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To obtain maximum credit for each question, show your work in detail. **Partial credit for questions will not be assigned if no work is shown. Indeed, no credit will be granted if complete work is not shown even for correct answers.** Feel free to use pictures/diagrams to illustrate your text answers and/or to use short text explanations to explain your drawings if your pictures are ambiguous. If you have to make assumptions, etc., to complete any answers, write me a short note stating and/or explaining your assumptions and testing them to the degree possible.

You have 15 minutes for the group part of this exam. The twenty five points for the group part of this exam correspond to \( \frac{1}{16} \) of the total points for this course. Together, the group and individual parts of this exam are worth \( \frac{1}{4} \) of the total course grade.

Grade /25 (group)
1 (25 points total). Balance each of the following chemical reactions.

\[
\begin{align*}
\text{C}_6\text{H}_12\text{O}_3 & + \text{HCl} \rightarrow \text{C}_6\text{H}_6\text{Cl}_6 + \text{H}_2\text{O} + \text{H}_2 \\
\text{Al}_2(\text{CO}_3)_3 & + \text{HCl} \rightarrow \text{AlCl}_3 + \text{H}_2\text{O} + \text{CO}_2 \\
\text{Fe} & + \text{HCl} + \text{O}_2 \rightarrow \text{FeCl}_3 + \text{H}_2\text{O} \\
\text{Cr}_2\text{O}_3 & + \text{Al} \rightarrow \text{Al}_2\text{O}_3 + \text{Cr} \\
\text{C}_3\text{H}_8\text{O} & + \text{CrO}_3 \rightarrow \text{Cr}_2\text{O}_3 + \text{CO}_2 + \text{H}_2\text{O}
\end{align*}
\]
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On the first question on this exam (i.e., pages 2 & 3), you are given a choice about which 5 out of the 6 parts to answer. On this question, be sure that you circle the part numbers of those parts you want me to grade.  [Note: If you do not clearly indicate your choice, I will count only the first 5 parts towards the grade.]

You have 45 minutes for the individual part of this exam. The seventy five points for the individual part of this exam correspond to 3/16th of the points for this course. Together, the group and individual parts of this exam are worth ¼ of the total course grade.

Grade /75 (individual)
1  (50 points total, each part is worth a maximum of 10 points). Answer five (5) of the six (6) parts of this question (i.e., on pages 2 & 3, below). Indicate the 5 parts you want me to grade by circling their part numbers.

a. Clearly described the effects on a car if the oxygen content of the atmosphere were to triple.

b. Give the number of significant figures for each of the following clearly describing how you come to this answer. If you wanted to do an accurate calculation, which number would you use (give me your reasoning).

\[2.1 \times 10^5 \rightarrow 210,000 \rightarrow 2.132 \times 10^5 \rightarrow\]

2.1 x 10^5 →

210,000 →

2.132 x 10^5 →

c. Convert the following numbers from scientific notation to conventional numbers or from conventional numbers to scientific notation, as required.

\[3,200 = \]

\[0.000,004 = \]

\[2.18 \times 10^{-4} = \]

\[4.14 \times 10^3 = \]

\[34,200,000,000 = \]
d. Describe in detail, one of the methods used to determine the toxicity of a new chemical. Give its strengths and weaknesses.

e. What is the largest constituent of Air? Discuss its properties and uses.

f. Calculate the mileage of a car that drives 234 miles using 17 gallons of gas. Show your work.
2 (25 points total). Balance each of the following chemical reactions.

\[ \text{___C}_4\text{H}_8 + \text{___O}_2 \rightarrow \text{___CO}_2 + \text{___H}_2\text{O} \]

\[ \text{___C}_6\text{H}_4 + \text{___HCl} \rightarrow \text{___C}_6\text{H}_5\text{Cl}_4 \]

\[ \text{___C}_6\text{H}_12\text{O}_3 + \text{___Cl}_2 \rightarrow \text{___C}_6\text{H}_6\text{Cl}_6 + \text{___H}_2\text{O} \]

\[ \text{___WC}_6\text{O}_6 + \text{___NO} \rightarrow \text{___CO} + \text{___WN}_4\text{O}_4 \]

\[ \text{___Na}_2\text{SO}_4 + \text{___HCl} \rightarrow \text{___NaCl} + \text{___H}_2\text{SO}_4 \]
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On the first question on this exam (i.e., pages 2 & 3), you are given a choice about which 5 out of the 6 parts to answer. On this question, be sure that you circle the part numbers of those parts you want me to grade. [Note: If you do not clearly indicate your choice, I will count only the first 5 parts towards the grade.]

