

Chemistry 500

Spring 2000

Dr. Hunter

Old Exams for Fall 1999

Chemistry 500, First Mid-Term Exam

Fall 1999

Dr. Hunter

Your Name: _____,
 last first

Student Number¹: _____

For all of the questions on the following four pages, make sure you clearly explain your reasoning and show your work. You may use a calculator (you may *not* program information into your calculator) but may not use any other outside materials such as books or notes. If you are unsure of how to interpret any of the questions, please ask me for help. On some of the following questions, you have a choice of which parts to answer. *Circle the letters of the parts you want me to mark.* When you are done, please hand your exam in to me at the front and then either wait quietly in your desk or in the hallway. This exam is scheduled for 50 minutes after which class will resume at 11:00.

Total Grade: /50 (i.e. 25% of the final grade)

Note: Your student number is your social security number.

(10 marks in total) For *two out of three* of the following questions, give a short answer in the space provided. **Clearly show which ones you want me to grade.** Show your reasoning and/or your work.

Clearly describe what is meant by the term black body radiation and relate this to the light given off by the sun.

Clearly describe three different ways that the toxicity of chemicals is determined. For one of these, give its advantages and disadvantages.

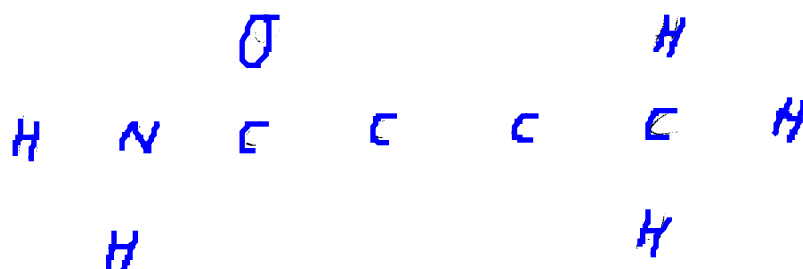
Define what is meant by the term Halon, give one example, and explain what they are used for and what their environmental consequences are.

(15 marks in total) Balance each of the following reactions. Show your work!!!!

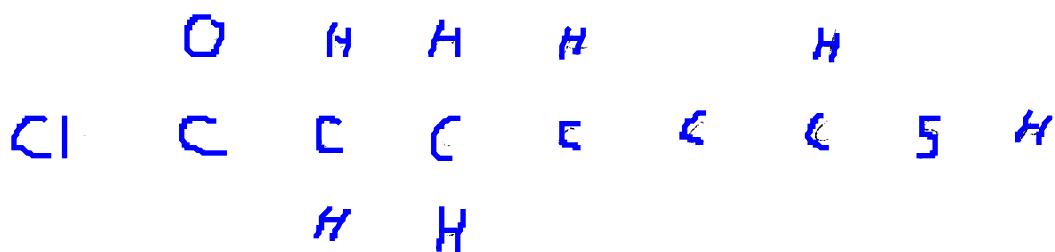


(15 marks in total) For each of the following molecules, determine the expected number of valence electrons, draw the Lewis structure, count the number of valence electrons on the structure you have drawn, and check if your Lewis structure is correct.

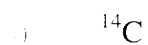
a)



b)



4. (10 marks in total) For each of the following isotopes, give the total number of protons, neutrons, and electrons and then the number of valence electrons and core electrons. Show your work.



total number of neutrons =

total number of protons =

total number of electrons =

number of valence electrons =

number of core electrons =



total number of neutrons =

total number of protons =

total number of electrons =

number of valence electrons =

number of core electrons =

1. (15 marks in total) For *three out of four* of the following questions, give a short answer in the space provided. **Clearly show which ones you want me to grade by circling their letters.** Show your reasoning and/or your work.

a. Is CO_2 or CH_4 a stronger greenhouse gas per molecule? Explain the reason for this.

b. Discuss the processes by which the oceans remove CO_2 from the atmosphere.

Describe what an Avagadro is and how it relates to a mole.

c. Calculate the molecular weight of a single molecule of propane (i.e., C_3H_8).

2. (20 marks in total) For *two out of three* of the following questions, give an answer in the space provided. **Clearly show which ones you want me to grade by circling their letters.** Show your reasoning and/or your work.

Discuss the steps and methods used to determine the structures of new molecules.

Clearly explain why you can safely put your hands inside of a hot oven for a few seconds but if you touch the racks in the same oven you will be burned almost instantly.

Using examples, discuss what is meant by the “rank” of coal.

