

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

# CHEMISTRY

Thursday, August 13, 1998 — 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 A sample of oxygen gas in a closed system has a volume of 200 milliliters at 600 K. If the pressure is held constant and the temperature is lowered to 300 K, the new volume of the gas will be

- (1) 100 mL                      (3) 300 mL  
(2) 200 mL                      (4) 400 mL

2 Which sample of water will have the highest vapor pressure?

- (1) 10.0 mL at 62°C          (3) 30.0 mL at 42°C  
(2) 20.0 mL at 52°C          (4) 40.0 mL at 32°C

3 Which statement best describes the molecules of H<sub>2</sub>O in the solid phase?

- (1) They move slowly in straight lines.  
(2) They move rapidly in straight lines.  
(3) They are arranged in a regular geometric pattern.  
(4) They are arranged in a random pattern.

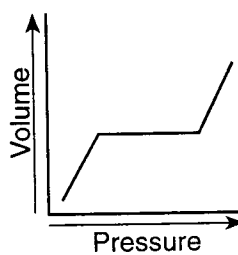
4 What occurs when a substance melts?

- (1) It changes from solid to liquid, and heat is absorbed.  
(2) It changes from solid to liquid, and heat is released.  
(3) It changes from liquid to solid, and heat is absorbed.  
(4) It changes from liquid to solid, and heat is released.

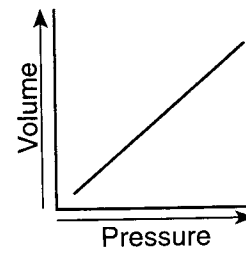
5 An assumption of the kinetic theory of gases is that the particles of a gas have

- (1) little attraction for each other and a significant volume  
(2) little attraction for each other and an insignificant volume  
(3) strong attraction for each other and a significant volume  
(4) strong attraction for each other and an insignificant volume

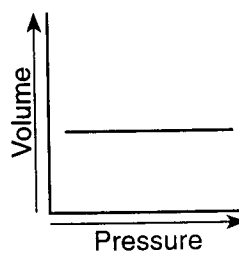
6 Which graph best shows the change in the volume of 1 mole of nitrogen gas as pressure increases and temperature remains constant?



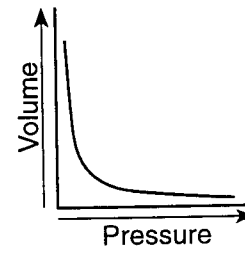
(1)



(3)



(2)



(4)

7 What is the total number of electrons needed to completely fill all of the orbitals in an atom's second principal energy level?

- (1) 16                              (3) 8  
(2) 2                                (4) 4

8 An atom in the excited state can have an electron configuration of

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

9 Compared to the charge and mass of a proton, an electron has

- (1) the same charge and a smaller mass  
(2) the same charge and the same mass  
(3) an opposite charge and a smaller mass  
(4) an opposite charge and the same mass

10 Which nuclear equation represents beta decay?

- (1)  ${}_{13}^{27}\text{Al} + {}_2^4\text{He} \rightarrow {}_{15}^{30}\text{P} + {}_0^1\text{n}$   
(2)  ${}_{92}^{238}\text{U} \rightarrow {}_{90}^{234}\text{Th} + {}_2^4\text{He}$   
(3)  ${}_{6}^{14}\text{C} \rightarrow {}_{7}^{14}\text{N} + {}_{-1}^0\text{e}$   
(4)  ${}_{18}^{37}\text{Ar} + {}_{-1}^0\text{e} \rightarrow {}_{17}^{37}\text{Cl}$

11 What is the total number of sublevels in the fourth principal energy level?

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

12 Which atom in the ground state has only one unpaired electron in its valence shell?

- (1) aluminum (3) phosphorus  
(2) silicon (4) sulfur

13 Which electron dot symbol represents the atom in Period 4 with the highest first ionization energy?

- (1)  $\ddot{\text{X}}$  (3)  $\cdot\ddot{\text{X}}\cdot$   
(2)  $\ddot{\text{X}}\cdot$  (4)  $\cdot\ddot{\text{X}}\cdot$

14 Which of these elements in Period 3 has the *least* tendency to attract electrons?

- (1) Mg (3) S  
(2) Al (4) Cl

15 Which terms describe a substance that has a low melting point and poor electrical conductivity?

- (1) covalent and metallic  
(2) covalent and molecular  
(3) ionic and molecular  
(4) ionic and metallic

