

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

PHYSICAL SETTING CHEMISTRY

Wednesday, June 22, 2011 — 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.

The answers to *all* questions in this examination are to be written in your separate answer booklet. Be sure to fill in the heading on the front of 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 in your answer booklet.

When you have completed the examination, you must sign the statement printed on the first page of your answer booklet, 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 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 in your answer booklet 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 A neutron has a charge of
(1) +1 (3) 0
(2) +2 (4) -1
- 2 Which particle has the *least* mass?
(1) alpha particle (3) neutron
(2) beta particle (4) proton
- 3 A sample of matter must be copper if
(1) each atom in the sample has 29 protons
(2) atoms in the sample react with oxygen
(3) the sample melts at 1768 K
(4) the sample can conduct electricity
- 4 In the electron cloud model of the atom, an orbital is defined as the most probable
(1) charge of an electron
(2) conductivity of an electron
(3) location of an electron
(4) mass of an electron
- 5 The elements on the Periodic Table are arranged in order of increasing
(1) atomic number
(2) mass number
(3) number of isotopes
(4) number of moles
- 6 Which element has the highest melting point?
(1) tantalum (3) osmium
(2) rhenium (4) hafnium
- 7 In a chemical reaction, there is conservation of
(1) energy, volume, and mass
(2) energy, volume, and charge
(3) mass, charge, and energy
(4) mass, charge, and volume
- 8 At STP, both diamond and graphite are solids composed of carbon atoms. These solids have
(1) the same crystal structure and the same properties
(2) the same crystal structure and different properties
(3) different crystal structures and the same properties
(4) different crystal structures and different properties
- 9 The gram-formula mass of a compound is 48 grams. The mass of 1.0 mole of this compound is
(1) 1.0 g (3) 48 g
(2) 4.8 g (4) 480 g
- 10 Given the balanced equation representing a reaction:
$$\text{Cl}_2 \rightarrow \text{Cl} + \text{Cl}$$

What occurs during this reaction?
(1) A bond is broken as energy is absorbed.
(2) A bond is broken as energy is released.
(3) A bond is formed as energy is absorbed.
(4) A bond is formed as energy is released.
- 11 Which atom has the *weakest* attraction for the electrons in a bond with an H atom?
(1) Cl atom (3) O atom
(2) F atom (4) S atom
- 12 Which substance can *not* be broken down by a chemical change?
(1) ammonia (3) propane
(2) mercury (4) water

13 At standard pressure, how do the boiling point and the freezing point of NaCl(aq) compare to the boiling point and the freezing point of H₂O(l)?

- (1) Both the boiling point and the freezing point of NaCl(aq) are lower.
- (2) Both the boiling point and the freezing point of NaCl(aq) are higher.
- (3) The boiling point of NaCl(aq) is lower, and the freezing point of NaCl(aq) is higher.
- (4) The boiling point of NaCl(aq) is higher, and the freezing point of NaCl(aq) is lower.

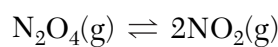
14 The temperature of a sample of matter is a measure of the

- (1) average kinetic energy of its particles
- (2) average potential energy of its particles
- (3) total kinetic energy of its particles
- (4) total potential energy of its particles

15 According to the kinetic molecular theory, the particles of an ideal gas

- (1) have no potential energy
- (2) have strong intermolecular forces
- (3) are arranged in a regular, repeated geometric pattern
- (4) are separated by great distances, compared to their size

16 Given the equation representing a closed system:



Which statement describes this system at equilibrium?

- (1) The volume of the NO₂(g) is greater than the volume of the N₂O₄(g).
- (2) The volume of the NO₂(g) is less than the volume of the N₂O₄(g).
- (3) The rate of the forward reaction and the rate of the reverse reaction are equal.
- (4) The rate of the forward reaction and the rate of the reverse reaction are unequal.

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

- (1) activation energy
- (2) kinetic energy
- (3) heat of reaction
- (4) rate of reaction

18 For a given chemical reaction, the addition of a catalyst provides a different reaction pathway that

- (1) decreases the reaction rate and has a higher activation energy
- (2) decreases the reaction rate and has a lower activation energy
- (3) increases the reaction rate and has a higher activation energy
- (4) increases the reaction rate and has a lower activation energy

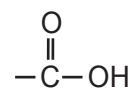
19 Which atoms can bond with each other to form chains, rings, or networks?

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

20 A molecule of an unsaturated hydrocarbon must have

- (1) at least one single carbon-carbon bond
- (2) at least one multiple carbon-carbon bond
- (3) two or more single carbon-carbon bonds
- (4) two or more multiple carbon-carbon bonds

21 Given a formula of a functional group:



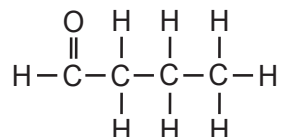
An organic compound that has this functional group is classified as

- (1) an acid
- (2) an aldehyde
- (3) an ester
- (4) a ketone

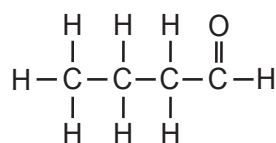
22 Which statement describes where the oxidation and reduction half-reactions occur in an operating electrochemical cell?

- (1) Oxidation and reduction both occur at the anode.
- (2) Oxidation and reduction both occur at the cathode.
- (3) Oxidation occurs at the anode, and reduction occurs at the cathode.
- (4) Oxidation occurs at the cathode, and reduction occurs at the anode.

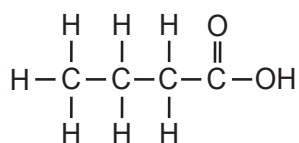
23 Given a formula representing a compound:



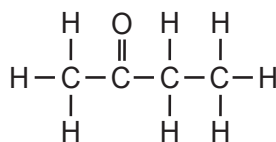
Which formula represents an isomer of this compound?



