Final Assignment_S2020
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SECTION: 06

S.ID : 1821301642

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Part-I

1. (5 points) Ethene (C_2H_4), a com

equation:

$$C_2H_4 + 3O_2 \Rightarrow 2CO_2 + 2H_2O$$

f.w. 28.054 f.w. 31.9988 f.w. 44.010 f.w. 18.015

How many grams of ethene were burned if 613.6 grams of CO_2 were produced during the combustion reaction?

Ans:

From the reaction we can see that,

1 moles of C_2H_4 is needed to produce 2 moles of CO_2

That means,

28.054 g C_2H_4 is needed to produce $2 \times 44.010 = 88.028 CO_2$

Now, we can write,

88.02 g CO_2 were produce from 28.054 g C_2H_4

1.0 g CO_2 " " " $= \frac{28.054}{88.02}$ g C_2H_4

613.6 g CO_2 " " $= \frac{28.054 \times 613.6}{88.02}$ g C_2H_4

$= 195.578$ g C_2H_4

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2. (5 Points) Methane (CH_4), the primary constituent of natural gas, burns according to the reaction:

$$CH_4(g) + 2O_2(g) \Longrightarrow CO_2 + 2H_2O$$

f.w. 16.0 f.w. 32.0 f.w. 44.0 f.w. 18.0

If you have 20.0g of CH_4 and 64.0g of O_2, which will be the limiting reagent? Support your answer with appropriate calculations.

Ans:

from the equation,

total formula of CH_4 = 16.0g and total formula weight of $2O_2 = 2 \times 32.0 = 64.0g$

so, we can write,

$\therefore$ 64.0g of O_2 reacts with = 16.0g CH_4

1g " O_2 " " = $\frac{16.0}{64.0}$ g CH_4

$\therefore$ 64.0g " O_2 " " = $\frac{16.0 \times 64.0}{64.0}$ g CH_4

= 16.0g CH_4

$\therefore$ we have 20.0g of CH_4 instead of 16.0g of CH_4 and 20.0g > 16.0g.

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3 (5 points) what kind of reaction is show below (between hydrogen peroxide and magnesium sulfite

(a) $H_2O(aq) + MgSO_3(aq) \Rightarrow MgSO_4(aq) + H_2O$

precipitation gasformation acid-base neutralization redox.

Ans: redox

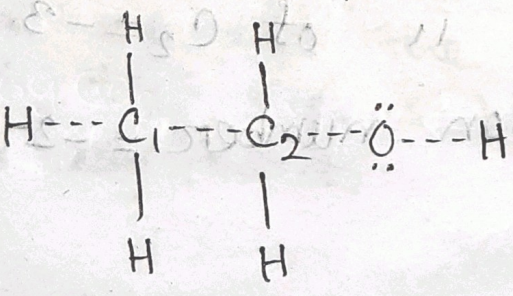
(b) write the total ionic equation for the reaction in question (a).

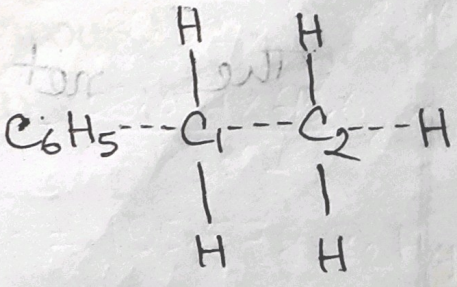
Ans: $H_2O + [O] + Mg^{2+} + SO_3^{2-} \Rightarrow MgSO_4 + H_2O$

