The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

CHEMISTRY

Tuesday, January 23, 2001 — 9:15 a.m. to 12:15 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 The heat absorbed when ice melts can be measured in a unit called a

(1) torr
(2) degree
(3) mole
(4) calorie

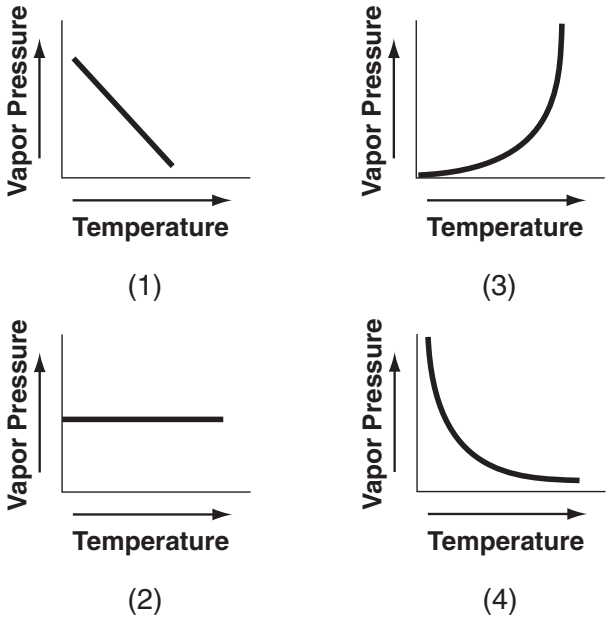
2 Which substance is a binary compound?

(1) ammonia
(2) argon
(3) glucose
(4) glycerol

3 Which sample of matter is a mixture?

(1) $H_2O(s)$
(2) $H_2O(g)$
(3) $NaCl(\ell)$
(4) NaCl(aq)

4 Which graph best represents the variation in the vapor pressure of water as temperature changes?



5 Which atom in the ground state has five electrons in its outer level and ten electrons in its kernel?

(1) C
(2) Cl
(3) Si
(4) P

6 Which type of radiation continues in a straight line when passed through an electric field?

(1) alpha
(2) beta
(3) gamma
(4) proton

7 The atomic mass unit is defined as exactly $\frac{1}{12}$ the mass of an atom of

(1) $^{12}_{6}C$
(2) $^{14}_{6}C$
(3) $^{24}_{12}Mg$
(4) $^{26}_{12}Mg$

8 When an atom loses an electron, the atom becomes an ion that is

(1) positively charged and gains a small amount of mass
(2) positively charged and loses a small amount of mass
(3) negatively charged and gains a small amount of mass
(4) negatively charged and loses a small amount of mass

9 The nucleus of which atom contains 48 neutrons?

(1) $^{32}_{16}S$
(2) $^{48}_{22}Ti$
(3) $^{85}_{37}Rb$
(4) $^{112}_{48}Cd$

10 Experiments performed to reveal the structure of atoms led scientists to conclude that an atom's

(1) positive charge is evenly distributed throughout its volume
(2) negative charge is mainly concentrated in its nucleus
(3) mass is evenly distributed throughout its volume
(4) volume is mainly unoccupied

11 Given the unbalanced equation:

$$\_\_\_Al(s) + \_\_\_O_2(g) \rightarrow \_\_\_Al_2O_3(s)$$

When this equation is correctly balanced using *smallest* whole numbers, what is the coefficient of $O_2(g)$?

(1) 6
(2) 2
(3) 3
(4) 4

12 Which pair of atoms is held together by a covalent bond?

(1) HCl
(2) LiCl
(3) NaCl
(4) KCl

13 The formula H_2O_2 is an example of

(1) a molecular formula
(2) an empirical formula
(3) an ionic formula
(4) an organic formula

14 What happens when NaCl(s) is dissolved in water?

(1) Cl^- ions are attracted to the oxygen atoms of water molecules.
(2) Na^+ ions are attracted to the oxygen atoms of water molecules.
(3) Cl^- ions are repelled by the hydrogen atoms of water molecules.
(4) Na^+ ions are repelled by the oxygen atoms of water molecules.