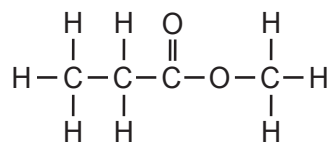
(1)



(3)



(2)



(4)

24 Which energy conversion occurs in an operating electrolytic cell?

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

25 Which compounds can be classified as electrolytes?

- (1) alcohols
- (2) alkynes
- (3) organic acids
- (4) saturated hydrocarbons

26 Potassium hydroxide is classified as an Arrhenius base because KOH contains

- (1) OH^- ions
- (2) O^{2-} ions
- (3) K^+ ions
- (4) H^+ ions

27 In which laboratory process is a volume of solution of known concentration used to determine the concentration of another solution?

- (1) deposition
- (2) distillation
- (3) filtration
- (4) titration

28 According to one acid-base theory, an acid is an

- (1) H^+ acceptor
- (2) H^+ donor
- (3) OH^- acceptor
- (4) OH^- donor

29 Energy is released during the fission of Pu-239 atoms as a result of the

- (1) formation of covalent bonds
- (2) formation of ionic bonds
- (3) conversion of matter to energy
- (4) conversion of energy to matter

30 Atoms of I-131 spontaneously decay when the

- (1) stable nuclei emit alpha particles
- (2) stable nuclei emit beta particles
- (3) unstable nuclei emit alpha particles
- (4) unstable nuclei emit beta particles

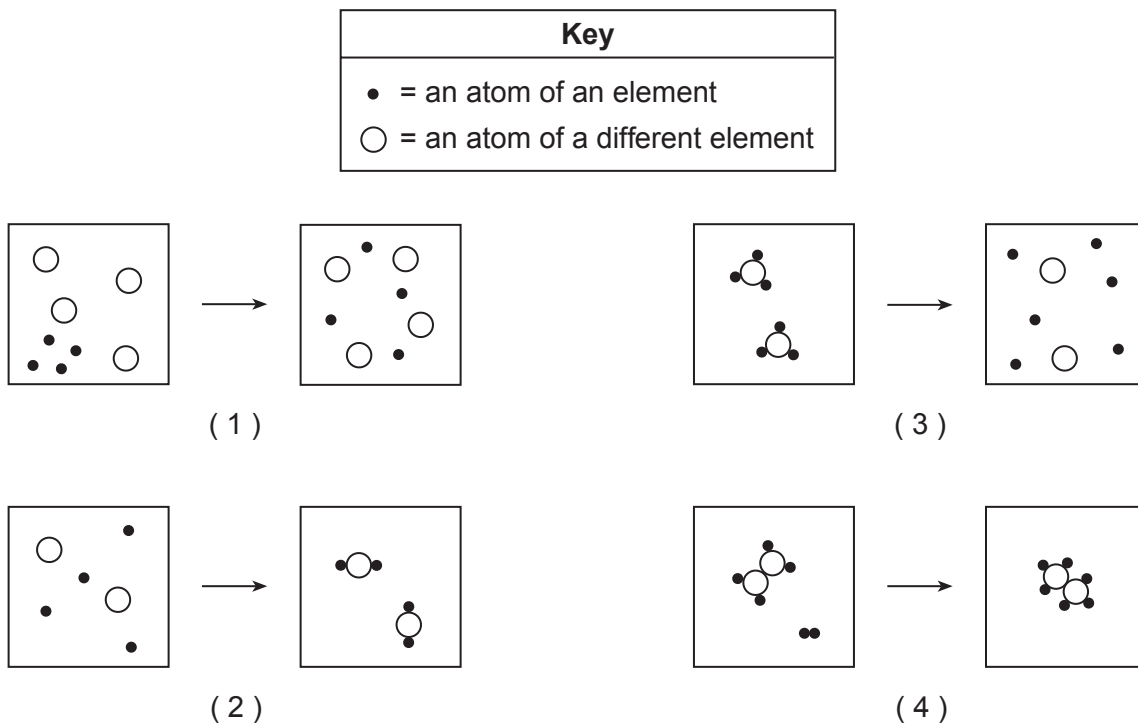
Part B-1

Answer all questions in this part.

Directions (31–50): For each statement or question, write in your answer booklet 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 Compared to the atoms of nonmetals in Period 3, the atoms of metals in Period 3 have
- (1) fewer valence electrons
 - (2) more valence electrons
 - (3) fewer electron shells
 - (4) more electron shells
- 32 Which elements are malleable and good conductors of electricity?
- (1) iodine and silver
 - (2) iodine and xenon
 - (3) tin and silver
 - (4) tin and xenon
- 33 Which atom in the ground state requires the *least* amount of energy to remove its valence electron?
- (1) lithium atom
 - (2) potassium atom
 - (3) rubidium atom
 - (4) sodium atom
- 34 What is the chemical formula of iron(III) sulfide?
- (1) FeS
 - (2) Fe₂S₃
 - (3) FeSO₃
 - (4) Fe₂(SO₃)₃
- 35 What is the percent composition by mass of sulfur in the compound MgSO₄ (gram-formula mass = 120. grams per mole)?
- (1) 20.%
 - (2) 27%
 - (3) 46%
 - (4) 53%
- 36 Which compound becomes *less* soluble in water as the temperature of the solution is increased?
- (1) HCl
 - (2) KCl
 - (3) NaCl
 - (4) NH₄Cl
- 37 Given the balanced equation representing a reaction:
- $$2\text{H}_2 + \text{O}_2 \rightarrow 2\text{H}_2\text{O}$$
- What is the mass of H₂O produced when 10.0 grams of H₂ reacts completely with 80.0 grams of O₂?
- (1) 70.0 g
 - (2) 90.0 g
 - (3) 180. g
 - (4) 800. g
- 38 Given two formulas representing the same compound:
- | Formula A | Formula B |
|-----------------|-------------------------------|
| CH ₃ | C ₂ H ₆ |
- Which statement describes these formulas?
- (1) Formulas A and B are both empirical.
 - (2) Formulas A and B are both molecular.
 - (3) Formula A is empirical, and formula B is molecular.
 - (4) Formula A is molecular, and formula B is empirical.
- 39 Given the balanced equation representing a reaction:
- $$\text{Zn}(s) + \text{H}_2\text{SO}_4(aq) \rightarrow \text{ZnSO}_4(aq) + \text{H}_2(g)$$
- Which type of reaction is represented by this equation?
- (1) decomposition
 - (2) double replacement
 - (3) single replacement
 - (4) synthesis
- 40 In a laboratory where the air temperature is 22°C, a steel cylinder at 100.°C is submerged in a sample of water at 40.°C. In this system, heat flows from
- (1) both the air and the water to the cylinder
 - (2) both the cylinder and the air to the water
 - (3) the air to the water and from the water to the cylinder
 - (4) the cylinder to the water and from the water to the air

