PRACTICE EXAM 9: PHYSICAL SETTING/CHEMISTRY SIMULATION (85 QUESTIONS)

1. As the elements are considered from left to right across a period, the atomic radius generally

A. increases

B. decreases

C. stays the same

D. increases, then decreases

2. As the elements are considered from top to bottom within a group, the atomic radius generally

A. decreases

B. stays the same

C. first decreases, then increases

D. increases

3. If the temperature of a reaction is increased, the reaction rate will most likely

A. decrease

B. increase

C. remain unchanged

D. stop completely

4. Which atom has the larger atomic radius, sodium (Na) or chlorine (Cl)?

A. Cl, because it has more protons

B. they have identical radii

C. Na, because atomic radius decreases across a period

D. neither has a measurable radius

5. As the elements are considered from left to right across a period, the first ionization energy generally

A. increases

B. decreases

C. stays constant

D. drops to zero

6. Increasing the concentration of a reactant in solution will generally cause the reaction rate to

A. decrease

B. increase

C. stay the same

D. reverse direction

7. As the elements are considered from bottom to top within a group, electronegativity generally

A. decreases

B. stays the same

C. increases

D. becomes negative

8. Which element has greater metallic character, sodium (Na) or sulfur (S)?

A. S, because it is a nonmetal

B. they are equally metallic

C. Na, because metallic character decreases across a period

D. neither shows metallic character

9. Grinding a solid reactant into a fine powder before a reaction will generally cause the rate to

A. decrease

B. increase

C. stay the same

D. become zero

10. Adding a catalyst to a reaction will

A. increase the rate by lowering the activation energy

B. decrease the rate by raising the activation energy

C. have no effect on the rate

D. permanently change the products

11. An element in Group 2 will most likely form an ion with a charge of

A. −2

B. +1

C. +2

D. −1

12. An element in Group 17 will most likely form an ion with a charge of

A. +1

B. +7

C. +2

D. −1

13. Which substance would be expected to have the higher boiling point at standard pressure, water (H_2O) or methane (CH_4)?

A. H_2O, because of strong hydrogen bonding

B. CH_4, because it is a smaller molecule

C. they boil at the same temperature

D. neither has a measurable boiling point

14. If the pressure on a gas is increased at constant temperature, its volume will

A. decrease

B. increase

C. stay the same

D. become zero

15. If the temperature of a gas is increased at constant pressure, its volume will

A. decrease

B. increase

C. stay the same

D. become negative

16. Which metal is more reactive, lithium (Li) or potassium (K)?

A. Li, because it is smaller

B. they are equally reactive

C. neither reacts with water

D. K, because reactivity increases down Group 1

17. Which nonmetal is more reactive, fluorine (F) or iodine (I)?

A. I, because it is larger

B. they are equally reactive

C. F, because reactivity increases up Group 17

D. neither is reactive

18. Adding heat to an endothermic reaction at equilibrium will shift the equilibrium

A. toward the products

B. toward the reactants

C. in no direction

D. to form a solid

19. Increasing the pressure on a gaseous equilibrium will shift it toward the side with

A. more gas molecules

B. fewer gas molecules

C. heavier molecules only

D. no shift ever occurs

20. For most solid solutes, increasing the temperature of the solvent will cause solubility to

A. increase

B. decrease

C. stay the same

D. drop to zero

21. For a gas dissolved in water, increasing the temperature will cause its solubility to

A. increase

B. stay the same

C. decrease

D. double

22. Which element has the higher first ionization energy, magnesium (Mg) or barium (Ba)?

A. Ba, because it is larger

B. Mg, because ionization energy decreases down a group

C. they are equal

D. neither can be ionized

23. Removing a product from a system at equilibrium will shift the equilibrium

A. toward the products

B. toward the reactants

C. in no direction

D. to form a precipitate

24. Adding salt to water will cause the freezing point of the water to

A. increase

B. stay the same

C. decrease

D. become positive

25. Adding a nonvolatile solute to water will cause the boiling point of the solution to

A. decrease

B. stay the same

C. drop to zero

D. increase

26. Which element has the greater electronegativity, oxygen (O) or sulfur (S)?

A. S, because it is larger

B. they are equal

C. O, because electronegativity increases up a group

D. neither attracts electrons

27. A student wants to dissolve more sugar in a cup of water. To do this, the student should

A. cool the water down

B. add more sugar without changing conditions

C. heat the water up

D. freeze the water

28. Which is more likely to conduct electricity when dissolved in water, sodium chloride (NaCl) or sugar ($C_{12}H_{22}O_{11}$)?

