The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

PHYSICAL SETTING
CHEMISTRY

Wednesday, June 23, 2004 — 9:15 a.m. to 12:15 p.m., only

This is a test of your knowledge of chemistry. Use that knowledge to answer all questions in this examination. Some questions may require the use of the *Reference Tables for Physical Setting/Chemistry*. You are to answer *all* questions in all parts of this examination according to the directions provided in the examination booklet.

Your answer sheet for Part A and Part B–1 is the last page of this examination booklet. Turn to the last page and fold it along the perforations. Then, slowly and carefully, tear off your answer sheet and fill in the heading.

The answers to the questions in Part B–2 and Part C are to be written in your separate answer booklet. Be sure to fill in the heading on the front of your answer booklet.

Record the number of your choice for each Part A and Part B–1 multiple-choice question on your separate answer sheet. Write your answers to the Part B–2 and Part C questions in your answer booklet. All work should be written in pen, except for graphs and drawings, which should be done in pencil. You may use scrap paper to work out the answers to the questions, but be sure to record all your answers on your separate answer sheet and in your answer booklet.

When you have completed the examination, you must sign the statement printed at the end of your separate 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 and answer booklet cannot be accepted if you fail to sign this declaration.

Notice. . .

A four-function or scientific calculator and a copy of the *Reference Tables for Physical Setting/Chemistry* must be available for your use while taking this examination.

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

Part A

Answer all questions in this part.

Directions (1–33): For *each* statement or question, write on the separate answer sheet the *number* of the word or expression that, of those given, best completes the statement or answers the question. Some questions may require the use of the *Reference Tables for Physical Setting/Chemistry*.

1 The modern model of the atom is based on the work of

(1) one scientist over a short period of time
(2) one scientist over a long period of time
(3) many scientists over a short period of time
(4) many scientists over a long period of time

2 Which statement is true about the charges assigned to an electron and a proton?

(1) Both an electron and a proton are positive.
(2) An electron is positive and a proton is negative.
(3) An electron is negative and a proton is positive.
(4) Both an electron and a proton are negative.

3 In the wave-mechanical model, an orbital is a region of space in an atom where there is

(1) a high probability of finding an electron
(2) a high probability of finding a neutron
(3) a circular path in which electrons are found
(4) a circular path in which neutrons are found

4 What is the charge of the nucleus in an atom of oxygen-17?

(1) 0   (3) +8
(2) –2   (4) +17

5 Which pair of symbols represents a metalloid and a noble gas?

(1) Si and Bi   (3) Ge and Te
(2) As and Ar   (4) Ne and Xe

6 Which statement describes a chemical property of iron?

(1) Iron can be flattened into sheets.
(2) Iron conducts electricity and heat.
(3) Iron combines with oxygen to form rust.
(4) Iron can be drawn into a wire.

7 Given the reaction:

$$N_2(g) + 3\,H_2(g) \rightleftharpoons 2\,NH_3(g)$$

What is the mole-to-mole ratio between nitrogen gas and hydrogen gas?

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

8 What is the percent by mass of oxygen in propanal, CH_3CH_2CHO?

(1) 10.0%   (3) 38.1%
(2) 27.6%   (4) 62.1%

9 Covalent bonds are formed when electrons are

(1) transferred from one atom to another
(2) captured by the nucleus
(3) mobile within a metal
(4) shared between two atoms

10 Which type of molecule is CF_4?

(1) polar, with a symmetrical distribution of charge
(2) polar, with an asymmetrical distribution of charge
(3) nonpolar, with a symmetrical distribution of charge
(4) nonpolar, with an asymmetrical distribution of charge

11 Which change occurs when a barium atom loses two electrons?

(1) It becomes a negative ion and its radius decreases.
(2) It becomes a negative ion and its radius increases.
(3) It becomes a positive ion and its radius decreases.
(4) It becomes a positive ion and its radius increases.

12 Conductivity in a metal results from the metal atoms having

(1) high electronegativity
(2) high ionization energy
(3) highly mobile protons in the nucleus
(4) highly mobile electrons in the valence shell

13 Which of these elements has the *least* attraction for electrons in a chemical bond?

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

14 Recovering the salt from a mixture of salt and water could best be accomplished by

(1) evaporation
(2) filtration
(3) paper chromatography
(4) density determination

15 The average kinetic energy of water molecules is greatest in which of these samples?

(1) 10 g of water at 35°C
(2) 10 g of water at 55°C
(3) 100 g of water at 25°C
(4) 100 g of water at 45°C

16 Helium is most likely to behave as an ideal gas when it is under

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

17 At STP, the element oxygen can exist as either O_2 or O_3 gas molecules. These two forms of the element have

(1) the same chemical and physical properties
(2) the same chemical properties and different physical properties
(3) different chemical properties and the same physical properties
(4) different chemical and physical properties

18 Which sample contains particles in a rigid, fixed, geometric pattern?

(1) $CO_2(aq)$ (3) $H_2O(\ell)$
(2) $HCl(g)$ (4) $KCl(s)$

19 Given the reaction at 25°C:

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

The rate of this reaction can be increased by using 5.0 grams of powdered zinc instead of a 5.0-gram strip of zinc because the powdered zinc has

(1) lower kinetic energy
(2) lower concentration
(3) more surface area
(4) more zinc atoms

20 Which statement about a system at equilibrium is true?

(1) The forward reaction rate is less than the reverse reaction rate.
(2) The forward reaction rate is greater than the reverse reaction rate.
(3) The forward reaction rate is equal to the reverse reaction rate.
(4) The forward reaction rate stops and the reverse reaction rate continues.