41 Which diagram represents a physical change, only?



42 During a laboratory activity to investigate reaction rate, a student reacts 1.0-gram samples of solid zinc with 10.0-milliliter samples of HCl(aq). The table below shows information about the variables in five experiments the student performed.

Reaction of Zn(s) with HCl(aq)

| Experiment | Description of Zinc Sample | HCl(aq) Concentration (M) | Temperature (K) |
|------------|----------------------------|---------------------------|-----------------|
| 1 | lumps | 0.10 | 270. |
| 2 | powder | 0.10 | 270. |
| 3 | lumps | 0.10 | 290. |
| 4 | lumps | 1.0 | 290. |
| 5 | powder | 1.0 | 280. |

Which two experiments can be used to investigate the effect of the concentration of HCl(aq) on the reaction rate?

(1) 1 and 3

(3) 4 and 2

(2) 1 and 5

(4) 4 and 3

- 43 Which temperature change would cause a sample of an ideal gas to double in volume while the pressure is held constant?
(1) from 400. K to 200. K
(2) from 200. K to 400. K
(3) from 400.°C to 200.°C
(4) from 200.°C to 400.°C
- 44 A 36-gram sample of water has an initial temperature of 22°C. After the sample absorbs 1200 joules of heat energy, the final temperature of the sample is
(1) 8.0°C (3) 30.°C
(2) 14°C (4) 55°C
- 45 Which statement explains why Br₂ is a liquid at STP and I₂ is a solid at STP?
(1) Molecules of Br₂ are polar, and molecules of I₂ are nonpolar.
(2) Molecules of I₂ are polar, and molecules of Br₂ are nonpolar.
(3) Molecules of Br₂ have stronger intermolecular forces than molecules of I₂.
(4) Molecules of I₂ have stronger intermolecular forces than molecules of Br₂.
- 46 Which balanced equation represents an oxidation-reduction reaction?
(1) $\text{Ba}(\text{NO}_3)_2 + \text{Na}_2\text{SO}_4 \rightarrow \text{BaSO}_4 + 2\text{NaNO}_3$
(2) $\text{H}_3\text{PO}_4 + 3\text{KOH} \rightarrow \text{K}_3\text{PO}_4 + 3\text{H}_2\text{O}$
(3) $\text{Fe}(\text{s}) + \text{S}(\text{s}) \rightarrow \text{FeS}(\text{s})$
(4) $\text{NH}_3(\text{g}) + \text{HCl}(\text{g}) \rightarrow \text{NH}_4\text{Cl}(\text{s})$
- 47 Which solution reacts with LiOH(aq) to produce a salt and water?
(1) KCl(aq) (3) NaOH(aq)
(2) CaO(aq) (4) H₂SO₄(aq)
- 48 Which volume of 2.0 M NaOH(aq) is needed to completely neutralize 24 milliliters of 1.0 M HCl(aq)?
(1) 6.0 mL (3) 24 mL
(2) 12 mL (4) 48 mL
- 49 Which type of reaction releases the greatest amount of energy per mole of reactant?
(1) combustion
(2) decomposition
(3) nuclear fusion
(4) oxidation-reduction
- 50 Which balanced equation represents natural transmutation?
(1) ${}^9_4\text{Be} + {}^1_1\text{H} \rightarrow {}^6_3\text{Li} + {}^4_2\text{He}$
(2) ${}^{14}_7\text{N} + {}^4_2\text{He} \rightarrow {}^{17}_8\text{O} + {}^1_1\text{H}$
(3) ${}^{239}_{94}\text{Pu} + {}^1_0\text{n} \rightarrow {}^{144}_{58}\text{Ce} + {}^{94}_{36}\text{Kr} + 2{}^1_0\text{n}$
(4) ${}^{238}_{92}\text{U} \rightarrow {}^{234}_{90}\text{Th} + {}^4_2\text{He}$

Part B-2

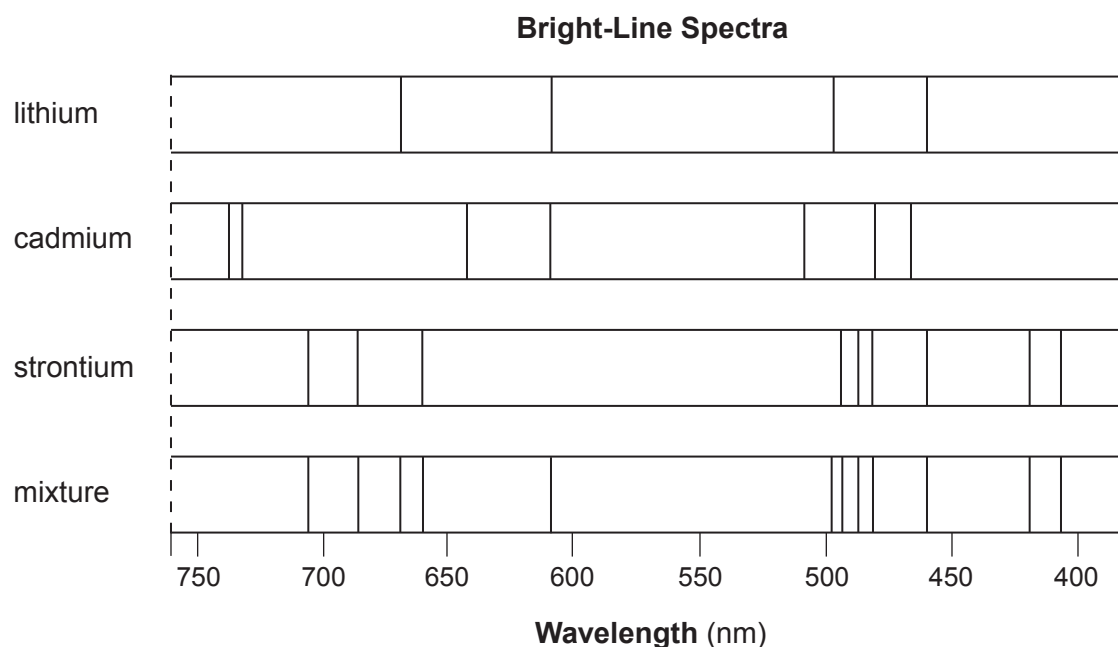
Answer all questions in this part.