16 Which chemical formula is both an empirical formula and a molecular formula?

- (1)  $\text{CH}_4$   
(2)  $\text{C}_2\text{H}_6$   
(3)  $\text{CH}_3\text{COOH}$   
(4)  $\text{CH}_3\text{CH}_2\text{COOCH}_3$

17 How many grams of sodium are represented by the symbol Na?

- (1) 1.0 g of Na (3) 11 g of Na  
(2) 10. g of Na (4) 23 g of Na

18 The shape and bonding in a diatomic bromine molecule are best described as

- (1) symmetrical and polar  
(2) symmetrical and nonpolar  
(3) asymmetrical and polar  
(4) asymmetrical and nonpolar

19 What is the total number of moles of hydrogen atoms contained in 1 mole of  $(\text{NH}_4)_2\text{C}_2\text{O}_4$ ?

- (1) 6 (3) 8  
(2) 2 (4) 4

20 Which element at STP is a poor conductor of electricity and has a relatively high electronegativity?

- (1) Cu (3) Mg  
(2) S (4) Fe

21 The element arsenic (As) has the properties of

- (1) metals, only  
(2) nonmetals, only  
(3) both metals and nonmetals  
(4) neither metals nor nonmetals

22 The elements calcium and strontium have similar chemical properties because they both have the same

- (1) atomic number  
(2) mass number  
(3) number of valence electrons  
(4) number of completely filled sublevels

23 Which element is malleable and ductile?

- (1) S (3) Ge  
(2) Si (4) Au

24 Which gas is monatomic at STP?

- (1) nitrogen (3) fluorine  
(2) neon (4) chlorine

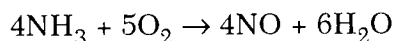
25 Which physical characteristic of a solution may indicate the presence of a transition element?

- (1) its density
- (2) its color
- (3) its effect on litmus
- (4) its effect on phenolphthalein

26 The observed regularities in the properties of elements are periodic functions of their

- (1) atomic numbers
- (2) mass numbers
- (3) oxidation states
- (4) nonvalence electrons

27 Given the reaction:



What is the maximum number of moles of  $\text{H}_2\text{O}$  that can be produced when 2.0 moles of  $\text{NH}_3$  are completely reacted?

- (1) 1.0
- (2) 2.0
- (3) 3.0
- (4) 6.0

28 A compound has an empirical formula of  $\text{HCO}_2$  and a molecular mass of 90. grams per mole. What is the molecular formula of this compound?

- (1)  $\text{HCO}$
- (2)  $\text{H}_2\text{C}_2\text{O}_4$
- (3)  $\text{H}_4\text{C}_4\text{O}_8$
- (4)  $\text{H}_6\text{C}_6\text{O}_{12}$

29 What is the volume occupied by 2.00 moles of  $\text{Ar}(\text{g})$  at STP?

- (1) 22.4 L
- (2) 44.8 L
- (3) 89.6 L
- (4) 179 L

30 What is the percent by mass of water present in 1.0 mole of  $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ ?

- (1) 10.%
- (2) 12%
- (3) 21%
- (4) 79%

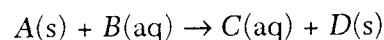
31 How many grams of  $\text{KCl}$  must be dissolved in 200 grams of water to make a saturated solution at  $60^\circ\text{C}$ ?

- (1) 30 g
- (2) 45 g
- (3) 56 g
- (4) 90 g

32 Based on Reference Table G, which compound forms spontaneously under standard conditions?

- (1)  $\text{NaCl}$
- (2)  $\text{HI}$
- (3)  $\text{C}_2\text{H}_4$
- (4)  $\text{NO}_2$

33 Given the reaction:



Which change would increase the rate of this reaction?

- (1) a decrease in pressure
- (2) an increase in pressure
- (3) a decrease in temperature
- (4) an increase in temperature

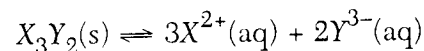
34 When a catalyst is added to a system at equilibrium, a decrease occurs in the

- (1) heat of the reaction
- (2) activation energy
- (3) potential energy of the reactants
- (4) potential energy of the products

35 Which reaction results in an increase in entropy?

- (1)  $\text{CO}_2(\text{g}) \rightarrow \text{CO}_2(\text{s})$
- (2)  $\text{H}_2\text{O}(\ell) \rightarrow \text{H}_2\text{O}(\text{s})$
- (3)  $\text{Ca}(\text{s}) + 2\text{H}_2\text{O}(\ell) \rightarrow \text{Ca}(\text{OH})_2(\text{aq}) + \text{H}_2(\text{g})$
- (4)  $\text{NaCl}(\text{aq}) + \text{AgNO}_3(\text{aq}) \rightarrow \text{AgCl}(\text{s}) + \text{NaNO}_3(\text{aq})$

36 Given the reaction at equilibrium:



What is the correct solubility product ( $K_{sp}$ ) for this reaction?

