IB Chemistry Summer Work 2024

Name: _____

DIRECTIONS: Answer the following questions. You may use your notes from your sophomore chemistry class and a calculator. You may also consult other students in the class and the Internet, but make certain you are doing your own work. On the multiple-choice questions (#2, 5 -11 & 24) circle the best answer. For the free response/calculation questions, write neatly and legibly, showing ALL work and circling the final answers.

This will be due on the first day of classes. Several questions will be graded at random. This assignment will serve as a quiz grade.

Pledge:

1. Below is a metric ruler. Each individual line represents one mm. If you were to use this ruler to measure the length of the copper wire, how many *significant digits* would be included in your measurement? Justify your answer.


2. Two students are conducting a laboratory investigation into the amount of heat produced in a chemical reaction. Part of the experiment is to record the initial temperature of the solutions. Which choice correctly shows the students' data table using the thermometers shown below? Circle your answer.
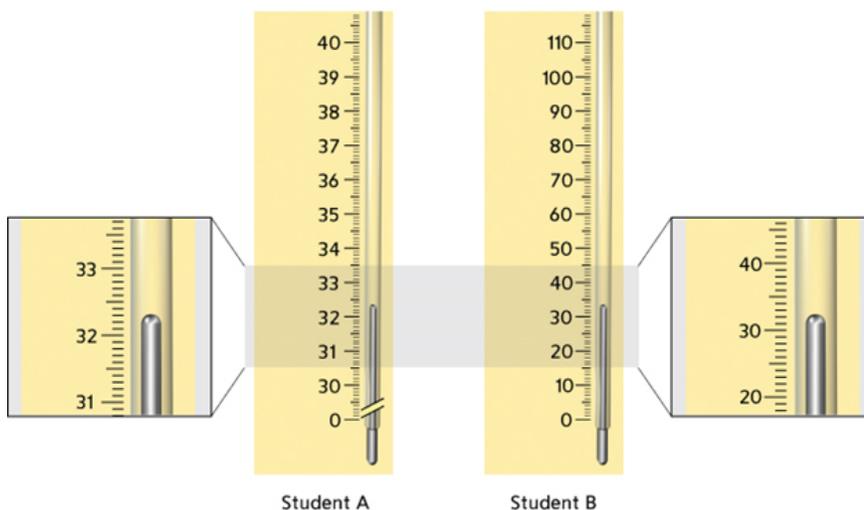
Student A   Student B

		Student A	Student B
a.	Initial temperature of the liquid	32°C	32°C
b.	Initial temperature of the liquid	32.3°C	32°C
c.	Initial temperature of the liquid	32.3°C	32.3°C
d.	Initial temperature of the liquid	32.33°C	32.3°C

3. The white spheres represent hydrogen atoms; the black spheres represent oxygen atoms. Does the following diagram represent a chemical or a physical change? Justify your answer in one sentence.
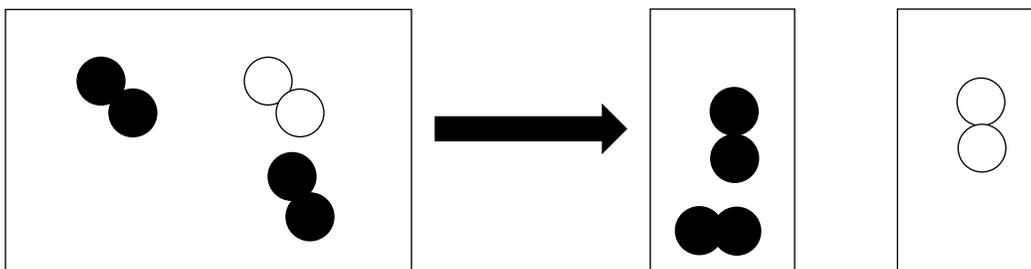
4. Below is some lab data collected by a Trinity student in sophomore chemistry. The student was attempting to ascertain the identity of an unknown substance by using the measurements below. He used water displacement to determine the volume of the material.

Mass (g)	Initial Volume (mL)	Final Volume (mL)
40.05	10.1	22.5

a. Would the information in the first column contain enough information alone to determine the identity of the material? Justify your answer using the terms.

b. With this data in hand, how would the student proceed to identify the composition of the unknown substance? Explain in full detail. What is needed?

c. What is the estimated digit in the mass measurement? Simply list it here. _____

d. To the correct number of significant figures, determine the volume of the unknown sample. Show all work; circle your answer.

e. To the correct number of significant figures, determine the density of the unknown sample. Show all work; circle your answer.

f. If the actual density of the material is 4.9 g/mL, calculate the percent error of the measurement. Show all work; circle your answer.

g. The student does not believe that he can evaluate the precision of these measurements. True or False? WHY?