21 A catalyst increases the rate of a chemical reaction by

(1) lowering the activation energy of the reaction
(2) lowering the potential energy of the products
(3) raising the temperature of the reactants
(4) raising the concentration of the reactants

22 Which element must be present in an organic compound?

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

23 Which compound is a saturated hydrocarbon?

(1) hexane   (3) hexanol
(2) hexene   (4) hexanal

24 Given the reaction:

$$CH_3\overset{\displaystyle O}{\overset{\|}{C}}{-}OH + HOC_2H_5 \rightleftharpoons CH_3\overset{\displaystyle O}{\overset{\|}{C}}{-}O{-}C_2H_5 + H_2O$$
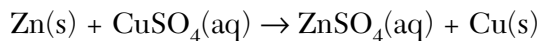
This reaction is an example of

(1) fermentation
(2) saponification

(3) hydrogenation
(4) esterification

25 Which of these compounds has chemical properties most similar to the chemical properties of ethanoic acid?

(1) C_3H_7COOH
(2) C_2H_5OH
(3) $C_2H_5COOC_2H_5$
(4) $C_2H_5OC_2H_5$

26 Given the reaction that occurs in an electro-chemical cell:

$$Zn(s) + CuSO_4(aq) \rightarrow ZnSO_4(aq) + Cu(s)$$

During this reaction, the oxidation number of Zn changes from

(1) 0 to +2
(2) 0 to –2
(3) +2 to 0
(4) –2 to 0

27 A voltaic cell spontaneously converts

(1) electrical energy to chemical energy
(2) chemical energy to electrical energy
(3) electrical energy to nuclear energy
(4) nuclear energy to electrical energy

28 Which pair of formulas represents two compounds that are electrolytes?

(1) HCl and CH_3OH
(2) HCl and NaOH
(3) C_5H_{12} and CH_3OH
(4) C_5H_{12} and NaOH

29 Hydrogen chloride, HCl, is classified as an Arrhenius acid because it produces

(1) H^+ ions in aqueous solution
(2) Cl^- ions in aqueous solution
(3) OH^- ions in aqueous solution
(4) NH_4^+ ions in aqueous solution

30 Which compound could serve as a reactant in a neutralization reaction?

(1) NaCl
(2) KOH
(3) CH_3OH
(4) CH_3CHO

31 Which of these particles has the greatest mass?

(1) alpha
(2) beta
(3) neutron
(4) positron

32 In a nuclear fusion reaction, the mass of the products is

(1) less than the mass of the reactants because some of the mass has been converted to energy
(2) less than the mass of the reactants because some of the energy has been converted to mass
(3) more than the mass of the reactants because some of the mass has been converted to energy
(4) more than the mass of the reactants because some of the energy has been converted to mass

33 Which of these types of radiation has the greatest penetrating power?

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

Part B–1

Answer all questions in this part.

Directions (34–50): For *each* statement or question, write on the separate answer sheet the *number* of the word or expression that, of those given, best completes the statement or answers the question. Some questions may require the use of the *Reference Tables for Physical Setting/Chemistry*.

34 How many electrons are contained in an Au^{3+} ion?

(1) 76   (3) 82
(2) 79   (4) 197

35 Which electron configuration represents the electrons of an atom in an excited state?

(1) 2–4   (3) 2–7–2
(2) 2–6   (4) 2–8–2

36 In comparison to an atom of $^{19}_{9}F$ in the ground state, an atom of $^{12}_{6}C$ in the ground state has

(1) three fewer neutrons
(2) three fewer valence electrons
(3) three more neutrons
(4) three more valence electrons

37 Element *X* is a solid that is brittle, lacks luster, and has six valence electrons. In which group on the Periodic Table would element *X* be found?

(1) 1   (3) 15
(2) 2   (4) 16

38 What is the empirical formula for the compound $C_6H_{12}O_6$?

(1) CH_2O (3) $C_3H_6O_3$
(2) $C_2H_4O_2$ (4) $C_6H_{12}O_6$

39 The bonds between hydrogen and oxygen in a water molecule are classified as

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

40 The graph below represents the uniform heating of a substance, starting with the substance as a solid below its melting point.
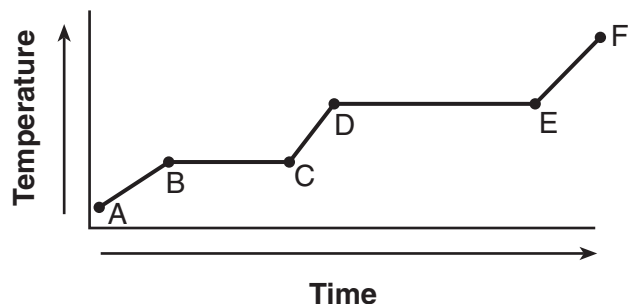
Which line segment represents an increase in potential energy and no change in average kinetic energy?

(1) $\overline{AB}$ (3) $\overline{CD}$
(2) $\overline{BC}$ (4) $\overline{EF}$

41 Using your knowledge of chemistry and the information in Reference Table *H*, which statement concerning propanone and water at 50°C is true?

