

CHM 1311: General Chemistry 1, Fall 2004
Exam #1, September 8, 2004

Name (print) _____ SSN _____

Pledge: I have neither given nor received aid on this exam: _____
Signature

For ALL problems: SHOW ALL WORK TO GET FULL CREDIT

Useful equations and constants

$$T_{\text{celcius}} = \frac{5}{9}(T_{\text{Fahrenheit}} - 32) \quad T_{\text{Fahrenheit}} = \frac{9}{5}(T_{\text{Celcius}}) + 32 \quad T_{\text{Kelvin}} = T_{\text{Celcius}} + 273.15$$

1 amu = 1.66054e-24 g

electron: mass (m_e) = 9.1093897e-28 g charge (e) = -1.60e-19 C
proton: mass = 1.673e-24 g
neutron: mass = 1.675e-24 g

1 inch = 2.54 cm

density = mass / volume

DO NOT WRITE IN THESE BLANKS

- | | |
|---------------|---------------|
| 1. (3) _____ | 15. (5) _____ |
| 2. (2) _____ | 16. (3) _____ |
| 3. (2) _____ | 17. (2) _____ |
| 4. (4) _____ | 18. (5) _____ |
| 5. (2) _____ | 19. (9) _____ |
| 6. (8) _____ | 20. (2) _____ |
| 7. (3) _____ | 21. (4) _____ |
| 8. (2) _____ | 22. (2) _____ |
| 9. (3) _____ | 23. (3) _____ |
| 10. (7) _____ | 24. (4) _____ |
| 11. (2) _____ | 25. (8) _____ |
| 12. (2) _____ | 26. (6) _____ |
| 13. (4) _____ | 27. (5) _____ |
| 14. (4) _____ | |

TOTAL (106) _____

1. (3 pts) Give the chemical symbols for the following elements:

Sulfur _____ **S** _____

Chromium _____ **Cr** _____

Zinc _____ **Zn** _____

2. (2 pts) Aluminum unites with a second element, which we will represent by the symbol E, to form a definite compound whose formula is AlE_3 . Element E is most probably (circle your answer):

an actinide element

an alkali metal

a member of Group VIA

a halogen

a transition element

3. (2 pts) The number of significant figures in 100850.0 is

a. 13

b. 5

c. **7**

d. 3

e. 4

4. (4 pts) Which one of the statements below is true?

a. When two atoms combine, they do so in definite proportions by weight.

b. When two different compounds combine to form an element, they do so in definite proportions by weight.

c. When two different elements combine to form a compound, they do so in definite proportions by weight.

d. When two molecules combine, they do so in definite proportions by weight.

e. When two different elements combine to form a mixture, they do so in definite proportions by weight.

5. (2 pts) The term used to describe how close a measurement is to the true value is:

a. exactness

b. accuracy

c. uncertainty

d. precision

e. significance

6. (8 pts) Give the correct name for the formula or the correct formula for the name, as appropriate (*no partial credit*):

P_2O_5	diphosphorus pentoxide
Potassium oxide	K_2O
Silver sulfate	Ag_2SO_4
IF_3	Iodine trifluoride
tin(IV) chloride	$SnCl_4$
$CuBr_2$	copper(II) bromide
Magnesium perchlorate	$Mg(ClO_4)_2$
$NaNO_2$	sodium nitrite

7. (3 pts) Label each of the following as either a physical process or a chemical process:

Melting of ice	physical
Pulverizing an aspirin	physical
Digesting a candy bar in your stomach	chemical

8. (2 pts) Which one of the following is correctly classified as a hydrocarbon?

- a. $C_6H_{12}O_6$
- b. C_8H_{16}
- c. $HC_2H_3O_2$
- d. $NaHCl$
- e. C_2H_5OH

9. (3 pts) Which of the following metric relationships is correct?

- | | |
|---------------------------------|----------------------------------|
| a. 100 liters = 1 centiliters | b. 1 deciliter = 10^1 liters |
| c. 1 megagram = 10^{-6} grams | d. 1 milligram = 10^{-3} grams |
| e. 1 nanometer = 10^9 meters | |

10. (7 pts) Fill in the gaps in the following table assuming each column represents a neutral atom:

symbol	$^{46}_{22}\text{Ti}$	$^{103}_{45}\text{Rh}$	$^{127}_{52}\text{Te}$
protons	22	45	52
neutrons	24	58	75
electrons	22	45	52
Atomic no.	22	45	52
Mass no.	46	103	127

11. (2 pts) Circle the correct number of atoms in one formula unit of the substance, $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$.

- a. 4 b. 17 c. 21
d. 23 e. 33

12. (2 pts) Circle the one of the following formulas that is incorrect because it does not represent a known ionic compound.