- (1)  $K_{sp} = [\text{X}^{2+}]^3[\text{Y}^{3-}]^2$
- (2)  $K_{sp} = [\text{X}^{2+}]^3 + 2[\text{Y}^{3-}]^2$
- (3)  $K_{sp} = 3[\text{X}^{2+}]2[\text{Y}^{3-}]$
- (4)  $K_{sp} = 3[\text{X}^{2+}] + 2[\text{Y}^{3-}]$

37 Which of the following Brønsted bases has the strongest conjugate acid?

- (1)  $\text{OH}^-$
- (2)  $\text{F}^-$
- (3)  $\text{HS}^-$
- (4)  $\text{NO}_3^-$

38 Which compound is a salt?

- (1)  $\text{Na}_3\text{PO}_4$  (3)  $\text{CH}_3\text{COOH}$   
(2)  $\text{H}_3\text{PO}_4$  (4)  $\text{Ca}(\text{OH})_2$

39 At 1 atm and 298 K, which of the  $K_a$  values listed below represents the strongest acid?

- (1)  $1.1 \times 10^{-7}$  (3)  $5.6 \times 10^{-11}$   
(2)  $1.8 \times 10^{-5}$  (4)  $4.6 \times 10^{-4}$

40 Which compound will conduct an electric current when dissolved in water?

- (1)  $\text{NaOH}$  (3)  $\text{C}_6\text{H}_{12}\text{O}_6$   
(2)  $\text{C}_2\text{H}_5\text{OH}$  (4)  $\text{C}_{12}\text{H}_{22}\text{O}_{11}$

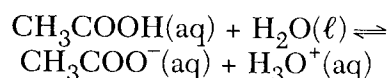
41 According to the Arrhenius theory of acids, citric acid in oranges and acetic acid in vinegar are classified as acids because their aqueous solutions contain

- (1) hydrogen ions (3) hydroxide ions  
(2) hydrogen atoms (4) hydroxide atoms

42 If 20. milliliters of a 1.0 M solution of HCl is exactly neutralized by 40. milliliters of NaOH, the molarity of the NaOH solution is

- (1) 1.0 M (3) 0.50 M  
(2) 2.0 M (4) 4.0 M

43 Given the reaction:



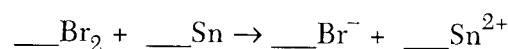
In this reaction, which substances are Brønsted-Lowry bases?

- (1)  $\text{CH}_3\text{COOH}(\text{aq})$  and  $\text{H}_2\text{O}(\ell)$   
(2)  $\text{CH}_3\text{COOH}(\text{aq})$  and  $\text{CH}_3\text{COO}^-(\text{aq})$   
(3)  $\text{H}_2\text{O}(\ell)$  and  $\text{H}_3\text{O}^+(\text{aq})$   
(4)  $\text{H}_2\text{O}(\ell)$  and  $\text{CH}_3\text{COO}^-(\text{aq})$

44 What is the oxidation number of sulfur in  $\text{H}_2\text{SO}_4$ ?

- (1) 0 (3) +6  
(2) -2 (4) +4

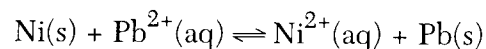
45 Given the unbalanced equation:



When the equation is correctly balanced using the smallest whole-number coefficients, the coefficient of  $\text{Br}^-$  is

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

46 Given the redox reaction in an electrochemical cell:



A salt bridge is used to connect

- (1)  $\text{Ni}(\text{s})$  and  $\text{Pb}(\text{s})$   
(2)  $\text{Pb}^{2+}(\text{aq})$  and  $\text{Ni}^{2+}(\text{aq})$   
(3)  $\text{Ni}(\text{s})$  and  $\text{Ni}^{2+}(\text{aq})$   
(4)  $\text{Pb}^{2+}(\text{aq})$  and  $\text{Pb}(\text{s})$

