

The University of the State of New York
REGENTS HIGH SCHOOL EXAMINATION

CHEMISTRY

Thursday, August 16, 2001 — 12:30 to 3:30 p.m., only

The last page of the booklet is the answer sheet. Fold the last page along the perforations and, slowly and carefully, tear off the answer sheet. Then fill in the heading of your answer sheet.

All of your answers are to be recorded on the separate answer sheet. For each question, decide which of the choices given is the best answer. Then on the answer sheet, in the row of numbers for that question, circle with pencil the number of the choice that you have selected. The sample below is an example of the first step in recording your answers.

SAMPLE: (1) 2 3 4

If you wish to change an answer, erase your first penciled circle and then circle with pencil the number of the answer you want. After you have completed the examination and you have decided that all of the circled answers represent your best judgment, signal a proctor and turn in all examination material except your answer sheet. Then and only then, place an X in ink in each penciled circle. Be sure to mark only one answer with an X in ink for each question. No credit will be given for any question with two or more X's marked. The sample below indicates how your final choice should be marked with an X in ink.

SAMPLE: (X) 2 3 4

The "Reference Tables for Chemistry," which you may need to answer some questions in this examination, are supplied separately. Be certain you have a copy of these reference tables before you begin the examination.

When you have completed the examination, you must sign the statement printed at the end of the answer sheet, indicating that you had no unlawful knowledge of the questions or answers prior to the examination and that you have neither given nor received assistance in answering any of the questions during the examination. Your answer sheet cannot be accepted if you fail to sign this declaration.

DO NOT OPEN THIS EXAMINATION BOOKLET UNTIL THE SIGNAL IS GIVEN.

Part I

Answer all 56 questions in this part. [65]

Directions (1–56): For *each* statement or question, select the word or expression that, of those given, best completes the statement or answers the question. Record your answer on the separate answer sheet in accordance with the directions on the front page of this booklet.

1 Which substance is a binary compound?

- (1) barium (3) carbon dioxide
(2) beryllium (4) calcium hydroxide

2 The temperature of a sample of nitrogen gas is a measure of the molecules' average

- (1) activation energy (3) kinetic energy
(2) potential energy (4) ionization energy

3 Which phase change is endothermic?

- (1) $\text{H}_2\text{O}(\ell) \rightarrow \text{H}_2\text{O}(\text{g})$ (3) $\text{Hg}(\ell) \rightarrow \text{Hg}(\text{s})$
(2) $\text{I}_2(\text{g}) \rightarrow \text{I}_2(\text{s})$ (4) $\text{H}_2\text{S}(\text{g}) \rightarrow \text{H}_2\text{S}(\ell)$

4 Standard temperature and pressure are

- (1) 0°C and 1 mmHg
(2) 0°C and 760 mmHg
(3) 273°C and 1 mmHg
(4) 273°C and 760 mmHg

5 The pressure on a 200-milliliter sample of $\text{CO}_2(\text{g})$ at constant temperature is increased from 600 torr to 1,200 torr. What is the new volume of the gas?

- (1) 100 mL (3) 400 mL
(2) 300 mL (4) 600 mL

6 What are the characteristics of a neutron?

- (1) It has no charge and no mass.
(2) It has no charge and a mass of 1 amu.
(3) It has a charge of +1 and no mass.
(4) It has a charge of +1 and a mass of 1 amu.

7 Which principal energy level can hold a maximum of eight electrons?

- (1) 1 (3) 3
(2) 2 (4) 4

8 Which electron-dot symbol represents an atom of argon in the ground state?



9 What is the structure of a krypton-85 atom?

- (1) 49 electrons, 49 protons, and 85 neutrons
(2) 49 electrons, 49 protons, and 49 neutrons
(3) 36 electrons, 36 protons, and 85 neutrons
(4) 36 electrons, 36 protons, and 49 neutrons

10 An electron will emit energy in quanta when its energy state changes from $4p$ to

- (1) $5s$ (3) $3s$
(2) $5p$ (4) $6p$

11 The half-life of ^{131}I is 8.07 days. What fraction of a sample of ^{131}I remains after 24.21 days?

- (1) $\frac{1}{2}$ (3) $\frac{1}{8}$
(2) $\frac{1}{4}$ (4) $\frac{1}{16}$

12 When $^{226}_{88}\text{Ra}$ undergoes a natural transmutation reaction, it emits

- (1) an alpha particle (3) a proton
(2) a beta particle (4) a neutron

13 Which equation is correctly balanced?

- (1) $\text{H}_2 + \text{O}_2 \rightarrow \text{H}_2\text{O}$
(2) $\text{Ca} + \text{Cl}_2 \rightarrow \text{CaCl}$
(3) $2\text{H}_2 + \text{O}_2 \rightarrow 2\text{H}_2\text{O}$
(4) $\text{Ca} + \text{Cl}_2 \rightarrow \text{Ca}_2\text{Cl}$

14 If the electronegativity difference between the elements in compound NaX is 2.0, what is element X?

- (1) bromine (3) fluorine
(2) chlorine (4) oxygen

15 The name of the compound KClO_2 is potassium

- (1) hypochlorite (3) chlorate
(2) chlorite (4) perchlorate

16 The primary forces of attraction between water molecules in $\text{H}_2\text{O}(\ell)$ are

- (1) ionic bonds
(2) hydrogen bonds
(3) molecule-ion attractions
(4) van der Waals forces

17 Which structural formula represents a dipole?

- (1) $\begin{array}{c} \text{S} \\ / \quad \backslash \\ \text{H} \quad \text{H} \end{array}$ (3) $\begin{array}{c} \text{H} \\ | \\ \text{H}-\text{C}-\text{H} \\ | \\ \text{H} \end{array}$
(2) $\text{O}=\text{C}=\text{O}$ (4) $\text{N}\equiv\text{N}$

