds in SO_2, compared to the single bonds in H_2O. Thus, this statement is incorrect.

$$SO_2 : \angle \text{O-S-O} \approx 119.5^\circ \quad H_2O : \angle \text{H-O-H} \approx 104.5^\circ$$

Conclusion: Statement I is correct, but Statement II is incorrect.

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4. **Answer: 17 - 17**

Explanation:

Explanation:
Given:Percentage of oxygen in the metal oxide = 32%We have to find the equivalent weight of metal oxide.Now, the percentage of metal will be = 100 - 32= 68%If we take 100 g of metal oxide, thenWeight of oxygen = 32 gWeight of metal = 68 gEquivalent weight is given by:Equivalent weight = $\frac{\text{Molecular weight}}{\text{Valency}}$ ..... (i)Valency of oxygen =

2Molecular weight of oxygen = 16Substituting the values in equation (i), we getEquivalent weight of oxygen = $\frac{16}{2}$ = 8 Let the equivalent weight of metal be 'E'.In a chemical reaction number of equivalents of reactants and products are equal, thus,No. of gram-equivalent of metal = No. of gram-equivalent of oxygenNow, gram equivalent is given by:Gram-equivalent = $\frac{\text{Weight}}{\text{Equivalent Weight}}$ Therefore,$\frac{\text{Weight of metal}}{\text{Equivalent weight of metal}}$ = $\frac{\text{Weight of oxygen}}{\text{Equivalent weight of oxygen}}$.....(ii)Substituting all the values in equation (ii), we get$\frac{68}{}$ = $\frac{32}{8}$ = $\frac{68\times8}{32}$ = 17Hence, the correct answer is 17.00.

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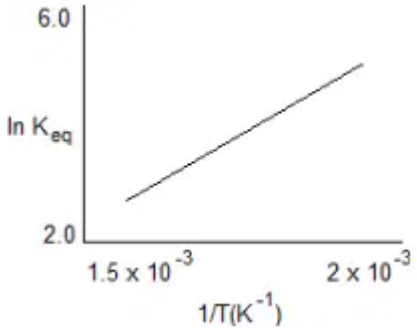
5. Answer: d

Explanation:

Explanation:
Standard Gibbs' free energy change, ΔG° is related to standard enthalpy change, ΔH^{O} temperature, T and standard entropy change, ΔS° as:ΔG° = ΔH° - TΔS°..... (i)Also, standard Gibbs' free energy change is related to equilibrium constant (Keq), temperature and gas constant as shown below:ΔG° = -RT ln Keq..... (ii)Where ΔG° = Gibbs' free energy changeΔH° = Standard Enthalpy changeT = TemperatureΔS° = Standard Entropy changeR = Gas constantKeq = Equilibrium constantComparing equations (i) and (ii), we get$\Delta H^{\circ} - T\Delta S^{\circ} = - RT \ln Keq$.$\ln Keq = -\frac{^{0}}{} + \frac{^{0}}{}$ .....(A)This equation is called Van't Hoff equation.Given that, when ln Keq is plotted against $\frac{1}{}$ a straight line is obtained as shown below:



The equation of a straight line is given as:y = mx + c..... (B)Where m = slopec = InterceptThe slope of the line is positive.∴ m = positiveComparing equations A and B we have:m = $\frac{\Delta}{}$However, as the slope is positive, ΔH is negative.Therefore, this reaction is an exothermic reaction.Hence, the correct option is (D).

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6. Answer: 1.5 - 1.5

Explanation:

Explanation:
de Broglie wavelength, = $\frac{}{\sqrt{2}}$ where is the kinetic energy, = $\frac{}{\sqrt{2}}$ and = $\frac{}{\sqrt{2}}$
— = $\sqrt{—}2 = \sqrt{\quad\quad - 1.5}$ or 4 = $\frac{}{-1.5}4$ − 6 = or = $\frac{6}{3}$ = 2eV
= (− 1.5)eV = 2eV − 1.5eV = 0.5eVAccording to Einstein's photoelectric equation,
= $_0$ + KE_{max} where the symbols have their usual meaning,or $_0$ = − KE_{max}
= 4.25eV − 2.00eV = 2.25eV = 4.70eV − 0.50eV = 4.20eVHence, the correct answer is 2.25eV, 4.20eV.