47 Which half-reaction correctly represents oxidation?

- (1)  $\text{Sn}^{2+} + 2\text{e}^- \rightarrow \text{Sn}^0$   
(2)  $\text{Sn}^{4+} + 2\text{e}^- \rightarrow \text{Sn}^{2+}$   
(3)  $\text{Sn}^{2+} \rightarrow \text{Sn}^0 + 2\text{e}^-$   
(4)  $\text{Sn}^{2+} \rightarrow \text{Sn}^{4+} + 2\text{e}^-$

48 In a redox reaction, the reducing agent will

- (1) lose electrons and be reduced  
(2) lose electrons and be oxidized  
(3) gain electrons and be reduced  
(4) gain electrons and be oxidized

49 Which element is present in all organic compounds?

- (1) hydrogen (3) oxygen  
(2) nitrogen (4) carbon

50 Which products are obtained when  $\text{CH}_4(\text{g})$  burns completely in an excess of oxygen?

- (1)  $\text{CO}$  and  $\text{H}_2\text{O}$  (3)  $\text{CO}_2$  and  $\text{H}_2\text{O}$   
(2)  $\text{CO}$  and  $\text{C}$  (4)  $\text{CO}_2$  and  $\text{CO}$

51 Which hydrocarbon is a member of the alkene series?

- (1)  $C_2H_2$                       (3)  $C_4H_{10}$   
(2)  $C_3H_6$                       (4)  $C_5H_{12}$

52 Which formula represents butane?

- (1)  $CH_3CH_3$   
(2)  $CH_3CH_2CH_3$   
(3)  $CH_3CH_2CH_2CH_3$   
(4)  $CH_3CH_2CH_2CH_2CH_3$

53 A hydrocarbon molecule is considered to be saturated if the molecule contains

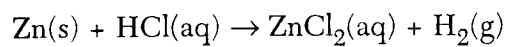
- (1) single covalent bonds, only  
(2) a double covalent bond, only  
(3) a triple covalent bond  
(4) single and double covalent bonds

**Note that questions 54 through 56 have only three choices.**

54 In a chemical reaction, as a species is oxidized, its oxidation number

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

55 Given the reaction:



As the concentration of the  $HCl(aq)$  decreases at constant temperature, the rate of the reaction

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

56 As a chemical bond forms between two hydrogen atoms in a system, energy is released and the stability of the system

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

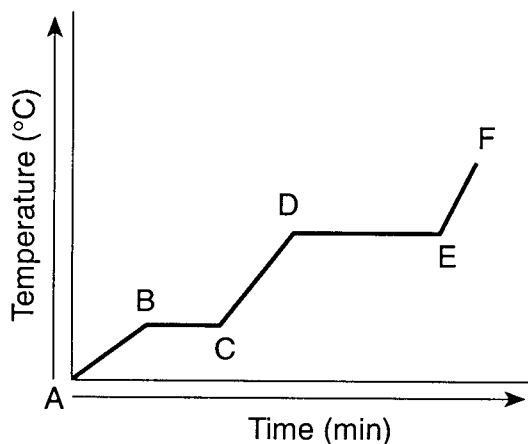
## Part II

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 I — Matter and Energy

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

- 57 The graph below represents the uniform heating of a substance, starting with the substance as a solid below its melting point.



Which segment of the graph represents a time when both the solid and liquid phases are present?

- (1) AB (2) BC (3) DE (4) EF
- 58 A gas at STP has a volume of 1.0 liter. If the pressure is doubled and the temperature remains constant, the new volume of the gas will be
- (1) 0.25 L (2) 2.0 L (3) 0.50 L (4) 4.0 L

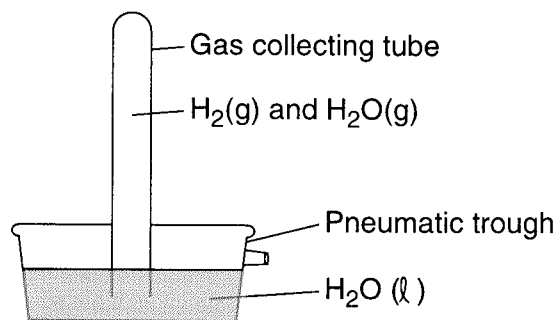
- 59 What is the normal boiling point of methane?

- (1) 20 K (2) 109 K (3) 121 K (4) 240 K

- 60 Which gas is *least* likely to obey the ideal gas laws at very high pressures and very low temperatures?