A. NaCl, because it dissociates into ions

B. sugar, because it is molecular

C. they conduct equally

D. neither conducts at all

29. A catalyst increases reaction rate because it provides a reaction pathway with

A. higher activation energy

B. lower activation energy

C. no products

D. fewer reactants

30. A reaction using a powdered metal versus the same mass as a single block will proceed

A. faster with the powder

B. faster with the block

C. at the same rate

D. not at all with the powder

31. Lowering the temperature of a reaction will generally cause its rate to

A. increase

B. stay the same

C. double

D. decrease

32. Compared to its neutral atom, a sodium ion (Na^+) is

A. larger, because it gained electrons

B. the same size

C. larger, because it lost a proton

D. smaller, because it lost an electron shell

33. Compared to its neutral atom, a chloride ion (Cl^-) is

A. smaller, because it lost electrons

B. the same size

C. larger, because gaining an electron increases repulsion

D. smaller, because it gained a proton

34. A bond between two atoms with a very large electronegativity difference is most likely

A. nonpolar covalent

B. metallic

C. ionic

D. a network of equal sharing

35. A bond between two identical nonmetal atoms is most likely

A. ionic

B. nonpolar covalent

C. metallic

D. a hydrogen bond

36. Adding more reactant to a system at equilibrium will shift the equilibrium

A. toward the products

B. toward the reactants

C. in no direction

D. toward forming a gas only

37. Which is the better conductor of electricity in the solid state, copper metal or solid table salt (NaCl)?

A. NaCl, because it contains ions

B. they conduct equally

C. neither conducts when solid

D. copper, because of its mobile electrons

38. Increasing the temperature of a sample of gas will cause the average kinetic energy of its particles to

A. decrease

B. stay the same

C. become zero

D. increase

39. Which generally has the higher melting point, an ionic compound or a molecular compound?

A. molecular, because of weak forces

B. ionic, because of strong electrostatic attractions

C. they melt at the same temperature

D. neither melts

40. Compressing a gas into a smaller volume at constant temperature will cause its pressure to

A. decrease

B. increase

C. stay the same

D. become zero

41. Which element has the higher first ionization energy, sodium (Na) or argon (Ar)?

A. Na, because it has fewer protons

B. they are equal

C. Ar, because ionization energy increases across a period

D. neither can be ionized

42. Compared to a weak acid solution, a strong acid solution of the same concentration will have a

A. higher pH

B. identical pH

C. neutral pH

D. lower pH

43. A solution with a pH of 11 is best described as

A. acidic

B. basic

C. neutral

D. impossible

44. Adding a base to an acidic solution will cause the pH to

A. decrease

B. stay the same

C. increase

D. become negative

45. A more active metal placed in a solution containing the ions of a less active metal will

A. not react at all

B. dissolve the container

C. replace the less active metal from solution

D. become a gas

46. Removing heat from a liquid will eventually cause it to

A. boil

B. sublime

C. stay liquid forever

D. freeze into a solid

47. Adding enough heat to a solid will cause its particles to

A. slow down and lock in place

B. lose all energy

C. gain energy and eventually melt

D. disappear

48. For most substances, which state is the most dense?

A. the solid state

B. the gaseous state

C. the plasma state

D. all states are equally dense

49. Among nonpolar molecules, those with larger molar mass generally have

