

High School FIRST YEAR CHEMISTRY EXAMINATION
Orange County American Chemical Society Education Committee



DO NOT START THIS EXAM UNTIL INSTRUCTED TO DO SO

1. **USING A #2 PENCIL**, in the box titled *NAME* on the Scantron form, **CLEARLY PRINT** your **LAST NAME**, then first name, and middle initial. If you win, the spelling of your name **as it is read here** will appear on the school's plaque.
2. In the box titled *SUBJECT*, print your **SCHOOL NAME**.
3. In *DATE* box, print the last **NAME OF YOUR CHEMISTRY TEACHER**.
4. FIND THE **EXAM FORM** located in the upper right corner of the test booklet. In the box title *TEST NO.* print the Test Form **A or B, and COLOR**
5. In *PERIOD* box write the 'level' of your chemistry: **Honors, Regular, CP, IB**
6. Note your NAME and SCHOOL at the top of your test copy
* * * * *
7. You may **NOT USE ANY CALCULATOR during this test.**
8. On the back is a separate Periodic Table and other reference materials. When you are told to start the test, tear off this front cover so that the Periodic Table is readily available to use.
9. You have two hours to complete the examination. Do not spend too much time on any one question, for they all count equally. There is no penalty for guessing, so attempt every question. If you finish early, you may leave quietly.
10. Each question has only one best answer. All answers must be recorded on the Scantron answer sheet. Make clean erasures if needed. Extra pencils are available.
11. You **MAY** write on the exam. There is ample space with each problem for your work.
YOUR EXAM MUST BE TURNED IN WITH YOUR SCANTRON.
12. If you have any questions during the examination, a proctor will assist.

ABBREVIATIONS AND SYMBOLS				CONSTANTS	
amount of substance	n	Faraday constant	F	molar mass	M
ampere	A	free energy	G	mole	mol
atmosphere	atm	frequency	ν	Planck's constant	h
atomic mass unit	u	gas constant	R	pressure	P
Avogadro constant	N_A	gram	g	rate constant	k
Celsius temperature	$^{\circ}\text{C}$	hour	h	reaction quotient	Q
centi- prefix	c	joule	J	second	s
coulomb	C	kelvin	K	speed of light	c
density	d	kilo- prefix	k	temperature, K	T
electromotive force	E	liter	L	time	t
energy of activation	E_a	measure of pressure mm Hg	Hg	vapor pressure	VP
enthalpy	H	milli- prefix	m	volt	V
entropy	S	molal	m	volume	V
equilibrium constant	K	molar	M		

CONSTANTS	
$R = 8.314 \text{ J}\cdot\text{mol}^{-1}\cdot\text{K}^{-1}$	
$R = 0.0821 \text{ L}\cdot\text{atm}\cdot\text{mol}^{-1}\cdot\text{K}^{-1}$	
$1 F = 96,500 \text{ C}\cdot\text{mol}^{-1}$	
$1 F = 96,500 \text{ J}\cdot\text{V}^{-1}\cdot\text{mol}^{-1}$	
$N_A = 6.022 \times 10^{23} \text{ mol}^{-1}$	
$h = 6.626 \times 10^{-34} \text{ J}\cdot\text{s}$	
$c = 2.998 \times 10^8 \text{ m}\cdot\text{s}^{-1}$	
$0^{\circ}\text{C} = 273.15 \text{ K}$	

EQUATIONS		
$E = E^{\circ} - \frac{RT}{nF} \ln Q$	$\ln K = \left(\frac{-\Delta H}{R} \right) \left(\frac{1}{T} \right) + \text{constant}$	$\ln \left(\frac{k_2}{k_1} \right) = \frac{E_a}{R} \left(\frac{1}{T_1} - \frac{1}{T_2} \right)$