- (1) He (2) Ne (3) Kr (4) Xe

- 61 The diagram below shows the collection of  $H_2$  gas over water at  $25^\circ C$ . The total pressure in the tube is 760.0 torr.



What is the pressure exerted by the hydrogen gas alone?

- (1) 23.8 torr (2) 736.2 torr (3) 760.0 torr (4) 793.8 torr





### Group 4 — Periodic Table

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

- 72 In which area of the Periodic Table are the elements with the strongest nonmetallic properties located?
- (1) lower left                      (3) lower right  
(2) upper left                      (4) upper right
- 73 All of the atoms of the elements in Period 2 have the same number of
- (1) protons  
(2) neutrons  
(3) valence electrons  
(4) occupied principal energy levels
- 74 Which of these metals loses electrons most readily?
- (1) calcium                      (3) potassium  
(2) magnesium                      (4) sodium
- 75 If  $M$  represents an element in Group 2, the formula of its chloride would be
- (1)  $MCl$                       (3)  $M_2Cl$   
(2)  $MCl_2$                       (4)  $M_2Cl_2$
- 76 Which statement best compares the atomic radius of a potassium atom and the atomic radius of a calcium atom?
- (1) The radius of the potassium atom is smaller because of its smaller nuclear charge.  
(2) The radius of the potassium atom is smaller because of its larger nuclear charge.  
(3) The radius of the potassium atom is larger because of its smaller nuclear charge.  
(4) The radius of the potassium atom is larger because of its larger nuclear charge.
- 

### Group 5 — Mathematics of Chemistry

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

- 77 The table below lists four gases and their molecular mass.

Gas	Molecular Mass (g/mol)
A	2
B	4
C	17
D	20

Which gas diffuses at the *slowest* rate at STP?

- (1) A                      (3) C  
(2) B                      (4) D
- 78 At 1 atmosphere of pressure, 25.0 grams of a compound at its normal boiling point is converted to a gas by the addition of 8,180 calories. What is the heat of vaporization for this compound, in calories per gram?
- (1) 25.0 cal/g                      (3) 540. cal/g  
(2) 327 cal/g                      (4) 8,180 cal/g
- 79 If 11 grams of a gas occupies 5.6 liters at STP, what is its gram molecular mass?
- (1) 11 g/mol                      (3) 44 g/mol  
(2) 22 g/mol                      (4) 88 g/mol
- 80 An 80.-gram sample of water at 10.°C absorbs 400. calories of heat energy. What is the final temperature of the water?
- (1) 50.°C                      (3) 5.0°C  
(2) 15°C                      (4) 4.0°C
- 81 Given the reaction:  $4Al + 3O_2 \rightarrow 2Al_2O_3$
- What is the total number of moles of aluminum oxide that can be formed when 54 grams of aluminum reacts completely with oxygen?
- (1) 1.0 mole                      (3) 3.0 moles  
(2) 2.0 moles                      (4) 4.0 moles
-

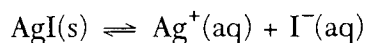
### Group 6 — Kinetics and Equilibrium

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

82 Based on Reference Table E, which salt is *least* soluble?

- (1)  $\text{FeCO}_3$                       (3)  $\text{BaCl}_2$   
(2)  $\text{Na}_2\text{CO}_3$                     (4)  $\text{CaCl}_2$

83 Given the reaction at equilibrium:



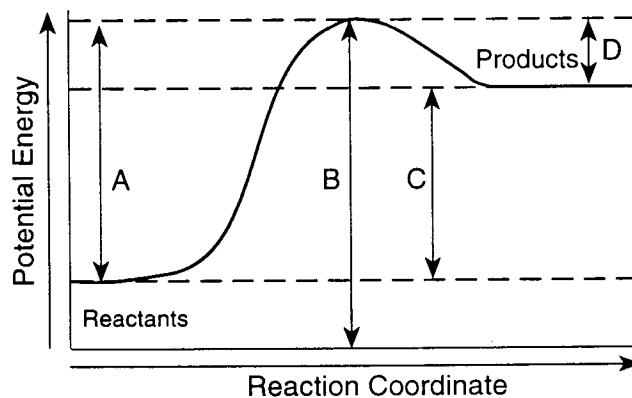
What happens as  $\text{KI}(s)$  is added to the solution?