15 Which molecule has an asymmetrical shape?

(1) N_2
(2) NH_3
(3) Cl_2
(4) CCl_4

16 The forces between atoms that create chemical bonds are the result of interactions between

(1) nuclei
(2) electrons
(3) protons and electrons
(4) protons and nuclei

17 Which Group 16 element undergoes natural radioactive disintegration?

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

18 Pure silicon is chemically classified as a metalloid because silicon

(1) is malleable and ductile
(2) is an excellent conductor of heat and electricity
(3) exhibits hydrogen bonding
(4) exhibits metallic and nonmetallic properties

19 In which group of elements do most atoms have completely filled *s* and *p* valence sublevels?

(1) halogens
(2) noble gases
(3) alkali metals
(4) alkaline earth metals

20 Which ion has the largest radius?

(1) Na^+
(2) Mg^{2+}
(3) K^+
(4) Ca^{2+}

21 An aqueous solution of XCl_2 contains colored ions. Element *X* could be

(1) Ba
(2) Ca
(3) Ni
(4) Bi

22 Which properties are most common in nonmetals?

(1) low ionization energy and low electronegativity
(2) low ionization energy and high electronegativity
(3) high ionization energy and low electronegativity
(4) high ionization energy and high electronegativity

23 One mole of O_2 has approximately the same mass as one mole of

(1) CH_4
(2) S
(3) LiH
(4) Cl_2

24 Based on Reference Table *E*, which compound could form a concentrated solution?

(1) AgBr
(2) AgCl
(3) Ag_2CO_3
(4) $AgNO_3$

25 A 2.00-liter sample of a gas has a mass of 1.80 grams at STP. What is the density, in grams per liter, of this gas at STP?

(1) 0.900
(2) 1.80
(3) 11.2
(4) 22.4

26 What is the total number of neon atoms contained in 20.2 grams of neon gas?

(1) 1.01×10^{24}
(2) 2.02×10^{24}
(3) 3.01×10^{23}
(4) 6.02×10^{23}

27 What is the total number of moles of oxygen atoms in 1 mole of N_2O_3?

(1) 1
(2) 2
(3) 3
(4) 5

28 Which 1.0-mole sample at 1 atm has particles with the greatest entropy?

(1) $CH_4(g)$ at 25°C
(2) $H_2S(g)$ at 40°C
(3) $CH_4(g)$ at 300 K
(4) $H_2S(g)$ at 310 K

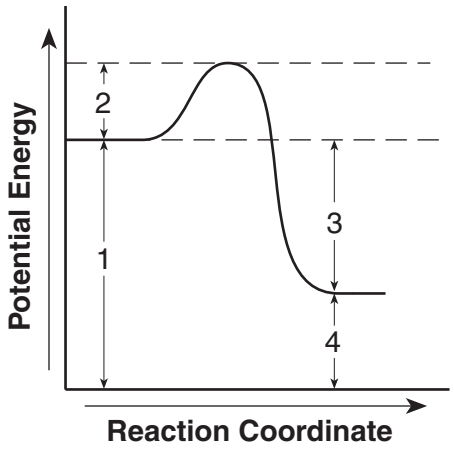
29 A 1.0-gram sample of powdered Zn reacts faster with HCl than a single 1.0-gram piece of Zn because the surface atoms in powdered Zn have

(1) higher average kinetic energy
(2) lower average kinetic energy
(3) more contact with the H^+ ions in the acid
(4) less contact with the H^+ ions in the acid

30 In a reversible reaction, chemical equilibrium is attained when the

(1) rate of the forward reaction is greater than the rate of the reverse reaction
(2) rate of the reverse reaction is greater than the rate of the forward reaction
(3) concentration of the reactants reaches zero
(4) concentration of the products remains constant

Base your answers to questions 31 and 32 on the potential energy diagram below, which represents the reaction $A + B \rightarrow C$ + energy.



31 Which statement correctly describes this reaction?

(1) It is endothermic and energy is absorbed.
(2) It is endothermic and energy is released.
(3) It is exothermic and energy is absorbed.
(4) It is exothermic and energy is released.

32 Which numbered interval will change with the addition of a catalyst to the system?

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

33 Carbon dioxide gas is most soluble in water under conditions of

(1) high pressure and low temperature
(2) high pressure and high temperature
(3) low pressure and low temperature
(4) low pressure and high temperature

34 A solution contains 130 grams of KNO_3 dissolved in 100 grams of water. When 3 more grams of KNO_3 is added, none of it dissolves, nor do any additional crystals appear. Based on Reference Table *D*, the temperature of the solution is closest to

(1) 65°C
(2) 68°C
(3) 70°C
(4) 72°C

35 If equal volumes of 0.1 M NaOH and 0.1 M HCl are mixed, the resulting solution will contain a salt and

(1) HCl (3) H_2O
(2) NaOH (4) NaCl

36 According to Reference Table *L*, which of the following 1.0 M acid solutions has the greatest $[H_3O^+]$ at 1 atmosphere and 298 K?