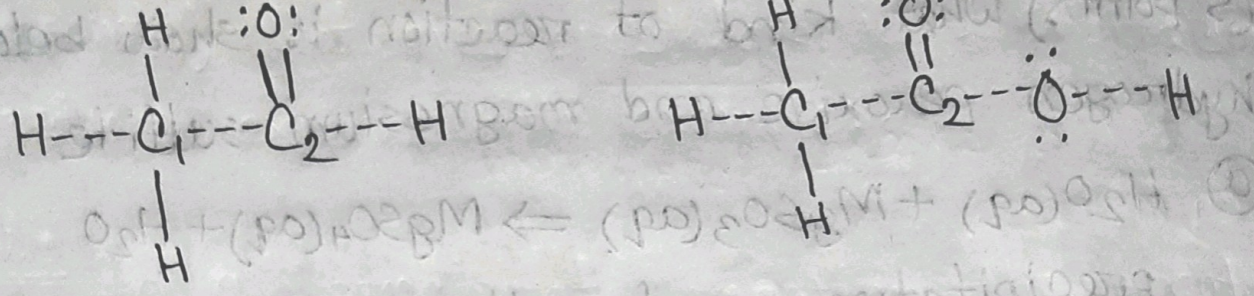
(c) Now convert the total ionic equation in question (b) into its net ionic equation.

Ans: $[O] + Mg^{2+} + SO_3^{2-} \Rightarrow MgSO_4$

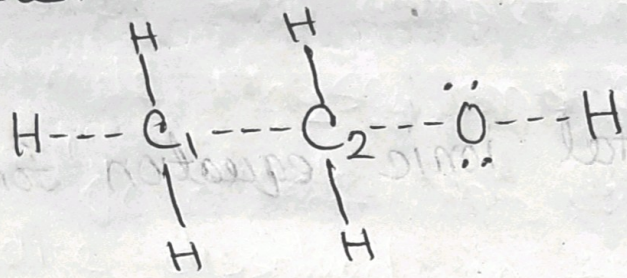
4 (5 points) which of the following compoundsrepresent the MOST OXIDIZED and MOST REDUCED class of organic compounds and explain why? (2+2=4 points)







Ans: Here.



The oxidation number of $C_1 = 4-7 = -3$

" " " of $C_2 = 4-5 = -1$

The net oxidation number $= -3-1 = -4$

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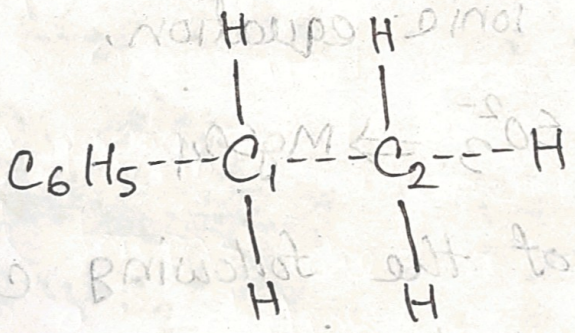

The oxidation number of $C_1 = -2$

" " " of $C_2 = -3$

The net oxidation number $= -2+3 = -5$

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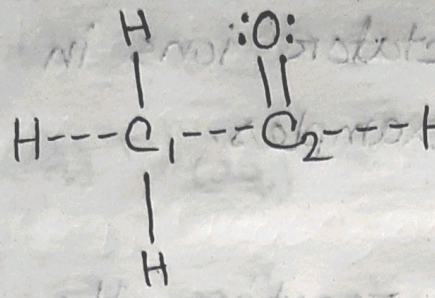
Here,



The oxidation number of $C_1 = 4-7 = -3$

" " " of $C_1 = 4-3 = 1$

The net oxidation number $= -3+1 = -2$

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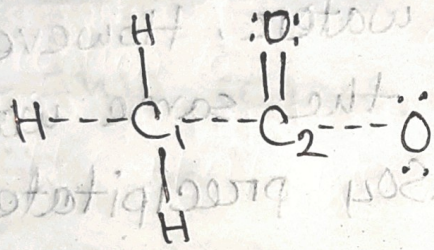

The oxidation number of $C_1 = 4-7 = -3$

" " " of $C_2 = 4-1 = 3$

The net oxidation number $= -3+3 = 0$

We know that the compound which has highest oxidation number is the most oxidzed compound and the compound which has the lowest oxidation number is the most reduced compound. So, we can say that the 4rt compound is the most oxidized and the 2nd compound is the most reduced compounds.

