**Vitamin A**

Helps form and maintain healthy teeth, skeletal and soft tissue, mucous membranes, and skin.
CHEM 1305/1405 Final Exam

PART I – Multiple choice (2 points each)

Mark your correct answer on your Scantron.

1. Which number does not have 5 significant figures?
   A) 203.28  B) 426.00  C) 5123.200  D) 60812

2. A patient with heat stroke has a temperature of 109 °F. What does this read on a Celsius thermometer?
   A) 45°C  B) 43°C  C) 41°C  D) 39.5°C

3. What is the mass (in amu) of a carbon-12 atom?
   A) 12 amu exactly  B) 12.01 amu  C) 6.00 amu  D) 11.99 amu

4. How many grams of gold (Au) are there in 15.3 moles of Au?
   A) 9.21 x 10^{24} g  B) 7.77 x 10^{-2} g  C) 15.3 g  D) 3.01 x 10^3 g

5. Perform the following calculation and round off the answer to the proper significant figures: \(0.3614 \times 2.75 =\)
   A) 0.99385  B) 0.994  C) 0.99  D) 1.00

6. How many electrons (e), protons (p), and neutrons (n) are in an atom of \(^{127}_{53}X^-\)?
   A) 74e, 53p, 74n  B) 54e, 53p, 74n  C) 54e, 74p, 53n  D) 53e, 54p, 74n

7. Which electron sublevel comes after the 5p sublevel according to increasing energy?
   A) 6p  B) 5d  C) 5s  D) 6s

8. The correct name for Na\(_3\)PO\(_4\) is:
   A) trisodium phosphate  B) sodium phosphite  C) sodium phosphate  D) trisodium phosphorous tetraoxide

9. How many neutrons are in the nucleus of an atom of \(^{60}_{27}\)Co?
   A) 27  B) 33  C) 60  D) 87

10. Under constant-pressure conditions a sample of hydrogen gas initially at 88 °C and 9.6 L is cooled until its final volume is 3.4 L. What is its final temperature?
    A) 31.2 °C  B) 31.2 K  C) 1.0 x 10^3 K  D) 1.3 x 10^2 K

11. What is the chemical formula for sulfuric acid?
    A) H\(_2\)S  B) H\(_2\)SO\(_3\)  C) H\(_2\)SO\(_4\)  D) H\(_3\)SO\(_4\)

12. Which of the following types of chemical reactions is illustrated below?
    \(\text{H}_2\text{SO}_4\text{(aq)} + \text{NaOH}\text{(aq)} \rightarrow \text{Na}_2\text{SO}_4\text{(aq)} + \text{H}_2\text{O}\text{(l)}\)
    A) combination  B) decomposition  C) single replacement  D) double replacement
13. Which one of the following is properly labeled?
   A) Ar (noble gas)  B) K (alkaline earth metal)
   C) Ca (halogen)    D) Br (alkaline earth metal)

14. Which name is incorrect?
   A) N₂O₄, dinitrogen dioxide  B) PCl₃, phosphorous trichloride
   C) Na₄C, sodium carbide      D) Cu₂O, copper (I) oxide

15. A 0.118 kg block of zinc (Sₚ = 1.45 J/g. °C) is cooled from 187°C to 102°C. How much
    energy, in kilojoules, is removed?
    A) 76.9 kJ  B) 14.5 kJ  C) 151 kJ  D) none of the above

16. The formulas of the nitrate ion, the phosphate ion, and the hydrogen sulfite ion
    are represented, respectively, as:
    A) NO₂⁻, PO₃³⁻, HSO₄⁻  B) NO₃⁻, PO₄³⁻, HSO₃⁻
    C) NO₂⁻, PO₄³⁻, HSO₄⁻  D) NO₂⁻, PO₃³⁻, HSO₃⁻

17. 4.75 micrometers are equal to how many nanometers?
    A) 0.475 nm  B) 47.5 nm  C) 4750 nm  D) none of the above

18. The boiling point of nitrogen is −77.0 °C. What is it on the Fahrenheit scale?
    A) −171 °F  B) −107 °F  C) −60.6 °F  D) −74.2 °F

19. Which one of the following compounds will have both dipole and London forces operating between
    the molecules?
    A) CCl₄  B) H₂O  C) CH₃CH₂–O–CH₃  D) CO₂

20. What are the atomic number, mass number, and number of electrons in ³¹P³⁻?
    A) 15, 31, 18  B) 31, 15, 15  C) 15, 31, 15  D) 31, 15, 31

21. 1.35 liters are equal to how many milliliters?
    A) 0.00135 mL  B) 135 mL  C) 1350 mL  D) 0.0135 mL

22. The correct name for K₂CO₃ is;
    A) calcium bicarbonate  B) potassium bicarbonate
    C) calcium carbonate    D) potassium carbonate

23. How many moles are there in 57 g of C₂H₆?
    A) 34  B) 0.5263  C) 0.1710  D) 1.9

24. The total pressure in a vessel containing helium collected over water at 25.0 °C was
    0.87 atm. The vapor pressure of water at that temperature is 23.8 torr.
    What was the pressure of helium in torr?
    A) 23.02  B) 637.4  C) 22.93  D) 661.2

25. How many grams of NaCl are present in 125 mL of a 5 % w/v NaCl solution?
    A) 6.25  B) 25  C) 0.4  D) 5
26. What are the predicted products from the following decomposition reaction?
   \[ \text{Al(HCO}_3\text{)}_3 \text{(s)} \rightarrow \]
   A) Al, H₂, and CO₂
   B) Al₂(CO₃)₃ and H₂O
   C) Al₂(CO₃)₃, H₂, and CO₂
   D) Al₂(CO₃)₃, H₂O, and CO₂

