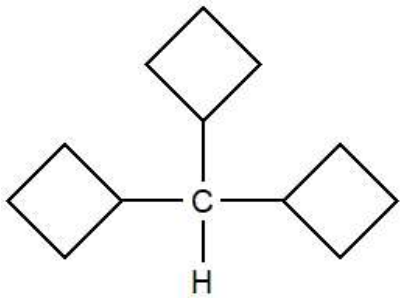
1. Choose the correct IUPAC name of the following compound:



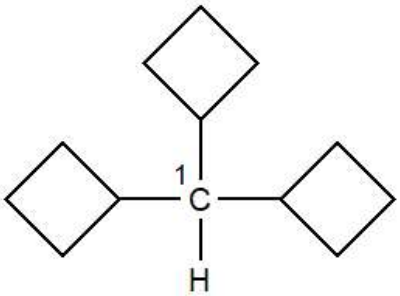
A. tricyclobutylmethane

B. methyltricyclobutane

C. 1-methyltributane

D. None of the above

For determing the parent chain :
when, more than one alicyclic ring is attached to a single chain.
Then,
Rings - Substituents
Attached Alkyl - Parent Chain
Here, three rings are substituents and the numbered carbon is the parent chain , as shown :



The correct IUPAC name of the above structure is tricyclobutylmethane

2. Which one of the following process uses water gas shift reaction?

A. Merck's process

B. Lane's process

C. Permutit's process

D. Bosch's process

Bosch's process is used to produce dihydrogen Commercially and it uses Bosch's process for dihydrogen production.

$C(s) + 2H_2O(g) \overset{1270\ K}{\longrightarrow} CO(g) + H_2(g)$

THEORY
Commercial production of hydrogen:
Bosch process:

$C(s) + 2H_2O(g) \overset{1270\ K}{\longrightarrow} CO(g) + H_2(g)$

$CO(g) + H_2(g)$ -water gas or “syngas”
The process of producing ‘syngas’ from coal is called coal gasification
To increase the production of dihydrogen:
Water-gas shift reaction:

$$H_2(g) + CO(g) + H_2O(g) \xrightarrow[Fe_2O_3.Cr_2O_3]{773\ K} CO_2(g) + 2H_2(g)$$

CO_2 is dissolved in water under high pressure (20-25 atm) and the H_2 left undissolved is collected.

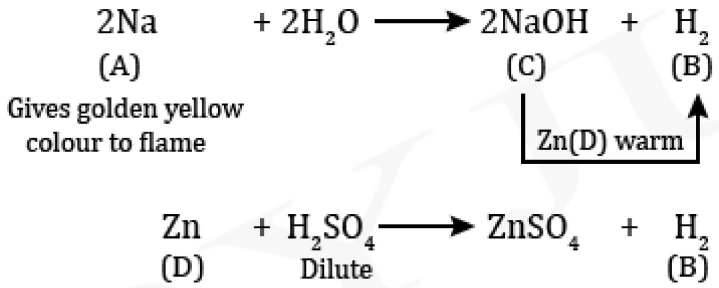
3. When a substance A reacts with water, it produces a combustible gas B and a solution of substance C in water. D reacts with this solution C and produces the same gas B on warming. D can also produce gas B on reaction with dilute H_2SO_4. A imparts a deep golden yellow colour to smokeless flame. A, B, C and D respectively are

A. $Na,\ H_2,\ NaOH,\ Zn$

B. $K,\ H_2,\ KOH,\ Al$

C. $Ca,\ H_2,\ Ca(OH)_2,\ Sn$

D. $CaC_2,\ C_2H_2,\ Ca(OH)_2,\ Fe$



Alkali on reacting with water, liberate hydrogen and forms respective hydroxide. CaC_2 on reacting with water form calcium hydroxide and acetylene which is also combustible.
Potassium imparts lilac colour to flame test
Ca imparts orange-red colour to flame test
Only sodium imparts a deep golden yellow colour to fame test.
Hence the correct option is (a).

Water:

1. Due to the presence of lone pairs, the geometry of water is distorted

2. The geometry of the molecule is regarded as angular or bent

3. H-O-H bond angle 104.5^o is less than the normal tetrahedral angle 109.5^o

4. Each O-H bond is polar. E.N. of O (3.5) > E.N. of H (2.1)

High freezing point, high boiling point, high heat of vapourisation and high heat of fusion. as compared to H_2S to H_2Te

Water has a higher specific heat, thermal conductivity, surface tension, dipole moment and dielectric constant. In comparison to other liquids. Hence, the

density of ice is less than that of water and ice floats over water

Physical properties :

One of the properties of water that makes it suitable for organism to survive during differing weather condition is that, water expands as it freezes. Here we fill a glass bottle up to brim and place a coin on its loosely held cap. As soon as water starts freezing, we observe that coin has gradually started to fall. After complete freezing we observe that coin has fallen and bottle start cracking due to expansion of water on freezing. Due to this volume increase density of ice is less than that of water hence ice floats on water.

Triple point - At 273 K water is in equilibrium with ice and vapour.