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 Explain, in terms of protons and neutrons, why U-235 and U-238 are different isotopes of uranium. [1]

Base your answers to questions 52 through 54 on the information below.

The bright-line spectra for three elements and a mixture of elements are shown below.



- 52 Explain, in terms of *both* electrons and energy, how the bright-line spectrum of an element is produced. [1]
- 53 Identify *all* the elements in the mixture. [1]
- 54 State the total number of valence electrons in a cadmium atom in the ground state. [1]
-

Base your answers to questions 55 through 59 on the information below.

The ionic radii of some Group 2 elements are given in the table below.

Ionic Radii of Some Group 2 Elements

| Symbol | Atomic Number | Ionic Radius (pm) |
|--------|---------------|-------------------|
| Be | 4 | 44 |
| Mg | 12 | 66 |
| Ca | 20 | 99 |
| Ba | 56 | 134 |

- 55 On the grid *in your answer booklet*, mark an appropriate scale on the axis labeled “Ionic Radius (pm).” [1]
- 56 On the same grid, plot the data from the data table. Circle and connect the points. [1]
- 57 Estimate the ionic radius of strontium. [1]
- 58 State the trend in ionic radius as the elements in Group 2 are considered in order of increasing atomic number. [1]
- 59 Explain, in terms of electrons, why the ionic radius of a Group 2 element is smaller than its atomic radius. [1]
-

Base your answers to questions 60 and 61 on the information below.

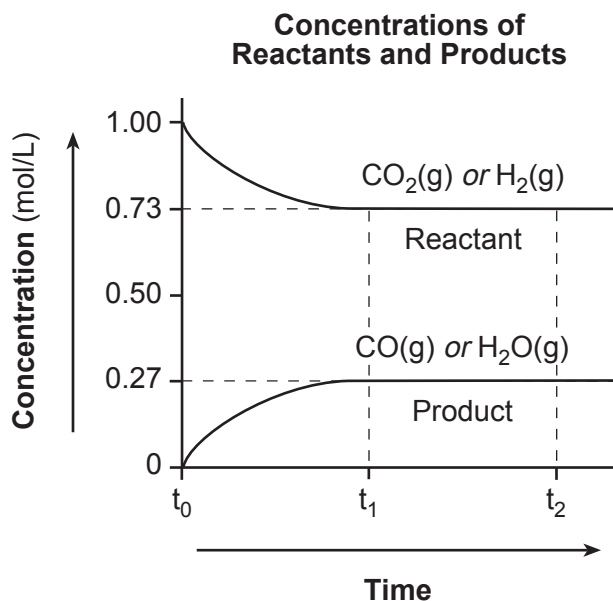
The balanced equation below represents the decomposition of potassium chlorate.



- 60 Determine the oxidation number of chlorine in the reactant in the equation. [1]
- 61 State why the entropy of the reactant is less than the entropy of the products. [1]
-

Base your answers to questions 62 and 63 on the information below.

At 550°C, 1.00 mole of CO₂(g) and 1.00 mole of H₂(g) are placed in a 1.00-liter reaction vessel. The substances react to form CO(g) and H₂O(g). Changes in the concentrations of the reactants and the concentrations of the products are shown in the graph below.

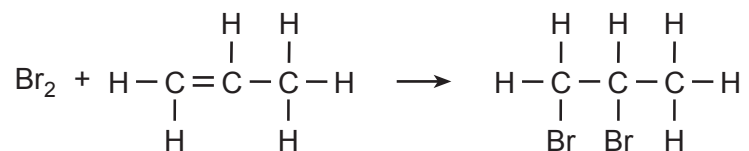


62 Determine the change in the concentration of CO₂(g) between time t_0 and time t_1 . [1]

63 What can be concluded from the graph about the concentrations of the reactants and the concentrations of the products between time t_1 and time t_2 ? [1]

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

A reaction between bromine and a hydrocarbon is represented by the balanced equation below.



64 Identify the type of organic reaction. [1]

65 Write the name of the homologous series to which the hydrocarbon belongs. [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 *Reference Tables for Physical Setting/Chemistry*.

Base your answers to questions 66 through 68 on the information below.

Ozone, $\text{O}_3(\text{g})$, is produced from oxygen, $\text{O}_2(\text{g})$, by electrical discharge during thunderstorms. The unbalanced equation below represents the reaction that forms ozone.



- 66 Balance the equation *in your answer booklet* for the production of ozone, using the smallest whole-number coefficients. [1]
- 67 Identify the type of bonding between the atoms in an oxygen molecule. [1]
- 68 Explain, in terms of electron configuration, why an oxygen molecule is more stable than an oxygen atom. [1]
-

Base your answers to questions 69 and 70 on the information below.

Natural gas is a mixture that includes butane, ethane, methane, and propane. Differences in boiling points can be used to separate the components of natural gas. The boiling points at standard pressure for these components are listed in the table below.