- (1) The concentration of  $\text{Ag}^+(aq)$  decreases and the concentration of  $\text{I}^-(aq)$  increases.  
(2) The concentration of  $\text{Ag}^+(aq)$  decreases and the concentration of  $\text{I}^-(aq)$  remains the same.  
(3) The concentration of  $\text{Ag}^+(aq)$  increases and the concentration of  $\text{I}^-(aq)$  increases.  
(4) The concentration of  $\text{Ag}^+(aq)$  increases and the concentration of  $\text{I}^-(aq)$  remains the same.

84 A reaction will be spontaneous if it results in products that have

- (1) lower potential energy and less randomness  
(2) lower potential energy and more randomness  
(3) greater potential energy and less randomness  
(4) greater potential energy and more randomness

85 In the diagram below, which letter represents the activation energy for the reverse reaction?



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

86 Given the equation:  $\Delta G = \Delta H - T\Delta S$

The  $\Delta S$  represents a change in

- (1) entropy                              (3) enthalpy  
(2) free energy                        (4) temperature

### Group 7 — Acids and Bases

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

87 Which relationship is present in a solution that has a pH of 7?

- (1)  $[\text{H}^+] = [\text{OH}^-]$
- (2)  $[\text{H}^+] > [\text{OH}^-]$
- (3)  $[\text{H}^+] < [\text{OH}^-]$
- (4)  $[\text{H}^+] + [\text{OH}^-] = K_w$

88 According to Reference Table N, which metal will react spontaneously with hydrochloric acid?

- (1) Ag
- (2) Hg
- (3) Cu
- (4) Ni

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

- (1) HI
- (2)  $\text{OH}^-$
- (3) HF
- (4)  $\text{NH}_4^+$

90 The pH of a 0.1 M solution is 11. What is the concentration of  $\text{H}_3\text{O}^+$  ions, in moles per liter?

- (1)  $1 \times 10^{-1}$
- (2)  $1 \times 10^{-3}$
- (3)  $1 \times 10^{-11}$
- (4)  $1 \times 10^{-13}$

91 Red litmus will turn blue when placed in an aqueous solution of

- (1) KCl
  - (2) KOH
  - (3)  $\text{CH}_3\text{OH}$
  - (4)  $\text{CH}_3\text{COOH}$
- 

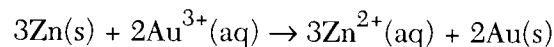
### Group 8 — Redox and Electricity

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

92 Equilibrium is attained in a chemical cell when the cell voltage is equal to

- (1) +1.00 V
- (2) +2.00 V
- (3) 0.00 V
- (4) -1.00 V

93 Given the reaction:



What is the maximum cell voltage ( $E^0$ ) for the overall reaction?

- (1) +1.50 V
- (2) +2.26 V
- (3) +5.28 V
- (4) +0.74 V

94 Based on Reference Table N, which ion will oxidize Pb to  $\text{Pb}^{2+}$ ?

- (1)  $\text{Cu}^{2+}$
- (2)  $\text{Ni}^{2+}$
- (3)  $\text{Fe}^{2+}$
- (4)  $\text{Zn}^{2+}$

95 Which net reaction occurs by the process of electrolysis?

- (1)  $2\text{H}_2\text{O}(\ell) \rightarrow 2\text{H}_2(\text{g}) + \text{O}_2(\text{g})$
- (2)  $2\text{HgO}(s) \rightarrow 2\text{Hg}(\ell) + \text{O}_2(\text{g})$
- (3)  $2\text{KClO}_3(\ell) \rightarrow 2\text{KCl}(s) + 3\text{O}_2(\text{g})$
- (4)  $\text{MgCO}_3(s) \rightarrow \text{MgO}(s) + \text{CO}_2(s)$

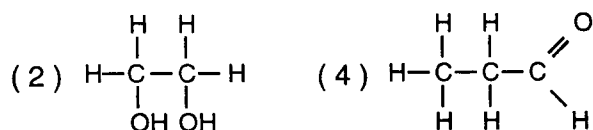
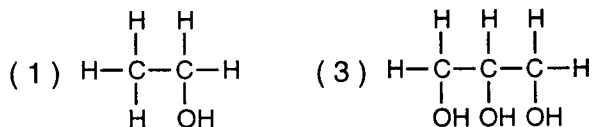
96 Which reaction is a nonspontaneous redox reaction under standard conditions?

