Chemistry
Higher level

PL Vaults

Paper 2

Question 1:
C 71.93 TH 12.1

C	71.93
TH	12.1

1. Why is/isn't is the compound a hydrocarbon?
[Answer]
A hydrocarbon only contains carbon (C) and hydrogen (H) atoms. Without knowing the exact identities of the elements represented by "TH", we cannot be certain about the compound's classification.
100-71.93-12.1 does not equal 0.

2. Write down the Empirical formula of the compound.
[Answer]
100-71.93-12.1 = 15.97
71.93/12.01 = 5.99
12.1/1.01 = 11.99
15.97/16 = 1.00
C6 H12 O

3.Given temperature (200 Celsius), pressure (1*10^5), density (2.54*10^3)
Write down the molar mass and molecular formula.
[Answer]
200+273 = 473 Kelvins
PV = nRT
PV = M/M * RT
M = m/V x RT/P
M = 2.54x10^3 x 8.31x473/10^5
= 99.84
4.Identify functional group Gr is if molar mass is greater than CH (diagram)

		H
R	- C	
		0

5.Don't have last but it was CH cooked in K2Cr207
Answer: H11 C5 -C = up 0-H, down, 0 (line diagram)

Question 2:
Ozone 03, 0 = 0 - 0

1. Give electron configuration
[Answer]
3 zeros; first 0 has 4 zeros on the top and bottom equally; 2 zeros on the top, 2 on the bottom; 2nd zero has O X X on the right hand side, vertically, with XX on the top horizontally, and XX on the right vertically, and the 3rd zero has 0 0 on all the other 3 sides, being the top, right, and bottom.

2. Number of unpaired electrons
[Answer]
= 2

3. Lewis structure of 9zen
[Answer]
= Draw a Bent diagram with 3 0's with a structure like this: 0 = 0 - 0, the first 0 has 2 lines on top and on bottom, the 2nd zero just has one line on top, the 3rd zero had lines on the top, bottom, and right side; vertically, with top and bottom lines being horizontal.

4. Explain the shape and angle bond of zan.
[Answer]
120 - 2.5 = 117.5 degrees

5. Identify bond length (section 26 of booklet)
[Answer]
= (121, 148) picometers (This bond length represents the average distance between the oxygen atoms in the molecule)

6. Graph given of 03 and flo, explain the free radicals of each.
[Answer]
Final form = Cl 0 (dot) + 0 = 20(2 on bottom) + Cl (dot)
Explanation:
Ozone (Os) and chlorine monoxide (CIO) are both free radicals because they contain unpaired electrons. Ozone has two unpaired electrons, while CIO has one unpaired electron.

7. Then, explain why fell creates a hole in 03, based on the graph (they interfere around the middle)

[Answer]

Chlorine monoxide (CIO) is involved in the depletion of ozone (Os) in the ozone layer. CIO can act as a catalyst in ozone depletion reactions. When CIO reacts with ozone (Os), it forms oxygen (O) and a chlorine radical (CI•). This chlorine radical can then react with ozone

Question 3:

1. What environmental issues are caused by S02

[Answer]

Acid Rain. (S02 is a major air pollutant emitted from burning fossil fuels. It contributes to acid rain formation, respiratory problems in humans, and can harm vegetation and aquatic life.)

2. Write down the equation for when SO2 reacts with atmosphere to get a secondary Pollutant

[Answer]

When SO2 reacts with atmospheric oxygen and water, it forms sulfuric acid (H2S04)
2S02(g) +02(g) +2H20(1) +2H2S04(aq)

3. Write down empirical formula (this question specifically might be inaccurate)

[Answer]

0.1 mol of NaQ + H20 = (volume of 1dm10^3 of unknown compound)

4. Find pH of that

[Answer/Uncertain]

Formed compound is definitely 2NaOH

5. Find K constant and final product for H3PO4+H20

[Answer]

H3P04(aq)+H20(0)=H30+(aq)+H2P04-(aq)
The K constant for this equilibrium can be expressed as:
K=[H3PO4][H30+] divided by [H2P04-]

6. What would K be if temperature is increased (this may not be accurate: assuming that original K<H)

[Answer]

increasing the temperature of a reaction will increase the equilibrium constant K if the reaction is endothermic (heat absorbing) and decrease K if the reaction is exothermic (heat releasing).

7. Explain why P-3 has a greater ionic radius than S-2

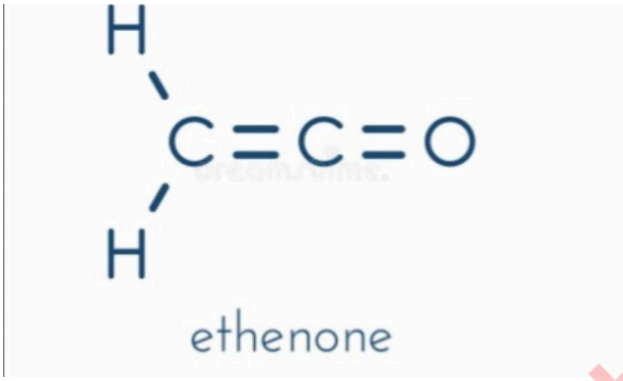
[Answer]

The ionic radius of an element depends on its electronic configuration and the number of

electron shells. In general, for ions with the same charge, the ionic radius increases as you move
down a group in the periodic table due to the addition of electron shells. Phosphorus (P3-) and sulfur (S2-) are in different groups of the periodic table, but if we're comparing P3- with S2-, the greater ionic radius of P3- compared to S2- can be attributed to the extra electron shell in phosphorus.

Question 4: (Not accurate)

1. Justify the IUPAC name of the compound (I don't remember it, smth like H2C2O, probably ethanene) based on the following diagram:
[Answer]



2. Question missing - so sorry!

3. Find the entropy of the reaction (using (section 12) (Inaccurate: Propane is a product of ethanene and water) - unclear question

4. Draw a graph for energy vs time for the reaction you found entropy for - incomplete/missing/can't recall.

5. The gas from the original given can be converted into compound G has to be identified based on a graph (Intensity/m) is ethanol
[Answer]
You will need to explain its IUPAC name.
One possible reaction pathway is the reduction of the carbonyl group in ethenone to form a hydroxyl group, resulting in the formation of ethanol.
Reduction of Carbonyl Group: The carbonyl group (C=0) in ethenone can be reduced to form a hydroxyl group (-OH), resulting in the formation of ethanol. This reduction reaction typically require
a reducing agent such as hydrogen gas (H2) in the presence of a catalyst, such as a metal catalyst
like palladium (Pd) or nickel (Ni).

The overall reaction can be represented as:
Ethenone+Hydrogen-#Ethanol

6. Calculation question for mass being given volume (not accurate)
[Answer]
At high temperatures, ethenone and carbon may deviate from ideal behavior because of increased intermolecular interactions. Ethenone molecules can undergo polymerization at high temperatures, leading to non-ideal behavior. Carbon can form various allotropes (such as graphite
diamond, and fullerenes), each with different properties, which can affect its behavior at high temperatures.

7. Real gasses assumed to be ideal. Explain why ethanene end and carbon less ideal at high temperatures.
[Answer]

8. Last question is for IUPAC and Lewis structure.
[Answer]

Question 5:
Don’t remember the reaction fully…

RCl (blue color) + HO(not 100% sure)(aq) = Smth (colorless) +(aq)
(data of the initial reaction and calculated are given)

1. List all possible reasons why the calculated reaction may be lower than the initial Graph given RCl vs time (non-linear reverse relationship, starts at 6*10^3 becomes flat at 0.2*10^3, total time is 300s)
[Answer]
Possible reasons for the calculated reaction rate being lower than the initial rate:
Incomplete mixing: If the reactants weren't thoroughly mixed initially, the reactir rate might be slower than expected.
Side reactions: There could be competing reactions occurring simultaneously, reducing the overall reaction rate.
Loss of reactants: Reactants may have evaporated or reacted with impurities, reducing the amount available for the main reaction.
Catalyst deactivation: If a catalyst was present initially and has since become deactivated, it could slow down the reaction.

2. Give the initial amount of RCl

3. Calculate the initial rate of the reaction

4. On molecular level, explain why the rate of the reaction decreasing.

Question 6:

1. Write down both half-equations for formation of positive anode and negative cathode for when molten bromide is electrolyzed.

[Answer]

Anode (Positive): 2Br (1) # Br_(g) + 2e-

Cathode (Negative): Br,(g) + 2€- > 2Br (1)

Or

Anode (Positive): 2Br (1) + Bra(g) + 2€

Cathode (Negative): Pb?*(1) + 2e° * Pb(U)

2. 2MnO4(-)+SO3(-)+2OH(-)=2MnO4(2-)+SO4(2-)+H2O

Which compounds are oxidized - Number of electrons transferred.

[Answer]

2MnO; + S0, - + 20M- > 2MnO,?- + S0,? + H,O

The compound that is oxidized is SO,?- to SO,?. To determine the number of electrons transferred,

we can balance the electrons in the half-reaction.

The oxidation half-reaction is: SO,= + SO,?+ 2e

So, 2 electrons are transferred in this oxidation reaction.