

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

# PHYSICAL SETTING CHEMISTRY

Thursday, January 24, 2008 — 1:15 to 4:15 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 you to use while taking this examination.

The use of any communications device is strictly prohibited when taking this examination. If you use any communications device, no matter how briefly, your examination will be invalidated and no score will be calculated for you.

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

## Part A

### Answer all questions in this part.

*Directions (1–30):* 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*.

- Which quantity identifies an element?
  - atomic number
  - mass number
  - total number of neutrons in an atom of the element
  - total number of valence electrons in an atom of the element
- Which atom in the ground state has a partially filled second electron shell?
  - hydrogen atom
  - lithium atom
  - potassium atom
  - sodium atom
- What is the total charge of the nucleus of a nitrogen atom?
  - +5
  - +2
  - +7
  - +14
- Which value of an element is calculated using both the mass and the relative abundance of each of the naturally occurring isotopes of this element?
  - atomic number
  - atomic mass
  - half-life
  - molar volume
- The mass of 12 protons is approximately equal to
  - 1 atomic mass unit
  - 12 atomic mass units
  - the mass of 1 electron
  - the mass of 12 electrons
- Sodium atoms, potassium atoms, and cesium atoms have the same
  - atomic radius
  - first ionization energy
  - total number of protons
  - oxidation state
- Which statement describes a chemical property of hydrogen gas?
  - Hydrogen gas burns in air.
  - Hydrogen gas is colorless.
  - Hydrogen gas has a density of  $0.000\ 09\ \text{g/cm}^3$  at STP.
  - Hydrogen gas has a boiling point of  $20\ \text{K}$  at standard pressure.
- Which element has the greatest density at STP?
  - calcium
  - carbon
  - chlorine
  - copper
- Which equation shows conservation of atoms?
  - $\text{H}_2 + \text{O}_2 \rightarrow \text{H}_2\text{O}$
  - $\text{H}_2 + \text{O}_2 \rightarrow 2\text{H}_2\text{O}$
  - $2\text{H}_2 + \text{O}_2 \rightarrow 2\text{H}_2\text{O}$
  - $2\text{H}_2 + 2\text{O}_2 \rightarrow 2\text{H}_2\text{O}$
- Which term indicates how strongly an atom attracts the electrons in a chemical bond?
  - alkalinity
  - atomic mass
  - electronegativity
  - activation energy
- A solid substance is an excellent conductor of electricity. The chemical bonds in this substance are most likely
  - ionic, because the valence electrons are shared between atoms
  - ionic, because the valence electrons are mobile
  - metallic, because the valence electrons are stationary
  - metallic, because the valence electrons are mobile

- 12 Magnesium nitrate contains chemical bonds that are
- (1) covalent, only
  - (2) ionic, only
  - (3) both covalent and ionic
  - (4) neither covalent nor ionic
- 13 Which substance can be broken down by a chemical change?
- (1) antimony
  - (2) carbon
  - (3) hexane
  - (4) sulfur
- 14 Which barium salt is *insoluble* in water?
- (1) BaCO<sub>3</sub>
  - (2) BaCl<sub>2</sub>
  - (3) Ba(ClO<sub>4</sub>)<sub>2</sub>
  - (4) Ba(NO<sub>3</sub>)<sub>2</sub>
- 15 Which unit can be used to express solution concentration?
- (1) J/mol
  - (2) L/mol
  - (3) mol/L
  - (4) mol/s
- 16 Under which conditions of temperature and pressure is a gas most soluble in water?
- (1) high temperature and low pressure
  - (2) high temperature and high pressure
  - (3) low temperature and low pressure
  - (4) low temperature and high pressure
- 17 Given the equation representing a system at equilibrium:
- $$\text{H}_2\text{O}(s) \rightleftharpoons \text{H}_2\text{O}(\ell)$$
- At which temperature does this equilibrium exist at 101.3 kilopascals?
- (1) 0 K
  - (2) 0°C
  - (3) 32 K
  - (4) 273°C
- 18 In a redox reaction, the total number of electrons lost is
- (1) less than the total number of electrons gained
  - (2) greater than the total number of electrons gained
  - (3) equal to the total number of electrons gained
  - (4) equal to the total number of protons gained
- 19 Which formula represents an alkene?
- (1) C<sub>2</sub>H<sub>6</sub>
  - (2) C<sub>3</sub>H<sub>6</sub>
  - (3) C<sub>4</sub>H<sub>10</sub>
  - (4) C<sub>5</sub>H<sub>12</sub>
- 20 Which term refers to the difference between the potential energy of the products and the potential energy of the reactants for any chemical change?
- (1) heat of deposition
  - (2) heat of fusion
  - (3) heat of reaction
  - (4) heat of vaporization
- 21 Which energy conversion occurs in a voltaic cell?
- (1) chemical energy to electrical energy
  - (2) chemical energy to nuclear energy
  - (3) electrical energy to chemical energy
  - (4) nuclear energy to electrical energy
- 22 Which metal is more active than Ni and *less* active than Zn?
- (1) Cu
  - (2) Cr
  - (3) Mg
  - (4) Pb
- 23 As water is added to a 0.10 M NaCl aqueous solution, the conductivity of the resulting solution
- (1) decreases because the concentration of ions decreases
  - (2) decreases, but the concentration of ions remains the same
  - (3) increases because the concentration of ions decreases
  - (4) increases, but the concentration of ions remains the same
- 24 Which substance is an Arrhenius acid?
- (1) Ba(OH)<sub>2</sub>
  - (2) CH<sub>3</sub>COOCH<sub>3</sub>
  - (3) H<sub>3</sub>PO<sub>4</sub>
  - (4) NaCl
- 25 Which compound releases hydroxide ions in an aqueous solution?
- (1) CH<sub>3</sub>COOH
  - (2) CH<sub>3</sub>OH
  - (3) HCl
  - (4) KOH