- (1)  $\text{Sn}(s) + 2\text{HCl}(\text{aq}) \rightarrow \text{SnCl}_2(\text{aq}) + \text{H}_2(\text{g})$
  - (2)  $\text{Cu}(s) + 2\text{HCl}(\text{aq}) \rightarrow \text{CuCl}_2(\text{aq}) + \text{H}_2(\text{g})$
  - (3)  $\text{Ba}(s) + 2\text{HCl}(\text{aq}) \rightarrow \text{BaCl}_2(\text{aq}) + \text{H}_2(\text{g})$
  - (4)  $\text{Mg}(s) + 2\text{HCl}(\text{aq}) \rightarrow \text{MgCl}_2(\text{aq}) + \text{H}_2(\text{g})$
-

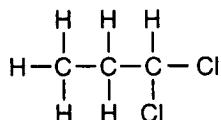
### Group 9 — Organic Chemistry

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

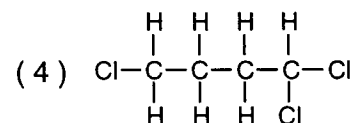
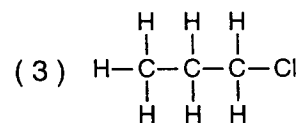
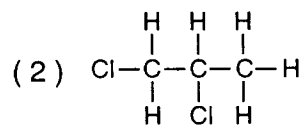
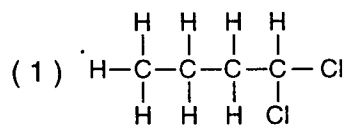
97 Which structural formula represents a dihydroxy alcohol?



98 Given the compound:



Which structural formula represents an isomer?



99 Which set contains one natural polymer and one synthetic polymer?

- (1) cellulose and starch
- (2) polyethylene and nylon
- (3) protein and starch
- (4) protein and nylon

100 Aldehydes can be synthesized by the oxidation of

- (1) primary alcohols      (3) organic acids
- (2) secondary alcohols      (4) inorganic acids

101 What is the general formula for an ether?

- (1)  $\text{R}_1-\text{O}-\text{R}_2$       (3)  $\begin{array}{c} \text{O} \\ || \\ \text{R}-\text{C}-\text{H} \end{array}$
- (2)  $\text{R}-\text{OH}$       (4)  $\begin{array}{c} \text{O} \\ || \\ \text{R}-\text{C}-\text{OH} \end{array}$

**Group 10 — Applications of Chemical Principles**

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

- 102 Which type of chemical reaction occurs when an iron nail rusts?  
(1) neutralization  
(2) condensation  
(3) oxidation-reduction  
(4) ionization-dissociation
- 103 Which of these gases obtained from petroleum is also known as bottled gas?  
(1) ethane (3) propane  
(2) ethene (4) propene
- 104 Which element is obtained only by the electrolysis of its fused salt?  
(1) K (3) Cr  
(2) Zn (4) Fe
- 105 Which metals occur naturally as sulfide ores and then are changed to oxides and reduced to free metals?  
(1) Au and Ag (3) Cu and Zn  
(2) K and Li (4) Cu and K
- 106 Which compound is produced in the first step of the contact process?  
(1)  $\text{SO}_2$  (3)  $\text{H}_2\text{S}$   
(2)  $\text{SO}_3$  (4)  $\text{H}_2\text{SO}_3$
- 

**Group 11 — Nuclear Chemistry**

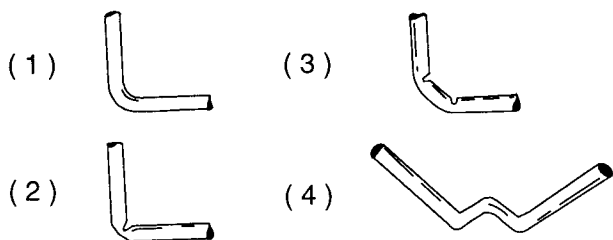
If you choose this group, be sure to answer questions 107–111.

- 107 Which substance can be used as a fuel in a fission reactor?  
(1)  $^2\text{H}$  (3)  $^{226}\text{Ra}$   
(2)  $^4\text{H}$  (4)  $^{235}\text{U}$
- 108 Which characteristics should a radioactive isotope have if it is to be used for medical diagnosis?  
(1) short half-life and slow elimination from the body  
(2) short half-life and fast elimination from the body  
(3) long half-life and slow elimination from the body  
(4) long half-life and fast elimination from the body
- 109 Which particles can be accelerated in an electric or magnetic field?  
(1) alpha and gamma (3) alpha and beta  
(2) beta and neutron (4) beta and gamma
- 110 Which is a gaseous radioactive waste product that is released into the atmosphere after it has decayed to a safe radiation level?  
(1) radon-222 (3) cesium-137  
(2) radium-226 (4) cobalt-60
- 111 During a fission reaction, which type of particle is captured by a nucleus?  
(1) deuteron (3) neutron  
(2) electron (4) proton
-