Dissociation of water:

Water is quite stable and does not dissociate into its elements even at high temperatures

Amphoteric nature of water:

$$H_2O(l) + NH_3(aq) \rightleftharpoons OH^-(aq) + NH_4^+(aq)$$

$$H_2O(l) + H_2S(aq) \rightleftharpoons H_3O^+(aq) + HS^-(aq)$$

$$H_2O(l) + H_2O(aq) \rightleftharpoons H_3O^+(aq) + OH^-(aq)$$

$Acid\ 1 \quad base\ 2 \qquad\qquad conjugate\ acid \quad conjugate\ base$

Oxidizing and reducing nature:

$$2Na + H_2O \longrightarrow 2NaOH + H_2$$

$$2F_2 + H_2O \longrightarrow 4HF + O_2$$

Hydrolytic reactions:

Hydrolyses many oxides, halides, hydrides, carbides, nitrides, phosphides, carbonates, etc., to give an acid or a base or both

$$H_2O + SO_2 \longrightarrow H_2SO_3$$

$$Mg_3N_2 + 6H_2O \longrightarrow 3Mg(OH)_2 + 2NH_3$$

$$CaH_2 + 2H_2O \longrightarrow Ca(OH)_2 + 2H_2$$

$$SiCl_4 + 4H_2O \longrightarrow Si(OH)_4 + 4HCl$$

$$Ca_3P_2 + 6H_2O \longrightarrow 3Ca(OH)_2 + 2PH_3$$

Water forms three types of hydrates with metal :

a. Compounds in which water molecules are coordinated to the metal ion (complex compounds)

E.g. $[Fe(H_2O)_6]Cl_3$

b. Compound in which water molecules may be hydrogen bonded to oxygen

c. In some compounds, water molecules occupy the interstitial sites in the crystal lattice

4. Balance the following equation :
$PbS + H_2O_2 \rightarrow PbSO_4 + H_2O$

A. $2PbS + 4H_2O_2 \rightarrow 2PbSO_4 + 4H_2O$

B. $PbS + 4H_2O_2 \rightarrow PbSO_4 + 4H_2O$

C. $PbS + 2H_2O_2 \rightarrow PbSO_4 + 2H_2O$

D. $2PbS + 2H_2O_2 \rightarrow 2PbSO_4 + 4H_2O$

Writing oxidation numbers of all the atoms,
$\overset{+2\ -2}{PbS} + \overset{+1-1}{H_2O_2} \rightarrow \overset{+2\ +6\ -2}{PbSO_4} + \overset{+1-2}{H_2O}$
The oxidation number of S has increased and O has decreased.
$\overset{-2}{PbS} \rightarrow \overset{+6}{PbSO_4}$ ...(i)
$\overset{-1}{H_2O_2} \rightarrow \overset{-2}{H_2O}$ ...(ii)
Increase in oxidation number of S = $8\ units\ per\ PbS\ molecule$
Decrease in oxidation number of $O = 1\ unit\ per\ \frac{1}{2}H_2O_2\ molecule$
$= 2\ units\ per\ H_2O_2\ molecule$
Multiplying eq. (ii) by 4 as to make increase and decrease equal.
$PbS + 4H_2O_2 \rightarrow PbSO_4 + 4H_2O$

5. On an industrial scale, H_2O_2 is prepared by auto - oxidation of:

A. 2- Ethylanthraquinol

B. 1- Ethylanthraquinol.

C. 1-Ethylanthraquinone.

D. All of the above.

(I) 2-Ethyl anthraquinone is reduced to 2-ethyl anthraquinol by H_2 in the presence of palladium.
(II) This 2-ethyl anthraquinol is oxidised by air to 2-ethyl anthrequinone again. Then H_2O_2 (20% solution) forms.

Theory :

Hydrogen Peroxide:
It is non linear, non planar.
It has an open book structure.
$-O-O-$ linkage is called peroxy linkage.
In solid phase, the OH bond length is 98.8 pm and $-O-O-$ bond length is 145.8 pm. In the gas phase, the OH bond length is 95.0 pm and $-O-O-$ bond length is 147.5 pm.
Preparation:
Laboratory method:
Prepared by Merck's process: Calculated amounts of sodium peroxide is added to ice cold dilute (20%) solution of H_2SO_4.
$Na_2O_2 + H_2SO_4 \rightarrow Na_2SO_4 + H_2O_2$
Action of H_2SO_4 or phosphoric acid on hydrated barium peroxide:
$\underset{\text{Barium peroxide}}{BaO_2.8H_2O} + H_2SO_4 \rightarrow BaSO_4 \downarrow + H_2O_2 + 8H_2O$
$3BaO_2 + 2H_3PO_4 \rightarrow Ba_3(PO_4)_2 + 3H_2O_2$
$Ba_3(PO_4)_2 + 3H_2SO_4 \rightarrow 3BaSO_4 + 2H_3PO_4$
Industrial method:
Prepared by the electrolysis of 50% H_2SO_4 solution: In a cell, peroxydisulfuric acid is formed at the anode.
$2H_2SO_4 \overset{\text{Electrolysis}}{\rightarrow} \underset{\text{Peroxy disulphuric acid}}{H_2S_2O_8(aq)} + H_2(g)$
Peroxy disulphuric acid is hydrolysed with water.
$H_2S_2O_8 + 2H_2O \rightarrow 2H_2SO_4 + H_2O_2$
By redox process:
Industrially H_2O_2 is prepared by the auto-oxidation of 2-alkyl anthraquinols
The net reaction is the catalytic union of H_2 and O_2 to give H_2O_2

6. In blood, carboxyhaemoglobin is formed by

- **A.** Inhalation of CO
- **B.** Inhalation of CO_2
- **C.** Inhalation of SO_2
- **D.** Inhalation of Ozone

Carbon monoxide is a poisonous gas released during the incomplete combustion of fossil fuels. It has greater affinity for haemoglobin than oxygen. When it is inhaled, CO binds to haemoglobin to form carboxyhaemoglobin which is about 300 times more stable than the oxygen-haemoglobin complex. When the concentration of carboxyhaemoglobin reaches about 3–4 percent, the oxygen carrying capacity of blood is greatly reduced which may be fatal.

