PRACTICE EXAM 12: PHYSICAL SETTING/CHEMISTRY SIMULATION (85 QUESTIONS)

1. Which lists these Period 3 elements in order of increasing atomic radius?

A. Cl, S, Si, Na

B. Na, Si, S, Cl

C. Si, S, Cl, Na

D. S, Cl, Na, Si

2. Which lists these Group 1 elements in order of increasing atomic radius?

A. Li, Na, K, Rb

B. Rb, K, Na, Li

C. Na, Li, K, Rb

D. K, Rb, Li, Na

3. Which lists these Period 2 elements in order of increasing first ionization energy?

A. F, O, N, Li

B. N, O, F, Li

C. Li, B, N, F

D. F, N, B, Li

4. Which lists these elements in order of increasing electronegativity?

A. F, Cl, Br, I

B. F, O, N, C

C. I, F, Br, Cl

D. I, Br, Cl, F

5. Which lists these solutions in order of increasing pH?

A. soap (10), water (7), lemon juice (2)

B. water (7), lemon juice (2), soap (10)

C. soap (10), lemon juice (2), water (7)

D. lemon juice (2), water (7), soap (10)

6. Which lists these elements in order of increasing atomic number?

A. H, He, Li, Be

B. Be, Li, He, H

C. He, H, Be, Li

D. Li, Be, H, He

7. Which lists these Period 3 metals in order of increasing reactivity?

A. Na, Mg, Al

B. Na, Al, Mg

C. Al, Mg, Na

D. Mg, Na, Al

8. As heat is added to ice below 0 °C until it becomes steam, which is the correct order of phases?

A. gas, liquid, solid

B. liquid, solid, gas

C. solid, gas, liquid

D. solid, liquid, gas

9. An 80 g sample decays by half-lives. Which lists the mass remaining after 0, 1, 2, and 3 half-lives in order?

A. 80, 20, 40, 10 g

B. 80, 40, 20, 10 g

C. 10, 20, 40, 80 g

D. 80, 60, 40, 20 g

10. Which lists these Group 2 elements in order of decreasing first ionization energy?

A. Ba, Ca, Mg, Be

B. Be, Mg, Ca, Ba

C. Mg, Be, Ca, Ba

D. Ca, Ba, Be, Mg

11. Which lists these Period 3 elements in order of increasing electronegativity?

A. Cl, S, P, Si

B. S, Cl, Si, P

C. Si, P, S, Cl

D. Cl, P, S, Si

12. Which lists the three states of matter in order of increasing particle energy?

A. gas, liquid, solid

B. liquid, gas, solid

C. solid, gas, liquid

D. solid, liquid, gas

13. Which lists these Period 2 elements in order of decreasing atomic radius?

A. Li, Be, B, C

B. C, B, Be, Li

C. Be, Li, C, B

D. B, C, Li, Be

14. Which lists these halogens in order of increasing reactivity?

A. F, Cl, Br, I

B. Cl, F, I, Br

C. I, Br, Cl, F

D. Br, I, Cl, F

15. Which is the correct order of steps in a scientific investigation?

A. hypothesis, question, experiment, conclusion

B. question, hypothesis, experiment, conclusion

C. experiment, question, hypothesis, conclusion

D. conclusion, question, hypothesis, experiment

16. Which lists these Period 2 elements in order of increasing number of valence electrons?

A. F, O, N, C

B. C, N, O, F

C. N, C, F, O

D. O, F, C, N

17. Which lists these solutions in order of decreasing pH?

A. ammonia (11), pure water (7), vinegar (3)

B. vinegar (3), water (7), ammonia (11)

C. water (7), ammonia (11), vinegar (3)

D. ammonia (11), vinegar (3), water (7)

18. Which lists the elements Na, K, and Li in order of increasing atomic radius?

A. K, Na, Li

B. Na, K, Li

C. K, Li, Na

D. Li, Na, K

19. Which lists these gases in order of increasing molar mass? ($H_2 = 2$, $He = 4$, $O_2 = 32$, $CO_2 = 44$)

A. CO_2, O_2, He, H_2

B. O_2, CO_2, H_2, He

C. He, H_2, O_2, CO_2

D. H_2, He, O_2, CO_2

20. Which lists these Period 3 elements in order of increasing first ionization energy?

A. Ar, Cl, S, Na

B. Na, S, Cl, Ar

C. S, Na, Cl, Ar