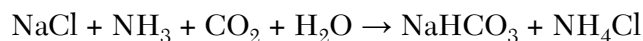
Data Table

| Component of Natural Gas | Boiling Point at Standard Pressure (°C) |
|---------------------------------|--|
| butane | -0.5 |
| ethane | -88.6 |
| methane | -161.6 |
| propane | -42.1 |

- 69 Identify a process used to separate the components of natural gas. [1]
- 70 List the *four* components of natural gas in order of increasing strength of intermolecular forces. [1]
-

Base your answers to questions 71 through 73 on the information below.

In 1864, the Solvay process was developed to make soda ash. One step in the process is represented by the balanced equation below.



- 71 Write the chemical formula for *one* compound in the equation that contains *both* ionic bonds and covalent bonds. [1]
- 72 Explain, in terms of electronegativity difference, why the bond between hydrogen and oxygen in a water molecule is more polar than the bond between hydrogen and nitrogen in an ammonia molecule. [1]
- 73 In the space *in your answer booklet*, draw a Lewis electron-dot diagram for the reactant containing nitrogen in the equation. [1]
-

Base your answers to questions 74 through 76 on the information below.

A student prepared two mixtures, each in a labeled beaker. Enough water at 20.°C was used to make 100 milliliters of each mixture.

Information about Two Mixtures at 20.°C

| | Mixture 1 | Mixture 2 |
|-----------------------------|---|---|
| Composition | NaCl in H ₂ O | Fe filings in H ₂ O |
| Student Observations | <ul style="list-style-type: none">• colorless liquid• no visible solid on bottom of beaker | <ul style="list-style-type: none">• colorless liquid• black solid on bottom of beaker |
| Other Data | <ul style="list-style-type: none">• mass of NaCl(s) dissolved = 2.9 g | <ul style="list-style-type: none">• mass of Fe(s) = 15.9 g• density of Fe(s) = 7.87 g/cm³ |

- 74 Classify *each* mixture using the term “homogeneous” or the term “heterogeneous.” [1]
- 75 Determine the volume of the Fe filings used to produce mixture 2. [1]
- 76 Describe a procedure to physically remove the water from mixture 1. [1]
-

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

A student performed a laboratory activity to observe the reaction between aluminum foil and an aqueous copper(II) chloride solution. The reaction is represented by the balanced equation below.



The procedures and corresponding observations for the activities are given below.

| Procedure | Observation |
|--|--|
| In a beaker, completely dissolve 5.00 g of CuCl_2 in 80.0 mL of H_2O . | <ul style="list-style-type: none">• The solution is blue green. |
| Cut 1.5 g of $\text{Al}(s)$ foil into small pieces. Add all the foil to the mixture in the beaker. Stir the contents for 1 minute. | <ul style="list-style-type: none">• The surface of $\text{Al}(s)$ foil appears partially black.• The beaker feels warm to the touch. |
| Observe the beaker and contents after 10 minutes. | <ul style="list-style-type: none">• The liquid in the beaker appears colorless.• A reddish-brown solid is seen at the bottom of the beaker.• Some pieces of $\text{Al}(s)$ with a partially black coating remain in the beaker. |

77 State *one* observation that indicates Cu^{2+} ions became Cu atoms. [1]

78 Describe *one* change in the procedure that would cause the reaction to occur at a faster rate. [1]

79 State *one* safety procedure the student should perform after completing the laboratory activity. [1]

Base your answers to questions 80 through 82 on the information below.

Some carbonated beverages are made by forcing carbon dioxide gas into a beverage solution. When a bottle of one kind of carbonated beverage is first opened, the beverage has a pH value of 3.

- 80 State, in terms of the pH scale, why this beverage is classified as acidic. [1]
- 81 Using Table M, identify *one* indicator that is yellow in a solution that has the same pH value as this beverage. [1]
- 82 After the beverage bottle is left open for several hours, the hydronium ion concentration in the beverage solution decreases to $\frac{1}{1000}$ of the original concentration. Determine the new pH of the beverage solution. [1]
-

Base your answers to questions 83 through 85 on the information below.

Polonium-210 occurs naturally, but is scarce. Polonium-210 is primarily used in devices designed to eliminate static electricity in machinery. It is also used in brushes to remove dust from camera lenses.

Polonium-210 can be created in the laboratory by bombarding bismuth-209 with neutrons to create bismuth-210. The bismuth-210 undergoes beta decay to produce polonium-210. Polonium-210 has a half-life of 138 days and undergoes alpha decay.

- 83 State *one* beneficial use of Po-210. [1]
- 84 Complete the nuclear equation *in your answer booklet* for the decay of Po-210, by writing a notation for the missing product. [1]
- 85 Determine the total mass of an original 28.0-milligram sample of Po-210 that remains unchanged after 414 days. [1]
-

PHYSICAL SETTING CHEMISTRY

Wednesday, June 22, 2011 — 1:15 to 4:15 p.m., only

ANSWER BOOKLET

Student Sex: Male
 Female

Teacher

School Grade

Answer all questions in this examination. 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 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