18 Which type of solid is silicon carbide (SiC)?

- (1) ionic (3) network
(2) molecular (4) metallic

19 Which type of bond exists between an atom of carbon and an atom of fluorine?

- (1) ionic (3) polar covalent
(2) metallic (4) nonpolar covalent

20 Which of these elements has an atom with the most stable outer electron configuration?

- (1) Ne (3) Ca
(2) Cl (4) Na

21 Which Group 16 element has only unstable isotopes?

- (1) Po (3) Se
(2) Te (4) S

22 Which group contains a metalloid?

- (1) 1 (3) 15
(2) 11 (4) 18

23 Which element has properties most like those of magnesium?

- (1) calcium (3) potassium
(2) cesium (4) sodium

24 Which compound forms a green aqueous solution?

- (1) RbCl (3) NiCl_2
(2) CaCl_2 (4) ZnCl_2

25 As the elements of Group 16 are considered in order from top to bottom, the covalent radius of each successive element increases. This increase is primarily due to an increase in

- (1) atomic number
(2) mass number
(3) the number of protons occupying the nucleus
(4) the number of occupied principal energy levels

26 What is the total number of moles of solute in 250 milliliters of a 1.0 M solution of NaCl ?

- (1) 1.0 mole (3) 0.50 mole
(2) 0.25 mole (4) 42 moles

27 The percent by mass of carbon in $\text{HC}_2\text{H}_3\text{O}_2$ is equal to

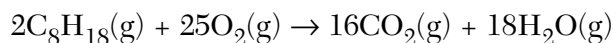
- (1) $\frac{12}{60} \times 100$ (3) $\frac{60}{24} \times 100$
(2) $\frac{24}{60} \times 100$ (4) $\frac{60}{12} \times 100$

28 Given the reaction: $4\text{NH}_3 + 5\text{O}_2 \rightarrow 4\text{NO} + 6\text{H}_2\text{O}$

What is the total number of moles of NO produced when 1.0 mole of O_2 is completely consumed?

- (1) 1.0 mole (3) 0.80 mole
(2) 1.2 moles (4) 4.0 moles

29 Given the reaction:



What volume of $\text{C}_8\text{H}_{18}(\text{g})$ will completely react to produce exactly 36 liters of $\text{H}_2\text{O}(\text{g})$?

- (1) 27 L (3) 36 L
(2) 2.0 L (4) 4.0 L

30 What is the total volume occupied by 132 grams of $\text{CO}_2(\text{g})$ at STP?

- (1) 22.4 L (3) 44.8 L
(2) 33.6 L (4) 67.2 L

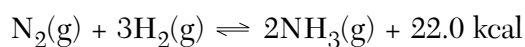
31 According to Reference Table D, which solution at equilibrium contains 50 grams of solute per 100 grams of H_2O at 75°C ?

- (1) an unsaturated solution of KCl
(2) an unsaturated solution of KClO_3
(3) a saturated solution of KCl
(4) a saturated solution of KClO_3

32 According to Reference Table G, which statement best describes the formation of $\text{HF}(\text{g})$?

- (1) It is exothermic, and heat is released.
(2) It is exothermic, and heat is absorbed.
(3) It is endothermic, and heat is released.
(4) It is endothermic, and heat is absorbed.

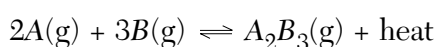
33 Given the reaction:



When equilibrium is reached in this system, the rate of the forward reaction is

- (1) less than the rate of the reverse reaction
(2) greater than the rate of the reverse reaction
(3) equal to the rate of the reverse reaction
(4) unrelated to the rate of the reverse reaction

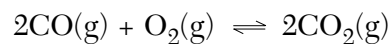
34 Given the reaction at equilibrium:



Which change will *not* affect the equilibrium concentrations of $\text{A}(\text{g})$, $\text{B}(\text{g})$, and $\text{A}_2\text{B}_3(\text{g})$?

- (1) adding more $\text{A}(\text{g})$
(2) adding a catalyst
(3) increasing the temperature
(4) increasing the pressure

35 Given the reaction at equilibrium:



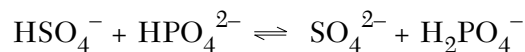
What is the correct equilibrium expression for this reaction?

- (1) $K_{eq} = \frac{[2\text{CO}][\text{O}_2]}{[2\text{CO}_2]}$ (3) $K_{eq} = \frac{[\text{CO}_2]^2}{[\text{CO}]^2[\text{O}_2]}$
(2) $K_{eq} = \frac{[\text{CO}]^2[\text{O}_2]}{[\text{CO}_2]^2}$ (4) $K_{eq} = \frac{[2\text{CO}_2]}{[2\text{CO}][\text{O}_2]}$

36 A student dissolves a substance in water, tests the resulting solution, and observes that red litmus paper turns blue. Based on this result, the solution is

- (1) organic (3) basic
(2) inorganic (4) acidic

37 Given the reaction:



Which pair represents an acid and its conjugate base?

- (1) HSO_4^- and SO_4^{2-} (3) SO_4^{2-} and H_2PO_4^-
(2) HSO_4^- and HPO_4^{2-} (4) SO_4^{2-} and HPO_4^{2-}

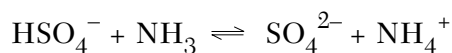
38 What is the H_3O^+ ion concentration of a solution that has an OH^- ion concentration of $1.0 \times 10^{-3} \text{ M}$?