D. Cl, Ar, Na, S

21. Which lists these temperatures in order of increasing value? (0 °C = 273 K)

A. 100 K, 0 °C, 300 K, 100 °C

B. 100 °C, 300 K, 0 °C, 100 K

C. 0 °C, 100 K, 100 °C, 300 K

D. 300 K, 100 °C, 100 K, 0 °C

22. Which lists these elements in order of increasing electronegativity?

A. C, N, O, F

B. F, O, N, C

C. O, N, F, C

D. N, C, O, F

23. In a reaction, which is the correct order from highest to lowest potential energy for an exothermic reaction?

A. reactants, products, activated complex

B. products, reactants, activated complex

C. activated complex, reactants, products

D. activated complex, products, reactants

24. Which lists the elements F, Cl, and Br in order of increasing atomic radius?

A. Br, Cl, F

B. Cl, F, Br

C. Br, F, Cl

D. F, Cl, Br

25. Which lists these solutions from most acidic to least acidic?

A. pH 1, pH 4, pH 7, pH 10

B. pH 10, pH 7, pH 4, pH 1

C. pH 7, pH 1, pH 10, pH 4

D. pH 4, pH 1, pH 7, pH 10

26. Which lists these Group 1 metals in order of increasing reactivity?

A. K, Na, Li

B. Na, K, Li

C. K, Li, Na

D. Li, Na, K

27. Which lists the elements Li, Na, and K in order of increasing number of occupied electron shells?

A. Na, Li, K

B. Li, Na, K

C. K, Na, Li

D. Na, K, Li

28. A radioactive sample is measured over time. Which lists the masses in the order they occur as the sample decays from 160 g?

A. 160, 80, 40, 20 g

B. 20, 40, 80, 160 g

C. 160, 40, 80, 20 g

D. 80, 160, 40, 20 g

29. Which lists Na, Mg, and Ar in order of increasing first ionization energy?

A. Ar, Mg, Na

B. Mg, Na, Ar

C. Ar, Na, Mg

D. Na, Mg, Ar

30. Which lists these bonds in order of increasing strength?

A. triple, double, single

B. double, single, triple

C. single, double, triple

D. single, triple, double

31. Which lists these Group 17 elements in order of decreasing electronegativity?

A. I, Br, Cl, F

B. Br, Cl, F, I

C. F, Cl, Br, I

D. Cl, F, I, Br

32. Which lists the elements O, S, and Se in order of increasing atomic radius?

A. Se, S, O

B. S, O, Se

C. Se, O, S

D. O, S, Se

33. As steam is cooled to ice, which is the correct order of phases?

A. gas, liquid, solid

B. solid, liquid, gas

C. liquid, gas, solid

D. gas, solid, liquid

34. Which lists these solutions in order of increasing molarity?

A. 2.0, 1.0, 0.5, 0.1 M

B. 0.1, 0.5, 1.0, 2.0 M

C. 0.5, 0.1, 1.0, 2.0 M

D. 1.0, 0.5, 0.1, 2.0 M

35. Which lists K, Na, and Li in order of increasing first ionization energy?

A. Li, Na, K

B. K, Na, Li

C. Na, K, Li

D. Li, K, Na

36. Which lists these noble gases in order of increasing boiling point? (He, Ne, Ar)

A. Ar, Ne, He

B. Ne, He, Ar

C. He, Ne, Ar

D. Ar, He, Ne

37. Which lists Na, Mg, and Al in order of decreasing reactivity?

A. Al, Mg, Na

B. Mg, Al, Na

C. Na, Mg, Al

D. Al, Na, Mg

38. Which lists these pH values in order of increasing hydrogen-ion concentration?

A. pH 1, pH 4, pH 7

B. pH 7, pH 4, pH 1

C. pH 4, pH 1, pH 7

D. pH 1, pH 7, pH 4

39. Which lists K, Na, and Li in order of decreasing atomic radius?

A. Li, Na, K

B. Na, Li, K

C. K, Na, Li

D. Li, K, Na

40. Which is the correct order in which electrons fill the first three energy levels?

A. first level, second level, third level

B. third level, second level, first level

C. second level, first level, third level

D. first level, third level, second level

41. Which lists these compounds in order of increasing gram-formula mass? (H_2O = 18, CO_2 = 44, NaCl = 58.5, $CaCO_3$ = 100)

