The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

PHYSICAL SETTING
CHEMISTRY

Tuesday, June 18, 2013 — 9:15 a.m. to 12:15 p.m., only

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

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 *2011 Edition Reference Tables for Physical Setting/Chemistry*. You are to answer *all* questions in all parts of this examination according to the directions provided in this examination booklet.

A separate answer sheet for Part A and Part B–1 has been provided to you. Follow the instructions from the proctor for completing the student information on your answer sheet. Record your answers to the Part A and Part B–1 multiple-choice questions on this separate answer sheet. Record your answers for the questions in Part B–2 and Part C in your separate answer booklet. Be sure to fill in the heading on the front of your answer booklet.

All answers in your answer booklet 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 or in your answer booklet as directed.

When you have completed the examination, you must sign the statement printed on 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 *2011 Edition Reference Tables for Physical Setting/Chemistry* must be available for you to 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 (1–30): For *each* statement or question, record on your 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 *2011 Edition Reference Tables for Physical Setting/Chemistry*.

1 According to the wave-mechanical model of the atom, an orbital is a region of the most probable location of

(1) an alpha particle (3) an electron
(2) a gamma ray (4) a proton

2 Which particles have approximately the same mass?

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

3 During a flame test, a lithium salt produces a characteristic red flame. This red color is produced when electrons in excited lithium atoms

(1) are lost by the atoms
(2) are gained by the atoms
(3) return to lower energy states within the atoms
(4) move to higher energy states within the atoms

4 Compared to the energy and charge of the electrons in the first shell of a Be atom, the electrons in the second shell of this atom have

(1) less energy and the same charge
(2) less energy and a different charge
(3) more energy and the same charge
(4) more energy and a different charge

5 Which quantity can vary among atoms of the same element?

(1) mass number
(2) atomic number
(3) number of protons
(4) number of electrons

6 Which substances have atoms of the same element but different molecular structures?

(1) He(g) and Ne(g) (3) K(s) and Na(s)
(2) O_2(g) and O_3(g) (4) P_4(s) and S_8(s)

7 An atom that has 13 protons and 15 neutrons is an isotope of the element

(1) nickel (3) aluminum
(2) silicon (4) phosphorus

8 Which elements have the most similar chemical properties?

(1) Si, As, and Te (3) Mg, Sr, and Ba
(2) N_2, O_2, and F_2 (4) Ca, Cs, and Cu

9 Which list includes three types of chemical formulas for organic compounds?

(1) covalent, metallic, isotopic
(2) covalent, metallic, molecular
(3) empirical, structural, isotopic
(4) empirical, structural, molecular

10 In a bond between an atom of carbon and an atom of fluorine, the fluorine atom has a

(1) weaker attraction for electrons
(2) stronger attraction for electrons
(3) smaller number of first-shell electrons
(4) larger number of first-shell electrons

11 A sample of CO_2(s) and a sample of CO_2(g) differ in their

(1) chemical compositions
(2) empirical formulas
(3) molecular structures
(4) physical properties

12 Which statement defines the temperature of a sample of matter?

(1) Temperature is a measure of the total electromagnetic energy of the particles.
(2) Temperature is a measure of the total thermal energy of the particles.
(3) Temperature is a measure of the average potential energy of the particles.
(4) Temperature is a measure of the average kinetic energy of the particles.

13 For a chemical reaction, the difference between the potential energy of the products and the potential energy of the reactants is equal to the

(1) heat of fusion
(2) heat of reaction
(3) activation energy of the forward reaction
(4) activation energy of the reverse reaction

14 Which equation represents sublimation?

(1) $Hg(\ell) \rightarrow Hg(s)$
(2) $H_2O(s) \rightarrow H_2O(g)$
(3) $NH_3(g) \rightarrow NH_3(\ell)$
(4) $CH_4(\ell) \rightarrow CH_4(g)$

15 Which statement describes the particles of an ideal gas, based on the kinetic molecular theory?

(1) The motion of the gas particles is orderly and circular.
(2) The gas particles have no attractive forces between them.
(3) The gas particles are larger than the distances separating them.
(4) As the gas particles collide, the total energy of the system decreases.

16 Two grams of potassium chloride are completely dissolved in a sample of water in a beaker. This solution is classified as

(1) an element
(2) a compound
(3) a homogeneous mixture
(4) a heterogeneous mixture

17 Which compound has the strongest hydrogen bonding between its molecules?

(1) HBr
(2) HCl
(3) HF
(4) HI

18 Powdered sulfur is yellow, and powdered iron is gray. When powdered sulfur and powdered iron are mixed at 20°C, the powdered iron

(1) becomes yellow
(2) becomes a liquid
(3) remains ionic
(4) remains magnetic

19 An effective collision between reactant particles requires the particles to have the proper

(1) charge and mass
(2) charge and orientation
(3) energy and mass
(4) energy and orientation

20 Which term is defined as a measure of the disorder of a system?

(1) heat
(2) entropy
(3) kinetic energy
(4) activation energy

21 Which process is used to determine the concentration of an acid?

(1) chromatography
(2) distillation
(3) electrolysis
(4) titration

22 The compounds CH_3OCH_3 and CH_3CH_2OH have different functional groups. Therefore, these compounds have different

(1) chemical properties
(2) gram-formula masses
(3) percent compositions by mass
(4) numbers of atoms per molecule

23 Which term identifies the half-reaction that occurs at the anode of an operating electrochemical cell?

(1) oxidation
(2) reduction
(3) neutralization
(4) transmutation

24 During the operation of a voltaic cell, the cell produces

(1) electrical energy spontaneously
(2) chemical energy spontaneously
(3) electrical energy nonspontaneously
(4) chemical energy nonspontaneously