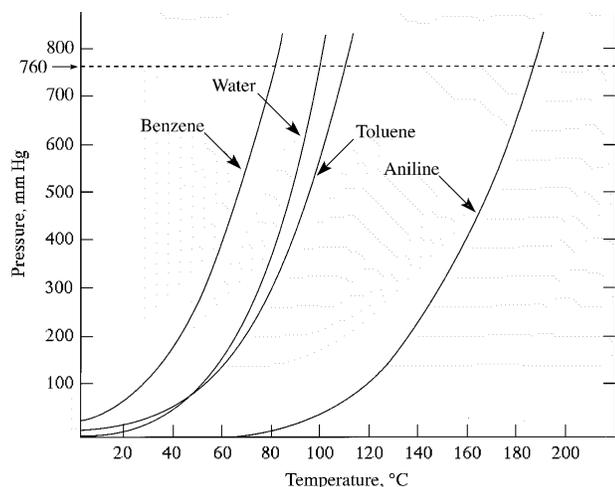
PERIODIC TABLE OF THE ELEMENTS

1																18	
1A																8A	
1	2											13	14	15	16	17	2
H	He											B	C	N	O	F	Ne
1.008	4.003											10.81	12.01	14.01	16.00	19.00	20.18
3	4											5	6	7	8	9	10
Li	Be											B	C	N	O	F	Ne
6.941	9.012											10.81	12.01	14.01	16.00	19.00	20.18
11	12	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Na	Mg	3B	4B	5B	6B	7B	8B	8B	8B	1B	2B	Al	Si	P	S	Cl	Ar
22.99	24.31											26.98	28.09	30.97	32.07	35.45	39.95
19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr
39.10	40.08	44.96	47.88	50.94	52.00	54.94	55.85	58.93	58.69	63.55	65.39	69.72	72.61	74.92	78.96	79.90	83.80
37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54
Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe
85.47	87.62	88.91	91.22	92.91	95.94	(98)	101.1	102.9	106.4	107.9	112.4	114.8	118.7	121.8	127.6	126.9	131.3
55	56	57	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86
Cs	Ba	La	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn
132.9	137.3	138.9	178.5	180.9	183.8	186.2	190.2	192.2	195.1	197.0	200.6	204.4	207.2	209.0	(209)	(210)	(222)
87	88	89	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118
Fr	Ra	Ac	Rf	Db	Sg	Bh	Hs	Mt	Ds	Rg	Cn	(Uut)	(Uuq)	(Uup)	(Uuh)	(Uus)	(Uuo)
(223)	(226)	(227)	(261)	(262)	(266)	(264)	(277)	(268)	(281)	(272)	(277)						
58	59	60	61	62	63	64	65	66	67	68	69	70	71				
Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu				
140.1	140.9	144.2	(145)	150.4	152.0	157.3	158.9	162.5	164.9	167.3	168.9	173.0	175.0				
90	91	92	93	94	95	96	97	98	99	100	101	102	103				
Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	Lr				
232.0	231.0	238.0	(237)	(244)	(243)	(247)	(247)	(251)	(252)	(257)	(258)	(259)	(262)				

- An atom
 - is the smallest unit of matter with chemical and physical properties.
 - is the smallest unit of a compound.
 - cannot be broken into smaller pieces.
 - of each element always has the same number of protons and the same total mass
 - of carbon is always identical
- Calculate the molarity of a $\text{Ba}(\text{OH})_2$ solution if 100.0 mL is completely titrated by 200.0 mL of 0.500 M HNO_3 .
 - 0.250 M
 - 0.500 M
 - 1.00 M
 - 2.00 M
 - .167 M
- If $[\text{H}_3\text{O}^+] = 8.26 \times 10^{-5} \text{ M}$, what is the pH of the solution?
 - 5
 - between 4 and 5
 - between 5 and 6
 - between 9 and 10
 - between 8 and 9
- What is the velocity of hydrogen gas if oxygen gas travels at 1000 m/sec at the same temperature and pressure?
 - 250 m/sec
 - 500 m/sec
 - 1000 m/sec
 - 2000 m/sec
 - 4000 m/sec
- Four identical erlenmeyer flasks contain different gases at the same temperature and pressure, which of the following will have the greatest average kinetic energy
 - hydrogen
 - helium
 - oxygen
 - carbon dioxide
 - all the same
- The shape of the methane (CH_4) molecule is
 - linear
 - tetrahedral
 - planar triangular
 - trigonal pyramid
 - v-shaped or bent angular
- In the equilibrium system $\text{CH}_3\text{COOH}(\text{aq}) + \text{H}_2\text{O}(\text{l}) \rightleftharpoons \text{H}_3\text{O}^+(\text{aq}) + \text{CH}_3\text{COO}^-(\text{aq})$, which species is present in the highest concentration at equilibrium?
 - CH_3COOH
 - H_3O^+
 - CH_3COO^-
 - Equal concentrations of CH_3COOH , H_3O^+ and CH_3COO^- are present.
- During the boiling of a liquid
 - the temperature of a liquid remains constant and the potential energy increases.
 - the temperature of a liquid increases and the potential energy increases.
 - the temperature of a liquid remains constant and the kinetic energy increases.
 - the temperature of a liquid increases and the kinetic energy increases.
 - the kinetic energy increases and the potential energy increases.
- When a weak electrolyte dissolves,
 - all of the solute molecules dissociate or ionize.
 - the boiling point decreases.
 - the solution conducts brightly.
 - the solution is colored.
 - none of the above
- What is the oxidation number of sulfur in Na_2SO_4 ?
 - 2
 - 0
 - +4
 - +6
- Which of the following is not very soluble in water?
 - potassium nitrate
 - ammonia
 - methane (CH_4)
 - all are very soluble
 - none are very soluble
- The volume of a sample of oxygen is 300.0 mL when the pressure is 1.00 atm and the temperature is 27.0°C. At what volume is the temperature 327 °C and the pressure 0.500 atm? In this problem ignore significant figures
 - 75 ml
 - 600 ml
 - 300ml
 - 1200 ml
 - some other answer
- Bases do not have which of the following properties
 - produce salt and water when mixed with acids.
 - taste bitter.
 - are slippery
 - turn blue litmus paper red
 - none of the above answers as all of the answers are true about bases
- Under which conditions do real gases most resemble ideal gases?
 - low pressure and low temperature
 - low pressure and high temperature
 - high pressure and high temperature
 - high pressure and low temperature
 - when they have very strong intermolecular forces
- Which of the following contain a permanent dipole or are called polar molecules
 - CCl_4 .
 - CO_2 .
 - NH_3 .
 - Cl_2 .
 - MgI_2
- How many protons, electrons and neutrons are in ${}^{15}_7\text{X}^{+2}$?
 - 7,2,15
 - 7,7,8
 - 7,5,8
 - 7,9,8
 - some other values

