

For 1 – 4:

- $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$
- $\text{CH}_3\text{CH}(\text{Br})\text{CH}(\text{Br})\text{CH}_3$
- $\text{CH}_3\text{CH}_2\text{CH}(\text{Br})\text{CH}_3$
- $\text{CH}_3\text{CH}_2\text{CH}_2\text{COOH}$
- $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_3$

- $\text{CH}_3\text{CH}=\text{CHCH}_3 + \text{H}_2 \rightarrow 1.$
- $1. + \text{Br}_2 \rightarrow \text{HBr} + 2.$
- $\text{CH}_3\text{CH}=\text{CHCH}_3 + \text{Br}_2 \rightarrow 3.$
- Which compound would most likely turn litmus paper to a red color?

For 5 – 8:

- Heisenberg Uncertainty principle
 - Pauli Exclusion Principle
 - Schrodinger Wave Equation
 - Hund's Rule
 - Bohr model of the hydrogen atom
- No two electrons can have the same quantum number because they must have opposite spins.
 - We cannot know the exact location of an electron in space.
 - The electrons will occupy an orbital singly, with parallel spins, before pairing up.
 - The energy changes that an electron may undergo are quantized.

For 9 – 12:

- H_2
- CO_2
- H_2O
- NaCl
- CH_2CH_2

- Contains just one sigma bond
- Has a bond formed from the transfer of electrons
- Has an atom that is *sp* hybridized
- Is a polar molecule

For 13 – 16:

- F
- Li
- Fe
- He
- Si

- Shows both the properties of both metals and non-metals
- Has the greatest ionization energy
- Has the greatest electronegativity
- Has colored salts that will produce colored aqueous solutions

For 17 – 19:

- $\text{NaC}_2\text{H}_3\text{O}_2$
- $\text{HC}_2\text{H}_3\text{O}_2$
- KCl
- NH_3
- HCl

- Is a salt that will undergo hydrolysis to form a basic solution
- Will form a coordinate covalent bond with a hydronium ion
- Is a strong acid

For 20 – 22:

- $q = mc\Delta T$
- $q = H_v m$
- $P_1 V_1 = P_2 V_2$
- $D = m/V$
- $K = C + 273$

- Can be used to find the mass of an irregularly shaped solid
- Boyle's Law
- Used to find energy gained or lost during a particular phase change.

For 23 – 25:

- Alpha particle
- Beta particle
- Neutron
- Gamma ray
- Positron

- Has the greatest mass
- Has the greatest positive charge
- Has the same mass and charge as an electron

Q	Statement I	Because	Statement II
26.	^{12}C is an isotope of ^{14}C	Because	The nuclei of both atoms have the same number of neutrons
27.	Ne is an inert gas	Because	Ne has a complete octet in its valence shell
28.	A solution with a pH of 5 is less acidic than a solution with a pH of 8	Because	A solution with a pH of 5 has 1000 times more hydronium ions than a solution with a pH of 8
29.	A reaction with a positive ΔH is considered to be exothermic	Because	An exothermic reaction has more heat released than absorbed
30.	A voltaic cell spontaneously converts chemical energy into electrical energy	Because	A voltaic cell needs an externally applied current to work
31.	K is considered to be a metal	Because	When K becomes an ion its atomic radius increases
32.	At equilibrium the concentration of reactants and products remain constant	Because	At equilibrium the rates of the forward and reverse reactions are equal
33.	Powdered zinc will react faster with HCl than one larger piece of zinc of the same mass	Because	Powdered zinc has less surface area than one larger piece of zinc of the same mass
34.	An organic compound with the molecular formula C_4H_{10} can exist as two compounds	Because	<i>n</i> -butane and 2-methylpropane are isomers that have the molecular formula of C_4H_{10}
35.	At STP, 22.4 liters of He will have the same volume as one mole of H_2 (assume ideal gases)	Because	One mole or 22.4 liters of any gas at STP will have the same mass
36.	Halogen molecules can exist as solids, liquids or gases at room temperature	Because	As nonpolar molecules are considered by increasing mass the dispersion forces between them increases
37.	Hydrocarbons will dissolve in water	Because	Substances that have the same polarity are miscible and can dissolve each other
38.	Ammonia has a trigonal pyramidal molecular geometry	Because	Ammonia has a tetrahedral electron pair geometry with the three atoms bonded to the central atom
39.	AlCl_3 is called aluminum trichloride	Because	Prefixes are used when naming covalent compounds
40.	When a Li atom reacts and becomes an ion, the Li atom can be considered to be a reducing agent	Because	The Li atom lost an electron and was oxidized