(1) Propanone has a higher vapor pressure and stronger intermolecular forces than water.
(2) Propanone has a higher vapor pressure and weaker intermolecular forces than water.
(3) Propanone has a lower vapor pressure and stronger intermolecular forces than water.
(4) Propanone has a lower vapor pressure and weaker intermolecular forces than water.

42 A solution that is at equilibrium must be

(1) concentrated   (3) saturated
(2) dilute   (4) unsaturated

43 Given the reaction:

$$N_2(g) + O_2(g) + 182.6 \text{ kJ} \rightleftharpoons 2 \text{ NO}(g)$$
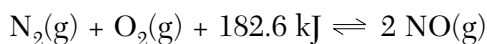
Which change would cause an immediate increase in the rate of the forward reaction?

(1) increasing the concentration of $NO(g)$
(2) increasing the concentration of $N_2(g)$
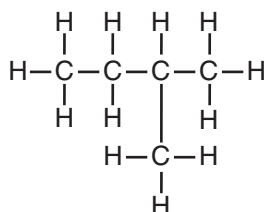(3) decreasing the reaction temperature
(4) decreasing the reaction pressure

44 Which 10-milliliter sample of water has the greatest degree of disorder?

(1) $H_2O(g)$ at 120°C
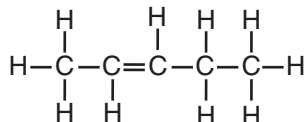(2) $H_2O(\ell)$ at 80°C
(3) $H_2O(\ell)$ at 20°C
(4) $H_2O(s)$ at 0°C

45 Which pH indicates a basic solution?
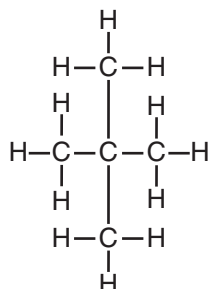
(1) 1   (3) 7
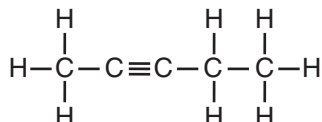(2) 5   (4) 12

46 Which structural formula represents 2-pentyne?

(1)

(3)

(2)

(4)

47 Which structural formula represents an ether?
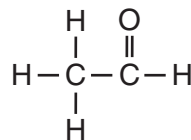
(1)
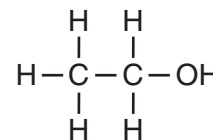
(3)
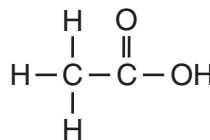
(2)
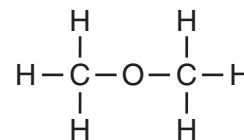
(4)

48 Given the reaction for the corrosion of aluminum:

$$4 \text{ Al} + 3 \text{ O}_2 \rightarrow 2 \text{ Al}_2\text{O}_3$$
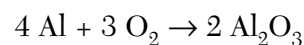
Which half-reaction correctly represents the oxidation that occurs?

(1) $Al + 3e^- \rightarrow Al^{3+}$
(2) $Al \rightarrow Al^{3+} + 3e^-$
(3) $O_2 + 4e^- \rightarrow 2 \text{ O}^{2-}$
(4) $O_2 \rightarrow 2 \text{ O}^{2-} + 4e^-$

49 Based on Reference Table N, what fraction of a sample of gold-198 remains radioactive after 2.69 days?

(1) $\frac{1}{4}$ (3) $\frac{3}{4}$

(2) $\frac{1}{2}$ (4) $\frac{7}{8}$

Note that question 50 has only three choices.

50 As the elements of Group 1 on the Periodic Table are considered in order of increasing atomic radius, the ionization energy of each successive element generally

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

Part B–2

Answer all questions in this part.

Directions (51–64): Record your answers in the spaces provided in your answer booklet. Some questions may require the use of the *Reference Tables for Physical Setting/Chemistry.*

Base your answers to questions 51 through 53 on the balanced chemical equation below.

$$2 \, H_2O \rightarrow 2 \, H_2 + O_2$$
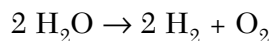
51 What type of reaction does this equation represent?   [1]

52 How does the balanced chemical equation show the Law of Conservation of Mass?   [1]

53 What is the total number of moles of O_2 produced when 8 moles of H_2O is completely consumed?   [1]

Base your answers to questions 54 and 55 on the unbalanced redox reaction below.

$$Cu(s) + AgNO_3(aq) \rightarrow Cu(NO_3)_2(aq) + Ag(s)$$
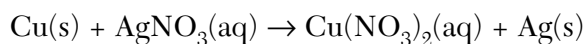
54 Write the reduction half-reaction.   [1]

55 Balance the redox equation *in your answer booklet,* using the smallest whole-number coefficients.   [1]

Base your answers to questions 56 through 58 on the information below.

A student titrates 60.0 mL of $HNO_3(aq)$ with 0.30 M $NaOH(aq)$. Phenolphthalein is used as the indicator. After adding 42.2 mL of $NaOH(aq)$, a color change remains for 25 seconds, and the student stops the titration.

