Poisoner's Handbook Video Questions Name _____per____

Section #1: Introduction and Cyanide (Beginning-21:40 minutes)

Directions: Please watch the Poisoner's Handbook using the following You Tube link.

https://youtu.be/V2_2862CFxA

Answer the questions below. You can write directly on this sheet or you can write on a separate sheet of paper. You will receive directions about how to submit this assignment. Look for a message from your teacher via Remind, Teams, and/or the School Website.

Introduction

1. There were _____(what number) poisonings in NYC in 1918.
2. True / False: The mayor appointed the Coroner. The position of Coroner could be occupied by anyone from the milkman to a construction worker; anyone could have the job.
3. Coroners were paid by the hour/body (circle one)
4. True / False: Coroners would sell manner or cause of death.
5. In 1918, Dr. Norris was the 1st Medical Examiner in NYC. He wanted a medical, legal, _____ system.
   Forensic / Justice

Cyanide

Dr. Gettler was Dr. Norris's toxicologist. At the beginning of the scene, Dr. Gettler asks the lab technicians to begin to prepare the chemicals needed for the steam distillation test for cyanide. Some of the chemicals included hydrochloric acid, sodium hydroxide, and ferric chloride. Answer the questions below about each of these chemicals. **Use the attached periodic table and reference sheet if needed.**

6. Write the chemical formula for sodium hydroxide. _____

7. Write the chemical formula for magnesium hydroxide. _____

8. Draw the Lewis structure for the polyatomic ion hydroxide—look up the formula & charge of hydroxide on the reference sheet if needed. This has **covalent bonding**.

9. Draw the Lewis structure for HCl (hydrochloride acid). This has **covalent bonding**.

10. Another name for ferric chloride is iron(III) chloride. Write the chemical formula for this compound.

11. Draw Lewis dot diagrams with **arrows** to show how iron(III) chloride is formed by **ionic bonds**. Remember, arrows show the transfer of valence electrons.

12. Cyanide chemical suffocation interferes with the body using what gas: hydrogen /oxygen / nitrogen?

13. Draw the Lewis structure for H_2 gas. (Covalent bonding)

14. Draw the Lewis structure for O_2 gas. (Covalent bonding)

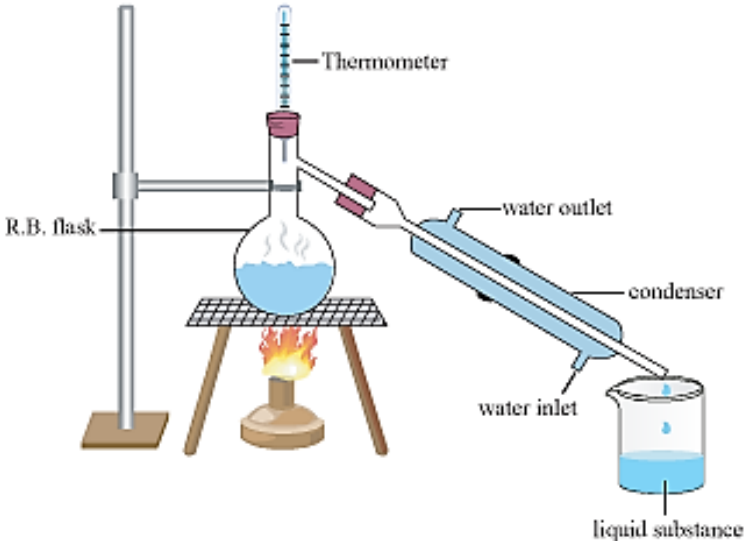
15. Draw the Lewis structure for N_2 gas. (Covalent bonding)

16. Arrange the gases from questions 13, 14, and 15 in terms of increasing bond length: shortest →longest.

17. Arrange the gases from questions 13, 14, and 15 in terms of increasing bond strength: weakest →strongest.

18. Dr. Gettler and the lab technicians performed a distillation. Click on the link below to watch the animation of a simple distillation. https://youtu.be/omBAWsyyOtw

    After watching the animation, use the diagram to explain how distillation works. Briefly list the summary steps involved in distillation.