7. Photochemical smog consists of:

- **A.** O_3, SO_2 and hydrocarbons
- **B.** O_3, PAN and NO_2
- **C.** SO_2, CO_2 and hydrocarbons
- **D.** SO_2 PAN and smoke

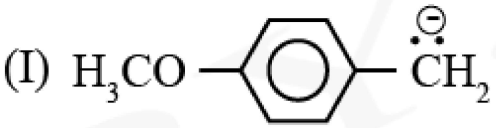
In photochemical smog, sunlight induces chemical reaction between the primary pollutants to form the secondary pollutants. This produces an effect of smoke and fog. The primary pollutants like volatile organic compounds, hydrocarbons, oxides of nitrogen, oxides of sulphur react with water vapours and oxygen in the presence of sunlight to form the ozone, peroxyacetyl nitrate and nitrous oxides. These secondary pollutants persist in the environment and decrease the visibility other than causing the deficiency of oxygen. Their presence induces severe respiratory illness in humans and animals and also affect the physiology of plants.
Hence, the correct answer is O_3, PAN and NO_2.

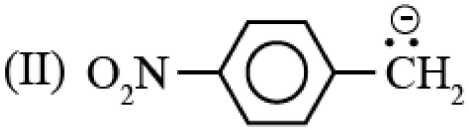
8. Ozone is an air pollutant that is a major component of:

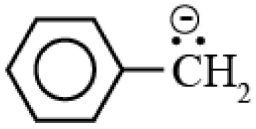
- ✔ **A.** Photochemical smog
- ✘ **B.** Smoke
- ✘ **C.** Dust
- ✘ **D.** Fog

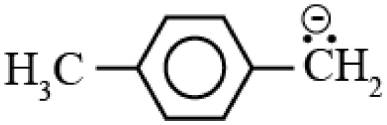
At ground level, ozone is an air pollutant that is a major component of photochemical smog which is dangerous for both humans and plants. It causes nose and throat irritation. In high concentration, it can cause headache, chest pain, dryness of the throat, cough and difficult in breathing. Ozone is also an eye irritant.

9. Consider the following carbanions.

(I) 

(II) 

(III) 

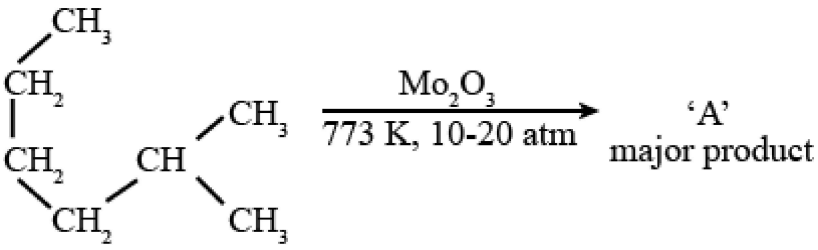
(IV) 

Correct decreasing order of stability is:

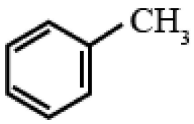
- ✔ **A.** $II > III > IV > I$
- ✘ **B.** $III > IV > I > II$
- ✘ **C.** $IV > I > II > III$
- ✘ **D.** $I > II > III > IV$

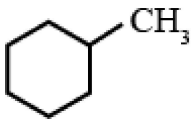
Electron withdrawing group at ortho and para position in aromatic ring increases the stability of carbanion whereas electron donating group bonded at ortho and para position decreases the stability of carbanion.
$-NO_2$ group is -R showing group and is present at para position in II.
$-OCH_3$ group is +R showing group and is present at para position in I.
$-CH_3$ group is also electron donating group through hyperconjugation and is present at para position in structure IV. Hence order of stability of carbanions will be:
$II > III > IV > I$

10. Identify 'A' in the given chemical reaction:



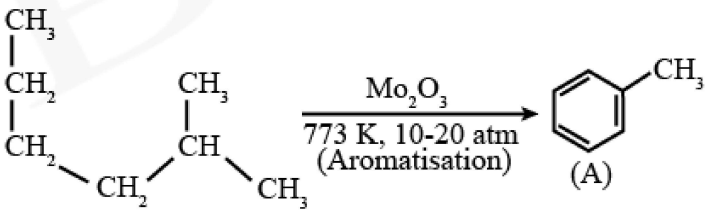
A. 

B. 

C. 

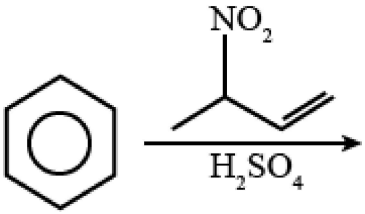
D. 

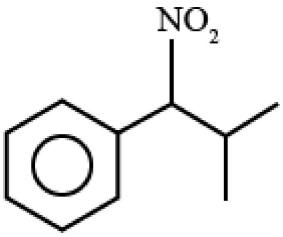
Aromatization: n-Alkanes on heating to $773\ \mathrm{K}\ at\ 10-20\ \mathrm{atm}$ in presence of oxides of vanadium, molybdenum or chromium supported over alumina get aromatized to benzene and its homologues.