25 In which type of chemical reaction are electrons transferred?

(1) organic addition
(2) oxidation-reduction
(3) double replacement
(4) acid-base neutralization

26 A substance that dissolves in water and produces hydronium ions as the only positive ions in the solution is classified as

(1) an alcohol
(2) an acid
(3) a base
(4) a salt

27 According to one acid-base theory, a base is an

(1) H^+ acceptor
(2) H^+ donor
(3) Na^+ acceptor
(4) Na^+ donor

28 Which compound is an electrolyte?

(1) CCl_4
(2) CH_3OH
(3) $C_6H_{12}O_6$
(4) $Ca(OH)_2$

29 Which term identifies a type of nuclear reaction?

(1) fermentation
(2) deposition
(3) reduction
(4) fission

30 Which radioisotopes have the same decay mode and have half-lives greater than 1 hour?

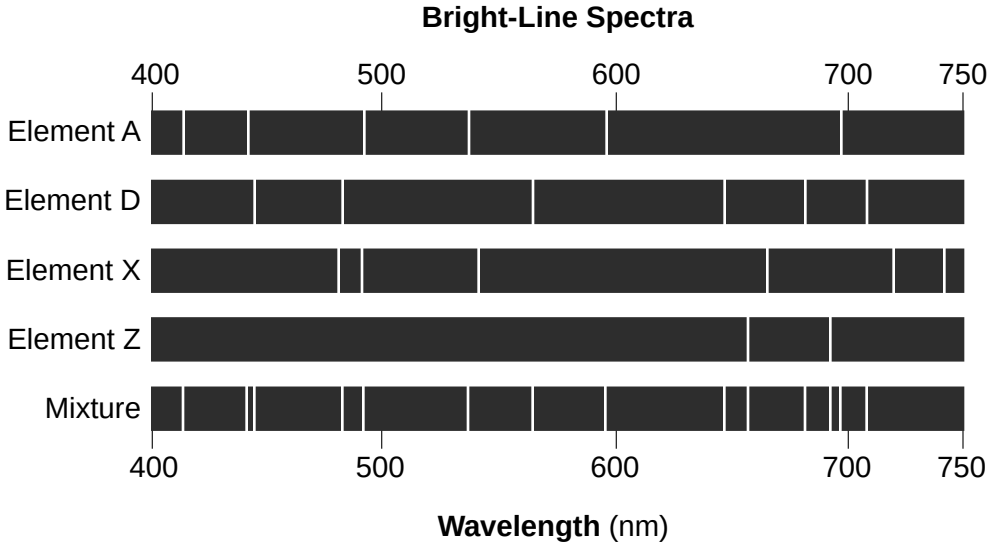
(1) Au-198 and N-16
(2) Ca-37 and Fe-53
(3) I-131 and P-32
(4) Tc-99 and U-233

Part B–1

Answer all questions in this part.

Directions (31–50): For *each* statement or question, record on your 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 *2011 Edition Reference Tables for Physical Setting/Chemistry*.

31 The diagram below represents the bright-line spectra of four elements and a bright-line spectrum produced by a mixture of three of these elements.



Which element is *not* present in the mixture?

(1) *A*
(2) *D*
(3) *X*
(4) *Z*

32 What is the overall charge of an ion that has 12 protons, 10 electrons, and 14 neutrons?

(1) 2−
(2) 2+
(3) 4−
(4) 4+

33 As the elements in Period 3 are considered in order of increasing atomic number, there is a general *decrease* in

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

34 Which electron configuration represents the electrons of a sulfur atom in an excited state?

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

35 Given the word equation:

sodium chlorate → sodium chloride + oxygen

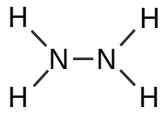
Which type of chemical reaction is represented by this equation?

(1) double replacement
(2) single replacement
(3) decomposition
(4) synthesis

36 Which compound has the highest percent composition by mass of strontium?

(1) $SrCl_2$ (3) SrO
(2) SrI_2 (4) SrS

37 Given the formula for hydrazine:



How many pairs of electrons are shared between the two nitrogen atoms?

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

38 Which formulas represent one ionic compound and one molecular compound?

(1) N_2 and SO_2 (3) $BaCl_2$ and N_2O_4
(2) Cl_2 and H_2S (4) NaOH and $BaSO_4$

39 Which Kelvin temperature is equal to 200.°C?

(1) −73 K (3) 200. K
(2) 73 K (4) 473 K

40 A 10.0-gram sample of $H_2O(\ell)$ at 23.0°C absorbs 209 joules of heat. What is the final temperature of the $H_2O(\ell)$ sample?

(1) 5.0°C (3) 28.0°C
(2) 18.0°C (4) 50.0°C

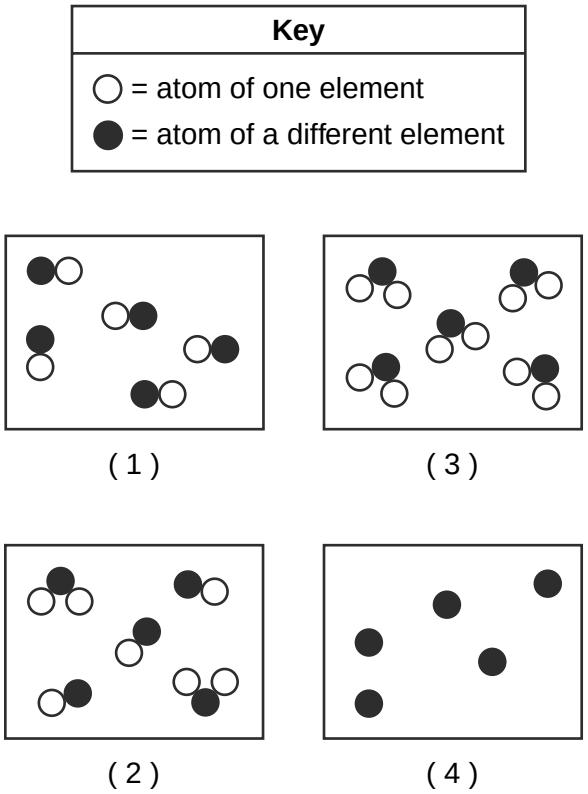
41 Given the equation representing a system at equilibrium:

$$AgCl(s) \overset{H_2O}{\rightleftharpoons} Ag^+(aq) + Cl^-(aq)$$

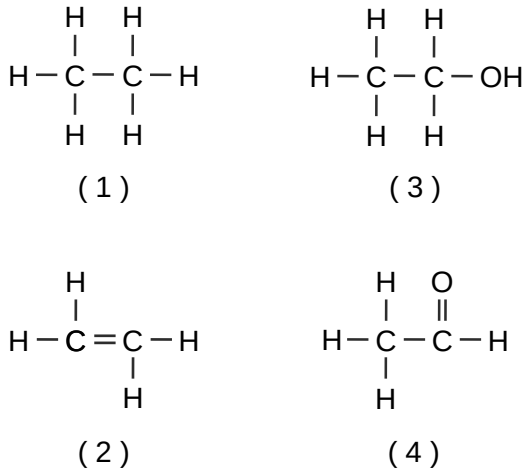
When the concentration of $Cl^-(aq)$ is increased, the concentration of $Ag^+(aq)$

(1) decreases, and the amount of AgCl(s) increases
(2) decreases, and the amount of AgCl(s) decreases
(3) increases, and the amount of AgCl(s) increases
(4) increases, and the amount of AgCl(s) decreases

42 Which particle diagram represents a sample of matter that can *not* be broken down by chemical means?



43 Which formula represents an unsaturated hydrocarbon?



44 When the pH of a solution is changed from 4 to 3, the hydronium ion concentration of the solution

(1) decreases by a factor of 10
(2) increases by a factor of 10
(3) decreases by a factor of 100
(4) increases by a factor of 100

45 Three samples of the same solution are tested, each with a different indicator. All three indicators, bromthymol blue, bromcresol green, and thymol blue, appear blue if the pH of the solution is

(1) 4.7
(2) 6.0
(3) 7.8
(4) 9.9

46 A 10.0-milliliter sample of NaOH(aq) is neutralized by 40.0 milliliters of 0.50 M HCl. What is the molarity of the NaOH(aq)?

(1) 1.0 M
(2) 2.0 M
(3) 0.25 M
(4) 0.50 M

47 Radiation is spontaneously emitted from hydrogen-3 nuclei, but radiation is *not* spontaneously emitted from hydrogen-1 nuclei or hydrogen-2 nuclei. Which hydrogen nuclei are stable?

(1) nuclei of H-1 and H-2, only
(2) nuclei of H-1 and H-3, only
(3) nuclei of H-2 and H-3, only
(4) nuclei of H-1, H-2, and H-3

48 Given the equation representing a nuclear reaction in which X represents a nuclide:

$$^{232}_{90}\text{Th} \rightarrow {}^{4}_{2}\text{He} + X$$

Which nuclide is represented by X?

(1) $^{236}_{92}\text{Ra}$
(2) $^{228}_{88}\text{Ra}$
(3) $^{236}_{92}\text{U}$
(4) $^{228}_{88}\text{U}$

49 After decaying for 48 hours, $\frac{1}{16}$ of the original mass of a radioisotope sample remains unchanged. What is the half-life of this radioisotope?

(1) 3.0 h
(2) 9.6 h
(3) 12 h
(4) 24 h

50 Which balanced equation represents nuclear fusion?

(1) $^{2}_{1}\text{H} + {}^{2}_{1}\text{H} \rightarrow {}^{4}_{2}\text{He}$

(2) $2H_2 + O_2 \rightarrow 2H_2O$

(3) $^{6}_{3}\text{Li} + {}^{1}_{0}\text{n} \rightarrow {}^{3}_{1}\text{H} + {}^{4}_{2}\text{He}$

(4) $CaO + CO_2 \rightarrow CaCO_3$

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 *2011 Edition Reference Tables for Physical Setting/Chemistry.*

Base your answers to questions 51 through 53 on the information below and on your knowledge of chemistry.

When magnesium is ignited in air, the magnesium reacts with oxygen and nitrogen. The reaction between magnesium and nitrogen is represented by the unbalanced equation below.

$$Mg(s) + N_2(g) \rightarrow Mg_3N_2(s)$$

51 Balance the equation *in your answer booklet* for the reaction between magnesium and nitrogen, using the smallest whole-number coefficients. [1]

52 In the ground state, which noble gas has atoms with the same electron configuration as a magnesium ion? [1]

53 Explain, in terms of electrons, why an atom of the metal in this reaction forms an ion that has a smaller radius than its atom. [1]

Base your answers to questions 54 through 56 on the information below and on your knowledge of chemistry.