19. Distillation is used to separate a liquid/liquid mixture using differences in: _____ of the two liquids.

20. What chemical test is used to detect cyanide? Russian Blue /Prussian Blue / Spot Test

21. Hydrogen cyanide was used to fumigate against pests/rodents. Hydrogen Cyanide must in ____ to cause death.

Inhaled / Ingested

22. Prussian blue and acid yields HCN. HCN stands for what chemical?
Hydrogen Carbon Monoxide / Hydrogen Cyanide / Helium Carbon Monoxide / Hydrogen Peroxide

23. Draw the Lewis structure for HCN. (Hint: carbon is in the middle. The molecule has covalent bonding.)

24. What is the molecular geometry (VSEPR) shape of HCN?

25. What is the bond angle around carbon (C) in HCN?

26. The Jackson double murder in the hotel: The victims' lips were blue and their skin had red spots. What was the COD (Cause of Death)? Alcohol poisoning / Cyanide Poisoning / Lead Poisoning

27. In what organ was cyanide found in Mr. Jackson? _____

28. True/False: A body after death produces a significant amount of cyanide during the decomposition process.

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Section #2: Arsenic & Methanol (21:40 minutes to 40:46 minutes)

Directions: Please watch the Poisoner's Handbook using the following You Tube link.

https://youtu.be/V2_2862CFxA

Answer the questions below. You can write directly on this sheet or you can write on a separate sheet of paper. You will receive directions about how to submit this assignment. Look for a message from your teacher via Remind, Teams, and/or the School Website.

Arsenic

1. What were some of the symptoms of arsenic poisoning that Fanny's brother experienced before his death?

2. Fanny was also accused of murdering her: mother in law/sister in law.

3. How do arsenic and bismuth behave differently upon heating?

4. Write the standard electron configuration for arsenic (As).

5. Write the noble gas electron configuration for arsenic (As).

6. How many valence electrons does arsenic contain?

7. The charge of an arsenide ion is As^{3-}. Using the periodic table, how many total electrons does this ion contain?

8. If the circle below represents the radius of an arsenic atom (As), draw a circle to represent the radius of a phosphorus (P) atom.

9. If the circle below represents the radius of an arsenic atom (As), draw a circle to represent the radius of a germanium (Ge) atom.

10. Use dimensional analysis (stoichiometry) to determine the number of moles of As present in 516 mg (milligrams) of arsenic powder. HINT: You need to convert milligrams to grams first! Show your work and label each quantity with a unit!

Methanol

11. When Prohibition initially occurred, what did the Salvation Army set up to help people quench their thirst?

12. Wood chips, furniture and sawdust / rocks/ cyanide were used to distill deadly methyl (wood) alcohol.

13. As methanol (methyl alcohol) breaks down in humans it produces 2 substances including: _____ and _____.

14. Formic acid attacks the _____ nerve, which will eventually leads to _____.

15. Symptoms of wood alcohol poisoning include nausea, seizures, and: heart attacks / coma

16. Methanol is so dangerous because its poisonous effects are slow to develop. It may take _____ days before the breakdown of methanol occurs and leads to the symptoms of poisoning.

17. Methanol has the formula CH_3OH. Using the skeleton diagram below, complete the Lewis structure for methanol. Remember the octet rule and the fact that hydrogen is an exception to the octet rule.

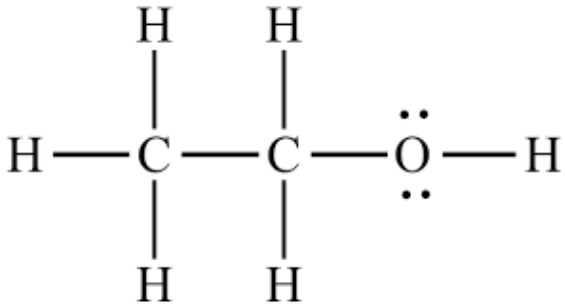
H

H C O H

H

18. Based on your Lewis structure for methanol CH_3OH, what is the molecular geometry around the carbon atom?

19. **Ethanol** CH_3CH_2OH is shown below. What is the bond angle around oxygen? What type of molecular geometry is around the **oxygen** atom in ethanol?



20. Using the Lewis structure for ethanol shown above in #19, how many lone electron pairs are present?

21. Using the Lewis structure for ethanol shown above in #19, how many total electrons are involved in **bonding**? How many pairs is this?

22. Balance the equation for the combustion of ethanol shown below.

$$\_\_\_\_\_C_2H_5OH + \_\_\_\_\_O_2 \rightarrow \_\_\_\_\_CO_2 + \_\_\_\_\_H_2O$$

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Section #3: Lead & Carbon Monoxide (42:15 minutes to 1:02:43 minutes)

Directions: Please watch the Poisoner's Handbook using the following You Tube link.

https://youtu.be/V2_2862CFxA

Answer the questions below. You can write directly on this sheet or you can write on a separate sheet of paper. You will receive directions about how to submit this assignment. Look for a message from your teacher via Remind, Teams, and/or the School Website.

Lead

1. In 1924, the most lucrative poison was _____.

2. True/False: Symptoms of lead poisoning include memory problems, irritability, dementia and hallucinations.

3. The employer of victims who worked at the "looney gas building" said the victims died due to what cause?

4. What was the benefit to adding tetra-ethyl lead to gasoline?

5. Although tetra-ethyl lead had been developed in the 1850's it had not been widely used because:

6. During the chemical test for lead, the liquid turns _____. Orange / Blue / Red / White

7. Calculate the molar mass of $Pb(NO_3)_2$. Show your work below.

8. What is the percent by mass of nitrogen in $Pb(NO_3)_2$? Show your work below.

$$\%\ by\ mass = \frac{mass\ of\ element}{mass\ of\ compound} \times 100$$

9. Use stoichiometry and the balanced equation to answer the following question with a calculation. Hydrogen sulfide gas is bubbled through a solution of lead(II) nitrate to produce a precipitate of lead(II) sulfide as shown by the equation below.

$H_2S + Pb(NO_3)_2 \rightarrow PbS + 2HNO_3$

What mass of H_2S is need to react completely with 14.5 g of $Pb(NO_3)_2$? Show your work below.

10. Classify the type of chemical reaction that is shown below. _____

$H_2S + Pb(NO_3)_2 \rightarrow PbS + 2HNO_3$

11. Lead(II) sulfide is a precipitate and HNO_3 is an aqueous solution. Using the reaction below, use symbols and/or letters to show how to represent the state of matter in a chemical reaction.

Fill in the open parentheses.

$H_2S(g) + Pb(NO_3)_2(aq) \rightarrow PbS(\quad) + 2HNO_3(\quad)$

12. True/False: Lead enters the body through inhalation and absorbing through the skin.

Carbon Monoxide

13. What evidence was Dr. Norris able to use to determine that the dismembered female victim was not murdered, but rather died from carbon monoxide poisoning?

14. The symptoms of Carbon Monoxide (CO) includes skin flushing cherry pink, and blood that is a brilliant _____ in color.

15. True/False: The color of the blood with CO poisoning lasts for weeks after death.

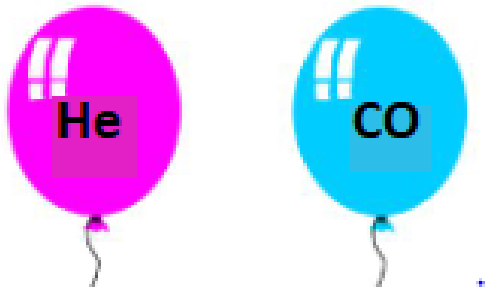
16. True/False: Illuminating gas was in homes all over NYC. The illuminating gas contained CO. Carbon monoxide killed more people than TB (tuberculosis), measles, and typhoid combined.

17. What were the uses of illuminating gas in homes? List at least 2.

18. Carbon monoxide gas (CO) has an initial pressure of 1.12 atm and a volume of 18.0 mL. Holding the temperature constant, the gas is compressed to a final volume of 6.0 mL. What is the new pressure of the gas? You will need to use a gas law equation to solve this problem. Use your chemistry reference sheet. Show your work below.

Use the picture below to answer questions 19-23.

The balloons below are identical in that they have equivalent volumes, the gases are at the same pressure, and the temperature of each gas is the same. The balloon on the left contains helium gas. The balloon on the right contains carbon monoxide gas.