(1) HNO_3 (3) H_3PO_4
(2) HF (4) HNO_2

37 The $[H_3O^+]$ of a solution is 1×10^{-8}. This solution has a pH of

(1) 6, which is acidic (3) 6, which is basic
(2) 8, which is basic (4) 8, which is acidic

38 Which of the following is the strongest Brönsted-Lowry base?

(1) I^- (3) Cl^-
(2) Br^- (4) F^-

39 In the reaction $NH_3 + HCl \rightarrow NH_4^+ + Cl^-$, the NH_3 acts as

(1) a Brönsted acid, only
(2) a Brönsted base, only
(3) both a Brönsted acid and a Brönsted base
(4) neither a Brönsted acid nor a Brönsted base

40 Which species is amphoteric (amphiprotic)?

(1) H_2 (3) HSO_4^-
(2) H_2SO_4 (4) SO_4^{2-}

41 When a redox reaction occurs, there must be a transfer of

(1) electrons (3) protons
(2) neutrons (4) ions

42 What is the oxidation number of carbon in $NaHCO_3$?

(1) –2 (3) –4
(2) +2 (4) +4

43 A redox reaction is set up so that both half-reactions take place in separate beakers that are connected by a salt bridge and an external conductor. A path for the transfer of ions is provided by the

(1) anode
(2) cathode
(3) salt bridge
(4) external conductor

44 An oxidation half-reaction always involves the

(1) gain of electrons and a decrease in the oxidation number
(2) gain of electrons and an increase in the oxidation number
(3) loss of electrons and a decrease in the oxidation number
(4) loss of electrons and an increase in the oxidation number

45 Given the electrochemical cell reaction:

$$Zn(s) + Ni^{2+}(aq) \rightarrow Zn^{2+}(aq) + Ni(s)$$

Which species is the reducing agent?

(1) Zn (3) Zn^{2+}
(2) Ni^{2+} (4) Ni

46 Which equation represents an oxidation-reduction reaction?

(1) $HCl + KOH \rightarrow KCl + H_2O$
(2) $4HCl + MnO_2 \rightarrow MnCl_2 + 2H_2O + Cl_2$
(3) $2HCl + CaCO_3 \rightarrow CaCl_2 + H_2O + CO_2$
(4) $2HCl + FeS \rightarrow FeCl_2 + H_2S$

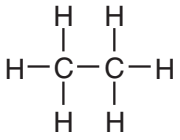
47 An example of a synthetic polymer is

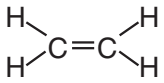
(1) starch (3) protein
(2) cellulose (4) nylon

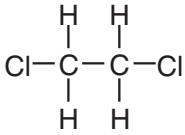
48 What are the two main products of a fermentation reaction?

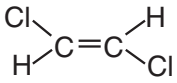
(1) ethanol and carbon dioxide
(2) ethanol and water
(3) sugar and carbon dioxide
(4) sugar and water

49 Which structural formula represents a saturated hydrocarbon?

(1) 

(3) 

(2) 

(4) 

50 A compound with the formula CH_3CH_2OH is classified as an

(1) alkane
(2) alkene
(3) alcohol
(4) acid

51 In general, which property do organic compounds share?

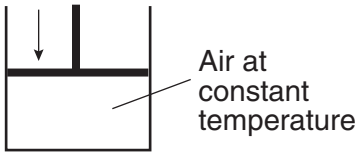
(1) high melting point
(2) high electrical conductivity
(3) readily soluble in water
(4) slow reaction rate

Note that questions 52 through 56 have only three choices.

52 As an acid solution is added to neutralize a base solution, the OH^- concentration of the base solution

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

53 A cylinder with a tightly fitted piston is shown in the diagram below.



As the piston moves downward, the number of molecules of air in the cylinder

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

54 As the noble gases are considered in order of increasing atomic number, the van der Waals forces between the atoms in a given sample of each of these gases

(1) decrease
(2) increase
(3) remains the same

55 Within Period 2 of the Periodic Table, as the atomic number increases, the atomic radius generally

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

56 As an electron moves from a 3*s* orbital to a 2*s* orbital, the energy of the atom

(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 What is the boiling point of water when the atmospheric pressure exerted on the water is 525.8 mmHg?