- 117 grams of NaCl are dissolved in water to make 500 mL of solution. Water is then added to this solution to make a total of one liter of

- solution. The final molarity of the solution will be
- 4 M
 - 2 M

- 1 M
- 0.5 M
- 0.585 M

42. How many pi bonds are in the molecule 2-butyne, $\text{CH}_3\text{C}\equiv\text{CCH}_3$?
- 1
 - 2
 - 4
 - 6
 - 10
43. How many atoms lie in a straight line in the molecule 2-butyne, $\text{CH}_3\text{C}\equiv\text{CCH}_3$?
- 10
 - 8
 - 6
 - 4
 - 2
44. A solution of a weak acid, HA, has a concentration of 0.100 M. What is the concentration of hydronium ion and the pH of this solution if the K_a value for this acid is 1.0×10^{-6} ?
- 1.0×10^{-3} and $\text{pH} = 11$
 - 1.0×10^{-6} and $\text{pH} = 6$
 - 1.0×10^{-4} and $\text{pH} = 8$
 - 3.0×10^{-4} and $\text{pH} = 4$
 - 1.0×10^{-3} and $\text{pH} = 3$
45. Given the reaction at STP: $\text{Mg(s)} + 2\text{HCl(aq)} \rightarrow \text{MgCl}_2\text{(aq)} + \text{H}_2\text{(g)}$, how many liters of $\text{H}_2\text{(g)}$ can be produced from the reaction of 12.15 g Mg and excess HCl(aq) ?
- 2.0 L
 - 4.0 L
 - 11.2 L
 - 22.4 L
 - 44.8 L
46. A student performed a single titration using 2.00 M HCl to completely titrate 40.00 mL of 1.00 M NaOH. If the initial reading on the buret containing HCl was 2.05 mL, what will be the final reading?
- 82.05 mL
 - 42.05 mL
 - 20.00 mL
 - 10.00 mL
 - 22.05 mL
47. Which of the following was NOT a conclusion of Rutherford's gold foil experiment?
- The atom is mainly empty space
 - The nucleus has a negative charge
 - The atom has a dense nucleus
 - Alpha particles can pass through a thin sheet of gold foil
 - All of the above are correct regarding the gold foil experiment
48. In a reaction the potential energy of the reactants is 40 kJ/mol, the potential energy of the products is 10 kJ/mol and the potential energy of the activated complex is 55 kJ/mol. What is the activation energy for the reverse reaction?
- 45 kJ/mol
 - 30 kJ/mol
 - 15 kJ/mol
 - 35 kJ/mol
 - 55 kJ/mol
49. Which reactions would form at least one solid precipitate as a product? Assume aqueous reactants.
- $\text{AgNO}_3 + \text{NaCl} \rightarrow \text{NaNO}_3 + \text{AgCl}$
 - $\text{Pb}(\text{NO}_3)_2 + 2\text{KI} \rightarrow \text{PbI}_2 + 2\text{KNO}_3$
 - $2\text{NaOH} + \text{H}_2\text{SO}_4 \rightarrow \text{Na}_2\text{SO}_4 + 2\text{H}_2\text{O}$
- i only
 - ii only
 - iii only
 - i and ii only
 - ii and iii only
50. What is the mass action equation for $2\text{A(aq)} + \text{B(aq)} \rightleftharpoons 3\text{C(aq)} + \text{D(s)}$
- $$K_{\text{eq}} = \frac{[\text{C}]^3}{[\text{A}]^2[\text{B}]}$$
 - $$K_{\text{eq}} = \frac{[\text{C}]^3 + [\text{D}]}{[\text{A}]^2 + [\text{B}]}$$
 - $$K_{\text{eq}} = \frac{[\text{A}]^2 + [\text{B}]}{[\text{C}]^3}$$
