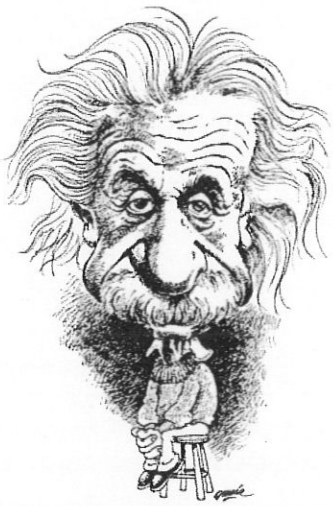
AP Chemistry

DIAGNOSTIC TEST



Multiple Choice:

_____# correct _____# guessed at

1. Read all directions
2. You do not have to take the entire test at once (**see Schedule)
3. Correct the test (Answers packet enclosed)]
   Your Goals: Multiple Choice: at least 40 correct
   Free-response: two parts correct per question
4. Look up the ones you missed in the answer packet.
5. Go through the entire multiple choice portion within 15-20 minutes only answering those question you know with little thought. If there is a question you have no idea circle it and forget it until the end. (you are allowed about 15 of these) at the end make an educated guess

**Remember you are taking this test without a review or not learning chapters 19 and 20.

6. This test will give you an indication of areas you need to review.

TIME & EFFORT = SUCCESS = 5

PART I

A Diagnostic Test

The purpose of this test is to give you an indication of how well you will perform on the AP Chemistry exam. These questions are representative of the AP Chemistry examination, but bear in mind it is impossible to predict exactly how well you will do on the actual exam. Calculators may not be used for answering questions in the first section of this test. The first section is 45% of your total test grade. Time yourself to finish this part in 90 minutes. There are two types of multiple-choice questions used in this examination. The first type consists of five lettered headings followed by a listing of number phrases. For each phrase you are to select the one heading that is most closely related to it. Headings may be used once, more than once, or not at all. The majority of multiple-choice questions consist of a question or incomplete statements followed by five possible answers. Select the one that is best in each case.

AP CHEMISTRY EXAMINATION
Section I: Multiple-Choice Questions
Time: 90 minutes
Number of Questions: 75

No calculators are to be used in this section; no tables (except Periodic Table) permitted.

Questions 1–3 refer to the following elements:

(A) Chromium
(B) Sodium
(C) Copper
(D) Phosphorus
(E) Beryllium

1. Forms colored ions having the formulas $X_2O_7^{2-}$ and XO_4^{2-}

2. Forms an oxide that yields aqueous solutions that are acidic

3. Forms hydrogen gas when it reacts with cold water

Questions 4–7 refer to the following substances:

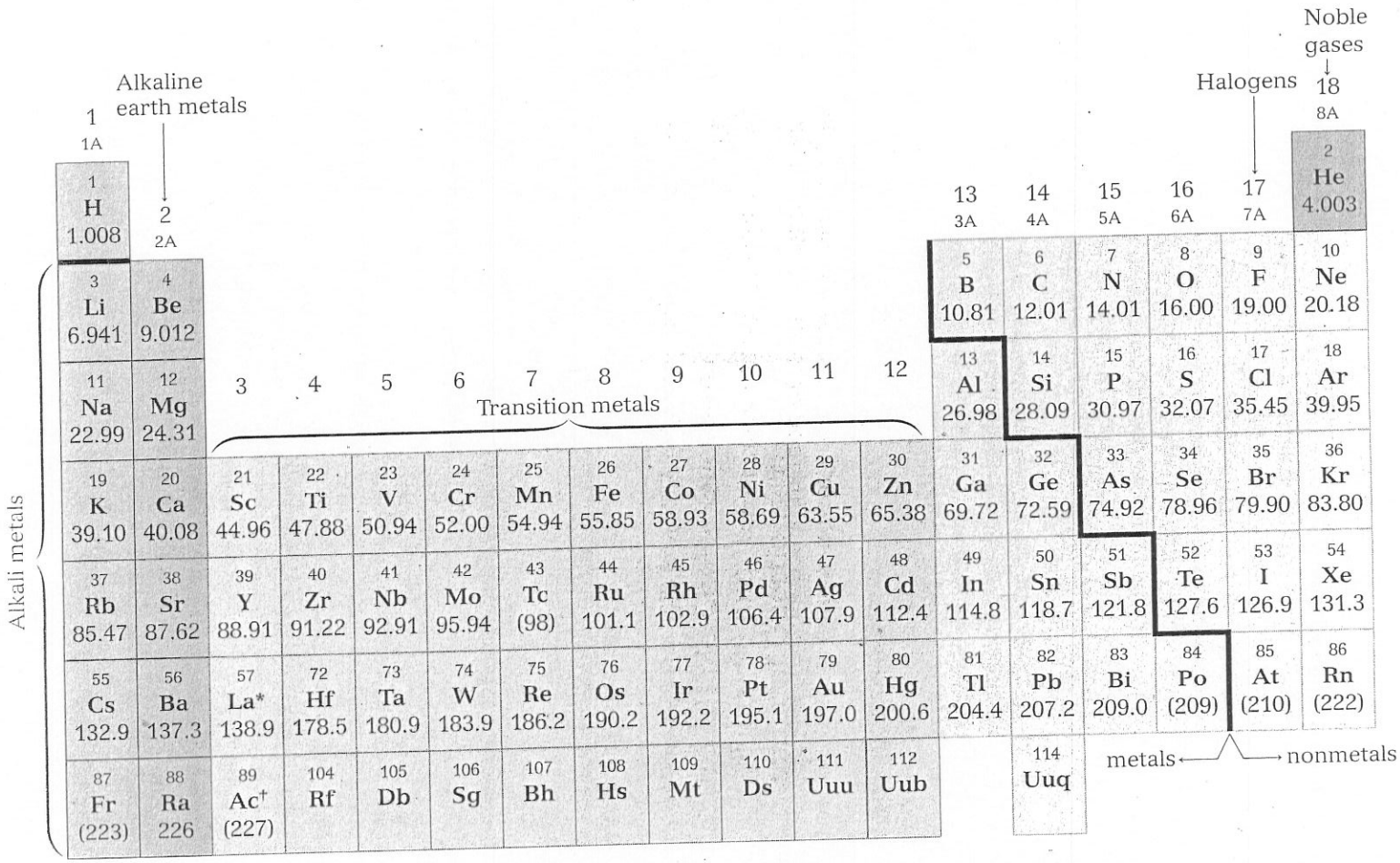
(A) Hydrofluoric acid, HF
(B) Hydrobromic acid, HBr
(C) Sodium hydroxide, NaOH
(D) Nitrous acid, HNO_2
(E) Carbon dioxide, CO_2

4. Will dissolve or etch glass

5. Is a strong acid

6. Will neutralize acids

7. Contributes to the greenhouse effect



	1 1A	2 2A	3	4	5	6	7	8	9	10	11	12	13 3A	14 4A	15 5A	16 6A	17 7A	18 8A
	1 H 1.008																	2 He 4.003
	3 Li 6.941	4 Be 9.012											5 B 10.81	6 C 12.01	7 N 14.01	8 O 16.00	9 F 19.00	10 Ne 20.18
	11 Na 22.99	12 Mg 24.31											13 Al 26.98	14 Si 28.09	15 P 30.97	16 S 32.07	17 Cl 35.45	18 Ar 39.95
	19 K 39.10	20 Ca 40.08	21 Sc 44.96	22 Ti 47.88	23 V 50.94	24 Cr 52.00	25 Mn 54.94	26 Fe 55.85	27 Co 58.93	28 Ni 58.69	29 Cu 63.55	30 Zn 65.38	31 Ga 69.72	32 Ge 72.59	33 As 74.92	34 Se 78.96	35 Br 79.90	36 Kr 83.80
	37 Rb 85.47	38 Sr 87.62	39 Y 88.91	40 Zr 91.22	41 Nb 92.91	42 Mo 95.94	43 Tc (98)	44 Ru 101.1	45 Rh 102.9	46 Pd 106.4	47 Ag 107.9	48 Cd 112.4	49 In 114.8	50 Sn 118.7	51 Sb 121.8	52 Te 127.6	53 I 126.9	54 Xe 131.3
	55 Cs 132.9	56 Ba 137.3	57 La* 138.9	72 Hf 178.5	73 Ta 180.9	74 W 183.9	75 Re 186.2	76 Os 190.2	77 Ir 192.2	78 Pt 195.1	79 Au 197.0	80 Hg 200.6	81 Tl 204.4	82 Pb 207.2	83 Bi 209.0	84 Po (209)	85 At (210)	86 Rn (222)
	87 Fr (223)	88 Ra 226	89 Ac† (227)	104 Rf	105 Db	106 Sg	107 Bh	108 Hs	109 Mt	110 Ds	111 Uuu	112 Uub		114 Uuq				