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7. Answer: d

Explanation:

Explanation:
Here, elevation of boiling point ΔT_b = (100 + 273) − (99.63 + 273) = 0.37 KMass of water, $_1$ = 500 gMolar mass of sucrose ($C_{12}H_{22}O_{11}$)M_2 = 11 × 12 + 22 × 1 + 11 × 16 = 342 g mol^{-1}
Molal elevation constant, K_b = 0.52 k kg mol^{-1} We know that:Δ = $\frac{\times 1000 \times \_2}{\_2 \times \_1}$
$_2$ = $\frac{\Delta \times \_2 \times \_1}{\times 1000}$ = $\frac{(0.37 \times 342 \times 500)}{(0.52 \times 1000)}$ = 121.67 g (approximately)so, 121.67 g of sucrose is to be added.Hence, the correct option is (D).

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8. Answer: 4 - 4

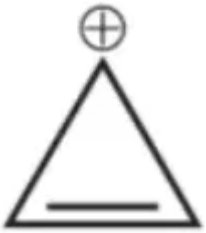
Explanation:

Explanation:
In organic chemistry, definition of aromatic compound is given by Huckel's rule. Huckel's rule state, for a compound to be aromatic, compound should be planar, cyclic and should have (4 + 2) electrons that should be in continuous delocalization or an uninterrupted cyclic pi electron cloud should be there.
Here = 0, 1, 2 ... ...
So if we put = 0, we get 2 electrons
If we put = 1, we get 6 electrons
If we put = 2, we get 10 electrons and so on

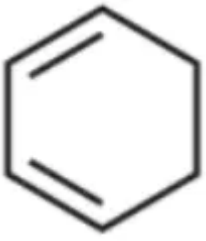
For example benzene, we all know are aware of the structure of benzene. It is planar, it is cyclic and it has 6 electrons (for = 1 we get, $4 \times 1 + 2 = 6$)
1st we have cyclooctatetraene,

it is cyclic, and non-planar and the number of electrons are 8, it does not follow huckel's rule, hence it is not aromatic.
2nd we have cyclopropane anion

It is cyclic, planar and has 4 electrons and Is not following huckel's rule hence not aromatic.
3rd we have cyclopropane cation.



It is cyclic, but it has only 2 electron, hence obey huckel's rule hence is aromatic.
4th we have cyclohexa-1,3-diene

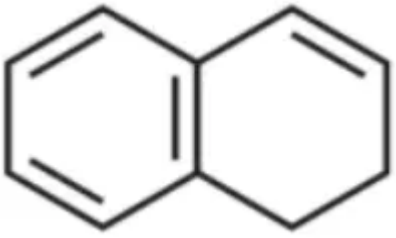


It is cyclic, planar but has 4 electron. Do not obey huckel's rule . hence is not aromatic.

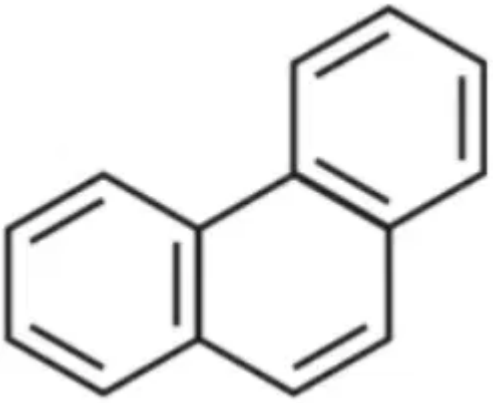
It is cyclic, planar, and has 6 electron and because of + charge the pi electrons are in continuous delocalization, hence this compound is aromatic.
6th we have cyclopenta-1,3-diene cation,

It is cyclic, not planar. It does not obey huckel's rule. hence is not aromatic
7th we have cyclopenta-1,3-diene anion,

It is cyclic, planar and has 6 conjugated electrons that means all the pi electrons are in continuous delocalization hence we consider negative charge in conjugation. Hence it is aromatic.
8th we have



It is cyclic, planar but the electron cloud is not in conjugation. Hence is not aromatic.
9th we have phenanthrene



It is cyclic, planar and has 14 electron which are in conjugation. Hence it does obey huckel's rule.
Hence it is aromatic.
The total number of aromatic compounds is 4.Hence, the correct answer is 4.