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6. (3 points) what are spectator ions in precipitate reactions explain with examples.

Ans: In a precipitate reaction the spectator ions are the species which remain in ionic form after the completion reaction.
for example, Na_2SO_4 and $Ca(OH)_2$ are both individually soluble in water. However, after both are dissolved in the same water solution they form a solid $CaSO_4$ precipitate.
Here,

$$Ca^{+2} + SO_4^{-2} \Rightarrow CaSO_4(s)$$

Na^{+1}, OH^{-1} are spectator ions.

5. (5 points) Write the formula for the precipitate that forms when a solution of $AgNO_3$ is added to a solution of NaI. Explain why?

Ans: The equation is given in the following:

$$AgNO_3(aq) + NaI(aq) \Rightarrow AgI(s) + NaNO_3(aq)$$

Total ionic equation:

$$Ag^+ + NO_3^+ + Na^+ + I^- \Longrightarrow AgI(s) + Na^+ + NO_3^-$$

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Net ionic equation:

$$Ag^+_{(aq)} + I^-_{(aq)} \Rightarrow AgI_{(s)}$$

Here, Ag^+ is not always soluble and I^- is usually soluble and AgI is insoluble.

we know,

Not always soluble + usually soluble = insoluble.

∴ for this reason AgI precipitates in that solution

7. (2 points) what type of system is shown in the figure below and why?

Ans: The system is shown in the figure below is a open system. Because the system is not sealed. The system is open to atmosphere lose mass and energy across boundary.

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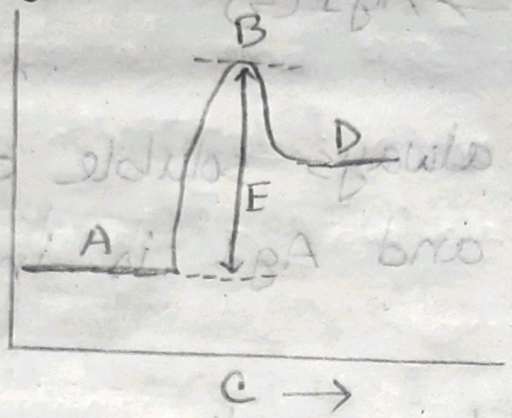
8 (5 points) Examin the figure and below answer the following questions



ⓐ what type of reaction is this Endothermic.

ⓑ what is indicated by the letter A energy of reactants.

ⓒ what is indicated by the letter B transition state.

ⓓ what is indicated by the letter C progress of reaction or direction of reaction.

ⓔ what is indicated by the letter E activation energy Eact.

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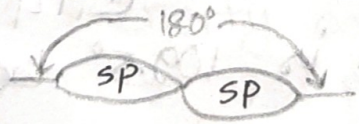
Part-II

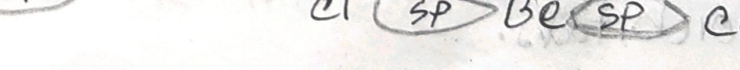
1. What is hybridization? Describe all types of hybridization with examples involving s and p orbitals. (10 points)

Ans:

Hybridization: It is the proces of mixing at last 2 nonequaralent atomic orbitals to form a new set of hybrid orbitals. Hybrid orbitals have very different shape from original atomic orbitals. The number of hybrid orbitals is equal to the number of pure atomic orbitals used is the hybridization process. Only co-valent bond can be formed from hybrid orbitals with atomic orbitals or another hybrid orbitals. There are three typs of hybridization involving s and p orbitals. They are sp, sp^2 and sp^3.

sp: In this hybridization process 1 s orbital and 1p orbital form 2 sp hybrid orbitals. The percentages of s and p orbital is 50-50%. The shape of the hybrid orbitals is linear,