17. For the reaction represented by the equation $2\text{H}_2 + \text{O}_2 \rightarrow 2\text{H}_2\text{O}$, what is the maximum yield of water produced from 6.00 moles of hydrogen and 6.00 moles of oxygen ?
a. 2.00 g b. 6.00 g c. 54.0 g d. 108 g e. 216
18. If the total pressure on the equilibrium system $2\text{CO}(g) + \text{O}_2(g) \rightleftharpoons 2\text{CO}_2(g)$ is increased,
a. the quantity of $\text{CO}(g)$ and $\text{CO}_2(g)$ both increase. b. the quantity of $\text{CO}(g)$ and $\text{CO}_2(g)$ both decrease. c. the quantity of $\text{CO}(g)$ increases and $\text{CO}_2(g)$ decrease. d. the quantities in the system do not change. e. the quantity of $\text{CO}(g)$ decreases and $\text{CO}_2(g)$ increases
19. Which of the following will dissolve most rapidly if stirred?
a. sugar cubes in cold water b. sugar cubes in hot water c. powdered sugar in cold water d. powdered sugar in hot water e. all the same since they are all sugar
20. Name the compound $\text{Fe}(\text{NO}_3)_2$.
a. iron(II) nitrate b. iron(II) nitrite c. iron(III) nitrate d. iron(III) nitride
21. What is the mass of 0.20 moles of Calcium nitrate?
a. 33 g b. 820 g c. 3.0×10^1 g d. 2.0×10^1 g e. 1.2×10^{23}
22. How would 0.00930 m be expressed in scientific notation and significant figures?
a. 93×10^{-4} m b. 9.3×10^{-3} m c. 9.30×10^{-3} m d. 9.30×10^{-5} m e. 9.30×10^3 m
23. Which of the following liquids has a pH greater than 7.0 ?
a. lemons b. vinegar c. dish soap d. distilled water e. diet Coke
24. All of the following are examples of units *except*
a. cm^2 . b. pound. c. milligram. d. seconds. e. density
25. What is the concentration of OH^- ions in distilled water?
a. 10^{-7} M b. 0.0 M c. 55.4 M d. 10^{-14} M e. 7
26. Four identical erlenmeyer flasks contain different gases at the same temperature and pressure, which of the following will have the greatest density
a. hydrogen b. helium c. oxygen d. carbon dioxide e. all the same
27. The mass of 2.0 moles of oxygen gas is
a. 16 g. b. 32 g. c. 48 g. d. 64 g. e. 8.0 g.
28. The ionization energies required to remove successive electrons from one mole of this unknown element are 590 kJ/mol, 1145 kJ/mol, 2412 kJ/mol, 9474 kJ/mol, and 12326 kJ/mol. The most common ion is probably
a. X^+ . b. X^{2+} . c. X^{3+} . d. X^{4+} . e. X^{5+} .
29. Solid sodium acetate is heated in a small amount of water and completely dissolves. The new solution is allowed to cool down. After cooling some undissolved solute is visible at the bottom of the flask, you know the mixture must be _____?
a. saturated b. dilute c. supersaturated d. homogeneous e. concentrated

30.