A. $CaCO_3$, NaCl, CO_2, H_2O

B. NaCl, H_2O, CO_2, $CaCO_3$

C. CO_2, H_2O, NaCl, $CaCO_3$

D. H_2O, CO_2, NaCl, $CaCO_3$

42. Which lists Be, C, and O in order of increasing first ionization energy?

A. O, C, Be

B. C, Be, O

C. Be, C, O

D. O, Be, C

43. Which lists these substances in order of increasing pH? (stomach acid ≈ 1, black coffee ≈ 5, blood ≈ 7.4, bleach ≈ 13)

A. bleach, blood, coffee, stomach acid

B. stomach acid, coffee, blood, bleach

C. coffee, stomach acid, blood, bleach

D. stomach acid, blood, coffee, bleach

44. Which lists C, N, and O in order of increasing atomic radius?

A. N, C, O

B. O, N, C

C. C, N, O

D. N, O, C

45. Which lists an electron, a proton, and a neutron in order of increasing mass?

A. electron, proton, neutron

B. neutron, proton, electron

C. proton, electron, neutron

D. electron, neutron, proton

46. Which lists Na, P, and Cl in order of increasing electronegativity?

A. Cl, P, Na

B. P, Na, Cl

C. Cl, Na, P

D. Na, P, Cl

47. Which lists Cl, Si, and Na in order of increasing metallic character?

A. Na, Si, Cl

B. Si, Na, Cl

C. Na, Cl, Si

D. Cl, Si, Na

48. A sample with a 5-year half-life is followed. Which lists the elapsed times in order as it passes 1, 2, and 3 half-lives?