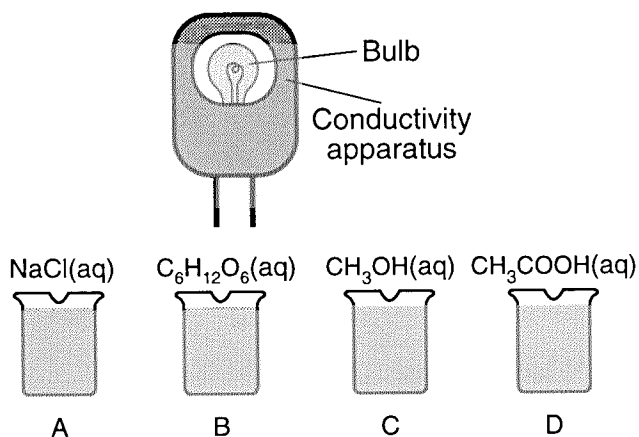
## Group 12 — Laboratory Activities

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

112 Which diagram best represents a piece of glass tubing that has been properly bent?



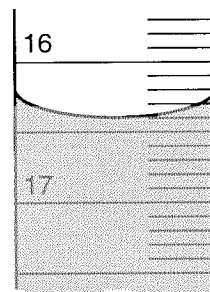
113 Beakers A, B, C, and D shown below each contain a different solution.



The bulb will glow when the conductivity apparatus is placed into which beakers?

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

114 The diagram below shows a portion of a buret.



What is the meniscus reading in milliliters?

- (1) 16.00                      (3) 17.00  
 (2) 16.40                      (4) 17.60

115 The volume of a gas sample is 22.4 liters at STP. The density of the gas is 1.34 grams per liter. What is the mass of the gas sample, expressed to the correct number of significant figures?

- (1) 16.7 g                      (3) 30 g  
 (2) 17 g                        (4) 30.0 g

116 A student determined that the percent of H<sub>2</sub>O in a hydrate was 39.0%. The percent of H<sub>2</sub>O in this hydrate is 36.0% according to an accepted chemistry reference. What is the student's percent of error?

- (1) 9.1%                        (3) 3.0%  
 (2) 8.3%                        (4) 11%

The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

**CHEMISTRY**

Thursday, August 13, 1998 — 12:30 to 3:30 p.m., only

**ANSWER SHEET**

Male

Student ..... Sex:  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 .....

Tear Here

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.

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

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



# FOR TEACHERS ONLY

# C

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

## CHEMISTRY

Thursday, August 13, 1998 — 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	X	2	3	4	21	1	2	X	4	41	X	2	3	4
2	X	2	3	4	22	1	2	X	4	42	1	2	X	4
3	1	2	X	4	23	1	2	3	X	43	1	2	3	X
4	X	2	3	4	24	1	X	3	4	44	1	2	X	4
5	1	X	3	4	25	1	X	3	4	45	1	X	3	4
6	1	2	3	X	26	X	2	3	4	46	1	X	3	4
7	1	2	X	4	27	1	2	X	4	47	1	2	3	X
8	1	X	3	4	28	1	X	3	4	48	1	X	3	4
9	1	2	X	4	29	1	X	3	4	49	1	2	3	X
10	1	2	X	4	30	1	2	X	4	50	1	2	X	4
11	1	2	3	X	31	1	2	3	X	51	1	X	3	4
12	X	2	3	4	32	X	2	3	4	52	1	2	X	4
13	1	2	3	X	33	1	2	3	X	53	X	2	3	4
14	X	2	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	X	2	3	4	36	X	2	3	4	56	1	X	3	
17	1	2	3	X	37	1	2	3	X					
18	1	X	3	4	38	X	2	3	4					
19	1	2	X	4	39	1	2	3	X					
20	1	X	3	4	40	X	2	3	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	<input checked="" type="checkbox"/>	3	4	
58	1	2	<input checked="" type="checkbox"/>	4	
59	1	<input checked="" type="checkbox"/>	3	4	
60	1	2	3	<input checked="" type="checkbox"/>	
61	1	<input checked="" type="checkbox"/>	3	4	

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

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

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

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

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

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

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

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

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

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

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