p Block Elements JEE Main PYQ - 3

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

Instructions

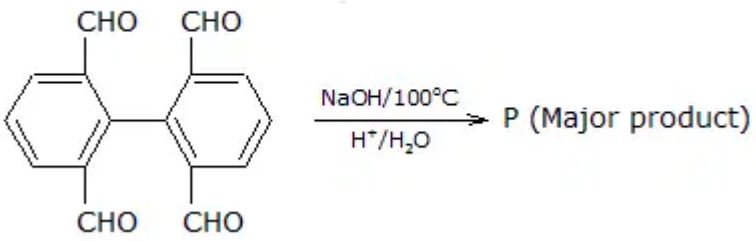
Instructions

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.

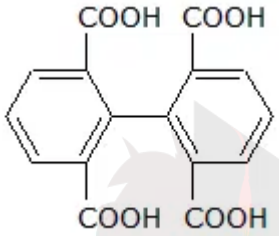
p Block Elements

1. 

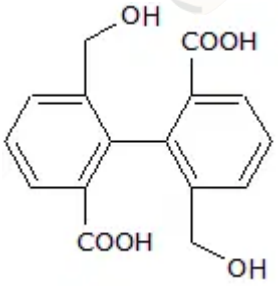
(+4, -1)

P is:

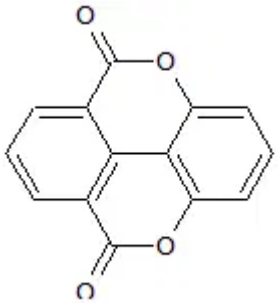
a. (A)



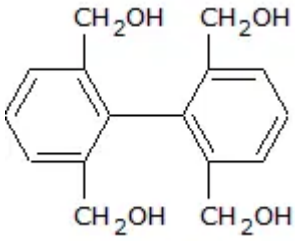
b. (B)



c. (C)



d. (D)



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2. Molar volume is equal to: (Answer _____ L at NTP) **(+4, -1)**

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3. Calculate the energy of one mole of photons of radiation whose frequency is 5×10^{14} . **(+4, -1)**

a. (A) 119.51 mol^{-1}

b. (B) 192.51 mol^{-1}

c. (C) 111.51 mol^{-1}

d. (D) 199.51 mol^{-1}

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4. The bond order of CO molecule on the basis of the molecular orbital theory is: **(+4, -1)**

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5. The correct order of increasing basicity of the given conjugate bases (= $_3$) **(+4, -1)** is:

a. (A) $^- <$ $^- <$ $_2 <$ $^-$

b. (B) $^- <$ $^- <$ $^- <$ $_2$

c. (C) $^- <$ $^- <$ $^- <$ $_2$

d. (D) $^- <$ $_2 <$ $^- <$ $^-$

---

6. The number of S – S bonds in sulphur trioxide trimer $[S_3O_9]$ is: **(+4, -1)**

7. Which of the following is tetrabasic acid? **(+4, -1)**

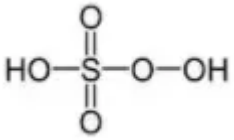
a. (A) Hypo phosphorous acid

b. (B) Ortho phosphoric acid

c. (C) Meta phosphoric acid

d. (D) Pyro phosphoric acid

8. Identify the given structure. **(+4, -1)**



a. (A) Thiosulphuric acid

b. (B) Sulphuric acid

c. (C) Peroxymonosulphuric acid

d. (D) Sulphurous acid

9. S_1: Be^{+2} has higher SRP than other alkaline earth metals. **(+4, -1)**
S_2: Be^{+2} has higher hydration energy and greater $\triangle aH$ (atomisation enthalpy) than other alkaline earth metals.