- 26 Which reaction converts an atom of one element to an atom of another element?  
(1) combustion                      (3) saponification  
(2) polymerization                (4) transmutation
- 27 Which nuclear emission has the greatest mass?  
(1) alpha particle                    (3) gamma ray  
(2) beta particle                     (4) positron
- 28 Which two radioisotopes have the same decay mode?  
(1)  $^{37}\text{Ca}$  and  $^{53}\text{Fe}$                 (3)  $^{37}\text{K}$  and  $^{42}\text{K}$   
(2)  $^{220}\text{Fr}$  and  $^{60}\text{Co}$                 (4)  $^{99}\text{Tc}$  and  $^{19}\text{Ne}$
- 29 Which list of nuclear emissions is arranged in order from the *least* penetrating power to the greatest penetrating power?  
(1) alpha particle, beta particle, gamma ray  
(2) alpha particle, gamma ray, beta particle  
(3) gamma ray, beta particle, alpha particle  
(4) beta particle, alpha particle, gamma ray
- 30 One benefit of nuclear fission reactions is  
(1) nuclear reactor meltdowns  
(2) storage of waste materials  
(3) biological exposure  
(4) production of energy
-

Part B-1

Answer all questions in this part.

Directions (31–50): 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*.

31 Which list of elements consists of metalloids, only?

- (1) B, Al, Ga                      (3) O, S, Se  
(2) C, N, P                        (4) Si, Ge, As

32 Which two notations represent different isotopes of the same element?

- (1)  ${}^6_4\text{Be}$  and  ${}^9_4\text{Be}$               (3)  ${}^{14}_7\text{N}$  and  ${}^{14}_6\text{C}$   
(2)  ${}^7_3\text{Li}$  and  ${}^7_3\text{Li}$               (4)  ${}^{32}_{15}\text{P}$  and  ${}^{32}_{16}\text{S}$

33 Which general trend is found in Period 2 on the Periodic Table as the elements are considered in order of increasing atomic number?

- (1) decreasing atomic mass  
(2) decreasing electronegativity  
(3) increasing atomic radius  
(4) increasing first ionization energy

34 What is the gram-formula mass of  $\text{Ca}_3(\text{PO}_4)_2$ ?

- (1) 248 g/mol                      (3) 279 g/mol  
(2) 263 g/mol                      (4) 310. g/mol

35 What is the total number of pairs of electrons shared between the carbon atom and the oxygen atom in a molecule of methanal?

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

36 When sodium and fluorine combine to produce the compound NaF, the ions formed have the same electron configuration as atoms of

- (1) argon, only  
(2) neon, only  
(3) both argon and neon  
(4) neither argon nor neon

37 In which compound is the ratio of metal ions to nonmetal ions 1 to 2?

- (1) calcium bromide              (3) calcium phosphide  
(2) calcium oxide                (4) calcium sulfide

38 What is the concentration of  $\text{O}_2(\text{g})$ , in parts per million, in a solution that contains 0.008 gram of  $\text{O}_2(\text{g})$  dissolved in 1000. grams of  $\text{H}_2\text{O}(\ell)$ ?

- (1) 0.8 ppm                        (3) 80 ppm  
(2) 8 ppm                         (4) 800 ppm

39 The table below shows data for the temperature, pressure, and volume of four gas samples.

Data for Four Gas Samples

Gas Sample	Temperature (K)	Pressure (atm)	Volume (mL)
A	100.	2	400.
B	200.	2	200.
C	100.	2	400.
D	200.	4	200.

Which two gas samples have the same total number of molecules?

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

40 At which temperature is the vapor pressure of ethanol equal to the vapor pressure of propanone at  $35^\circ\text{C}$ ?

- (1)  $35^\circ\text{C}$                         (3)  $82^\circ\text{C}$   
(2)  $60.^\circ\text{C}$                         (4)  $95^\circ\text{C}$