A. 15, 10, 5 years

B. 5, 10, 15 years

C. 10, 5, 15 years

D. 5, 15, 10 years

49. Which lists these intermolecular attractions in order of increasing strength?

A. hydrogen bonding, dipole-dipole, dispersion

B. dispersion, dipole-dipole, hydrogen bonding

C. dipole-dipole, dispersion, hydrogen bonding

D. hydrogen bonding, dispersion, dipole-dipole

50. Which lists these noble gases in order of increasing atomic number? (He, Ne, Ar, Kr)

A. He, Ne, Ar, Kr

B. Kr, Ar, Ne, He

C. Ne, He, Kr, Ar

D. Ar, Ne, He, Kr

51. Which lists Si, S, and Cl in order of decreasing electronegativity?

A. Si, S, Cl

B. S, Si, Cl

C. Cl, S, Si

D. Cl, Si, S

52. Which lists these solutions in order of increasing pH?

A. pH 2, pH 5, pH 8, pH 11

B. pH 11, pH 8, pH 5, pH 2

C. pH 5, pH 2, pH 8, pH 11

D. pH 8, pH 5, pH 11, pH 2

53. For most substances, which lists the states in order of increasing density?

A. solid, liquid, gas

B. liquid, solid, gas

C. solid, gas, liquid

D. gas, liquid, solid

54. Which lists F, Cl, Br, and I in order of increasing atomic radius?

A. I, Br, Cl, F

B. F, Cl, Br, I

C. Cl, F, Br, I

D. Br, I, F, Cl

55. Which lists these conditions from coldest to hottest? (freezing water, boiling water, room temperature)

A. freezing water, room temperature, boiling water

B. boiling water, room temperature, freezing water

C. room temperature, freezing water, boiling water

D. freezing water, boiling water, room temperature

56. Which lists Be, N, and Ne in order of increasing first ionization energy?

A. Ne, N, Be

B. N, Be, Ne

C. Ne, Be, N

D. Be, N, Ne

57. Which lists Cs, Ca, and F in order of increasing electronegativity?

A. F, Ca, Cs

B. Ca, Cs, F

C. Cs, Ca, F

D. F, Cs, Ca

58. A 200 g sample decays. Which lists the masses in order as half-lives pass?

A. 25, 50, 100, 200 g

B. 200, 100, 25, 50 g

C. 200, 100, 50, 25 g

D. 100, 200, 50, 25 g

59. Which lists Na, Mg, and Al in order of increasing atomic radius?

A. Na, Mg, Al

B. Al, Mg, Na

C. Mg, Al, Na

D. Al, Na, Mg

60. Which lists these solutions in order of decreasing pH?

A. pH 3, pH 6, pH 9, pH 12

B. pH 6, pH 3, pH 12, pH 9

C. pH 9, pH 12, pH 3, pH 6

D. pH 12, pH 9, pH 6, pH 3

61. Which lists carbon, oxygen, and neon in order of increasing number of protons?

A. neon, oxygen, carbon

B. carbon, oxygen, neon

C. oxygen, carbon, neon

D. neon, carbon, oxygen

62. Which lists F, Cl, and Br in order of decreasing reactivity?

A. Br, Cl, F

B. Cl, F, Br

C. F, Cl, Br

D. Br, F, Cl

63. Which lists the first four energy levels in the order they are filled?

A. 4, 3, 2, 1

B. 2, 1, 3, 4

C. 1, 2, 3, 4

D. 1, 3, 2, 4

64. Which lists Li, B, N, and F in order of increasing electronegativity?

A. Li, B, N, F

B. F, N, B, Li

C. B, Li, N, F

D. Li, N, B, F

65. Which lists Na, Al, P, and Cl in order of increasing first ionization energy?

A. Na, Al, P, Cl

B. Cl, P, Al, Na

C. Al, Na, P, Cl

D. Na, P, Al, Cl

66. Which lists F, Cl, and K in order of increasing atomic radius?

A. K, Cl, F

B. Cl, F, K

C. K, F, Cl

D. F, Cl, K

67. Which lists these solutions from most basic to least basic?

A. pH 13, pH 10, pH 8

B. pH 8, pH 10, pH 13

C. pH 10, pH 13, pH 8

D. pH 8, pH 13, pH 10

68. Which lists methane (CH_4), ethane (C_2H_6), and propane (C_3H_8) in order of increasing boiling point?

A. propane, ethane, methane