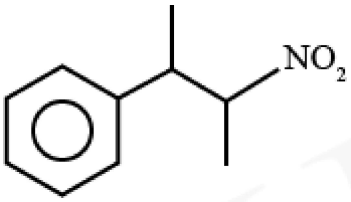


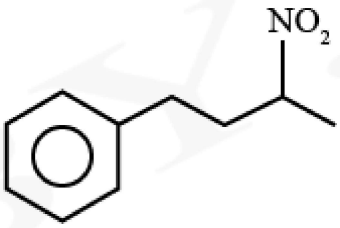
Hence, option (b) is correct.

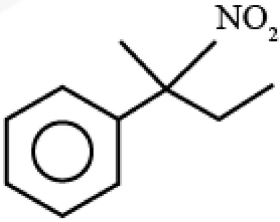
11. The major product of the following reaction is :



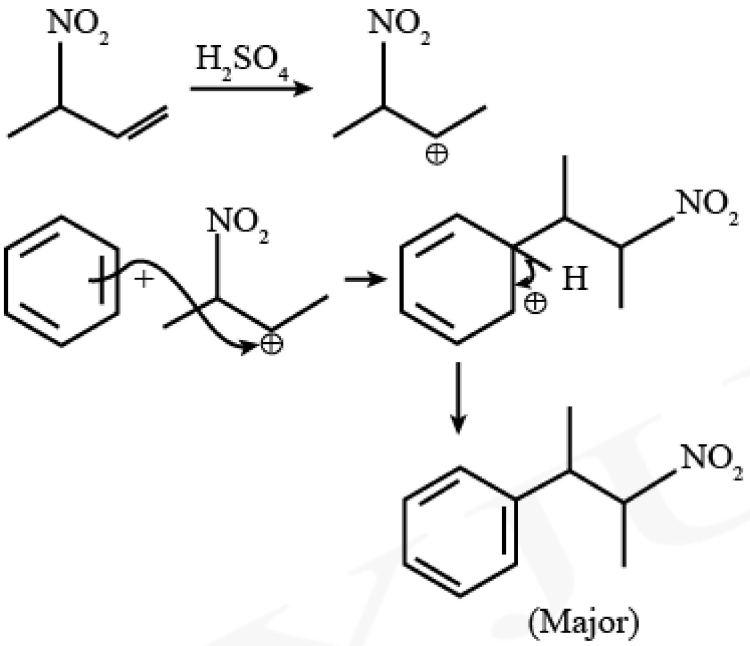
A. 

B. 

C. 

D. 

The double bond in alkene attacks the H^+ to form stable secondary carbocation. This act as electrophile for the electrophilic aromatic substitution.
Now, the benzene attack the nucleophile to give the following friedel craft alkylation product.



Hence, option (b) is correct.

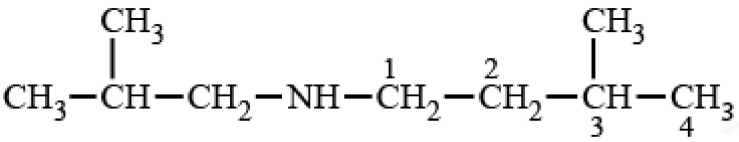
12. A species $'X'$ can show reaction with both HCl and $NaOH$. $'X'$ cannot be:

- ✗ **A.** Al_2O_3
- ✗ **B.** Zn
- ✓ **C.** PbS
- ✗ **D.** $ZnCO_3$

Al_2O_3, Zn, $ZnCO_3$ are amphoteric substances i.e., they react with both acids and bases where as PbS cannot show reaction with both HCl and $NaOH$.
$PbS + 3HCl \rightarrow H[PbCl_3] + H_2S$
$PbS + NaOH \rightarrow$ No reaction

13. Which of the following is a proper name for $(CH_3)_2CHCH_2NHCH_2CH_2CH(CH_3)_2$?

- ✗ **A.** 2,7-dimethyl-4-azaoctane
- ✓ **B.** 3-methyl-N(2-methlypropyl)-1-butanamine
- ✗ **C.** 2,7-dimethylpropylbutylamine
- ✗ **D.** 3-amino-2,7-dimethyloctane



3-methyl-N-(2-methylpropyl)-1-butanamine

14. Which among the following alkali metal has the highest density?

- ✗ **A.** Rb
- ✗ **B.** Na
- ✗ **C.** K
- ✓ **D.** Cs

Because of the larger size, alkali metal have low density which increases down the group from Li to Cs.

Theory:
Physical properties:
All the alkali metals are silvery white, soft and light metals
Because of the larger size, these elements have low density which increases from Li to Cs. However, potassium is lighter than sodium.

The melting and boiling points are low due to weak metallic bonding (single valence electron).