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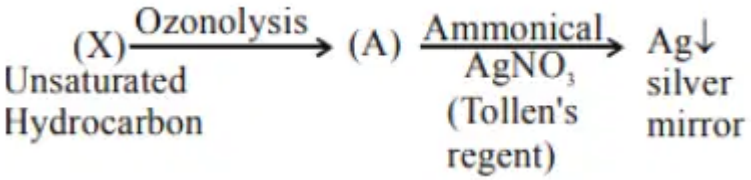
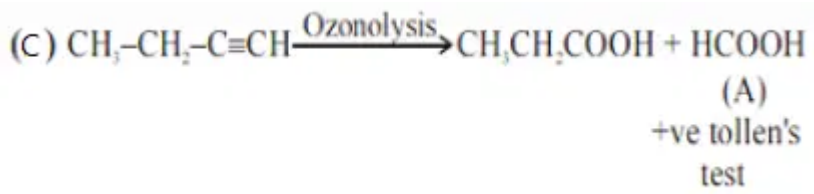
9. **Answer: c**

Explanation:

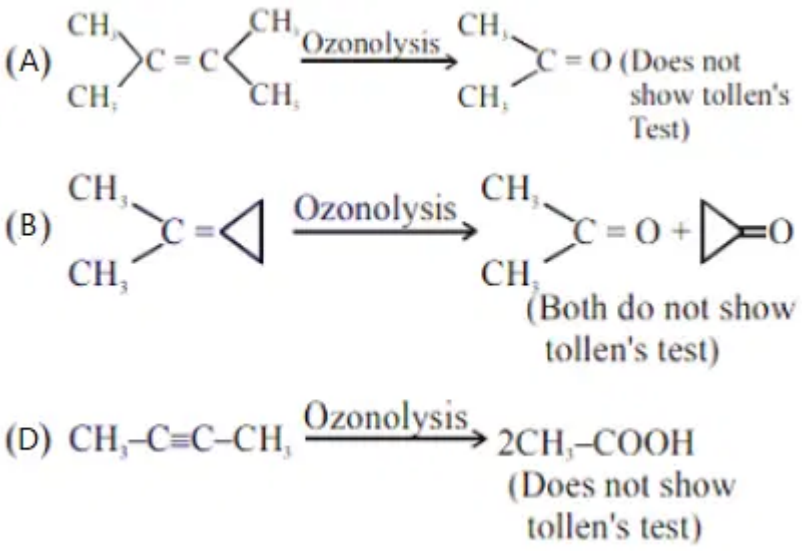
Explanation:



As (A) compound given positive tollen's test hence it may consist - CHO (aldehyde group). or it can be HCOOHSo for the given option:



And for other compounds (options):



Hence, the correct option is (C).

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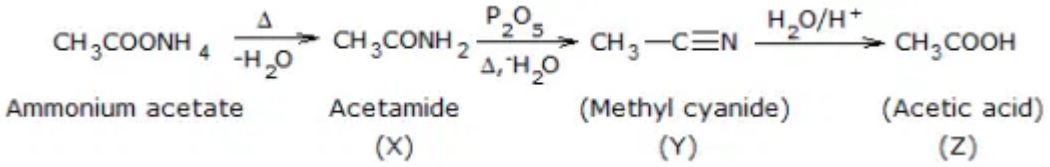
10. Answer: 2 - 2

Explanation:

Explanation:
Ammonium acetate when heated undergoes dehydration to give acetamide. Acetamide when heated with phosphorus pentoxide (P2O5), again undergoes dehydration to give methyl cyanide. Methyl cyanide on acidic hydrolysis gives acetic acid.The overall chemical reaction is represented as:



Therefore,X = CH3CONH2Y = CH3CNZ = CH3COOHThus, there are two carbon atoms in Z.Hence, the correct answer is 2.00.