*Lanthanides	58 Ce 140.1	59 Pr 140.9	60 Nd 144.2	61 Pm (145)	62 Sm 150.4	63 Eu 152.0	64 Gd 157.3	65 Tb 158.9	66 Dy 162.5	67 Ho 164.9	68 Er 167.3	69 Tm 168.9	70 Yb 173.0	71 Lu 175.0
†Actinides	90 Th 232.0	91 Pa (231)	92 U 238.0	93 Np (237)	94 Pu (244)	95 Am (243)	96 Cm (247)	97 Bk (247)	98 Cf (251)	99 Es (252)	100 Fm (257)	101 Md (258)	102 No (259)	103 Lr (260)

Group numbers 1–18 represent the system recommended by the International Union of Pure and Applied Chemistry.

Most of the multiple-choice questions are questions or incomplete statements followed by five suggested answers or completions. You should select the best one in each case.

For questions 8–9, consider the electrochemical cell:

$$Ag \mid Ag^{+}(1\ M) \parallel Cu^{2+}(1M) \mid Cu$$

The cell reaction is
$2Ag^{+}(aq) + Cu\ (s) \rightarrow Cu^{2+}(aq) + 2Ag(s)$.

The measured voltage is +0.46 volts.

8. Increasing the concentration of silver ions will
   (A) cause a decrease in blue color in the cell.
   (B) increase the cell voltage above +0.46 volts.
   (C) decrease the concentration of copper (II) ions.
   (D) cause no change in the cell voltage.
   (E) cause a change in the direction of electron flow through the external circuit.

9. The reaction at the anode is
   (A) $Ag^{+}(aq) + e^{-} \rightarrow Ag(s)$.
   (B) $Ag\,(s) \rightarrow Ag^{+}(aq)$.
   (C) $Cu(s) \rightarrow Cu^{2+}(aq) + 2e^{-}$.
   (D) $Cu^{2+}(aq) + 2e^{-} \rightarrow Cu(s)$.
   (E) $Cu(s) + 2e^{-} \rightarrow Cu^{2+}(aq)$.

10. A spark coil is used to begin the reaction between hydrogen and oxygen in a balloon. The spark
    (A) allows the gases to obtain the activation energy.
    (B) causes the hydrogen to vaporize, then react.
    (C) causes both the hydrogen and the oxygen to vaporize, then react.
    (D) provides the enthalpy for this reaction.
    (E) increases the entropy of both oxygen and hydrogen.

11. The amount of silver which will be formed when 0.00200 mol of Ag_2S reacts completely with excess zinc is
    (A) 0.00100 mol.
    (B) 0.00200 mol.
    (C) 0.00400 mol.
    (D) 0.00248 grams.
    (E) 0.00456 grams.

12. The flame test color for a solution of sodium nitrate is
    (A) pale yellow.
    (B) blue.
    (C) violet.
    (D) purple.
    (E) crimson.

13. In the expression $PV = nRT$,
    (A) R is a temperature dependent constant.
    (B) R is a pressure dependent constant.
    (C) R is valid for gases at high temperatures and low pressures.
    (D) T must be expressed in Celsius degrees.
    (E) the ratio, PV/nRT, is a very large value @ STP.

14. The aqueous solution with the lowest freezing temperature is
    (A) 0.100 m $AlCl_3$.
    (B) 0.200 m $AlCl_3$.
    (C) 0.300 m NaCl.
    (D) 0.300 m KF.
    (E) 0.350 m KF.

15. Calcium oxide, CaO, has a lower melting temperature than magnesium oxide, MgO, due to the
    (A) higher charge density of Mg^{+2} than of Ca.
    (B) higher charge density of Ca^{+2} than of O^{-2}.
    (C) greater atomic volume of Mg^{+2} than of O^{-2}.
    (D) greater atomic volume of Mg^{+2} than of Ca^{+2}.
    (E) greater positive charge on Ca than on Mg.

16. The general classification for the compound C_3H_7OH is
    (A) an alcohol.
    (B) an aldehyde.
    (C) a carboxylic acid.
    (D) a ketone.
    (E) an ester.

17. A solution of 50.0 mL of 0.0010 M $Ba(NO_3)_2$ is slowly titrated with 50.0 mL of 0.0030 M H_2SO_4. The conductivity of this solution will
    (A) decrease to near zero, then increase.
    (B) decrease to near zero and remain very low.
    (C) increase as the acid is added.
    (D) increase as the acid is added then become constant at a high value.
    (E) increase as the acid is added and then slowly become very low.

18. Which of the following pairs illustrates the Law of Multiple Proportions?
    (A) SO_2, SO_3
    (B) CO_2, CCl_4
    (C) NaCl, NaBr
    (D) NH_4Cl, NH_4Br
    (E) SO_2, CO_2

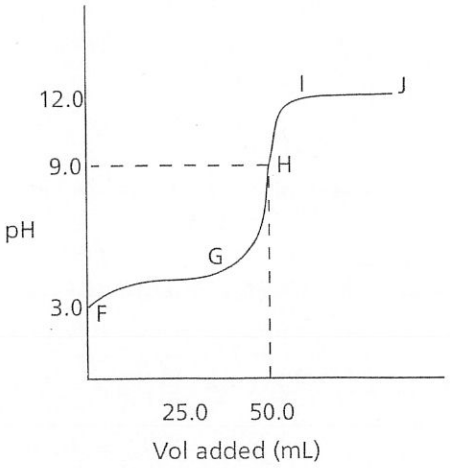
19. The scientist who is remembered for the alpha particle scattering properties of gold foil, concluding that the nucleus is small, dense, and positively charged, is
    (A) Ernest Rutherford.
    (B) J. J. Thomson.
    (C) John Dalton.
    (D) Robert Boyle.
    (E) Antoine Lavoisier.

20. Isotopic forms of the same element
    (A) differ in the number of neutrons in the nucleus.
    (B) are formed by gaining electrons.
    (C) always have a positive charge.
    (D) are found only in metals.
    (E) have the same number of neutrons.

21. The number of moles of oxygen atoms in one mole of iron (II) phosphate is
    (A) 1.
    (B) 2.
    (C) 3.
    (D) 4.
    (E) 8.

22. Magnesium fluoride, a salt of low solubility in water, has a K_{sp} of 6.4×10^{-9}. The concentration of Mg^{2+} ions in this solution would be
    (A) $\sqrt{6.4\times10^{-9}\ \text{M}}$.
    (B) $\sqrt{(6.4\times10^{-9}/2)\ \text{M}}$.
    (C) $\sqrt[3]{(6.4\times10^{-9}/3)\ \text{M}}$.
    (D) $\sqrt[3]{(6.4\times10^{-9}/4)\ \text{M}}$.
    (E) $\sqrt[3]{6.4\times10^{-9}\ \text{M}}$.

Questions 23 and 24 refer to this pH curve for the titration of 50.0 mL of 0.100 M acid with 0.100 M base.



23. This is the curve
    (A) for a strong acid/strong base titration.
    (B) for a strong acid/weak base titration.
    (C) for a weak acid/strong base titration.
    (D) for either a strong acid/strong base or a weak acid/strong base titration.
    (E) for an acid/base titration but it is impossible to describe the strength of the acid and of the base used without more information.

24. Buffering is most effective
    (A) between points F and G.
    (B) between points G and H.
    (C) at point H between points I and J.
    (D) between both F and G and between I and J.
    (E) none of these

25. The systematic (Stock Nomenclature) name for $Ca(OCl)_2$ is
    (A) calcium (II) hypochlorite.
    (B) calcium hypochlorite.
    (C) calcium dioxochloride.
    (D) calcium monoxodichloride.
    (E) calcium dichloride.

26. Bond angle data shows the following angles for three compounds:

    CH_4 109.5°,
    NH_3 107°,
    H_2O 104.5°.

    This trend is basically because
    (A) lone pairs of electrons require more room than bonding pairs.
    (B) hydrogen atoms repel each other more in water than in CH_4 or NH_3.
    (C) oxygen has a higher electronegativity than does N, and C has even less.
    (D) of the attempt of all central atoms to achieve the tetrahedral shape.
    (E) only the positions of nuclei determine molecular shapes and bond angles.

27. The acid $HClO_4$ is given the name
    (A) perchloric acid.
    (B) chloric acid.
    (C) chlorous acid.
    (D) hypochlorous acid.
    (E) hypochlorotetroxide.

28. When 100.0 mL of 2.0 M NH_3 and 100.0 mL of 1.0 M $AgNO_3$ are mixed, but before any reaction occurs, the major species in solution are
    (A) Ag^+, NO_3^-, NH_3, and H_2O.
    (B) Ag^+, NO_3^-, and $Ag(NH_3)^+$.
    (C) $Ag(NH_3)^+$ and $Ag(NH_3)_2^+$.
    (D) NH_3 and $Ag(NH_3)_2^+$.
    (E) NH_3, $Ag(NH_3)_2^+$ and H_2O.

29. H_3PO_4 is a triprotic acid with equilibrium constants of

$K_{a_1} = 7 \times 10^{-3}$,
$K_{a_2} = 6 \times 10^{-8}$,
$K_{a_3} = 5 \times 10^{-13}$.

This information leads to the conclusion that
I H_3PO_4 is a weak acid.
II H_3PO_4 dissociates in three steps to form PO_4^{3-}.
III Only the first dissociation will make an important contribution to the $[H^+]$ when dissolved in water.

Of these three statements
(A) only I is valid.
(B) only II is valid.
(C) only III is valid.
(D) both I and II are valid but not III.
(E) all three statements (I, II, and III) are valid.

30. Burets can usually be read to the nearest ±0.01 mL. If the liquid volume in a buret is recorded as 22.00 mL, the number of significant figures in this value is
(A) 1.
(B) 2.
(C) 3.
(D) 4.
(E) 5.

31. The mass of a sample of $KClO_3$ is determined with five weighings:

1.391 g; 1.392 g; 1.299 g; 1.390 g; 1.388 g.

The number of significant figures in the average of these five readings is
(A) 1.
(B) 2.
(C) 3.
(D) 4.
(E) 5.

32. A weighing tray has a mass of 0.911 g. To this tray is added 3.2 g of NaOH. The total mass of tray plus NaOH is
(A) 4.1 g.
(B) 4.11 g.
(C) 4.111 g.
(D) 4.100 g.
(E) 4.10 g.

33. The density of a new plastic is determined experimentally by first measuring the volume using water displacement; the mass of the dry sample is also found. The Data:

Initial volume of water—13.0 mL

Final volume, water and sample—27.1 mL

Mass of sample —36.123 g

The density of this sample of plastic is best expressed as
(A) 2.5619 g/mL.
(B) 2.562 g/mL.
(C) 2.56 g/mL.
(D) 2.6 g/mL.
(E) 3. g/mL.

34. The density of diethyl ether is 0.714 g/cm^3. The volume occupied by 10.00 g of this liquid is
(A) 1.4 cm^3.
(B) 14. cm^3.
(C) 14.0 cm^3.
(D) 14.01 cm^3.
(E) 71.4 cm^3.

35. When equal volumes of 0.150 M NaOH and 0.150 M $HC_2H_3O_2$ are mixed, the resulting solution has a pH about 9. This is due to
(A) incomplete reaction of acetic acid in water.
(B) an unequal number of moles of OH^- (from the NaOH) and H^+ (from the $HC_2H_3O_2$).
(C) the $C_2H_3O_2^-$ reacting with water to provide more OH^-.
(D) the cation of the acid, which remains in solution at the equivalent point, and is a base.
(E) both the $C_2H_3O_2^-$ reacting with water and the acidic nature of the anion of the acid.

36. An isotope has the atomic number of 8 and a mass number of 17. This element
(A) is an isotopic form of oxygen.
(B) has 8 neutrons.
(C) has 9 protons if it is in ionic form.
(D) is an isotopic form of fluorine.
(E) has 17 electrons.

37. The rate of reaction in a collection of gas particles is always much lower than the calculated collision frequency would indicate. This means that only in a small percentage of the collisions does a reaction result. This is because

I few particles have the required activation energy.
II few particles have formed the activated complex.
III few particles have the correct orientation when they collide. Of these three statements, those that are valid are

(A) only I.
(B) only II.
(C) only III.
(D) both I and II only.
(E) all three (I, II, and III).

38. The pH of a 0.00100 M HBr solution is
(A) 0.00100M.
(B) 3.0.
(C) 7.0.
(D) 11.0.
(E) impossible to determine without more data.

39. Aqueous solutions of lead (II) nitrate and potassium chromate are allowed to react. The results show
(A) both lead (II) chromate and potassium nitrate precipitate.
(B) no solid forms from this reaction.
(C) lead (II) chromate will precipitate from solution.
(D) potassium nitrate precipitates.
(E) potassium chromate is insoluble so there is no reaction.

40. A rigid cylinder contains CO_2 gas; some of the carbon dioxide is allowed to escape with temperature adjusted to a constant value. Which of the following applies to the CO_2?
(A) The pressure of the gas increases.
(B) The volume of the gas decreases.
(C) The total number of gas molecules within the cylinder remains unchanged.
(D) The average molecular speed decreases.
(E) The distance between CO_2 molecules is increased.

41. Gases are less soluble in water at
(A) high temperature, low pressure.
(B) low temperature, high pressure.
(C) high temperature, high pressure.
(D) low temperature, low pressure.
(E) pressure has no effect on the solubility of gases in water.

42. $2NH_3 \rightarrow N_2 + 3H_2$

The above reaction occurs in a closed system of constant volume and temperature. What is the resultant pressure of the hydrogen if the partial pressure of the ammonia decreases by 0.40 atm.?
(A) increases by 0.20 atm
(B) increases by 0.40 atm
(C) increased by 0.60 atm
(D) decreased by 0.60 atm
(E) impossible to calculate without more data

43. Air is pumped into a rigid steel cylinder at constant temperature. The increase in pressure is due to
(A) increased molecular collisions.
(B) the greater kinetic energy of the gas particles.
(C) increase in the size of the individual molecules.
(D) the greater force of attraction between gas molecules at high pressure.
(E) the molecular contraction at higher pressure.

44. Real gases depart from ideal at conditions of
(A) high pressure, low temperature.
(B) low pressure, low temperature.
(C) high pressure, high temperature.
(D) low pressure, low temperature.
(E) constant pressure and temperature.

45. Gas pressure is due to gas particles
(A) slowing down at high temperature.
(B) colliding with container walls.
(C) neither attracting or repelling each other.
(D) attracting each other.
(E) moving in random patterns.

46. $2KClO_3(s) \rightarrow 2KCl(s) + 3O_2(g)$

According to the above equation, 0.40 mol of solid $KClO_3$ completely decomposes, forming KCl and O_2. The dry gas is collected at STP. The volume of this oxygen gas would be most nearly
(A) 1.4 L.
(B) 14 L.
(C) 140 L.
(D) 1400 L.
(E) 14,000 L.

47. A hollow steel cylinder of volume 24 L contains 1.0 mole of Ne and 2.0 mol of Ar. The partial pressure of the Ne is
(A) 1/2 the total pressure.
(B) 1/3 the total pressure.
(C) 3 times that of the Ar.
(D) 2 times that of the Ar.
(E) equal to that of the Ar.

48. As the atomic number changes in Period Two of the Periodic Table from alkaline metals to halogens, the atomic radii
(A) do not change.
(B) increase.
(C) decrease.
(D) decrease, then slightly increase.
(E) cannot be predicted because there is no trend.

49. Assume that $2A + B \rightarrow C$ is the rate determining step. 3.0 moles of A and 2.0 moles of B are placed in a 1.0-L flask; after five minutes the concentration of C reaches 1.0 M. After five minutes the rate will have
(A) increased by a factor of 9.
(B) increased by a factor of 18.
(C) decreased by a factor of 9.
(D) decreased by a factor of 10.
(E) decreased by a factor of 18.

50. For a given reaction at a temperature of 27°C, the rate law is Rate = $k[X][Y]$. If the concentration of X and of Y are both 0.40 M, the rate is 4.0×10^{-6} mol/L min. Determine the value of k (the rate constant) at this temperature.
(A) 2.5×10^{-5} L/mol·min
(B) 2.5×10^{-3} L/mol·min
(C) 2.5×10^{-5} mol/L·min
(D) 1.0×10^{-6} L/mol·min
(E) 1.0×10^{-5} L/mol·min

51. The major reason an increase in temperature causes an increase in reaction rate is that
(A) the activation energy changes with temperature.
(B) the fraction of high energy molecules increases.
(C) the reactant molecule pressure increases.
(D) molecules collide with greater frequency.
(E) catalysts become more effective.

52. Catalysts effectively increase reaction rate by
(A) increasing the K_{eq}.
(B) increasing the concentration of the reactant.
(C) decreasing the concentration of the products.
(D) lowering the activation energy requirements.
(E) decreasing the reaction temperature.

53. For all zero-order reactions,
(A) the reaction rate is independent of time.
(B) the rate constant equals zero.
(C) the concentration of reactants does not change over time.
(D) activation energy is very low.
(E) the concentration of reactants does not change and the rate is independent of time.

54. It is found that in a certain first order reaction the half-life is 1.4 minutes. The rate constant, k, for that same temperature is about
(A) 0.35 min^{-1}.
(B) 0.50 min^{-1}.
(C) 0.71 min.
(D) 2.0 min.
(E) 2.0 min^{-1}.

55. To determine the order with respect to Br^- in the reaction $BrO_3^-(aq) + 5Br^-(aq) + 6H^+(aq) \rightarrow 3H_2O(l) + 3Br_2(g)$ solutions should be prepared which differ in
(A) $[BrO_3^-]$ and $[Br^-]$.
(B) $[Br^-]$.
(C) $[H^+]$.
(D) $[BrO_3^-]$ and $[Br^-]$ and $[H^+]$.
(E) $[H_2O]$ and $[Br_2]$.

56. The first-order rate constant for nuclear unstable ^{60}Co is 0.13 yr^{-1}, and for ^{90}Sr it is 0.24 yr^{-1}.
(A) The half-life of Sr is longer than that of Co.
(B) The half-life of Sr is shorter than that of Co.
(C) The half-lives of Sr and Co are equal.
(D) The half-lives of Sr and Co cannot be compared from these data.
(E) There is no simple relationship between half-life and stability.

57. The activation energy for a reaction is +30 kJ/mol; therefore the activation energy for the reverse reaction must be
(A) –30 kJ / mol.
(B) greater than 30 kJ / mol.
(C) less than 10 kJ / mol.
(D) + 30 kJ / mol.
(E) a value that cannot be calculated without more data.

58. The rate law expression is rate = $k[X]^2[Y]$ for a certain reaction. Both X and Y are reactant gases. If the volume of the system is reduced to 1/3 of the original volume, the relative new reaction rate will be
(A) 3 times greater.
(B) 9 times greater.
(C) 27 times greater.
(D) 27 times less.
(E) 9 times less.

59. For the reaction $X + 2B \rightarrow Z$, the rate law is rate = $k\,[X]\,[B]^2$. If the concentration of B increases by a factor of 3 while $[X]$ is held constant, the rate of the reaction will
(A) increase by 3 times.
(B) increase by 6 times.
(C) increase by 9 times.
(D) increase by 27 times.
(E) decrease.

60. Spontaneous reactions at all temperatures are favored by values for enthalpy and entropy of

	ΔH	ΔS
(A)	+	+
(B)	–	–
(C)	0	0
(D)	+	–
(E)	–	+

61. A certain liquid boils at 27° C at 1.0 atm. pressure, with a heat of vaporization of 60.0 kJ / mol. Determine the entropy change for the boiling of one mole of this liquid.
(A) +200. J/mol deg.K
(B) –200. J/mol deg.K
(C) +2.00 J/mol deg.K
(D) –2.00 J/mol deg.K
(E) 0.050 J/mol deg.K

62. The K_a for a weak acid is 5.0×10^{-10} at 25°C. Determine the value of K_b for the conjugate base of this weak acid.
(A) 0.50×10^{-5}
(B) 1.5×10^{-5}
(C) 2.0×10^{-5}
(D) 5.0×10^{-5}
(E) 5.0×10^{-10}

63. Determine the pH of a 0.10 M solution of a base, B, with a K_b of 1.0×10^{-5}.
(A) 1.0
(B) 3.0
(C) 6.0
(D) 8.0
(E) 11.0

64. Which of the following is most likely to be a brittle compound with low conductivity as a solid, and have a high melting temperature?
(A) RbF
(B) CCl_4
(C) CS_2
(D) ICl
(E) SF_6

65. Of the following, the species that has the correctly predicted largest radius is
(A) Ar.
(B) Cl^-.
(C) Br^-.
(D) K^+.
(E) Sr^{2+}.

66. The species with the most polar bond is
(A) Cl–Cl.
(B) Si–Si.
(C) Cr–Br.
(D) P–Cl.
(E) Ca–Ca.

67. The molecule whose Lewis structure requires resonance structures to best explain its bonding is
(A) $BeCl_2$.
(B) CO_2.
(C) PCl_5.
(D) OF_5.
(E) SO_2.

68. The geometry of a PH_3 molecule is described by the VSEPR model as
(A) linear.
(B) trigonal planar.
(C) tetrahedral.
(D) bent or angular.
(E) trigonal pyramidal.

69. The hybridization of an As atom in the AsF_5 molecule is
(A) sp.
(B) sp^2.
(C) sp^3.
(D) dsp^3.
(E) d^2sp^3.

70. The following are in order of increasing boiling temperatures:
(A) $RbCl < CH_3Cl < CH_3OH < CH_4$.
(B) $CH_4 < CH_3Cl < CH_3OH <$ RbCl.
(C) $CH_3Cl < CH_3OH <$ RbCl $< CH_4$.
(D) $CH_4 < CH_3OH < CH_3Cl <$ RbCl.
(E) $RbCl < CH_3OH < CH_3Cl < CH_4$.

71. The following liquids are in order of increasing vapor pressure:
(A) $CH_3CH_2OH < CH_3OCH_3 < CH_3CH_2CH_3$.
(B) $CH_3CH_2OH < CH_3CH_2CH_3 < CH_3OCH_3$.
(C) $CH_3CH_2CH_3 < CH_3OCH_3 < CH_3CH_2OH$.
(D) $CH_3OCH_3 < CH_3CH_2OH < CH_3CH_2CH_3$.
(E) $CH_3CH_2CH_3 < CH_3CH_2OH < CH_3OCH_3$.

72. The equilibrium system not affected by the pressure change which results from a volume change at constant temperature is
(A) $2O_3(g) \rightleftharpoons 3O_2(g)$.
(B) $PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$.
(C) $2NaCl(s) \rightleftharpoons 2Na(s) + Cl_2(g)$.
(D) $H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$.
(E) $2NO_2(g) \rightleftharpoons N_2O_4(g)$.

73. Given: $2X + Y \rightleftharpoons 3C + D$ (all are gases)

Equal numbers of moles of X and Y are added to an empty tank; when equilibrium is achieved,
(A) [X] < [Y].
(B) [D] = [Y].
(C) [X] = [Y].
(D) [Y] < [X].
(E) [X] + [Y] < [C] + [D].

74. The K_c for $A + B \rightleftharpoons C$ is 4.0. The K_c for $2C \rightleftharpoons 2A + 2B$ is
(A) 1 / 16.
(B) 1 / 4.
(C) 8.
(D) 16.
(E) 32.

75. The solubility of $Zn(OH)_2$ is 2.0×10^{-6}M at a certain temperature. Determine the value of the K_{sp} at this same temperature.
(A) 2.0×10^{-6}
(B) 4.0×10^{-6}
(C) 8.0×10^{-6}
(D) 16×10^{-18}
(E) 32×10^{-18}