The balanced equation below represents a reaction.

$$O_2(g) + \text{energy} \rightarrow O(g) + O(g)$$

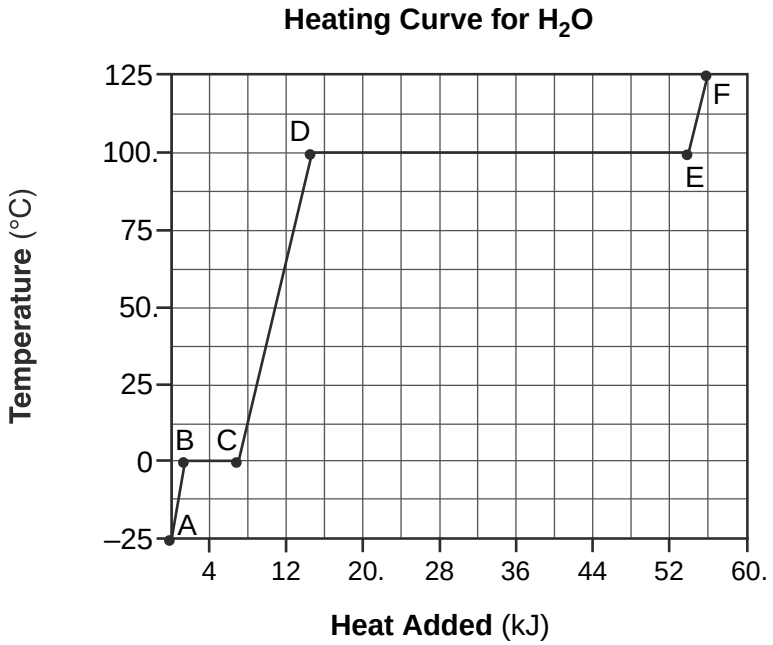
54 Identify the type of chemical bond in a molecule of the reactant. [1]

55 In the space *in your answer booklet*, draw a Lewis electron-dot diagram of one oxygen atom. [1]

56 Explain, in terms of bonds, why energy is absorbed during this reaction. [1]

Base your answers to questions 57 through 59 on the information below and on your knowledge of chemistry.

Starting as a solid at −25°C, a sample of H_2O is heated at a constant rate until the sample is at 125°C. This heating occurs at standard pressure. The graph below represents the relationship between temperature and heat added to the sample.



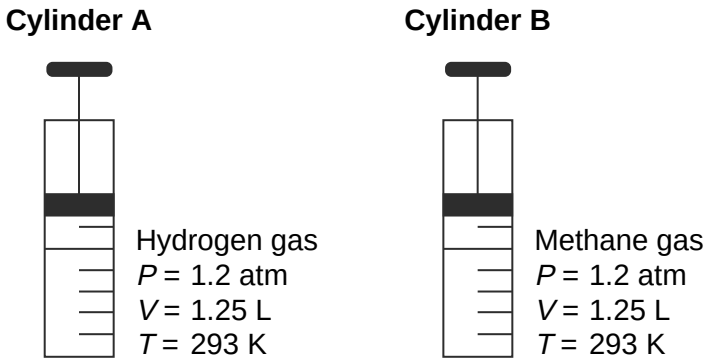
57 Describe what happens to *both* the potential energy and the average kinetic energy of the molecules in the H_2O sample during interval *AB*. [1]

58 Using the graph, determine the total amount of heat added to the sample during interval *CD*. [1]

59 Explain, in terms of heat of fusion and heat of vaporization, why the heat added during interval *DE* is greater than the heat added during interval *BC* for this sample of water. [1]

Base your answers to questions 60 through 62 on the information below and on your knowledge of chemistry.

Cylinder *A* has a movable piston and contains hydrogen gas. An identical cylinder, *B*, contains methane gas. The diagram below represents these cylinders and the conditions of pressure, volume, and temperature of the gas in each cylinder.



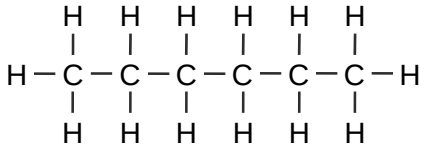
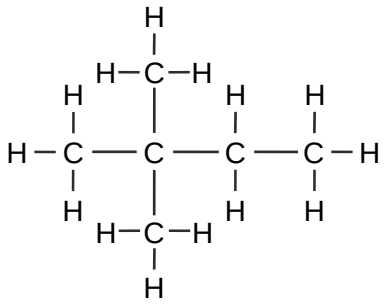
60 Compare the total number of gas molecules in cylinder *A* to the total number of gas molecules in cylinder *B*. [1]

61 State a change in temperature and a change in pressure that will cause the gas in cylinder *A* to behave more like an ideal gas. [1]

62 In the space *in your answer booklet*, show a numerical setup for calculating the volume of the gas in cylinder *B* at STP. [1]

Base your answers to questions 63 through 65 on the information below and on your knowledge of chemistry.

There are several isomers of C_6H_{14}. The formulas and boiling points for two of these isomers are given in the table below.

Isomer	Formula	Boiling Point at 1 atm (°C)
1		68.7
2		49.7

63 Identify the homologous series to which these isomers belong. [1]

64 Write the empirical formula for isomer 1. [1]

65 Explain, in terms of intermolecular forces, why isomer 2 boils at a lower temperature than isomer 1. [1]

Part C

Answer all questions in this part.

Directions (66–85): Record your answers in the spaces provided in your answer booklet. Some questions may require the use of the *2011 Edition Reference Tables for Physical Setting/Chemistry*.

Base your answers to questions 66 through 69 on the information below and on your knowledge of chemistry.

Before atomic numbers were known, Mendeleev developed a classification system for the 63 elements known in 1872, using oxide formulas and atomic masses. He used an R in the oxide formulas to represent any element in each group. The atomic mass was listed in parentheses after the symbol of each element. A modified version of Mendeleev's classification system is shown in the table below.