56 What color change does phenolphthalein undergo during this titration?   [1]

57 In the space provided *in your answer booklet,* show a correct numerical setup for calculating the molarity of the $HNO_3(aq)$.   [1]

58 According to the data, how many significant figures should be present in the calculated molarity of the $HNO_3(aq)$?   [1]

Base your answers to questions 59 through 61 on the data table below, which shows three isotopes of neon.

Isotope	Atomic Mass (atomic mass units)	Percent Natural Abundance
^{20}Ne	19.99	90.9%
^{21}Ne	20.99	0.3%
^{22}Ne	21.99	8.8%

59 In terms of *atomic particles,* state one difference between these three isotopes of neon. [1]

60 Based on the atomic masses and the natural abundances shown in the data table, in the space provided *in your answer booklet,* show a correct numerical setup for calculating the average atomic mass of neon. [1]

61 Based on natural abundances, the average atomic mass of neon is closest to which whole number? [1]

_____

62 Based on the Periodic Table, explain why Na and K have similar chemical properties. [1]

63 In the space to the right of the reactants and arrow provided *in your answer booklet,* draw the structural formula for the product of the reaction shown. [1]

64 Given the nuclear equation:

$$^{58}_{29}Cu \rightarrow {}^{58}_{28}Ni + X$$
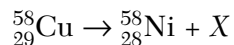
What nuclear particle is represented by X? [1]

_____

Part C

Answer all questions in this part.

Directions (65–85): Record your answers in the spaces provided in your answer booklet. Some questions may require the use of the *Reference Tables for Physical Setting/Chemistry.*

Base your answers to questions 65 through 67 on the information and equation below.

Antacids can be used to neutralize excess stomach acid. Brand *A* antacid contains the acid-neutralizing agent magnesium hydroxide, $Mg(OH)_2$. It reacts with $HCl(aq)$ in the stomach, according to the following balanced equation:

$$2\ HCl(aq) + Mg(OH)_2(s) \rightarrow MgCl_2(aq) + 2\ H_2O(\ell)$$
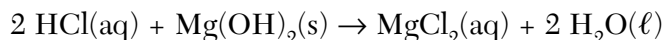
65 In the space provided *in your answer booklet,* show a correct numerical setup for calculating the number of moles of $Mg(OH)_2$ (gram-formula mass = 58.3 grams/mole) in an 8.40-gram sample. [1]

66 If a person produces 0.050 mole of excess HCl in the stomach, how many moles of $Mg(OH)_2$ are needed to neutralize this excess hydrochloric acid? [1]

67 Brand *B* antacid contains the acid-neutralizing agent sodium hydrogen carbonate. Write the chemical formula for sodium hydrogen carbonate. [1]

Base your answers to questions 68 through 70 on the information below.

Naphthalene, a nonpolar substance that sublimes at room temperature, can be used to protect wool clothing from being eaten by moths.

68 Explain, in terms of *intermolecular forces,* why naphthalene sublimes. [1]

69 Explain why naphthalene is *not* expected to dissolve in water. [1]

70 The empirical formula for naphthalene is C_5H_4 and the molecular mass of naphthalene is 128 grams/mole. What is the molecular formula for naphthalene? [1]

Base your answers to questions 71 through 74 on the data table below, which shows the solubility of a solid solute.

The Solubility of the Solute at Various Temperatures

Temperature (°C)	Solute per 100 g of H_2O(g)
0	18
20	20
40	24
60	29
80	36
100	49

71 On the grid provided *in your answer booklet,* mark an appropriate scale on the axis labeled "Solute per 100 g of H_2O(g)." An appropriate scale is one that allows a trend to be seen. [1]

72 On the same grid, plot the data from the data table. Circle and connect the points. [1]

Example:

73 Based on the data table, if 15 grams of solute is dissolved in 100 grams of water at 40°C, how many *more* grams of solute can be dissolved in this solution to make it saturated at 40°C? [1]

74 According to Reference Table G, how many grams of $KClO_3$ must be dissolved in 100 grams of H_2O at 10°C to produce a saturated solution? [1]

Base your answers to questions 75 through 78 on the information below.

A weather balloon has a volume of 52.5 liters at a temperature of 295 K. The balloon is released and rises to an altitude where the temperature is 252 K.

75 How does this temperature change affect the gas particle motion? [1]

76 The original pressure at 295 K was 100.8 kPa and the pressure at the higher altitude at 252 K is 45.6 kPa. Assume the balloon does not burst. In the space provided *in your answer booklet,* show a correct numerical setup for calculating the volume of the balloon at the higher altitude. [1]

77 What Celsius temperature is equal to 252 K? [1]

78 What pressure, in atmospheres (atm), is equal to 45.6 kPa? [1]

Base your answers to questions 79 and 80 on the information and equation below.

Human blood contains dissolved carbonic acid, H_2CO_3, in equilibrium with carbon dioxide and water. The equilibrium system is shown below.

$$H_2CO_3(aq) \rightleftharpoons CO_2(aq) + H_2O(\ell)$$

79 Explain, using LeChatelier's principle, why decreasing the concentration of CO_2 decreases the concentration of H_2CO_3. [1]

80 What is the oxidation number of carbon in $H_2CO_3(aq)$? [1]

Base your answers to questions 81 through 84 on the information below.