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

The declaration below must 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

Part B-2

**For Raters
Only**

51 _____

51

52 _____

52

53 _____

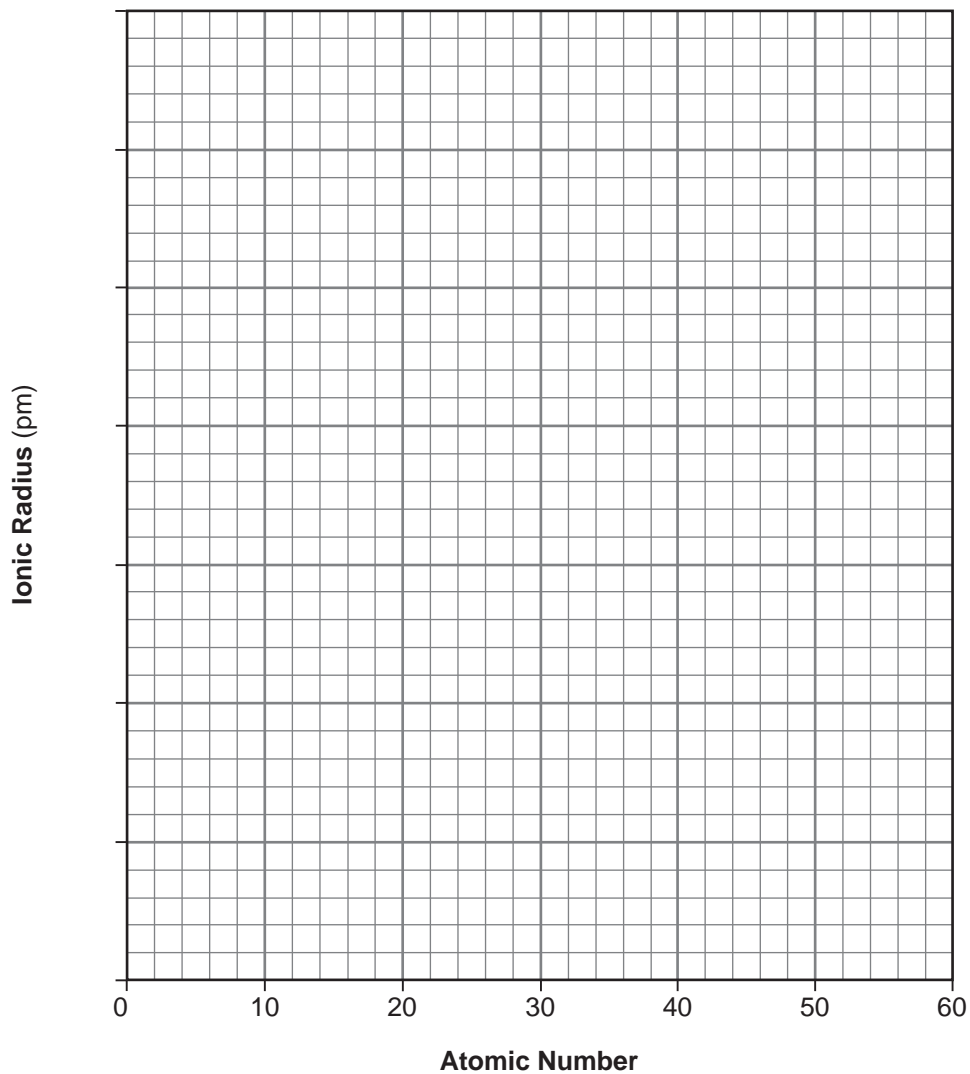
53

54 _____

54

55 and 56

Ionic Radius Versus Atomic Number



55

56

57 _____ pm

57

58 _____

58

59 _____

59

**For Raters
Only**

60 _____

60

61 _____

61

62 _____ mol/L

62

63 _____

63

64 _____

64

65 _____

65

**Total Score
for Part B-2**

**For Raters
Only**

74 Mixture 1: _____

74

Mixture 2: _____

75 _____ cm^3

75

76 _____

76

77 _____

77

78 _____

78

79 _____

79

80 _____

80

81 _____

81

82 _____

82

**For Raters
Only**

83 _____

83

84 ${}_{84}^{210}\text{Po} \rightarrow {}_2^4\text{He} + \text{_____}$

84

85 _____ mg

85

**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

Wednesday, June 22, 2011 — 1:15 to 4:15 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/apda/> 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 | | | Part B-1 | |
|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|
| 1 3 | 11 4 | 21 1 | 31 1 | 41 1 |
| 2 2 | 12 2 | 22 3 | 32 3 | 42 4 |
| 3 1 | 13 4 | 23 2 | 33 3 | 43 2 |
| 4 3 | 14 1 | 24 2 | 34 2 | 44 3 |
| 5 1 | 15 4 | 25 3 | 35 2 | 45 4 |
| 6 2 | 16 3 | 26 1 | 36 1 | 46 3 |
| 7 3 | 17 3 | 27 4 | 37 2 | 47 4 |
| 8 4 | 18 4 | 28 2 | 38 3 | 48 2 |
| 9 3 | 19 1 | 29 3 | 39 3 | 49 3 |
| 10 1 | 20 2 | 30 4 | 40 4 | 50 4 |

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.

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 more than approximately one-half of 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 scale score by using the conversion chart that will be posted on the Department's web site at: <http://www.p12.nysed.gov/apda/> on Wednesday, June 22, 2011. The student's scale score should be entered in the labeled box on the student's answer booklet. The scale score is the student's final examination score. On the front of the student's answer booklet, raters must enter their initials on the lines next to "Rater 1" or "Rater 2."

Beginning in June 2011, schools are no longer 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 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:

A U-235 atom has 92 protons and 143 neutrons, and a U-238 atom has 92 protons and 146 neutrons.

A U-235 atom and a U-238 atom have the same number of protons but a different number of neutrons.

52 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

When electrons in an excited state return to a lower energy state, specific amounts of energy are emitted. These energies are associated with specific wavelengths of light that are characteristic of the bright-line spectrum of an element.

Energy is emitted when excited electrons fall back to lower shells.

