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: ⊗ 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
(2) beryllium
(3) carbon dioxide
(4) calcium hydroxide

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

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

3 Which phase change is endothermic?

(1) $H_2O(\ell) \rightarrow H_2O(g)$
(2) $I_2(g) \rightarrow I_2(s)$
(3) $Hg(\ell) \rightarrow Hg(s)$
(4) $H_2S(g) \rightarrow H_2S(\ell)$

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 $CO_2(g)$ at constant temperature is increased from 600 torr to 1,200 torr. What is the new volume of the gas?

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

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

(1) Ar:
(2) ·Ar:
(3) ·Ar:
(4) :Ar:

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 4*p* to

(1) 5*s*
(2) 5*p*
(3) 3*s*
(4) 6*p*

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

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

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

13 Which equation is correctly balanced?

(1) $H_2 + O_2 \rightarrow H_2O$
(2) $Ca + Cl_2 \rightarrow CaCl$
(3) $2H_2 + O_2 \rightarrow 2H_2O$
(4) $Ca + Cl_2 \rightarrow Ca_2Cl$

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

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

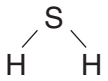
15 The name of the compound $KClO_2$ is potassium

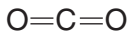
(1) hypochlorite
(2) chlorite
(3) chlorate
(4) perchlorate

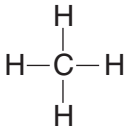
16 The primary forces of attraction between water molecules in $H_2O(\ell)$ are

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

17 Which structural formula represents a dipole?

(1) 

(2) 

(3) 

(4)

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

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

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

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

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

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

21 Which Group 16 element has only unstable isotopes?

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

22 Which group contains a metalloid?

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

23 Which element has properties most like those of magnesium?

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

24 Which compound forms a green aqueous solution?

(1) RbCl
(2) $CaCl_2$
(3) $NiCl_2$
(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
(2) 0.25 mole
(3) 0.50 mole
(4) 42 moles

27 The percent by mass of carbon in $HC_2H_3O_2$ is equal to

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

28 Given the reaction: $4NH_3 + 5O_2 \rightarrow 4NO + 6H_2O$

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

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

29 Given the reaction:

$$2C_8H_{18}(g) + 25O_2(g) \rightarrow 16CO_2(g) + 18H_2O(g)$$

What volume of $C_8H_{18}(g)$ will completely react to produce exactly 36 liters of $H_2O(g)$?

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

30 What is the total volume occupied by 132 grams of $CO_2(g)$ at STP?

(1) 22.4 L
(2) 33.6 L
(3) 44.8 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 HF(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:

$$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g) + 22.0 \text{ kcal}$$

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:

$$2A(g) + 3B(g) \rightleftharpoons A_2B_3(g) + \text{heat}$$

Which change will *not* affect the equilibrium concentrations of $A(g)$, $B(g)$, and $A_2B_3(g)$?

(1) adding more $A(g)$
(2) adding a catalyst
(3) increasing the temperature
(4) increasing the pressure

35 Given the reaction at equilibrium:

$$2CO(g) + O_2(g) \rightleftharpoons 2CO_2(g)$$

What is the correct equilibrium expression for this reaction?

(1) $K_{eq} = \dfrac{[2CO]\,[O_2]}{[2CO_2]}$
(2) $K_{eq} = \dfrac{[CO]^2\,[O_2]}{[CO_2]^2}$
(3) $K_{eq} = \dfrac{[CO_2]^2}{[CO]^2[O_2]}$
(4) $K_{eq} = \dfrac{[2CO_2]}{[2CO]\,[O_2]}$

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
(2) inorganic
(3) basic
(4) acidic

37 Given the reaction:

$$HSO_4^- + HPO_4^{2-} \rightleftharpoons SO_4^{2-} + H_2PO_4^-$$

Which pair represents an acid and its conjugate base?

(1) HSO_4^- and SO_4^{2-}
(2) HSO_4^- and HPO_4^{2-}
(3) SO_4^{2-} and $H_2PO_4^-$
(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 1.0×10^{-3} M?