A. lower boiling points

B. no boiling point

C. identical boiling points

D. higher boiling points

50. Which is the strongest bond between two atoms, a single bond, a double bond, or a triple bond?

A. the single bond

B. all are equal

C. the double bond

D. the triple bond

51. A sealed syringe of gas is pushed to half its original volume at constant temperature. The pressure inside will

A. fall to half

B. roughly double

C. stay the same

D. drop to zero

52. In an exothermic reaction, the products have

A. more energy than the reactants

B. the same energy as the reactants

C. infinite energy

D. less energy than the reactants

53. Adding a catalyst to a system at equilibrium will

A. speed up the forward and reverse rates equally, without shifting the position

B. shift the equilibrium toward the products

C. shift the equilibrium toward the reactants

D. stop the reaction

54. Which molecule is nonpolar, carbon dioxide (CO_2) or water (H_2O)?

A. CO_2, because its linear shape makes the bond polarities cancel

B. H_2O, because it is bent

C. both are nonpolar

D. both are polar

55. Solid sodium chloride does not conduct electricity, but molten (liquid) sodium chloride does, because

A. melting destroys the ions

B. molten salt contains no charges

C. melting frees the ions to move

D. liquids never conduct

56. Adding heat to an exothermic reaction at equilibrium will shift it

A. toward the reactants

B. toward the products

C. in no direction

D. toward forming a solid

57. Which atom is larger, fluorine (F) or chlorine (Cl)?

A. F, because it has fewer electrons

B. Cl, because atomic radius increases down a group

C. they are the same size

D. neither has a defined radius

58. Adding water to a solution will cause its concentration to

A. increase

B. decrease

C. stay the same

D. become infinite

59. Two different gas samples are at the same temperature. Their average kinetic energies are

A. equal, because temperature measures average kinetic energy

B. different, depending on the gas

C. zero for both

D. impossible to compare

60. Copper is more active than silver. Which combination will react, copper placed in silver nitrate solution, or silver placed in copper nitrate solution?

A. silver in copper nitrate

B. both will react

C. neither will react

D. copper in silver nitrate

61. Compared to a weak acid, a strong acid of equal concentration will conduct electricity

A. more poorly

B. identically

C. better, because it ionizes more completely

D. not at all

62. A sugar cube and an equal mass of granulated sugar are added to identical cups of water. The granulated sugar will dissolve

A. more slowly

B. at the same rate

C. not at all

D. faster, because of its greater surface area

63. Which solution conducts electricity better, one containing a strong electrolyte or one containing a nonelectrolyte?

A. the nonelectrolyte

B. the strong electrolyte

C. they conduct equally

D. neither conducts

64. Raising the temperature increases reaction rate mainly because the particles

A. become larger

B. lose energy

C. stop colliding

D. collide more frequently and with more energy

65. Which bond is more polar, H–F or H–I? (Fluorine is more electronegative than iodine.)

A. H–F, because of the larger electronegativity difference

B. H–I, because iodine is larger

C. they are equally polar

D. neither bond is polar

66. Increasing the pressure on a solid or a liquid changes its volume

A. very little, because they are nearly incompressible

B. greatly, like a gas

C. to zero

D. to infinity

67. A puddle of water evaporates faster on a hot day than on a cold day because the higher temperature gives the molecules

