

Name _____

ID # _____

INSTRUCTIONS:

- PRINT your name and ID# above.
- Code the answers to the True-False and Multiple-Choice questions on the scantron form. Mark **A** for true and **B** for false. There is only *one* correct answer for each multiple choice question. There is no partial credit given for this section.
- Show all work on the problems section because partial credit is awarded for this section.
- On the scantron form, write the color of your exam above your name.
- Below your ID# above, answer the following question. What is your favourite colour? You will receive 1 bonus pt.
- There are **86** points on this exam.

GOOD LUCK! ENJOY!!

PART I: True-false statements (3 points each)

1. The number 1.050×10^9 contains **3** significant figures.
2. The $^{37}\text{Cl}^-$ ion has 3 more neutrons than protons.
3. $\text{H}_2\text{SO}_4(aq)$ is a strong electrolyte.
4. A student uses a 10 mL pipet to measure out three 10 mL volumes. The volumes were determined to be 10.03 mL, 9.98 mL, and 10.01 mL. The student's data is precise, but not accurate.

PART II: Multiple Choice (3 points each)

5. The SI prefixes *kilo* and *nano* represent, respectively:

[a] 10^3 and 10^{-9} [b] 10^{-3} and 10^9 [c] 10^3 and 10^{-6} [d] 10^3 and 10^{-3} [e] 10^1 and 10^{-9}

6. After carrying out the following operations, how many **significant figures** are appropriate to show in the result?

$$(13.7 + 0.027) \div 8.221 =$$

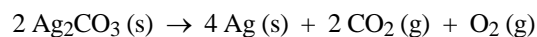
[a] 1 [b] 2 [c] 3 [d] 4 [e] 5

7. How many **cubic inches** are in 1.00 L? [2.54 cm = 1 in, 1 mL = 1 cm³]
- [a] 61.0 in³ [b] 155 in³ [c] 394 in³ [d] 1.64×10^4 in³ [e] none of these
8. When J.J. Thomson discovered the electron, what physical property of the electron did he measure?
- [a] its numerical charge [b] its charge-to-mass ratio [c] its temperature
[d] its mass [e] its atomic number
9. The elements in a column of the periodic table are known as:
- [a] metalloids [b] a period [c] noble gases [d] a group [e] nonmetals
10. Isotopes are atoms that have the same number of _____ but differing number of _____ .
- [a] protons, electrons [b] neutrons, protons [c] protons, neutrons
[d] electrons, protons [e] neutrons, electrons
11. Which pair of elements would be most likely to form an **ionic** compound?
- [a] P and Br [b] K and Cu [c] Al and F [d] C and S [e] Al and Rb
12. The formula of a salt is MCl₂, where M represents an unknown metal. The metal ion (M^{+x}) in this salt contains 28 electrons. The metal M is _____ .
- [a] Ni [b] Zn [c] Fe [d] V [e] Pd
13. What is the **molar mass** of acetaminophen, C₈H₉NO₂?
- [a] 151 g/mol [b] 76 g/mol [c] 43 g/mol [d] 162 g/mol [e] 125 g/mol
14. Calculate the number of **moles** of xenon (Xe) in 12.0 g of xenon.
- [a] 1.00 mol [b] 0.0457 mol [c] 0.183 mol [d] 7.62×10^{-3} mol [e] 0.0914 mol
15. Which of the following samples contains the *greatest* number of **atoms**?
- [a] 200 g of Pb [b] 3.0 mol of Ar [c] 0.10 mol of Fe [d] 16 g He
[e] 6.022×10^{23} O₂ molecules
16. How many **moles** of *oxygen* atoms are there in 10 moles of KClO₃?
- [a] 3 mol [b] 3.3 mol [c] 10 mol [d] 30 mol [e] 6.02×10^{24} mol
17. What is the **coefficient of H₂O** when the following equation is properly balanced with the smallest set of *whole number* coefficients?
- $$\text{___ Al}_4\text{C}_3 + \text{___ H}_2\text{O} \rightarrow \text{___ Al(OH)}_3 + \text{___ CH}_4$$
- [a] 3 [b] 4 [c] 6 [d] 12 [e] 24

18. A compound with the empirical formula, CH_2 , has a molar mass of 84 g/mol. What is the **molecular formula** of this compound?