- (1) $1.0 \times 10^{-3} \text{ M}$ (3) $1.0 \times 10^{-11} \text{ M}$
(2) $1.0 \times 10^{-7} \text{ M}$ (4) $1.0 \times 10^{-14} \text{ M}$

39 According to Reference Table L, which substance is amphoteric (amphiprotic)?

- (1) HI (3) HF
(2) NH_3 (4) HNO_3

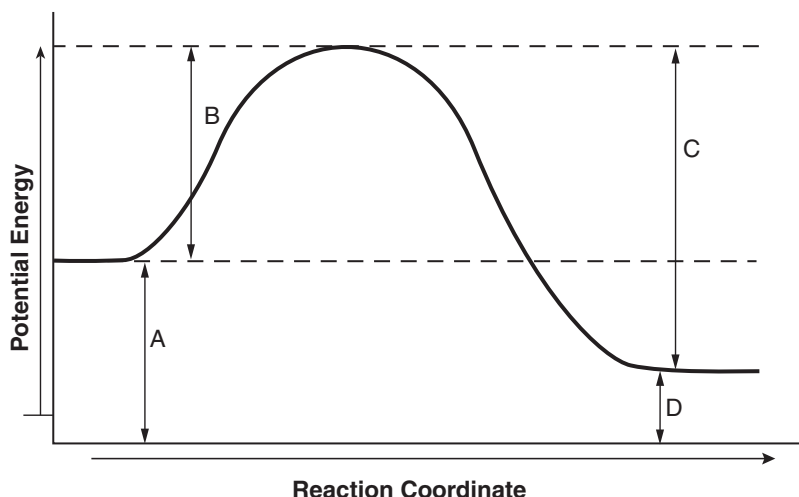
40 Given the reaction at equilibrium:



What are the two Brønsted-Lowry acids?

- (1) NH_3 and NH_4^+ (3) HSO_4^- and SO_4^{2-}
(2) NH_3 and SO_4^{2-} (4) HSO_4^- and NH_4^+

41 A potential energy diagram is shown below.



Which letters represent the activation energy of the forward and reverse reactions, respectively?

- (1) A and C
 (2) A and D
 (3) B and C
 (4) B and D

42 What is the pH of a 0.0001 M aqueous solution of HCl?

- (1) 1
 (2) 2
 (3) 3
 (4) 4

43 Which reaction occurs when equivalent quantities of H^+ (or H_3O^+) and OH^- are mixed?

- (1) oxidation
 (2) reduction
 (3) hydrolysis
 (4) neutralization

44 An electrochemical setup consists of two half-cells, an anode, a cathode, an external circuit, and a salt bridge. When a reaction occurs, ion migration takes place through the

- (1) anode
 (2) cathode
 (3) salt bridge
 (4) external circuit

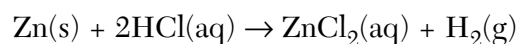
45 The oxidation number of a reducing agent can change from

- (1) -1 to -3
 (2) -2 to -1
 (3) 3 to -1
 (4) 4 to -3

46 In which compound does carbon have an oxidation state of -4?

- (1) CO
 (2) CO_2
 (3) CCl_4
 (4) CH_4

47 Given the reaction:



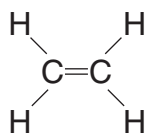
The oxidation number of Zn(s) increases because it

- (1) loses electrons
 (2) gains electrons
 (3) loses protons
 (4) gains protons

48 Which redox equation is correctly balanced?

- (1) $\text{Cr(s)} + 3\text{Fe}^{2+}\text{(aq)} \rightarrow 2\text{Cr}^{3+}\text{(aq)} + \text{Fe(s)}$
 (2) $\text{Pb(s)} + 2\text{H}^+\text{(aq)} \rightarrow \text{Pb}^{2+}\text{(aq)} + \text{H}_2\text{(g)}$
 (3) $\text{Pb(s)} + \text{Ag}^+\text{(aq)} \rightarrow \text{Pb}^{2+}\text{(aq)} + \text{Ag(s)}$
 (4) $\text{Zn(s)} + \text{Br}_2\text{(aq)} \rightarrow \text{Zn}^{2+}\text{(aq)} + \text{Br}^-\text{(aq)}$

49 What is the correct name for the substance represented by the structural formula below?



- (1) acetylene (3) ethene
(2) benzene (4) propene

50 What is the general formula for the members of the alkane series?

- (1) C_nH_{2n} (3) $\text{C}_n\text{H}_{2n-2}$
(2) $\text{C}_n\text{H}_{2n+2}$ (4) $\text{C}_n\text{H}_{2n-6}$

51 What is the maximum number of covalent bonds that can be formed by one carbon atom?

- (1) 1 (3) 3
(2) 2 (4) 4

52 Which organic compounds are often used to create fragrances for the perfume industry?

- (1) ethers (3) alkanes
(2) esters (4) alkynes

53 Which formula represents a saturated hydrocarbon?

- (1) C_2H_2 (3) C_3H_4
(2) C_2H_4 (4) C_3H_8

Note that questions 54 through 56 have only three choices.

54 As the temperature of a given sample of a gas decreases at constant pressure, the volume of the gas

- (1) decreases
(2) increases
(3) remains the same

55 As an atom of nitrogen gains electrons, its oxidation number

- (1) decreases
(2) increases
(3) remains the same

56 As the atomic number of elements within Group 2 increases, the metallic character of each successive element

- (1) decreases
(2) increases
(3) remains the same

Part II

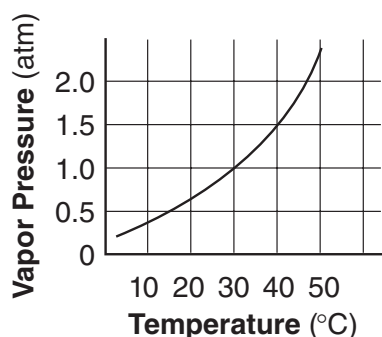
This part consists of twelve groups, each containing five questions. Each group tests a major area of the course. Choose seven of these twelve groups. Be sure that you answer all five questions in each group chosen. Record the answers to these questions on the separate answer sheet in accordance with the directions on the front page of this booklet. [35]

Group 1 — Matter and Energy

If you choose this group, be sure to answer questions 57–61.