- 41 A rigid cylinder with a movable piston contains a 2.0-liter sample of neon gas at STP. What is the volume of this sample when its temperature is increased to 30.°C while its pressure is decreased to 90. kilopascals?
- (1) 2.5 L (3) 1.6 L  
(2) 2.0 L (4) 0.22 L
- 42 Which compound is a saturated hydrocarbon?
- (1) CH<sub>2</sub>CH<sub>2</sub> (3) CH<sub>3</sub>CHO  
(2) CH<sub>3</sub>CH<sub>3</sub> (4) CH<sub>3</sub>CH<sub>2</sub>OH
- 43 A molecule of a compound contains a total of 10 hydrogen atoms and has the general formula C<sub>n</sub>H<sub>2n+2</sub>. Which prefix is used in the name of this compound?
- (1) but- (3) oct-  
(2) dec- (4) pent-
- 44 Reduction occurs at the cathode in
- (1) electrolytic cells, only  
(2) voltaic cells, only  
(3) both electrolytic cells and voltaic cells  
(4) neither electrolytic cells nor voltaic cells
- 45 What are the products of a reaction between KOH(aq) and HCl(aq)?
- (1) H<sub>2</sub> and KClO (3) KH and HClO  
(2) H<sub>2</sub>O and KCl (4) KOH and HCl
- 46 Which volume of 0.10 M NaOH(aq) exactly neutralizes 15.0 milliliters of 0.20 M HNO<sub>3</sub>(aq)?
- (1) 1.5 mL (3) 3.0 mL  
(2) 7.5 mL (4) 30. mL
- 47 Which indicator, when added to a solution, changes color from yellow to blue as the pH of the solution is changed from 5.5 to 8.0?
- (1) bromcresol green (3) litmus  
(2) bromthymol blue (4) methyl orange
- 48 The pH of an aqueous solution changes from 4 to 3 when the hydrogen ion concentration in the solution is
- (1) decreased by a factor of  $\frac{3}{4}$   
(2) decreased by a factor of 10  
(3) increased by a factor of  $\frac{4}{3}$   
(4) increased by a factor of 10
- 49 Which fraction of an original 20.00-gram sample of nitrogen-16 remains unchanged after 36.0 seconds?
- (1)  $\frac{1}{5}$  (3)  $\frac{1}{16}$   
(2)  $\frac{1}{8}$  (4)  $\frac{1}{32}$
- 50 Which radioactive isotope is used in treating cancer?
- (1) carbon-14 (3) lead-206  
(2) cobalt-60 (4) uranium-238

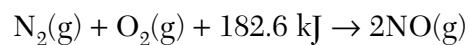
## Part B-2

### Answer all questions in this part.

*Directions (51–65):* 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*.

51 Describe *one* chemical property of Group 1 metals that results from the atoms of each metal having only one valence electron. [1]

52 Given the balanced equation representing a reaction:



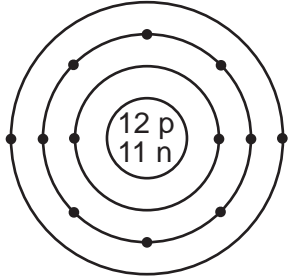
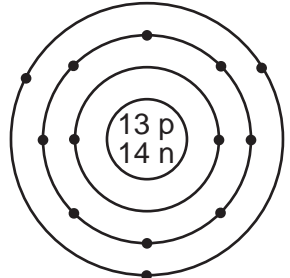
On the labeled axes *in your answer booklet*, draw a potential energy diagram for this reaction. [1]

53 Write *one* electron configuration for an atom of silicon in an excited state. [1]

54 Write the empirical formula for the compound  $\text{C}_8\text{H}_{18}$ . [1]

Base your answers to questions 55 through 57 on the information below.

### Atomic Diagrams of Magnesium and Aluminum

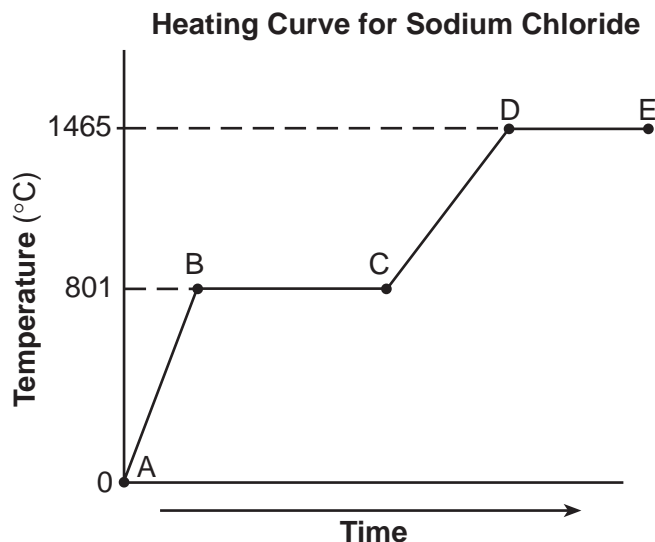
<b>Key</b> • = electron	<b>Element</b>	<b>Lewis Electron-Dot Diagram</b>	<b>Electron-Shell Diagram</b>
	magnesium	Mg:	
	aluminum	Al:	

- 55 Identify *one* piece of information shown in the electron-shell diagrams that is *not* shown in the Lewis electron-dot diagrams. [1]
- 56 Determine the mass number of the magnesium atom represented by the electron-shell diagram. [1]
- 57 Explain why Lewis electron-dot diagrams are generally more suitable than electron-shell diagrams for illustrating chemical bonding. [1]
-



Base your answers to questions 58 through 60 on the information below.

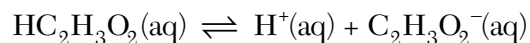
A 100.0-gram sample of NaCl(s) has an initial temperature of 0°C. A chemist measures the temperature of the sample as it is heated. Heat is *not* added at a constant rate. The heating curve for the sample is shown below.



- 58 Determine the temperature range over which the entire NaCl sample is a liquid. [1]
- 59 Identify *one* line segment on the curve where the average kinetic energy of the particles of the NaCl sample is changing. [1]
- 60 Identify *one* line segment on the curve where the NaCl sample is in a single phase and capable of conducting electricity. [1]
- 

Base your answers to questions 61 through 63 on the information below.

A beaker contains 100.0 milliliters of a dilute aqueous solution of ethanoic acid at equilibrium. The equation below represents this system.



- 61 Compare the rate of the forward reaction to the rate of the reverse reaction for this system. [1]
- 62 Describe what happens to the concentration of  $\text{H}^+(\text{aq})$  when 10 drops of concentrated  $\text{HC}_2\text{H}_3\text{O}_2(\text{aq})$  are added to this system. [1]
- 63 In the space *in your answer booklet*, draw a structural formula for ethanoic acid. [1]
-

Base your answers to questions 64 and 65 on the information below.

A solution is made by completely dissolving 90. grams of  $\text{KNO}_3(\text{s})$  in 100. grams of water in a beaker. The temperature of this solution is  $65^\circ\text{C}$ .

- 64 Describe the effect on the solubility of  $\text{KNO}_3(\text{s})$  in this solution when the pressure on the solution increases. [1]
- 65 Determine the total mass of  $\text{KNO}_3(\text{s})$  that settles to the bottom of the beaker when the original solution is cooled to  $15^\circ\text{C}$ . [1]
-

## Part C

### Answer all questions in this part.

*Directions (66–83):* 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 66 through 68 on the information below.

The compound 1,2-ethanediol can be mixed with water. This mixture is added to automobile radiators as an engine coolant. The cooling system of a small van contains 6690 grams of 1,2-ethanediol. Some properties of water and 1,2-ethanediol are given in the table below.

**Properties of Water and 1,2-ethanediol**

Property	Water (H <sub>2</sub> O)	1,2-ethanediol (CH <sub>2</sub> OHCH <sub>2</sub> OH)
gram-formula mass (g/mol)	18.0	62.0
boiling point at standard pressure (°C)	100.0	197.2

- 66 Identify the class of organic compounds to which 1,2-ethanediol belongs. [1]
- 67 State, in terms of molecular polarity, why 1,2-ethanediol is soluble in water. [1]
- 68 In the space *in your answer booklet*, calculate the total number of moles of 1, 2-ethanediol in the small van's cooling system. Your response must include *both* a correct numerical setup and the calculated result. [2]
- 

Base your answers to questions 69 through 71 on the information below.

“Hand Blasters” is a toy that consists of a set of two ceramic balls, each coated with a mixture of sulfur and potassium chlorate, KClO<sub>3</sub>. When the two balls are struck together, a loud popping noise is produced as sulfur and potassium chlorate react with each other.

- 69 Balance the equation *in your answer booklet* for the “Hand Blaster” reaction, using the smallest whole-number coefficients. [1]
- 70 Identify *one* source of the activation energy for this reaction. [1]
- 71 Determine the oxidation number of chlorine in the reactant that contains chlorine. [1]
-

Base your answers to questions 72 through 74 on the information below.

A laboratory worker filled a bottle with a hydrochloric acid solution. Another bottle was filled with methanol, while a third bottle was filled with a sodium hydroxide solution. However, the worker neglected to label each bottle. After a few days, the worker could not remember which liquid was in each bottle.

The worker needed to identify the liquid in each bottle. The bottles were labeled *A*, *B*, and *C*. Using materials found in the lab (indicators, conductivity apparatus, and pieces of Mg metal), the worker tested samples of liquid from each bottle. The test results are shown in the table below.

**Table of Tests and Results**

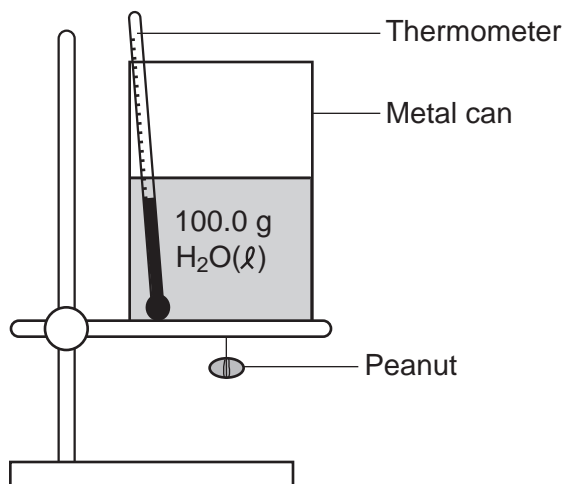
Test	Test Results		
	Bottle A	Bottle B	Bottle C
methyl orange indicator	yellow	yellow	yellow
bromthymol blue indicator	blue	green	yellow
electrical conductivity	conductor	nonconductor	conductor
reactivity with Mg metal	no reaction	no reaction	reaction

- 72 Using the test results, state how the worker differentiated the bottle that contained methanol from the other two bottles. [1]
- 73 The worker concluded that bottle *C* contained hydrochloric acid. Identify *one* test and state the corresponding test result that supports this conclusion. [1]
- 74 Explain, in terms of pH, why the methyl orange indicator test results were the same for each of the three liquids. [1]
-

Base your answers to questions 75 and 76 on the information below.