a. Both S_1 & S_2 are true

b. S_1 is true ; S_2 is false

c. S_1 is false ; S_2 is true

d. Both S_1 & S_2 are false

10. H_2O_2 behave like reducing agent in which of the following reactions: **(+4, -1)**

a. $Fe^{+2} + H_2O_2 \rightarrow Fe^{+3} + H_2O$

b. $H_2S + H_2O_2 \rightarrow SO_4^{2-} + H_2O$

c. $HOCl + H_2O_2 \rightarrow Cl^- + 2H_2O + O_2$

d. $Mn^{+2} + H_2O_2 \rightarrow MnO_2 + H_2O$

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11. A group 13 element 'X' reacts with chlorine gas to produce a compound $XCl_3.XCl_3$ is electron deficient and easily reacts with NH_3 to form $Cl_3X \leftarrow NH_3$ adduct; however, XCl_3 does not dimerise. X is **(+4, -1)**

a. B

b. Al

c. Ga

d. In

---

12. Which of the following statements is false? **(+4, -1)**

a. BH_3 is not a stable compound.

b. All the B-H bonds in B_2H_6 are equal.

c. The horon hydrides are readily hydrolysed.

d. Boron hydrides are prepared by the action of dil. HCl on Mg_3B_2 .

---

13. Which of the following is the wrong statement? **(+4, -1)**

a. ONCl and ONO^- are not isoelectronic

b. O_3 molecule is bent

c. Ozone is violet-black in solid state

d. Ozone is diamagnetic gas

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14. XeF_6 on partial hydrolysis with water produces a compound $'X'$. The same compound $'X'$ is formed when XeF_6 reacts with silica. The compound $'X'$ is : **(+4, -1)**

a. XeF_2

b. XeF_4

c. $XeOF_4$

d. XeO_3

---

15. XeO_4 molecule is tetrahedral having : **(+4, -1)**

a. Two $p\pi - d\pi$ bonds

b. One $p\pi - d\pi$ bonds

c. Four $p\pi - d\pi$ bonds

d. Three $p\pi - d\pi$ bonds

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16. Xenon hexafluoride on partial hydrolysis produces compounds ?X? and ?Y?. Compounds ?X? and ?Y? and the oxidation state of Xe are respectively : **(+4, -1)**

a. $XeO_2(+4)$ and $XeO_3(+6)$

b. $XeOF_4(+6)$ and $XeO_3(+6)$

c. $XeO_2F_2(+6)$ and $XeO_2(+4)$

d. $XeOF4(+6)$ and $XeO2F2(+6)$

---

17. Which has trigonal bipyramidal shape ? **(+4, -1)**

a. $XeOF_4$

b. XeO_3

c. XeO_3F_2

d. $XeOF_2$

---

18. When metal ? M ? is treated with $NaOH$, a white gelatinous precipitate ?X? is obtained, which is soluble in excess of $NaOH$. Compound ?X? when heated strongly gives an oxide which is used in chromatography as an adsorbent. The metal ?M? is : **(+4, -1)**

a. Zn

b. Ca

c. Al

d. Fe

---

19. Lithium aluminium hydride reacts with silicon tetrachloride to form : **(+4, -1)**

a. $LiCl, AlH_3$ and SiH_4

b. $LiCl, AlCl_3$ and SiH_4

c. $LiH, AlCl_3$ and $SiCl_2$

d. LiH, AlH_3 and SiH_4

---

20. Iodine reacts with concentrated HNO_3 to yield Y along with other products. The oxidation state of iodine in Y, is : **(+4, -1)**

a. 5

b. 3

c. 1

d. 7

---

21. In XeO_3F_2, the number of bond pair(s), π-bond(s) and lone pair(s) on Xe atom respectively are : **(+4, -1)**

a. 5,3,0

b. 5,2,0

c. 4,2,2

d. 4,4,0

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22. Electron gain enthalpy with negative sign of fluorine is less than that of chlorine due to : **(+4, -1)**

a. High ionization enthalpy of fluorine

b. Smaller size of chlorine atom

c. Smaller size of fluorine atom

d. Bigger size of $2p$ orbital of fluorine

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23. Diborane $(B2H6)$ reacts independently with O_2 and $H2O$ to produce, respectively **(+4, -1)**

a. HBO_2 and $H3BO3$

b. $H3BO3$ and B_2O_3

c. B_2O_3 and H_3BO_3

d. B_2O_3 and $[BH_4]^-$

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24. Correct statements among a to d regarding silicones are : (a) They are polymers with hydrophobic character (b) They are biocompatible. (c) In general, they have high thermal stability and low dielectric strenth. (d) Usually, they are resistant to oxidation and used as greases. **(+4, -1)**