According to the figure above, the boiling point of benzene at 300 mm Hg is nearest to what temperature in °C?

a. 20 b. 40 c. 60 d. 80 e. 100

31. Which of the following is a homogeneous mixture?

a. distilled water b. a solution of sugar and water c. oxygen gas d. silver e. garden soil

32. Which element has the greatest electronegativity?

a. oxygen. b. sodium. c. chlorine. d. xenon. e. sulfur

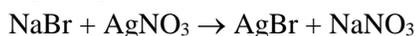
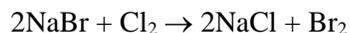
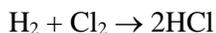
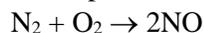
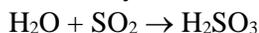
33. The shape of the carbon dioxide (CO₂) molecule is

a. linear b. tetrahedral c. planar triangular d. trigonal pyramid e. v-shaped or bent angular

34. How much energy does a 10.0 g sample of water absorb as energy in the form of heat if its specific heat is 4.2 J/(g·°C) and it is heated from 10.0°C to 40.0°C?

a. 1.26 kJ b. 30°C c. 12.6 joules d. 300 joules e. some other answer

35. How many of the following five equations represent a single replacement reaction?



a. 0 b. 1 c. 2 d. 3 e. 4

36. As the atomic number increases for different elements in a row in the periodic table, the atomic radius generally

a. decreases because of more protons. b. decreases because of more electrons. c. increases because of more protons. d. increases because of more electrons.

37. Which of the following elements have the greatest first ionization energy

a. sulfur b. phosphorus c. chlorine d. oxygen e. nitrogen

38. When NaCl is placed in a well adjusted bunsen burner, the flame has what color?

a. yellowish orange b. reddish c. faint purple d. bright green e. no color except the normal blue color of the flame

Use the table below to answer the following questions.

General Solubility Guidelines
1. Most alkali metal and ammonium compounds are soluble in water.
2. Most nitrates and acetates are soluble.
3. Most chlorides are soluble, except those of silver, mercury(I), and lead (II).
4. Most sulfates are soluble, except those of barium, strontium, and lead.
5. Most carbonates and phosphates are insoluble, except those in rule 1
6. Most hydroxides are insoluble, except those of strontium, barium and the alkali metals.