3. (8 marks in total) For each of the following molecular formulae, draw *four* structural isomers. Be sure that you show *all* atoms and bonds for each.



4. (7 marks in total) In your answers to question **3**, above, identify and name seven different functional groups.

Chemistry 500, Final Exam

Fall 1999

Dr. Hunter

Your Name: _____
 last first

Student Number: _____

For all of the questions on the following five pages, make sure you clearly explain your reasoning and show your work. You may use a calculator (you may *not* program information into your calculator) but may not use any other outside materials such as books or notes. If you are unsure of how to interpret any of the questions, please ask the instructor for help. On some of the following questions, you have a choice of which parts to answer. *Circle the letters of the parts you want marked.* When you are done, please hand your exam in to the instructor at the front and initial the attendance sheet before you leave.

Total Grade: /100 (i.e. 50% of the final grade)

1. (20 marks in total) For *two out of three* of the following parts, give an answer in the space provided. **Clearly show which ones you want me to grade by circling its letter.** Show your reasoning and/or your work.

a. Clearly explain the role of the moderator in a nuclear reactor.

b. Draw the structure of a polyester molecule having three repeating units.

c. Clearly describe the differences between the additives and the polymers in plastics and give three reasons for using the additives.

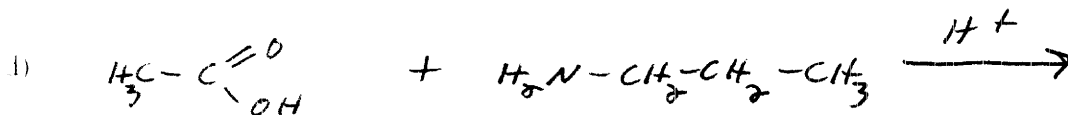
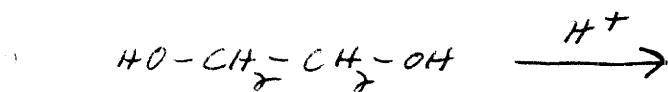
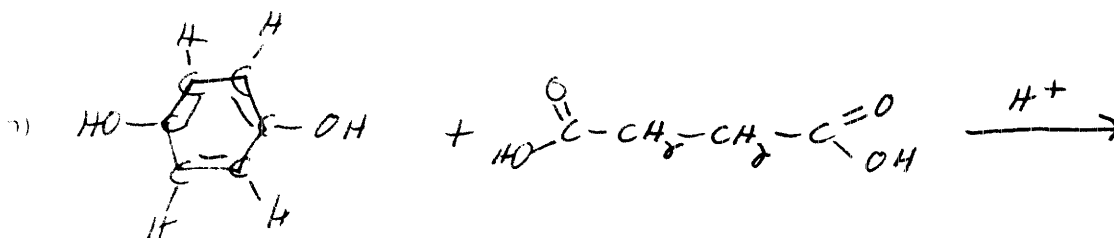
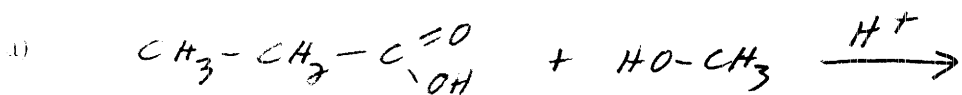
2. (20 marks in total) For *two out of three* of the following parts, give an answer in the space provided. **Clearly show which ones you want me to grade by circling its letter.** Show your reasoning and/or your work.

a) Clearly describe the difference between a Fusion Bomb and a Fission Bomb.

b) Clearly describe what is meant by the concept of molecular weight as it applies to polymers.

c) Define what gamma and alpha radiation are. Which is normally more dangerous and why?

3 (20 marks in total) Draw the structures of the products of each of the following reactions/



4. (20 marks in total) For *two out of three* of the following parts, give an answer in the space provided. **Clearly show which ones you want me to grade by circling its letter.** Show your reasoning and/or your work.

(a) Using words *and pictures*, clearly describe the structure of a ^{12}C atom and its nucleus.

(b) What is meant by the greenhouse effect? Clearly describe the roles of Chlorofluorocarbons in the greenhouse effect.

(c) What is X-ray crystallography and what information does it tell us?

5. (20 points maximum) For *one out of two* of the following parts, give an answer in the space provided. **Clearly show which ones you want me to grade by circling its letter.** Show your reasoning and/or your work.

(a) Clearly describe how crude oil is processed to give the maximum yield of gasoline and other light components.