B. ethane, methane, propane

C. methane, ethane, propane

D. propane, methane, ethane

69. Which lists B, Al, and Ga in order of increasing atomic radius?

A. Ga, Al, B

B. Al, B, Ga

C. Ga, B, Al

D. B, Al, Ga

70. Which lists Cs, K, Na, and Li in order of increasing first ionization energy?

A. Li, Na, K, Cs

B. Na, Li, Cs, K

C. K, Cs, Na, Li

D. Cs, K, Na, Li

71. Which lists K, Mg, and O in order of increasing electronegativity?

A. O, Mg, K

B. Mg, K, O

C. K, Mg, O

D. O, K, Mg

72. Which is the correct order of phase changes as a solid is heated to a gas?

A. boiling, melting

B. condensation, melting

C. melting, boiling

D. freezing, boiling

73. Which lists these solutions in order of increasing acidity?

A. pH 2, pH 5, pH 7

B. pH 7, pH 5, pH 2

C. pH 5, pH 2, pH 7

D. pH 2, pH 7, pH 5

74. Which lists He, C, Ne, and Ca in order of increasing atomic mass? (He = 4, C = 12, Ne = 20, Ca = 40)

A. Ca, Ne, C, He

B. C, He, Ne, Ca

C. He, Ne, C, Ca

D. He, C, Ne, Ca

75. Which lists Na, Si, S, and Cl in order of decreasing atomic radius?

A. Cl, S, Si, Na

B. Na, Si, S, Cl

C. Si, Na, S, Cl

D. Na, S, Si, Cl

76. Which lists Cs, Ca, and Cl in order of increasing first ionization energy?

A. Cl, Ca, Cs

B. Ca, Cs, Cl

C. Cs, Ca, Cl

D. Cl, Cs, Ca

77. Which lists Li, K, and Cs in order of increasing reactivity?

A. Cs, K, Li

B. K, Li, Cs

C. Cs, Li, K

D. Li, K, Cs

78. Which lists F, O, N, and C in order of decreasing electronegativity?

A. C, N, O, F

B. F, O, N, C

C. O, F, C, N

D. N, C, F, O

79. Which lists battery acid (pH 0), milk (pH 6.5), and oven cleaner (pH 13) in order of increasing pH?

A. battery acid, milk, oven cleaner

B. oven cleaner, milk, battery acid

C. milk, battery acid, oven cleaner

D. battery acid, oven cleaner, milk

80. Which lists O, S, Se, and Te in order of increasing atomic radius?

A. Te, Se, S, O

B. S, O, Se, Te

C. O, S, Se, Te

D. O, Se, S, Te

81. Which lists B, C, N, and O in order of increasing first ionization energy?

A. B, C, N, O

B. O, N, C, B

C. C, B, O, N

D. B, N, C, O

82. Which lists an element from Group 1, Group 14, and Group 17 in order of increasing number of valence electrons?

A. Group 17, Group 14, Group 1

B. Group 1, Group 14, Group 17

C. Group 14, Group 1, Group 17

D. Group 1, Group 17, Group 14

83. Which lists Al, Mg, Na, and K in order of increasing reactivity?

A. K, Na, Mg, Al

B. Al, Mg, Na, K

C. Mg, Al, K, Na

D. Na, K, Al, Mg

84. Which lists F_2, Cl_2, and Br_2 in order of increasing boiling point?

A. F_2, Cl_2, Br_2

B. Br_2, Cl_2, F_2

C. Cl_2, F_2, Br_2

D. F_2, Br_2, Cl_2

85. Which lists hydrogen, helium, lithium, and beryllium in order of increasing atomic number?

A. beryllium, lithium, helium, hydrogen

B. hydrogen, helium, lithium, beryllium

C. helium, hydrogen, beryllium, lithium

D. lithium, beryllium, hydrogen, helium

Practice Exam 12 – Explained Answer Key

1. A — Atomic radius decreases left to right across a period, so the increasing order runs from the right-side Cl to the left-side Na: Cl, S, Si, Na. Sodium, on the far left, is the largest. The increasing nuclear charge across the period shrinks the atoms.
2. A — Atomic radius increases down a group as electron shells are added, so increasing order is Li, Na, K, Rb. Lithium, at the top, is smallest. Each lower element gains a shell.