39. Which of the following pairs of solutions produces a precipitate when combined?
 a. KOH and NH₄Cl b. Fe(NO₃)₃ and MgCl₂ c. CaSO₄ and KCl d. NH₄Cl and Pb(NO₃)₂ e. KBr and Hg(NO₃)₂
40. What is the net ionic equation for the precipitation reaction between silver nitrate solution and sodium sulfide solution?
 a. $2\text{Ag}^+(\text{aq}) + 2\text{NO}_3^-(\text{aq}) + 2\text{Na}^+(\text{aq}) + \text{S}^{2-}(\text{aq}) \rightarrow \text{Ag}_2\text{S}(\text{s}) + 2\text{Na}^+(\text{aq}) + 2\text{NO}_3^-(\text{aq})$
 b. $2\text{Ag}^+(\text{aq}) + \text{S}^{2-}(\text{aq}) \rightarrow \text{Ag}_2\text{S}(\text{s})$
 c. $\text{Na}^+(\text{aq}) + \text{NO}_3^-(\text{aq}) \rightarrow \text{NaNO}_3(\text{s})$
 d. $2\text{Ag}^+(\text{aq}) + 2\text{NO}_3^-(\text{aq}) + 2\text{Na}^+(\text{aq}) + \text{S}^{2-}(\text{aq}) \rightarrow \text{Ag}_2\text{S}(\text{s}) + 2\text{NaNO}_3(\text{s})$
 e. no net ionic equation everything is a spectator ion
41. Given: $2\text{H}_2(\text{g}) + 2\text{O}_2(\text{g}) \rightarrow 2\text{H}_2\text{O}(\text{g}) + 483.6 \text{ kJ}$, which of the following is true
 a. The reaction is endothermic b. $\Delta H = -483.6 \text{ kJ}$ c. entropy is increasing d. two of the above answers are true
 e. all three answers are true
42. What units are used to measure energy as heat?
 a. joules/mole or kilojoules/mole b. kelvins or degrees Celsius c. joules or kilojoules d. J/(g·°C) e. J/°C
43. When the formula equation $\text{Fe}_3\text{O}_4 + \text{Al} \rightarrow \text{Al}_2\text{O}_3 + \text{Fe}$ is correctly balanced the total of all of the coefficients is
 a. 3. b. 7. c. 18. d. 24. e. some other value
44. What is the molar mass of magnesium chloride, ?
 a. 83.9 g/mole b. 59.8 g/mole c. 95.3 g/mole d. 130.8 g/mole e. some other answer that is more than 1.0 g/mole different than the previous answers
45. The total number of d orbitals in the fourth energy level is
 a. 32. b. 4 c. 5. d. 10 e. 16
46. What volume of a 0.40 M NH₃ solution contains 3.4 grams ammonia? (ignore significant figures)
 a. 500 ml b. 200 ml c. 1.36 liters d. .5 ml e. .4 liters
47. Who discovered that the nucleus was very small compared to the atom?
 a. Rutherford b. Dalton c. Millikan d. Bohr e. Schroedinger
48. What is the formula for the compound formed by lead(IV) ions and carbonate ions?
 a. PbCO₃ b. Pb₂CO₃ c. Pb₄CO₃ d. Pb(CO₃)₂

49. How many of the following five equations represent an oxidation-reduction reaction?
 $\text{H}_2\text{O} + \text{SO}_2 \rightarrow \text{H}_2\text{SO}_3$ $\text{N}_2 + \text{O}_2 \rightarrow 2\text{NO}$
 $\text{H}_2 + \text{Cl}_2 \rightarrow 2\text{HCl}$ $2\text{NaBr} + \text{Cl}_2 \rightarrow 2\text{NaCl} + \text{Br}_2$
 $\text{NaBr} + \text{AgNO}_3 \rightarrow \text{AgBr} + \text{NaNO}_3$
- a. 0 b. 1 c. 2 d. 3 e. 4
50. What is the molarity of an HCl solution if 50.0 mL is neutralized in a titration by 40.0 mL of 0.400 M NaOH?
a. 0.200 M b. 0.280 M c. 0.320 M d. 0.500 M e. none of the above are true
51. The volume of a gas is 5.0 L when the temperature is 50.0 °C. If the temperature is increased to 100.0 °C without changing the pressure, what is the new volume?
a. 2.5 L b. 4.3 L c. 5.8 L d. 10.0 L
52. Which of the following is **not** an example of a chemical change or property?
a. rusting or tarnishing b. burning in air c. boiling or melting d. answers a,b,c are all examples of physical change e. answers a,b,c are all examples of chemical change
53. How many electrons must be shown in the Lewis structure of the hydroxide ion, OH⁻?
a. 1 b. 8 c. 9 d. 10

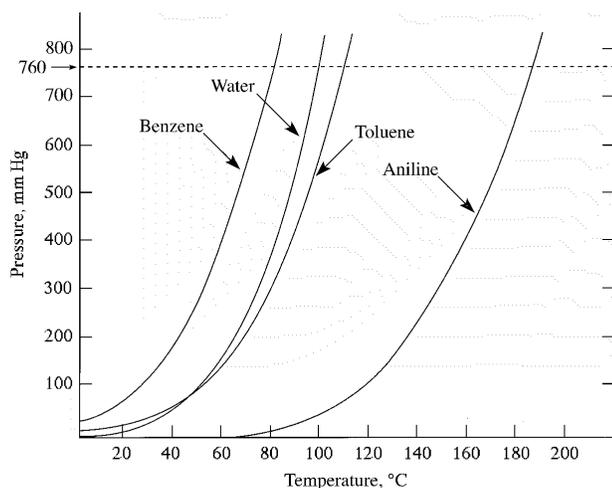
Use the table below to answer the following question.