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11. Answer: a

Explanation:

Explanation:
We are given,N_2 = 3.0×10^{-3} MO_2 = 4.2×10^{-3} MNO = 2.8×10^{-3} MApplying the law of

chemical equilibrium, we will get -$K_C = \frac{[NO]^2}{[N_2][O_2]}$ (1)Adding the values in equation 1 , $K_C = \frac{[2.8 \times 10^{-3}\,M]}{[3.0 \times 10^{-3}\,M][4.2 \times 10^{-3}\,M]} = 0.622$The value of K_C is 0 . 622Hence, the correct option is (A).

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12. **Answer: 2 - 2**

Explanation:

Assessment of Cement Quality:

The quality of cement is assessed based on the ratio of lime (CaO) to the sum of oxides (SiO_2, Al_2O_3, and Fe_2O_3). The formula for this ratio is:

Ratio = $\frac{\%CaO}{\%SiO_2 + \%Al_2O_3 + \%Fe_2O_3}$

For good quality cement, this ratio lies in the range of 1.9 to 2.1, which ensures the proper strength and binding properties of the cement. If the ratio deviates significantly:

- **Higher ratio:** May make the cement weak in resistance to environmental effects.
- **Lower ratio:** May reduce the binding efficiency and durability of the cement.

Conclusion: Since the ratio is closest to 2, the correct answer is **2.**

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: 6 - 6**

Explanation:

Calculation of Radial Nodes:

The number of radial nodes for an electron in an orbital is given by:

Radial nodes = n - l - 1,

where:

- **n:** Principal quantum number
- **l:** Azimuthal quantum number

Calculations for the given orbitals:

- **5s:** $n - l - 1 = 5 - 0 - 1 = 4$ radial nodes
- **6s:** $n - l - 1 = 6 - 0 - 1 = 5$ radial nodes
- **7s:** $n - l - 1 = 7 - 0 - 1 = 6$ radial nodes
- **6p:** $n - l - 1 = 6 - 1 - 1 = 3$ radial nodes
- **4p:** $n - l - 1 = 4 - 1 - 1 = 1$ radial node

Conclusion:

Only the **6s orbital** has five radial nodes. Therefore, the correct answer is **6s.**

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
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- Group 17 Elements: Fluorine family
- Group 18 Elements: Neon family

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14. Answer: 17 - 17

Explanation:

Formula of Borax is $Na_2B_4O_5(OH)_4 \cdot 8H_2O$.

Hence, x = 5, y = 4, and z = 8.

Therefore, x + y + z = 5 + 4 + 8 = 17.

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.
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---

15. Answer: a

Explanation:

Borazine, also known as "inorganic benzene," has the molecular formula $B_3N_3H_6$ and is a six-membered cyclic compound. It has the following characteristics:
- It is indeed a cyclic compound, so statement (1) is correct.
- Borazine exhibits electronic delocalization similar to benzene due to the alternating single and double bonds between boron and nitrogen, making statement (2) correct.
- Borazine can react with water to form boric acid and ammonia, so statement (3) is also correct.
- The term "banana bonds" typically refers to bonds in compounds like diborane, where boron atoms form unconventional bonds with hydrogen. Borazine does not contain banana bonds; instead, it has regular covalent bonds. Therefore, statement (4) is incorrect.

Thus, the incorrect statement is (4).

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.
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16. Answer: 11 - 11

Explanation:

The reaction is:

$$\mathrm{XeF_4 + SbF_5 \rightarrow [XeF_3]^+ + (SbF_6)^-}$$

From the reaction:

$$m + n + y + z = 3 + 1 + 6 + 1 = 11$$

Concepts:

1. Group 17 Elements:

Halogens are the group 17 elements of the periodic table. The term '*halogen*' means '*salt-producing*', hence the name halogens as they possess the tendency to form salts after reacting to metals. It generally has five elements:

- **Fluorine (F)**
- **Chlorine (Cl)**
- **Bromine (Br)**

- Iodine (I)
- Astatine (At)

These are all naturally occurring halogens but Tennessine (Ts) is an artificially created halogen.