3. C — First ionization energy increases left to right across a period, so increasing order is Li, B, N, F. Fluorine holds its electrons most tightly. The growing nuclear charge raises the energy needed to remove an electron.
4. D — Electronegativity increases up Group 17, so increasing order is I, Br, Cl, F. Fluorine attracts shared electrons most strongly. Smaller atoms higher in the group pull electrons more effectively.
5. D — Increasing pH runs from most acidic to most basic, so the order is lemon juice (2), water (7), soap (10). Higher pH means less acidic. The values rise from 2 to 10.
6. A — Atomic number increases with proton count, so the order is H (1), He (2), Li (3), Be (4). Each element has one more proton than the last. This is their order on the periodic table.
7. C — Metallic reactivity decreases left to right across a period, so increasing reactivity runs Al, Mg, Na. Sodium, farthest left, loses its electron most easily. Reactivity grows toward the left.
8. D — Heating ice to steam passes through solid, then liquid, then gas. Energy is added to melt and then boil the substance. This is the order of states with increasing energy.
9. B — Each half-life halves the mass, giving 80, 40, 20, 10 g after 0, 1, 2, and 3 half-lives. The sample loses half its remaining mass each interval. The values fall by half each step.
10. B — First ionization energy decreases down Group 2, so decreasing order is Be, Mg, Ca, Ba. Beryllium, at the top, holds its electrons most tightly. Larger atoms lower in the group lose electrons more easily.
11. C — Electronegativity increases left to right across a period, so increasing order is Si, P, S, Cl. Chlorine attracts shared electrons most strongly. The trend rises toward the right.
12. D — Particle energy increases from solid to liquid to gas. Solid particles vibrate in place, liquid particles flow, and gas particles move freely. The states gain kinetic energy in this order.
13. A — Atomic radius decreases left to right, so decreasing order from the left is Li, Be, B, C. Lithium is largest and carbon smallest. The atoms shrink across the period.
14. C — Halogen reactivity increases up the group, so increasing order is I, Br, Cl, F. Fluorine, at the top, is the most reactive. Smaller halogens gain electrons more readily.
15. B — A scientific investigation proceeds as question, hypothesis, experiment, conclusion. A question prompts a hypothesis, which the experiment tests, leading to a conclusion. This is the standard order of the scientific method.
16. B — Valence electrons increase across Period 2, so increasing order is C (4), N (5), O (6), F (7). The group number gives the valence count. The outer electrons increase toward the right.
17. A — Decreasing pH runs from most basic to most acidic, so the order is ammonia (11), water (7), vinegar (3). Higher pH comes first. The values fall from 11 to 3.
18. D — Atomic radius increases down Group 1, so increasing order is Li, Na, K. Potassium, lowest, is largest. Added shells make each lower atom bigger.
19. D — Increasing molar mass orders the gases H_2 (2), He (4), O_2 (32), CO_2 (44). Each successive gas is heavier. The masses rise from 2 to 44.
20. B — First ionization energy increases across Period 3, so increasing order is Na, S, Cl, Ar. Argon, on the right, holds its electrons most tightly. The energy needed rises toward the right.
21. A — Converting to kelvin gives 100 K, 273 K (0 °C), 300 K, and 373 K (100 °C). The increasing order is 100 K, 0 °C, 300 K, 100 °C. The kelvin values rank the temperatures.
22. A — Electronegativity increases across Period 2, so increasing order is C, N, O, F. Fluorine attracts shared electrons most strongly. The trend rises toward the right.
23. C — In an exothermic reaction, the activated complex is the highest energy point, followed by the reactants, then the lower-energy products. The peak is the activated complex, and the products lie below the reactants. This is the order from highest to lowest potential energy.

24. D — Atomic radius increases down Group 17, so increasing order is F, Cl, Br. Bromine, lowest, is largest. Added shells enlarge each lower atom.
25. A — Most acidic means lowest pH, so the order from most to least acidic is pH 1, 4, 7, 10. The values rise as acidity falls. Lower pH indicates greater acidity.
26. D — Reactivity increases down Group 1, so increasing order is Li, Na, K. Potassium, lowest, is most reactive. Its outer electron is most easily lost.
27. B — The number of occupied shells increases down a group, so increasing order is Li (2 shells), Na (3), K (4). Each lower element has one more shell. The period number gives the shell count.
28. A — A sample decaying from 160 g halves each interval, giving 160, 80, 40, 20 g. Each value is half the one before. The mass falls by half each step.
29. D — First ionization energy increases across Period 3, so increasing order is Na, Mg, Ar. Argon holds its electrons most tightly. The energy needed rises toward the right.
30. C — Bond strength increases from single to double to triple. More shared electron pairs mean a stronger bond. The triple bond is the strongest.
31. C — Electronegativity decreases down Group 17, so decreasing order is F, Cl, Br, I. Fluorine, at the top, is highest. The values fall going down the group.
32. D — Atomic radius increases down Group 16, so increasing order is O, S, Se. Selenium, lowest, is largest. Added shells enlarge each lower atom.
33. A — Cooling steam to ice passes through gas, then liquid, then solid. Energy is removed to condense and then freeze the substance. This is the order of states with decreasing energy.
34. B — Increasing molarity orders the solutions 0.1, 0.5, 1.0, 2.0 M. Each is more concentrated than the last. The values rise from 0.1 to 2.0.
35. B — First ionization energy increases up Group 1, so increasing order is K, Na, Li. Lithium, at the top, holds its electron most tightly. The energy rises going up the group.
36. C — Boiling point increases down the noble gases, so increasing order is He, Ne, Ar. Larger atoms with more electrons have stronger dispersion forces. Argon boils at the highest temperature of the three.
37. C — Metallic reactivity decreases left to right, so decreasing order is Na, Mg, Al. Sodium, farthest left, is most reactive. Reactivity falls toward the right.
38. B — Lower pH means higher hydrogen-ion concentration, so increasing [H^+] runs from highest pH down: pH 7, 4, 1. The most acidic solution has the most H^+. Concentration rises as pH falls.
39. C — Atomic radius decreases up Group 1, so decreasing order is K, Na, Li. Potassium, lowest, is largest. The atoms shrink going up the group.
40. A — Electrons fill the energy levels from lowest to highest: first, then second, then third. Lower levels fill before higher ones. This follows the principle of minimum energy.
41. D — Increasing gram-formula mass orders the compounds H_2O (18), CO_2 (44), NaCl (58.5), $CaCO_3$ (100). Each successive compound is heavier. The masses rise from 18 to 100.
42. C — First ionization energy increases across Period 2, so increasing order is Be, C, O. Oxygen holds its electrons most tightly of the three. The energy rises toward the right.
43. B — Increasing pH orders the substances stomach acid (1), coffee (5), blood (7.4), bleach (13). Higher pH means less acidic. The values rise from 1 to 13.
44. B — Atomic radius decreases left to right, so increasing order from the right is O, N, C. Carbon, farthest left of the three, is largest. The atoms grow toward the left.
45. A — Increasing mass orders the particles electron, proton, neutron. The electron has almost no mass, while the neutron is slightly heavier than the proton. The two nucleons far outweigh the electron.