Modified Version of Mendeleev's Table

Group ⟶		I	II	III	IV	V	VI	VII
Oxide formulas		R_2O	RO	R_2O_3	RO_2	R_2O_5	RO_3	R_2O_7
Series	1	H(1)						
	2	Li(7)	Be(9.4)	B(11)	C(12)	N(14)	O(16)	F(19)
	3	Na(23)	Mg(24)	Al(27.3)	Si(28)	P(31)	S(32)	Cl(35.5)
	4	K(39)	Ca(40)		Ti(48)	V(51)	Cr(52)	Mn(55)
	5	Cu(63)	Zn(65)			As(75)	Se(78)	Br(80)
	6	Rb(85)	Sr(87)	Yt(88)	Zr(90)	Nb(94)	Mo(96)	
	7	Ag(108)	Cd(112)	In(113)	Sn(118)	Sb(122)	Te(125)	I(127)
	8	Cs(133)	Ba(137)	Di(138)	Ce(140)			

66 Identify *one* characteristic used by Mendeleev to develop his classification system of the elements. [1]

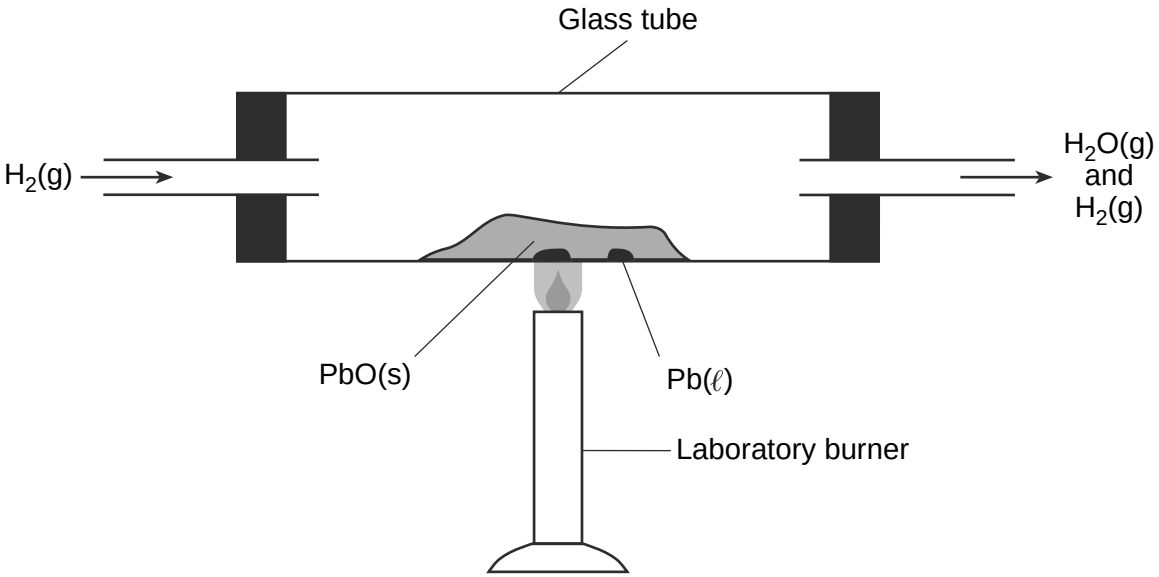
67 Based on Mendeleev's oxide formula, what is the number of electrons lost by each atom of the elements in Group III? [1]

68 Based on Table *J*, identify the *least* active metal listed in Group I on Mendeleev's table. [1]

69 Explain, in terms of chemical reactivity, why the elements in Group 18 on the modern Periodic Table were *not* identified by Mendeleev at that time. [1]

Base your answers to questions 70 through 73 on the information below and on your knowledge of chemistry.

In a laboratory apparatus, a sample of lead(II) oxide reacts with hydrogen gas at high temperature. The products of this reaction are liquid lead and water vapor. As the reaction proceeds, water vapor and excess hydrogen gas leave the glass tube. The diagram and balanced equation below represent this reaction.



$$PbO(s) + H_2(g) + heat \longrightarrow Pb(\ell) + H_2O(g)$$

70 Determine the change in oxidation number for the hydrogen that reacts. [1]

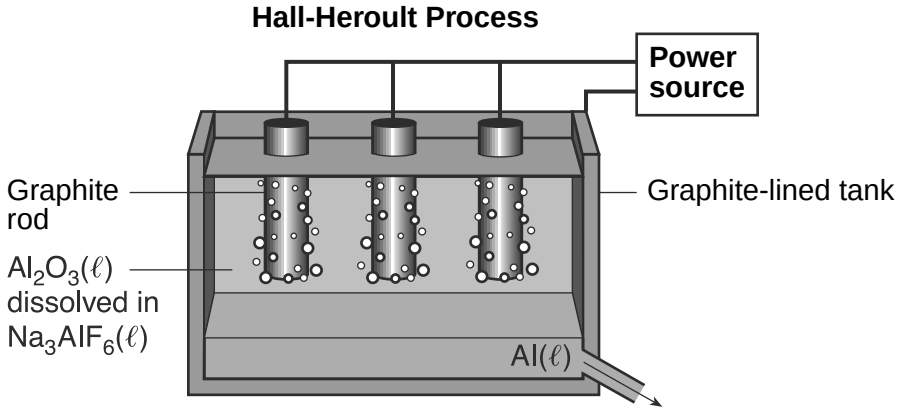
71 Write a balanced half-reaction equation for the reduction of the Pb^{2+} ions in this reaction. [1]

72 Explain why the reaction that occurs in this glass tube can *not* reach equilibrium. [1]

73 State *one* change in reaction conditions, other than adding a catalyst, that would cause the rate of this reaction to increase. [1]

Base your answers to questions 74 through 77 on the information below and on your knowledge of chemistry.