- a. BaCl_2 b. Al_2F_3 c. NaSO_3
d. RbBr e. CaO

13. (4 pts) Which among the following represent a set of isotopes? Atomic nuclei containing:

- 20 protons and 20 neutrons
 - 21 protons and 19 neutrons
 - 22 neutrons and 18 protons
 - 20 protons and 22 neutrons
 - 21 protons and 20 neutrons
- a. 1, 2 and 3
b. 3 and 4
c. 1 and 5
d. 1, 4 and 2, 5
e. no isotopes are indicated

14. (4 pts) Liquid hydrogen boils at $-253\text{ }^{\circ}\text{C}$.

What is its boiling point on the Kelvin scale? **20. K**

15. (5 pts) Consider a typical ionic solid and a typical molecular solid. Which do you expect to have the higher melting point? Why?

Ionic substances will have the higher melting point. Ionic substances are held together by strong positive charge – negative charge interactions in a lattice structure, while molecular solids are held together by weaker intermolecular forces.

16. (3 pts) Name the chemical element represented by the following symbols:

Cu	copper	Si	silicon
Ca	calcium		

17. (2 pts) Are the equations below balanced (yes / no)?

a. $\text{CH}_4 + 2\text{O}_2 \rightarrow \text{CO}_2 + 2\text{H}_2\text{O}$ **Yes**

b. $\text{Na}_2\text{CO}_3 + 2\text{HCl} \rightarrow 2\text{NaCl} + \text{H}_2\text{O} + 2\text{CO}_2$ **No**

18. (5 pts) A sample of vegetable oil has a density of 0.916 g/mL . What is the mass of 225 mL of the oil?

- a. 245 g
 - b. $4.07 \times 10^{-3}\text{ g}$
 - c. 206 g**
 - d. 225 g
 - e. none of the above
-

19. (9 pts) For each of the following elements, write its chemical symbol, determine the name of the group to which it belongs (if the group has a special name), and indicate whether it is a metal, metalloid or nonmetal:

Element	Symbol	Name of group	Metal, metalloid or nonmetal
iodine	I	halogens	nonmetal
magnesium	Mg	alkaline earths	metal
argon	Ar	noble gases	nonmetal

20. (2 pts) Circle the correct formula for the phosphate ion.

- a. PO_4^{2-} b. PO_4^{3-} c. PO_4^-
d. P_2O_4^- e. $\text{P}_2\text{O}_4^{2-}$

21. (4 pts) Rutherford made the following observations during his α -scattering (gold foil) experiments.

1. most α particles were not appreciably deflected as they passed through the gold foil.
2. a few α particles were deflected at very large angles.

What did these tell him about the structure of the atom?

1. The atom is mostly empty space.
2. There is a small nucleus which includes most of the mass and has a positive charge, which repels the α particles strongly.

22. (2 pts) Which one of the following compounds is correctly described as a hydrate?

- a. CaH_2 b. $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$ c. H_2O
d. HCl e. NaOH
-

23. (3 pts) The statement in Dalton's atomic theory that all atoms of the same element are exactly alike has been replaced in the modern atomic theory because of the discovery of:

- a. atoms of the same element with different masses
- b. the bending of cathode rays by magnets
- c. electrons and protons in the same atom
- d. the law of multiple proportions

24. (4 pts) (a) Use the periodic table to write the symbols for the ions of:

K K^+ Al Al^{3+}

(b) What is the charge on all the simple ions of metals of Group IIA? +2

(c) What is the charge on all the simple ions of non-metals of Group VIIA? -1

25. (8 pts) Two elements, Qr and E, combine to form an ionic compound whose formula is QrE_2 . Qr also combines with element Z to form an ionic compound, Qr_3Z_2 . Based on this information, what is a reasonable value for the charge on E? Circle your answer.

- a. +1
 - b. -1
 - c. +2
 - d. -2
 - e. -3
-

26. (6 pts) Express the result of the following operations (involving measured quantities) to the correct number of significant figures.

(a) $8.520 + 12.0 + 0.7 = 21.2$

(b) $\frac{(35.1 - 34.2)}{1.620} = 0.6$

27. (5 pts) A caterpillar travels 86.2 feet in 2.0 days. What is speed of the caterpillar in millimeters per minute?

$$\frac{86.2 \text{ ft}}{2.0 \text{ days}} \cdot \frac{12 \text{ in}}{1 \text{ ft}} \cdot \frac{2.54 \text{ cm}}{1 \text{ in}} \cdot \frac{10 \text{ mm}}{1 \text{ cm}} \cdot \frac{1 \text{ day}}{24 \text{ hr}} \cdot \frac{1 \text{ hr}}{60 \text{ min}} =$$

$$9.1 \text{ mm/min}$$