Lattice energy decreases from Li to Cs and thus melting points and boiling points also decrease from
Li to Cs.
M.P. $= Li > Na > K > Rb > Cs$
B.P. $= Li > Na > K > Rb > Cs$

15. Which of the following is an example of interstitial carbide?

A. CaC_2

B. Fe_3C

C. SiC

D. Mg_2C_3

CaC_2 and $Mg_2C_2 \rightarrow$ Ionic carbide
$Fe_3C \rightarrow$ Interstitial carbide
$SiC \rightarrow$ Covalent carbide

16. A solution of sodium metal in liquid ammonia is strongly reducing due to the presence of

A. Sodium atoms

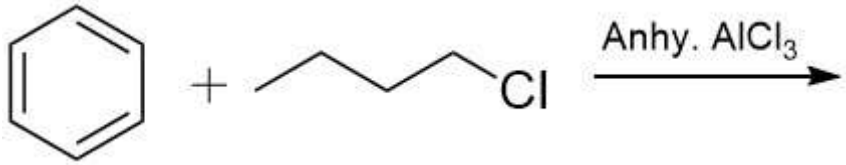
B. Sodium hydride

C. Sodium amide

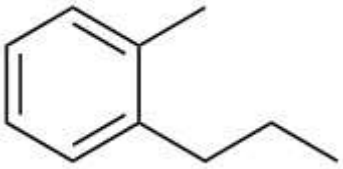
D. Solvated electrons

The free ammoniated electrons make the solution of Na in liquid NH_3 a very powerful reducing agent.
Note: The ammonical solution of an alkali metal is rather favoured as a reducing agent than its aqueous solution because in aqueous solution the alkali metal being highly electropositive evolves hydrogen from water (thus H_2O acts as an oxidising agent) while its solution in ammonia is quite stable, provided no catalyst (transition metal) is present.

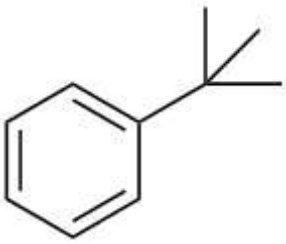
17. Predict the major organic product for given Friedel-Crafts alkylation reaction:



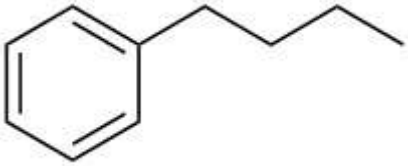
✗ **A.**



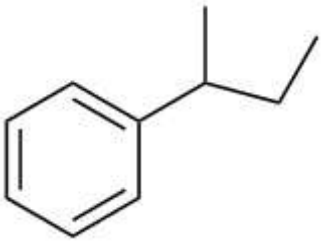
✗ **B.**



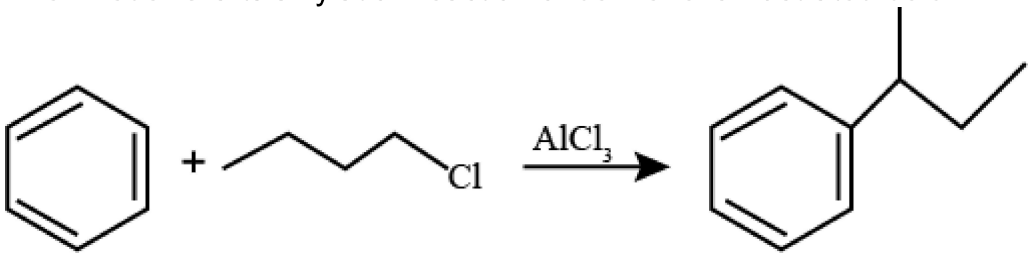
✗ **C.**



✓ **D.**



The Friedel-Crafts alkylation reaction is a method of generating alkylbenzenes by using alkyl halides as reactants in presence of $AlCl_3$
This is done through an electrophilic attack on the aromatic ring with the help of a carbocation. Here primary carbocation formed initally rearranges to a more stable secondary carbocation.
The Friedel-Crafts alkylation reaction of benzene is illustrated below.



18. When Na and Li are placed in dry air, generally we get:

A. $Na_3N,\ Na_2O,\ Li_2O$

B. $NaO_2,\ Li_2O$

C. $Na_2O,\ Li_2O,\ Li_3N,\ NH_3$

D. $Na_2O,\ Li_3N,\ Li_2O$

When Na and Li are placed in dry air we get :

$Na + \text{dry air}/O_2 \rightarrow Na_2O$

$6Li + N_2 \rightarrow 2Li_3N$

$4Li + O_2 \rightarrow 2Li_2O$

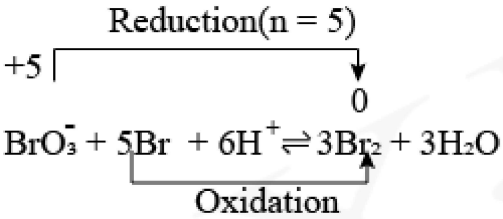
Lithium results in the formation of monoxides, sodium result in the peroxides.

Thus we get, $Na_2O,\ Li_2O,\ Li_3N$.

19. When BrO_3^- ion reacts with Br^- in acidic medium, Br_2 is liberated. The equivalent weight of Br_2 in this reaction is:

- A. $\frac{5M}{8}$
- B. $\frac{5M}{3}$
- C. $\frac{3M}{5}$
- D. $\frac{4M}{6}$

Given:
BrO_3^- reacts with Br^- in acidic medium
The reaction involved



Here, in BrO^{3-}, Br has $+5$ oxidation state and in $BrO^{3-} \rightarrow 3Br_2$ reduction is 5.
Also, in $5Br^- \rightarrow 3Br_2$ oxidation is 5.
$\therefore$ n-factor $= 5$

$$\text{Now, Equivalent weight} = \frac{\text{Molecular weight}}{\text{n-factor}}$$

$$\Rightarrow \text{Equivalent weight of } 3Br_2 = \frac{3M}{5}$$

20. What are the products formed when ammonia reacts with excess chlorine?

A. N_2 and NCl_3

B. NCl_3 and HCl

C. N_2 and NH_4Cl

D. N_2 and HCl

Ammonia reacts with chlorine and produces nitrogen trichloride (NCl_3) and hydrogen chloride vapor.
This reaction is also a redox reaction.
When Ammonia reacts with excess chlorine, the reaction proceeds such that;
$NH_3 + 3Cl_2 \rightarrow NCl_3 + 3HCl$
Nitrogen trichloride is a yellow oily liquid.
This is a disproportionation reaction as chlorine is reduced as well as oxidized. The oxidation number of chlorine (0) is changed to $+1$ and -1 respectively.
No change of oxidation number of nitrogen when products are given.