A. less energy to escape

B. more energy to escape the liquid

C. a heavier mass

D. a stronger bond

68. Which type of element tends to lose electrons in chemical reactions, a metal or a nonmetal?

A. a nonmetal

B. a metal

C. both equally

D. neither

69. Which type of element tends to gain electrons in chemical reactions?

A. a nonmetal

B. a metal

C. a noble gas

D. an alkali metal

70. Noble gases are generally unreactive because they have

A. one valence electron

B. no electrons at all

C. a positive charge

D. a stable, filled outer electron shell

71. Increasing the concentration of reactants increases the reaction rate because it increases the

A. frequency of collisions between particles

B. size of the particles

C. temperature of the system

D. activation energy required

72. In a potential energy diagram, a reaction with a lower activation energy will generally proceed

A. faster than one with a higher activation energy

B. slower than one with a higher activation energy

C. at the same rate regardless

D. only in reverse

73. Compared to a weak base, a strong base of equal concentration will have a pH that is

A. lower

B. higher

C. exactly 7

D. negative

74. Adding a catalyst to a reaction changes the

A. amount of product formed at equilibrium

B. rate at which equilibrium is reached

C. identity of the products

D. energy of the products

75. Which is more chemically reactive, an alkali metal (Group 1) or a noble gas (Group 18)?

A. the alkali metal, because it readily loses an electron

B. the noble gas, because it has a full shell

C. they are equally reactive

D. neither reacts

76. Heating most substances causes them to expand, which makes their density

A. increase

B. stay the same

C. become infinite

D. decrease

77. A real gas behaves most like an ideal gas under conditions of

A. low temperature and high pressure

B. high temperature and low pressure

C. low temperature and low pressure

D. high temperature and high pressure

78. A substance that conducts electricity as a solid, is shiny, and is malleable is most likely

A. an ionic compound

B. a molecular compound

C. a noble gas

D. a metal

79. Increasing the pressure on a liquid will cause its boiling point to

A. decrease

B. stay the same

C. drop to zero

D. increase

80. Which solution will have the lower freezing point, one with more dissolved salt or one with less, using the same amount of water?

A. the one with less salt

B. they freeze at the same temperature

C. the one with more salt

D. neither will freeze

81. A bond between two atoms with identical electronegativity values will be

A. ionic

B. polar covalent

C. nonpolar covalent

D. both metallic and ionic

82. Compared to metals, nonmetals generally have ionization energies that are

A. lower

B. equal

C. zero

D. higher

83. Which has stronger intermolecular forces, a substance that is a solid at room temperature or one that is a gas at room temperature?

A. the gas

B. the solid

C. they are equal

D. neither has forces

84. Across Period 3, from sodium to chlorine, the elements change from

A. nonmetals to metals

B. all gases to all solids

C. metallic to nonmetallic in character

D. unreactive to noble

85. Which of the following would generally slow down a reaction rather than speed it up?

A. increasing the temperature

B. increasing the concentration

C. decreasing the temperature

D. increasing the surface area

Practice Exam 9 – Explained Answer Key

1. B — Atomic radius decreases from left to right across a period. Each added proton pulls the electrons in the same outer shell more strongly, shrinking the atom. The increasing nuclear charge outweighs the constant shell count.
2. D — Atomic radius increases from top to bottom within a group. Each lower element adds a new electron shell, placing the outer electrons farther from the nucleus. More shells mean a larger atom.