a. (a), (b) and (c) only

b. (a), and (b) only

c. (a), (b), (c) and (d)

d. (a), (b) and (d) only

---

25. Chlorine water on standing loses its colour and forms : **(+4, -1)**

a. HCl only

b. $HOCl$ and $HOCl_2$

c. HCl and $HOCl$

d. HCl and $HClO_2$

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26. Chlorine on reaction with hot and concentrated sodium hydroxide gives : **(+4, -1)**

a. Cl^- and ClO_2^-

b. Cl^- and ClO_3^-

c. Cl^- and ClO^-

d. ClO_3^- and ClO_2^-

---

27. C_{60}, an allotrope of carbon contains : **(+4, -1)**

a. 20 hexagons and 12 pentagons

b. 12 hexagons and 20 pentagons

c. 18 hexagons and 14 pentagons

d. 16 hexagons and 16 pentagons

---

28. Nitrogen and Oxygen are the main components in the atmosphere but these do not react to form oxides of nitrogen. The reaction between nitrogen and oxygen requires high temperature. **(+4, -1)**

a. Both assertion and reason are correct, and the reason is the correct explanation for the assertion

b. Both assertion and reason are correct, but the reason is not the correct explanation for the assertion

c. The assertion is incorrect, but the reason is correct

d. Both the assertion and reason are incorrect

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29. Among the following oxoacids, the correct decreasing order of acidic strength is **(+4, -1)**

a. $HOCl > HClO_2 > HClO_3 > HClO_4$

b. $HClO_4 > HOCl > HClO_2 > HClO_3$

c. $HClO_4 > HClO_3 > HClO_2 > HOCl$

d. $HClO_2 > HClO_4 > HClO_3 > HOCl$

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30. Aluminium is usually found in $+3$ oxidation stagte. In contarast, thallium exists in $+1$ and $+3$ oxidation states. This is due to : **(+4, -1)**

a. lanthanoid contraction

b. lattice effect

c. diagonal relationship

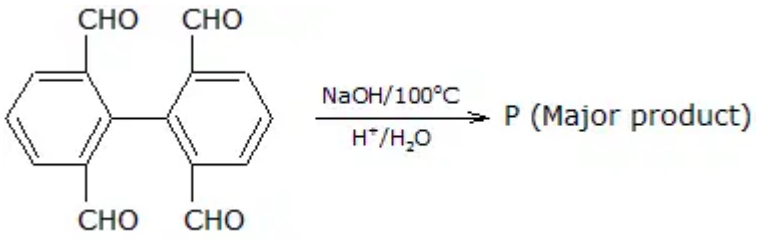
d. inert pair effect

Answers

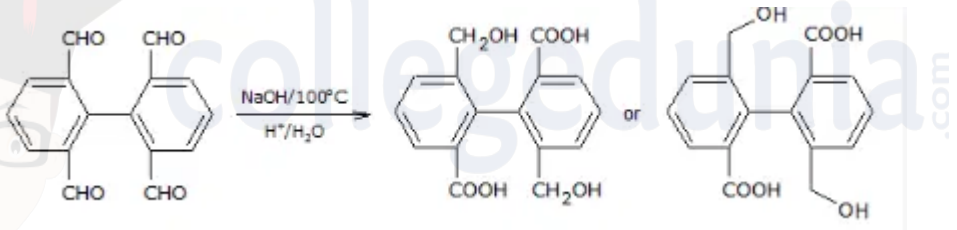
1. **Answer: b**

Explanation:

Explanation:
Given:The following reaction:



It is an example of an intramolecular Cannizzaro reaction in which one group is reduced while the other group oxidised simultaneously.The reaction is given as:



Hence, the correct option is (B).

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2. **Answer: 22.41 - 22.41**

Explanation:

Explanation:
The volume occupied by one mole of any substance is called its molar volume.The molar volume of a substance depends upon temperature and pressure. The molar volume of all gaseous substance at 273 K and under 1 atm pressure (NTP conditions) is found to be 22.41 litre of 22400 mL.Thus, one mole of any gaseous substance at 273 K and 1 atm pressure occupies a volume equal to 22.41 L.The unit of molar volume is litre per mol (L/mol) or millilitre per mol (mL/mol)Hence, the correct answer is 22.41.