 - $$K_{\text{eq}} = \frac{[\text{A}]^2 - [\text{B}]}{[\text{C}]^3 - [\text{D}]}$$
 - $$K_{\text{eq}} = \frac{[\text{C}]}{[\text{A}] + [\text{B}]}$$
51. If the equilibrium constant for a reverse reaction is 9.0×10^{-4} , what is the equilibrium constant for the forward reaction?
- 3.0×10^{-2}
 - -3.0×10^{-2}
 - -9.0×10^{-2}
 - $1 / 9.0 \times 10^{-4}$
 - $1 / -9.0 \times 10^{-4}$
52. A compound's composition by mass is 50% S and 50% O. What is the empirical formula of this compound?
- SO
 - SO₂
 - S₂O
 - S₂O₃
 - S₃O₄
53. What percentage of the total mass of KHCO_3 is made up by nonmetallic elements?
- 17%
 - 83%
 - 61%
 - 20%
 - 50%
54. Which aqueous solution is expected to have the highest boiling point?
- 0.2 m CaCl_2
 - 0.2 m NaCl
 - 0.1 m AlCl_3
 - 0.2 m CH_3OH
 - 0.2 m $\text{NaC}_2\text{H}_3\text{O}_2$
55. Which of the following solids are known to undergo sublimation?
- CO₂
 - I₂
 - Napthalene
- i only
 - ii only
 - i and ii only
 - ii and iii only
 - i, ii and iii
56. Which of the following demonstrates a decrease in entropy?
- Dissolving a solid into a solution
 - An expanding universe
 - Burning a log in a fireplace
 - Raking up leaves into a trash bag
 - Spilling a glass of water
57. Which of the following substances is/are liquid(s) at room temperature?
- Hg
 - Br₂
 - Si
- i only
 - ii only
 - i and ii only
 - ii and iii only
 - i, ii and iii
58. Which of the following would be considered to be unsafe in a laboratory setting?
- Using a test tube holder to handle a hot test tube
 - Tying one's long hair back before experimenting
 - Wearing open-toed shoes
 - Pouring liquids while holding the reagent bottles over the sink
 - Working under a fume hood
59. A sample of a gas at STP contains 3.01×10^{23} molecules and has a mass of 20.0 grams. This gas would
- have a molar mass of 20.0 g/mol and occupy 11.2 liters
 - occupy 22.4 liters and have a molar mass of 30.0 g/mol
 - occupy 22.4 liters and have a molar mass of 20.0 g/mol
 - have a molar mass of 40.0 g/mol and occupy 33.6 liters
 - have a molar mass of 40.0 g/mol and occupy 11.2 liters
60. Given the reaction: $\text{Ca(s)} + \text{Cl}_2\text{(g)} \rightarrow \text{CaCl}_2\text{(s)}$, when 80 g Ca (molar mass is 40) is reacted with 213 g Cl_2 (molar mass is 71) one will have
- 40 g Ca excess
 - 71 g Cl_2 excess
 - 293 g CaCl_2 formed
 - 133 g CaCl_2 formed
 - 113 g CaCl_2 formed
61. A student performed an experiment to determine the solubility of a salt at various temperatures. The data from the experiment can be seen below:
- | Trial | Temp (°C) | Solubility in 100 g water |
|-------|-----------|---------------------------|
| 1 | 20 | 44 |
| 2 | 30 | 58 |

3	40	67
4	50	62
5	60	84

Which trial seems to be in error?