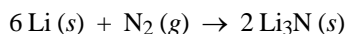
- [a] C_7H_{14} [b] C_6H_{12} [c] C_4H_8 [d] C_3H_6 [e] CH_2

19. How many **grams of Ag_2CO_3** must have been decomposed if 75.1 g of silver (Ag) was obtained in the reaction



- [a] 14.7 g [b] 58.8 g [c] 96.0 g [d] 192 g [e] 384 g

20. Lithium and nitrogen react to produce lithium nitride:



In a certain experiment, 18.0 moles of Li are reacted with excess N_2 . If 4.00 moles of Li_3N are actually obtained during this reaction, what is the **percent yield** of this reaction?

- [a] 89.9% [b] 22.2% [c] 33.3% [d] 50.0% [e] 66.7%

21. Which of the following compounds are **soluble** in water?

- I) K_2SO_4 II) AlPO_4 III) BaSO_4 IV) FeCl_3 V) NaOH

- [a] I, IV, V [b] II, III [c] II, III, V [d] I, IV [e] I only

22. In accordance with the solubility rules, which of the following is **true** when solutions of $\text{ZnSO}_4(\text{aq})$ and $\text{MgCl}_2(\text{aq})$ are mixed?

- [a] ZnCl_2 will precipitate.
[b] ZnSO_4 will precipitate.
[c] MgSO_4 will precipitate.
[d] MgCl_2 will precipitate.
[e] No precipitate will form.

PART III: Problems

23. Naming compounds. [6pts]

[a] Write correct names for the following formulas.

1) CuO _____

2) Al(NO₂)₃ _____

3) NF₃ _____

[b] Write correct chemical formulas for the following compounds.

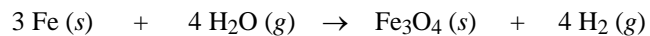
1) tetraphosphorus decasulfide _____

2) iron(III) carbonate _____

3) sodium sulfide _____

24. Mannitol, a sugar found in seaweed, is 39.56% C, 7.747% H, and 52.70% O by mass. What is the **empirical formula** of mannitol? [5 pts]

25. A commercial method of manufacturing hydrogen involves the reaction of iron (Fe) and steam (H₂O).



Molar masses: 55.85 g/mol 18.02 g/mol 231.6 g/mol 2.016 g/mol

[a] 1.25 moles of Fe are combined with 1.60 moles of H₂O. Which reactant is the **limiting reagent**? You must **SHOW WORK** to receive credit. [3 pts]

[b] How many **grams** of Fe₃O₄ are produced in the above reaction, assuming complete reaction? [3 pts]

[c] How many **moles** of excess reactant remain after the reaction is complete? [3 pts]

Potentially Useful Information

Avogadro's number = 6.022×10^{23} particles/mole

1 g = 6.022×10^{23} amu

electron charge = -1.6022×10^{-19} C

1 in = 2.54 cm (exactly)

% yield = $\frac{\text{actual yield}}{\text{theoretical yield}} \times 100$

1 lb = 454 g

1 L = 1.06 qt

4 qts = 1 gal

1 mi = 1609 m

molar mass = $\frac{\text{g of substance}}{\text{mol of substance}}$

SOLUBLE COMPOUNDS	EXCEPTIONS
Compounds containing alkali metal ions (Li^+ , Na^+ , K^+ , Rb^+ , Cs^+) and the ammonium ion (NH_4^+)	
Nitrates (NO_3^-), bicarbonates (HCO_3^-), and chlorates (ClO_3^-)	
Halides (Cl^- , Br^- , I^-)	Halides of Ag^+ , Hg_2^{2+} , and Pb^{2+}
Sulfates (SO_4^{2-})	Sulfates of Ag^+ , Ca^{2+} , Sr^{2+} , Ba^{2+} , and Pb^{2+}
INSOLUBLE COMPOUNDS	EXCEPTIONS
Carbonates (CO_3^{2-}), phosphates (PO_4^{3-}), chromates (CrO_4^-), and sulfides (S^{2-})	Compounds containing alkali metal ions and the ammonium ion
Hydroxides (OH^-)	Compounds containing alkali metal ions and the Ba^{2+} ion

Answer Key

- 1) F 2) T 3) T 4) F 5) a 6) c 7) a 8) b 9) d
10) c 11) c 12) b 13) a 14) e 15) d 16) d 17) d 18) b
19) c 20) e 21) a 22) e

- 23) a) 1) copper(II) oxide
2) aluminum nitrite
3) nitrogen trifluoride

- b) 1) P_4S_{10}
2) $Fe_2(CO_3)_3$
3) Na_2S

24) $C_3H_7O_3$

- 25) a) H_2O
b) 92.64 g Fe_3O_4
c) 0.0500 mol Fe