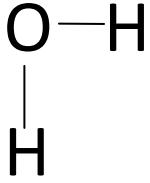


Objective: what are the 7 important properties of water, and what is the fundamental reason that they exist? Additionally some water vocabulary words and some review.

1. To this water molecule add dipole arrows, and add tiny + or - signs by each atom showing polarity



2. Then draw 6 water molecules (atoms/bonds only) and indicate the hydrogen bonding between them with dotted lines

3. Define Hydrogen Bonding:

4. Get 6 red/white water molecule magnets now, Red = _____ white = _____

5. Which magnets (atoms) attract molecule to molecule? _____ + _____ only
That is a hydrogen bond between molecules

6. Make them bond into a 6 molecule ring. This shape is called a _____

7. If you squish the 6 magnets (water molecules) in your hands and move them slowly they take up less space than when in the ring shape.

The density of pure water is _____ or you could say it this way as well:

_____.

8. The density of ICE must be: _____ since ice floats in liquid water.

9. The hole in the ring creates a slightly greater _____ for the 6 molecules of water that the liquid water just doesn't have.

10. What temperature does liquid water freeze at? _____ K or _____ °C
11. To melt one gram of ice into one gram of water takes the _____ of _____,
12. And for water, that constant is written this way: _____
14. Put an ice cube in your hand - does the cold go into your hand or does your hand's heat go into the ice?
15. Why does your hand get cold? _____
16. The energy it takes to MELT ICE is called the _____ of _____
17. For water that constant is on table B, and it's written as _____
18. How many water molecules does it take to form a normal crystal of ice? _____
19. How many points, or sides, do ALL SNOW FLAKES have? _____

The 7 Most Important Properties Of Water (and what causes them)

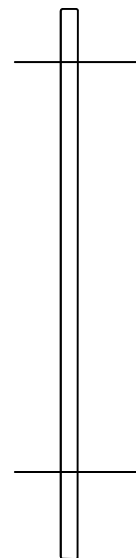
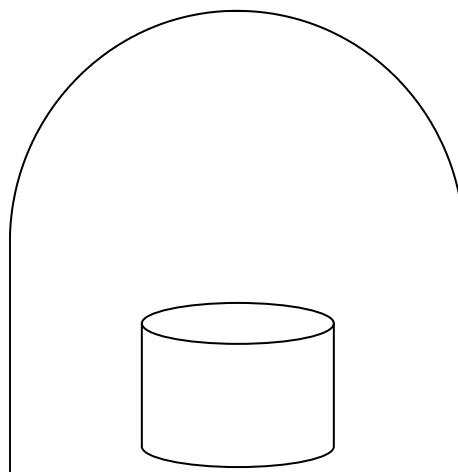
20. Water has a _____. This is due to _____.

The intermolecular hydrogen bonds hold the water molecules loose enough for them to move, but tight enough so that it's hard to separate them apart into a gas. It takes lots of energy.

21. Water has a _____.

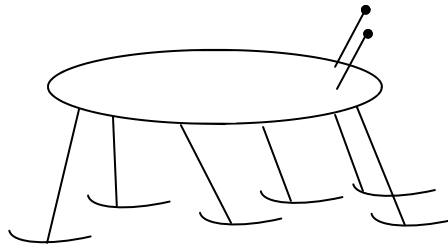
This is due to _____.

The intermolecular hydrogen bonds hold the water molecules together which makes it harder for water to evaporate than molecules that have less intermolecular attraction.



22. Water has a _____ . This is due to _____ .

The intermolecular hydrogen bonds hold the water molecules tight to themselves and not at all to the air. This creates a “skin” or what is called surface tension. I hate those bugs, don’t you?



23. Solid water (ice) can _____ on liquid water. This is due to _____ .

Water molecules form rings of six, which creates a small “hole” in the center of them. It makes frozen water slightly less dense than liquid water. Liquid water molecules fit together more tightly, so liquid water is more dense.



24. Water has a very high _____ . This is due to _____ .

25. The “C” for H₂O is written this way: _____

26. Water has _____ .

This is due to _____ .

27. This can be stated more casually as: _____

28. Water has the ability to form _____.

This is due to _____.

29. Examples of these are: _____ + _____.

ELEVEN WATER VOCABULARY Words to Memorize by Tomorrow.

Solvation: the process of dissolving into a liquid

Solute: dissolves into the solvent in a solution (the salt in salty water)

Solvent: the part of the solution that solute dissolves into (the water part)

Immiscible: when 2 liquids do not mix, like oil and water, due to a difference in polarity
(water is a polar molecule, oil is a nonpolar molecule).

