

# LexSciBowl

## Chemistry Test

### Part A:

Every correct answer is worth 1 point.

1. What is the SI unit for length?
2. What is the SI unit for electric current?
3. How many significant figures are in the value 0.003010?
4. What is Avogadro's number, in scientific notation and to three significant figures?
5. How many valence electrons does nitrogen have?
6. How many valence electrons does barium have?
7. What is the name for an atom that contains more electrons than protons?
8. What is the name for an atom that contains more protons than electrons?
9. What is the general name for elements that belong to group 2A of the periodic table?
10. What is the general name for elements that belong to group 8A of the periodic table?
11. How many ions does each unit of  $\text{AlCl}_3$  separate into?
12. How many ions does each molecule of  $\text{SCl}_6$  separate into?
13. A thermometer that reads 62 degrees Celsius at 3:00 PM reads 14 degrees Celsius at 4:00PM. By how many degrees Kelvin did the temperature decrease?
14. Referring to the question above, by how many degrees Fahrenheit did the temperature decrease? Round your answer to the nearest whole number.
15. What are the two elements that are liquids at room temperature and pressure? (Both elements must be stated correctly to earn the point.)
16. Organic chemistry revolves around what element of the periodic table of elements?

Name the following compounds

17.  $\text{AlCl}_3$
18.  $\text{Na}_2\text{SO}_4$
19.  $\text{SF}_4$
20.  $\text{N}_2\text{O}_3$

Give the common names for these compounds

21.  $\text{NH}_3$
22.  $\text{CH}_4$
23.  $\text{NaHCO}_3$
24.  $\text{NaOH}$

25. What is the term for a solid that comes out of a solution?
26. A battery using the ion of what element is most commonly used in cell phones?
27.  $\text{H}_2\text{O}$  in what state of matter contains the most structure?
28. J.J. Thompson discovered what particle in 1897?

29. At most how many electrons can fill the 1s subshell?  
 30. At most how many electrons can fill the 3d subshell?

## Part B:

Every correct answer is worth 2 points.

31. In Rutherford's atomic experiments in 1910, what element did he use for his "foil"?
32. Identify the following molecules as polar or non-polar (Correctly answering at least three will earn one point, correctly answering all six will earn two points)
- $\text{CCl}_4$
  - $\text{H}_2\text{O}$
  - $\text{C}_6\text{H}_6$
  - $\text{CO}_2$
  - $\text{NH}_3$
  - $\text{N}_2$
33. What are the electron pair and molecular geometries of the compound  $\text{CO}_2$ ?
34. What is the bond angle of an  $\text{O}=\text{C}=\text{O}$  bond in the compound  $\text{CO}_2$ ?
35. What are the electron pair and molecular geometries of the compound  $\text{NH}_3$ ?
36. Given the following chart, roughly by what factor is the rate of formation of  $\text{ClO}_3^-$  increased when the concentration of  $\text{ClO}_2$  is doubled?

EXPERIMENT	INITIAL CONCENTRATION (mol/L)		INITIAL RATE OF FORMATION OF $\text{ClO}_3^-$ (mol/L min)
	$[\text{OH}^-]$	$[\text{ClO}_2]$	
1	0.030	0.020	0.166
2	0.060	0.020	0.331
3	0.030	0.040	0.661

37. What is the bond angle of a H-N-H bond in the compound  $\text{HN}_3$ ?
38. Draw the Lewis dot structure for  $\text{CCl}_4$ .
39. What is the empirical formula of glucose?
40. How many liters of water is necessary to dilute a 3L solution of 5M HBr to 2M?
41. What is the pH and pOH of a 1.0 M solution of HCl?
42. What is the pH and pOH of a 0.001 M solution of HCl?
43. What element has the smallest atomic radius?
44. What is the colour of a solution created by dissolving  $\text{Ni}_3(\text{PO}_4)_2$  in water?
45. How many millimeters of mercury are equivalent to 1 ATM?
46. The Daniell cell, a type of electrochemical cell, uses what metals as electrodes?
47. The brass alloy is composed of what two metals?
48. The billon alloy is composed of what two metals?
49. Tungsten light bulbs most commonly contain which noble gas?
50. In the reaction,  $2\text{NO}_{2(g)} \rightleftharpoons \text{N}_2\text{O}_{4(g)}$ , if pressure is increased in the system, then what direction will the equilibrium shift?

## Part C:

Every correct answer is worth 3 points.

51. List 3 strong acids. (Each correct answer will earn one point)
52. Name three allotropes of carbon? (Each correct answer will earn one point)
53. What is the pH and pOH of a 100 M solution of HCl?
54. Identify the following as soluble or insoluble in water (each correct answer yields one point)
  - a)  $\text{Ca}(\text{NO}_3)_2$
  - b)  $\text{CuS}$
  - c)  $\text{NH}_4\text{Br}$
55. Identify the following as miscible or immiscible with water (every two correct answers yields one point)
  - a)  $\text{CH}_3\text{Cl}$
  - b)  $\text{C}_6\text{H}_6$
  - c)  $\text{CCl}_4$
  - d) Ethanol
  - e) Oil
  - f) Formic acid
56. What process adds a coat of zinc to steel to prevent rusting?
57. What is the  $K_{sp}$  of  $\text{CaF}_2$  if the calcium ion concentration has been found to be  $2.1 \times 10^{-4} \text{ mol/L}$ ?  
Express your answer in scientific notation with two significant figures.
58. From what subshell is the first electron removed when copper undergoes its first ionization, from  $\text{Cu}$  to  $\text{Cu}^{1+}$ ?
59. Identify the type of colloid for the following examples (each correct answer yields one point)
  - a) Mayonnaise
  - b) Smoke
  - c) Ruby glass
60. For the following metals, name the flame colour that an ionic compound with the metal cation would produce (every four correct answers earns one point)
  - a) Li
  - b) Na
  - c) Ca
  - d) Ba
  - e) Se
  - f) As
  - g) Cu
  - h) Mg
  - i) Pb
  - j) K
  - k) Sr
  - l) B