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

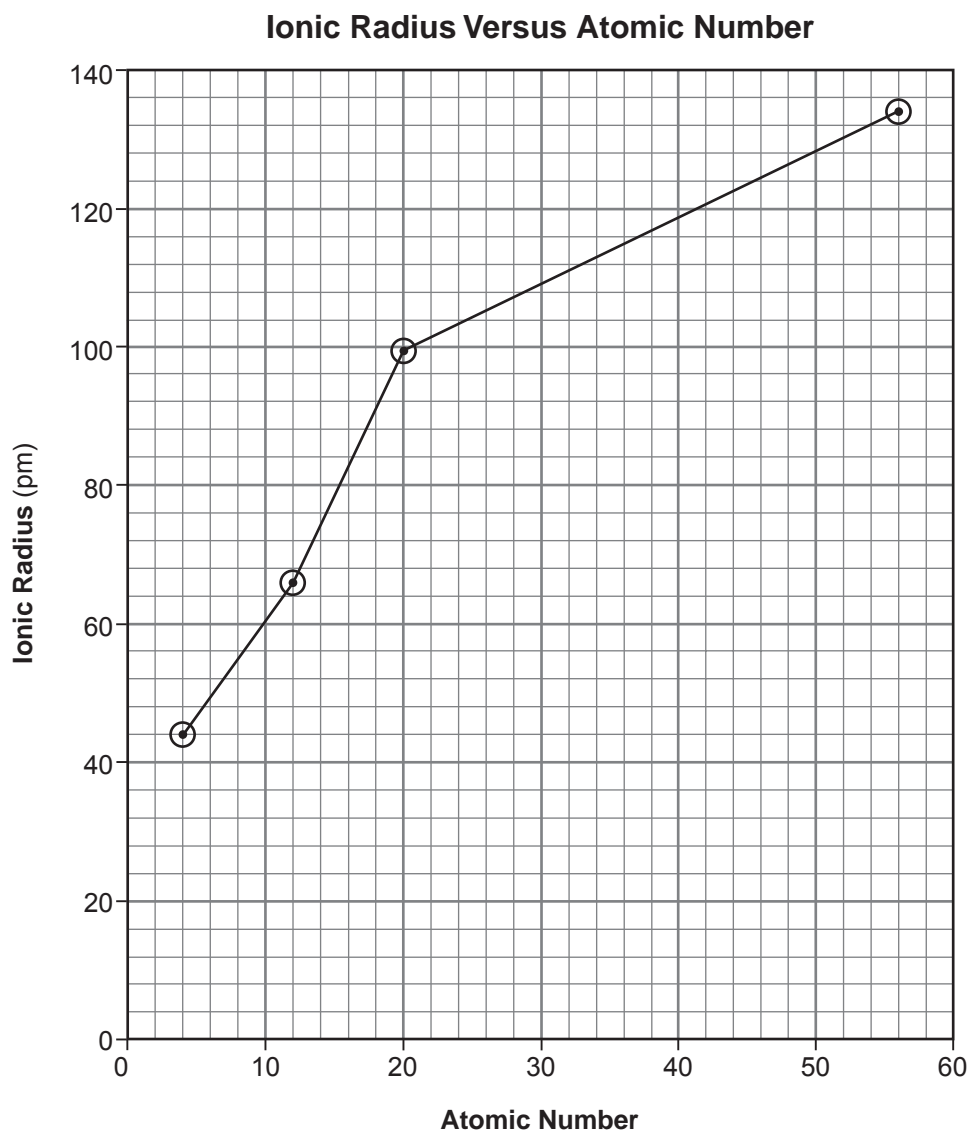
lithium and strontium

Sr and Li

54 [1] Allow 1 credit for 2 *or* two.

- 55 [1] Allow 1 credit for marking an appropriate scale. An appropriate scale is linear and allows a trend to be seen.
- 56 [1] Allow 1 credit for plotting all four points correctly ± 0.3 grid space. Plotted points do *not* need to be circled or connected.

Example of a 2-credit response for questions 55 and 56:



- 57 [1] Allow 1 credit for $117 \text{ pm} \pm 2 \text{ pm}$ *or* for a response consistent with the student's graph.
- 58 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

As the atomic number of elements in Group 2 increases, the ionic radius increases.

The ionic radius increases.

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

The valence electron shell of a Group 2 atom is lost when it becomes an ion.

A Group 2 ion has two fewer electrons than the atom from which it was formed.

60 [1] Allow 1 credit for +5.

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

The gaseous product is more disordered than the solid reactant.

The solid reactant is more ordered than the products.

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

-0.27 mol/L

0.27 mol/L

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

Between time t_1 and time t_2 , the concentrations of the reactants and the concentrations of the products are no longer changing.

The concentrations of the reactants and the products remain constant.

The concentration of each reactant is 0.73 mol/L, and the concentration of each product is 0.27 mol/L.

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

addition

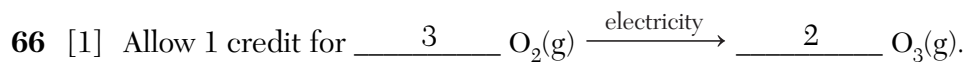
halogenation

bromination

65 [1] Allow 1 credit for alkene *or* alkenes.

Part C

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



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

nonpolar covalent

covalent

double covalent

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

Both atoms in an O_2 molecule have achieved a noble gas electron configuration.

An oxygen atom does not have a stable octet of valence electrons.

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

fractional distillation

distillation

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

| | | | |
|-------------------------------------|-----------------------------------|-----------------------------------|---------------------------------------|
| <u>methane</u> | <u>ethane</u> | <u>propane</u> | <u>butane</u> |
| Weakest intermolecular forces | | | Strongest intermolecular forces |
| <u>CH₄</u> | <u>C₂H₆</u> | <u>C₃H₈</u> | <u>C₄H₁₀</u> |
| Weakest intermolecular forces | | | Strongest intermolecular forces |

71 [1] Allow 1 credit for NaHCO_3 or NH_4Cl .

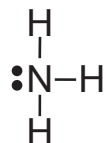
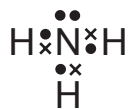
72 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

The electronegativity difference is 1.4 for H and O, which is higher than the 0.9 for H and N.

The difference in electronegativity between hydrogen and oxygen is greater than that for hydrogen and nitrogen.

73 [1] Allow 1 credit.

Examples of 1-credit responses:



74 [1] Allow 1 credit for *two* acceptable responses.

Mixture 1: homogeneous

Mixture 2: heterogeneous

75 [1] Allow 1 credit for 2.02 cm^3 . Significant figures do *not* need to be shown.

76 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

Heat mixture 1 until all the water evaporates.

Allow the water to evaporate.

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

The solution is no longer blue green.

A reddish-brown solid is formed.