Or

(b) What is acid rain and what efforts are being made to control it?

Chemistry 500, First Mid-Term Exam

Fall 1999

Dr. Hunter

Your Name: Answers
last first

Student Number¹: _____

For all of the questions on the following four pages, make sure you clearly explain your reasoning and show your work. You may use a calculator (you may *not* program information into your calculator) but may not use any other outside materials such as books or notes. If you are unsure of how to interpret any of the questions, please ask me for help. On some of the following questions, you have a choice of which parts to answer. *Circle the letters of the parts you want me to mark.* When you are done, please hand your exam in to me at the front and then either wait quietly in your desk or in the hallway. This exam is scheduled for 50 minutes after which class will resume at 11:00.

Total Grade: /50 (i.e. 25% of the final grade)

¹ Note: Your student number is your social security number.

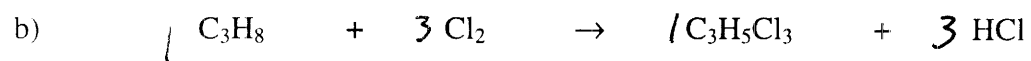
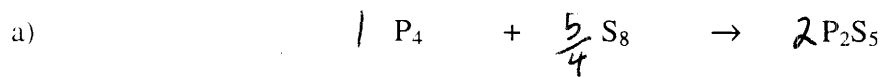
1. (10 marks in total) For *two out of three* of the following questions, give a short answer in the space provided. **Clearly show which ones you want me to grade.** Show your reasoning and/or your work.

a. Clearly describe what is meant by the term black body radiation and relate this to the light given off by the sun.

c. Clearly describe three different ways that the toxicity of chemicals is determined. For one of these, give its advantages and disadvantages.

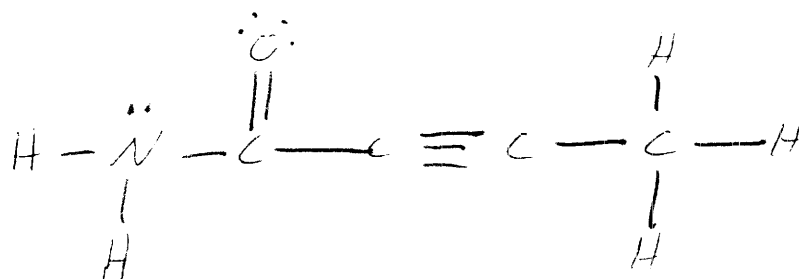
d. Define what is meant by the term Halon, give one example, and explain what they are used for and what their environmental consequences are.

2. (15 marks in total) Balance each of the following reactions. Show your work!!!!



3. (15 marks in total) For each of the following molecules, determine the expected number of valence electrons, draw the Lewis structure, count the number of valence electrons on the structure you have drawn, and check if your Lewis structure is correct.

a)

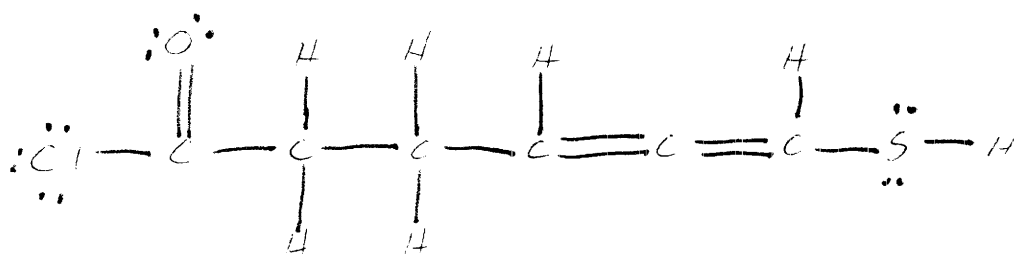


$$5H + 1N + O + 4C$$

$$5 + 5 + 6 + 16 = 38 e^-$$

correct ✓

b)



$$7H + Cl + O + S + 6C$$

$$7 + 7 + 6 + 6 + 24 = 50 e^-$$

correct ✓

4. (10 marks in total) For each of the following isotopes, give the total number of protons, neutrons, and electrons and then the number of valence electrons and core electrons. Show your work.



total number of neutrons = 8

total number of protons = 6

total number of electrons = 6

number of valence electrons = 4

number of core electrons = 2



total number of neutrons = 20

total number of protons = 17

total number of electrons = 17

number of valence electrons = 7

number of core electrons = 10

Chemistry 500, Second Mid-Term Exam

Fall 1999

Dr. Hunter

Your Name:

 last first

Student Number¹: _____

For all of the questions on the following three pages, make sure you clearly explain your reasoning and show your work. You may use a calculator (you may *not* program information into your calculator) but may not use any other outside materials such as books or notes. If you are unsure of how to interpret any of the questions, please ask me for help. On some of the following questions, you have a choice of which parts to answer. *Circle the letters of the parts you want me to mark.* When you are done, please hand your exam in to me at the front and then either wait quietly in your desk or in the hallway. This exam is scheduled for 50 minutes after which class will resume at 11:00.