(1) 50°C (3) 100°C
(2) 90°C (4) 110°C

58 Which phase change is exothermic?

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

59 What happens when two oxygen atoms combine to form a molecule of oxygen?

(1) Chemical bonds are broken and energy is absorbed.
(2) Chemical bonds are broken and energy is released.
(3) Chemical bonds are formed and energy is absorbed.
(4) Chemical bonds are formed and energy is released.

60 The average kinetic energy of water molecules increases when

(1) $H_2O(s)$ changes to $H_2O(\ell)$ at 0°C
(2) $H_2O(\ell)$ changes to $H_2O(s)$ at 0°C
(3) $H_2O(\ell)$ at 10°C changes to $H_2O(\ell)$ at 20°C
(4) $H_2O(\ell)$ at 20°C changes to $H_2O(\ell)$ at 10°C

61 The heat energy required to change a unit mass of a solid into a liquid at constant temperature is called

(1) heat of vaporization (3) heat of solution
(2) heat of formation (4) heat of fusion

Group 2 — Atomic Structure

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

62 The mass of a proton is approximately equal to the total mass of 1,836

(1) electrons (3) helium nuclei
(2) neutrons (4) alpha particles

63 A carbon-14 atom spontaneously decayed to form a nitrogen-14 atom. This change took place because

(1) a transmutation occurred without particle emission
(2) a transmutation occurred with particle emission
(3) nitrogen-14 has an unstable nucleus
(4) carbon-14 has a stable nucleus

64 What is the total number of sublevels that contain electrons in the third principal energy level of a nickel atom in the ground state?

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

65 What is the nuclear charge of an iron atom?

(1) +26 (3) +56
(2) +30 (4) +82

66 Which electron configuration represents an element with the highest first ionization energy?

(1) $1s^2 2s^1$ (3) $1s^2 2s^2 2p^6 3s^1$
(2) $1s^2 2s^2$ (4) $1s^2 2s^2 2p^6 3s^2$

Group 3 — Bonding

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

67 Which type of bond is formed when an atom of potassium transfers an electron to a bromine atom?

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

68 What is the simplest ratio of nitrogen to oxygen atoms in the compound nitrogen (IV) oxide?

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

69 A diamond crystal differs from an ice crystal in that a diamond crystal

(1) crushes easily
(2) conducts electricity
(3) contains no discrete particles
(4) melts at a temperature below 0°C

70 When compared to H_2S, H_2O has a higher boiling point because H_2O contains stronger

(1) metallic bonds
(2) covalent bonds
(3) ionic bonds
(4) hydrogen bonds

71 Which quantity of particles is correctly represented by the formula H_2SO_4?

(1) 1.0 mole of ions
(2) 1.0 mole of molecules
(3) 6.0×10^{23} ions
(4) 6.0×10^{23} atoms

Group 4 — Periodic Table

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

72 An element with a partially filled *d* sublevel in the ground state is classified as

(1) a halogen
(2) a transition metal
(3) an alkali metal
(4) an alkaline earth metal

73 Which statement describes the elements in Period 3?

(1) Each successive element has a greater atomic radius.
(2) Each successive element has a lower electronegativity.
(3) All elements have similar chemical properties.
(4) All elements have valence electrons in the same principal energy level.

74 Which element in Period 4 is classified as an active nonmetal?

(1) Ga
(2) Ge
(3) Br
(4) Kr

75 Which of the following Group 15 elements has the most metallic properties?

(1) Bi
(2) P
(3) Sb
(4) N

76 Which characteristic describes most nonmetals in the solid phase?

(1) good conductors of electricity
(2) good conductors of heat
(3) malleable
(4) brittle

Group 5 — Mathematics of Chemistry

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

77 What is the total number of nitrogen atoms in 0.25 mole of NO_2 gas?

(1) 1.5×10^{23}
(2) 6.0×10^{23}
(3) 3.0×10^{23}
(4) 1.2×10^{24}

78 As a solute is added to a solvent, what happens to the freezing point and the boiling point of the solution?

(1) The freezing point decreases and the boiling point decreases.
(2) The freezing point decreases and the boiling point increases.
(3) The freezing point increases and the boiling point decreases.
(4) The freezing point increases and the boiling point increases.