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

Heat the solution before adding the aluminum foil.

Increase the concentration of the CuCl_2 solution.

Cut the Al foil into even smaller pieces.

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

Thoroughly wash the lab equipment and return it to its proper storage place.

Dispose of the chemicals as directed by the teacher.

Wash hands before leaving the lab room.

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

The beverage is acidic because its pH value is below 7.

A pH of 3 is in the acid range on the pH scale.

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

bromthymol blue

bromocresol green

thymol blue

82 [1] Allow 1 credit for 6 *or* six.

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

Polonium-210 is used to eliminate static electricity in machinery.

removes dust from camera lenses

84 [1] Allow 1 credit. Acceptable responses include, but are not limited to:



lead-206

85 [1] Allow 1 credit for 3.5 mg.

Regents Examination in Physical Setting/Chemistry

June 2011

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

The *Chart for Determining the Final Examination Score for the June 2011 Regents Examination in Physical Setting/Chemistry* will be posted on the Department's web site at: <http://www.p12.nysed.gov/apda/> on Wednesday, June 22, 2011. 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 2011 Physical Setting/Chemistry | | | |
|---|--|---|--|
| Question Numbers | | | |
| Key Ideas/Performance Indicators | Part A | Part B | Part C |
| Standard 1 | | | |
| Math Key Idea 1 | | 48, 55, 56, 57 | |
| Math Key Idea 2 | | 36, 62 | 66 |
| Math Key Idea 3 | | 34, 38, 43, 60 | 75, 85 |
| Science Inquiry Key Idea 1 | | 31, 49, 52, 53, 54, 58, 59, 61 | 67, 68, 72, 73 |
| Science Inquiry Key Idea 2 | | 42 | 78, 79 |
| Science Inquiry Key Idea 3 | | 34, 35, 37, 40, 41, 42, 45, 47, 50, 53, 58, 60 | 66, 68, 69, 70, 71, 74, 77, 81 |
| Engineering Design Key Idea 1 | | | |
| Standard 2 | | | |
| Key Idea 1 | | | 83 |
| Key Idea 2 | | | |
| Key Idea 3 | | | |
| Standard 6 | | | |
| Key Idea 1 | | | |
| Key Idea 2 | | | |
| Key Idea 3 | | | 82 |
| Key Idea 4 | | 63 | |
| Key Idea 5 | | | |
| Standard 7 | | | |
| Key Idea 1 | | | |
| Key Idea 2 | | | |
| Standard 4 Process Skills | | | |
| Key Idea 3 | | 32, 33, 35, 36, 37, 39, 41, 43, 46, 51, 53, 58, 61, 62, 63, 64, 65 | 66, 69, 76, 80, 81 |
| Key Idea 4 | | 44 | 83, 84, 85 |
| Key idea 5 | | 45 | 70, 73 |
| Standard 4 | | | |
| Key Idea 3 | 1, 2, 3, 4, 5, 6, 7, 9, 12, 13, 15, 16, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 30 | 31, 32, 33, 34, 35, 36, 37, 38, 39, 41, 42, 43, 46, 47, 48, 51, 52, 53, 54, 55, 56, 57, 58, 60, 61, 62, 63, 64, 65 | 66, 69, 74, 75, 76, 77, 78, 79, 80, 81, 82 |
| Key Idea 4 | 14, 17 | 40, 44, 50 | 83, 84, 85 |
| Key Idea 5 | 8, 10, 11, 29 | 45, 49, 59 | 67, 68, 70, 71, 72, 73 |
| Reference Tables | | | |
| 2002 Edition | 2, 3, 5, 6, 9, 11, 21, 30 | 32, 33, 36, 38, 43, 44, 45, 48, 50, 54, 59, 60 | 68, 71, 72, 73, 80, 81, 85 |

Regents Examination in Physical Setting/Chemistry June 2011

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

| Raw Score | Scale Score | Raw Score | Scale Score | Raw Score | Scale Score | Raw Score | Scale Score |
|-----------|-------------|-----------|-------------|-----------|-------------|-----------|-------------|
| 85 | 100 | 63 | 74 | 41 | 59 | 19 | 38 |
| 84 | 98 | 62 | 73 | 40 | 58 | 18 | 36 |
| 83 | 96 | 61 | 72 | 39 | 57 | 17 | 35 |
| 82 | 94 | 60 | 72 | 38 | 57 | 16 | 34 |
| 81 | 93 | 59 | 71 | 37 | 56 | 15 | 32 |
| 80 | 91 | 58 | 70 | 36 | 55 | 14 | 30 |
| 79 | 90 | 57 | 70 | 35 | 54 | 13 | 29 |
| 78 | 89 | 56 | 69 | 34 | 53 | 12 | 27 |
| 77 | 87 | 55 | 68 | 33 | 53 | 11 | 25 |
| 76 | 86 | 54 | 67 | 32 | 52 | 10 | 23 |
| 75 | 85 | 53 | 67 | 31 | 51 | 9 | 22 |
| 74 | 84 | 52 | 66 | 30 | 50 | 8 | 20 |
| 73 | 83 | 51 | 66 | 29 | 49 | 7 | 17 |
| 72 | 82 | 50 | 65 | 28 | 48 | 6 | 15 |
| 71 | 81 | 49 | 64 | 27 | 47 | 5 | 13 |
| 70 | 80 | 48 | 63 | 26 | 46 | 4 | 11 |
| 69 | 79 | 47 | 63 | 25 | 45 | 3 | 8 |
| 68 | 78 | 46 | 62 | 24 | 44 | 2 | 6 |
| 67 | 77 | 45 | 61 | 23 | 43 | 1 | 3 |
| 66 | 76 | 44 | 61 | 22 | 42 | 0 | 0 |
| 65 | 76 | 43 | 60 | 21 | 40 | | |
| 64 | 75 | 42 | 59 | 20 | 39 | | |

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 "Final Score" on the student's answer sheet.

Beginning in June 2011, schools are no longer 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.