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3. **Answer: d**

Explanation:

Explanation:
Energy (E) of one photon is given by the expression, = We know that, = 6.626×10^{-34} = 5×10^{14} $^{-1}$ (Given) = $(6.626 \times 10^{-34}$) × $(5 \times 10^{14}$ $^{-1}$) = 3.313×10^{-19} One mole of photon, = 6.023×10^{23} photonsEnergy of one mole of photons, = E × A = $(3.313 \times 10^{-19}$) × $(6.022 \times 10^{23}$ mol^{-1}) = 199.51 mol^{-1} Hence, the correct option is (D).

---

4. **Answer: 3 - 3**

Explanation:

Explanation:
The bond order shows the number of chemical bonds present between a pair of atoms. The bond order formula can be defined as half of the difference between the number of electrons in bonding orbitals and antibonding orbitals.The bond order formula is given as below-Bond order = $\frac{1}{2}$[−]where = Number of electrons in bonding molecular orbitals.b = Number of electrons in antibonding molecular orbitals.Electronic configuration of CO(14 electrons) = (1 s)^2 (1 s)^2 (2 s)^2 (2 s)^2 ( )^4 $(2p_z)^2$ = 10 = 4Bond order = $\frac{1}{2}$(10 − 4)Hence, the correct answers is 3.

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5. **Answer: a**

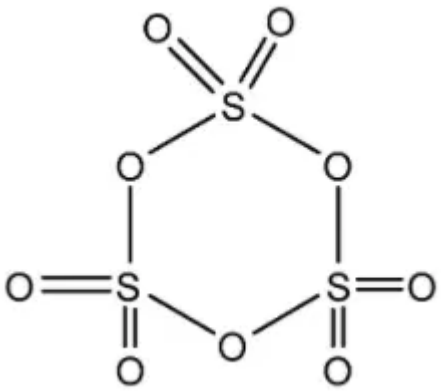
Explanation:

Explanation:
The order of acidity can be explained on the basis of the acidity of the acids of the given conjugate base. Stronger is the acid, weaker is the conjugate base. Since RCOOH is the strongest acid amongst all, $RCOO^-$ is the weakest base. Due to hybridised carbon, acetylene is also acidic and hence a weak base but stronger than $RCOO^-$. As ^{3} carbon is less electronegative than ^{3} nitrogen, R^- is more basic than NH_2^-.Hence, the correct option is (A).

6. **Answer: 0 - 0**

Explanation:

Explanation:
We can draw the structure of the Sulphur trioxide trimer as follows.



In the structure of the Sulphur trioxide trimer above, we can see that all three sulphur atoms are bonded with oxygen atoms on all sides. We see that there is no bond taking place between the sulphur atoms. So, we can conclude that the number of – bonds in sulphur trioxide trimer, ($_3$ $_9$) is zero.Hence, the correct answer is 0.

---

7. **Answer: d**

Explanation:

Explanation:
Tetrabasic acid means acids having 4 – replaceable hydrogen atoms.Pyro phosphoric acid $H_4P_2O_7$ Ortho phosphoric acid H_3PO_4 Hypo phosphorus acid H_3PO_2 Meta phosphoric acid $(HPO_3)_n$ Here, pyro phosphoric acid, $H_4P_2O_7$ have 4 removable H^+ ions, thus it is a tetrabasic.Hence, the correct option is (D).

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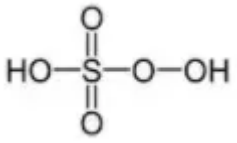
8. **Answer: c**

Explanation:

Explanation:
The given structure is Peroxymonosulphuric acid. The image is shown below:



Peroxymonosulfuric acid, ($_2$ $_5$), also known as persulfuric acid, peroxysulphuric acid, or Caro's acid. In this acid, the ( ) center adopts its characteristic tetrahedral geometry; the connectivity is indicated by the formula – – ( )$_2$ – . It is one of the strongest oxidants known ($_0$ = + 2.51) and is highly explosive. $_2$ $_5$ is sometimes confused with $_2$ $_2$ $_8$, known as peroxydisulfuric acid. The disulfuric acid, which appears to be more widely used as its alkali metal salts, has the structure – ( )$_2$ – – – ( )$_2$ – .Hence, the correct option is (C).