3. B — Raising the temperature increases reaction rate. Particles move faster, colliding more often and with enough energy to react. Higher kinetic energy produces more effective collisions.
4. C — Sodium has the larger radius because radius decreases across a period and Na sits to the left of Cl in Period 3. The smaller nuclear charge on Na pulls its electrons less tightly. Position in the period determines the trend.
5. A — First ionization energy increases across a period. The stronger nuclear charge holds the outer electrons more tightly, making them harder to remove. Removing an electron requires more energy toward the right side.
6. B — Increasing reactant concentration increases the reaction rate. More particles in a given volume collide more frequently. More frequent collisions speed up the reaction.
7. C — Electronegativity increases from bottom to top within a group. Higher elements have smaller radii, so the nucleus attracts bonding electrons more strongly. Smaller atoms pull shared electrons more effectively.
8. C — Sodium has greater metallic character because metallic character decreases across a period and Na lies to the left of S. Metals readily lose electrons, a property strongest on the left. Sulfur, a nonmetal, is far less metallic.
9. B — Grinding a solid into powder increases its surface area, which increases the reaction rate. More exposed surface allows more contact and collisions. Greater surface area speeds up the reaction.
10. A — A catalyst increases the rate by providing a pathway with lower activation energy. With less energy needed, more collisions succeed. The catalyst is not consumed in the reaction.
11. C — Group 2 elements have two valence electrons, which they lose to form +2 ions. Losing both outer electrons gives a stable configuration. The group number predicts the ion charge.
12. D — Group 17 elements have seven valence electrons and gain one to complete an octet, forming −1 ions. Gaining a single electron achieves a noble-gas configuration. This is characteristic of the halogens.
13. A — Water has the higher boiling point because of strong hydrogen bonding between its molecules. These attractions require more energy to overcome than the weak forces in methane. Stronger intermolecular forces raise the boiling point.
14. A — Increasing pressure at constant temperature decreases a gas's volume, following Boyle's law. The gas is compressed into a smaller space. Pressure and volume are inversely related.
15. B — Increasing temperature at constant pressure increases a gas's volume, following Charles's law. Faster-moving particles push the volume outward. Volume and kelvin temperature are directly related.
16. D — Potassium is more reactive because reactivity increases down Group 1. Its outer electron is farther from the nucleus and more easily lost. Easier electron loss means greater reactivity.
17. C — Fluorine is more reactive because halogen reactivity increases up Group 17. Its small size lets it attract and gain an electron more strongly. Higher position means greater reactivity for nonmetals.
18. A — Adding heat to an endothermic reaction shifts the equilibrium toward the products. Heat acts as a reactant in an endothermic process, so adding it drives the forward reaction. The system shifts to consume the added heat.
19. B — Increasing pressure shifts a gaseous equilibrium toward the side with fewer gas molecules. The system reduces pressure by favoring fewer moles of gas. This follows Le Châtelier's principle.
20. A — For most solid solutes, raising the solvent temperature increases solubility. Added thermal energy helps break the solid apart and keep more in solution. Warmer water dissolves more solid.

21. C — For a dissolved gas, increasing the temperature decreases its solubility. Higher energy lets gas molecules escape the liquid more easily. Warm liquids hold less dissolved gas.
22. B — Magnesium has the higher first ionization energy because ionization energy decreases down a group. Mg's outer electrons are closer to the nucleus and held more tightly than Ba's. Higher position means harder electron removal.
23. A — Removing a product shifts the equilibrium toward the products. The system responds by making more product to replace what was removed. This drives the forward reaction.
24. C — Adding salt lowers the freezing point of water. Dissolved particles interfere with the formation of the ice structure. This freezing-point depression is a colligative property.
25. D — Adding a nonvolatile solute raises the boiling point of the solution. The solute lowers the vapor pressure, so more heat is needed to boil. This boiling-point elevation is a colligative property.
26. C — Oxygen has the greater electronegativity because it lies above sulfur in Group 16. Its smaller size lets the nucleus attract bonding electrons more strongly. Electronegativity increases up a group.
27. C — Heating the water increases the solubility of the solid sugar, allowing more to dissolve. Added energy helps break apart the solute. Warmer solvent holds more dissolved solid.
28. A — Sodium chloride conducts because it dissociates into mobile ions in water. Free-moving charged particles carry electric current. Sugar dissolves as neutral molecules and cannot conduct.
29. B — A catalyst provides a pathway with lower activation energy, increasing the rate. With a smaller energy barrier, more collisions are effective. The catalyst itself is not consumed.
30. A — The powdered metal reacts faster because its greater surface area allows more contact. More exposed surface produces more collisions per second. Surface area directly affects reaction rate.
31. D — Lowering the temperature decreases the reaction rate. Particles move more slowly, colliding less often and with less energy. Fewer effective collisions slow the reaction.
32. D — A sodium ion is smaller than its neutral atom because it loses its outer electron shell. With one fewer shell, the remaining electrons are pulled closer. Cations are smaller than their parent atoms.
33. C — A chloride ion is larger than its neutral atom because the added electron increases electron-electron repulsion. The extra electron spreads the cloud outward. Anions are larger than their parent atoms.
34. C — A large electronegativity difference produces an ionic bond. One atom pulls electrons away completely, forming oppositely charged ions. The greater the difference, the more ionic the bond.
35. B — A bond between two identical nonmetal atoms is nonpolar covalent. Equal electronegativities mean the electrons are shared evenly. No charge separation forms.
36. A — Adding reactant shifts the equilibrium toward the products. The system consumes the added reactant by driving the forward reaction. This restores balance per Le Châtelier's principle.
37. D — Copper conducts in the solid state because of its mobile, delocalized electrons. Metals carry current through these free electrons. Solid ionic NaCl has fixed ions and cannot conduct.
38. D — Increasing temperature increases the average kinetic energy of gas particles. Temperature is a direct measure of average kinetic energy. Hotter gases have faster-moving particles.
39. B — Ionic compounds generally have higher melting points because of strong electrostatic attractions between ions. These forces require much energy to overcome. Molecular compounds have weaker forces and melt more easily.
40. B — Compressing a gas at constant temperature increases its pressure. The same particles strike the walls more often in the smaller volume. Pressure and volume are inversely related.