A student performed an experiment to determine the total amount of energy stored in a peanut. The accepted value for the energy content of a peanut is 30.2 kilojoules per gram.

The student measured 100.0 grams of water into a metal can and placed the can on a ring stand, as shown in the diagram below. The peanut was attached to a wire suspended under the can. The initial temperature of the water was recorded as 22.0°C. The peanut was ignited and allowed to burn. When the peanut finished burning, the final water temperature was recorded as 57.0°C. The student's experimental value for the energy content of this peanut was 25.9 kilojoules per gram.



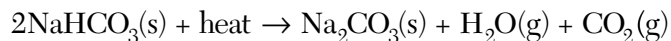
75 In the space *in your answer booklet*, calculate the total amount of heat absorbed by the water. Your response must include *both* a correct numerical setup and the calculated result. [2]

76 Determine the student's percent error for the energy content of this peanut. [1]

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Base your answers to questions 77 through 79 on the information below.

Some dry chemicals can be used to put out forest fires. One of these chemicals is NaHCO<sub>3</sub>. When NaHCO<sub>3</sub>(s) is heated, one of the products is CO<sub>2</sub>(g), as shown in the balanced equation below.



77 In the space *in your answer booklet*, show a correct numerical setup for calculating the percent composition by mass of carbon in the product Na<sub>2</sub>CO<sub>3</sub>. [1]

78 Identify the type of chemical reaction represented by this equation. [1]

79 Determine the total number of moles of CO<sub>2</sub>(g) produced when 7.0 moles of NaHCO<sub>3</sub>(s) is completely reacted. [1]

---

Base your answers to questions 80 and 81 on the information below.

In an investigation, a dripless wax candle is massed and then lighted. As the candle burns, a small amount of liquid wax forms near the flame. After 10 minutes, the candle's flame is extinguished and the candle is allowed to cool. The cooled candle is massed.

80 Identify *one* physical change that takes place in this investigation. [1]

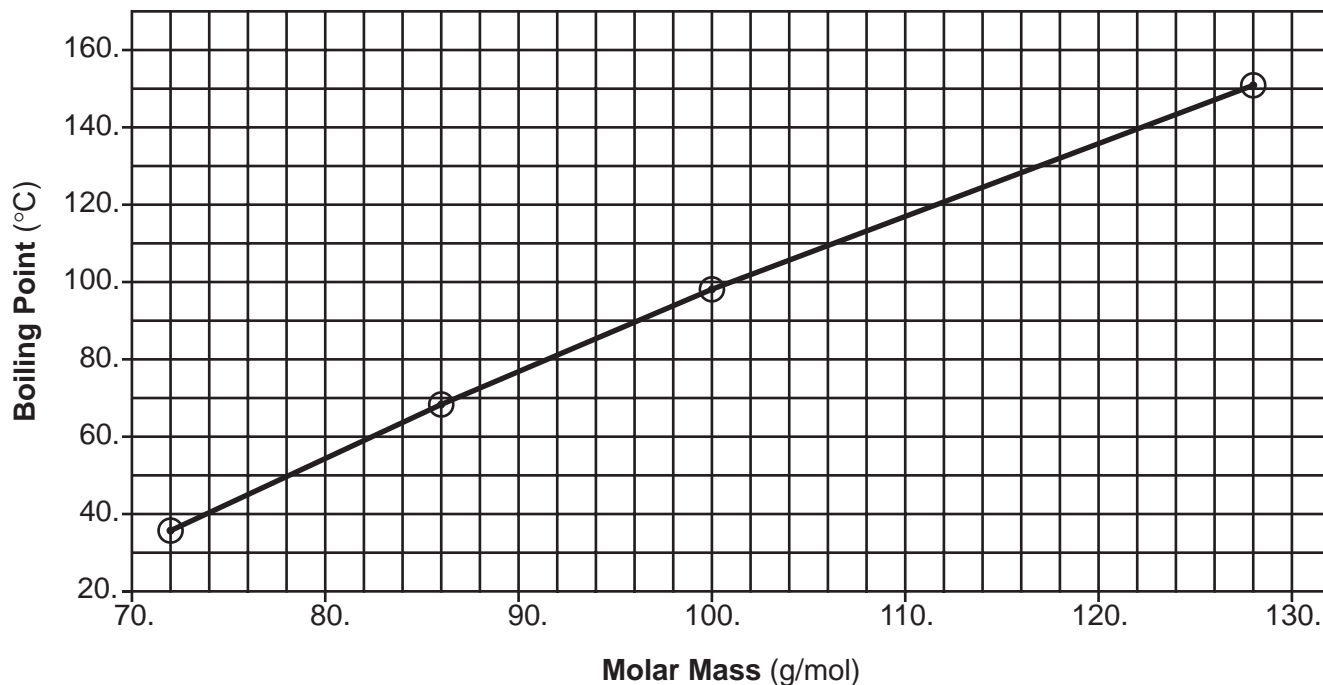
81 State *one* observation that indicates a chemical change has occurred in this investigation. [1]

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Base your answers to questions 82 and 83 on the information below.

