

## Chemistry Summer Work (30 questions):

**Question #1.** Which of the following chemical species is an ion?

- a) He
- b)  $I_3^-$
- c)  $H_2S$
- d)  $Br_2$

**Question #2.** Which of the following chemical species is a compound?

- a) He
- b)  $I_3^-$
- c)  $H_2S$
- d)  $Br_2$

**Question #3.** Carbon-14 has an atomic number of 6 and a mass number of 14. This implies that:

- a) Carbon-14 has 6 neutrons and 6 protons
- b) Carbon-14 has 14 neutrons and 6 protons
- c) Carbon-14 has 8 neutrons and 6 protons
- d) Carbon-14 has 6 neutrons and 8 protons

**Question #4.** Which of the following atoms is the most electronegative?

- a) Si
- b) P
- c) O
- d) F

**Question #5.** Among the following elements, assign them to the appropriate families of *alkali metals*, *alkali earth metals*, *halogens*, *noble gases*, *transition metal*, *other*

element	family
sodium:	
magnesium:	
barium:	
phosphorus:	
neon:	
rhodium:	
fluorine:	

**Question #6.** In every Periodic Table, even the most basic, one can find two numbers associated with each type of element. For example, for zinc (Zn) those numbers are 30 and 65.409. Explain what these numbers represent.

**Question #7.**  $^{55}\text{Fe}$  is a radioactive isotope of iron that can be used to trace the movement of iron in biological systems. In biological experiments it is often added to a system as the +2 or +3 cation. How many protons, electrons and neutrons does the +2 cation of this isotope of iron ( $^{55}\text{Fe}^{2+}$ ) have (the atomic number of iron is 26)?

**Question #8.** The correct formula for nitric acid is:

- a)  $\text{HNO}_4$
- b)  $\text{H}_2\text{NO}_3$
- c)  $\text{HNO}_2$
- d)  $\text{HNO}_3$
- e)  $\text{H}_2\text{NO}$

**Question #9.** What is the molecular weight of  $\text{H}_2\text{O}$ ?

- a) 16.00 g
- b) 18.0 g
- c) 32.0 g
- d) 2.0 g
- e) 34.0 g

**Question #10.** Vanillin gives vanilla its pleasing smell. The formula for vanillin is  $\text{C}_8\text{H}_8\text{O}_3$ . How many moles of carbon are present in 2.75 grams of vanillin?

- a) 0.145 mole
- b) 0.108 mole
- c) 0.0145 mole
- d) 0.0108 mole
- e) 0.032 mole

**Question #11.** One gram of alum,  $\text{KAl}(\text{SO}_4)_2 \cdot 12\text{H}_2\text{O}$ , contains  $1.3 \times 10^{21}$  Al atoms. How many oxygen atoms are contained in 1.0 g alum?

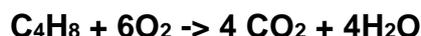
- a)  $1.3 \times 10^{21}$
- b)  $2.6 \times 10^{22}$
- c)  $1.6 \times 10^{22}$
- d)  $1.0 \times 10^{22}$
- e)  $2.1 \times 10^{22}$

**Question #12.** According to the following reaction, how many moles of water are formed out of a reactive mixture of 8 moles of  $\text{H}_2$  and 2 moles of  $\text{O}_2$ ?



- a) 8 moles
- b) 2 moles
- c) 4 moles
- d) 1 mole

**Question #13.** How many moles of oxygen (O<sub>2</sub>) are needed to produce 12 moles of carbon dioxide (CO<sub>2</sub>) in the following reaction:



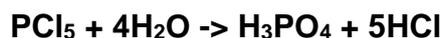
- a) 18 moles
- b) 6 moles
- c) 3 moles
- d) 2 moles

**Question #14.** Which of the choices completes this chemical equation correctly?



- a) (OH)<sub>3</sub><sup>3-</sup>
- b) 3 OH<sup>-</sup>
- c) 3 OH<sup>+</sup>
- d) 3 OH<sup>3-</sup>

**Question #15.** If 12.0 g of PCl<sub>5</sub> reacts completely with water in the balanced chemical reaction below, how many grams of HCl will be produced?

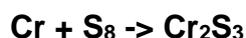


- a) 10.5 g
- b) 2.10 g
- c) 0.420 g
- d) 0.0952 g
- e) 0.0576 g

**Question #16.** Ammonia (NH<sub>3</sub>) is produced commercially by a very costly procedure in which nitrogen gas (N<sub>2</sub>) and hydrogen gas (H<sub>2</sub>) are combined at very high temperatures and pressures. If 9.246 x 10<sup>3</sup> g of nitrogen gas and 2.438 x 10<sup>3</sup> grams of hydrogen gas are reacted in this process, how many grams of NH<sub>3</sub> will be produced? The unbalanced chemical reaction for this process is: N<sub>2</sub> + H<sub>2</sub> → NH<sub>3</sub>

- a) 1.88 x 10<sup>3</sup> g
- b) 2.82 x 10<sup>3</sup> g
- c) 2.07 x 10<sup>4</sup> g
- d) 1.12 x 10<sup>4</sup> g
- e) 5.62 x 10<sup>3</sup> g

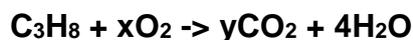
**Question #17.** When the equation below is properly balanced, what is the coefficient for S<sub>8</sub>?