Halogens:

Halogens are highly reactive elements and are highly electronegative. They have a high tendency to react with metals to form salts. They are also known as Group 17 elements. They have 7 electrons in their outer shell with a configuration of (ns2 np5). Fluorine being the first halogen in group 17, is highly reactive. Astatine is a halogen because of its resemblance with iodine despite it being radioactive.

Electronic Configuration:

The general electronic configuration for group 17 elements is ns2np5. This configuration clearly shows that they have 7 electrons in their valence shell. They require one more electron to complete their octet and achieve noble gas configuration.

Element	Atomic Number	Electronic Configuration	Group Number	Period Number
Fluorine	9	$[He]\ 2s^2 2p^5$	17	2
Chlorine	17	$[Ne]\ 3s^2 3p^5$	17	3
Bromine	35	$[Ar]\ 3d^{10} 4s^2 4p^5$	17	4
Iodine	53	$[Kr]\ 4d^{10} 5s^2 5p^5$	17	5
Astatine	85	$[Xe]\ 4f^{14} 5d^{10} 6s^2 6p^5$	17	6

---

17. **Answer: d**

Explanation:

Correct answer is (d) A-II, B-I, C-IV, D-III

Element	Colour in flame test
K	Violet
Ca	Brick red
Sr	Crimson red
Ba	Apple green

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.
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P block elements consist of:

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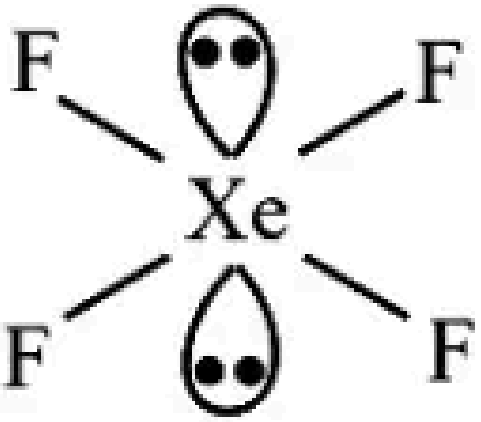
---

18. **Answer: c**

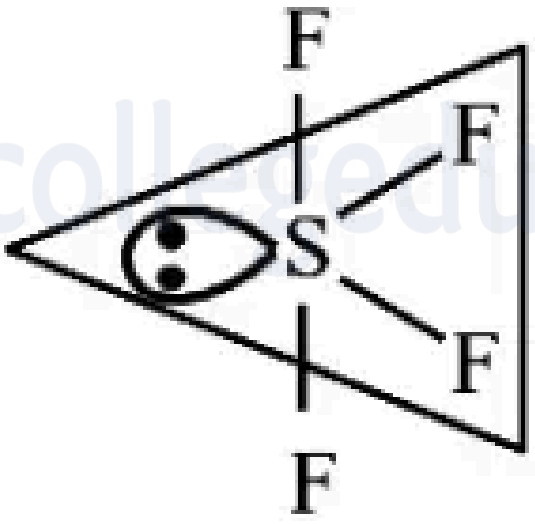
Explanation:

(A)



