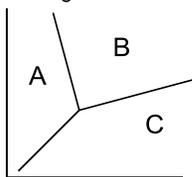


For 1 – 4:

- Sublimation
- Deposition
- Vaporization
- Condensation
- Melting



- Phase A → Phase B
- Phase C → Phase A
- Phase A → Phase C
- Phase B → Phase C

For 5 – 8:

- R—COOH
- R—CHO
- R—CO—R
- R—COO—R
- R—CO—NH₂

- can be neutralized with a base
- could be named 2-pentanone
- amide functional group
- aldehyde functional group

For 9 – 11:

- 6.02×10^{23} molecules
- 11.2 liters
- 58.5 grams/mole
- 2.0 moles
- 5 atoms

- 88 grams of CO₂(g) at STP
- 1 molecule of CH₄
- 32 grams of SO₂ gas at STP

For 12 – 15:

- Alkali metal
- Alkaline earth metal
- Transition metal
- Halogen
- Noble gas

- reacts most vigorously with water
- is chemically inert
- has the highest first ionization energy in its period
- forms ions with a 2+ charge

For 16 – 18:

- blue
- red
- pink/purple
- colorless
- orange

- phenolphthalein in base
- litmus in acid
- phenolphthalein in acid

For 19 – 22:

- boyle's law
- charle's law
- ideal gas equation
- combined gas law
- dalton's law of partial pressures

- $P_{\text{total}} = P_1 + P_2 + P_3 + \dots$
- $P_1V_1 = P_2V_2$
- $PV = nRT$
- $P_1V_1/T_1 = P_2V_2/T_2$

For 23 – 25:

- ${}^4_2\text{He}$
- ${}^0_{-1}\text{e}$
- γ
- ${}^1_0\text{n}$
- ${}^1_1\text{H}$

- has a charge of 2+
- has the lowest mass
- has the greatest mass

Q	Statement I	Because	Statement II
26.	The double and single bonds in benzene are subject to resonance	Because	Benzene has delocalized pi electrons that stabilize its structure
27.	The element with an electron configuration of [He]2s ¹ has a larger atomic radius than fluorine	Because	The element with an electron configuration of [He]2s ¹ has a greater nuclear charge than fluorine
28.	1 m NaCl(aq) will have a higher boiling point than that of 1 m CaCl ₂ (aq)	Because	1 mole of NaCl yields 3 moles of ions in solution
29.	Neutrons and protons are classified as nucleons	Because	Neutrons and protons are both located in the principal energy levels of the atom
30.	HCl is considered to be an acid	Because	HCl is a proton donor
31.	Powdered zinc reacts faster with acid than a larger piece of zinc	Because	Powdered zinc has a greater surface area
32.	NH ₃ can best be collected by water displacement	Because	NH ₃ is a polar substance
33.	At 1 atm, pure water can boil at a temperature less than 273 K	Because	Water boils when the vapor pressure of the water is equal to the atmospheric pressure
34.	An exothermic reaction has a negative value for ΔH	Because	In an exothermic reaction the products have less potential energy than the reactants
35.	As pressure on a gas increases, the volume of the gas decreases	Because	Pressure and volume have a direct relationship
36.	The addition of H ₂ to ethene will form an unsaturated compound called ethane	Because	Ethane, has as many hydrogen atoms bonded to the carbon atoms as possible
37.	AgCl is insoluble in water	Because	All chlorides are soluble in water except for those of silver, lead and mercury
38.	ΔS will be positive in value as vaporization occurs	Because	Vaporization increases the order of the molecules entering the gas phase
39.	Pure water has a pH of 7	Because	The number of H ⁺ ions is equal to the number OH ⁻ ions
40.	CH ₃ CH ₂ —OH and CH ₃ —O—CH ₃ are isomers	Because	CH ₃ CH ₂ —OH and CH ₃ —O—CH ₃ have the same molecular formula but different structures

- One mole of each of the following substances is dissolved in 1.0 kg of water. Which solution will have the lowest freezing point?
 - NaC₂H₃O₂
 - NaCl
 - MgCl₂
 - CH₃OH
 - C₆H₁₂O₆

- Which of the following equations is/are properly balanced?

- Cl₂ + 2NaBr → Br₂ + 2NaCl
 - 2Na + O₂ → Na₂O
 - 2K + 2H₂O → H₂ + 2KOH
- i only
 - ii only
 - iii only
 - i and iii only
 - i, ii and iii

- Propane and oxygen react according to the equation: C₃H₈(g) + 5O₂(g) → 3CO₂(g) + 4H₂O(g).