Water Vapor Pressure	
Temperature (°C)	Pressure (mm Hg)
0	4.6
5	6.5
10	9.2
15	12.8
20	17.5
25	23.8
30	31.8
35	42.2
40	55.3
50	92.5

54. A sample of gas is collected by water displacement at 600.0 mm Hg and 40°C. What is the partial pressure of the unknown gas?
a. 55.3 mm Hg b. 600.0 mm Hg c. 655.3 mm Hg d. 544.7 mm Hg e. some other value
55. In the equation $2\text{KClO}_3 \rightarrow 2\text{KCl} + 3\text{O}_2$, how many grams of oxygen are produced when 4.00 mol of KClO_3 decompose completely?
a. 6.00 b. 96.0 c. 192 d. 128 e. approximately 81
56. Gamma radiation compared to alpha and beta radiation has ?
a. greatest penetrating power b. greatest velocity c. greatest mass d. two of the above answers e. all three of the above answers
57. What is the formula for aluminum sulfate?
a. AlSO_4 b. Al_2SO_4 c. $\text{Al}_2(\text{SO}_4)_3$ d. $\text{Al}(\text{SO}_4)_3$ e. AlSO_3

58. What is the value of ΔG at 300 K and is the reaction spontaneous if $\Delta H = -150$ kJ/mol and $\Delta S = +200$ J/mol·K?
 a. -210 kJ/mol and spontaneous b. -210 kJ/mol and not spontaneous c. -90 kJ/mol and spontaneous d. $+450$ kJ/mol and not spontaneous e. none of the above
59. If the temperature of the equilibrium system $\text{CH}_3\text{OH}(g) + 101 \text{ kJ} \rightleftharpoons \text{CO}(g) + 2\text{H}_2(g)$ increases,
 a. $[\text{CH}_3\text{OH}]$ increases and $[\text{CO}]$ decreases. b. $[\text{CH}_3\text{OH}]$ decreases and $[\text{CO}]$ increases. c. both $[\text{CH}_3\text{OH}]$ and $[\text{CO}]$ increase. d. the concentrations in the system do not change. e. both $[\text{CH}_3\text{OH}]$ and $[\text{CO}]$ decrease.
60. The Haber process for producing ammonia commercially is represented by the equation $\text{N}_2(g) + 3\text{H}_2(g) \rightarrow 2\text{NH}_3(g)$. To completely convert 12.0 grams of hydrogen gas to ammonia gas, how many moles of nitrogen gas are required?
 a. 1.0 mol b. 2.0 mol c. 3.0 mol d. 6.0 mol e. some other value
61. The solution produced when sugar dissolves in distilled water does what to the freezing and boiling point of the solution as compared to pure water.
 a. depress freezing point and elevate boiling point. b. elevate freezing point and depress boiling point. c. depress both freezing point and boiling point. d. elevate both freezing point and boiling point. e. nothing they stay the same
62. What is the pH of a 10^{-4} M NaOH solution?
 a. 4 b. 6 c. 8 d. 10 e. 0
63. The element that has the greatest second ionization energy is
 a. aluminum. b. sodium. c. calcium. d. magnesium. e. potassium
64. A very high value of K indicates that
 a. equilibrium is reached slowly. b. products are favored. c. reactants are favored. d. equilibrium has been reached. e. equilibrium has been reached quickly
65. The shape of a H_2O molecule is ?
 a. tetrahedral b. linear c. bent angular or V shaped d. trigonal pyramid e. planar triangular
66. In the alkaline-earth group, atoms with the smallest radii
 a. are the most reactive. b. have a greater electronegativity. c. have more valence electrons. d. have the highest ionization energies.
67. The number of valence electrons and unpaired electrons in the electronic configuration of the ground state of silicon is ___ and ___ respectively
 a. 4 and 0 b. 4 and 2. c. 14 and 0 d. 14 and 2 e. 4 and 4
68. Two ideal gases have the same temperature but different pressures. The kinetic-molecular theory does *not* predict that
 a. molecules in both gases have the same average kinetic energies. b. molecules in the low-pressure gas travel farther before they collide with other molecules. c. both gases have the same density. d. all collisions of the molecules are elastic. e. both gases have no intermolecular attractions
69. Balance the following equation:
 alpha particle + ${}^9_4\text{Be} \rightarrow {}^{12}_6\text{C} + \text{_____}$
 a. ${}^4_2\text{He}$ b. 1_0n c. ${}^9_3\text{X}$ d. ${}^0_{-1}e$ e. ${}^9_5\text{X}$
70. Which of the following is more likely to react explosively with water.
 a. sodium b. iron c. nitrogen d. ammonia e. magnesium chloride