46. D — Electronegativity increases across Period 3, so increasing order is Na, P, Cl. Chlorine attracts shared electrons most strongly. The trend rises toward the right.
47. D — Metallic character increases right to left, so increasing order is Cl, Si, Na. Sodium, farthest left, is the most metallic. The trait grows toward the left.
48. B — With a 5-year half-life, 1, 2, and 3 half-lives take 5, 10, and 15 years. Each half-life adds 5 years. The elapsed times rise in equal steps.
49. B — Intermolecular forces increase in strength from dispersion to dipole-dipole to hydrogen bonding. Dispersion forces are weakest, and hydrogen bonds are strongest. This is the order of increasing strength.
50. A — Increasing atomic number orders the noble gases He (2), Ne (10), Ar (18), Kr (36). Each has more protons than the last. This is their order down Group 18.
51. C — Electronegativity decreases right to left, so decreasing order is Cl, S, Si. Chlorine, farthest right, is highest. The values fall toward the left.
52. A — Increasing pH orders the solutions pH 2, 5, 8, 11. The values rise steadily. Higher pH means less acidic.
53. D — For most substances, density increases from gas to liquid to solid. Gas particles are far apart, while solid particles are packed tightly. The solid is the most dense.
54. B — Atomic radius increases down Group 17, so increasing order is F, Cl, Br, I. Iodine, lowest, is largest. Added shells enlarge each lower atom.
55. A — From coldest to hottest, the order is freezing water (0 °C), room temperature (about 20 °C), boiling water (100 °C). The temperatures rise in this order. Freezing is coldest and boiling hottest.
56. D — First ionization energy increases across Period 2, so increasing order is Be, N, Ne. Neon, a noble gas on the right, holds its electrons most tightly. The energy rises toward the right.
57. C — Electronegativity increases from the bottom-left to the top-right, so increasing order is Cs, Ca, F. Cesium is lowest and fluorine highest. The trend rises across and up the table.
58. C — A 200 g sample halves each interval, giving 200, 100, 50, 25 g. Each value is half the one before. The mass falls by half each step.
59. B — Atomic radius decreases left to right, so increasing order from the right is Al, Mg, Na. Sodium, farthest left, is largest. The atoms grow toward the left.
60. D — Decreasing pH orders the solutions pH 12, 9, 6, 3. The values fall steadily. Lower pH means more acidic.
61. B — Increasing proton count orders the elements carbon (6), oxygen (8), neon (10). Each has more protons than the last. The atomic number gives the order.
62. C — Halogen reactivity decreases down the group, so decreasing order is F, Cl, Br. Fluorine, at the top, is most reactive. Reactivity falls going down.
63. C — Energy levels fill from lowest to highest, so the order is 1, 2, 3, 4. Lower levels fill before higher ones. This follows the principle of minimum energy.
64. A — Electronegativity increases across Period 2, so increasing order is Li, B, N, F. Fluorine attracts shared electrons most strongly. The trend rises toward the right.
65. A — First ionization energy increases across Period 3, so increasing order is Na, Al, P, Cl. Chlorine holds its electrons most tightly of the four. The energy rises toward the right.
66. D — Fluorine is smallest (top right), chlorine larger (one period down), and potassium largest (bottom left), so increasing order is F, Cl, K. Radius grows down and to the left. Potassium is the largest of the three.
67. A — Most basic means highest pH, so from most to least basic the order is pH 13, 10, 8. Higher pH comes first. The values fall as basicity decreases.