19. Which balloon contains a gas that can be described as a molecule? _____

20. Which balloon contains gas particles with the greatest average kinetic energy? _____

21. Which balloon contains the greatest mass of gas? _____

22. If a small hole of identical size was made in each balloon, which balloon would be the smallest after 12 hours?

23. If the volume of the CO balloon is increased by a factor of 4 while holding the temperature constant, the pressure of the CO gas will _____ by a factor of _____.

24. True/False: A dead body **can** absorb Carbon Monoxide after death.

25. How did Gettler show experimentally that it was possible or impossible for a person to absorb carbon monoxide post-mortem?

26. Carbon monoxide is a molecular compound that contains covalent bonds. Draw a molecule of carbon monoxide (CO) using a Lewis structure.

Use covalent prefixes to name the following compounds. If the compound is NOT molecular—does not contain covalent bonds—write the word "ionic."

27. _____ N_2O_5
28. _____ $NaNO_3$
29. _____ SF_6

30. _____ CBr_4
31. _____ H_2O
32. _____ AgCl

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Section #4: Denatured Alcohol & Radium (1:02:43 minutes to 1:18:32)

Directions: Please watch the Poisoner's Handbook using the following You Tube link.

https://youtu.be/V2_2862CFxA

Answer the questions below. You can write directly on this sheet or you can write on a separate sheet of paper. You will receive directions about how to submit this assignment. Look for a message from your teacher via Remind, Teams, and/or the School Website.

Denatured Alcohol

1. What does the term "denatured" mean in reference to alcohol?

2. Why did the U.S. Government require alcohol to be denatured?

3. What was "smoke" and where was it primarily served?

4. What did bootleggers do to the denatured alcohol to avoid killing their customers?

5. Was the process bootleggers used effective? Why or why not?

6. What types of poisons were found in the alcohol samples tested by Gettler? List at least 4.

7. One of the poisons added to alcohol was gasoline. Gasoline contains several hydrocarbons, one of which is butane, C_4H_{10}. When butane is combusted it reacts with oxygen gas.

Predict the products of the **combustion reaction** and balance the equation below.

_____ C_4H_{10} + _____ O_2 → _____ + _____

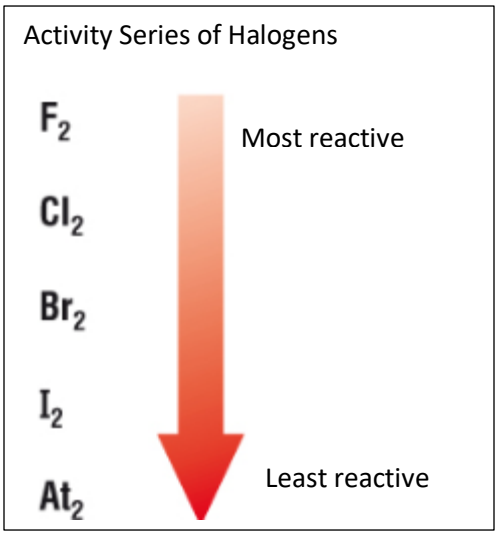
8. Pentane, C_5H_{12}, is another component of gasoline. At STP (standard temperature & pressure), 1 mole of a gas = 22.4 L. Thus, the volume of 1 mole of a gas is 22.4 L at STP. Using the balanced equation below & the principles of stoichiometry, determine the volume of O_2 gas in liters that is needed to react with 120 g of pentane. Show your work and express your answer to the correct number of significant figures.

$$C_5H_{12} + 8O_2 \rightarrow 5CO_2 + 6H_2O$$

9. Iodine (I_2) was a poison the government added to denatured alcohol. Use the activity series for single replacement reactions to determine if the two reactions below can occur. If so, predict the products and balance the equations.

a. ____ $FeCl_2$ + _____ I_2 → _____ + _____

b. _____ KI + _____ Br_2 → _____ + _____



10. Iodine (I_2) is one of the 7 diatomic molecules. Write the formulas for the other diatomic molecules and draw Lewis structures for all of them.