In the late 19th century, the Hall-Herroult process was invented as an inexpensive way to produce aluminum. In this process, $Al_2O_3(\ell)$ extracted from bauxite is dissolved in $Na_3AlF_6(\ell)$ in a graphite-lined tank, as shown in the diagram below. The products are carbon dioxide and molten aluminum metal.



74 Compare the chemical properties of a 300.-kilogram sample of $Al_2O_3(\ell)$ with the chemical properties of a 600.-kilogram sample of $Al_2O_3(\ell)$. [1]

75 Write the chemical name for the liquid compound dissolved in the $Na_3AlF_6(\ell)$. [1]

76 What is the melting point of the substance that collects at the bottom of the tank? [1]

77 Compare the density of the $Al(\ell)$ with the density of the mixture of $Al_2O_3(\ell)$ and $Na_3AlF_6(\ell)$. [1]

Base your answers to questions 78 through 80 on the information below and on your knowledge of chemistry.

One process used to manufacture sulfuric acid is called the contact process. One step in this process, the reaction between sulfur dioxide and oxygen, is represented by the forward reaction in the system at equilibrium shown below.

$$2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g) + 394\ kJ$$

A mixture of platinum and vanadium(V) oxide may be used as a catalyst for this reaction. The sulfur trioxide produced is then used to make sulfuric acid.

78 Determine the amount of energy released when 1.00 mole of sulfur trioxide is produced. [1]

79 Write the chemical formula for vanadium(V) oxide. [1]

80 On the labeled axes *in your answer booklet*, complete the potential energy diagram for the forward reaction represented by this equation. [1]

Base your answers to questions 81 and 82 on the information below and on your knowledge of chemistry.

Two very stable compounds, Freon-12 and Freon-14, are used as liquid refrigerants. A Freon-12 molecule consists of one carbon atom, two chlorine atoms, and two fluorine atoms. A Freon-14 molecule consists of one carbon atom and four fluorine atoms.

81 In the space *in your answer booklet*, draw a structural formula for Freon-12. [1]

82 To which class of organic compounds do Freon-12 and Freon-14 belong? [1]

Base your answers to questions 83 through 85 on the information below and on your knowledge of chemistry.

Chemical concepts are applied in candy making. A recipe for making lollipops is shown below.

Hard-Candy Lollipops Recipe

Ingredients:

414 grams of sugar
177 grams of water
158 milliliters of light corn syrup

Step 1: In a saucepan, mix the sugar and water. Heat this mixture, while stirring, until all of the sugar dissolves.

Step 2: Add the corn syrup and heat the mixture until it boils.

Step 3: Continue boiling the mixture until the temperature reaches 143°C at standard pressure.

Step 4: Remove the pan from the heat and allow it to stand until the bubbling stops. Pour the mixture into lollipop molds that have been coated with cooking oil spray.

83 Explain, in terms of the polarity of sugar molecules, why the sugar dissolves in water. [1]

84 Determine the concentration, expressed as percent by mass, of the sugar dissolved in the mixture produced in step 1. [1]

85 Explain, in terms of the concentration of sugar molecules, why the boiling point of the mixture in step 3 increases as water evaporates from the mixture. [1]

P.S./CHEMISTRY

The University of the State of New York

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PHYSICAL SETTING
CHEMISTRY

Tuesday, June 18, 2013 — 9:15 a.m. to 12:15 p.m., only

ANSWER BOOKLET

Student . . . . . Sex: ☐ Male ☐ Female

Teacher . . . . . .

School . . . . . Grade . . . . . .

Record your answers for Part B–2 and Part C in this booklet.

Part B–2

51 _____ $Mg(s)$ + _____ $N_2(g)$ → _____ $Mg_3N_2(s)$

52 _____

53 _____

_____

_____

54 _____

55

56 _____

_____

_____

57 _____

_____

58 _____ **kJ**

59 _____

_____

_____

60 _____

_____

61 Temperature: _____

Pressure: _____

62

63 _____

64 _____

65 _____

_____

_____

Part C

66 _____

67 _____

68 _____

69 _____

_____

_____

70 From _____ to _____

71 _____

72 _____

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74 _____

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75 _____

76 _____ **K**

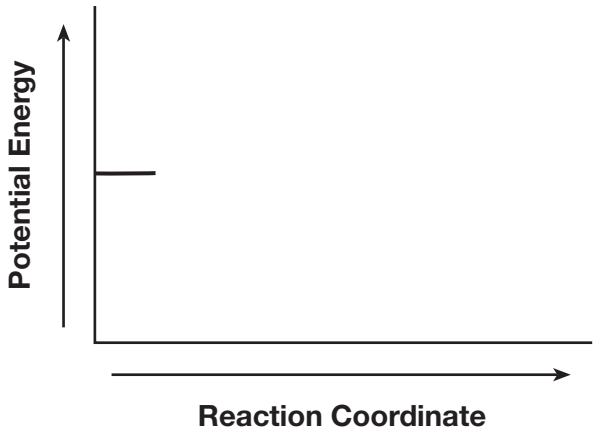
77 _____

_____

78 _____ **kJ**

79 _____

80



81

82 _____

83 _____

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84 _____ **%**

85 _____

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P.S./CHEMISTRY

FOR TEACHERS ONLY

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

P.S.–CH PHYSICAL SETTING/CHEMISTRY

Tuesday, June 18, 2013 — 9:15 a.m. to 12:15 p.m., only

SCORING KEY AND RATING GUIDE

Directions to the Teacher:

Refer to the directions on page 2 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 at: http://www.p12.nysed.gov/assessment/ and select the link "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

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

Part B–1

31 . . . . . **3**	36 . . . . . **3**	41 . . . . . **1**	46 . . . . . **2** . . . . .
32 . . . . . **2**	37 . . . . . **1**	42 . . . . . **4**	47 . . . . . **1** . . . . .
33 . . . . . **2**	38 . . . . . **3**	43 . . . . . **2**	48 . . . . . **2** . . . . .
34 . . . . . **2**	39 . . . . . **4**	44 . . . . . **2**	49 . . . . . **3** . . . . .
35 . . . . . **3**	40 . . . . . **3**	45 . . . . . **4**	50 . . . . . **1** . . . . .