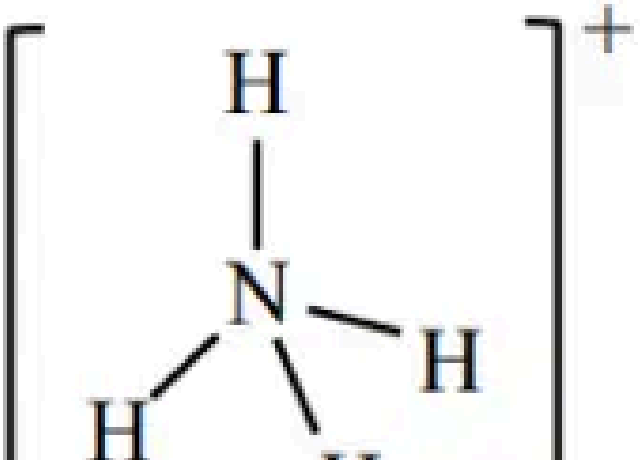
Square planer

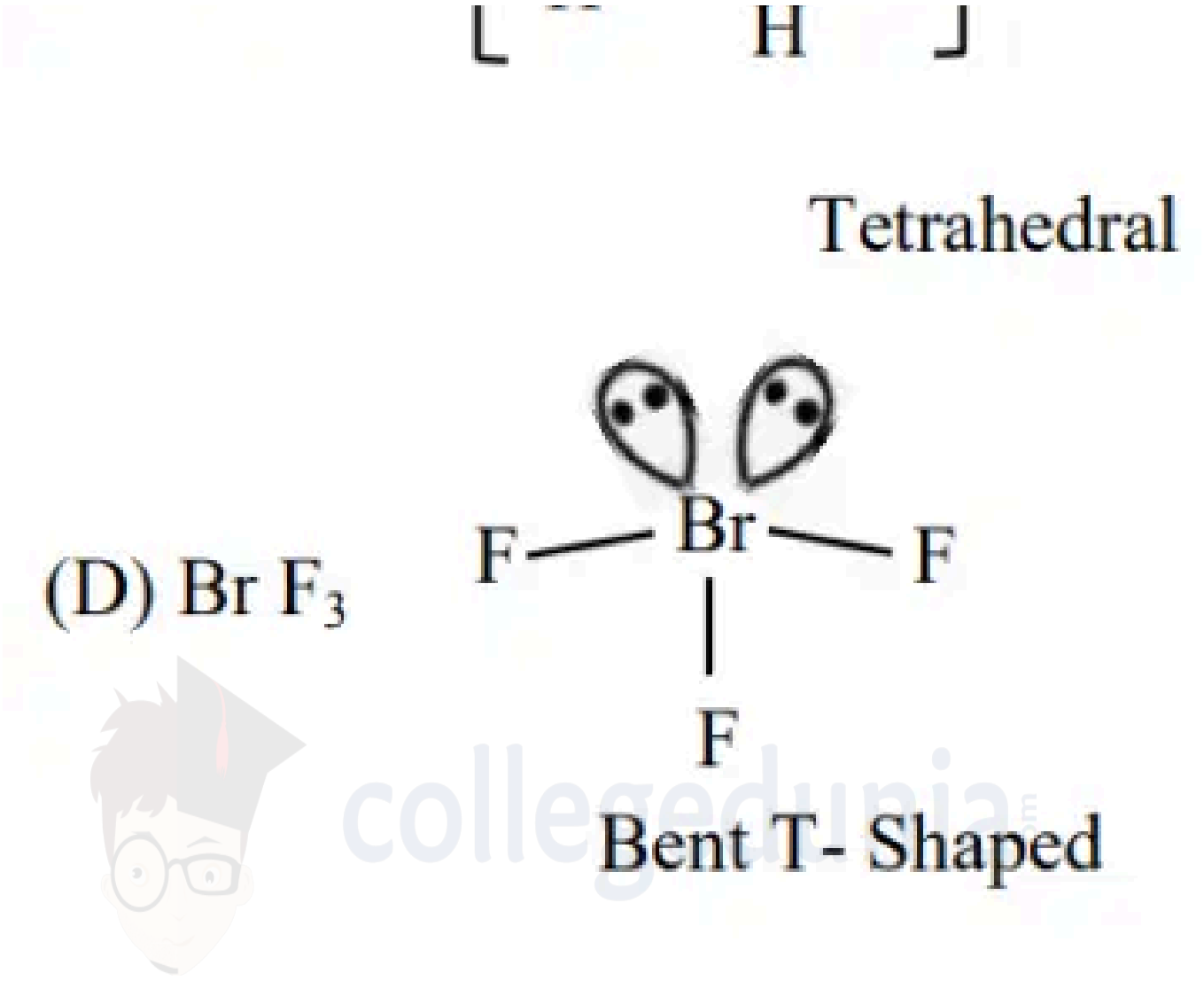
(B) SF_4



See-Saw

(C) NH_4^+





Correct answer is (C): A-II, B-I, C-IV, D-III

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.
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---