- 1
 - 2
 - 3
 - 4
 - 5
62. Given the following reaction at equilibrium: $3\text{H}_2(\text{g}) + \text{N}_2(\text{g}) \rightleftharpoons 2\text{NH}_3(\text{g}) + \text{heat energy}$, which of the following conditions would shift the equilibrium of this reaction so that the formation of ammonia is favored?
- Increasing the pressure of the reaction
 - Heating the reaction
 - Removing hydrogen gas from the reaction
 - Adding more ammonia to the reaction
 - Removing nitrogen gas from the reaction
63. Given equal conditions, which gas below is expected to have the greatest density?
- H_2
 - Ne
 - Ar
 - H_2S
 - Cl_2
64. Given equal conditions, which gas below is expected to have the greatest rate of effusion?
- H_2
 - Ar
 - Kr
 - F_2
 - Cl_2
65. Ideal gases
- Have forces of attraction between them
 - Are always linear in shape
 - Never travel with a straight line motion
 - Have molecules that are close together
 - Have low masses and are spread far apart
66. Which substance will combine with oxygen gas to produce a greenhouse gas?
- Na
 - S
 - H_2
 - Ne
 - C
67. Which general formula below represents that of an organic ester?
- $\text{R}-\text{OH}$
 - $\text{R}-\text{COOH}$
 - $\text{R}-\text{O}-\text{R}$
 - $\text{R}-\text{COO}-\text{R}$
 - $\text{R}-\text{CO}-\text{R}$

68. When an alkaline earth metal, M, reacts with oxygen the formula of the compound produced will be

- M_2O
- MO
- M_2O_3
- MO_2
- M_3O_4

69. A catalyst can change the

- Heat of reaction and the potential energy of the reactants
- Heat of reaction and the time it takes the reaction to proceed
- Activation energy of the reverse reaction and the potential energy of the activated complex
- Potential energy of the reactants and the time it takes the reaction to proceed
- Activation energy of the forward reaction and the potential energy of the products

70. A neutral atom has a total of 17 electrons. The electron configuration in the outermost principle energy level will look closest to

- $1s^2 2s^2 2p^5$
- $3s^5 3p^2$
- $s^2 p^5$
- $s^2 p^8 d^7$
- sp^7

71. Given a 22.4 liter sample of helium gas at STP, if the temperature is increased by 15 degrees Celsius and the pressure changed to 600 torr, what would the new volume be?

- $(760)(22.4)(15) / (273)(600)$
- $(273)(600)(288) / (760)(22.4)$
- $(760)(22.4)(15) / (600)$
- $(760)(22.4)(288) / (273)(600)$
- $(273)(600) / (760)(22.4)(288)$

72. Which of the following are correct about the subatomic particles found in $^{37}\text{Cl}^{1-}$?

- 21 neutrons
 - 17 protons
 - 16 electrons
- ii only
 - iii only
 - i and ii only
 - i and iii only
 - ii and iii only

73. A hydrated blue copper(II) sulfate salt with a formula $\text{YCuSO}_4 \cdot \text{XH}_2\text{O}$ is heated until it is completely white in color. The student who performed the dehydration of this salt took note of the mass of the sample before and after heating and recorded it as follows:

Mass of hydrated salt = 500 g
Mass of dehydrated salt = 320 g

What is the value of "X" in the formula of the hydrated salt?

- 1
- 2
- 4
- 5
- 10

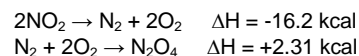
74. Which of the following oxides can dissolve in water to form a solution that would turn litmus indicator red in color?

- MgO
- K_2O
- CO_2
- ZnO
- H_2O

75. The process in which water vapor changes phase to become liquid is called

- Deposition
- Sublimation
- Vaporization
- Fusion
- condensation

76. What is the value for ΔH for the reaction $\text{N}_2\text{O}_4 \rightarrow 2\text{NO}_2$ given the following:



- +13.89 kcal
- +18.51 kcal
- +37.42 kcal
- 13.89 kcal
- 18.51 kcal

77. A liquid will boil when

- Enough salt has been added to it
- The vapor pressure of the liquid is equal to the atmospheric or surrounding pressure
- The vapor pressure of the liquid reaches 760 mmHg
- Conditions favor the liquid's molecules to be closer together
- It has been brought up to a higher elevation

78. A conductivity experiment is set up with a light bulb and five beakers of 0.1 M solutions of the substances below. Which solution would allow the bulb to glow the brightest?