21. For the given disproportionation reaction:
$H_3PO_2 \rightarrow PH_3 + H_3PO_3$
The equivalent mass of H_3PO_2 in grams is :
(Given : Atomic mass of $P = 31\ u$)

Accepted Answers

49.5 49.50

Solution:

$\overset{+1}{H_3}\overset{}{P}O_2 \rightarrow \overset{-3}{P}H_3 + \overset{+3}{H_3}\overset{}{P}O_3$
n-factor calculation,
$n_f = (|O.S._{Product} - O.S._{Reactant}|) \times \text{number of atoms}$
$\overset{+1}{H_3}\overset{}{P}O_2 \rightarrow \overset{+3}{H_3}\overset{}{P}O_3$ oxidation
$(n_f)_{\text{oxidation}} = |3-1| \times 1 = 2$
$\overset{+1}{H_3}\overset{}{P}O_2 \rightarrow \overset{-3}{P}H_3$ reduction
$(n_f)_{\text{reduction}} = |-3-1| \times 1 = 4$
valency factor in disproportionation reaction is given by
$$\frac{1}{n_f} = \frac{1}{(n_f)_{\text{oxidation}}} + \frac{1}{(n_f)_{\text{reduction}}}$$
$$\frac{1}{n_f} = \frac{1}{2} + \frac{1}{4}$$
$$n_f = \frac{4}{3}$$
$\therefore$ The equivalent weight of
$$H_3PO_2 = \frac{\text{Molar mass of } H_3PO_2}{\frac{4}{3}} = \frac{3 \times \text{Molar mass of } H_3PO_2}{4}$$
$\text{Molar mass of } H_3PO_2 = 3 + 31 + 32 = 66\ g\ mol^{-1}$
$$\text{Equivalent weight} = \frac{3 \times 66}{4} = 49.5\ g$$

22. What is the degree of hardness (in ppm) of a sample of water containing $24\ \text{mg of}\ MgSO_4$ (molecular mass $= 120$) per kg of water.

Accepted Answers

20 20.0 20.00

Solution:

$24\ \text{mg of}\ MgSO_4\ \text{present in}\ 10^3\ \text{g}$ of water.
$10^6\ \text{g water will contain} = 24000\ \text{mg of}\ MgSO_4 = 24\ \text{g of}\ MgSO_4$
$1\ \text{mole of}\ MgSO_4 \equiv 1\ \text{mole of}\ CaCO_3$
$120\ \text{g of}\ MgSO_4 \equiv 100\ \text{g of}\ CaCO_3$
So,
$24\ \text{g of}\ MgSO_4 = \dfrac{100}{120} \times 24 = 20\ \text{g of}\ CaCO_3$
$\text{Hardness of water} = 20\ \text{ppm}$

23. For alkali metal M:
$M_2O + H_2O \rightarrow x$
$M_2O_2 + H_2O \rightarrow x + y$
$MO_2 + H_2O \rightarrow x + y + z$
Sum of the number of atoms present in one molecule of each of $x,\ y,\ z$ is:

Accepted Answers

9 9.0 9.00

Solution:

The oxides of alkali metals are easily hydrolysed by water to form the hydroxides according to the following reactions:
$M_2O + H_2O \rightarrow 2\underset{x}{MOH}$
$M_2O_2 + H_2O \rightarrow 2\underset{x}{MOH} + \underset{y}{H_2O_2}$
$2MO_2 + H_2O \rightarrow 2\underset{x}{MOH} + \underset{y}{H_2O_2} + \underset{z}{O_2}$
Number of atoms in one molecule of $MOH,\ H_2O_2$ and O_2 are $3, 4$ and 2 respectively.
$\therefore$ Sum of atoms present in x, y and z is 9.

24. How many of the following nitrates of metal M decompose on heating similar to as given below in the scheme?
where $M: \ Li, \ Be, \ Mg, \ K, \ Ca, \ Sr, \ Na, \ Rb, \ Ba$

$$\text{Metal nitrate} \xrightarrow{\text{heat}} \text{Metal oxide} + \text{Nitrogen dioxide} + \text{oxygen gas}$$

Accepted Answers

6 6.0 6.00

Solution:

Lithium nitrate decomposes as:

$$2LiNO_3 \xrightarrow{\text{heat}} 2Li_2O + 4NO_2 + O_2$$

$Na, \ K, \ Rb$ decomposes as follows:

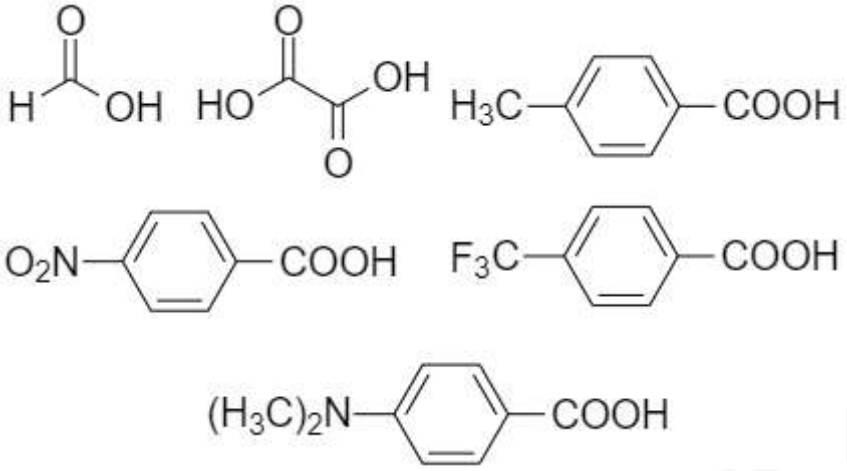
$$2NaNO_3 \xrightarrow{\text{heat}} 2NaNO_2 + O_2$$

$Be, \ Mg, \ Ca, \ Sr, \ Ba$ decomposes as:

$$2Mg(NO_3)_2 \xrightarrow{\text{heat}} 2MgO + 4NO_2 + O_2$$

Hence, out of the given metals, nitrates of 6 metals
$(Li, \ Be, \ Mg, \ Ca, \ Sr, \ Ba)$ will decompose according to the given scheme.

25. Find out the number of compounds which are more acidic than benzoic acid among the following.

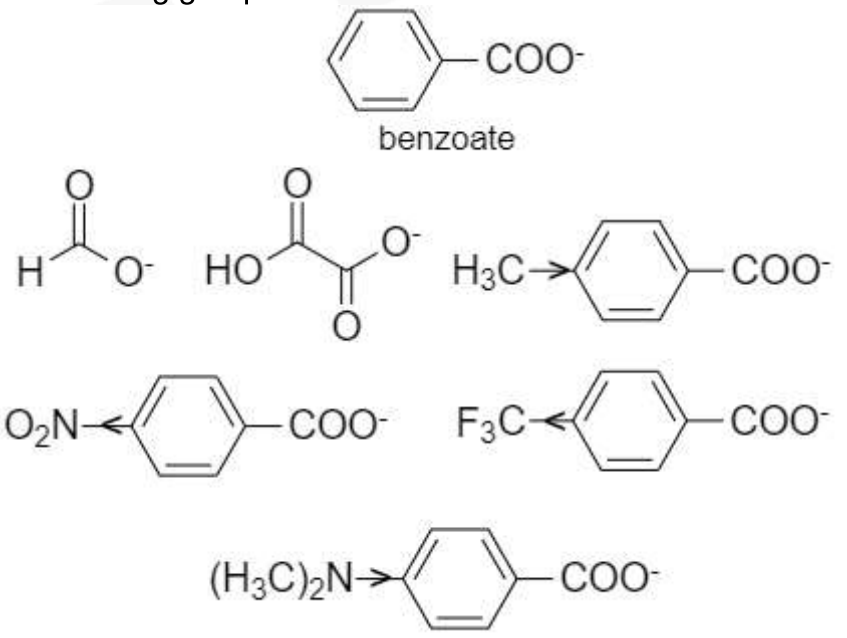


Accepted Answers

4 4.00 4.00

Solution:

Acidic strength can be attributed to the stability of the conjugate base. Electron donating species destabilise the conjugate base, whereas electron withdrawing group stabilises it.



benzoate

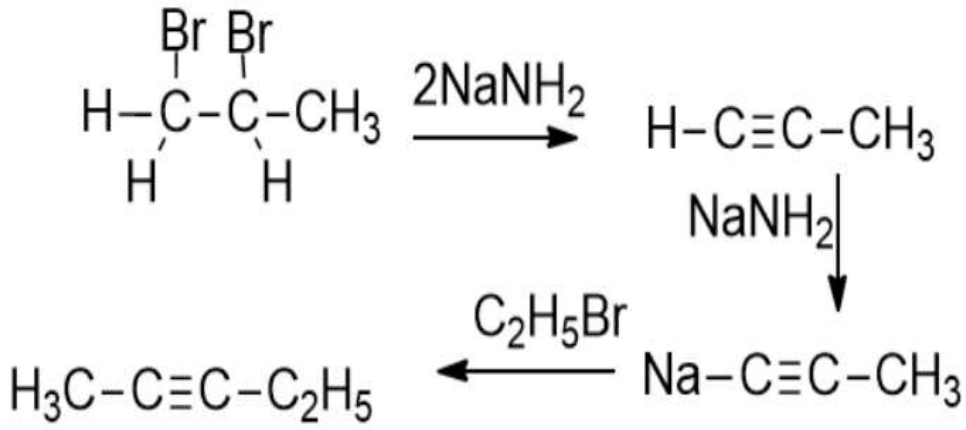
Formic acid and oxalic acid are stronger acids than benzoic acid. Thus, a total of 4 acids are stronger than benzoic acid among the given compounds.