5. F-20, a radioactive isotope of fluorine, has:
   a. 9 protons, 10 neutrons, and 1 electron
   b. 9 protons, 10 neutrons and 9 electrons
   c. 9 protons, 11 neutrons and 9 electrons
   d. 10 protons, 20 neutrons and 1 electron
   e. 9 protons, 20 neutrons and 9 electrons

6. What is the identity of $^{55}_{25}X^{+7}$?
   a. Zinc
   b. Silver
   c. Iridium
   d. Cesium
   e. Manganese

7. Which two atoms below have the same number of neutrons?
$$^{15}_{8}O \quad ^{16}_{8}O \quad ^{20}_{9}F \quad ^{20}_{10}Ne \quad ^{22}_{11}Na$$

   a. $^{15}_{8}O$ and $^{16}_{8}O$
   b. $^{16}_{8}O$ and $^{22}_{11}Na$
   c. $^{20}_{9}F$ and $^{20}_{10}Ne$
   d. $^{20}_{9}F$ and $^{22}_{11}Na$
   e. $^{20}_{10}Ne$ and $^{22}_{11}Na$

8. Which group of three elements contains a transition metal, a halogen, and a noble gas?
   a. S, I, Cu
   b. Br, Kr, Ba
   c. Ar, Hg, Rn
   d. Ce, N, He
   e. Cu, I, Xe

9. Magnesium reacts with a certain element X to form a compound with the general formula MgX. What is the most likely identity of element X?
   a. Cl
   b. O
   c. Mg
   d. N
   e. None of the above

10. Aluminum reacts with a certain element X to form a compound with the general formula Al_2X_3. What would the most likely formula be for the compound formed between potassium (K) and element X?
   a. K_2X
   b. KX_2
   c. K_2X_3
   d. KX
   e. None of the above

11. There are _____ electrons, _____ protons, and _____ neutrons in an atom of $^{132}_{54}Xe$
   a. 132, 132, 54
   b. 54, 54, 132
   c. 78, 78, 54
   d. 54,54,78
   e. 78, 78, 132

12. Element Xz has three naturally occurring isotopes with the following abundances and masses. Determine the average atomic mass.

| Abundance	mass (amu)
75.54%	30.9546
16.42%	31.9612
8.04%	32.9238

13. Determine the number of atoms in 2.05 g of carbon.

5

14. In a Bunsen burner, methane reacts with oxygen to produce carbon dioxide and water, as seen in the balanced equation below:

$$CH_4(g) + 2O_2(g) \rightarrow CO_2(g) + 2H_2O(g)$$
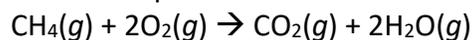
What mass of water can be produced from 16 grams of methane and excess oxygen?

15. A compound contains 1.10 mol of K, 0.55 mol of Te, and 1.65 mol of O. What is the simplest (empirical) formula of this compound?

16. When the equation below is balanced and all of the coefficients are reduced to lowest whole number terms, what is the coefficient for H_3PO_4?

$$Ca_3(PO_4)_2(s) + H_3PO_4(l) \rightarrow Ca(H_2PO_4)_2(s)$$
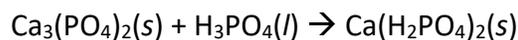
17. What is the mass (in grams) of 0.546 mol of cocaine ($C_{17}H_{21}NO_4$)?

18. **How many molecules** of dichloromethane (CH_2Cl_2) are present in 0.465 g?

19. If 16.4 g of oxygen gas react with excess hydrogen, what mass of water is produced?

20. Fill in the table below.

Isotope Symbol		$^{64}_{29}Cu^{2+}$			
Protons	3		76		
Neutrons	4				30
Electrons	3		75	18	
Atomic #					25
Mass #			190	32	
Net charge				-2	0

21. What is the mass in grams of 0.338 mol of glucose ($C_6H_{12}O_6$)?

22. A mixture of urea [$(NH_2)_2CO$] and H_2O are prepared by reacting ammonia (NH_3) with carbon dioxide. In one process, 637.2 g of NH_3 are allowed to react with 1142 g of CO_2.

    a. Write the balanced equation for the reaction (Ignore phases of matter).

    b. What is the theoretical yield of NH3 given the amounts of reactants listed above.

    c. What of the two reactants is the limiting reagent? To receive full credit, JUSTIFY your answer by supporting your claim with evidence from the calculations.

23. What is the charge on an ion with 21 protons, 25 neutrons, and 18 electrons?

24. Choose the correct statement.
    a. Metals make positive cations and nonmetals make negative anions.
    b. Metals make negative cations and nonmetals make positive anions.
    c. Metals make positive anions and nonmetals make negative cations.
    d. Metals make negative anions and nonmetals make positive cations.

25. Calculate the theoretical yield of ammonia that can be obtained from 150.0 g of N_2 and 65.5 g of H_2, according the balanced chemical equation, properly identifying the limiting reactant and the excess reactant below. To receive full credit, JUSTIFY your answer by supporting your claim with evidence from the calculations.

$$N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$$
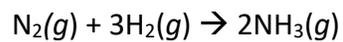
LIMITING REACTANT:

EXCESS REACTANT: