



# **Potions and Poisons Test**

## **Bayard Rustin Invitational**

### **Division B – 2018**



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School \_\_\_\_\_ Names \_\_\_\_\_ Team # \_\_\_\_\_

**Important – Before you begin the written test, go to page 12 and set up Part B: Dragon Eggs and Mentos pH testing NOW. Waiting until later may affect your results.**

## Potions and Poisons (Begin... if you dare!)

### Part I

#### Ionic and Covalent Bonds

For each of the following bonds: **(3 pts each – Total 6 points)**

- Write the symbols for each element.
- Draw a Lewis Dot diagram for the valence shell of each element.
  - For ionic bonds – draw an arrow (1 or more if needed) to show the transfer of electrons to the new element.
  - For covalent bonds – Rearrange the electrons to pair up electrons from each atom. Draw circles to show the sharing of electrons between each pair of atoms. Draw the structural formula.
- Write the resulting chemical formula

1. Sodium + Chlorine

2. Carbon + Hydrogen

Chemical Bonding: Determine if the elements in the following compounds are metals or non-metals. Describe the type of bonding that occurs in the compound. **(1 pt each row – Total 3 pts)**

Compound	Element #1 Element symbol and metal or non-metal (M or NM)	Element #2 Element symbol and metal or non-metal (M or NM)	Bond Type Ionic = I Covalent = C
<b>XY (example)</b>	<b>X = NM</b>	<b>Y = NM</b>	<b>C</b>
3. NO <sub>2</sub>			
4. NaCl			
5. SO <sub>2</sub>			

Define: **(1 pt each)**

6. Heterogeneous substance –

7. Homogeneous substance –

8. Pure Substance –

9. Identify each of the following substances as pure substances (PS), heterogeneous mixtures (HE) or homogeneous mixtures (HO). **(0.5 pts each – 3 points total)**

Substance	HE	HO
Alphabet soup		
Salt		
Concrete		
Vegetable oil		
Carbonated soft drink (opened)		
Aluminum Foil		

Chemical vs. Physical Properties

10. Classify the following properties as either Chemical or Physical: **(0.5 pts each – 7 points total)**

<u>Property</u>	<u>Physical</u>	<u>Chemical</u>
blue color		
density		
flammability		
solubility		
bitter taste		
melting point		
reacts with acid to form hydrogen		
hardness		
boiling point		
luster		
odor		
can neutralize a base		
reacts with a base to form water		
supports combustion		

11. Identify the following as a physical change (P) or a chemical change (C): **(0.5 pts each – 2 points total)**

Sodium Hydroxide dissolves in water –

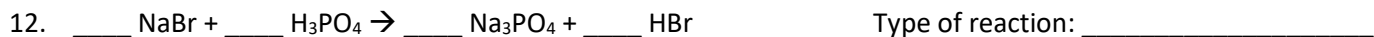
A pellet of sodium is sliced in two –

Potassium chlorate decomposes to potassium chloride and oxygen gas –

Iron rusts –

\_\_\_\_\_ / 12 (24)

Balancing Equations (Write *and balance the following chemical equation.*) (2 pts each – 4 pts total)



14. Choose two of the following scenarios below and use the physical properties of the mixtures in the table to plan a method for separating a mixture containing water and the substance. Write details in the Separation Procedure box.

(2 pts each – 4 pts total)

Substance	Physical Properties	Separation Procedure
Sawdust	solid particles; visible to the eye, does not dissolve in water; floated on top of the water; non-magnetic	
Potassium Chloride	Solid, white crystals; able to see small grains, quickly dissolves in water; non-magnetic	
Powered Limestone	Solid, fine white particles; too tiny to see; does not dissolve in water; are suspended in water; non-magnetic	
Nickel Powder	Solid, fine gray particles; too tiny to see; does not dissolve in water; sink in water and fall to bottom; magnetic	

15. Techniques used to separate mixtures rely on differences in the physical properties of the components. Pick **2 techniques** useful for the separation of mixtures and describe each process separately. **(2 pts each – total 4 pts)**

**DISTILLATION –**

**EXTRACTION –**

**FILTRATION –**

Place an X in ***all applicable*** box/boxes suitable for separating the following mixtures. **(1 pt each row – total 3 pts)**

Situation	Distillation	Evaporation	Crystallization	Chromatography	Filtration	Mechanical Separation
16. Obtain clear water from muddy water						
17. To separate petrol from crude oil						
18. Remove leaves from a swimming pool						

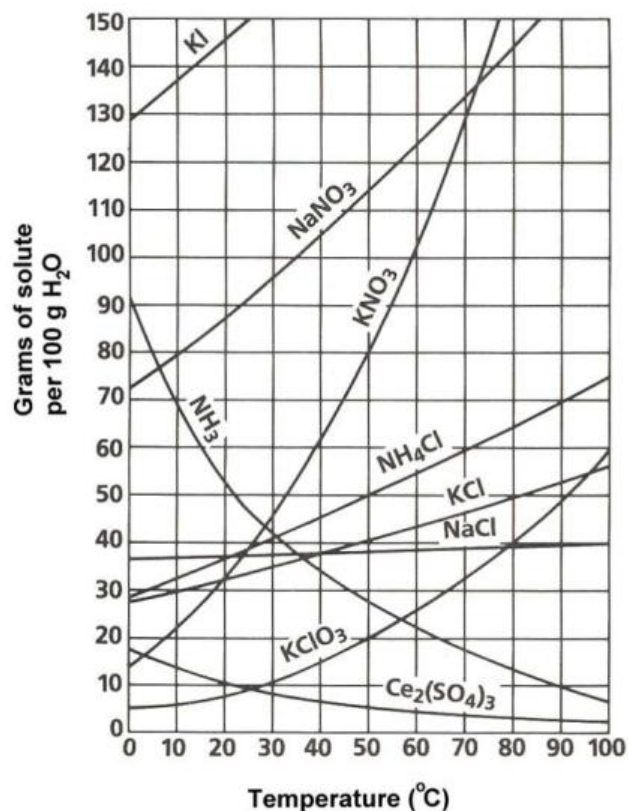
Answer the following short answer questions: **(5 points total)**

19. What are the three different types of mixtures? (1 pt))

20. What is the difference between a solute and a solution? (1 pt)

21. What is considered to be the universal solvent? Why? (1 pt)

22. What is the Tyndall Effect and why does it occur? (2 pts)



Use the solubility curve above to answer questions 23 - 28. **(0.5 pts each – 3 points total)**

23. In general, how does temperature affect solubility?

24. Which compound is least soluble at 10°C?

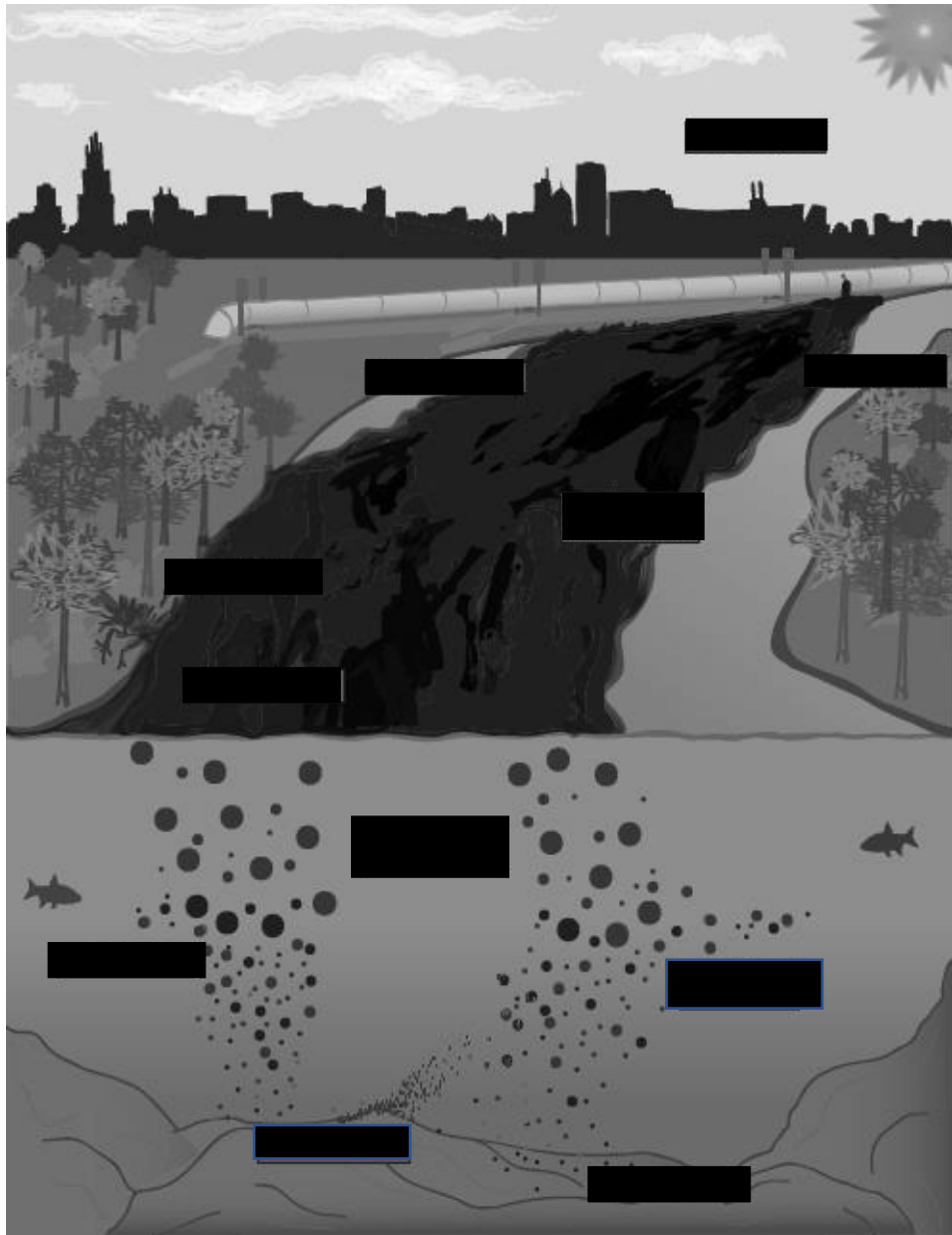
25. How many grams of KCl can be dissolved in 100g of water at 80°C?

26. How many grams of NaCl can be dissolved in 100g of water at 90°C?

27. At 40°C, how much KNO<sub>3</sub> can be dissolved in 100g of water?

28. Which compound shows the least amount of change in solubility from 0°C-100°C?

\_\_\_\_\_ / 3 (47)



In this drawing of an oil spill, diluted bitumen (a mixture of petroleum distillate residue) diluted using either conventional light crude or a cocktail of natural gas liquids with a resulting consistency of conventional crude and can be pumped through pipelines. This can be the cause of environmental spills. Based on this drawing, identify at least 4 separate processes that can act on the spill material: **(0.5 pts each – total 2 pts)**

- 29.
- 30.
- 31.
- 32.

\_\_\_\_ / 2 (49)

Answer all questions 33-54 in space provided, or by circling the correct letter/answer:  
(0.5 pt each – total 5 points)

33. Acute polyneuropathy can occur from contact with this plant.

- a. poison ivy
- b. poison oak
- c. tree nettle
- d. jimson weed
- e. death-cap mushroom

34. The two types of household bleach are \_\_\_\_\_ bleach and \_\_\_\_\_ bleach.

35. Jimson weed belongs to the nightshade family. (circle one) True False

36. When a Pacific newt curls its tail, it is a sign of

- a. romantic intentions
- b. defense
- c. hunger
- d. illness

37. Which person is going to have the most toxic effects from swallowing five iron supplement tablets?

- a. A four-year-old boy who weighs 40lbs.
- b. A ten-year-old girl who weighs 90lbs.
- c. A twenty-five-year-old woman who weighs 125lbs.
- d. A forty-year-old man who weighs 195lbs.

38. The brown recluse spider is known as the

- a. violin spider
- b. Stradivarius spider
- c. cello spider
- d. mandolin spider

39. The death cap mushroom, Amanita phalloides, is actually a deadly fungus. (circle one) True False

40. How many eggs can one female cane toad lay at one time?

- a. 3,000
- b. 30,000
- c. 300,000
- d. 3,000,000

41. Cane toads are continuing to adapt to different environments in Australia. (circle one) True False

42. Name two (2) forms of iron frequently used in supplements: \_\_\_\_\_ / \_\_\_\_\_

\_\_\_\_\_ / 5 (54)



43. Women of reproductive age who have menorrhagia, or abnormally heavy bleeding during menstruation, are at increased risk of iron deficiency. At least 10% of menstruating women are believed to have menorrhagia. Menorrhagia means a

- a. light menstrual cycle
- b. normal menstrual cycle
- c. absent menstrual cycle
- d. abnormally heavy menstrual cycle

44. Strong acids generally have a pH of about 3, whereas a strong base can be as high as 14. (circle one) True False

45. The chemical formula for Epsom salts is

- a.  $\text{Mg}_2\text{SO}_4$
- b.  $\text{MgSO}_4$
- c.  $\text{MnSO}_3$
- d.  $\text{Mg}_3\text{SO}_2$

46. After ingesting death cap mushrooms, those who fall ill can improve after a day or two, giving a false impression of recovery. But by that stage the toxin can have caused serious brain damage which can be fatal. (circle one) True False

47. Two other spiders that have markings like the brown recluse spiders are \_\_\_\_ and \_\_\_\_\_. (circle the two correct letters)

- a. cellar spiders
- b. evening spiders
- c. morning spiders
- d. pirate spiders

48. Dioxin is found in in all household bleaches and bleaching products used in the wood pulp and paper industry as a result of the presence of chlorine gas. (circle one) True False

49. Poison ivy has leaves that grow in only in groups of three. (circle one) True False

50. Difficulty breathing or swallowing is possible after coming in contact with poison ivy. (circle one) True False

51. Jimson weed is also known as:

- a. devil's tuba
- b. hell's bells
- c. Devil's snare
- d. Only c
- e. Only b & c
- f. all of the above

52. Bleach is the common name for a solution of \_\_\_\_ sodium hypochlorite in water.

- a. 0.025%
- b. 0.25%
- c. 2.5%
- d. 25%

\_\_\_\_\_ / 5 (59)

53. Dilution was the preferred solution to pollution when populations were small. Everything people wanted to get rid of went into the water. These wastes were typically organic, such as human wastes and animal carcasses and all biodegradable. This is also a viable solution for large populations, as these same waste products become food for animals, macroinvertebrates, bacteria, and fungi that decompose the waste.

(circle one) True False

54. Monitoring iron levels during pregnancy is important as plasma volume and red cell mass expand due to \_\_\_\_\_ in maternal red blood cell production.

- a. increases
- b. decreases
- c. stable levels

\_\_\_\_\_ / 1 (60)

**Important – Before you begin the written test, have one student set up Part B and Part C NOW. Waiting until later may affect your results.**

**Part II – Lab:**

**Part A: Solution, Colloid or Suspension (1 pt/box - 30 pts total)**

*Recommended Materials: 3 small beakers, glass stirrer, test tube rack w/ at least 6 test tubes, pipettes*

1. Half fill 6 test tubes with water from the water (distilled) available in beaker.
2. Add the following materials to the following test tubes:
  - a. 3 drops of food dye (No > 3 drops!) – test tube #1
  - b. 0.5 g sugar – test tube #2
  - c. Up to 10 drops milk of magnesia – test tube #3
  - d. 1 dropper full of oil (0.5-1.0mL) – test tube #4
  - e. 0.5 g CuSO<sub>4</sub> – test tube #5
  - f. 0.5 g soil – test tube #6
3. Mix each of the test tubes with a stirring rod until thoroughly mixed. Make sure to rinse the stirring rod in between each stir. Don't mix the contents of the test tubes.
4. Record an observation about each mixture.
5. Use a laser/LED light (**BE CAREFUL OF THOSE ACROSS FROM YOU!**) to shine through each of your solutions to determine if the Tyndall Effect is present. Record answers in your data table.
6. Allow the solutions/mixtures to settle and record in data table if in fact they settle out into layers.
7. Use the information in your data table to then classify each mixture as a True Solution, Colloid, or Suspension.

Sample	Observations	Tyndall Effect?	Settles?	Solution, Colloid or Suspension	Why?
A food dye					
B sugar					
C milk of mag					
D oil					
E CuSO <sub>4</sub>					
F soil					

\_\_\_\_\_ / 30 (90)

## **Part II – Lab:**

### **Part B: Dragon Eggs (1/2 pt each question – Total 1 point)**

Materials:

You will be given a small number of “Dragon Eggs” by the event supervisor.

Procedure: Place the dragon eggs in a small container, and add about 10 ml of water. After 30 - 40 minutes, observe the dragon eggs and answer these questions on the answer key.

1. What happened to the eggs? \_\_\_\_\_
2. Is this a chemical change or a physical change? \_\_\_\_\_

Clean up: When you are done, place the dragon eggs and water in a container provided by the event supervisor. DO NOT RINSE THEM DOWN THE SINK, OR YOU WILL BE PENALIZED.

### **Part C: Mentos pH Testing (1pt each box – Total 9 points)**

Materials:

You will be given one Mentos chewy mint candy, and one chewy strawberry mint candy, 2 small Post-its

Procedure:

Moisten a paper towel and wipe off the colored outer coating of the fruit flavored Mento. (Make sure you can tell it apart from the mint flavored Mento). Place 25 ml of water in each of three containers. Put the fruit Mento in one of the containers, the mint Mento in another container, and leave the third container for a control. (\*Note - the Mentos will not dissolve completely). Let the Mentos dissolve for 5 - 10 minutes or longer, then swirl and record the pH. You must fill in every box of table.

In Solution	Solution Color	pH	Citric acid?
Mento (mint-flavored)			
Mento (fruit-flavored)			
Control Solution			

#### **Mentos lab, continued.**

Questions (Record all these answers in table above):

1. Record the color and pH of the mint mento solution
2. Record the color and pH of the fruit Mento solution
3. Record the color and pH of the control solution
4. Citric acid is used to make the one type of Mento but not the other. Based on your data, which type of Mento do you think – *most likely* – contains citric acid?

Clean up: Throw the Mentos in the trash and pour the liquids down the sink.

\_\_\_\_\_ / 10 (100)