- 57 A mixture of gases has a total pressure of 2000 torr. The mixture contains 8 moles of nitrogen gas and 2 moles of oxygen gas. What pressure is exerted by the oxygen gas molecules?
- (1) 200 torr (3) 2000 torr
(2) 400 torr (4) 4000 torr

- 58 The graph below shows the relationship between vapor pressure and temperature for substance X.



What is the normal boiling point for substance X?

- (1) 50°C (3) 30°C
(2) 20°C (4) 40°C
- 59 At 25°C, in which phase of matter do most of the known elements exist?
- (1) solid (3) gas
(2) liquid (4) supercooled liquid
- 60 Which quantity is equivalent to 50 kilocalories?
- (1) 5000 cal (3) 5×10^3 cal
(2) 0.05 cal (4) 5×10^4 cal
- 61 What is conserved during a chemical reaction?
- (1) energy, only
(2) matter, only
(3) both matter and energy
(4) neither matter nor energy

Group 2 — Atomic Structure

If you choose this group, be sure to answer questions 62–66.

- 62 What is the total number of occupied sublevels in the third principal energy level of a zinc atom in the ground state?
- (1) 1 (3) 3
(2) 2 (4) 4
- 63 How much energy is required to remove the most loosely bound electron from a neutral atom of carbon in the gaseous phase?
- (1) 363 kcal/mol (3) 191 kcal/mol
(2) 260 kcal/mol (4) 141 kcal/mol
- 64 Which electron configuration represents an atom of lithium in an excited state?
- (1) $1s^1 2s^1$ (3) $1s^2 2s^1$
(2) $1s^1 2s^2$ (4) $1s^2 2s^2$
- 65 Which species contains only 12 nucleons in the nucleus?
- (1) $^{12}_6\text{C}$ (3) $^{24}_{12}\text{Mg}$
(2) $^{52}_{24}\text{Cr}$ (4) $^{23}_{11}\text{Na}$
- 66 What is the total number of orbitals containing only one electron in an atom of nitrogen in the ground state?
- (1) 1 (3) 3
(2) 2 (4) 4
-

Group 3 — Bonding

If you choose this group, be sure to answer questions 67–71.

67 Which two compounds have the same empirical formula?

- (1) C_2H_2 and C_2H_4 (3) HO and H_2O
(2) CH_2 and C_3H_8 (4) NO_2 and N_2O_4

68 Which sample contains a total of 9.0×10^{23} atoms?

- (1) 0.50 mole of HCl (3) 1.5 moles of Cu
(2) 0.75 mole of H_2O (4) 1.5 moles of H_2

69 Which elements combine by forming an ionic bond?

- (1) sodium and potassium
(2) sodium and oxygen
(3) carbon and oxygen
(4) carbon and sulfur

70 Which characteristic of the compound C_5H_{12} causes it to have a higher normal boiling point than C_2H_6 ?

- (1) The distance between molecules of C_5H_{12} is greater.
(2) The force of attraction between molecules of C_5H_{12} is greater.
(3) C_5H_{12} has a larger number of ionic bonds.
(4) C_5H_{12} has a larger number of double bonds.

71 In which liquid is hydrogen bonding strongest?

- (1) $HF(\ell)$ (3) $CH_4(\ell)$
(2) $H_2(\ell)$ (4) $NH_3(\ell)$
-

Group 4 — Periodic Table

If you choose this group, be sure to answer questions 72–76.

72 Which group contains elements that are monatomic gases at STP?

- (1) 1 (3) 17
(2) 2 (4) 18

73 Which property is characteristic of nonmetals?

- (1) They have a high electronegativity.
(2) They lose electrons easily.
(3) They have a low first ionization energy.
(4) They are good conductors of electricity.

74 Which element is an alkali metal?

- (1) hydrogen (3) sodium
(2) calcium (4) zinc

75 Which element forms an ion that is larger than its atom?

- (1) aluminum (3) magnesium
(2) chlorine (4) sodium

76 As elements of Group 1 of the Periodic Table are considered in order from top to bottom, the ionization energy of each successive element decreases. This decrease is due to

- (1) decreasing radius and decreasing shielding effect
(2) decreasing radius and increasing shielding effect
(3) increasing radius and decreasing shielding effect
(4) increasing radius and increasing shielding effect
-

Group 5 — Mathematics of Chemistry

If you choose this group, be sure to answer questions 77–81.

77 A sample of an unknown gas at STP has a density of 1.25 grams per liter. What is the gram-molecular mass of this gas?

- (1) 28.0 g (3) 64.0 g
(2) 44.0 g (4) 80.0 g

78 The temperature of a sample of water changes from 10°C to 20°C when the water absorbs 100 calories of heat. What is the mass of the sample?

- (1) 1 g (3) 100 g
(2) 10 g (4) 1000 g

79 Given the reaction: $2\text{H}_2(\text{g}) + \text{O}_2(\text{g}) \rightarrow 2\text{H}_2\text{O}(\ell)$

What is the total number of liters of $\text{O}_2(\text{g})$ at STP needed to produce 6.0×10^{23} molecules of $\text{H}_2\text{O}(\ell)$?