- How many grams of water can be produced from the complete combustion of 2.0 moles of C₃H₈(g)?
- 144.0
 - 82.0
 - 8.0
 - 44.8
 - 22.4

- A compound was analyzed and found to be composed of 75% carbon and 25%

hydrogen. What is the empirical formula of this compound?

- C₂H₄
- CH₄
- CH₃
- CH₂
- CH

45. Which compound below has a bent molecular geometry?

- H₂SO₄
- CH₄
- CO₂
- H₂S
- C₂H₂

46. Of the equipment listed below, which one would require you to read a meniscus?

- 100 mL beaker
- 500 mL flask
- Watch glass
- 50 mL buret
- Trough

47. Given the following reaction at equilibrium: Fe³⁺(aq) + SCN⁻(aq) ⇌ FeSCN²⁺(aq). Which of these would shift the equilibrium to the left?

- Adding FeCl₃ to the reaction
- Adding NH₄SCN to the reaction
- Increasing the pressure on the reaction
- Adding a catalyst
- Adding FeSCN²⁺(aq) to the reaction

48. Which letter in the boxes below has a value of 7?

isotope	p	n	e ⁻	mass #	atomic #
¹⁶ O	A				
¹³ C		B			E
²³ Na			C		
¹⁰ B				D	

- A
- B
- C
- D
- E

49. Each of the elements listed below is placed in water. Which one will react violently with the water?

- Na
- Fe
- Cu
- Au
- Ne

50. Which unit is paired incorrectly?

- Torr and pressure
- Mass and grams
- Heat energy and kilopascals
- Volume and milliliter
- Temperature and Kelvin

51. Which amount of Pb(NO₃)₂, when added to enough water to make 1 liter of solution, will produce a solution with a molarity of 1.0 M?

- 144 grams
- 331 grams

- 317 grams
- 0.003 moles
- 0.5 moles

52. Enough AgCl(s) is dissolved in water at 298 K to produce a saturated solution. The concentration of Ag⁺ ions found to be 1.3 x 10⁻⁵ M. The K_{sp} value for AgCl will be

- 2.6 x 10⁻¹⁰
- 1.3 x 10⁻¹⁰
- 1.3 x 10⁻⁵
- 1.8 x 10⁻⁵
- 1.8 x 10⁻¹⁰

53. Which statement below is inconsistent with the concept of isotopes?

- Each element is composed of atoms
- All atoms of an element are identical
- The atoms of different elements have different chemical and physical properties
- The combining of elements leads to the formation of compounds
- In a compound, the kinds and numbers of atoms are constant

54. Which sample below has its atoms arranged in a regular, geometric pattern?

- NaC₂H₃O₂(s)
- H₂O(l)
- Ar(g)
- NaCl(aq)
- CH₄(g)

55. Of the statements below, which holds true for the elements found in Na₂HPO₄?

- The total molar mass of 71 grams/mole
- The percent by mass of oxygen is 45%
- The percent by mass of sodium is 16%
- The percent by mass of phosphorus is 44%
- The percent by mass of hydrogen is 13%

56. Carbon and oxygen react to form carbon dioxide according to the reaction: C(s) + O₂(g) → CO₂(g). how much carbon dioxide can be formed from the reaction of 36 grams of carbon with 64 grams of oxygen gas?

- 36 grams
- 64 grams
- 28 grams
- 132 grams
- 88 grams

57. What is the correct mass-action expression for the reaction 2NO(g) + Cl₂(g) ⇌ 2NOCl(g)?

- $\frac{[\text{NO}][\text{Cl}_2]}{[\text{NOCl}]}$
- $\frac{[\text{NOCl}]}{[\text{NO}][\text{Cl}_2]}$
- $\frac{[\text{NO}]^2[\text{Cl}_2]}{[\text{NOCl}]^2}$
- $\frac{[\text{NOCl}]^2}{[\text{NO}]^2[\text{Cl}_2]}$
- $\frac{[\text{NOCl}]^2}{[\text{NO}]^2 + [\text{Cl}_2]}$

58. Which of the following processes will decrease the rate of a chemical reaction?

- Using highly concentrated reactants
 - Decreasing the temperature by 25 K
 - Stirring the reactants
- i only
 - ii only
 - i and iii only
 - ii and iii only
 - i, ii, and iii

59. Of the substances below, which is best able to conduct electricity?

- KBr(l)
- NaC₂H₃O₂(s)
- C₆H₁₂O₆(aq)
- CH₃OH(aq)
- NaCl(s)

60. A voltaic cell is set up and a chemical reaction proceeds spontaneously. Which of the following will not occur in this reaction?