41. C — Argon has the higher first ionization energy because ionization energy increases across a period. As a noble gas, Ar has a stable, full outer shell that resists electron removal. Sodium's lone outer electron is easily lost.
42. D — A strong acid has a lower pH than a weak acid of the same concentration. Complete ionization releases more hydrogen ions. More H^+ means a lower pH.
43. B — A pH of 11 indicates a basic solution. Values above 7 are basic, with higher numbers more strongly basic. The solution contains more hydroxide than hydrogen ions.
44. C — Adding a base to an acidic solution raises the pH. The base neutralizes hydrogen ions, moving the solution toward neutral or basic. Reducing H^+ increases the pH.
45. C — A more active metal replaces a less active metal from solution. The active metal gives up electrons more readily and displaces the other ion. This is a single-replacement reaction.
46. D — Removing heat from a liquid eventually causes it to freeze into a solid. As particles lose energy, they slow and lock into a fixed structure. Cooling drives the liquid-to-solid change.
47. C — Adding heat to a solid gives its particles energy and eventually melts it. The added energy overcomes the forces holding particles in place. Melting is the solid-to-liquid phase change.
48. A — For most substances, the solid state is the most dense because its particles are packed most closely. Tighter packing means more mass per volume. Solids generally have the highest density.
49. D — Among nonpolar molecules, larger molar mass gives higher boiling points. More electrons create stronger temporary dispersion forces. Stronger attractions require more energy to separate.
50. D — A triple bond is the strongest because it involves three shared electron pairs. More shared pairs mean a stronger, shorter bond. Triple bonds hold atoms together most tightly.
51. B — Halving the volume at constant temperature roughly doubles the pressure. The same particles strike the walls twice as often in half the space. This follows Boyle's inverse relationship.
52. D — In an exothermic reaction, the products have less energy than the reactants. The released energy is given off to the surroundings. The drop in energy is why heat is released.
53. A — A catalyst speeds the forward and reverse rates equally, so it does not shift the equilibrium position. It only helps the system reach equilibrium faster. The final amounts of product remain the same.
54. A — Carbon dioxide is nonpolar because its linear shape makes its two polar bonds cancel. The symmetrical arrangement balances the bond dipoles. Water's bent shape leaves it polar.
55. C — Molten sodium chloride conducts because melting frees the ions to move. Mobile charged particles carry current. In the solid, the ions are locked in place and cannot conduct.
56. A — Adding heat to an exothermic reaction shifts the equilibrium toward the reactants. Heat is a product in an exothermic process, so adding it drives the reverse reaction. The system shifts to consume the added heat.
57. B — Chlorine is larger than fluorine because atomic radius increases down a group. Cl has an additional electron shell beyond F. More shells produce a larger atom.
58. B — Adding water to a solution decreases its concentration. The same amount of solute is spread through more solvent. Dilution lowers the molarity.
59. A — At the same temperature, two gas samples have equal average kinetic energies. Temperature is defined by average kinetic energy. Identical temperatures mean identical average energies.
60. D — Copper in silver nitrate reacts because copper is more active than silver and displaces it. The more active metal loses electrons and replaces the less active ion. Silver cannot displace the more active copper.
61. C — A strong acid conducts better because it ionizes more completely, producing more ions. More dissolved ions carry more current. Complete ionization makes it a strong electrolyte.