- (1) 11.2 L (3) 33.6 L
(2) 22.4 L (4) 44.8 L

80 Which aqueous solution has the *lowest* freezing point?

- (1) 1.0 M $\text{C}_6\text{H}_{12}\text{O}_6$ (3) 1.0 M CH_3COOH
(2) 1.0 M $\text{C}_2\text{H}_5\text{OH}$ (4) 1.0 M NaCl

81 What is the empirical formula of a compound that contains 28% iron, 24% sulfur, and 48% oxygen by mass?

- (1) FeSO_3 (3) $\text{Fe}_2(\text{SO}_3)_3$
(2) FeSO_4 (4) $\text{Fe}_2(\text{SO}_4)_3$
-

Group 6 — Kinetics and Equilibrium

If you choose this group, be sure to answer questions 82–86.

82 The change in the free energy of a reaction (ΔG) is equal to

- (1) $T\Delta H - \Delta S$ (3) $\Delta H - T\Delta S$
(2) $T\Delta H + \Delta S$ (4) $\Delta H + T\Delta S$

83 Which compound forms a saturated solution at 40°C that contains 46 grams per 100 grams of water?

- (1) KNO_3 (3) NaNO_3
(2) NH_4Cl (4) KCl

84 According to Reference Table G, which of these compounds is most stable?

- (1) ethene (3) aluminum oxide
(2) ethyne (4) carbon dioxide

85 According to Reference Table M, which of these compounds is most soluble at 298 K and 1 atm?

- (1) AgCl (3) PbCrO_4
(2) AgI (4) PbCO_3

86 Which equilibrium constant indicates the highest concentration of product?

- (1) $K_{eq} = 1 \times 10^{-1}$ (3) $K_{eq} = 3 \times 10^{-3}$
(2) $K_{eq} = 2 \times 10^{-2}$ (4) $K_{eq} = 4 \times 10^{-4}$
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Group 7 — Acids and Bases

If you choose this group, be sure to answer questions 87–91.

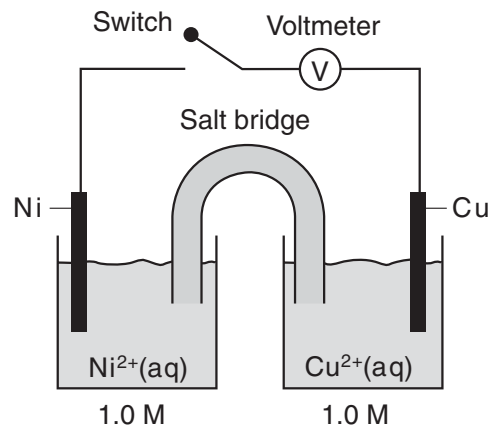
- 87 According to the Brønsted-Lowry theory, an acid is any species that
- (1) releases hydroxide ions into solution
 - (2) releases oxide ions into solution
 - (3) donates protons to another species
 - (4) accepts protons from another species
- 88 According to Reference Table L, which of these acids has the *smallest* ionization constant (K_a)?
- (1) HCl
 - (2) HBr
 - (3) HNO_2
 - (4) HNO_3
- 89 How many milliliters of 0.600 M H_2SO_4 are required to exactly neutralize 100. milliliters of 0.300 M $\text{Ba}(\text{OH})_2$?
- (1) 25.0 mL
 - (2) 50.0 mL
 - (3) 100. mL
 - (4) 200. mL
- 90 When the salt NH_4NO_3 is dissolved in water, it produces a solution that is
- (1) acidic, with a pH less than 7
 - (2) acidic, with a pH greater than 7
 - (3) basic, with a pH less than 7
 - (4) basic, with a pH greater than 7
- 91 Which compound is a nonelectrolyte?
- (1) HNO_3
 - (2) H_2SO_4
 - (3) NaOH
 - (4) CH_3OH
-

Group 8 — Redox and Electrochemistry

If you choose this group, be sure to answer questions 92–96.

- 92 According to Reference Table N, which metal will react with Zn^{2+} but will *not* react with Mg^{2+} ?
- (1) Al(s)
 - (2) Cu(s)
 - (3) Ni(s)
 - (4) Ba(s)
- 93 In an electrolytic cell, the positive electrode is the
- (1) anode, where oxidation occurs
 - (2) anode, where reduction occurs
 - (3) cathode, where oxidation occurs
 - (4) cathode, where reduction occurs

Base your answers to questions 94 and 95 on Reference Table N and on the diagram below, which shows a chemical cell at 298 K.



- 94 When the switch is closed, the potential (E^0) of the cell is
- (1) -0.60 V
 - (2) -0.26 V
 - (3) $+0.26\text{ V}$
 - (4) $+0.60\text{ V}$
- 95 When this chemical cell reaches equilibrium, the potential (E^0) of the cell will be
- (1) -0.26 V
 - (2) 0.00 V
 - (3) $+0.08\text{ V}$
 - (4) $+0.34\text{ V}$
-
- 96 According to Reference Table N, which of these ions is most easily reduced?
- (1) Ca^{2+}
 - (2) Cr^{3+}
 - (3) Cu^+
 - (4) Ag^+
-

Group 9 — Organic Chemistry

If you choose this group, be sure to answer questions 97–101.