---

9. **Answer: a**

Explanation:

The correct option is(A): Both S_1 & S_2 are true.

Be has least –ve SRP value because of high △aH (atomisation enthalpy), inspite of maximum hydration energy.

The correct option is (A): Both S_1 & S_2 are true.

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

---

10. **Answer: c**

Explanation:

H_2O_2 reduces $HOCl$ to Cl^- and itself gets oxidised to O_2.

The correct option is (c): $HOCl + H_2O_2 \rightarrow Cl^- + 2H_2O + O_2$

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11. Answer: a

Explanation:

The shape of the BCl_3 molecule is a planar triangle with bond angles of $120°$. This is predicted by VSEPR theory as the most stable shape for three outer electron pairs round B. The valence bond theory also predicts a planar triangle with hybridisation of one s and two p orbitals used for bonding. However, the B atom only has six electrons in its outer shell and this is termed electron deficient. The empty $2p_z$ orbital on the boron atom in BCl_3 can also be filled by a lone pair of electrons from donor molecule such as NH_3.BCl_3 does not dimerise.

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---

12. **Answer: b**

Explanation:

All the B-H bonds in B_2H_6 are not equal. The four terminal B-H bonds are shorter (B-H bond length = 1.19 $\AA$) than the two bridged B-H-B bonds (bond length - 1.33 $\AA$).

So, the correct option is (B): All the B-H bonds in B_2H_6 are equal.

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---

13. **Answer: c**

Explanation:

(a) $ONCl = 8 + 7 + 17 = 32e^-$ $ONO = 8 + 7 + 8 + 1 = 24e^-$ (correct)
(b) Central O-atom is sp^2-hybridised with 1 lone pair, so bent shape (correct).
(c) In solid state, ozone is violet-black. Ozone does not exist in solid state, thus incorrect.
(d) 0_3 has no unpaired electrons, so diamagnetic (correct).

Hence, the correct option is (C): Ozone is violet-black in solid state.

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---

14. Answer: c

Explanation:

Partial hydrolysis of XeF_6 gives $XeOF_4$ (compound X) $XeF_6 + H_2O \rightarrow XeOF_4 + 2HF$
XeF_6 reacts with silica SiO_2 to form $XeOF_4$ (compound X) $2XeF_6 + SiO_2 \rightarrow 2XeOF_4 + SiF_4$

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15. Answer: c

Explanation:

Xenon undergo sp^3 hybridization.
In the fourth excited state xenon atom, has 8 unpaired electrons
One s and three p orbital undergo sp^3 hybridization. Four sp^3 hybrid orbitals form four a bonds with oxygen atoms. They are $\sigma sp^3 - p$. Four $p\pi - d\pi$ bonds are also formed with oxygen atoms by the unpaired electrons.

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---

16. Answer: d

Explanation:

The reactions involved are as follows:

$$XeF_6 + H_2O \rightarrow \underset{(X)}{\overset{+6}{X}eOF_4} + 2HF$$

$$\underset{(X)}{XeOF_4} + H_2O \rightarrow \underset{(Y)}{\overset{+6}{X}eO_2F_2} + 2HF$$

Concepts:

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---

17. **Answer: c**

Explanation:

The shape of XeO_3F_2 is Trigonal bipyramidal.
(Trigonal bipyramidal Structure)

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- 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:

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---

18. Answer: c

Explanation:

$Al^{3+} -> [NaOH] \underset{\text{White gelatinous ppt.}}{Al(OH)_3 \downarrow} -> [\text{ Excess } NaOH] \underset{\text{Sodium meta aluminate (soluble)}}{NaAlO_2}$

$2Al(OH)_3 -> [\text{ Strong heating }] Al_2O_3 + 3H_2O$

Al_2O_3 is used in column chromatography.

