

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

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

- 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) $+531^{\circ}\text{F}$
- 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 embedded.

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 $\text{Ti}(\text{NO}_3)_4$ 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%

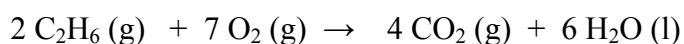
Q7. The copper sulfate crystal has the molecular formula, $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$. How many oxygen atoms are there in a 1.00 g sample of crystalline copper sulfate?

- 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) $\text{C}_5\text{N}_2\text{H}_{14}$
- B) $\text{C}_4\text{N}_2\text{H}$
- C) C_5NH_7
- D) C_4NH_{10}
- E) C_4NH_7

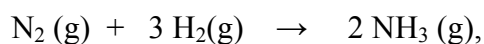
Q9. If 36.8 g C_2H_6 are burned in the presence of 112 g oxygen, according to the equation,



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

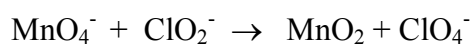
Q10. The reaction,



has a percent yield of 85 %. How many grams of NH_3 are produced from 12.0 g N_2 when H_2 is present 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,



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

Q13. When aqueous solutions of CaCl_2 and Na_3PO_4 are mixed, $\text{Ca}_3(\text{PO}_4)_2$ precipitates. Calculate the mass of $\text{Ca}_3(\text{PO}_4)_2$ formed when 2.00 liters of 1.00 M CaCl_2 and 3.00 liters of 0.500 M Na_3PO_4 are mixed.

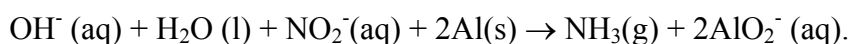
- A) 207 g
- B) 232 g
- C) 0.667 g
- D) 0.750 g
- E) 610 g

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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,



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) Cl₂
- B) Br₂
- C) H₂
- D) O₂
- E) N₂

Q19. A 2.00 L sample of O₂ gas was collected over water at a total pressure of 785 torr and 25.0°C. When the O₂ 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 CH₄ 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