Q1. Perform the following calculations to the correct number of significant figures.

$$\frac{(4.562 \text{ x } 3.99870)}{(452.6755 - 452.33)}$$

A) 53
B) 52.8
C) 52.80
D) 52.799
E) 52.7990

Q2. The boiling point of helium is 4K. An equivalent temperature would be,

A) −452°F
B) −269°F
C) +531°F
D) −180°F
E) −212°F

Q3. Which one of the following statements is true?

A**)** The number of electrons and protons are equal in the neutral atom.
B) All particles in the nucleus of an atom is charged.
C) The number of neutrons must be equal to number of electrons in the neutral atom.
D) The mass of the nucleus is a very small fraction of the mass of the entire atom.
E) The atom is best described as a uniform sphere of matter in which electrons are embeded.

Q4. Two elements, A and B, combine to form two binary compounds. In the first compound, 14.0 g of A combines with 3.00 g of B. In the second compound, 7.00 g of A combines with 4.50 g of B. If the formula of the second compound is AB then the formula of the first compound would be,

A) A_3B
B) AB_3
C) A_2B_3
D) A_2B
E) AB_2

Q5. The correct name for $Ti(NO_3)_4$ is,

A) Titanium(IV) nitrate.
B) Titanium(VI) nitrite.
C) Titanium nitrate
D) Titanium tetranitrate
E) Titanium nitrite.

Q6. The atomic mass of an element X is 51.7 amu. If the element X consists of two isotopes of mass 50 amu and 52 amu, what is the natural abundance of the lighter isotope?

A) 15%
B) 100%
C) 45%
D) 85%
E) 55%

Q7. The copper sulfate crystal has the molecular formula, $CuSO_4 \bullet 5H_2O$. How many oxygen atoms are there in a 1.00 g sample of crystalline copper sulfate?

A) 2.17×10^{22} atoms
B) 9.65×10^{21} atoms
C) 1.21×10^{22} atoms
D) 1.62×10^{22} atoms
E) 8.25×10^{21} atoms

Q8. Determine the empirical formula for a compound that contains only C, H, and N, given the following composition by mass: 58.82 % C and 27.45 % N.

A) $C_5N_2H_{14}$
B) C_4N_2H
C) C_5NH_7
D) C_4NH_{10}
E) C_4NH_7

Q9. If 36.8 g C_2H_6 are burned in the presence of 112 g oxygen, according to the equation,

$$2\ C_2H_6\ (g) + 7\ O_2\ (g) \rightarrow 4\ CO_2\ (g) + 6\ H_2O\ (l)$$

How many grams of C_2H_6 will be left after the burn?

A) 6.73 g
B) 30.1 g
C) 4.37 g
D) 2.44 g
E) 8.23 g

Q10. The reaction,

$$N_2 (g) + 3 H_2(g) \rightarrow 2 NH_3 (g),$$

has a percent yield of 85 %. How many grams of NH_3 are produced from 12.0 g N_2 when H_2 is presence in excess?

A) 12.4 g
B) 14.6 g
C) 3.13 g
D) 7.30 g
E) 24.8 g

Q11. When the following oxidation-reduction reaction that occurs in **basic** solution is balanced,

$$MnO_4^- + ClO_2^- \rightarrow MnO_2 + ClO_4^-$$

the sum of **all** coefficients of the products and reactants is,

A) 20
B) 15
C) 24
D) 25
E) 30

Q12. Calculate the concentration of potassium ions, K^+, in a 500. mL solution containing 2.00 g K_3PO_4.

A) 5.65 $\times 10^{-2}$ M
A) 3.77 $\times 10^{-5}$ M
C) 1.88 $\times 10^{-2}$ M
D) 2.83 $\times 10^{-2}$ M
E) 1.41 $\times 10^{-2}$ M

Q13. When aqueous solutions of $CaCl_2$ and Na_3PO_4 are mixed, $Ca_3(PO_4)_2$ precipitates. Calculate the mass of $Ca_3(PO_4)_2$ formed when 2.00 liters of 1.00 M $CaCl_2$ and 3.00 liters of 0.500 M Na_3PO_4 are mixed.

A) 207 g
B) 232 g
C) 0.667 g
D) 0.750 g
E) 610 g

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Q14. An aqueous solution containing 2.20 g sample of an unknown acid which has one acidic proton per molecule required 25.0 mL of 0.500 M NaOH to react completely. Calculate the molar mass of the acid.

A) 176 g/mol
B) 27.5 g/mol
C) 55.0 g/mol
D) 89.0 g/mol
E) 124 g/mol

Q15. Consider the following oxidation-reduction reaction,

$$OH^- (aq) + H_2O (l) + NO_2^-(aq) + 2Al(s) \rightarrow NH_3(g) + 2AlO_2^- (aq).$$

Which of the following statements is correct?

A) Al is a reducing agent.
B) NO_2^- is a reducing agent.
C) H_2O is an oxidizing agent.
D) OH^- is a reducing agent.
E) The oxidation state of N in NO_2^- is -3.

Q16. If a 0.35 mole of argon gas at 13°C and 568 torr is heated to 56°C and a pressure of 897 torr, the change in its volume is,

A) –3 L
B) 1 L
C) –2 L
D) 5 L
E) –4 L

Q17. Which of the following statement(s) is (are) true.

I At constant temperature, the lighter the gas molecule, the faster the average velocity of the gas.
II At constant temperature and volume, as more gas is added to a container, the total pressure increases.
III At constant volume and moles, the kinetic theory predicts that pressure of gas is inversely proportional to temperature.

A) I and II
B) I and III
C) I only
D) II only
E) III only

Q18. An unknown diatomic gas has a density of 3.164 g/L at STP. This gas is,

A) Cl_2
B) Br_2
C) H_2
D) O_2
E) N_2

Q19. A 2.00 L sample of O_2 gas was collected over water at a total pressure of 785 torr and 25.0°C. When the O_2 gas was dried (water vapor removed), the gas had a volume of 1.94 L at 25.0°C and 785 torr. Calculate the vapor pressure of water at 25.0°C.

A) 23.5 torr
B) 75.2 torr
C) 50.4 torr
D) 785 torr
E) 100 torr

Q20. The root mean square velocity of CH_4 at 273 K is,

A) 652 m/s
B) 50.1 m/s
C) 312 m/s
D) 11.1 m/s
E) 201 m/s