79 What is the volume, in liters, of 576 grams of SO_2 gas at STP?

(1) 101
(2) 202
(3) 216
(4) 788

80 A 2.0-molal sugar solution has approximately the same freezing point as a 1.0-molal solution of

(1) $CaCl_2$
(2) CH_3COOH
(3) C_2H_5OH
(4) NaCl

81 A compound contains 46.7% nitrogen and 53.3% oxygen by mass. What is the empirical formula of the compound?

(1) NO
(2) N_2O
(3) N_2O_3
(4) N_2O_5

Group 6 — Kinetics and Equilibrium

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

82 Given the K_{sp} expression: $K_{sp} = [A^{3+}]^2 [B^{2-}]^3$

Which reaction is represented by the expression?

(1) $A_2B_3(s) \rightleftharpoons 3A^{3+}(aq) + 2B^{2-}(aq)$
(2) $A_2B_3(s) \rightleftharpoons 2A^{3+}(aq) + 3B^{2-}(aq)$
(3) $A_3B_2(s) \rightleftharpoons 3A^{3+}(aq) + 2B^{2-}(aq)$
(4) $A_3B_2(s) \rightleftharpoons 2A^{3+}(aq) + 3B^{2-}(aq)$

83 Given the reaction at equilibrium:

$$X + Y \rightleftharpoons 2Z + \text{heat}$$

The concentration of the product could be increased by

(1) adding a catalyst
(2) adding more heat to the system
(3) increasing the concentration of *Y*
(4) decreasing the concentration of *X*

84 Based on Reference Table *M*, which of the following compounds is *least* soluble in water?

(1) AgCl
(2) $PbCl_2$
(3) Ag_2CrO_4
(4) $PbCrO_4$

85 Given the system at equilibrium:

$$PbCO_3(s) \rightleftharpoons Pb^{2+}(aq) + CO_3^{2-}(aq)$$

How will the addition of $Na_2CO_3(aq)$ affect $[Pb^{2+}](aq)$ and the mass of $PbCO_3(s)$?

(1) $[Pb^{2+}]$ (aq) will decrease and the mass of $PbCO_3(s)$ will decrease.
(2) $[Pb^{2+}]$ (aq) will decrease and the mass of $PbCO_3(s)$ will increase.
(3) $[Pb^{2+}]$ (aq) will increase and the mass of $PbCO_3(s)$ will decrease.
(4) $[Pb^{2+}]$ (aq) will increase and the mass of $PbCO_3(s)$ will increase.

86 Which condition is necessary for a chemical reaction to occur spontaneously?

(1) ΔS must be negative.
(2) ΔS must be positive.
(3) ΔG must be negative.
(4) ΔG must be positive.

Group 7 — Acids and Bases

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

87 The pH of a solution that is formed by the neutralization of 1.0 M H_2SO_4 and 1.0 M KOH is closest to

(1) 1 (3) 10
(2) 7 (4) 4

88 Both $HNO_3(aq)$ and $CH_3COOH(aq)$ can be classified as

(1) Arrhenius acids that turn blue litmus red
(2) Arrhenius bases that turn blue litmus red
(3) Arrhenius acids that turn red litmus blue
(4) Arrhenius bases that turn red litmus blue

89 What is the molarity of a nitric acid solution, HNO_3, if 20.0 mL of the solution is needed to exactly neutralize 10.0 mL of a 1.67 M NaOH solution?

(1) 3.34 M (3) 0.835 M
(2) 1.67 M (4) 0.334 M

90 In the reaction $NH_3 + H_2O \rightleftharpoons NH_4^+ + OH^-$, a conjugate acid-base pair is

(1) NH_3 and H_2O (3) H_2O and NH_4^+
(2) NH_3 and OH^- (4) H_2O and OH^-

91 Which compound is classified as an electrolyte?

(1) $C_6H_{12}O_6$ (3) CH_3OH
(2) $C_{12}H_{22}O_{11}$ (4) $Ca(OH)_2$

Group 8 — Redox and Electrochemistry

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

92 Given the reaction:

$$\_\_\_Cl_2(g) + \_\_\_Fe^{2+}(aq) \rightarrow \_\_\_Fe^{3+}(aq) + \_\_\_Cl^-(aq)$$

When the equation is correctly balanced using *smallest* whole numbers, the coefficient of $Cl^-(aq)$ will be

(1) 1 (3) 6
(2) 2 (4) 7

93 Given the reaction:

$$Mg + Fe^{2+} \rightarrow Mg^{2+} + Fe$$

What is the net cell potential (E^0) for the overall reaction?

(1) 0.45 V (3) 2.37 V
(2) 1.92 V (4) 2.82 V

94 According to Reference Table *N*, what is the strongest oxidizing agent?

(1) $F_2(g)$ (3) Li^+
(2) F^- (4) Li(s)

95 A metal object is to be electroplated with silver. Which set of electrodes should be used?

(1) a silver anode and a metal object as the cathode
(2) a platinum anode and a metal object as the cathode
(3) a silver cathode and a metal object as the anode
(4) a platinum cathode and a metal object as the anode

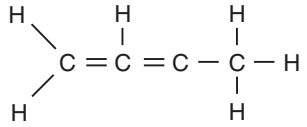
96 In an electrolytic cell, the anode is always the

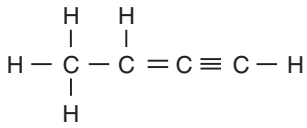
(1) negative electrode, where reduction occurs
(2) negative electrode, where oxidation occurs
(3) positive electrode, where reduction occurs
(4) positive electrode, where oxidation occurs

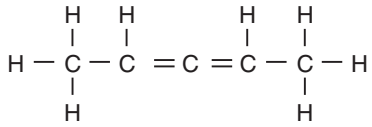
Group 9 — Organic Chemistry

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

97 Which structural formula correctly represents an organic compound?

(1) 

(2) 

(3) 

(4)

98 Which type of bond is formed between the carbon atom and the oxygen atom in CH_3OH?

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

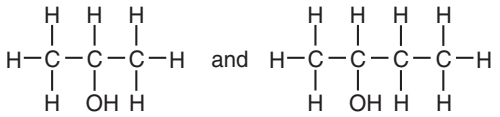
99 When hydrocarbons burn completely in an excess of oxygen, the products are

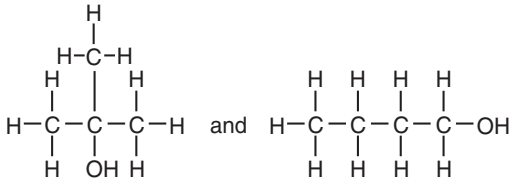
(1) carbon monoxide and water
(2) carbon dioxide and water
(3) carbon monoxide and carbon dioxide
(4) carbon dioxide and carbon

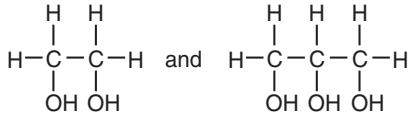
100 Molecules of propene combine in a chemical reaction to produce a single molecule. This reaction is called

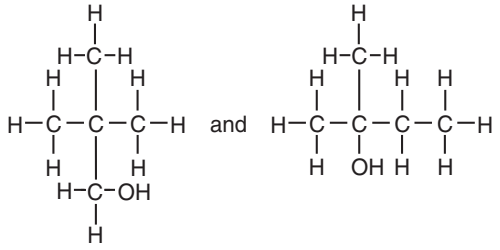
(1) substitution
(2) saponification
(3) polymerization
(4) esterification

101 Which organic compounds are secondary alcohols?

(1) 

(2) 

(3) 

(4) 

Group 10 — Applications of Chemical Principles

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

102 Petroleum is primarily a mixture of

(1) alcohols
(2) ethers
(3) hydrocarbons
(4) ketones

103 Given the reaction for the Haber process:

$$N_2 + 3H_2 \rightleftharpoons 2NH_3 + \text{heat}$$

The temperature of the reaction is raised in order to

(1) increase the percent yield of nitrogen
(2) increase the rate of formation of ammonia
(3) affect the forward reaction rate most
(4) affect the reverse reaction rate least

104 Given the lead-acid battery reaction:

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

When the battery is being charged, what are the reactants?