19. **Answer: b**

Explanation:

Neutral Oxides $-N_2O, NO, CO$
Acidic Oxides - $B_2O_3, N_2O_5, SO_3, P_4O_{10}$

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.
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20. **Answer: a**

Explanation:

Beryllium has a less negative reduction potential compared to other alkaline earth metals (AEM). This is because of:
• **High hydration energy:** Due to the small size of the Be2+ ion, the hydration energy is very large, which stabilizes the ion in aqueous solutions.
• **Large atomization enthalpy:** Beryllium has strong metallic bonding due to its small atomic size, which increases its atomization enthalpy. These factors reduce the tendency of beryllium to get reduced, leading to a less negative reduction potential.
Since the reason (R) explains why beryllium has a less negative reduction potential, both A and R are correct, and R is the correct explanation of A.

Concepts:

1. P-Block Elements:

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21. **Answer: 8 - 8**

Explanation:

• Peroxodisulphuric acid: Structure:

$$H - O - S(=O)_2 - O - O - S(=O)_2 - O - H$$

Number of π-bonds = 4 (two in each SO_3 group)

• Pyrosulphuric acid: Structure:

$$H - O - S(=O)_2 - O - S(=O)_2 - O - H$$

Number of π-bonds = 4 (two in each SO_3 group).

Total π-bonds = $4 + 4 = 8$.

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.
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22. **Answer: c**

Explanation:

$$\underset{(A)}{Ca(OH)_2} + 2NH_4Cl \xrightarrow{\Delta} \underset{(B)}{2NH_3} + CaCl_2 + 2H_2O$$

$$\underset{(B)}{NH_3} + H_2O + \underset{(exc)}{CO_2} \longrightarrow \underset{(C)}{NH_4HCO_3}$$

$$\underset{(c)}{NH_4HCO_3} + NaCl \longrightarrow NaHCO_3 \downarrow + NH_4Cl$$

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.
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23. **Answer: b**

Explanation:

Sodium has the lowest oxidation potential in alkali metals. Hence it is the weakest reducing agent among alkali metals. Low ionization energy should be present for the element to act as a reducing agent. Alkali metals have low ionization energy thus making them a strong reducing agent.

So, the correct option is (B): Na.

> *Read more from the chapter: Classification of Elements and Periodicity in Properties*

Concepts:

1. P-Block Elements:

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24. Answer: a

Explanation:

Assertion A is incorrect. Alkali metals and their salts typically impart distinct colors to an oxidizing flame, not a reducing flame. When alkali metal salts are heated in a flame, they excite the metal ions, which then emit characteristic colors as they return to their ground state. These colors are observed in an oxidizing flame (such as that produced by a Bunsen burner with sufficient oxygen), not in a reducing flame, which lacks the necessary oxidizing conditions for such reactions to occur.

Reason R is correct. Flame tests are indeed a common and reliable method for identifying alkali metals and other metal ions based on the characteristic colors they emit when heated. For example, lithium produces a red flame, sodium a bright yellow flame, and potassium a lilac flame. This principle is widely used in qualitative analysis.

Concepts:

1. P-Block Elements:

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---

25. Answer: c

Explanation:

$$2NH_4Cl + \underset{(A)}{Ca(OH)_2} \rightarrow \underset{(B)}{2NH_3} + CaCl_2 + 2K_2O$$

$$\underset{(B)}{2NH_3} + H_2O + 2CO_2 \rightarrow \underset{(C)}{2NH_4HCO_3}$$

$$(A) = Ca(OH)_2, \quad B = NH_3 \quad (C) = NH_4HCO_3$$

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.
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---

26. Answer: a

Explanation:

To correctly match List I with List II, let's analyze each item:
A. Chlorophyll: - Chlorophyll contains magnesium (Mg^{2+}) as its central metal ion. - **Match: A – III** (Mg^{2+}).
B. Soda ash: - Soda ash is chemically sodium carbonate (Na_2CO_3). - **Match: B – I** (Na_2CO_3).
C. Dentistry, Ornamental work: - Calcium sulfate ($CaSO_4$) is used in dentistry and ornamental work, especially in plaster form. - **Match: C – II** ($CaSO_4$).
D. Used in white washing: - Slaked lime ($Ca(OH)_2$) is commonly used in white washing. - **Match: D – IV** $Ca(OH)_2$
Conclusion: The correct matches are:

$$A - III, B - I, C - II, D - IV$$

Concepts:

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27. **Answer: d**

Explanation:

Metallic character refers to the ability of an element to lose electrons and form positive ions. As we move down a group in the periodic table, the atomic size increases, and the outer electrons are further from the nucleus, making it easier for the element to lose electrons. This results in an increase in metallic character down a group. On the other hand, as we move from left to right across a period, the atomic size decreases, and the effective nuclear charge increases, making it harder for the element to lose electrons.

Therefore, metallic character decreases across a period from left to right. Among the given elements: Potassium (K) is an alkali metal located in Group 1, and it is farthest to the left and down the group. Therefore, it has the highest metallic character. Silicon (Si), being a metalloid in Group 14, has a lower metallic character compared to metals. It is further to the right and higher in the period, so it has the least metallic character among the elements listed. So, the correct sequence is $Si < Be < Mg < K$.

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.
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---

28. Answer: d

Explanation:

Step 1: Determine the Lone Pairs for Each Molecule/Ion
The number of lone pairs on the central atom can be determined using the following steps:
Count the total valence electrons of the central atom.
Subtract the electrons used for bonding with surrounding atoms.
Divide the remaining electrons by 2 to get the number of lone pairs.
Step 2: Analyze Each Molecule/Ion
IF_7: Iodine has 7 valence electrons. All are used for bonding with 7 fluorine atoms. Therefore, 0 lone pairs (IV).
ICl_4^-: Iodine has 7 valence electrons and gains 1 due to the negative charge. Four are used for bonding with chlorine atoms, leaving 4 electrons (2 lone pairs). Therefore, 2 lone pairs (III).
XeF_6: Xenon has 8 valence electrons. Six are used for bonding with fluorine atoms, leaving 2 electrons (1 lone pair). Therefore, 1 lone pair (II).
XeF_2: Xenon has 8 valence electrons. Two are used for bonding with fluorine atoms, leaving 6 electrons (3 lone pairs). Therefore, 3 lone pairs (I)}

Concepts:

1. P-Block Elements:

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---

29. Answer: b

Explanation:

Extent of back bonding, reduces down the group leading to more Lewis acidic strength

$\underset{(2p-2p)}{BF_3} > \underset{(2p-3p)}{BCl_3} > \underset{(2p-4p)}{BBr_3} > \underset{(2p-5p)}{BI_3}$ (extent of back bonding)

$BF_3 < BCl_3 < BBr_3 < BI_3$ (lewis acidic nature)

So, the correct option is (B).

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.
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---

30. Answer: 4 - 4

Explanation:

Explanation:
Given:Bond dissociation energy of , $_2$ and $_2$ are in the ratio 1: 1: 0.5Δ of $= -100$ $^{-1}$ Let the bond dissociation energy for be 'a'.Therefore, for $_2$ it is 'a' and for $_2$ it is $\frac{}{2}$Now,$\frac{1}{2}$ $_2 + \frac{1}{2}$ $_2$; Δ $= -100$ $^{-1}$ One $-$ and one $-$ are broken and one $-$ is formed: $\frac{1}{2}$ $+\frac{1}{2}(\frac{}{2}) -$ $= -100$ $^{-1}$ $_2 + \frac{}{4} -$ $= -100$ $\frac{2 + -4}{4} = -100$ $= -400$ $= 400$Here, 'a' is the bond dissociation energy of $_2$ = 100 100 = 400 = 4Hence, the correct answer is 4.