A safe level of fluoride ions is added to many public drinking water supplies. Fluoride ions have been found to help prevent tooth decay. Another common source of fluoride ions is toothpaste. One of the fluoride compounds used in toothpaste is tin(II) fluoride.
A town located downstream from a chemical plant was concerned about fluoride ions from the plant leaking into its drinking water. According to the Environmental Protection Agency, the fluoride ion concentration in drinking water cannot exceed 4 ppm. The town hired a chemist to analyze its water. The chemist determined that a 175-gram sample of the town's water contains 0.000 250 gram of fluoride ions.

81 In the box provided *in your answer booklet,* draw a Lewis electron-dot diagram for a fluoride ion. [1]

82 What is the chemical formula for tin(II) fluoride? [1]

83 How many parts per million of fluoride ions are present in the analyzed sample? [1]

84 Is the town's drinking water safe to drink? Support your decision using information in the passage and your calculated fluoride level in question 83. [1]

85 A plan is being developed for an experiment to test the effect of concentrated strong acids on a metal surface protected by various coatings. Some safety precautions would be the wearing of chemical safety goggles, an apron, and gloves. State one additional safety precaution that should be included in the plan. [1]

Tear Here

Tear Here

Tear Here

PHYSICAL SETTING
CHEMISTRY

Wednesday, June 23, 2004 — 9:15 a.m. to 12:15 p.m., only

ANSWER BOOKLET

Student . . . .   Sex: ☐ Male
☐ Female

Teacher . . . .

School . . . .   Grade . . . .

Answer all questions in Part B–2 and Part C. Record your answers in this booklet.

Part	Maximum Score	Student's Score
A	33	
B–1	17	
B–2	14	
C	21	

Total Written Test Score
(Maximum Raw Score: 85)

Final Score
(from conversion chart)

Raters' Initials:

Rater 1 . . . . Rater 2 . . . .

Part B–2

For Raters Only

51 _____   51 ☐

52 _____

_____   52 ☐

_____

53 _____ **mol**   53 ☐

54 _____   54 ☐

55 _____ **Cu(s) +** _____ **AgNO₃(aq) →** _____ **Cu(NO₃)₂(aq) +** _____ **Ag(s)**   55 ☐

$$\_\_\_\_\_ \; Cu(s) + \_\_\_\_\_ \; AgNO_3(aq) \rightarrow \_\_\_\_\_ \; Cu(NO_3)_2(aq) + \_\_\_\_\_ \; Ag(s)$$

56 _____ **to** _____   **56** ☐

57   **57** ☐

58 _____   **58** ☐

59 _____   **59** ☐

60   **60** ☐

61 _____   **61** ☐
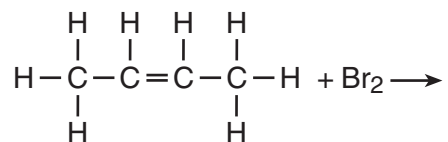
62 _____

_____

_____

63

H—C—C=C—C—H + Br$_2$ ⟶

(with H atoms bonded above and below each carbon)

64 _____

Part C

65

66 _____ **mol**

67 _____

[3]

68 _____

_____

_____

68 ☐

69 _____

_____

_____

69 ☐

70 _____

70 ☐

71 and 72

Solubility Curve

Solute per 100 g of H$_2$O(g)

0   10   20   30   40   50   60   70   80   90   100

Temperature (°C)

73 _____ **g**

74 _____ **g**

75 _____

_____

75 ☐

76

76 ☐

77 _____ **°C**

77 ☐

78 _____ **atm**

78 ☐

79 _____

_____

79 ☐

_____

80 _____

80 ☐
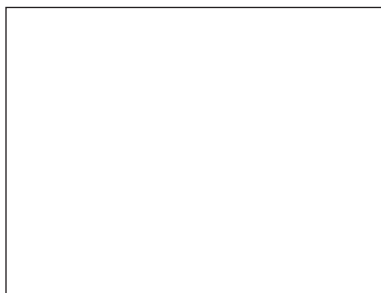
81

82 _____

83 _____ **ppm**

84 _____

_____

_____

85 _____

_____

FOR TEACHERS ONLY

PS–CH   PHYSICAL SETTING/CHEMISTRY

SCORING KEY AND RATING GUIDE

Directions to the Teacher:

Refer to the directions on page 3 before rating student papers.

Updated information regarding the rating of this examination may be posted on the New York State Education Department's web site during the rating period. Visit the site http://www.emsc.nysed.gov/osa/ and select the link "Latest Information" for any recently posted information regarding this examination. This site should be checked before the rating process for this examination begins and at least one more time before the final scores for the examination are recorded.

Part A and Part B–1
Allow 1 credit for each correct response.

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

Directions to the Teacher

Follow the procedures below for scoring student answer papers for the Physical Setting/Chemistry examination. Additional information about scoring is provided in the publication *Information Booklet for Administering and Scoring Regents Examinations in the Sciences*.

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

On the detachable answer sheet for Part A and Part B–1, indicate by means of a checkmark each incorrect or omitted answer. In the box provided at the end of each part, record the number of questions the student answered correctly for that part.

At least two science teachers must participate in the scoring of each student's responses to the Part B–2 and Part C open-ended questions. Each of these teachers should be responsible for scoring a selected number of the open-ended questions on each answer paper. No one teacher is to score all the open-ended questions on a student's answer paper.

