

A Data Sheet with useful information is at the end.

1. (4) Write the molecular formula next to the names of the following compounds:

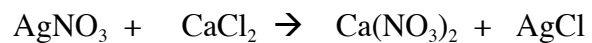
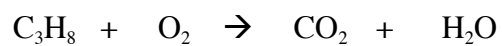
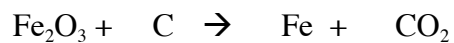
Ammonia

Ethane

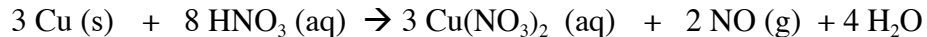
Calcium Carbonate

Potassium Perchlorate

2. (8) Balance the following chemical equations:

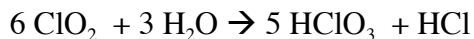


3. (8) Copper dissolves in dilute nitric acid according to the equation:



How many grams of nitric acid are required to dissolve 11.45 g of Cu according to this equation?

4. (8) Chlorine dioxide has been used as a disinfectant in air-conditioning systems. It reacts with water according to the equation:



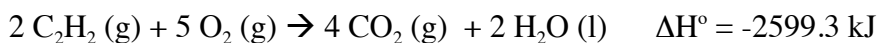
142.0 g of ClO_2 are mixed with 38.0 g of H_2O .

a) (4) Which is the limiting reactant

b) (4) How many g of the excess reactant will remain if the reaction goes to completion?

5. (8) How many mL of O₂ measured at 27 °C and 654 torr are needed to react completely with 16.8 mL of CH₄ measured at 35 °C and 725 torr?

6. (8) The thermochemical equation for the combustion of acetylene is:



Use this equation and data from your data sheet to calculate the enthalpy of formation of acetylene gas.

7. (4) Calculate the percentage composition by mass for CaSO₄.

8. (4) Calculate the energy in joules of a photon of green light having a wavelength of 560 nm.

9. (4) Write an abbreviated (noble gas core) electron configuration for the following:

Zn

O^{2-}

In

Ni^{2+}

10. (4) (a) (2) Circle the larger atom in each pair:

i) Na or Si

ii) P or Sb

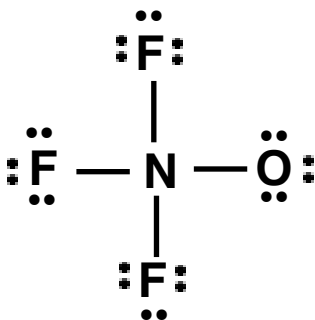
(b) (2) Circle the atom with the larger ionization energy in each pair:

i) B or O

ii) Cl or As

11. (10) (a) Draw all possible resonance structures for dinitrogen tetroxide (the two nitrogens are bonded to each other and two oxygens are bonded to each N). What is the nature of the NO and NN bonds (single, double, etc)?

12. (5) Assign formal charges to each atom in the following Lewis structure:



13. (8) Use Lewis structures and the VSEPR method to predict the molecular geometry and the bond angles of formaldehyde (CH_2O). What is the hybridization of the C atom?

14. (5) Using the VSEPR method and your knowledge about electronegativity and bond polarity, predict whether the molecule CCl_2F_2 is polar or nonpolar.

15. (5) Assign oxidation numbers to each element in the following compounds:

a) NaOCl

b) MnO_4^{2-}

c) TiCl_4

d) SO_3^{2-}

e) NO^+

16. (7) In a titration, 23.25 mL of 0.105 M NaOH was needed to react with 21.45 mL of H_2SO_4 solution. What is the molarity of the acid?

DATA SHEET

Speed of light : 2.9979×10^8 m/s

Planck's constant : 6.626×10^{-34} Js

$E_n = -2.179 \times 10^{-18} \text{ J/n}^2$

Mass of a proton: 1.67262×10^{-24} g

Mass of an electron: 9.10939×10^{-28} g

$R = 0.082058 \text{ L atm / (mol K)} = 62.364 \text{ L torr / (mol K)} = 8.3145 \text{ J / (mol K)}$

Substance ΔH_f° , kJ/mol

NH_3 (g) -46.11

H_2O (g) -241.8

H_2O (l) -285.9

NH_4Cl (s) -314.4

HCl (g) -92.31

C_2H_4 (g) 52.26

C_2H_6 (g) -84.68

CO_2 (g) -393.5

O_2 (g) 0