- The electrons will migrate through the wire
- The cations in the salt bridge will migrate to the anode half-cell
- The cathode will gain mass
- The anode will lose mass
- Reduction will occur at the cathode

61. What is the value for ΔH for the reaction: D + A + B → F

- $$\begin{aligned} A + B &\rightarrow C & \Delta H &= -390 \text{ kJ} \\ D + \frac{1}{2}B &\rightarrow E & \Delta H &= -280 \text{ kJ} \\ F + \frac{1}{2}B &\rightarrow C + E & \Delta H &= -275 \text{ kJ} \end{aligned}$$
- 165 kJ
 - +385 kJ
 - 395 kJ
 - 945 kJ
 - +400 kJ

62. The oxidation state of the elements in the choices below will be -1 except for

- F in HF
- Cl in NaCl
- O in H₂O₂
- F in NaF
- H in Na₂HPO₄

63. Which substance is not correctly paired with the type of bonding found between the atoms of that substance?

- CH₄—covalent bonds
- CaO—ionic bonds
- Fe—metallic bonds

- d. H_3O^+ —coordinate covalent bonds
e. Cl_2 —polar covalent bonds
64. Which electron configuration shows that of an excited atom?
a. $1s^2 2s^2 2p^6 3s^1$
b. $1s^2 2s^2 2p^6 3s^2 3p^6 3d^1$
c. $1s^2 2s^2 2p^4$
d. $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2$
e. $1s^2 2s^2 2p^6 3s^2 3p^3$
65. Given the chemical reaction $3\text{H}_2(\text{g}) + \text{N}_2(\text{g}) = 2\text{NH}_3(\text{g}) + \text{energy}$, the forward reaction can best be described as a(n)
i. Synthesis reaction
ii. Phase equilibrium
iii. Exothermic reaction
a. ii only
b. i and ii only
c. i and iii only
d. ii and iii only
e. i, ii and iii
66. Which of the following is not true regarding conjugates and conjugate pairs?
a. HF and F^- are conjugate pairs
b. $\text{NaC}_2\text{H}_3\text{O}_2$ and $\text{C}_2\text{H}_3\text{O}_2^-$ are conjugate pairs
c. CO_3^{2-} is the conjugate base of HCO_3^-
d. NH_4^+ is the conjugate acid of NH_3
e. A conjugate pair will differ by an H^+ ion
67. What is the ratio of the rate of effusion of hydrogen gas to that of helium gas?
a. 1.41
b. 2.00
c. 4.00
d. 0.50
e. 1.00
68. Which substance below will exhibit hydrogen bonding between the molecules of the substance?
a. CH_4
b. HBr
c. HCl
d. H_2O
e. H_2
69. Given the reaction: $\text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) = 2\text{NH}_3(\text{g}) + 22\text{kcal}$, what is the value of ΔH for the reverse reaction when 6 moles of NH_3 are consumed to produce nitrogen gas and hydrogen gas?
a. +22 kcal
b. +66 kcal
c. -22 kcal
d. -66 kcal
e. +33 kcal
70. A titration is set up so that 40.0 mL of 1.0 M NaOH are titrated with 2.0 M HCl . If the initial reading of the meniscus of the acid's buret is 3.15 mL, what will the final buret reading be?
a. 20.00 mL
b. 40.00 mL
c. 43.15 mL
d. 23.15 mL
e. 13.15 mL
71. Which of the following best describes the orbital overlap in a molecule of
$$\begin{array}{c} \text{H}-\text{C}=\text{C}-\text{H} \\ | \quad | \\ \text{H} \quad \text{H} \end{array}$$