Miscible: when 2 liquids do mix because both are polar, or both are nonpolar LIKE DISSOLVES LIKE
(example: water and alcohol)

Aqueous: dissolved in water

Soluble: able to dissolve

Insoluble: unable to dissolve, (precipitates)

Saturated: holding as much solute in solution as possible (Charlie choc. milk)

Unsaturated: holding less solute in solution than is possible (Janet choc. milk)

Supersaturated: holding more solute than is normally possible (not common) (sugar, sodium acetate)

OB: Mastering Table G – the Solubility Curves for 10 Compounds Take it out now.

30. Table G is titled: _____ - at standard pressure - which is: _____

31. The Y axis (up/down) is solubility _____ which really means this:

32. _____. Cross it out and replace it now.

33. The X axis across the bottom has the units _____. Why doesn't it go lower than zero or higher than 100? _____

34. How many grams of KCl fits into 100 mL of water at 10°C? _____

35. How many grams of SO₂ fits into 100 mL of water at 40°C? _____

36. How many grams of ammonium chloride fits into 100 mL of water at 5°C? _____

37. How many lines are on this graph? _____ How many compounds are on this graph? _____

38. How many of the graph lines go "up" as the temperature rises? _____

39. How many of the graph lines go "down" as the temperature rises? _____

40. How many of these compounds are IONIC? _____

41. How many of these compounds are MOLECULAR (or covalent) ? _____

42. State something sensible about the last 4 statements that proves you are awake:

43. How many lines can you look at on this graph at any time? _____

44. When something like KI or NaCl goes into water, what particles end up in the water? _____

45. When something like sugar $C_{12}H_{22}O_{11}$, or CO_2 go into water,
what particles end up in the liquid water? _____

46. How many grams of ammonia fit into 100 mL of water at $90^\circ C$? _____

47. When water (or any other solvent) holds the maximum amount of solute at a given temperature,
this solution is said to be: _____

THINK: How would you figure out this problem? (Don't do it yet)

48. How many grams of ammonia fit into 50 mL of water at $90^\circ C$? _____

49. How many grams of KCl fit into 100 mL of water at $10^\circ C$? _____

50. How many grams of KCl fit into 350 mL of water at $10^\circ C$? _____ (show work!)

51. How many grams of NH_3 fit into 100 mL of water at $10^\circ C$? _____

52. How many grams of NH_3 fit into 12.0 mL of water at $10^\circ C$? _____ (show work!)

This question is the same type, but asked a bit differently:

53. How many grams of KClO_3 solute fits into 844 mL of water at 373 Kelvin? (show work)

This question is the same type, but again, asked a bit differently:

54. How many grams of sodium nitrate will it take to saturate 64.0 mL of water at 283 Kelvin?

55. Why does NY State Regents put 10 curves on one graph and call it table G? _____

56. Should this ever get to you? _____

57. 100 mL of water has the mass of _____

58. The density of pure water is _____

59. Do other substances have this $1 \text{ gram} = 1 \text{ mL}$ or $1 \text{ gram} = 1 \text{ cm}^3$? _____ Why not?

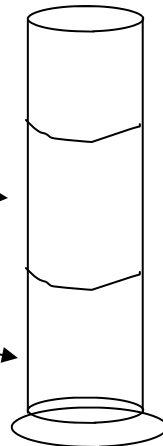
60. What's special about this Table G graph?

Objective: More table G practice, more Water Vocabulary, and oil in water!

Shade in the 2 liquids in the tube. Label them OIL & Water

61. _____ →

62. _____ →



63. They do not mix because: _____

64. In this case the OIL is _____ and the water is _____.

65. The reason that the oil is ON TOP and not on under the water is: _____

66. When a solution holds the most solute possible in the solvent it is said to be _____

67. If the solution holds LESS than that maximum amount of solute, it's called: _____

68. Charlie Chocolate milk would be _____ ☺ while Janet's is _____ ☹

69. Is a 100 mL $\text{HCl}_{(\text{AQ})}$ at 80°C saturated if it contains 37 grams of HCl? _____

70. Is a 100 mL $\text{NaNO}_{3(\text{AQ})}$ at 25°C saturated if it contains 90.0 g NaNO_3 ? _____

71. How many grams of NaCl will saturate 100 mL of 90°C water? _____

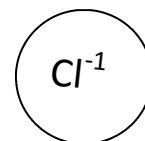
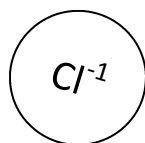
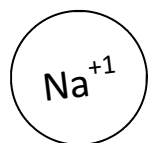
72. If you attempted to put 43 grams NaCl into that 100 mL of 90°C water, what would happen?

