Name _____ Section _____

General Instructions: Write all answers in your blue book, beginning on the second page.

Part I. Short Answer---6 POINTS EACH -60 POINTS MAXIMUM

1. Give the number of protons (p), electrons (e), and neutrons (n) in one atom of chlorine-37.

a. 37 p, 37 e, 17 n
b. 17 p, 17 e, 37 n
c. 17 p, 17 e, 20 n
d. 37 p, 17 e, 20 n
e. 17 p, 37 e, 17 n

2. The following properties describe the element zinc. Which one(s) is (are) **chemical** properties?

I. It is bluish-white metal.
II. It corrodes upon prolonged contact with moist air.
III. Its density is 7.14 g/cm^3.
IV. It melts at 419°C.
V. It conducts electricity.

(a) IV and V
(b) IV
(c) V
(d) II, IV, and V
(e) II

3. Consider the following balanced equation. $2H_2 + O_2 \rightarrow 2H_2O$

Which one of the following statements is **false**?

(a) One molecule of O_2 will react with 2 molecules of H_2.
(b) One mole of O_2 will react with 2 moles of H_2.
(c) The complete reaction of 32.0 g of O_2 will produce 2 moles of H_2O.
(d) The complete reaction of 2.0 g of H_2 will produce 36.0 g of H_2O.
(e) The amount of reaction that consumes 32.0 g of O_2 produces 36.0 g of H_2O.

4. Which statement is false?

(a) The charge on a proton is positive, the charge on a neutron is neutral.
(b) A molecule is the smallest unit of a compound.
(c) The nucleus of an atom has a small volume yet contains nearly all the mass.
(d) An extensive property is independent on the amount or mass of a substance.
(e) Physical processes are used to separate mixtures of substances.

5. How many millimeters are there in 25 feet?

(a) 7.6×10^2 mm
(b) 2.6×10^3 mm
(c) 1.0×10^2 mm
(d) 7.6×10^3 mm
(e) 1.2×10^3 mm

6. Which of the following pairs of elements would be most likely to form an ionic compound?

(a) P and Br
(b) Cu and K
(c) C and O
(d) O and Zn
(e) Al and Rb

7. Which of the following is **not** a correct description of 16.0 grams of methane, CH_4?

(a) It is one mole of methane.
(b) It is the amount of methane that contains 12.0 g of carbon.
(c) It is $16.0 \times 6.02 \times 10^{23}$ molecules of methane.
(d) It is the amount of methane that contains 4.0 grams of hydrogen.
(e) It is the amount of methane that contains $4 \times 6.02 \times 10^{23}$ hydrogen atoms.

8. What is the mass in grams of 2.2×10^9 CO_2 molecules?

(a) 9.7×10^{10} g
(b) 1.0×10^{-12} g
(c) 1.2×10^6 g
(d) 4.4×10^{-14} g
(e) 1.6×10^{-13} g

9./10. Complete the following table as needed in your bluebook using the correct chemical formula or the correct name of the compound on new lines. Just write the answer not the information given.

Compound Name	Chemical Formula	Answer in your bluebook
Sulphuric acid		a)
	HCl(g)	b)
Sodium bicarbonate		c)
Phosphoric acid		d)
	$(NH_4)_2SO_4$	e)
Ferric nitrite		f)
	HNO_3	g)
potassium dichromate		h)

	NaClO	i)
	N_2F_4	j)
Magnesium nitride		k)
	$Ca(ClO_3)$	l)

Part II. Short Problems—10 POINTS EACH—30 POINTS MAXIMUM

Answer 3 of the following 5 questions. All work and answers are to be written in the blue book provided. If you do more than three, then cross out the questions not to be counted or the first three listed in the bluebook will be graded.

13. What is the percent by mass of sulfur in $Al_2(SO_4)_3$?

14. A 25.0 kilogram bag of fertilizer is found to be 10.00% potassium by mass. Calculate the number of grams of potassium per square centimeter of land if the contents of the bag covers 2.5 square miles of a field (1 foot = 12 inch, 2.54 cm = 1 in, 1 mile = 1.609 km).