97 If a compound contains only one —OH functional group attached to the end carbon in the chain, it is classified as a

- (1) primary alcohol (3) tertiary alcohol
(2) secondary alcohol (4) dihydroxy alcohol

98 A characteristic of most organic compounds is that they

- (1) have low melting points
(2) have high melting points
(3) are soluble in water
(4) conduct electricity when dissolved in water

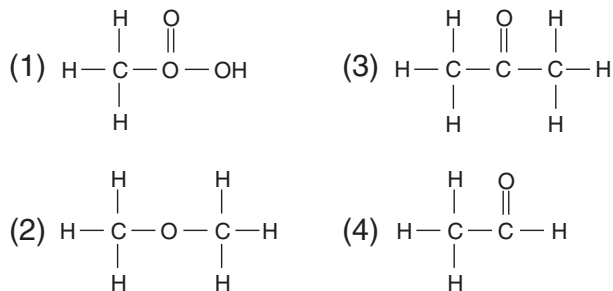
99 Which organic compound is most soluble in water?

- (1) ethyne (3) butane
(2) benzene (4) ethanol

100 The reaction $n\text{C}_2\text{H}_4 \rightarrow (-\text{C}_2\text{H}_4-)_n$ is an example of

- (1) saponification (3) polymerization
(2) esterification (4) fermentation

101 Which structural formula represents an ether?



Group 10 — Applications of Chemical Principles

If you choose this group, be sure to answer questions 102–106.

102 Which substance is the primary source of many textiles and plastics?

- (1) coal (3) mineral ore
(2) wood (4) petroleum

103 Cracking hydrocarbon molecules will result in

- (1) larger molecules with lower boiling points
(2) larger molecules with higher boiling points
(3) smaller molecules with lower boiling points
(4) smaller molecules with higher boiling points

104 Metals from which groups are obtained by the reduction of their fused salts?

- (1) Group 1 and Group 2
(2) Group 1 and Group 12
(3) Group 2 and Group 11
(4) Group 11 and Group 12

105 Given the reaction:



Which substance in this process acts as the oxidizing agent?

- (1) Fe (3) CO
(2) Fe_2O_3 (4) CO_2

106 Given the lead-acid battery reaction:



Which electronic equation represents the half-reaction for the oxidation that occurs?

- (1) $\text{Pb} \rightarrow \text{Pb}^{2+} + 2\text{e}^-$ (3) $\text{Pb}^{2+} + 2\text{e}^- \rightarrow \text{Pb}$
(2) $\text{Pb}^{4+} + 4\text{e}^- \rightarrow \text{Pb}$ (4) $\text{Pb} \rightarrow \text{Pb}^{4+} + 4\text{e}^-$
-

Group 11 — Nuclear Chemistry

If you choose this group, be sure to answer questions 107–111.

107 Which materials are commonly used for shielding in a nuclear fission reactor?

- (1) uranium and plutonium
- (2) boron and cadmium
- (3) steel and concrete
- (4) beryllium and heavy water

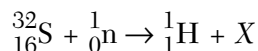
108 Which radioactive isotope is used for the diagnosis of thyroid disease?

- (1) iodine-131
- (2) potassium-42
- (3) carbon-14
- (4) cobalt-60

109 Which components of a fission reactor are used to slow neutrons during a fission reaction?

- (1) control rods
- (2) coolants
- (3) shields
- (4) moderators

110 Given the nuclear reaction:



What does X represent in this reaction?

- (1) ${}_{15}^{31}\text{P}$
- (2) ${}_{15}^{32}\text{P}$
- (3) ${}_{16}^{31}\text{S}$
- (4) ${}_{16}^{32}\text{S}$

111 Given the reaction: ${}^9_4\text{Be} + {}^1_1\text{H} \rightarrow {}^6_3\text{Li} + {}^4_2\text{He}$

Which type of reaction is represented?

- (1) natural transmutation
 - (2) artificial transmutation
 - (3) fission
 - (4) fusion
-

Group 12 — Laboratory Activities

If you choose this group, be sure to answer questions 112–116.

112 A student noted that the temperature of water increased as a result of dissolving a salt in it. From this observation, the student should conclude that dissolving the salt

- (1) produced an acid solution
- (2) produced a basic solution
- (3) was endothermic
- (4) was exothermic

113 The measurement 0.41006 gram, rounded to three significant figures, is expressed as

- (1) 0.41 g
- (2) 0.410 g
- (3) 0.4100 g
- (4) 0.4101 g

114 Flame tests are used to identify

- (1) metallic ions
- (2) nonmetallic ions
- (3) polar molecules
- (4) nonpolar molecules

115 When 10 grams of a compound was dissolved in 100 grams of water, the temperature of the water rose from 25°C to 30°C. For each gram of compound dissolved, how many calories of heat were absorbed by the water?

- (1) 5 cal
- (2) 10 cal
- (3) 50 cal
- (4) 100 cal

116 What is the safest method for diluting concentrated sulfuric acid with water?

- (1) add the acid to the water quickly
 - (2) add the water to the acid quickly
 - (3) add the acid to the water slowly while stirring
 - (4) add the water to the acid slowly while stirring
-

Part II (35 credits)

Answer the questions in only seven of the twelve groups in this part. Be sure to mark the answers to the groups of questions you choose in accordance with the instructions on the front cover of the test booklet. Leave blank the five groups of questions you do not choose to answer.