The graph below shows the relationship between boiling point and molar mass at standard pressure for pentane, hexane, heptane, and nonane.

**Boiling Point Versus Molar Mass of Some Alkanes**



82 Octane has a molar mass of 114 grams per mole. According to this graph, what is the boiling point of octane at standard pressure? [1]

83 State the relationship between molar mass and the strength of intermolecular forces for the selected alkanes. [1]

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The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

PHYSICAL SETTING CHEMISTRY

Thursday, January 24, 2008 — 1:15 to 4:15 p.m., only

ANSWER SHEET

Student ..... Sex:  Male  Female Grade .....

Teacher ..... School .....

Record your answers to Part A and Part B-1 on this answer sheet.

Part A

- 1 ..... 11 ..... 21 .....
2 ..... 12 ..... 22 .....
3 ..... 13 ..... 23 .....
4 ..... 14 ..... 24 .....
5 ..... 15 ..... 25 .....
6 ..... 16 ..... 26 .....
7 ..... 17 ..... 27 .....
8 ..... 18 ..... 28 .....
9 ..... 19 ..... 29 .....
10 ..... 20 ..... 30 .....

Part A Score

[Box for Part A Score]

Part B-1

- 31 ..... 41 .....
32 ..... 42 .....
33 ..... 43 .....
34 ..... 44 .....
35 ..... 45 .....
36 ..... 46 .....
37 ..... 47 .....
38 ..... 48 .....
39 ..... 49 .....
40 ..... 50 .....

Part B-1 Score

[Box for Part B-1 Score]

Write your answers to Part B-2 and Part C in your answer booklet.

The declaration below should be signed when you have completed the examination.

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

Tear Here

# PHYSICAL SETTING CHEMISTRY

Thursday, January 24, 2008 — 1:15 to 4:15 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	30	
B-1	20	
B-2	15	
C	20	
Total Written Test Score (Maximum Raw Score: 85)		<input type="text"/>
Final Score (from conversion chart)		<input type="text"/>
Raters' Initials: Rater 1 ..... Rater 2 .....		

**Part B-2**

51 \_\_\_\_\_  
\_\_\_\_\_

52

Reaction Coordinate

For Raters  
Only

51

52



**For Raters  
Only**

53 \_\_\_\_\_

53

54 \_\_\_\_\_

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56 \_\_\_\_\_

56

57 \_\_\_\_\_

57

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\_\_\_\_\_

58 \_\_\_\_\_

58

59 \_\_\_\_\_

59

60 \_\_\_\_\_

60

**For Raters  
Only**

**61**

\_\_\_\_\_

\_\_\_\_\_

**61**

**62**

\_\_\_\_\_

\_\_\_\_\_

**62**

**63**

**63**

**64**

\_\_\_\_\_

\_\_\_\_\_

**64**

**65**

\_\_\_\_\_ g

**65**

**Total Score  
for Part B-2**

Part C

For Raters  
Only

66 \_\_\_\_\_

66

67 \_\_\_\_\_  
\_\_\_\_\_

67

68

68

\_\_\_\_\_ mol

69 \_\_\_\_\_ S(s) + \_\_\_\_\_ KClO<sub>3</sub>(s) → \_\_\_\_\_ SO<sub>2</sub>(g) + \_\_\_\_\_ KCl(s) + energy

69

70 \_\_\_\_\_

70

71 \_\_\_\_\_

71



**For Raters  
Only**

77

77

78 \_\_\_\_\_

78

79 \_\_\_\_\_ mol

79

80 \_\_\_\_\_

80

81 \_\_\_\_\_  
\_\_\_\_\_

81

82 \_\_\_\_\_ °C

82

83 \_\_\_\_\_  
\_\_\_\_\_

83

**Total Score  
for Part C**

# FOR TEACHERS ONLY

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

## PS-CH

### PHYSICAL SETTING/CHEMISTRY

Thursday, January 24, 2008 — 1:15 to 4:15 p.m., only

## 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. Check this web site <http://www.emsc.nysed.gov/osa/> and select the link "Examination Scoring Information" for any recently posted information regarding this examination. This site should be checked before the rating process for this examination begins and several times throughout the Regents examination period.

### Part A and Part B-1

Allow 1 credit for each correct response.

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

**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 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 check mark 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 Thursday, January 24, 2008. 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 for that administration be used to determine the student's final score.