Directions to the Teacher

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

Do not attempt to correct the student's work by making insertions or changes of any kind. If the student's responses for the multiple-choice questions are being hand scored prior to being scanned, the scorer must be careful not to make any marks on the answer sheet except to record the scores in the designated score boxes. Marks elsewhere on the answer sheet will interfere with the accuracy of the scanning.

Allow 1 credit for each correct response.

At least two science teachers must participate in the scoring of the Part B–2 and Part C open-ended questions on a student's paper. 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 more than approximately one-half of the open-ended questions on a student's answer paper. Teachers may not score their own students' answer papers.

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. On the student's separate answer sheet, for each question, record the number of credits earned and the teacher's assigned rater/scorer letter.

Fractional credit is *not* allowed. Only whole-number credit may be given for a response. If the student gives more than one answer to a question, only the first answer should be rated. Units need not be given when the wording of the questions allows such omissions.

For hand scoring, raters should enter the scores earned in the appropriate boxes printed on the separate answer sheet. Next, the rater should add these scores and enter the total in the box labeled "Total Raw Score." Then the student's raw score should be converted to a scale score by using the conversion chart that will be posted on the Department's web site at: http://www.p12.nysed.gov/assessment/ on Tuesday, June 18, 2013. The student's scale score should be entered in the box labeled "Scale Score" on the student's answer sheet. The scale score is the student's final examination score.

Schools are not permitted to rescore any of the open-ended questions on this exam after each question has been rated once, regardless of the final exam score. Schools are required to ensure that the raw scores have been added correctly and that the resulting scale score has been determined accurately.

Because scale scores corresponding to raw scores in the conversion chart may change from one administration 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 for _3_ Mg(s) + ___ $N_2(g)$ → ___ $Mg_3N_2(s)$.

Allow credit even if the coefficient "1" is written in front of $N_2(g)$ and/or $Mg_3N_2(s)$.

52 [1] Allow 1 credit for Ne *or* neon.

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

An atom of magnesium loses its outer shell electrons to form the Mg^{2+} ion.

The electron configuration of a magnesium atom is 2-8-2, and the electron configuration of the magnesium ion is 2-8.

An atom of the metal loses electrons to form the ion.

54 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

covalent

double covalent

nonpolar

double

55 [1] Allow 1 credit.

Examples of 1-credit responses:

56 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

Energy is needed to break the bonds in O_2.

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

The potential energy remains the same, but the average kinetic energy of the H_2O molecules increases.

There is no change in potential energy. There is an increase in the average kinetic energy.

58 [1] Allow 1 credit for 8 kJ ± 1 kJ.

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

The heat of vaporization of water is 2260 J/g and the heat of fusion for water is only 334 J/g.

The heat of fusion of water is much less than its heat of vaporization.

60 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

The number of gas molecules in cylinder *A* is the same as the number of gas molecules in cylinder *B*.

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

Temperature: above 293 K
Pressure: below 1.2 atm

Temperature: higher
Pressure: lower

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

$$\frac{(1.2\text{ atm})(1.25\text{ L})}{293\text{ K}} = \frac{(1.0\text{ atm})(V_2)}{273\text{ K}}$$

$$\frac{(273)(1.2)(1.25)}{293}$$

63 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

alkanes

C_nH_{2n+2}

64 [1] Allow 1 credit for C_3H_7. The order of the elements can vary.

65 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

Isomer 2 boils at a lower temperature because it has weaker intermolecular forces than isomer 1.

The intermolecular forces in isomer 1 are stronger.

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:

increasing atomic mass

atomic mass

oxide formulas

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

three electrons

three

3

68 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

Ag

silver

69 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

Since the Group 18 elements tend not to react with other elements, there were no oxide compounds for Mendeleev to study.

Group 18 elements are generally unreactive.

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

From 0 to +1

From zero to one

71 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

$Pb^{2+} + 2e^{-} \rightarrow Pb$

72 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

The glass tube is not a closed system.

Gases are entering and leaving the system.

The reaction is *not* reversible under these conditions.

73 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

Increase the temperature.

Increase the concentration of the hydrogen gas in the tube.

Grind the metal oxide to increase its surface area.

74 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

Both samples have the same chemical properties.

75 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

aluminum oxide

76 [1] Allow 1 credit for 933 K.

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

The density of the aluminum is greater than the density of the Al_2O_3 and Na_3AlF_6 mixture.

The density of Al(ℓ) is greater.

78 [1] Allow 1 credit for 197 kJ.

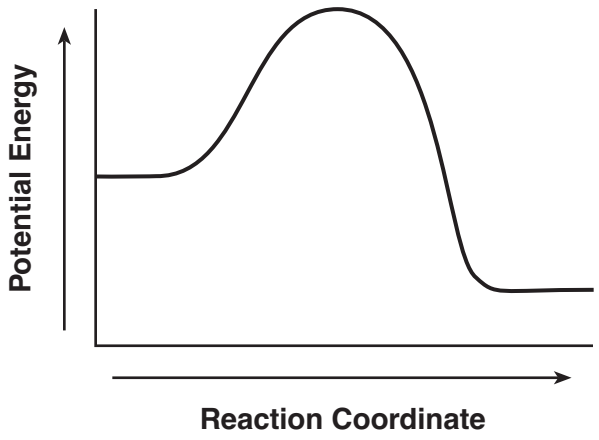
79 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

V_2O_5

O_5V_2

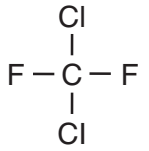
80 [1] Allow 1 credit.