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19. **Answer: b**

Explanation:

Lithium aluminium hydride reacts with silicon tetrachloride to form lithium chloride, aluminium chloride and silicon hydride.

$$SiCl_4 + LiAlH_4 \rightarrow LiCl + AlCl_3 + SiH_4$$

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20. **Answer: a**

Explanation:

$I_2 + 10HNO_3 -> 2HIO_3 + 10NO_2 + 4H_2O$
In $HIO3$ oxidation state of iodine is $+5$.

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21. Answer: a

Explanation:

XeO_3F_2 is a compound that is formed by three oxygen and two fluorine.
There are 5 bond pairs, three double bonds and two single bonds.
Number of π bonds is 3 and there is no lone pair.
Therefore, the answer is 5,3,0.

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22. Answer: c

Explanation:

The electron gain enthalpy order for halogens is
$CI > F > Br > I$
Due to small size of fluorine the extra electron to be added feels more electron-electron repulsion. Therefore fluorine has less value for electron affinity than chlorine.

Concepts:

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23. Answer: c

Explanation:

$$B2H6 + 3H2O- > 2H3BO3 + 3H2$$
$$B2H6 + 302- > B2O3 + 3H2O$$

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24. **Answer: c**

Explanation:

These are properties and uses of silicones.

Concepts:

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25. **Answer: c**

Explanation:

Chlorine water on standing loses its colour and forms HCl and $HOCl$.
$$
Cl _{2}+ H _{2} O \rightarrow HCl + HOCl
$$
This is a disproportionation reaction.
The hypochlorous acid so formed gives nascent oxygen which is responsible for oxidizing and bleaching properties of chlorine.

Concepts:

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---

26. **Answer: b**

Explanation:

$$3Cl_2 + 6OH^- \rightarrow 5Cl^- + ClO_3^- + 3H_2O$$

Concepts:

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---

27. Answer: a

Explanation:

In C_{60} molecule there are 20 hexagons and 12 pentagons $\therefore$ Ans.(1)

Concepts:

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28. Answer: a

Explanation:

Nitrogen and oxygen are the main components in the atmosphere but these do not react to form oxides of nitrogen.
This is because the reaction between nitrogen and oxygen requires high temperature to overcome the activation energy barrier.
Thus, both Assertion and Reason are correct and Reason is the correct explanation for Assertion.

Concepts:

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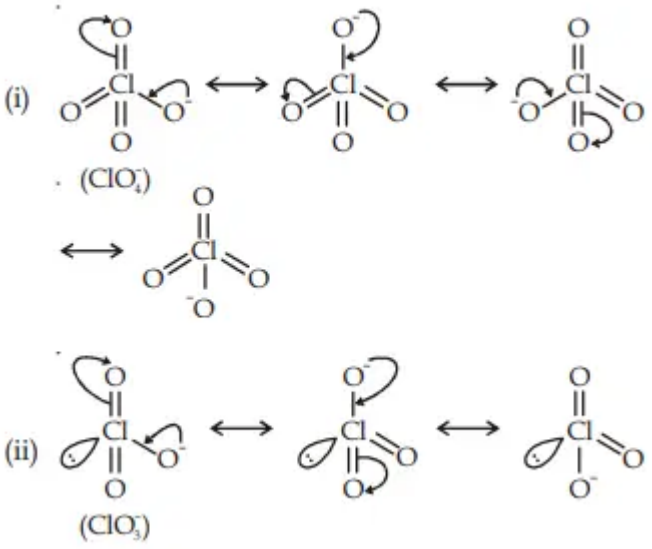
29. **Answer: c**

Explanation:

$$HClO_4 <=> ClO_4^- + H^+$$
$$HClO_3 <=> ClO_3^- + H^+$$
$$HClO_2 <=> ClO_2^- + H^+$$
$$HOCl <=> ClO^- + H^+$$

Resonance produced conjugate base



(iv) ClO^- is not resonance stabilized

As per resonance stability order of conjugate base is

$$ClO_4^- > ClO_3^- > ClO_2^- > ClO^-$$

Hence acidic strength order is

$$HClO_4 > HClO_3 > HClO_2 > HClO$$

Concepts:

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30. **Answer: d**

Explanation:

Inert pair effect is promenent character of p - block element.

Concepts:

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