(1) 1.0×10^{-3} M
(2) 1.0×10^{-7} M
(3) 1.0×10^{-11} M
(4) 1.0×10^{-14} M

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

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

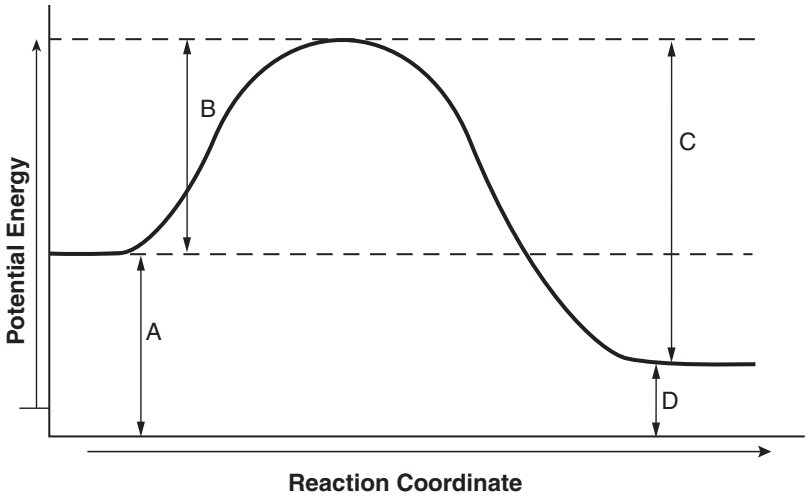
40 Given the reaction at equilibrium:

$$HSO_4^- + NH_3 \rightleftharpoons SO_4^{2-} + NH_4^+$$

What are the two Brönsted-Lowry acids?

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

$$Zn(s) + 2HCl(aq) \rightarrow ZnCl_2(aq) + H_2(g)$$

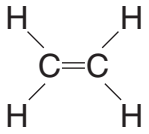
The oxidation number of Zn(s) increases because it

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

48 Which redox equation is correctly balanced?

(1) $Cr(s) + 3Fe^{2+}(aq) \rightarrow 2Cr^{3+}(aq) + Fe(s)$
(2) $Pb(s) + 2H^+(aq) \rightarrow Pb^{2+}(aq) + H_2(g)$
(3) $Pb(s) + Ag^+(aq) \rightarrow Pb^{2+}(aq) + Ag(s)$
(4) $Zn(s) + Br_2(aq) \rightarrow Zn^{2+}(aq) + Br^-(aq)$

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



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

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

(1) C_nH_{2n}
(2) C_nH_{2n+2}
(3) C_nH_{2n-2}
(4) C_nH_{2n-6}

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

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

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

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

53 Which formula represents a saturated hydrocarbon?

(1) C_2H_2
(2) C_2H_4
(3) C_3H_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]

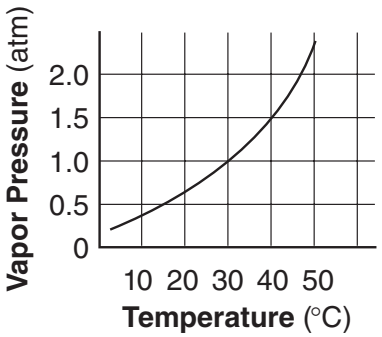
Group 1 — Matter and Energy

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
(2) 400 torr
(3) 2000 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
(2) 20°C
(3) 30°C
(4) 40°C

59 At 25°C, in which phase of matter do most of the known elements exist?

(1) solid
(2) liquid
(3) gas
(4) supercooled liquid

60 Which quantity is equivalent to 50 kilocalories?

(1) 5000 cal
(2) 0.05 cal
(3) 5×10^3 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
(2) 2
(3) 3
(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
(2) 260 kcal/mol
(3) 191 kcal/mol
(4) 141 kcal/mol

64 Which electron configuration represents an atom of lithium in an excited state?

(1) $1s^1 2s^1$
(2) $1s^1 2s^2$
(3) $1s^2 2s^1$
(4) $1s^2 2s^2$

65 Which species contains only 12 nucleons in the nucleus?

(1) ${}^{12}_{6}\mathrm{C}$
(2) ${}^{52}_{24}\mathrm{Cr}$
(3) ${}^{24}_{12}\mathrm{Mg}$
(4) ${}^{23}_{11}\mathrm{Na}$

66 What is the total number of orbitals containing only one electron in an atom of nitrogen in the ground state?

(1) 1
(2) 2
(3) 3
(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
(2) CH_2 and C_3H_8
(3) HO and H_2O
(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
(2) 0.75 mole of H_2O
(3) 1.5 moles of Cu
(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) $HF(\ell)$
(2) $H_2(\ell)$
(3) $CH_4(\ell)$
(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
(2) 2
(3) 17
(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
(2) calcium
(3) sodium
(4) zinc

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

(1) aluminum
(2) chlorine
(3) magnesium
(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
(2) 44.0 g
(3) 64.0 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
(2) 10 g
(3) 100 g
(4) 1000 g

79 Given the reaction: $2H_2(g) + O_2(g) \rightarrow 2H_2O(\ell)$

What is the total number of liters of $O_2(g)$ at STP needed to produce 6.0×10^{23} molecules of $H_2O(\ell)$?