73. Will a 100 mL $\text{NaCl}_{(\text{AQ})}$ at 90°C be saturated if it contains 43 g NaCl? _____

Get table G. Let's fill in the chart (use pencil, or write SMALL until you know you are right. We'll check our work in a few minutes, we'll go over any mistakes you made.

	Temp	Solute	If a solution contains this Mass in grams	Is it Saturated or Unsaturated?	If unsaturated, how many more grams are needed to saturate this solution?
74	30°C	HCl	60 g		
75	60°C	KNO ₃	100 g		
76	10°C	NaNO ₃	80 g		
77	90°C	NH ₄ Cl	73 g		
78	20°C	KCl	20 g		
79	5°C	NaCl	31 g		

80. Below are 2 NaCl formula units that have ionized into water. Draw 3 water molecules surrounding each ion showing proper orientation towards these ions. Note their charges indicated in the little circles.



81. Explain in one sentence why the water molecules are going to orient themselves to these ions in solution.

82. Oil molecules (vegetable oil, motor oil, mineral oil, etc.) are all nonpolar. When oil is put into (polar) water, why can't the oil dissolve into the water like salts, or polar sugar molecules?

83. How many grams of KClO_3 fits into 100 mL of water at 90°C _____

84. How many grams of KClO_3 fits into 100 mL of water at just 40°C _____

THINK HARD NOW...

85. If you have a saturated $\text{KClO}_{3(\text{AQ})}$ at 90°C and put it into a cooler and the temperature drops to just 40°C , what could possibly happen to all that KClO_3 that was in solution?

86. Your saturated solution of KNO_3 is at 60°C and 100 mL. You cool it down to 20°C . Describe what happens. Do the MATH too!

87. What happens when you put 140 g KI into 100 mL water at 10°C? _____

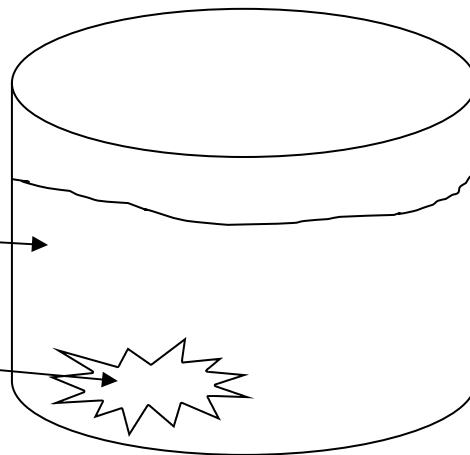
88. Does this "STOP"? _____

89. What does happen? _____

Draw a picture of this and label it all properly too.

90. _____

91. _____



92. In _____, the rate of the _____ reaction
is equal to the rate of the _____ reaction.

93. In this case we could say that the rate of _____ = rate of _____.

When $\text{NaCl}_{(s)} \rightarrow \text{Na}^{+}_{(aq)} + \text{Cl}^{-}_{(aq)}$ this is called _____ or _____

Does sugar, $\text{C}_{12}\text{H}_{22}\text{O}_{11}$ do this? _____ How does it dissolve into water?

	Substance	Is this an electrolyte?	Will this conduct electricity?
94	$\text{NaCl}_{(\text{AQ})}$		
95	$\text{NaCl}_{(\text{S})}$		
96	$\text{NaOH}_{(\text{AQ})}$		
97	$\text{NaOH}_{(\text{S})}$		
98	$\text{AgCl}_{(\text{S})}$		
99	$\text{AgCl}_{(\text{AQ})}$		
100	$\text{C}_{12}\text{H}_{22}\text{O}_{11(\text{AQ})}$		

101. Is $\text{Be}(\text{OH})_2$ an electrolyte? _____ Can it conduct electricity? _____

102. What about $\text{Be}(\text{OH})_{2(\text{L})}$ (melted beryllium hydroxide) Will that be able to conduct electricity? _____

103. How is that possible? _____

104. If liquid $\text{Be}(\text{OH})_2$ can conduct electricity, is it an electrolyte? _____

105. When sodium chloride goes into water, we would write the "equation" this way:

106. This is called _____ or _____

107. Does sugar do this? _____ What does sugar do? _____

108. Show the dissociation or the ionization for sodium acetate in water with phase symbols:
