



Potions and Poisons Test
Bayard Rustin Invitational
Division B – 2018
Answer Key



&



School _____ Names _____ Team # _____

Potions and Poisons Test – Bayard Rustin 2018 Answer Key

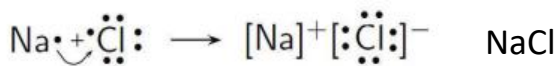
Part I

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

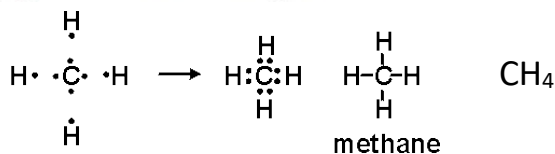
1. Sodium + Chlorine **IONIC**



Give credit (3) for:

- correct symbols
- correct transfer/sharing
- correct formula

2. Carbon + Hydrogen **COVALENT**



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
XY (example)	X = NM	Y = NM	C
3. NO ₂	N = NM	O = NM	C
4. NaCl	Na = M	Cl = NM	I
5. SO ₂	S = NM	O = NM	C

Metal + Non-Metal = Ionic

Non-Metal + Non-Metal = Covalent

Define: **(1 pt each)**

6. Heterogeneous substance – a **mixture** having a **non-uniform composition**
7. Homogeneous substance – a **substance** (can be a compound, element or mixture, though *not necessarily* a mixture) composed of the same proportions – **uniform** – of its components throughout a given sample
8. Pure Substance – substance made of only **one type of atom or molecule**

____ / 12

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	X	
Salt		X
Concrete	X	
Vegetable oil		X
Carbonated soft drink (opened)	X	
Aluminum Foil		X

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	X	
density	X	
flammability		X
solubility	X	
bitter taste	X	
melting point	X	
reacts with acid to form hydrogen		X
hardness	X	
boiling point	X	
luster	X	
odor	X	
can neutralize a base		X
reacts with a base to form water		X
supports combustion		X

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

Sodium Hydroxide dissolves in water **P**

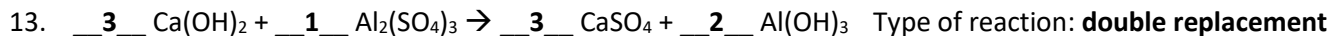
A pellet of sodium is sliced in two **P**

Potassium chlorate decomposes to potassium chloride and oxygen gas **C**

Iron rusts **C**

_____ / 12 (24)

Balancing Equations (Balance and identify the type of equations below.) (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	Skim off the sawdust from the top of the water using a plastic spoon – OR – Filter the mixture through a funnel with filter paper
Potassium Chloride	Solid, white crystals; able to see small grains, quickly dissolves in water; non-magnetic	Pour water into a small plastic cup. Allow water to evaporate overnight leaving potassium chloride crystals – OR – Do a distillation. Water will be the distillate and remaining solid will be calcium chloride.
Powered Limestone	Solid, fine white particles; too tiny to see; does not dissolve in water; are suspended in water; non-magnetic	Place funnel over small plastic cup. Pour mixture through filter paper. Collect particles of powdered limestone in filter paper. Let paper dry.
Nickel Powder	Solid, fine gray particles; too tiny to see; does not dissolve in water; sink in water and fall to bottom; magnetic	Place a magnet over the nickel powder and draw the particles out of the water, Scrape the nickel powder off the magnet – OR – Evaporate the water leaving the nickel powder behind.

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 – is the purification of a liquid by heating it to its boiling point, causing vaporization, and then condensing the vapors into the liquid state and collecting the liquid. Separation of two or more liquids requires that they have different boiling temperatures. All boiling temperatures can be reduced by decreasing the pressure on the liquid.

EXTRACTION – is the removal of one substance from a mixture because of its greater solubility in a given solvent, e.g. – liquid/liquid, solid/liquid and acid/base extractions. This is used to purify organic products.

FILTRATION – is the process of removing or "straining" a solid (the chemical term is precipitate) from a liquid by the use of filter paper or other porous material.

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	X	X			X	
17. To separate petrol from crude oil	X					
18. Remove leaves from a swimming pool					X	X

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

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

Solutions, Suspensions & Colloids

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

Either a **solute is a substance in which is dissolved in another substance, the solvent or a solvent is a substance which dissolves a solute.**

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

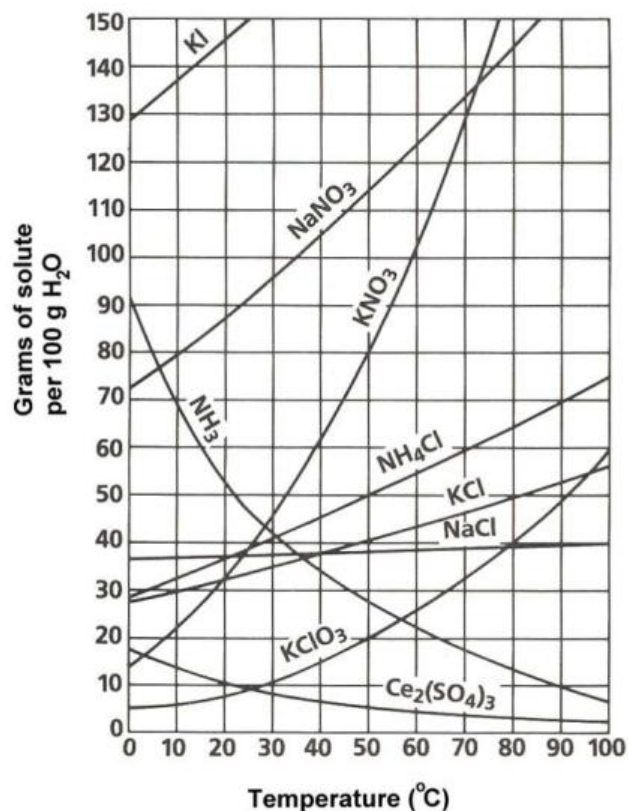
Water is capable of dissolving a variety of different substances, which is why it is such a good solvent, or water is called the "universal solvent" because it dissolves more substances than any other liquid.

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

a. It is light scattering by particles in a colloid, or else particles in a very fine suspension, and

b. is caused by reflection of the incident radiation from the surfaces of the particles, reflection from the interior walls of the particles, and refraction and diffraction of the radiation as it passes through the particles.

_____ / 12 (44)



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? **The > the temp. the > substance dissolves.**

24. Which compound is least soluble at 10°C? **KClO₃**

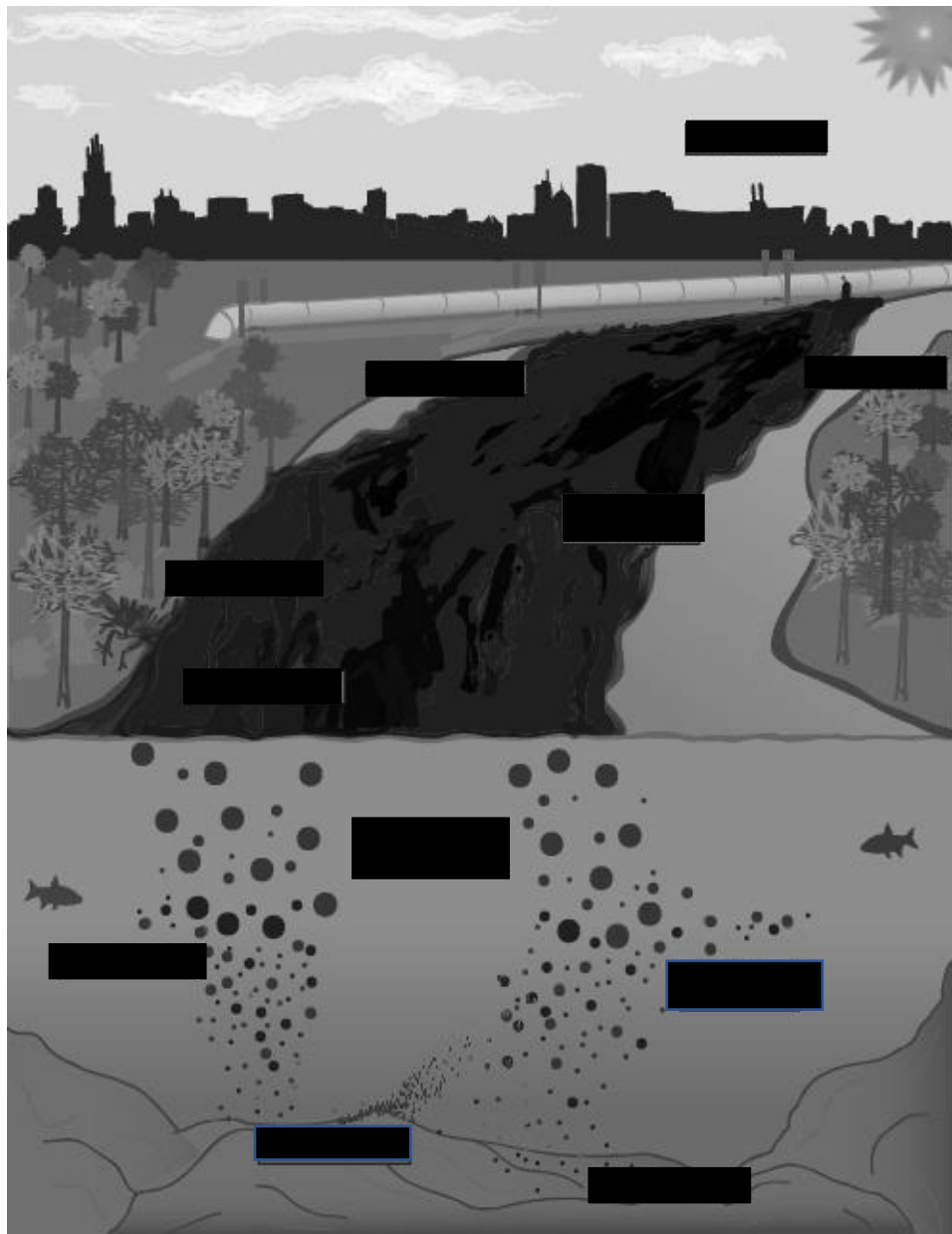
25. How many grams of KCl can be dissolved in 100g of water at 80°C? **50 g**

26. How many grams of NaCl can be dissolved in 100g of water at 90°C? **40 g**

27. At 40°C, how much KNO₃ can be dissolved in 100g of water? **about 60 g**

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

____ / 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.

Correct, but not limited to: evaporation, photo-oxidation, spreading, particle interaction, adhesion, emulsification, submergence and sinking, dissolution, natural dispersion, accumulation, biodegradation

____ / 2 (49)

Answer all questions in space provided, or by circling the correct 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. **chlorine and peroxide**

35. Jimson weed belongs to the nightshade family. **True**

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. **True**

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.

a. True b. False

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

(allow any two of these: **ferrous** and **ferric iron salts**, such as **ferrous sulfate**, **ferrous gluconate**, **ferric citrate**, and **ferric sulfate**)

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.

a. True b. False

45. The chemical formula for Epsom salts is

- a. Mg_2SO_4
 - b. $MgSO_4$**
 - c. $MnSO_3$
 - d. Mg_3SO_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. **False**

47. Two other spider that have markings like the brown recluse spiders are ____ and _____. **a & d**

- 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. **False**

49. Poison ivy has leaves that grow in only in groups of three. **True**

50. Difficulty breathing or swallowing is possible after coming in contact with poison ivy. **True**

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.

a. True b. **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)

Part II – Lab:

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

1. Half fill 6 test tubes with water from the beakers available.
2. Add the following materials to the 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 CuSO₄ – 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 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.

****Please keep in mind you may use these or any other acceptable answers****

Sample	Observations	Tyndall Effect?	Settles?	Solution, Colloid or Suspension	Why?
A food dye	Mixes well; goes into solution; dissolves	No	No	Solution	It dissolves into a homogenous mixture.
B sugar	Mixes well; dissolves; goes into solution after initially sinking to bottom	No	No	Solution	It dissolves into a homogenous mixture.
C milk of mag	Mixes; some sinks to bottom; some stays in suspension	Yes - before settling	Yes	Suspension	Large particles settle to the bottom and smaller particles float at the top or in the middle.
D oil	Floats to the top; does not mix	Yes	No	Colloid	Emulsions are an example of colloids composed of tiny particles suspended in an immiscible liquid. They do not mix
E CuSO ₄	Mixes well; most goes into solution, may be supersaturated	No	No	Solution	It dissolves into a homogenous mixture.
F soil	Mixes; some sinks to bottom; some stays in suspension	Yes - before settling	Yes	Suspension	Large particles settle to the bottom and smaller particles float at the top or in the middle.

_____ / 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? Record your observations. **The dragon eggs got bigger.**
2. Is this a chemical change or a physical change? **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.

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)	yellow	7	N
Mento (fruit-flavored)	orange	4-5	Y
Control Solution	yellow	7	N/A

Questions (Record all 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)

TIEBREAKERS – 43, 47 & 52