Students' responses must be scored strictly according to the Scoring Key and Rating Guide. For open-ended questions, credit may be allowed for responses other than those given in the rating guide if the response is a scientifically accurate answer to the question and demonstrates adequate knowledge as indicated by the examples in the rating guide. Complete sentences are *not* required. Phrases, diagrams, and symbols may be used. In the student's answer booklet, record the number of credits earned for each answer in the box printed to the right of the answer lines or spaces for that question.

Fractional credit is *not* allowed. Only whole-number credit may be given to a response. Units need not be given when the wording of the questions allows such omissions.

Raters should enter the scores earned for Part A, Part B–1, Part B–2, and Part C on the appropriate lines in the box printed on the answer booklet and then should add these four scores and enter the total in the box labeled "Total Written Test Score." Then, the student's raw score should be converted to a scaled score by using the conversion chart that will be posted on the Department's web site http://www.emsc.nysed.gov/osa/ on Wednesday, June 23, 2004. The student's scaled score should be entered in the labeled box on the student's answer booklet. The scaled score is the student's final examination score.

All student answer papers that receive a scaled score of 60 through 64 **must** be scored a second time. For the second scoring, a different committee of teachers may score the student's paper or the original committee may score the paper, except that no teacher may score the same open-ended questions that he/she scored in the first rating of the paper. The school principal is responsible for assuring that the student's final examination score is based on a fair, accurate, and reliable scoring of the student's answer paper.

Because scaled scores corresponding to raw scores in the conversion chart may change from one examination to another, it is crucial that for each administration, the conversion chart provided in the scoring key for that administration be used to determine the student's final score. The chart in this scoring key is usable only for this administration of the examination.

Part B–2

Allow a total of 14 credits for this part. The student must answer all questions in this part.

51   [1] Allow 1 credit for a correct response. Acceptable responses include, but are not limited to, these examples:

decomposition

analysis

redox

endothermic

electrolysis

52   [1] Allow 1 credit for a correct response. Acceptable responses include, but are not limited to, these examples:

4 H and 2 O on both sides

4 H = 4 H and 2 O = 2 O

same number of each element on both sides

53   [1] Allow 1 credit for **4**.

54   [1] Allow 1 credit for a correct response. Acceptable responses include, but are not limited to, these examples:

$Ag^+ + e^- \rightarrow Ag$

$2\,Ag^+ + 2e^- \rightarrow 2\,Ag$

55   [1] Allow 1 credit for _____ $Cu(s)$ + __**2**__ $AgNO_3(aq) \rightarrow$ _____ $Cu(NO_3)_2(aq)$ + __**2**__ $Ag(s)$.

Allow credit even if the coefficient "1" is written in front of $Cu(s)$ and $Cu(NO_3)_2(aq)$.

56   [1] Allow 1 credit for a correct response. Acceptable responses include, but are not limited to, these examples:

colorless to pink

no color to red

57   [1] Allow 1 credit for a correct numerical setup. Acceptable responses include, but are not limited to, these examples:

$$\frac{(0.30 \text{ M})(42.2 \text{ mL})}{60.0 \text{ mL}}$$

$(x)(60) = (.3)(42.2)$

58   [1] Allow 1 credit for **2**.

59   [1] Allow 1 credit for a correct response. Acceptable responses include, but are not limited to, these examples:

Each isotope has a different number of neutrons.

different number of neutrons

Ne-22 has two more neutrons than Ne-20 and one more neutron than Ne-21.

60   [1] Allow 1 credit for a correct numerical setup. Acceptable responses include, but are not limited to, these examples:

$(0.909)(19.99) + (0.003)(20.99) + (0.088)(21.99)$

$(90.9\%)(19.99) + (0.3\%)(20.99) + (8.8\%)(21.99)$

$$\frac{(90.9)(19.99) + (0.3)(20.99) + (8.8)(21.99)}{100}$$

61   [1] Allow 1 credit for **20**.

62   [1] Allow 1 credit for a correct response. Acceptable responses include, but are not limited to, these examples:

They have the same number of valence electrons.

form 1^+ ions

are located in same group

both alkali metals

63 [1] Allow 1 credit for a correct response. Acceptable responses include, but are not limited to, these examples:

$$
\begin{array}{ccccccc}
& H & & H & & H & & H \\
& | & & | & & | & & | \\
H- & C & - & C & - & C & - & C & -H \\
& | & & | & & | & & | \\
& H & & Br & & Br & & H
\end{array}
$$

$$
\begin{array}{ccccccc}
& & & Br & & & & \\
& | & & | & & | & & | \\
- & C & - & C & - & C & - & C & - \\
& | & & | & & | & & | \\
& & & & & Br & &
\end{array}
$$

$$
\begin{array}{ccccc}
CH_3 & - & CH & - & CH & - & CH_3 \\
& & | & & | & & \\
& & Br & & Br & &
\end{array}
$$

$CH_3CHBrCHBrCH_3$

64 [1] Allow 1 credit for $_{+1}^{0}e$ or $_{+1}^{0}\beta$ or β^{+} or **positron**.

Part C

Allow a total of 21 credits for this part. The student must answer all questions in this part.

65 [1] Allow 1 credit for a correct numerical setup. Acceptable responses include, but are not limited to, these examples:

$$8.40 \text{ g} \times \frac{1 \text{ mole}}{58.3 \text{ g}} =$$

$$\frac{8.4}{58.3}$$

66 [1] Allow 1 credit for **0.025**.