71. A compound's empirical formula is NO_2 . If the formula mass is between 85 and 95 amu, what is the molecular formula?
 a. N_3O_3 b. N_3O_6 c. N_4O_2 d. N_2O_4 e. NO_2
72. The most common negative ion of Phosphorus-33 contains _____ electrons.
 a. 33 . b. 15. c. 18. d. 12. e. 48
73. Which of the following is true about ice freezing. It
 a. is an exothermic process or reaction. b. is an example of entropy is decreasing. c. both answers a and b are true d. neither answer a or b is are true
74. The pair of elements that forms a bond with the most ionic character is
 a. Na and Cl. b. K and Cl. c. O and Cl. d. Mg and Cl. e. C and Cl
75. A compound contains 64 g of oxygen and 4 g of hydrogen. What is the empirical formula for this compound?
 a. H_2O b. H_2O_2 c. HO_2 d. HO e. HO_{16}
76. A substance that is a good conductor of electricity is a(n)
 a. solid sodium chloride. b. diamond. c. distilled water d. potassium chloride solution e. sugar solution
77. The equation for the production of methane is $\text{C} + 2\text{H}_2(\text{g}) \rightarrow \text{CH}_4(\text{g})$. How many grams of hydrogen are needed to produce 44.8 liters of methane at 273 K and 760 mm Hg?
 a. 2.0 g b. 4.0 g c. 6.0 g d. 8.0 g e. 89.6
78. What is the half-life of an isotope if 125 g of a 500 g sample of the isotope remain after 8.0 years?
 a. 8.0years b. 4.0 years c. 2.0 years d. 1.0 years e. 24 years
79. According to the figure below, which substance has the highest boiling point?



- a. benzene b. water c. toluene d. aniline e. there is no way to tell
80. The reason that the boiling point that CH_3OH is higher than the boiling point of CH_3OCH_3 is partially explained by
 a. London forces. b. covalent bonding. c. ionic bonding. d. hydrogen bonding. e. fewer atoms
81. What is not true during an acid-base titration of a strong base and strong acid
 a. salt and water are present at the end point. b. a very rapid change in pH occurs when the amounts of H_3O^+ ions and OH^- ions are nearly equivalent. c. the pH is approximately 7.0 at the end point. d. two of the above answers are true. e. answers a,b,c are all true.

82. The shape of an AlCl_3 molecule is
a. trigonal pyramid. b. tetrahedral. c. linear. d. bent angular or V shaped e. planar triangular
83. Using significant figures 50.0 cm is describes exactly the same length as
a. 500 mm. b. 5.00 m. c. 500 dm. d. 5.00 mm. e. .500 m
84. What is the molarity of a solution that contains 120 g NaOH in 600 ml
a. 0.20 M b. 5.0 M c. 0.005 M d. 1.8 M e. 72 M
85. If more $\text{CO}_2(g)$ is added to the system $\text{C}_3\text{H}_8(g) + 5\text{O}_2(g) \rightleftharpoons 3\text{CO}_2(g) + 4\text{H}_2\text{O}(g)$ at constant temperature, the equilibrium constant
a. increases. b. decreases. c. increases or decreases. d. does not change.
86. The shape of the ammonia (NH_3) molecule is
a. linear b. tetrahedral c. planar triangular d. trigonal pyramid e. v-shaped or bent angular
87. The volume of a gas is 2.0 L when the pressure is 1.00 atm. At the same temperature, what is the pressure at which the volume of the gas is 500.0 mL?
a. 0.25 atm b. 1.0 atm c. 0.004 atm d. 4.0 atm e. 2.0 atm
88. A unknown atom has atomic number of 7 and mass number 15. It has
a. 7 protons and 7 neutrons. b. 7 protons and 8 neutrons. c. 7 protons and 15 neutrons. d. 15 protons and 7 neutrons. e. 8 protons and 7 neutrons
89. How many OH^- ions are present in 3.00 mol of $\text{Ca}(\text{OH})_2$?
a. 3.00 b. 6.00 c. 3.61×10^{24} d. 1.81×10^{23} e. 2.00
90. Which of the following is a strong electrolyte?
a. $\text{HC}_2\text{H}_3\text{O}_2$ b. HNO_3 c. HF d. NH_3 e. water