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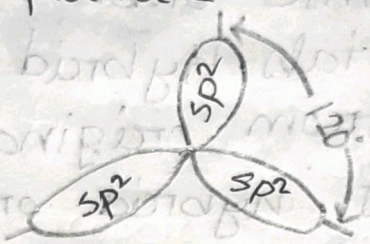
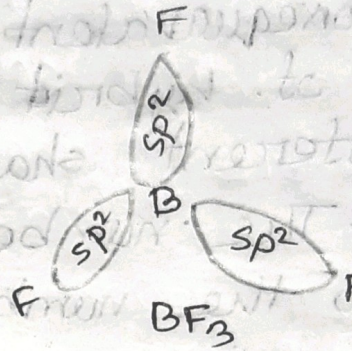
The angle is 180° between two orbitals.

sp^2: 1s orbital and 2p orbitals form 3 sp^2 hybrid orbitals The percentages of s orbital and p orbital is 33.33% and 66.67%. The shape of the hybrid orbitals is trigonal planar.

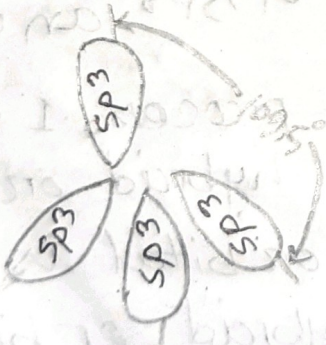


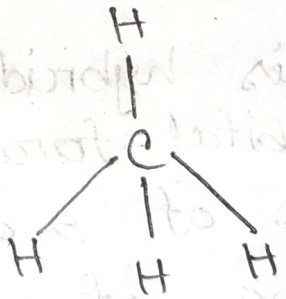


BF_3

The angle is 120° between two orbitals.

sp^3: 1s orbital and 3p orbitals form 4 sp^3 hybrid orbitals. The percentages of s and p orbital is 25% and 75%. The shape of the hybrid orbital is tetrahedral.





CH_4

The angle between is 109.5° between two orbitals.

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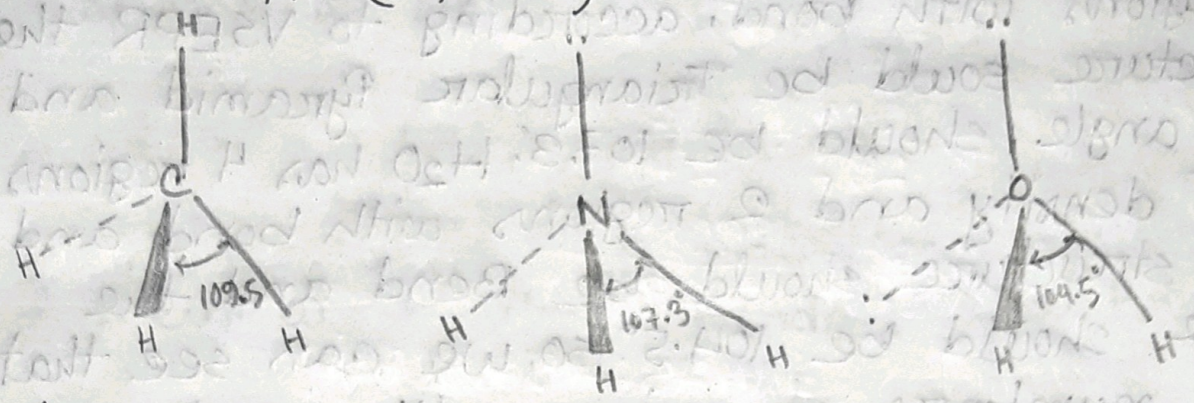
3 Explain the difference in bond angles and shapes of the molecules with reference to hybridization and VSEPR. (5 points)



Ans: Hybridization is the process of mixing of 2 or more nonequivalent atomic orbitals to form a new set of hybrid orbitals. Here the three central atoms C, O, N of given three molecules CH_4, NH_3 and H_2O have sp^3 hybridization. From the hybridization theory we know that sp^3 hybrid orbitals have an angle of 109.5° between each two hybrid orbitals and the shape of the shape of the hybrid orbitals is Tetrahedral.