62. D — Granulated sugar dissolves faster than a cube because of its greater surface area. More exposed surface allows more contact with water. Surface area increases the rate of dissolving.
63. B — A strong electrolyte solution conducts better because it produces many mobile ions. More charged particles carry more current. A nonelectrolyte produces no ions and does not conduct.
64. D — Raising the temperature speeds reactions because particles collide more frequently and with more energy. Both effects increase the number of successful collisions. This is the basis of collision theory.
65. A — The H–F bond is more polar because fluorine and hydrogen have a larger electronegativity difference than hydrogen and iodine. A greater difference creates more uneven electron sharing. This produces a stronger bond dipole.
66. A — Solids and liquids change volume very little under pressure because they are nearly incompressible. Their particles are already closely packed. Unlike gases, they have little empty space to compress.
67. B — Higher temperature gives water molecules more energy to escape the liquid, speeding evaporation. More molecules reach the energy needed to break free. Warmer conditions increase the evaporation rate.
68. B — Metals tend to lose electrons in reactions. Their few valence electrons are loosely held and easily given up. Losing electrons forms positive ions.
69. A — Nonmetals tend to gain electrons in reactions. Their nearly full outer shells attract additional electrons to complete an octet. Gaining electrons forms negative ions.
70. D — Noble gases are unreactive because they have a stable, filled outer electron shell. A complete octet gives little tendency to gain, lose, or share electrons. This stability explains their low reactivity.
71. A — Increasing concentration raises the rate by increasing the frequency of collisions between particles. More particles per volume meet more often. More collisions mean a faster reaction.
72. A — A reaction with lower activation energy proceeds faster because more collisions have enough energy to react. A smaller energy barrier is easier to overcome. Lower activation energy speeds the reaction.
73. B — A strong base has a higher pH than a weak base of equal concentration. Complete ionization releases more hydroxide ions. More OH^- raises the pH further.
74. B — A catalyst changes the rate at which equilibrium is reached, not the amounts present. It speeds both directions equally without shifting the balance. The catalyst is not consumed and does not change the products.
75. A — An alkali metal is far more reactive than a noble gas because it readily loses its single valence electron. This easy electron loss drives vigorous reactions. The noble gas's full shell makes it nearly inert.
76. D — Heating most substances makes them expand, decreasing their density. The same mass occupies a larger volume. Lower mass per volume means lower density.
77. B — A real gas behaves most ideally at high temperature and low pressure. Under these conditions, particles are far apart and intermolecular forces are negligible. Ideal behavior assumes no attractions and negligible particle volume.
78. D — A solid that conducts electricity, is shiny, and is malleable is a metal. These properties result from metallic bonding and delocalized electrons. They are the defining characteristics of metals.
79. D — Increasing the pressure on a liquid raises its boiling point. Higher external pressure requires a higher vapor pressure, and thus more heat, to boil. Greater pressure means a higher boiling temperature.

80. C — The solution with more dissolved salt has the lower freezing point. More solute particles cause greater freezing-point depression. The effect increases with the amount of dissolved solute.
81. C — A bond between atoms with identical electronegativities is nonpolar covalent. The electrons are shared equally with no charge separation. Equal attraction produces an even distribution.
82. D — Nonmetals generally have higher ionization energies than metals. Their stronger nuclear attraction holds outer electrons tightly. Removing an electron from a nonmetal takes more energy.
83. B — A solid at room temperature has stronger intermolecular forces than a gas. Strong attractions hold its particles in a fixed arrangement. Weak forces in a gas let its particles move freely apart.
84. C — Across Period 3, the elements change from metallic to nonmetallic in character. Sodium on the left is a reactive metal, while chlorine on the right is a reactive nonmetal. Metallic character decreases across a period.
85. C — Decreasing the temperature slows a reaction rather than speeding it up. Cooler particles move slower and collide less often and less energetically. The other choices all increase the rate.