- $\text{C}_6\text{H}_{12}\text{O}_6$
- HCl
- SiO_2
- $\text{HC}_2\text{H}_3\text{O}_2$
- CH_3OH

79. Which of the following represents a correctly balanced half-reaction?

- $\text{Cl}_2 + 2e^- \rightarrow \text{Cl}^-$
- $2e^- + \text{Fe} \rightarrow \text{Fe}^{2+}$
- $\text{O}_2 \rightarrow 2e^- + 2\text{O}^{2-}$
- $\text{Al}^{3+} \rightarrow \text{Al} + 3e^-$
- $2\text{H}^+ + 2e^- \rightarrow \text{H}_2$

80. A student prepares for an experiment involving a voltaic cell. Which of the following is needed the *least* to perform the experiment?

- Buret

- b. Salt bridge
c. Strip of zinc metal
d. Copper wire
e. Solution of zinc sulfate
81. When the equation : $__ \text{C}_3\text{H}_8 + __ \text{O}_2 \rightarrow __ \text{CO}_2 + __ \text{H}_2\text{O}$ is balanced using the lowest whole number coefficients, the coefficient before O_2 will be
a. 1
b. 2.5
c. 5
d. 10
e. 13
82. Which nuclear equation below demonstrates beta decay?
a. $^{238}\text{U} \rightarrow ^{234}\text{Th} + \text{X}$
b. $^1\text{H} + \text{X} \rightarrow ^3\text{H}$
c. $^{14}\text{N} + \text{X} \rightarrow ^{17}\text{O} + ^1\text{H}$
- d. $^{234}\text{Pa} \rightarrow ^{234}\text{U} + \text{X}$
e. None of the above demonstrate beta decay
83. Which of these processes could be associated with the following reaction: $2\text{H}_2\text{O} \rightarrow 2\text{H}_2 + \text{O}_2$
i. electrolysis
ii. neutralization
iii. decomposition
a. i only
b. iii only
c. i and iii only
d. i and ii only
e. ii and iii only
84. The following reaction occurs in a beaker: $\text{Ag}^+(\text{aq}) + \text{Cl}^-(\text{aq}) \rightarrow \text{AgCl}(\text{s})$. If a solution of sodium chloride were added to this beaker
- a. The solubility of the sodium chloride would decrease
b. The reaction would shift to the left
c. The concentration of silver ions in solution would increase
d. The solubility of the silver chloride would decrease
e. The equilibrium would not shift at all
85. How many atoms are represented in the equilibrium $\text{Pb}(\text{NO}_3)_2 + 2\text{KI} \rightarrow \text{PbI}_2 + 2\text{KNO}_3$?
a. 5
b. 12
c. 13
d. 18
e. 26

ANSWERS:

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

SCORE SHEET*

Number of questions right = _____
Less $\frac{1}{4}$ x number of wrong = _____ (NOTE: Omitted questions are *not* counted as wrong.)
Equals raw score = _____

Raw	Actual	Raw	Actual	Raw	Actual	Raw	Actual	Raw	Actual
85	800	63	710	41	570	19	440	-3	300
84	800	62	700	40	560	18	430	-4	300
83	800	61	700	39	560	17	430	-5	290
82	800	60	690	38	550	16	420	-6	290
81	800	59	680	37	550	15	420	-7	280
80	800	58	670	36	540	14	410	-8	270
79	790	57	670	35	530	13	400	-9	270
78	790	56	660	34	530	12	400	-10	260
77	790	55	650	33	520	11	390	-11	250
76	780	54	640	32	520	10	390	-12	250
75	780	53	640	31	510	9	380	-13	240
74	770	52	630	30	510	8	370	-14	240
73	760	51	630	29	500	7	360	-15	230
72	760	50	620	28	500	6	360	-16	230
71	750	49	610	27	490	5	350	-17	220
70	740	48	610	26	480	4	350	-18	220
69	740	47	600	25	470	3	340	-19	210
68	730	46	600	24	470	2	330	-20	210
67	730	45	590	23	460	1	330	-21	200
66	720	44	580	22	460	0	320		
65	720	43	580	21	450	-1	320		
64	710	42	570	20	440	-2	310		

*NOTE:

The conversion chart here is only an approximation. Since the conversion changes every year with a new test, this chart gives an estimate that is most likely within 10 points of the actual score.