67 [1] Allow 1 credit for **NaHCO$_3$**.

68 [1] Allow 1 credit for a correct response. Acceptable responses include, but are not limited to, these examples:

Naphthalene has weak intermolecular forces.

They are weak.

69 [1] Allow 1 credit for a correct response. Acceptable responses include, but are not limited to, these examples:

Naphthalene is nonpolar; water is polar.

Nonpolar won't dissolve in polar.

Like dissolves like.

70 [1] Allow 1 credit for a correct response. Acceptable responses include, but are not limited to, these examples:

C$_{10}$H$_8$

H$_8$C$_{10}$

[OVER]

71 and 72 An example of a correct response is shown below.

Solubility Curve
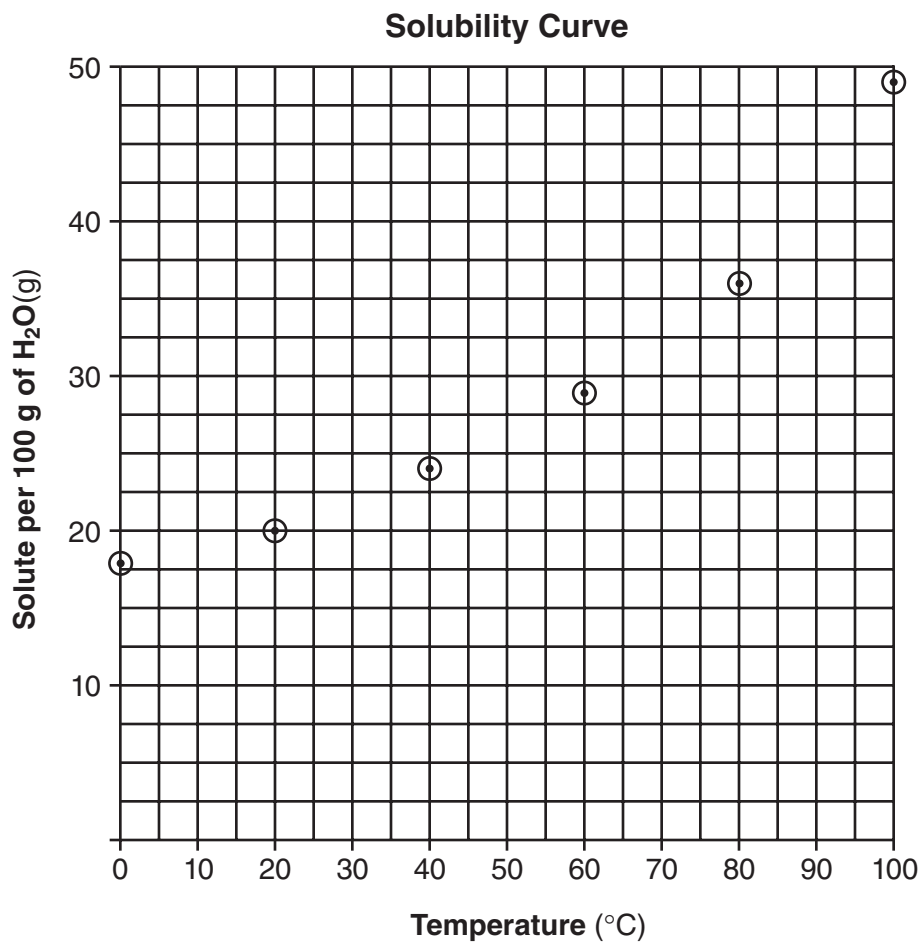
71 [1] Allow 1 credit for marking an appropriate scale. An appropriate scale is one that allows a trend to be seen.

72 [1] Allow 1 credit for plotting all the points correctly (±0.3 grid space). Plotted points do *not* need to be circled or connected.

73 [1] Allow 1 credit for **9**.

74 [1] Allow 1 credit for a response in the range of 6–8.

75   [1] Allow 1 credit for a correct response. Acceptable responses include, but are not limited to, these examples:

Particles move slower.

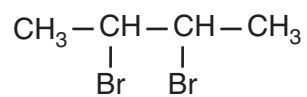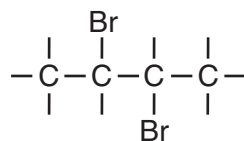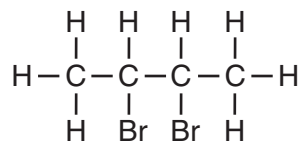The molecules will slow down as the temperature decreases.

The average kinetic energy of the particles decreases.

decreases

76   [1] Allow 1 credit for a correct numerical setup. Acceptable responses include, but are not limited to, these examples:

$$\frac{(100.8 \text{ kPa})(52.5 \text{ L})}{(295 \text{ K})} = \frac{(45.6 \text{ kPa})(X)}{(252 \text{ K})}$$

$$52.5 \times \frac{252}{295} \times \frac{100.8}{45.6}$$

77   [1] Allow 1 credit for **–21**.

78   [1] Allow 1 credit for **.45** or **0.45**. Significant figures do *not* need to be shown.

79   [1] Allow 1 credit for a correct response. Acceptable responses include, but are not limited to, these examples:

Removing CO_2 disrupts equilibrium and thus the system must shift to create more CO_2 from the H_2CO_3 in order to restore equilibrium.