**Part B–2**

**Allow a total of 15 credits for this part. The student must answer all questions in this part.**

**51** [1] Allow 1 credit. Acceptable responses include, but are not limited to:

form  $1^+$  ions

react vigorously with water

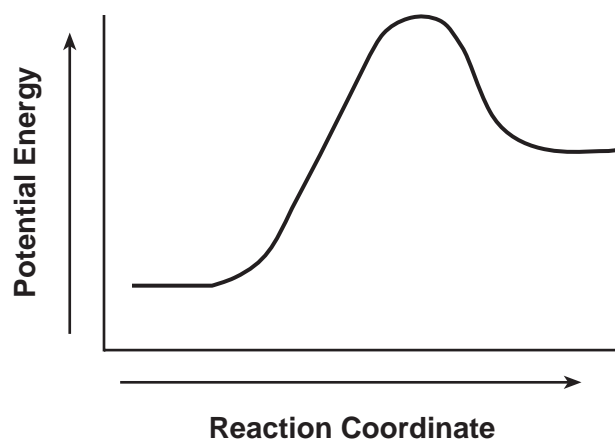
easily lose one electron

form ionic bonds with nonmetals

form halides with the general formula  $MX$

**52** [1] Allow 1 credit.

**Example of a 1-credit response:**



**53** [1] Allow 1 credit. Acceptable responses include, but are not limited to:

2–7–4–1

2–7–5

2–8–3–1

1–8–5

**Note:** Do *not* allow credit for 2–8–4.



**54** [1] Allow 1 credit for  $C_4H_9$ .

**55** [1] Allow 1 credit. Acceptable responses include, but are not limited to:

The electron-shell diagram shows the total number of protons and the total number of neutrons in an atom.

shows number of electrons in each inner shell

shows total number of protons in an atom

shows the number of electron shells

**56** [1] Allow 1 credit for 23.

**57** [1] Allow 1 credit. Acceptable responses include, but are not limited to:

Lewis electron-dot diagrams only show valence electrons, which are involved in bonding.

shows only electrons involved in bonding

**58** [1] Allow 1 credit. Acceptable responses include, but are not limited to:

801°C to 1465°C

**59** [1] Allow 1 credit. Acceptable responses include, but are not limited to:

*AB*

*CD*

**60** [1] Allow 1 credit for *CD*.

**61** [1] Allow 1 credit. Acceptable responses include, but are not limited to:

The rate of the forward reaction equals the rate of the reverse reaction.

- 62 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

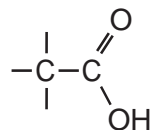
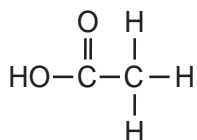
The  $\text{H}^+(\text{aq})$  concentration increases.

$[\text{H}_3\text{O}^+]$  increases.

Concentration increases.

- 63 [1] Allow 1 credit.

**Examples of 1-credit responses:**



- 64 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

The solubility of  $\text{KNO}_3(\text{s})$  is not affected by an increase in pressure.

When the pressure on the solution increases, the solubility of  $\text{KNO}_3$  remains the same.

- 65 [1] Allow 1 credit for  $62 \text{ g} \pm 2 \text{ g}$ .

**Part C**

**Allow a total of 20 credits for this part. The student must answer all questions in this part.**

**66** [1] Allow 1 credit. Acceptable responses include, but are not limited to:

alcohol

**67** [1] Allow 1 credit. Acceptable responses include, but are not limited to:

Water and 1,2-ethanediol molecules are both polar.

Both molecules have similar polarity.

**68** [2] Allow a maximum of 2 credits, allocated as follows:

- Allow 1 credit for a correct numerical setup. Acceptable responses include, but are not limited to:

$$\frac{6690 \text{ g}}{62.0 \text{ g/mol}}$$

$$\frac{6690}{62}$$

- Allow 1 credit for 108 mol *or* for a response consistent with the student's numerical setup. Significant figures do *not* need to be shown.

**Note:** Do *not* allow credit for a numerical setup and calculated result that are not related to the concept assessed by the question.

**69** [1] Allow 1 credit for  $\underline{3} \text{ S(s)} + \underline{2} \text{ KClO}_3\text{(s)} \rightarrow \underline{3} \text{ SO}_2\text{(g)} + \underline{2} \text{ KCl(s)} + \text{energy}$ .

**70** [1] Allow 1 credit. Acceptable responses include, but are not limited to:

The activation energy results from striking the balls together.

heat produced as the balls collide

mechanical energy

friction

- 71 [1] Allow 1 credit for +5.
- 72 [1] Allow 1 credit. Acceptable responses include, but are not limited to:
- Methanol does not conduct an electric current.
- Bromthymol blue tests blue in a base and yellow in an acid, so bottle *B* must be methanol.
- Bromthymol blue would be green in methanol because methanol is not an acid or a base.
- 73 [1] Allow 1 credit. Acceptable responses include, but are not limited to:
- Test: bromthymol blue  
Test result: yellow
- Test: reactivity with Mg  
Test result: reaction
- 74 [1] Allow 1 credit. Acceptable responses include, but are not limited to:
- All three solutions have a pH greater than 4.4.
- Methyl orange changes to yellow at a pH of 4.4, which is still in the acid range.
- A solution with a pH greater than 4.4 could be acidic, basic, or neutral.
- 75 [2] Allow a maximum of 2 credits, allocated as follows:
- Allow 1 credit for a correct numerical setup. Acceptable responses include, but are not limited to:  
$$q = mC\Delta T = (100.0 \text{ g})(4.18 \text{ J/g}\cdot^\circ\text{C})(57.0^\circ\text{C} - 22.0^\circ\text{C})$$
$$(100)(4.18)(35)$$
  - Allow 1 credit for 14 600 J *or* for a response consistent with the student's numerical setup. Significant figures do *not* need to be shown.
- Note:** Do *not* allow credit for a numerical setup and calculated result that are not related to the concept assessed by the question.
- 76 [1] Allow 1 credit for –14% *or* 14%. Significant figures do *not* need to be shown.