Radium

11. Who is credited with discovering radium?

12. What were some of the early uses of radium in consumer products? List at least 5.

13. How were children exposed to radium?

14. Symptoms of radium poisoning includes anemia, ulcers, tumors and which of the following:
decay of teeth / decay of the liver / decay of bones

15. How were the dial painters exposed to radium? Why did they put their paint brushes in their mouths?

16. Explain the test that Gettler used to show there was radium in the body of the first dial painter victim.

17. Explain why radium was so readily incorporated into the bones.

18. To what chemical group does radium belong? List the name of the group from the periodic table.

19. How many valence electrons does radium contain? Draw the Lewis dot diagram of a radium atom showing its valence electrons only.

20. Predict whether a radium atom has a larger or smaller radius than a calcium atom. **Justify your answer**.

21. Convert 2.80×10^{27} atoms of radium into grams of radium. Express your answer to the correct number of significant figures.

Poisoner's Handbook Video Questions Name _____per____

Section #5: Thallium to Conclusion (1:18:33 minutes to end)

Directions: Please watch the Poisoner's Handbook using the following You Tube link.

https://youtu.be/V2_2862CFxA

Answer the questions below. You can write directly on this sheet or you can write on a separate sheet of paper. You will receive directions about how to submit this assignment. Look for a message from your teacher via Remind, Teams, and/or the School Website.

Depression & End of Prohibition

1. Explain why the police began to believe that Frederick Gross killed his wife and four of his children.

2. What piece of evidence provided by the neighbor led investigators to assume the family had been poisoned with thallium?

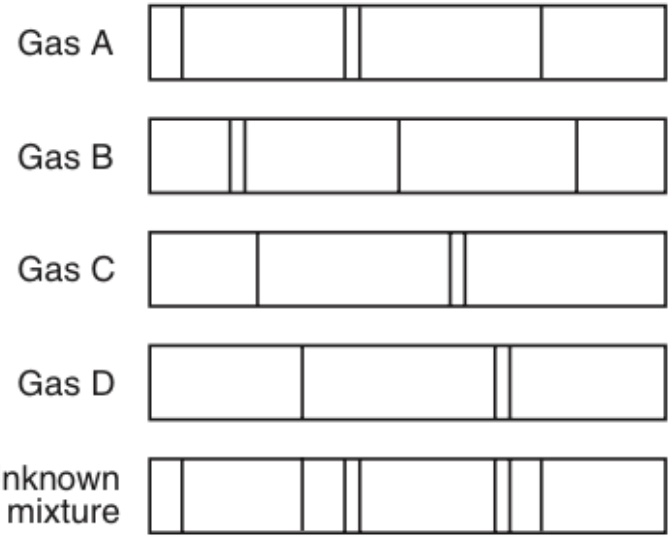
3. What was a commercial use of thallium?

4. When Ghettler and his team separated thallium from the cocoa and heated it in a flame, what color was emitted?

5. Spectroscopy can be used to identify elements in a mixture. When Ghettler preformed the spectroscopy experiment on the sample of presumed thallium from the cocoa, what element did he actually identify?