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

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

(1) 1.0 M $C_6H_{12}O_6$
(2) 1.0 M C_2H_5OH
(3) 1.0 M CH_3COOH
(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) $FeSO_3$
(2) $FeSO_4$
(3) $Fe_2(SO_3)_3$
(4) $Fe_2(SO_4)_3$

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) $T\Delta H - \Delta S$
(2) $T\Delta H + \Delta S$
(3) $\Delta H - T\Delta S$
(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
(2) NH_4Cl
(3) $NaNO_3$
(4) KCl

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

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

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

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

86 Which equilibrium constant indicates the highest concentration of product?

(1) $K_{eq} = 1 \times 10^{-1}$
(2) $K_{eq} = 2 \times 10^{-2}$
(3) $K_{eq} = 3 \times 10^{-3}$
(4) $K_{eq} = 4 \times 10^{-4}$

Group 7 — Acids and Bases

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

87 According to the Brönsted-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 (3) HNO_2
(2) HBr (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 $Ba(OH)_2$?

(1) 25.0 mL (3) 100. mL
(2) 50.0 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 (3) NaOH
(2) H_2SO_4 (4) CH_3OH

Group 8 — Redox and Electrochemistry

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

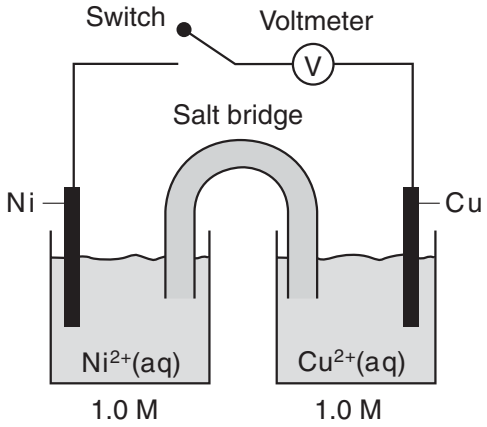
92 According to Reference Table *N*, which metal will react with Zn^{2+} but will *not* react with Mg^{2+}?

(1) Al(s) (3) Ni(s)
(2) Cu(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 (3) +0.26 V
(2) –0.26 V (4) +0.60 V

95 When this chemical cell reaches equilibrium, the potential (E^0) of the cell will be

(1) –0.26 V (3) +0.08 V
(2) 0.00 V (4) +0.34 V

96 According to Reference Table *N*, which of these ions is most easily reduced?

(1) Ca^{2+} (3) Cu^{+}
(2) Cr^{3+} (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
(2) secondary alcohol
(3) tertiary 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

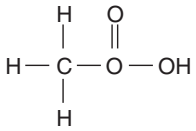
99 Which organic compound is most soluble in water?

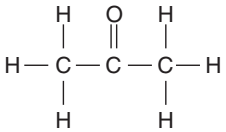
(1) ethyne
(2) benzene
(3) butane
(4) ethanol

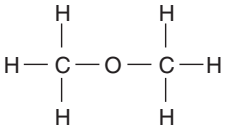
100 The reaction $nC_2H_4 \rightarrow (—C_2H_4—)_n$ is an example of

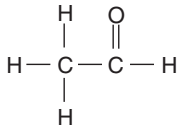
(1) saponification
(2) esterification
(3) polymerization
(4) fermentation

101 Which structural formula represents an ether?

(1)


(3)


(2)


(4)


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
(2) wood
(3) mineral ore
(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:

$$Fe_2O_3 + 3CO + \text{heat} \rightarrow 2Fe + 3CO_2$$

Which substance in this process acts as the oxidizing agent?

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

106 Given the lead-acid battery reaction:

$$Pb + PbO_2 + 2H_2SO_4 \rightarrow 2PbSO_4 + 2H_2O$$

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

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

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:

$$^{32}_{16}\mathrm{S} + {}^{1}_{0}\mathrm{n} \rightarrow {}^{1}_{1}\mathrm{H} + X$$

What does X represent in this reaction?

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

111 Given the reaction: $^{9}_{4}\mathrm{Be} + {}^{1}_{1}\mathrm{H} \rightarrow {}^{6}_{3}\mathrm{Li} + {}^{4}_{2}\mathrm{He}$

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

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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

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					

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 .....

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

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