27. What is the balanced equation for the complete combustion of \( \text{C}_7\text{H}_{14}\text{O}_7 \) (found in the fruit of the avocado tree)?
   A) \( \text{C}_7\text{H}_{14}\text{O}_7 \rightarrow 7 \text{CO}_2 + 7 \text{H}_2\text{O} \)
   B) \( 2 \text{C}_7\text{H}_{14}\text{O}_7 + 21 \text{O}_2 \rightarrow 14 \text{CO}_2 + 14 \text{H}_2\text{O} \)
   C) \( \text{C}_7\text{H}_{14}\text{O}_7 + 7 \text{O}_2 \rightarrow 7 \text{CO}_2 + 7 \text{H}_2\text{O} \)
   D) \( \text{C}_7\text{H}_{14}\text{O}_7 + \text{O}_2 \rightarrow 14 \text{CO}_2 + 14 \text{H}_2\text{O} \)

28. What is the percent by mass of water in the hydrate \( \text{CuSO}_4 \cdot 5 \text{H}_2\text{O} \)?
   A) 22.7%
   B) 36.1%
   C) 42.8%
   D) 49.2%

29. What is the term for the resistance of a liquid to flow?
   A) density
   B) dispersion forces
   C) surface tension
   D) viscosity

30. Draw the electron dot formula for silicon tetrabromide, \( \text{SiBr}_4 \). How many pairs of nonbonding electrons are in a silicon tetrabromide molecule?
   A) 1
   B) 2
   C) 4
   D) 12

31. How many moles of calcium (Ca) atoms are in 77.4 g of Ca?
   A) \( 4.66 \times 10^{-25} \text{ mol} \)
   B) 1.93 mol
   C) \( 1.29 \times 10^{-22} \text{ mol} \)
   D) 0.518 mol

32. A 36.4-L volume of methane gas is heated from 25 °C to 88 °C at constant pressure. What is the final volume of the gas?
   A) 128.1 L
   B) 44.1 L
   C) 30.0 L
   D) 80.5 L

33. Fifteen milligrams are equal to how many nanograms?
   A) \( 15 \times 10^6 \text{ ng} \)
   B) \( 15 \times 10^3 \text{ ng} \)
   C) \( 15 \times 10^9 \text{ ng} \)
   D) \( 15 \times 10^4 \text{ ng} \)

34. What is the overall ("electron pair or "electron domain") geometry and the molecular geometry of the water molecule?
   A) trigonal planar, bent
   B) tetrahedral, tetrahedral
   C) tetrahedral, bent
   D) trigonal pyramidal, linear

35. Which of the following pairs of elements are likely to form a covalent compound?
   A) Li and Cl
   B) O and Cl
   C) K and O
   D) Na and Mg
Show your work clearly in the space provided.

1. Complete the following table:

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<th>Symbol</th>
<th>Atomic Number</th>
<th>Mass Number</th>
<th>Number of Protons</th>
<th>Number of Electrons</th>
<th>Number of Neutrons</th>
<th>Overall Charge</th>
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2. In the following reaction, iron metal was reacted with excess oxygen gas, forming iron(III) oxide, $\text{Fe}_2\text{O}_3$, as the product. How many grams of $\text{Fe}_2\text{O}_3$ will form if we start with 5.00 g of iron?

$$4 \text{ Fe (s)} + 3 \text{ O}_2 (g) \rightarrow 2 \text{ Fe}_2\text{O}_3 (s)$$

3. Naturally occurring iron contains 5.82% $^{54}$Fe, 91.66% $^{56}$Fe, 2.19% $^{57}$Fe, and 0.33% $^{58}$Fe. The respective atomic masses are 53.940 amu, 55.935 amu, 56.935 amu, and 57.933 amu. Calculate the average atomic mass of iron.
4. Balance the following reactions.

a) \[ \underline{____} \text{C}_6\text{H}_{12}\text{O}_6 + \underline{____} \text{O}_2 \rightarrow \underline{____} \text{CO}_2 + \underline{____} \text{H}_2\text{O} \]

b) \[ \underline{____} \text{HPO}_3 + \underline{____} \text{C} \rightarrow \underline{____} \text{H}_2 + \underline{____} \text{P}_4 + \underline{____} \text{CO} \]

5. a) Draw the dot structure of the ozone molecule, \( \text{O}_3 \).

b) What is the overall, or "electron pair" geometry of this ion? _______________________________

c) What is the molecular geometry of this ion? _______________________________

d) Is this ion polar or nonpolar? _______________________________

6. A substance, \( \text{C}_x\text{H}_y \), has the composition by mass 85.63 % \( \text{C} \) and 14.37 % \( \text{H} \).

a) Calculate the empirical formula of this substance.

b) What is its molecular formula if its molar mass is 70.1 g/mol?
Answers

Multiple Choice


Show Work

1. 

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2. moles of Fe = 0.08353 mol, moles of Fe$_2$O$_3$ = 0.04477 mol, grams of Fe$_2$O$_3$ = 7.15 g

3. 3.139308 amu + 51.270021 amu + 1.2468765 amu + 0.1911789 amu = 55.8473844 amu
   Round answer to two places after the decimal: 55.85 amu

4. a) Coefficients are 1, 6, 6, 6
   b) Coefficients are 4, 12, 2, 1, 12

5. a) (two resonance forms)
   b) Overall geometry = trigonal planar
   c) Molecular geometry = bent

6. a) Empirical formula = CH$_2$  b) Molecular formula = C$_5$H$_{10}$