Tear Here

Group 1 Matter and Energy					
57	1	2	3	4	
58	1	2	3	4	
59	1	2	3	4	
60	1	2	3	4	
61	1	2	3	4	

Group 2 Atomic Structure					
62	1	2	3	4	
63	1	2	3	4	
64	1	2	3	4	
65	1	2	3	4	
66	1	2	3	4	

Group 3 Bonding					
67	1	2	3	4	
68	1	2	3	4	
69	1	2	3	4	
70	1	2	3	4	
71	1	2	3	4	

Group 4 Periodic Table					
72	1	2	3	4	
73	1	2	3	4	
74	1	2	3	4	
75	1	2	3	4	
76	1	2	3	4	

Group 5 Mathematics of Chemistry					
77	1	2	3	4	
78	1	2	3	4	
79	1	2	3	4	
80	1	2	3	4	
81	1	2	3	4	

Group 6 Kinetics and Equilibrium					
82	1	2	3	4	
83	1	2	3	4	
84	1	2	3	4	
85	1	2	3	4	
86	1	2	3	4	

Group 7 Acids and Bases					
87	1	2	3	4	
88	1	2	3	4	
89	1	2	3	4	
90	1	2	3	4	
91	1	2	3	4	

Group 8 Redox and Electrochemistry					
92	1	2	3	4	
93	1	2	3	4	
94	1	2	3	4	
95	1	2	3	4	
96	1	2	3	4	

Group 9 Organic Chemistry					
97	1	2	3	4	
98	1	2	3	4	
99	1	2	3	4	
100	1	2	3	4	
101	1	2	3	4	

Group 10 Applications of Chemical Principles					
102	1	2	3	4	
103	1	2	3	4	
104	1	2	3	4	
105	1	2	3	4	
106	1	2	3	4	

Group 11 Nuclear Chemistry					
107	1	2	3	4	
108	1	2	3	4	
109	1	2	3	4	
110	1	2	3	4	
111	1	2	3	4	

Group 12 Laboratory Activities					
112	1	2	3	4	
113	1	2	3	4	
114	1	2	3	4	
115	1	2	3	4	
116	1	2	3	4	

I do hereby affirm, at the close of this examination, that I had no unlawful knowledge of the questions or answers prior to the examination and that I have neither given nor received assistance in answering any of the questions during the examination.

Signature

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The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

CHEMISTRY

Thursday, August 16, 2001 — 12:30 to 3:30 p.m., only

ANSWER SHEET

Student Sex: Male
 Female
 Teacher
 School

Record all of your answers on this answer sheet in accordance with the instructions on the front cover of the test booklet.

Part I (65 credits)

1	1	2	3	4	21	1	2	3	4	41	1	2	3	4
2	1	2	3	4	22	1	2	3	4	42	1	2	3	4
3	1	2	3	4	23	1	2	3	4	43	1	2	3	4
4	1	2	3	4	24	1	2	3	4	44	1	2	3	4
5	1	2	3	4	25	1	2	3	4	45	1	2	3	4
6	1	2	3	4	26	1	2	3	4	46	1	2	3	4
7	1	2	3	4	27	1	2	3	4	47	1	2	3	4
8	1	2	3	4	28	1	2	3	4	48	1	2	3	4
9	1	2	3	4	29	1	2	3	4	49	1	2	3	4
10	1	2	3	4	30	1	2	3	4	50	1	2	3	4
11	1	2	3	4	31	1	2	3	4	51	1	2	3	4
12	1	2	3	4	32	1	2	3	4	52	1	2	3	4
13	1	2	3	4	33	1	2	3	4	53	1	2	3	4
14	1	2	3	4	34	1	2	3	4	54	1	2	3	
15	1	2	3	4	35	1	2	3	4	55	1	2	3	
16	1	2	3	4	36	1	2	3	4	56	1	2	3	
17	1	2	3	4	37	1	2	3	4					
18	1	2	3	4	38	1	2	3	4					
19	1	2	3	4	39	1	2	3	4					
20	1	2	3	4	40	1	2	3	4					

Your answers for Part II should be placed in the proper spaces on the back of this sheet.

FOR TEACHER USE ONLY

Credits

Part I
 (Use table below)

Part II

Total

Rater's Initials:

Part I Credits

Directions to Teacher:

In the table below, draw a circle around the number of right answers and the adjacent number of credits. Then write the number of credits (not the number right) in the space provided above.

No. Right	Credits	No. Right	Credits
56	65	28	41
55	64	27	40
54	63	26	39
53	62	25	39
52	62	24	38
51	61	23	37
50	60	22	36
49	59	21	35
48	58	20	34
47	57	19	33
46	56	18	33
45	56	17	32
44	55	16	31
43	54	15	30
42	53	14	29
41	52	13	27
40	51	12	25
39	51	11	23
38	50	10	21
37	49	9	19
36	48	8	17
35	47	7	14
34	46	6	12
33	45	5	10
32	45	4	8
31	44	3	6
30	43	2	4
29	42	1	2
		0	0

No. right

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FOR TEACHERS ONLY

C

The University of the State of New York
REGENTS HIGH SCHOOL EXAMINATION

CHEMISTRY

Thursday, August 16, 2001—12:30 to 3:30 p.m., only

SCORING KEY

Part I

Refer to the table on the answer sheet for the number of credits to be given on Part I.

Part I (65 credits)

1	1	2	X	4	21	X	2	3	4	41	1	2	X	4
2	1	2	X	4	22	1	2	X	4	42	1	2	3	X
3	X	2	3	4	23	X	2	3	4	43	1	2	3	X
4	1	X	3	4	24	1	2	X	4	44	1	2	X	4
5	X	2	3	4	25	1	2	3	X	45	1	X	3	4
6	1	X	3	4	26	1	X	3	4	46	1	2	3	X
7	1	X	3	4	27	1	X	3	4	47	X	2	3	4
8	1	2	3	X	28	1	2	X	4	48	1	X	3	4
9	1	2	3	X	29	1	2	3	X	49	1	2	X	4
10	1	2	X	4	30	1	2	3	X	50	1	X	3	4
11	1	2	X	4	31	1	2	X	4	51	1	2	3	X
12	X	2	3	4	32	X	2	3	4	52	1	X	3	4
13	1	2	X	4	33	1	2	X	4	53	1	2	3	X
14	X	2	3	4	34	1	X	3	4	54	X	2	3	
15	1	X	3	4	35	1	2	X	4	55	X	2	3	
16	1	X	3	4	36	1	2	X	4	56	1	X	3	
17	X	2	3	4	37	X	2	3	4					
18	1	2	X	4	38	1	2	X	4					
19	1	2	X	4	39	1	X	3	4					
20	X	2	3	4	40	1	2	3	X					

Directions to the teacher:

Use only *red* ink or *red* pencil in rating Regents examination papers. Do *not* correct the student's work by making insertions or changes of any kind.