Equilibrium shifts to the right.

H_2CO_3 decreases to remove the stress of changing the CO_2.

80   [1] Allow 1 credit for **+4** or **4**.

81   [1] Allow 1 credit for a correct response. Brackets do *not* need to be shown. Acceptable responses include, but are not limited to, this example:

[OVER]

82 [1] Allow 1 credit for **SnF$_2$**.

83 [1] Allow 1 credit for **1.43**. Significant figures do *not* need to be shown.

84 [1] Allow 1 credit for a correct response. Acceptable responses include, but are not limited to, these examples:

> The water has a fluoride level of 1.43 ppm, which is below the maximum contaminant level for fluoride, so it is safe to drink.

> F$^-$ below 4 ppm, safe, below max level

> Safe: 1.43 ppm < 4 ppm

or

Allow 1 credit for a response consistent with the student's answer to question 83.

85 [1] Allow 1 credit for a correct response. Acceptable responses include, but are not limited to, these examples:

> Perform tests under ventilation (fume) hood.

> Avoid spills.

> no open-toed shoes

The *Chart for Determining the Final Examination Score for the June 2004 Regents Examination in Physical Setting/Chemistry* will be posted on the Department's web site http://www.emsc.nysed.gov/osa/ on Wednesday, June 23, 2004. Conversion charts provided for previous administrations of the Regents Examination in Physical Setting/Chemistry must NOT be used to determine students' final scores for this administration.

Map to Core Curriculum

June 2004 Physical Setting/ Chemistry			
Question Numbers			
Key Ideas	Part A	Part B	Part C
Standard 1			
Math Key Idea 1		58	71,72,77,78
Math Key Idea 2			
Math Key Idea 3			
Sci. Inq. Key Idea 1		52,62	
Sci. Inq. Key Idea 2			85
Sci. Inq. Key Idea 3		41,49,61	67,74,80,82
Eng. Des. Key Idea 1			
Standard 2			
Key Idea 1		41,49	
Key Idea 2			
Standard 6			
Key Idea 1			
Key Idea 2			
Key Idea 3			
Key Idea 4			
Key Idea 5			
Standard 7			
Key Idea 1			84
Key Idea 2			
Standard 4 Process Skills			
Key Idea 3		34,35,36,37,38, 42,43,44,45,46, 47,48,50,51,53, 54,55,56,57,59, 60,63	65,66,69,70,73, 74,75,76,79,83
Key Idea 4		40,49,64	
Key Idea 5		39,41	68,81
Standard 4			
Key Idea 3	1,2,3,4,5,6,7,8, 14,16,18,19,20, 21,22,23,24,25, 26,27,28,29,30, 31,33	34,35,36,37,38, 42,43,44,45,46, 47,48,50,51,52, 53,54,55,56,57, 58,59,60,61,62, 63	65,66,67,69,70, 71,72,73,74,75, 76,78,79,80,82, 83,84,85
Key Idea 4	15	40,49,64	77
Key Idea 5	9,10,11,12,13, 17,32	34,39,41	68,81
Reference Tables			
2002 Edition	2,4,5,8,10,11, 13,23,24,25,26, 31	34,35,37,39,41, 48,49,50,54,56, 57	67,74,76,77,78, 80,81,82,83

Regents Examination in Physical Setting / Chemistry
June 2004

Chart for Converting Total Test Raw Scores to
Final Examination Scores (Scaled Scores)

Raw Score	Scaled Score	Raw Score	Scaled Score	Raw Score	Scaled Score	Raw Score	Scaled Score
85	100	63	74	41	58	19	35
84	98	62	73	40	57	18	34
83	97	61	73	39	56	17	33
82	95	60	72	38	55	16	31
81	94	59	71	37	55	15	30
80	93	58	70	36	54	14	28
79	91	57	69	35	53	13	26
78	90	56	69	34	52	12	25
77	89	55	68	33	51	11	23
76	87	54	67	32	50	10	21
75	86	53	66	31	49	9	19
74	85	52	66	30	48	8	17
73	84	51	65	29	47	7	15
72	83	50	64	28	46	6	13
71	82	49	64	27	45	5	11
70	81	48	63	26	44	4	9
69	80	47	62	25	43	3	7
68	79	46	61	24	42	2	5
67	78	45	61	23	41	1	2
66	77	44	60	22	39	0	0
65	76	43	59	21	38		
64	75	42	58	20	37		

To determine the student's final examination score, find the student's total test raw score in the column labeled "Raw Score" and then locate the scaled score that corresponds to that raw score. The scaled score is the student's final examination score. Enter this score in the space labeled "Final Score" on the student's answer sheet.

All student answer papers that receive a scaled score of 60 through 64 **must** be scored a second time. For the second scoring, a different committee of teachers may score the student's paper or the original committee may score the paper, except that no teacher may score the same open-ended questions that he/she scored in the first rating of the paper. The school principal is responsible for assuring that the student's final examination score is based on a fair, accurate and reliable scoring of the student's answer paper.

Because scaled scores corresponding to raw scores in the conversion chart may change from one examination to another, it is crucial that for each administration, the conversion chart provided for that administration be used to determine the student's final score. The chart above is usable only for this administration of the physical setting / chemistry examination.