Total Grade: /50 (i.e. 25% of the final grade)

¹ Note: Your student number is your social security number.

1. (15 marks in total) For *three out of four* of the following questions, give a short answer in the space provided. **Clearly show which ones you want me to grade by circling their letters.** Show your reasoning and/or your work.

a. Is CO_2 or CH_4 a stronger greenhouse gas per molecule? Explain the reason for this.

b. Discuss the processes by which the oceans remove CO_2 from the atmosphere.

c. Describe what an Avogadro is and how it relates to a mole.

d. Calculate the molecular weight of a single molecule of propane (i.e., C_3H_8).

$$3 \times 12 + 8 \times 1 = 44 \text{ atomic mass units}$$

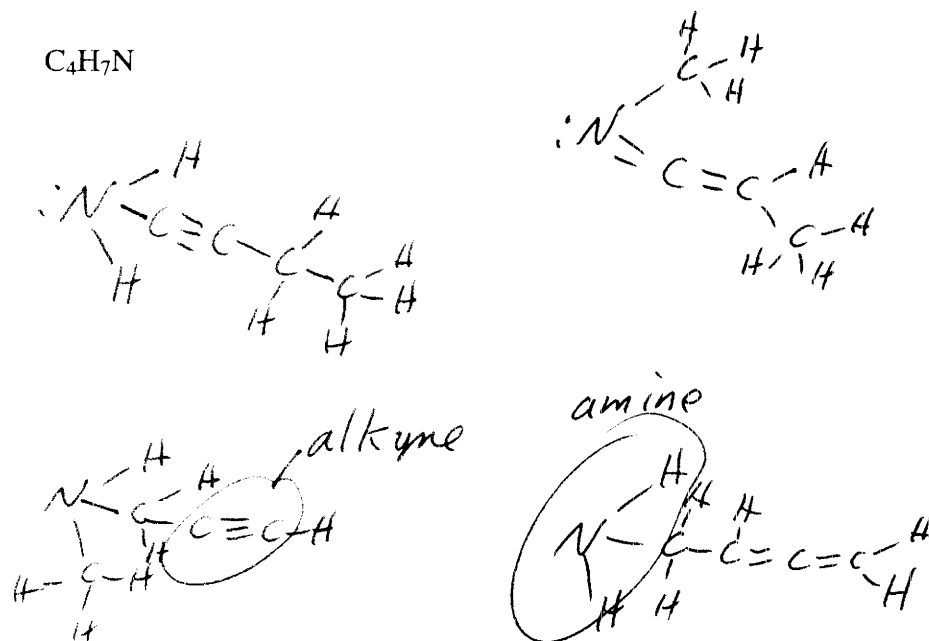
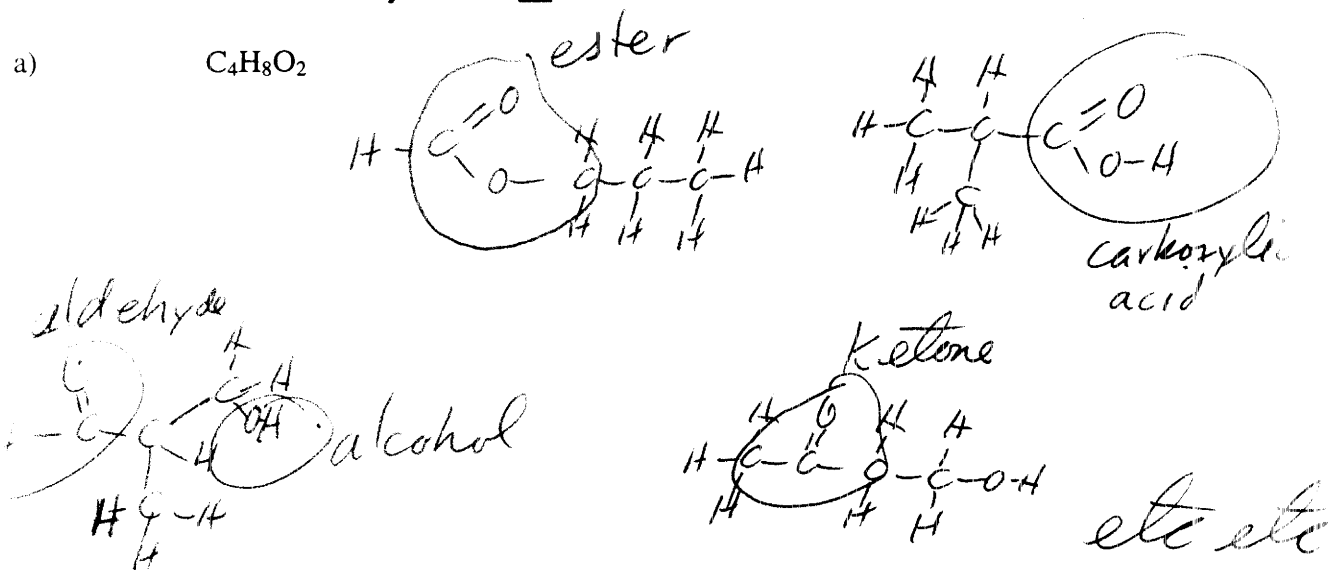
2. (20 marks in total) For *two out of three* of the following questions, give an answer in the space provided. **Clearly show which ones you want me to grade by circling their letters.** Show your reasoning and/or your work.