Though the given molecules have sp^3 hybridization but they are not same in shape and their angles are also different. The geometries of a molecule can be predicted from the Valence Shell Electron Pair Resonance (VSEPR) model. From the structures of the molecules we can see that, CH_4 has 4 regions of e^- density and 4 regions with bond and according to VSEPR model the structure

sould be Tetrahedral and angle should be 109.5°. NH_3 has 4 regions of e^- density and, 3 regions with bond, according to VSEPR the structure sould be Triangular Pyramid and the angle should be 107.3°. H_2O has 4 regions of e^- density and 2 regions with bond and the structure should be Bend and the angle should be 104.5°. So, we can see that the numbers of regions with bond are different for this reason their shapes and angles are different.

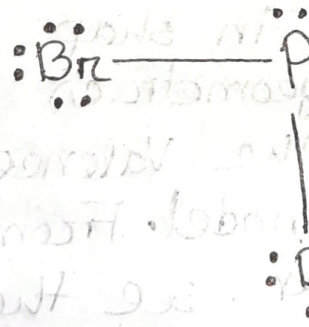
2. With proper reasoning answer the following questions for the compounds given bellow. (10 points)

PBr_3

ⓐ Number of valance 26 e's

ⓑ Now complete the Lewis structure here.

Ans:



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© From the Lewis structure answer the following questions:

Regions of electron density 3.

Regions with bonds 3

shape Trigonal Pyramidal.

(d) Δ e.n. of different bonds 2.8-2.1 = 0.7

(e) Is the molecule overall polar

Ionic polar covalent non-polar covalent

Ans: Yes, the molecule overall polar and it is polar covalent.

Part – III

1. A tank of compressed air shows a reading of 1590 psi at a room temperature of 24°C. If this is taken outside on a cold winter day when the temperature is only -3.0°C, what will it's new pressure be? (4 points)

Ans: Here, $P_1 = 1590$ psi

$P_2 = ?$

$T_1 = 24 + 273 = 297$ K

$T_2 = -3 + 273 = 270$ K

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We know from the Gray-Lussac's law,

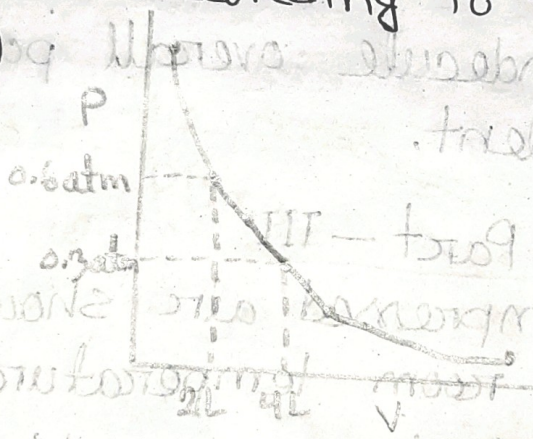
$$\therefore \frac{P_1}{T_1} = \frac{P_2}{T_2}$$

$$\Rightarrow \frac{1590}{297} = \frac{P_2}{270}$$

$$\Rightarrow P_2 = \frac{1590 \times 270}{297}$$

$$= 1445.4545 \text{ psi}$$

3. Determine the relation among Pressure and volume according to the following figure. (3 points)



Ans: This figure of pressure versus volume is hyperbola. Because PV is a constant, decreasing the pressure by a factor of two results in a twofold increase in volume and vice versa.

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3 If the moisture content of air is at 3.7% what partial pressure does H_2O exert on a typical 0.890 atm day in Dhaka? (3 points)

Ans:

Here,

$$P_{H_2O} = \frac{3.7}{100} \times 0.890$$

$$= 0.03293 \text{ atm}$$