(1) Pb and H_2SO_4
(2) Pb and PbO_2
(3) $PbSO_4$ and H_2SO_4
(4) $PbSO_4$ and H_2O

105 The components of petroleum are separated by a process called

(1) cracking
(2) saponification
(3) fractional distillation
(4) condensation polymerization

106 What is the final product in the contact process?

(1) SO_2
(2) H_2SO_4
(3) N_2
(4) N_2O_5

Group 11 — Nuclear Chemistry

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

107 In the reaction ${}^{9}_{4}\text{Be} + X \rightarrow {}^{6}_{3}\text{Li} + {}^{4}_{2}\text{He}$, the X represents

(1) ${}^{0}_{+1}\text{e}$
(2) ${}^{1}_{1}\text{H}$
(3) ${}^{0}_{-1}\text{e}$
(4) ${}^{1}_{0}\text{n}$

108 Artificial transmutation is brought about by using accelerated particles to bombard an atom's

(1) nucleus
(2) valence shells
(3) occupied sublevels
(4) inner principal energy levels

109 Which isotope can be used as a tracer in an organic reaction?

(1) H-1
(2) H-2
(3) C-12
(4) C-14

110 Water and molten sodium are used in nuclear reactors as

(1) coolants
(2) moderators
(3) control rods
(4) fuels

111 In a particle accelerator, the accelerated particle primarily gains

(1) heat energy
(2) kinetic energy
(3) nuclear energy
(4) potential energy

Group 12 — Laboratory Activities

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

112 A student found the boiling point of a liquid to be 80.4°C. If the liquid's actual boiling point is 80.6°C, the experimental percent error is equal to

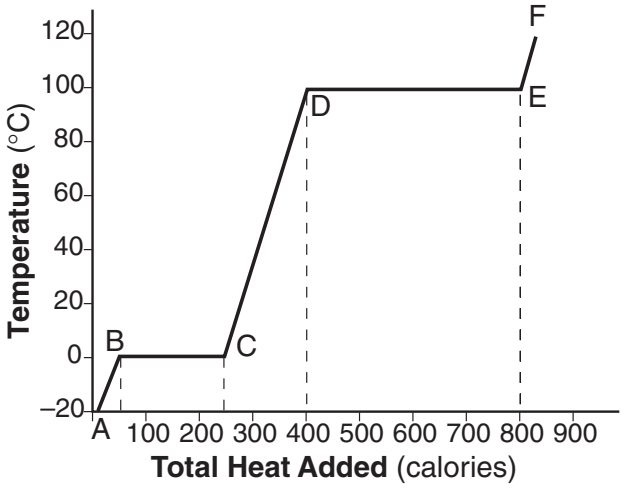
(1) $\frac{80.6 - 80.4}{80.6} \times 100$

(2) $\frac{80.6 - 80.4}{80.4} \times 100$

(3) $\frac{80.5 - 80.4}{80.5} \times 100$

(4) $\frac{80.5 - 80.4}{80.4} \times 100$

113 The graph below shows the heating curve of 1.0 gram of a solid as it is heated at a constant rate, starting at a temperature below its melting point.



Based on this graph, what is the heat of vaporization?

(1) 200 calories, as measured along line *BC*
(2) 250 calories, as measured along line *BC*
(3) 400 calories, as measured along line *DE*
(4) 800 calories, as measured along line *DE*

114 Which measurement contains a total of three significant figures?

(1) 0.12
(2) 012
(3) 120
(4) 120.

115 A student determined the solubility of an unknown solid in various solvents as shown in the table below.

Solvent	Solubility
benzene	insoluble
water	soluble
ethanol	slightly soluble
toluene	insoluble

Based on these solubility results, the unknown solid is best described as

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

116 In a laboratory experiment, a student reacted 2.8 grams of Fe(s) (steel wool) in excess $CuSO_4(aq)$, according to the following balanced equation:

$$Fe(s) + CuSO_4(aq) \rightarrow FeSO_4(aq) + Cu(s)$$

When the Fe(s) was completely consumed, the precipitated Cu(s) had a mass of 3.2 grams. Did the student's result in this experiment verify the mole ratio of Fe(s) to Cu(s) as predicted by the equation?

(1) Yes, because the experimental result was 2:1.
(2) No, because the experimental result was 2:1.
(3) Yes, because the experimental result was 1:1.
(4) No, because the experimental result was 1:1.

Tear Here

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.

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

Tear Here

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

Tuesday, January 23, 2001 — 9:15 a.m. to 12:15 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	
13	1	2	3	4	**33**	1	2	3	4	**53**	1	2	3	
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.

