

Useful constants and other information:

$R = 0.0821 \text{ L}\cdot\text{atm}/\text{K}\cdot\text{mole}$ $R = 8.314 \text{ J}/\text{K}\cdot\text{mole}$ $h = 6.626 \times 10^{-34} \text{ J}\cdot\text{s}$

Specific heat of $\text{H}_2\text{O}(\text{l}) = 4.314 \text{ J}/\text{g}\cdot^\circ\text{C}$ $1 \text{ cal} = 4.184 \text{ J}$

PART I.

1. The name of the element corresponding to the symbol Sn is _____tin_____.
2. The name of the element corresponding to the symbol K is ___potassium_____.
3. The name of the element corresponding to the symbol F is ___fluorine_____.
4. The formula for the calcium phosphate is _____ $\text{Ca}_3(\text{PO}_4)_2$ _____.
5. The formula of iron (III) hypochlorite is _____ $\text{Fe}(\text{ClO}_3)_3$ _____.
6. The formula of magnesium sulfate is _____ MgSO_4 _____.
7. The name for the compound P_4O_{10} is ___tetraphosphorus dec(a)oxide_____.
8. The name for the compound CuI_2 is ___copper (II) iodide_____.
9. The symbol for an isotope of a neutral atom which has 75 neutrons and 75 electrons is
____ $^{150}_{75}\text{Rh}$ _____.
10. The isotope symbol $^{90}\text{Sr}^{2+}$ represents an atomic ion with ___38___ protons, ___36___
electrons and ___52___ neutrons.
11. Provide the coefficients needed to make the following a balanced chemical equation:
___4___ $\text{CH}_3\text{NH}_2(\text{g})$ + ___9___ $\text{O}_2(\text{g})$ ___4___ $\text{CO}_2(\text{s})$ + ___2___ $\text{N}_2(\text{g})$ + ___10___ $\text{H}_2\text{O}(\text{g})$
12. The number 1.05672 has ___6___ significant figures.
13. The number 15782 would be expressed in scientific notation as ___ 1.5782×10^4 _____
and has ___5___ significant figures
14. The number 0.005683 would be expressed in scientific notation as ___ 5.683×10^{-3} _____
and has ___4___ significant figures.

PART II.

1. Given that 1 lb is equivalent to 454 g and 1 inch is equivalent to 2.43 cm, convert a density of 3.5 kg/dm^3 to pounds per cubic feet (lb/ft^3).

Answer: $4.2 \times 10^2 \text{ lb/ft}^3$

2. Calculate the atomic weight (average atomic mass) of boron. Boron comes in two naturally occurring isotopes: ^{10}B (10.013 amu, 19.78% abundance) and ^{11}B (11.009 amu, 80.22% abundance)

Answer 10.88 amu

3. a) Calculate the molecular weight of NO and b) determine the number of grams of N that are in NO per gram of O.

a) 30.01 g/mol b) 0.8756 g N per g O

4. Calculate the empirical formula for a compound that contains the following percents by mass: 31.9% potassium, 28.9% chlorine and 39.2% oxygen.

Answer: KClO_3

5. For the balanced equation below, how many grams of hydrogen gas will be produced if 24.0 g of CaH_2 is reacted in excess water?



Answer: 2.30 g H_2

6. For the balanced equation below, name the limiting reactant and determine the theoretical yield of Cu (in grams) if 50.0 g CuO is reacted with 6.00 g of NH_3 gas.



Answer: NH_3 is limiting and the theoretical yield is 33.6 g Cu

7. For the conditions listed in question 6 above, what would be the percent yield if 15.3 grams were the actual amount of Cu produced in the reaction.

Answer: 45.5% yield

8. A balloon is filled to a volume of $5.0 \times 10^2 \text{ mL}$ at a temperature of 20.0°C and a pressure of 710 torr. If the balloon is then cooled to a temperature of 100K at the same pressure, what is the new volume of the balloon?

Answer: 0.64 L

9. Calculate the density of ammonia gas (NH₃) at 27°C and 635 torr.

Answer: 0.58 g/L

10. Oxygen gas can be produced in small quantities from the decomposition of potassium chlorate (shown below):



If 3.7 g of KClO₃ is reacted, what will the volume of gas be collected over water at 27°C and 735 torr? At 27°C, the vapor pressure of water is 26.7 torr.

Answer: 1.2 L

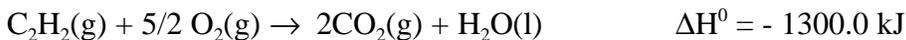
11. The diffusion rate of an unknown gas is measured to be 31.50 mL/min. Under identical conditions, the diffusion rate of O₂ gas is found to be 30.50 mL/min. What is the molecular weight of the unknown gas?

Answer: 34.13 g/mol

12. A 28.3 g sample of nickel metal, at a temperature of 99.8°C is dropped into 150.0 g of water with a temperature of 23.5°C. The final temperature of the metal and water is 25.0°C. Calculate the specific heat of the nickel metal.

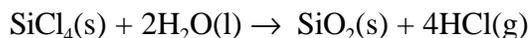
Answer: 0.44 J/g·K

13. Given the following data, calculate ΔH⁰ for the reaction, 2C(s) + H₂(g) → C₂H₂(g).



Answer: 229 kJ

14. Using the values of ΔH_f⁰ shown below, calculate ΔH⁰ for the reaction:



Compound	ΔH _f ⁰
SiCl ₄	-687 kJ
H ₂ O	-286 kJ
SiO ₂	-911 kJ
HCl	-92 kJ

Answer: -20 kJ

15. A bag of potato chips (total mass = 56 g) contains 19 g of fat, 28 g of carbohydrate and 5 g of protein. Calculate the total calorie content of the bag of potato chips. (fuel values are: fat = 38 J/g, carbohydrate = 17 J/g, protein = 17 J/g)

Answer: 0.3 Calories

16. The laser in a compact disk player uses a wavelength of 780 nm. What is the frequency of this light and what is the energy of a single photon emitted from this laser?

Answer: $3.8 \times 10^{14} \text{ s}^{-1}$

17. Give the full electronic configuration for the following neutral atoms: Si; Te

Si: $1s^2 2s^2 2p^6 3s^2 3p^2$

Te: $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6 5s^2 4d^{10} 5p^4$