a. Discuss the steps and methods used to determine the structures of new molecules.

b. Clearly explain why you can safely put your hands inside of a hot oven for a few seconds but if you touch the racks in the same oven you will be burned almost instantly.

c. Using examples, discuss what is meant by the “rank” of coal.

3. (8 marks in total) For each of the following molecular formulae, draw four structural isomers. Be sure that you show all atoms and bonds for each.



4. (7 marks in total) In your answers to question 3, above, identify and name seven different functional groups.

Chemistry 500, Final Exam

Fall 1999

Dr. Hunter

Your Name: Answers
last first

Student Number: _____

For all of the questions on the following five pages, make sure you clearly explain your reasoning and show your work. You may use a calculator (you may *not* program information into your calculator) but may not use any other outside materials such as books or notes. If you are unsure of how to interpret any of the questions, please ask the instructor for help. On some of the following questions, you have a choice of which parts to answer. *Circle the letters of the parts you want marked.* When you are done, please hand your exam in to the instructor at the front and initial the attendance sheet before you leave.

Total Grade: /100 (i.e. 50% of the final grade)

1. (20 marks in total) For *two out of three* of the following parts, give an answer in the space provided. **Clearly show which ones you want me to grade by circling its letter.** Show your reasoning and/or your work.

a. Clearly explain the role of the moderator in a nuclear reactor.

b. Draw the structure of a polyester molecule having three repeating units.

c. Clearly describe the differences between the additives and the polymers in plastics and give three reasons for using the additives.