15. Copper melts at 1083°C. What is its melting temperature in both °F and Kelvin ?

16. Silicon tetrachloride ($SiCl_4$) can be prepared by heating silicon in chlorine gas (Cl_2) according to the ***equation below which needs to be balanced***:

$$Si(s) + Cl_2(g) \text{ -------> } SiCl_4$$

If 0.5077 mole of $SiCl_4$ is produced as a product in this reaction, how many grams of molecular chlorine, Cl_2, were needed to produce this amount of $SiCl_4$?

17. The element boron consists of two isotopes, $^{10}_5B$ and $^{11}_5B$. Their masses are 10.01 and 11.01 amu, respectively. The abundance of $^{10}_5B$ is 20.0%. Compute the atomic mass of naturally occurring boron?

Part III. Problems---20 POINTS EACH—60 POINTS MAXIMUM

Answer any 3 of the next 6 questions. If you answer more than 3 questions cross out those questions you wish not to be graded, otherwise I will count the first three written in the bluebook. Show all work to receive credit.

18. A compound consisting of C, H and O only, has a molar mass of 331.5 g/mol. Combustion of 0.1000 g of this compound caused a 0.2921 g increase in the mass of the CO_2 absorber and a 0.0951 g increase in the mass of the H_2O absorber. What is: A) the empirical formula of the compound? B) The molecular formula of the compound? (Molar masses CO_2 = 44.01 g/mol, H_2O = 18.01 g/mol)?

19. Sodium chloride reacts with lead II nitrate producing sodium nitrate and lead II chloride. A) Write a balanced chemical equation for this reaction and B) calculate the mass in grams of sodium nitrate that would be produced from the complete reaction of 25.0 grams of lead II nitrate (assume excess sodium chloride).

20. A mixture of 3.50 g of H_2 and 26.0 g of O_2 are mixed and chemically react to form water as the lone product. How much water can be produced from this reaction (Molar Mass H = 1.007 g/mol; Molar mass O = 15.99 g/mol)?

21. Balance the following equations:

1. $NaNO_3 \rightarrow NaNO_2 + O_2$

2. $NH_3 + H_2SO_4 \rightarrow (NH_4)_2SO_4$

3. $RbOH + H_3PO_4 \rightarrow Rb_3PO_4 + H_2O$

4. $C_4H_{10} + O_2 \rightarrow CO_2 + H_2O$

5. $SnS_2 + HCl \rightarrow H_2SnCl_6 + H_2S$

22. The Kingston Steam Plant burns 14,000. metric tons (1000 kg = 1 metric ton) of coal each day and generates 10^{10} kilowatts-hours of electricity each year. Coal is primarily carbon which undergoes combustion in the following reaction:

$$C(s) + O_2\,(g) \rightarrow CO_2(g)$$

A) Compute how many kilograms of molecular oxygen is required for the combustion of 1 day's coal? B) How much carbon dioxide gas is produced each day at the plant? Express both answers in scientific notation.

23. Ethyl alcohol (C_2H_5OH) is produced by fermentation of sugars such as glucose, $C_6H_{12}O_6$. Make the necessary adjustments to the unbalanced equation below and calculate the number of liters of ethyl alcohol that can be produced by complete conversion of 8.67 kilograms of glucose to ethanol. The density of ethanol is 0.789 g/mL

$$C_6H_{12}O_6 \text{ ------> } C_2H_5OH + CO_2$$

BONUS POINTS SECTION

Answer one question that you did not answer in either Part 2 or Part 3 and receive bonus points respectively for each correct answer with work shown. Clearly mark a separate section "BONUS" in your bluebook and write the question number and your answer there. Do not convolute bonus answers with questions answered in the main part of the test in the blue book, or it will not be counted—sorry no exceptions.