Scan each answer sheet to make certain that the student has marked only one answer for each question. If a student has marked two or more answers with an X in ink, draw a red line through the row of numbers for that question to indicate that no credit is to be allowed for that question when the answer sheet is scored.

To facilitate scoring, the scoring key has been printed in the same format as the answer sheet. The scoring key may be made into a scoring stencil by punching out the correct answers. Be sure that the stencil is aligned with the answer sheet so that the holes correspond to the correct answers. To aid in proper alignment, punch out the first and last item numbers in each part and place the stencil on the answer sheet so that these item numbers appear through the appropriate holes.

CHEMISTRY — *concluded*

Part II

Allow a total of 35 credits, one credit for each question, for only seven of the twelve groups in this part. If more than seven groups are answered, only the first seven answered should be considered.

Group 1 Matter and Energy					
57	1	<input checked="" type="checkbox"/>	3	4	
58	1	2	<input checked="" type="checkbox"/>	4	
59	<input checked="" type="checkbox"/>	2	3	4	
60	1	2	3	<input checked="" type="checkbox"/>	
61	1	2	<input checked="" type="checkbox"/>	4	

Group 2 Atomic Structure					
62	1	2	<input checked="" type="checkbox"/>	4	
63	1	<input checked="" type="checkbox"/>	3	4	
64	1	<input checked="" type="checkbox"/>	3	4	
65	<input checked="" type="checkbox"/>	2	3	4	
66	1	2	<input checked="" type="checkbox"/>	4	

Group 3 Bonding					
67	1	2	3	<input checked="" type="checkbox"/>	
68	1	2	<input checked="" type="checkbox"/>	4	
69	1	<input checked="" type="checkbox"/>	3	4	
70	1	<input checked="" type="checkbox"/>	3	4	
71	<input checked="" type="checkbox"/>	2	3	4	

Group 4 Periodic Table					
72	1	2	3	<input checked="" type="checkbox"/>	
73	<input checked="" type="checkbox"/>	2	3	4	
74	1	2	<input checked="" type="checkbox"/>	4	
75	1	<input checked="" type="checkbox"/>	3	4	
76	1	2	3	<input checked="" type="checkbox"/>	

Group 5 Mathematics of Chemistry					
77	<input checked="" type="checkbox"/>	2	3	4	
78	1	<input checked="" type="checkbox"/>	3	4	
79	<input checked="" type="checkbox"/>	2	3	4	
80	1	2	3	<input checked="" type="checkbox"/>	
81	1	2	3	<input checked="" type="checkbox"/>	

Group 6 Kinetics and Equilibrium					
82	1	2	<input checked="" type="checkbox"/>	4	
83	1	<input checked="" type="checkbox"/>	3	4	
84	1	2	<input checked="" type="checkbox"/>	4	
85	<input checked="" type="checkbox"/>	2	3	4	
86	<input checked="" type="checkbox"/>	2	3	4	

Group 7 Acids and Bases					
87	1	2	<input checked="" type="checkbox"/>	4	
88	1	2	<input checked="" type="checkbox"/>	4	
89	1	<input checked="" type="checkbox"/>	3	4	
90	<input checked="" type="checkbox"/>	2	3	4	
91	1	2	3	<input checked="" type="checkbox"/>	

Group 8 Redox and Electrochemistry					
92	<input checked="" type="checkbox"/>	2	3	4	
93	<input checked="" type="checkbox"/>	2	3	4	
94	1	2	3	<input checked="" type="checkbox"/>	
95	1	<input checked="" type="checkbox"/>	3	4	
96	1	2	3	<input checked="" type="checkbox"/>	

Group 9 Organic Chemistry					
97	<input checked="" type="checkbox"/>	2	3	4	
98	<input checked="" type="checkbox"/>	2	3	4	
99	1	2	3	<input checked="" type="checkbox"/>	
100	1	2	<input checked="" type="checkbox"/>	4	
101	1	<input checked="" type="checkbox"/>	3	4	

Group 10 Applications of Chemical Principles					
102	1	2	3	<input checked="" type="checkbox"/>	
103	1	2	<input checked="" type="checkbox"/>	4	
104	<input checked="" type="checkbox"/>	2	3	4	
105	1	<input checked="" type="checkbox"/>	3	4	
106	<input checked="" type="checkbox"/>	2	3	4	

Group 11 Nuclear Chemistry					
107	1	2	<input checked="" type="checkbox"/>	4	
108	<input checked="" type="checkbox"/>	2	3	4	
109	1	2	3	<input checked="" type="checkbox"/>	
110	1	<input checked="" type="checkbox"/>	3	4	
111	1	<input checked="" type="checkbox"/>	3	4	

Group 12 Laboratory Activities					
112	1	2	3	<input checked="" type="checkbox"/>	
113	1	<input checked="" type="checkbox"/>	3	4	
114	<input checked="" type="checkbox"/>	2	3	4	
115	1	2	<input checked="" type="checkbox"/>	4	
116	1	2	<input checked="" type="checkbox"/>	4	