HOMEWORK ASSIGNMENT #5 ORGANIC CHEMISTRY I (20 pts)

**free radical reactions of ozone & higher alkanes**

**(due Friday 10 October post-mini-break)**

**Your name:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (1 pt)**

**5.1** The elementary reactions listed below are all part of the natural birth and death of ozone (O3) in the upper stratosphere of our planet. (4 pts)

i) Circle all the chain initiation steps.

ii) put checks by all the likely chain propagation steps

iii) put stars (\*) by the chain termination steps.

Elementary Reaction List for Natural Birth/Death of Ozone

**\***1) O + O3 🡪2O2 **√**  2) O + O2 + M (can be N2 ) --🡪 O3 + M\*

<250 nm uv light

3)O2 2O **\***4) O + O 🡪O2

250-300 nm light

**√**5) O3 O2 + O

1. *Circle the likely correct, natural birth-to-death (initiation-propagation-termination) order for ozone (use the reaction # above). (1 pt)*

5-3-2-(1 & 4)  **3-2-5-(1 & 4)** 3-5-2-(1 & 4) 2-3-5- (1 & 4)

(I) (II) (III) (IV)

**5.2 Drawn and quartered… 3 pts**

Sketch on the same plot below the reaction coordinate diagrams of Br and Cl with CH4 , making sure to emphasize where they differ.

Energy

Metastable state

Br

Cl

Chlorine reaches activated complex sooner and with less activation energy than Bromine. It also reaches the end of step 3 at a lower potential (more stable). Exaggerate the differences for clarity in any sketch .

**CH4 + Br or Cl**

**reaction progress**

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**5.4. Circle the carbon at which the most rapid chlorination is expected**

**in each of the two structures below ( 2 pts)**



**5.5) Productive thinking (4 pts)**

Photochemical bromination of 2,2,4-trimethylpentane yields 4 different monobromides. Draw them below

A (1o) B (1o)





C(2o) D (3o)





6.1b Compute the expected % yields of A-D you’ve drawn above given the following relative yield (R) data below: (see also- exercise 7 and supplement 7). 5 pts

**Site degree** **Relative yield/H for radical Bromination**

1o  1

20` 50

30 750

raw, unscaled yield % yield

**Compound expected % yield =y=# H \* R 100\* y/sum**

A \_\_\_\_\_1.04\_\_\_\_\_\_\_\_\_ 9\*1 =9 1.04

B \_\_\_\_\_\_0.7\_\_\_\_\_\_\_\_\_\_ 6\*1=6 0.7

C \_\_\_\_\_11.6\_\_\_\_\_\_\_\_\_\_ 2\*50=100 11.6

D \_\_\_\_\_86.7\_\_\_\_\_\_\_\_\_ 1\*750=750 86.7

sum= 865

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