You have 50 minutes for this exam. The one hundred points for this exam correspond to 1/4 th of the points for this course.

Grade /100 (individual)
1 (50 points total, each part is worth a maximum of 10 points). Answer five (5) of the six (6) parts of this question (i.e., on pages 2 & 3, below). Indicate the 5 parts you want me to grade by circling their part numbers.

a. For $^{31}\text{S}$, 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 =

b. Clearly describe what an **Isotope** is and give an example of a pair of isotopes.

c. Clearly describe what an **Allotrope** is and give an example of a pair of allotropes.
d. Give a clear description of the technique **X-Ray Diffraction/Crystallography** including how it is carried out and what information it tells us.

e. Clearly describe what the **Photoelectric Effect** is including how it is related to the nature of light.

f. Clearly describe the nature of the **Ozone Layer** including what it does and what has been happening to it.
2 (25 points total). Fully and clearly explain the origin and scientific importance of the following graphic from the text.
3 (25 points total). For each of the following molecules, draw the Lewis structure and check if your Lewis structure is correct.

Br C C C N C C O

Cl H H H H

F H

F Si C C Sn O N O

F H

H H

C C N

C C P

H H
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Grade   /25 (group)
1 (25 points total). Estimate the total number of kilograms of CO₂ produced from the burning of gasoline (use Octane as its formula, C₈H₁₈) by all YSU students, staff, & faculty in their cars during 2006. Be sure to discuss your assumptions, how you calculated the results, and the estimated accuracy of the results you get in detail.
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You have 45 minutes for this exam. The seventy five points for the individual part of this exam correspond to 3/16th of the total points for this course. Together, the group and individual parts of this exam are worth ¼ of the total course grade.

Grade /75 (individual)
1 (15 points total). Complete both parts of this question.
a. For the following molecule(s), calculate the Molecular Weight and the Elemental Composition.
\[ C_2H_3F_3 \]

b. For the following molecule(s), determine the number of moles or the weight of the substance, as required.
\[ C_2H_3F_3, 20g \]
\[ C_2H_3F_3, 11 \text{ moles} \]

2 (15 points total). Clearly describe the role of termites in global warming.
3 (15 points total). For each of the following molecule(s), draw the Lewis structure and then predict the bond lengths and angles.

Br C C C N C C O
Cl H H H H

H H
C C N
C C P
H H

4 (15 points total). Clearly describe what a Clathrate is and its relationship to global warming
5 (15 points total). Fully and clearly explain the origin and scientific importance of the following graphic from the text.
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You have 60 minutes for the group part of this exam. The twenty five points for the group part of this exam correspond to 1/16th of the total points for this course. Together, the group and individual parts of this exam are worth ¼ of the total course grade.

Grade /25 (group)
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You have 60 minutes for this exam. The seventy five points for the individual part of this exam correspond to $3/16$ of the total points for this course. Together, the group and individual parts of this exam are worth $1/4$ of the total course grade.

Grade  /75 (individual)
1 (15 points total). Discuss what is meant by the term **Heat Capacity** and give two examples to illustrate your description.

2 (10 points total). Discuss what is meant by the term **Activation Energy**. Use a diagram to help illustrate your description.
3 (25 points total). Discuss Coal, including how it is mined, its structure, and its uses, and how it relates to energy supplies/security and environmental issues.
4 (25 points total). Discuss Petroleum (Oil), including how it is mined, its structure, and its uses, and how it relates to energy supplies/security and environmental issues.