26. One mole of $1,2-\text{Dibromopropane}$ on treatment with x moles of $NaNH_2$ followed by treatment with ethyl bromide gave $2-pentyne$. The value of x is:

Accepted Answers

3 3.0 3.00

Solution:



27. Consider the following orders –

(1) $F_2 > Cl_2 > Br_2 > I_2$: boiling point

(2) $F_2 > Cl_2 > Br_2 > I_2$: oxidizing nature

(3) $F_2 > Cl_2 > Br_2 > I_2$: EN

(4) $F_2 > Cl_2 > Br_2 > I_2$: BDE

(5) $F_2 > Cl_2 > Br_2 > I_2$: EA

(6) $F_2 > Cl_2 > Br_2 > I_2$: Reactivity

(7) $HOCl > HClO_2 > HClO_3 > HClO_4$: Acidic nature

(8) $HOCl > HClO_2 > HClO_3 > HClO_4$: Oxidizing nature

Then calculate $(x^2 + y^2)$ when x is correct order and y is incorrect order.

Accepted Answers

34 34.0 34.00

Solution:

(1) The boiling point increases down the group because of the van der waals forces.
$F_2 < Cl_2 < Br_2 < I_2$
This statement is incorrect.

(2) Members of the halogen family act as strong oxidizing agents on account of their electron accepting tendency both in the molecular as well as well as atomic form.
$F_2 > Cl_2 > Br_2 > I_2$
This statement is correct.

(3) Electronegativity decreases down the group as the no. of valence electrons in an atom increase down the group.
$F_2 > Cl_2 > Br_2 > I_2$
This statement is correct.

(4) Bond dissociation energy of halogen family decreases down the group as the sie of atom increases.
$Cl_2 > Br_2 > F_2 > I_2$
Fluorine is an exception because of inter electronic repulsion is present in small atom fluorine.
This statement is incorrect.

(5) Since the atomic size increases down the group, electron affinity generally decreases. An electron will not be as attached to the nucleus, resulting in a low electron affinity.
$Cl_2 > F_2 > Br_2 > I_2$
This statement is incorrect.

(6) The reactivity of the halogens decreases down the group.
$F_2 > Cl_2 > Br_2 > I_2$
This statement is correct.

(7) Oxygen is more electronegative than chlorine with an increases in the no. of O atoms attached to Cl, more electrons are pulled away from O—H bond and weaker becomes the O—H bond.
$HClO_4 > HClO_3 > HClO_2 > HClO$
This statement is incorrect.

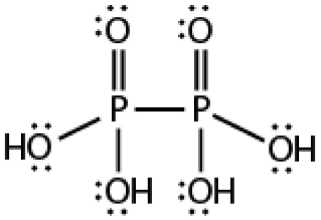
(8) Higher the oxidation state of chlorine stronger will be the oxidising power.
$HClO > HClO_2 > HClO_3 > HClO_4$
This statement is incorrect.
Here $x = 3, y = 5$
The value of $(x^2 + y^2) = (3^2 + 5^2) = 34$

28. Calculate value of "x + y" for "hypophosphoric acid" where x is total number of lone pair(s) and y is total number of π -bond(s) in given oxo acid.

Accepted Answers

14 14.0 14.00

Solution:



Hypo phosphoric acid

Total number of lone pairs (x) $= 12$
Total number of π-bonds (y) $= 2$
$\therefore$ x + y $= 12 + 2 = 14$

29. i) Involves complete shifting of π electrons.
ii) It is a temporary effect.
iii) In -E effect , π electrons of the multiple bond are transferred to the atom to which the reagent gets attached.
iv) It operates in organic compounds having multiple bonds under the influence of an outside attacking species.
How many statements are correct regarding Electromeric effect from above.

Accepted Answers

3 3.0 3.00

Solution:

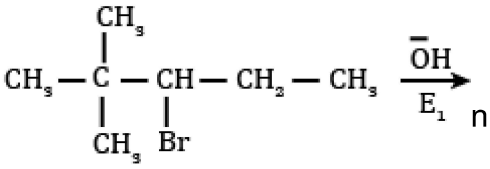
Electromeric effect :
Operates in organic compounds having multiple bonds under the influence of an outside attacking species.
It is temporary effect, since it is observed only in presence of attacking reagent.
Involves complete shifting of π electrons.

Types of electromeric effect :

+E effect : π electrons of the multiple bond are transferred to the atom to which the reagent gets attached.

-E effect : π electrons of the multiple bond are transferred to the atom to which the reagent does not get attached.

30. In the given reaction:

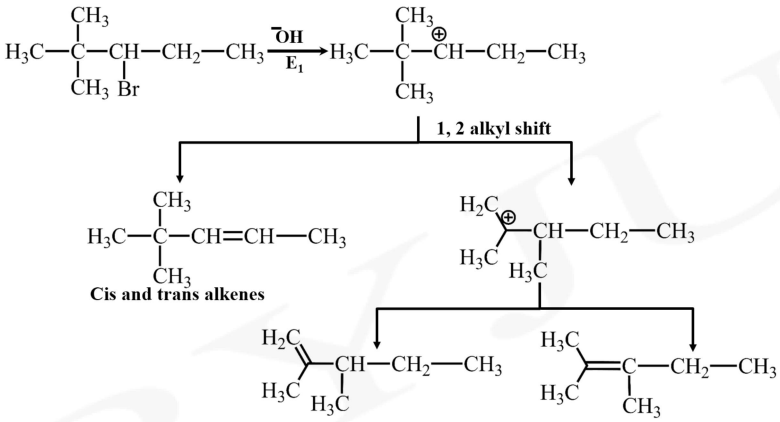


number of possible alkenes would form is

Accepted Answers

4 4.0 4.00

Solution:



There are four alkenes would form.