For reference only.

ANSWER SHEET
Practice Test 2

Determine the correct answer for each question. Then, using a No. 2 pencil, blacken completely the oval containing the letter of your choice.

1. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
2. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
3. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
4. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
5. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
6. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
7. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
8. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
9. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
10. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
11. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
12. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
13. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
14. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
15. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
16. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
17. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
18. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
19. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
20. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
21. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
22. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
23. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ

ON THE ACTUAL CHEMISTRY TEST, THE FOLLOWING TYPE OF QUESTION MUST BE ANSWERED ON A SPECIAL SECTION (LABELED "CHEMISTRY") AT THE LOWER LEFT-HAND CORNER OF PAGE 2 OF YOUR ANSWER SHEET. THESE QUESTIONS WILL BE NUMBERED BEGINING WITH 101 AND MUST BE ANSWERED ACCORDING TO THE DIRECTIONS.

CHEMISTRY* Fill in oval CE only if II is a correct explanation of 1.

	I	II	CE*
101.	Ⓣ Ⓕ	Ⓣ Ⓕ	○
102.	Ⓣ Ⓕ	Ⓣ Ⓕ	○
103.	Ⓣ Ⓕ	Ⓣ Ⓕ	○
104.	Ⓣ Ⓕ	Ⓣ Ⓕ	○
105.	Ⓣ Ⓕ	Ⓣ Ⓕ	○
106.	Ⓣ Ⓕ	Ⓣ Ⓕ	○
107.	Ⓣ Ⓕ	Ⓣ Ⓕ	○
108.	Ⓣ Ⓕ	Ⓣ Ⓕ	○
109.	Ⓣ Ⓕ	Ⓣ Ⓕ	○
110.	Ⓣ Ⓕ	Ⓣ Ⓕ	○
111.	Ⓣ Ⓕ	Ⓣ Ⓕ	○
112.	Ⓣ Ⓕ	Ⓣ Ⓕ	○
113.	Ⓣ Ⓕ	Ⓣ Ⓕ	○
114.	Ⓣ Ⓕ	Ⓣ Ⓕ	○
115.	Ⓣ Ⓕ	Ⓣ Ⓕ	○
116.	Ⓣ Ⓕ	Ⓣ Ⓕ	○

For reference only.

ANSWER SHEET
Practice Test 2

ON THE ACTUAL CHEMISTRY TEST, THE REMAINING QUESTIONS MUST BE ANSWERED BY RETURNING TO THE SECTION OF YOUR ANSWER SHEET YOU STARTED FOR CHEMISTRY.

24. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
25. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
26. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
27. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
28. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
29. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
30. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
31. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
32. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
33. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
34. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
35. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
36. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
37. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
38. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
39. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
40. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
41. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
42. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
43. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
44. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
45. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
46. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
47. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
48. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
49. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
50. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
51. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
52. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
53. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
54. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
55. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
56. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
57. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
58. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
59. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
60. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
61. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
62. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
63. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
64. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
65. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
66. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
67. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
68. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
69. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ

PRACTICE TEST 2

***Note**:* For all questions involving solutions and/or chemical equations, assume that the system is in water unless otherwise stated.

Reminder: You may *not* use a calculator on these tests.
The following symbols have the meanings listed unless otherwise noted.

H = enthalpy
M = molar
n = number of moles
P = pressure
R = molar gas constant
S = entropy
T = temperature
V = volume
atm = atmosphere
g = gram(s)
J = joules(s)
kJ = kilojoules
L = liter(s)
mL = milliliter(s)
mol = mole(s)
mm = millimeter(s)
V = volt(s)

PART A

Directions: Every set of the given lettered choices below refers to the numbered statements or formulas immediately following it. Choose the one lettered choice that best fits each statement or formula and then fill in the corresponding oval on the answer sheet. Each choice may be used once, more than once, or not at all in each set.

Questions 1–4 refer to the following terms:

(A) Boiling point
(B) Melting point
(C) Critical point
(D) Freezing point
(E) Triple point

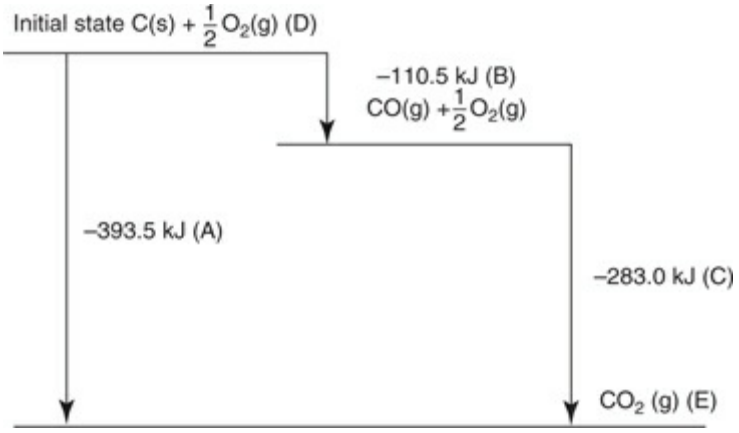
1. The temperature and pressure at which three states of a substance may coexist

2. The temperature at which a solid becomes a liquid

3. The temperature of 373 K for H_2O at standard pressure

4. The temperature at which the vapor pressure of a liquid equals the atmospheric pressure

Questions 5–7 refer to the following diagram:



5. The ΔH of the reaction to form CO from $C + O_2$

6. The ΔH of the reaction to form CO_2 from $CO + O_2$

7. The ΔH of the reaction to form CO_2 from $C + O_2$

Questions 8–11

(A) Hydrogen bond
(B) Ionic bond
(C) Polar covalent bond
(D) Nonpolar covalent bond
(E) Metallic bond

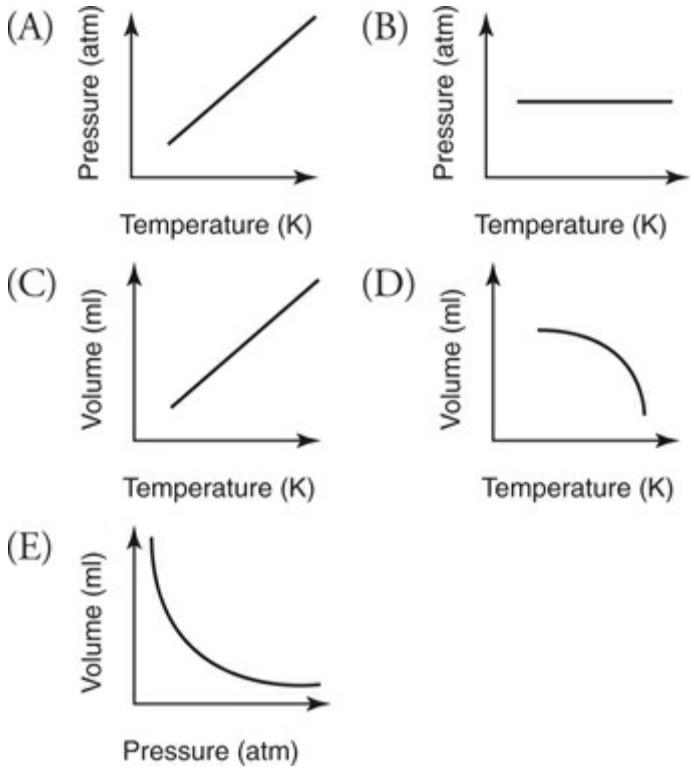
8. The type of bond between atoms of potassium and chloride when they form a crystal of potassium chloride

9. The type of bond between the atoms in a nitrogen molecule

10. The type of bond between the atoms in a molecule of CO_2 (electronegativity difference = 1)

11. The type of bond between the atoms of calcium in a crystal of calcium

Questions 12–14 refer to the following graphs:



12. The graph of volume vs. pressure for a gas at constant temperature

13. The graph of pressure vs. temperature for a gas at constant volume

14. The graph of volume vs. temperature for a gas at constant pressure

Questions 15–18

(A) Least-reactive family of elements
(B) Alkali metals
(C) Halogen family of elements
(D) Noble gases
(E) Family whose oxides form acids in water

15. The elements that most actively react with water to release hydrogen

16. The elements least likely to become involved in chemical reactions

17. Family that contains elements in the colored gaseous state, in the liquid state,

and with metallic properties

18. Group of nonmetallic elements containing N and P

Questions 19–23

(A) 1*s*
(B) 2*s*
(C) 3*s*
(D) 3*p*
(E) 3*d*

19. Electron energy sublevel filled by the first period of transition metals

20. The lowest energy orbital of those shown

21. Of the electron energy sublevels shown, the one that holds a maximum of 6 electrons

22. Largest of the orbitals with a spherical probability distribution

23. Orbital that describes the probability distribution for sodium's outermost electron in the ground state

PART B

ON THE ACTUAL CHEMISTRY TEST, THE FOLLOWING TYPE OF QUESTION MUST BE ANSWERED ON A SPECIAL SECTION (LABELED "CHEMISTRY") AT THE LOWER LEFT-HAND CORNER OF PAGE 2 OF YOUR ANSWER SHEET. THESE QUESTIONS WILL BE NUMBERED BEGINNING WITH 101 AND MUST BE ANSWERED ACCORDING TO THE FOLLOWING DIRECTIONS.

Directions: Every question below contains two statements, I in the left-hand column and II in the right-hand column. For each question, decide if statement I is true or false and if statement II is true or false and fill in the corresponding T or F ovals on your answer sheet. *Fill in oval CE only if statement II is a correct explanation of statement I.

Sample Answer Grid:

CHEMISTRY * Fill in oval CE only if II is a correct explanation of I.

	I		II		CE*
101.	T	F	T	F	○

I		II
101. The structure of SO_3 is shown by using more than one structural formula	BECAUSE	SO_3 is very unstable and resonates between these possible structures.
102. When the ΔG of a reaction at a given temperature is negative, the reaction occurs spontaneously	BECAUSE	when ΔG is negative, ΔH is also negative.
103. One mole of CO_2 has a greater mass than 1 mole of H_2O	BECAUSE	the molecular mass of CO_2 is greater than the molecular mass of H_2O.
104. Hydrosulfuric acid is often used in qualitative tests	BECAUSE	$H_2S(aq)$ reacts with many metallic ions to give colored precipitates.
105. Crystals of sodium chloride go into solution in water as ions	BECAUSE	the sodium ion has a 1+ charge and the chloride ion has a 1− charge and they are hydrated by the water molecules.
106. If some phosphoric acid, H_3PO_4, is added to the equilibrium mixture represented by the equation $H_3PO_4 + H_2O \leftrightarrow PO_4^{3-} + H_3O^+$, the concentration of H_3O^+ decreases	BECAUSE	the equilibrium constant of a reaction changes as the concentration of the reactants changes.
107. The $\Delta H_{reaction}$ of a particular reaction can be arrived at by the summation of the $\Delta H_{reaction}$ values of two or more reactions that, added together, give the $\Delta H_{reaction}$ of the particular reaction	BECAUSE	Hess's Law conforms to the First Law of Thermodynamics, which states that the total energy of the universe is a constant.
108. In a reaction that has both a forward and a reverse reaction, $A + B \rightleftharpoons AB$, when only A and B are introduced into a reacting vessel, the forward reaction rate is the highest at the beginning and begins to decrease from that point until equilibrium is reached	BECAUSE	the reverse reaction does not begin until equilibrium is reached.
109. At equilibrium, the forward reaction and reverse reaction stop	BECAUSE	at equilibrium, the reactants and products have reached the equilibrium concentrations.
		C_2H_2 is a linear molecule with a

110.	The hydrid orbital form of carbon in acetylene is believed to be the *sp* form	BECAUSE	triple bond between the carbons.
111.	The weakest of the bonds between molecules are coordinate covalent bonds	BECAUSE	coordinate covalent bonds represent the weak attractive force of the electrons of one molecule for the positively charged nucleus of another.
112.	A saturated solution is not necessarily concentrated	BECAUSE	*dilute* and *concentrated* are terms that relate only to the relative amount of solute dissolved in the solvent.
113.	Lithium is the most active metal in the first group of the Periodic Table	BECAUSE	lithium has only one electron in the outer energy level.
114.	The oxidation state of carbon is always +4	BECAUSE	carbon has 4 valence electrons.
115.	The atomic number of a neutral atom that has a mass of 39 and has 19 electrons is 19	BECAUSE	the number of protons in a neutral atom is equal to the number of electrons.
116.	For an element with an atomic number of 17, the most probable oxidation number is +1	BECAUSE	the outer energy level of the halogen family has a tendency to add one electron to itself.

PART C

Directions: Each of the questions or incomplete statements below is followed by five suggested answers or completions. Select the one that is best in each case and then fill in the corresponding oval on the answer sheet.

24. All of the following involve a chemical change EXCEPT
    (A) the formation of HCl from H_2 and Cl_2
    (B) the color change when NO is exposed to air
    (C) the formation of steam from burning H_2 and O_2
    (D) the solidification of vegetable oil at low temperatures
    (E) the odor of NH_3 when NH_4Cl is rubbed together with $Ca(OH)_2$ powder

25. When most fuels burn, the products include carbon dioxide and

(A) hydrocarbons
(B) hydrogen
(C) water
(D) hydroxide
(E) hydrogen peroxide

26. In the metric system, the prefix *kilo-* means

(A) 10^0
(B) 10^{-1}
(C) 10^{-2}
(D) 10^2
(E) 10^3

27. How many atoms are in 1 mole of water?

(A) 3
(B) 54
(C) 6.02×10^{23}
(D) $2(6.02 \times 10^{23})$
(E) $3(6.02 \times 10^{23})$

28. Which of the following elements normally exist as monoatomic molecules?

(A) Cl
(B) H
(C) O
(D) N
(E) He

29. The shape of a PCl_3 molecule is described as

(A) bent
(B) trigonal planar
(C) linear
(D) trigonal pyramidal
(E) tetrahedral

30. The complete loss of an electron of one atom to another atom with the consequent formation of electrostatic charges is referred to as

(A) a covalent bond
(B) a polar covalent bond
(C) an ionic bond
(D) a coordinate covalent bond
(E) a pi bond between *p* orbitals

31. In the decomposition of water with electricity (electrolysis), the following reaction occurs.

$$2H_2O(\ell) \rightarrow 2\ H_2(g) + O_2(g)$$

The hydrogen is

(A) oxidized from +1 to 0
(B) oxidized from 0 to +1
(C) reduced from 0 to +1
(D) reduced from +1 to 0
(E) not changing oxidation states

32. Which of the following radiation emissions has no mass?

(A) Alpha particle
(B) Beta particle
(C) Proton
(D) Neutron
(E) Gamma ray

33. If a radioactive element with a half-life of 100 years is found to have transmutated so that only 25% of the original sample remains, what is the age, in years, of the sample?

(A) 25
(B) 50
(C) 100
(D) 200
(E) 400

34. What is the pH of an acetic acid solution if the $[H_3O^+] = 1 \times 10^{-4}$ mole/liter?

(A) 1
(B) 2
(C) 3
(D) 4
(E) 5

35. The polarity of water is useful in explaining which of the following?

I. The solution process
II. The ionization process
III. The high conductivity of distilled water

(A) I only

(B) II only
(C) I and II only
(D) II and III only
(E) I, II, and III

36. When sulfur dioxide is bubbled through water, the solution will contain

(A) sulfurous acid
(B) sulfuric acid
(C) hyposulfuric acid
(D) persulfuric acid
(E) anhydrous sulfuric acid

37. Four grams of hydrogen gas at STP contain

(A) 6.02×10^{23} atoms
(B) 12.04×10^{23} atoms
(C) 12.04×10^{46} atoms
(D) 1.2×10^{23} molecules
(E) 12.04×10^{23} molecules

38. Analysis of a gas gave: C = 85.7% and H = 14.3%. If the formula mass of this gas is 42 atomic mass units, what are the empirical formula and the true formula?

(A) CH; C_4H_4
(B) CH_2; C_3H_6
(C) CH_3; C_3H_9
(D) C_2H_2; C_3H_6
(E) C_2H_4; C_3H_6

39. Which fraction would be used to correct a given volume of gas at 303 K to its new volume when it is heated to 333 K and the pressure is kept constant?

(A) $\frac{303-273}{60+273}$
(B) $\frac{60}{30}$
(C) $\frac{273}{333}$
(D) $\frac{303}{333}$
(E) $\frac{333}{303}$

40. Which of the substances listed decreases the freezing point of benzene (C_6H_6) more than the others if a lab tech tries to dissolve 5.00 grams in 500.0 g of

benzene?

(A) paradichlorobenzene, $C_6H_4Cl_2$
(B) sodium chloride, NaCl
(C) aluminum chloride, $AlCl_3$
(D) ethanol, C_2H_5OH
(E) sucrose, $C_{12}H_{22}O_{11}$

41. What is the approximate pH of a 0.005 M solution of H_2SO_4?

(A) 1
(B) 2
(C) 5
(D) 9
(E) 13

42. How many grams of NaOH are needed to make 100 grams of a 5% solution?

(A) 2
(B) 5
(C) 20
(D) 40
(E) 95

43. For the Haber process: $N_2 + 3H_2 \rightleftharpoons 2NH_3$ + heat (at equilibrium), which of the following statements concerning the reaction rate is/are true?

I. The reaction to the right will increase when pressure is increased.
II. The reaction to the right will decrease when the temperature is increased.
III. The reaction to the right will decrease when NH_3 is removed from the chamber.

(A) I only
(B) II only
(C) I and II only
(D) II and III only
(E) I, II, and III

44. If you titrate 1.0 M H_2SO_4 solution against 50. milliliters of 1.0 M NaOH solution, what volume of H_2SO_4, in milliliters, will be needed for neutralization?

(A) 10.