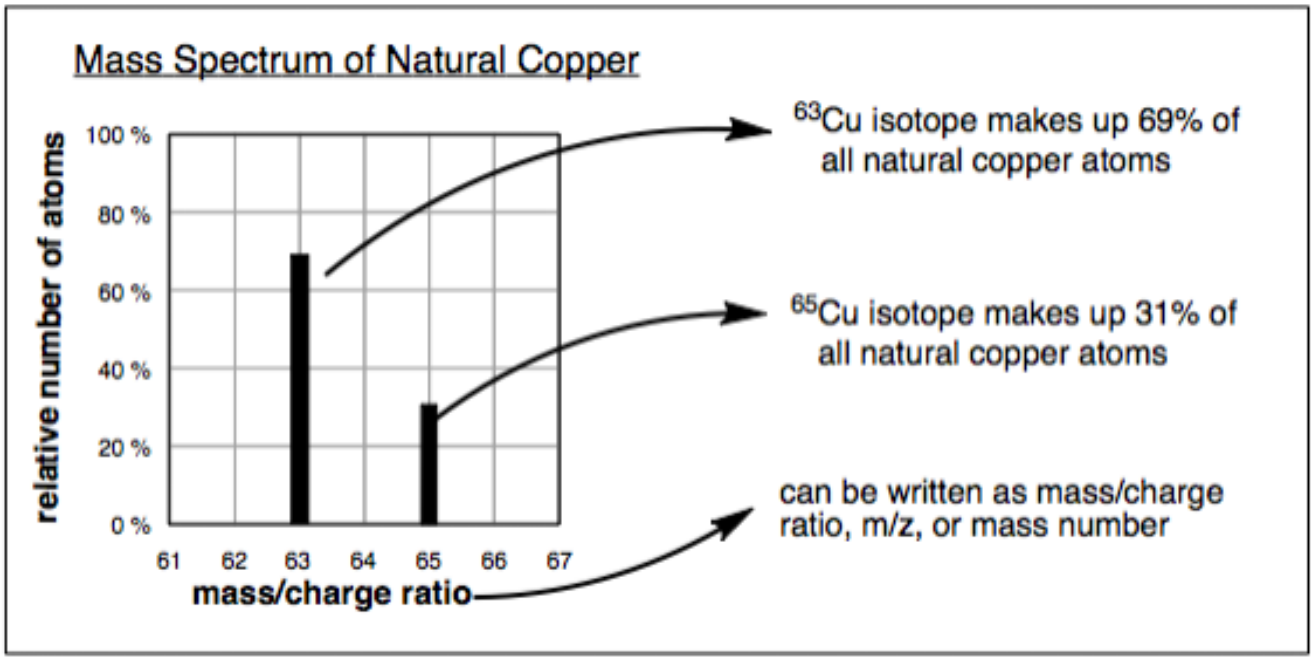
6. How did this element get into the cocoa powder?

7. Below is an example of emission spectra of known gases and one unknown mixture. Based on the pattern of the spectral lines, what gases are most likely present in the unknown mixture?



8. Copper has two naturally occurring isotopes. What is the definition of an isotope?

The information below shows the mass spectrum, representing the two isotopes of copper. Use this information to answer questions 9-14.



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9. Find copper on the periodic table. What is its atomic number? _____

10. What does the atomic number represent?

11. In the isotope Cu-63, how many protons, neutrons, and electrons are present in an atom of this isotope?

12. In the isotope Cu-65, how many protons, neutrons, and electrons are present in an atom of this isotope?

13. If the percent abundance of each Cu isotope had been omitted from the figure above, how could you predict that Cu-63 is more abundant than Cu-65?

14. The average atomic mass for copper is listed on the periodic table. Using the data in the figure above, write a set-up that shows how the average atomic mass of copper is calculated.

Arsenic—Again: Revisit Fanny Creighton Case

15. When Fanny was arrested for killing her housemate, Aida Applegate, she talked about the murder of her brother from years earlier. What was Fanny's motive for killing her brother?

16. How did Fanny poison her brother?

17. Explain the motive for Fanny killing Aida Applegate.

18. What product did Fanny use to murder Aida Applegate?

When Dr. Gettler testified against Fanny Creighton, he discussed not only arsenic as the method of poisoning, but also the identification of a soot filler that was present in the product Fanny used. Suppose you are given a 0.507 g tablet containing potassium nitrate and an inert sugar filler. Use this information to answer questions 19-25.

19. What is the chemical formula for potassium nitrate?

20. Draw the Lewis structure of the nitrate ion. If resonance is present, represent that.

21. What is the geometry of the nitrate ion based on the VSEPR theory.

22. What is the bond angle between O-N-O in the Lewis structure?

23. Calculate the molar mass of potassium nitrate.

24. Through experimentation, it is found that the tablet contains a mass of sugar filler that is 0.396 g. What is the mass of the potassium nitrate in the tablet? Express your answer in g.

25. Calculate the percent composition by mass of potassium nitrate in the tablet. Express your answer to 3 significant figures.

Conclusion

26. True / False: By 1958, it was almost impossible to get away with poisoning in NYC because of Gettler.

27. True / False: Gettler and Norris were on a mission to protect and help the people.

28. In 1959, the _____began policing the chemicals in our food supply.

29. Norris's quote that was placed on the medical examiner's office in NYC read, "Let conversation cease. Let _____ flee. This is the place where death delights to help the _____.