Tear Here

Tear Here

FOR TEACHERS ONLY

C

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

CHEMISTRY

Tuesday, January 23, 2001—9:15 a.m. to 12:15 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	3	**X**	**21**	1	2	**X**	4	**41**	**X**	2	3	4
2	**X**	2	3	4	**22**	1	2	3	**X**	**42**	1	2	3	**X**
3	1	2	3	**X**	**23**	1	**X**	3	4	**43**	1	2	**X**	4
4	1	2	**X**	4	**24**	1	2	3	**X**	**44**	1	2	3	**X**
5	1	2	3	**X**	**25**	**X**	2	3	4	**45**	**X**	2	3	4
6	1	2	**X**	4	**26**	1	2	3	**X**	**46**	1	**X**	3	4
7	**X**	2	3	4	**27**	1	2	**X**	4	**47**	1	2	3	**X**
8	1	**X**	3	4	**28**	1	**X**	3	4	**48**	**X**	2	3	4
9	1	2	**X**	4	**29**	1	2	**X**	4	**49**	**X**	2	3	4
10	1	2	3	**X**	**30**	1	2	3	**X**	**50**	1	2	**X**	4
11	1	2	**X**	4	**31**	1	2	3	**X**	**51**	1	2	3	**X**
12	**X**	2	3	4	**32**	1	**X**	3	4	**52**	**X**	2	3	
13	**X**	2	3	4	**33**	**X**	2	3	4	**53**	1	2	**X**	
14	1	**X**	3	4	**34**	1	**X**	3	4	**54**	1	**X**	3	
15	1	**X**	3	4	**35**	1	2	**X**	4	**55**	**X**	2	3	
16	1	2	**X**	4	**36**	**X**	2	3	4	**56**	**X**	2	3	
17	**X**	2	3	4	**37**	1	**X**	3	4					
18	1	2	3	**X**	**38**	1	2	3	**X**					
19	1	**X**	3	4	**39**	1	**X**	3	4					
20	1	2	**X**	4	**40**	1	2	**X**	4					

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.

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	**X**	3	4
58	1	2	**X**	4
59	1	2	3	**X**
60	1	2	**X**	4
61	1	2	3	**X**

Group 2
Atomic Structure

62	**X**	2	3	4
63	1	**X**	3	4
64	1	2	**X**	4
65	**X**	2	3	4
66	1	**X**	3	4

Group 3
Bonding

67	1	**X**	3	4
68	**X**	2	3	4
69	1	2	**X**	4
70	1	2	3	**X**
71	1	**X**	3	4

Group 4
Periodic Table

72	1	**X**	3	4
73	1	2	3	**X**
74	1	2	**X**	4
75	**X**	2	3	4
76	1	2	3	**X**

Group 5
Mathematics of Chemistry

77	**X**	2	3	4
78	1	**X**	3	4
79	1	**X**	3	4
80	1	2	3	**X**
81	**X**	2	3	4

Group 6
Kinetics and Equilibrium

82	1	**X**	3	4
83	1	2	**X**	4
84	1	2	3	**X**
85	1	**X**	3	4
86	1	2	**X**	4

Group 7
Acids and Bases

87	1	**X**	3	4
88	**X**	2	3	4
89	1	2	**X**	4
90	1	2	3	**X**
91	1	2	3	**X**

Group 8
Redox and Electrochemistry

92	1	**X**	3	4
93	1	**X**	3	4
94	**X**	2	3	4
95	**X**	2	3	4
96	1	2	3	**X**

Group 9
Organic Chemistry

97	1	2	**X**	4
98	1	2	**X**	4
99	1	**X**	3	4
100	1	2	**X**	4
101	**X**	2	3	4

Group 10
Applications of Chemical Principles

102	1	2	**X**	4
103	1	**X**	3	4
104	1	2	3	**X**
105	1	2	**X**	4
106	1	**X**	3	4

Group 11
Nuclear Chemistry

107	1	**X**	3	4
108	**X**	2	3	4
109	1	2	3	**X**
110	**X**	2	3	4
111	1	**X**	3	4

Group 12
Laboratory Activities

112	**X**	2	3	4
113	1	2	**X**	4
114	1	2	3	**X**
115	**X**	2	3	4
116	1	2	**X**	4