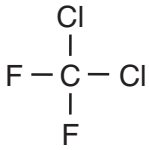
Example of a 1-credit response:



81 [1] Allow 1 credit.

Examples of 1-credit responses:





82 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

halide

halocarbon

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

The polarity of sugar molecules is similar to the polarity of water molecules.

Both substances consist of polar molecules.

84 [1] Allow 1 credit for 70.1%. Significant figures do *not* need to be shown.

85 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

The boiling point of the mixture increases as water evaporates because the concentration of dissolved molecules increases.

An increase in the concentration of sugar particles increases the boiling point.

Regents Examination in Physical Setting/Chemistry

June 2013

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

The *Chart for Determining the Final Examination Score for the June 2013 Regents Examination in Physical Setting/Chemistry* will be posted on the Department's web site at: http://www.p12.nysed.gov/assessment/ on Tuesday, June 18, 2013. 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.

Online Submission of 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 http://www.forms2.nysed.gov/emsc/osa/exameval/reexameval.cfm.
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

June 2013 Physical Setting/Chemistry			
Question Numbers			
Key Ideas/Performance Indicators	Part A	Part B	Part C
Standard 1			
Math Key Idea 1		39, 62	
Math Key Idea 2		51, 58, 60	
Math Key Idea 3		32, 36, 40, 46, 49, 53, 62, 64	67, 70, 78, 79, 84
Science Inquiry Key Idea 1		33, 53, 54, 56, 59, 61, 63, 65	66, 68, 69, 72, 73, 74, 77, 83, 85
Science Inquiry Key Idea 2			
Science Inquiry Key Idea 3		37, 38, 47, 50, 51, 53, 56, 60, 65	67, 69, 70, 75, 79, 82, 85
Engineering Design Key Idea 1			
Standard 2			
Key Idea 1		47	76
Key Idea 2			81
Standard 6			
Key Idea 1			
Key Idea 2		34	
Key Idea 3		44	
Key Idea 4			
Key Idea 5			
Standard 7			
Key Idea 1			
Key Idea 2			
Standard 4 Process Skills			
Key Idea 3		31, 33, 34, 35, 39, 41, 42, 43, 45, 51, 55, 62, 63, 64	66, 67, 68, 71, 81, 83, 84
Key Idea 4		40, 48, 49, 57, 58, 59	78, 80, 82
Key Idea 5		52, 54, 65	
Standard 4			
Key Idea 3	1, 2, 3, 4, 5, 7, 8, 9, 11, 15, 16, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28	31, 32, 33, 34, 35, 36, 41, 42, 43, 44, 45, 46, 47, 51, 60, 61, 62, 63, 64	66, 67, 68, 70, 71, 72, 73, 74, 75, 76, 77, 79, 81, 82, 83, 84, 85
Key Idea 4	12, 13, 14, 29, 30	39, 40, 48, 49, 50, 57, 58, 59	78, 80
Key Idea 5	6, 10, 17	37, 38, 52, 53, 54, 55, 56, 65	69
Reference Tables			
2011 Edition	2, 7, 8, 10, 17, 22, 28, 30	33, 34, 36, 38, 39, 40, 45, 46, 47, 48, 52, 53, 55, 59, 62, 63	68, 69, 70, 71, 75, 76, 79, 81, 82, 84

Regents Examination in Physical Setting/Chemistry – June 2013

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

Raw Score	Scale Score
85	**100**
84	**98**
83	**96**
82	**95**
81	**93**
80	**92**
79	**90**
78	**89**
77	**87**
76	**86**
75	**85**
74	**84**
73	**83**
72	**82**
71	**81**
70	**80**
69	**79**
68	**78**
67	**77**
66	**76**
65	**75**
64	**75**
63	**74**

Raw Score	Scale Score
62	**73**
61	**72**
60	**72**
59	**71**
58	**70**
57	**69**
56	**69**
55	**68**
54	**67**
53	**67**
52	**66**
51	**66**
50	**65**
49	**64**
48	**63**
47	**63**
46	**62**
45	**61**
44	**61**
43	**60**
42	**59**
41	**59**
40	**58**

Raw Score	Scale Score
39	**57**
38	**56**
37	**56**
36	**55**
35	**54**
34	**53**
33	**53**
32	**52**
31	**51**
30	**50**
29	**49**
28	**48**
27	**47**
26	**46**
25	**45**
24	**44**
23	**43**
22	**42**
21	**41**
20	**39**
19	**38**
18	**37**
17	**35**

Raw Score	Scale Score
16	**34**
15	**32**
14	**31**
13	**29**
12	**28**
11	**26**
10	**24**
9	**22**
8	**20**
7	**18**
6	**16**
5	**14**
4	**11**
3	**9**
2	**6**
1	**3**
0	**0**

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 scale score that corresponds to that raw score. The scale score is the student's final examination score. Enter this score in the space labeled "Scale Score" on the student's answer sheet.

Schools are not permitted to rescore any of the open-ended questions on this exam after each question has been rated once, regardless of the final exam score. Schools are required to ensure that the raw scores have been added correctly and that the resulting scale score has been determined accurately.

Because scale scores corresponding to raw scores in the conversion chart change from one administration 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 Regents Examination in Physical Setting/Chemistry.