- 77 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

$$\frac{12}{(2 \times 23) + 12 + (3 \times 16)} \times 100$$

$$\frac{12 \text{ g/mol}}{106 \text{ g/mol}} \times 100$$

- 78 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

decomposition

endothermic

- 79 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

3.5 mol

$3\frac{1}{2}$  mol

$\frac{7}{2}$  mol

- 80 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

melting

vaporization

solidification

- 81 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

The burning candle releases heat and light.

A cobalt chloride test indicates water is produced.

A limewater test indicates carbon dioxide gas is produced.

**82** [1] Allow 1 credit for  $124^{\circ}\text{C} \pm 2^{\circ}\text{C}$ .

**83** [1] Allow 1 credit. Acceptable responses include, but are not limited to:

As molar mass increases, there are stronger intermolecular forces.

The forces are greater between heavier molecules.

## Regents Examination in Physical Setting/Chemistry

January 2008

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

**The *Chart for Determining the Final Examination Score for the January 2008 Regents Examination in Physical Setting/Chemistry* will be posted on the Department's web site <http://www.emsc.nysed.gov/osa/> on Thursday, January 24, 2008. 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.**

### Submitting Teacher Evaluations of the Test to the Department

Suggestions and feedback from teachers provide an important contribution to the test development process. The Department provides an online evaluation form for State assessments. It contains spaces for teachers to respond to several specific questions and to make suggestions. Instructions for completing the evaluation form are as follows:

1. Go to [www.emsc.nysed.gov/osa/exameval](http://www.emsc.nysed.gov/osa/exameval).
2. Select the test title.
3. Complete the required demographic fields.
4. Complete each evaluation question and provide comments in the space provided.
5. Click the SUBMIT button at the bottom of the page to submit the completed form.

## Map to Core Curriculum

<b>January 2008 Physical Setting/Chemistry</b>			
<b>Question Numbers</b>			
Key Ideas	Part A	Part B	Part C
<b>Standard 1</b>			
Math Key Idea 1		38, 41, 46	68, 75, 76, 77, 82
Math Key Idea 2			
Math Key Idea 3		34, 43, 49, 54, 56, 58, 65	68, 69, 71, 79
Sci. Inquiry Key Idea 1		55, 57, 61, 64	70, 72, 80, 81
Sci. Inquiry Key Idea 2			
Sci. Inquiry Key Idea 3		35, 37, 39, 40, 47, 53, 65	66, 69, 71, 72, 73
Eng. Design Key Idea 1			
<b>Standard 2</b>			
Key Idea 1			
Key Idea 2			
<b>Standard 6</b>			
Key Idea 1			
Key Idea 2		41	
Key Idea 3		48	
Key Idea 4		62	
Key Idea 5		64, 65	82, 83
<b>Standard 7</b>			
Key Idea 1			
Key Idea 2			
<b>Standard 4 Process Skills</b>			
Key Idea 3		31, 32, 33, 34, 38, 41, 42, 44, 45, 46, 47, 51, 53, 54, 55, 56, 61, 62, 63, 65	66, 67, 68, 69, 73, 74, 77, 78, 79, 80, 81
Key Idea 4		49, 50, 52, 58, 59, 60	70, 75
Key Idea 5		36, 57	83
<b>Standard 4</b>			
Key Idea 3	1, 2, 3, 4, 5, 6, 7, 8, 9, 13, 14, 15, 16, 17, 18, 19, 21, 22, 23, 24, 25, 27, 29	31, 32, 33, 34, 37, 38, 39, 41, 42, 43, 44, 45, 46, 47, 48, 51, 53, 54, 55, 56, 61, 62, 63, 64, 65	66, 67, 68, 69, 71, 72, 73, 74, 77, 78, 79, 80, 81, 82
Key Idea 4	20, 28, 30	40, 49, 50, 52, 58, 59	70, 75, 76
Key Idea 5	10, 11, 12, 26	35, 36, 57, 60	83
<b>Reference Tables</b>			
2002 Edition	2, 3, 6, 8, 14, 15, 19, 22, 25, 27, 28	34, 35, 36, 37, 38, 40, 41, 42, 43, 46, 47, 49, 50, 51, 53, 63, 64, 65	66, 71, 74, 75, 76, 77



## Regents Examination in Physical Setting/Chemistry January 2008

### 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	60	19	39
84	98	62	74	40	59	18	37
83	96	61	73	39	58	17	36
82	95	60	72	38	57	16	34
81	93	59	71	37	57	15	33
80	92	58	71	36	56	14	31
79	90	57	70	35	55	13	30
78	89	56	69	34	54	12	28
77	88	55	69	33	54	11	26
76	86	54	68	32	53	10	24
75	85	53	67	31	52	9	22
74	84	52	67	30	51	8	20
73	83	51	66	29	50	7	18
72	82	50	66	28	49	6	16
71	81	49	65	27	48	5	13
70	80	48	64	26	47	4	11
69	79	47	64	25	46	3	8
68	78	46	63	24	45	2	6
67	77	45	62	23	44	1	3
66	77	44	62	22	43	0	0
65	76	43	61	21	41		
64	75	42	60	20	40		

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 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.