- a) 1
- b) 2
- c) 3

- d) 4
- e) none of the above

**Question #18.** Balance the chemical equation for the combustion of propane:



- a)  $x=3, y=5$
- b)  $x=5, y=3$
- c)  $x=3, y=3$
- d)  $x=5, y=5$

**Question #19.** A 4.25 g portion of sodium chloride was dissolved to make up a 250.0 ml solution. Calculate the mass concentration of sodium chloride in mg/mL.

- a) 17 mg/mL
- b) 4.25 mg/mL
- c) 1060 mg/mL
- d) 4250 mg/mL
- e) 17000 mg/mL

**Question #20.** If 1.0 L of a 0.50 M NaCl solution is diluted to  $2.5 \times 10^3$  mL, what is the molarity of the resulting solution?

- a) 0.40 M
- b)  $2.0 \times 10^{-4}$  M
- c)  $4.0 \times 10^{-3}$  M
- d) 0.20 M
- e) 0.0020 M

**Question #21.** A sample weighed 0.5005 g and it was found to contain 287 mg of sodium bromide. Calculate the weight percent of sodium bromide in the sample.

- a) 0.573 %
- b) 36.4 %
- c) 57.3 %
- d) 0.364 %

**Question #22.** 10.0 g of a liquid that has a density of 2.0 g/mL needs to be measured out in a graduated cylinder. What volume of liquid should be measured?

- a) 2 L
- b) 20.0 mL
- c) 200 mL
- d) 5.0 mL
- e) 10.0 mL

**Question #23.** The density of water at 22°C is 0.9978 g/mL. Calculate the volume of 24.76 g of water.

- a) 24.76 mL
- b) 24.81 mL
- c) 24.71 mL
- d) 22.0 mL

**Question #24.** What is the mass of one mole of calcium phosphate ( $\text{Ca}_3(\text{PO}_4)_2$ )?

- a) 183 g
- b) 215 g
- c) 278 g
- d) 310 g

**Question #25.** An antacid tablet containing 0.50 g of  $\text{NaHCO}_3$  is dissolved in 250 mL of water. What is the molar concentration of  $\text{NaHCO}_3$  in the solution?

- a) 0.024 M
- b) 4.1 M
- c) 0.022 M
- d) 0.0060 M
- e) 0.0041 M

**Question #26.** How many mL of 0.250M  $\text{H}_2\text{SO}_4$  is required to completely react with 25.0 mL of 1.500 M  $\text{NaOH}$ ?

- a) 150 mL
- b) 50.0 mL
- c) 300. mL
- d) 75.0 mL
- e) none of the above

**Question #27.** A 25.00 mL portion of sulfuric acid was neutralized by adding 0.005578 mole of sodium hydroxide. Calculate the molar amount of sulfuric acid previously in the sample.

- a) 0.011156 mole
- b) 0.005578 mole
- c)  $5.0 \times 10^3$  mole
- d) 1.00 mole
- e) 0.00279 mole

**Question #28.** In the laboratory, you weigh an empty beaker and find it weighs 40.11 g. You then fill it with 8.0 mL of an unknown liquid, and weigh it again. It now weighs 49.63 g. What is the density (mass/volume) of the liquid?

- a) 9.5 g/mL
- b) 6.2 g/mL
- c) 5.0 g/mL
- d) 1.2 g/mL

**Question #29.** One mole of  $K_2Cr_2O_7$  has a mass of 294 g. You need to prepare 2.00 L of a solution that contains 0.100 mol/L of  $K_2Cr_2O_7$ . How many grams of  $K_2Cr_2O_7$  do you need?

- a) 29.4 g
- b) 48.2 g
- c) 58.8 g
- d) 588 g

**Question #30.** Assume that you are a physician administering a drug in a solution containing 5.0 mg drug/L solution. If the recommended dosage of the drug is  $3.5 \times 10^{-6}$  g per kg of body weight, what volume of solution would you prescribe daily for a 150 lb patient (1 lb = 454 g)?

- a) 48 mL
- b) 53 mL
- c) 86 mL
- d) 23 mL
- e) 97 mL

TIPS:

Moles = mass  $\div$  Mr

Concentration = moles  $\div$  volume

1L = 1dm<sup>3</sup>

1ml = 1cm<sup>3</sup>