68. C — Boiling point increases with molar mass among these alkanes, so increasing order is methane, ethane, propane. Larger molecules have stronger dispersion forces. Propane boils at the highest temperature.
69. D — Atomic radius increases down Group 13, so increasing order is B, Al, Ga. Gallium, lowest, is largest. Added shells enlarge each lower atom.
70. D — First ionization energy increases up Group 1, so increasing order is Cs, K, Na, Li. Lithium, at the top, holds its electron most tightly. The energy rises going up the group.
71. C — Electronegativity increases across a period, so increasing order is K (Group 1), Mg (Group 2), O. Oxygen attracts shared electrons most strongly. The trend rises toward the right.
72. C — Heating a solid to a gas passes through melting, then boiling. Melting changes solid to liquid, and boiling changes liquid to gas. This is the order of phase changes.
73. B — Increasing acidity means decreasing pH, so the order is pH 7, 5, 2. The lowest pH is most acidic. Acidity rises as pH falls.
74. D — Increasing atomic mass orders the elements He (4), C (12), Ne (20), Ca (40). Each is heavier than the last. The masses rise from 4 to 40.
75. B — Atomic radius decreases left to right, so decreasing order from the left is Na, Si, S, Cl. Sodium is largest and chlorine smallest. The atoms shrink toward the right.
76. C — First ionization energy increases from the bottom-left to the right, so increasing order is Cs, Ca, Cl. Cesium loses its electron most easily and chlorine holds tightest. The energy rises across and up.
77. D — Reactivity increases down Group 1, so increasing order is Li, K, Cs. Cesium, lowest, is most reactive. Its outer electron is most easily lost.
78. B — Electronegativity decreases right to left across Period 2, so decreasing order is F, O, N, C. Fluorine is highest and carbon lowest. The values fall toward the left.
79. A — Increasing pH orders the substances battery acid (0), milk (6.5), oven cleaner (13). Higher pH means less acidic. The values rise from 0 to 13.
80. C — Atomic radius increases down Group 16, so increasing order is O, S, Se, Te. Tellurium, lowest, is largest. Added shells enlarge each lower atom.
81. A — Across Period 2, first ionization energy is taught as a steady increase, so the order is B, C, N, O. The growing nuclear charge raises the energy needed to remove an electron. Oxygen holds its electrons most tightly of the four.
82. B — Valence electrons increase with group number, so increasing order is Group 1 (1), Group 14 (4), Group 17 (7). The group number gives the valence count. The outer electrons rise across the table.
83. B — Metallic reactivity increases toward the bottom-left, so increasing order is Al, Mg, Na, K. Potassium, lowest and leftmost, is most reactive. Reactivity grows down and to the left.
84. A — Boiling point increases down the halogens, so increasing order is F_2, Cl_2, Br_2. Larger molecules have stronger dispersion forces. Bromine boils at the highest temperature of the three.
85. B — Increasing atomic number orders the elements hydrogen (1), helium (2), lithium (3), beryllium (4). Each has one more proton than the last. This is their order on the periodic table.