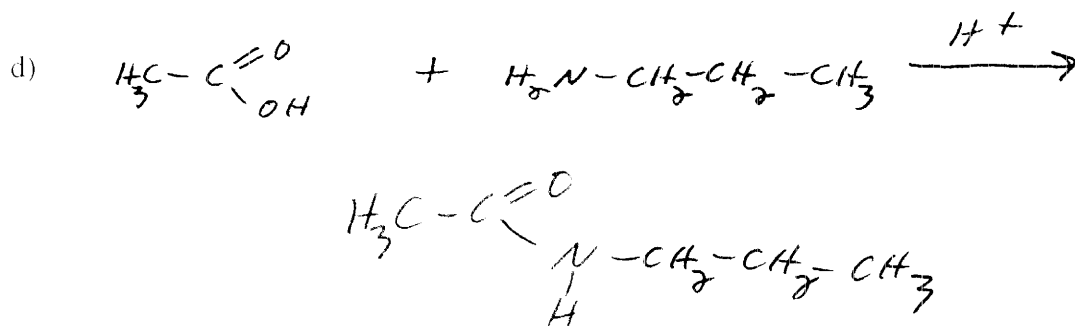
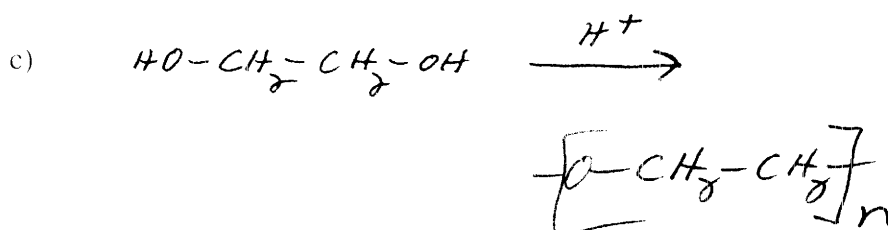
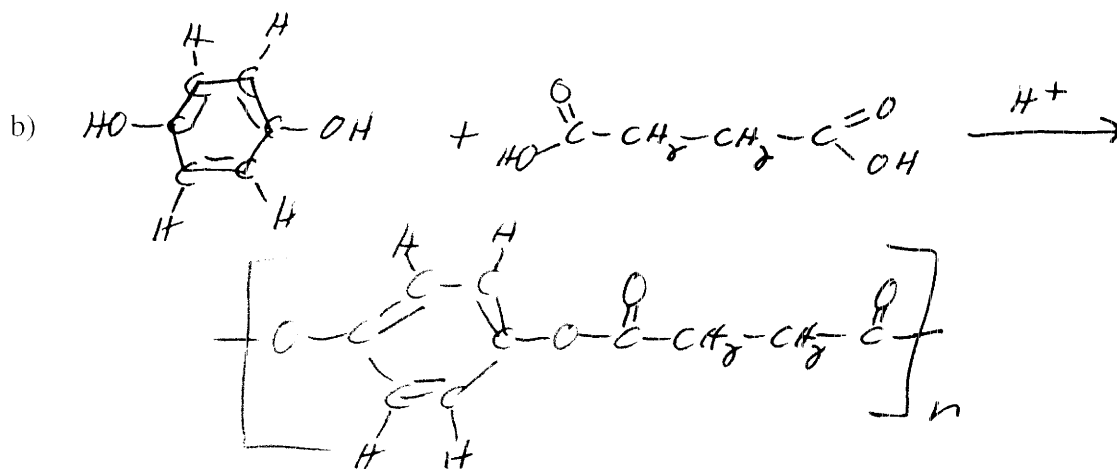
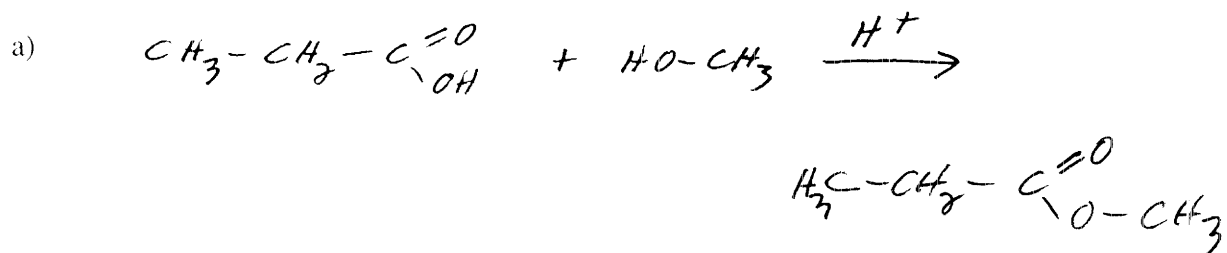
2. (20 marks in total) For *two out of three* of the following parts, give an answer in the space provided. **Clearly show which ones you want me to grade by circling its letter.** Show your reasoning and/or your work.

a) Clearly describe the difference between a Fusion Bomb and a Fission Bomb.

b) Clearly describe what is meant by the concept of molecular weight as it applies to polymers.

c) Define what gamma and alpha radiation are. Which is normally more dangerous and why?

3. (20 marks in total) Draw the structures of the products of each of the following reactions/



(20 marks in total) For *two out of three* of the following parts, give an answer in the space provided. **Clearly show which ones you want me to grade by circling its letter.** Show any reasoning and/or your work.

1) In *words and pictures*, clearly describe the structure of a ^{12}C atom and its nucleus.

2) What is meant by the greenhouse effect? Clearly describe the roles of chlorofluorocarbons in the greenhouse effect.

3) What is X-ray crystallography and what information does it tell us?

5. (20 points maximum) For *one out of two* of the following parts, give an answer in the space provided. **Clearly show which ones you want me to grade by circling its letter.** Show your reasoning and/or your work.

(a) Clearly describe how crude oil is processed to give the maximum yield of gasoline and other light components.

Or

(b) What is acid rain and what efforts are being made to control it?