i. s to s
ii. s to p
iii. sp^2 to sp^2
a. i only
b. ii only
c. i and iii only
d. ii and iii only
e. i, ii and iii
72. What will be the change in the freezing point of the water in a solution of 1 m $\text{NaCl}(\text{aq})$?
a. -1.86°C
b. -0.52°C
c. -3.72°C
d. 1.86°C
e. 3.72°C
73. Which metal will not generate hydrogen gas when placed in $\text{HCl}(\text{aq})$?
a. Au
b. Mg
c. Ca
d. Sr
e. Zn
74. Which substance is the best oxidizing agent?
a. Fe
b. O_2
c. Na
d. Li
e. F_2
75. Which substance is not correctly paired with the bonding found between the molecules of that substance?
a. NH_3 —hydrogen bonding
b. F_2 —van der waals (dispersion) forces
c. HCl —dipoles
d. CH_4 —dipoles
e. $\text{NaCl}(\text{aq})$ —molecule-ion attraction
76. Which solution is not expected to conduct electricity?
a. $\text{NaCl}(\text{aq})$
b. $\text{C}_6\text{H}_{12}\text{O}_6(\text{aq})$
c. $\text{KBr}(\text{aq})$
d. $\text{HC}_2\text{H}_3\text{O}_2(\text{aq})$
e. $\text{NaOH}(\text{aq})$
77. Which of the following statements about solubility is correct?
a. Gases decrease in solubility with an increase in temperature
b. NaCl is insoluble in water
c. PbI_2 is soluble in water
d. All nitrates are insoluble in water
e. Solubility depends solely upon the amount of solvent used
78. In 6.20 hours, a 50.0-gram sample of ^{112}Ag decays to 12.5 grams. What is the half-life of ^{112}Ag ?
a. 1.60 hours
b. 3.10 hours
c. 6.20 hours
d. 12.4 hours
e. 18.6 hours
79. The modern periodic table is based upon
a. Atomic mass of the elements
b. Number of neutrons in the nucleus
c. Number of isotopes of an element
d. Oxidation states
e. Number of protons in the nucleus
80. The prefix *centi-* means
a. One thousand
b. One thousandth
c. One hundred
d. One hundredth
e. One millionth
81. What is the pH of a 0.1 M acid solution where the acid has a K_a of 1×10^{-5} ?
a. 3
b. 5
c. 6
d. 4
e. 1
82. Which of the following would you not do in a laboratory setting?
i. Pour acids and bases over a sink
ii. Wear goggles
iii. Heat a stoppered test tube
a. i only
b. ii only
c. iii only
d. i and iii only
e. i, ii, and iii
83. Which of the following statements is not true regarding the kinetic molecular theory?
a. The volume that gas molecules occupy is negligible compared to the volume within which the gas is contained
b. There are no forces present between gas molecules
c. Collisions between gas molecules are perfectly elastic
d. Gas molecules travel in a continuous, random motion
e. The average kinetic energy of gas molecules is inversely proportional to temperature
84. How many times more basic is a solution with a pH of 10 than a solution with a pH of 8
a. A pH of 10 is two times as basic
b. A pH of 8 is two times as basic
c. A pH of 10 is 2,000 times as basic
d. A pH of 8 is 20 times as basic
e. A pH of 10 is 100 times as basic

85. Which of the following reactions is not labeled correctly?
a. $\text{Fe} + \text{Cr}^{3+} \rightarrow \text{Fe}^{3+} + \text{Cr}$ (redox)

- b. $\text{KBr} + \text{H}_2\text{O} \rightarrow \text{HBr} + \text{KOH}$ (hydrolysis)
c. $\text{CH}_4 + 2\text{O}_2 \rightarrow \text{CO}_2 + 2\text{H}_2\text{O}$ (combustion)

- d. $\text{CH}_4 + \text{Cl}_2 \rightarrow \text{CH}_3\text{Cl} + \text{HCl}$ (addition)
e. $\text{CO}_2 + \text{H}_2\text{O} \rightarrow \text{H}_2\text{CO}_3$ (synthesis)

ANSWERS:

- | | | | | | | |
|-------|-------|----------|----------|-------|-------|-------|
| 1. E | 14. E | 26. TTCE | 39. TTCE | 52. E | 65. C | 78. B |
| 2. B | 15. B | 27. TF | 40. TTCE | 53. B | 66. B | 79. E |
| 3. A | 16. C | 28. FF | 41. C | 54. A | 67. A | 80. D |
| 4. C | 17. B | 29. TF | 42. D | 55. B | 68. D | 81. A |
| 5. A | 18. D | 30. TTCE | 43. A | 56. E | 69. B | 82. C |
| 6. C | 19. E | 31. TTCE | 44. B | 57. D | 70. D | 83. E |
| 7. E | 20. A | 32. FT | 45. D | 58. B | 71. D | 84. E |
| 8. B | 21. C | 33. FT | 46. D | 59. A | 72. C | 85. D |
| 9. D | 22. D | 34. TTCE | 47. E | 60. B | 73. A | |
| 10. E | 23. A | 35. TF | 48. B | 61. C | 74. E | |
| 11. B | 24. C | 36. FT | 49. A | 62. E | 75. D | |
| 12. A | 25. A | 37. TTCE | 50. C | 63. E | 76. B | |
| 13. E | | 38. TF | 51. B | 64. B | 77. A | |