The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

PHYSICAL SETTING
CHEMISTRY

Wednesday, August 16, 2006 — 12:30 to 3:30 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.

PS/CHEMISTRY

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*.

1 Which statement correctly describes the charge of the nucleus and the charge of the electron cloud of an atom?

(1) The nucleus is positive and the electron cloud is positive.
(2) The nucleus is positive and the electron cloud is negative.
(3) The nucleus is negative and the electron cloud is positive.
(4) The nucleus is negative and the electron cloud is negative.

2 Which Period 4 element has the most metallic properties?

(1) As
(2) Br
(3) Ge
(4) Sc

3 Which property makes it possible to separate the oxygen and the nitrogen from a sample of liquefied air?

(1) boiling point
(2) conductivity
(3) hardness
(4) electronegativity

4 Which statement explains why ozone gas, O_3, and oxygen gas, O_2, have different properties?

(1) They are formed from different elements.
(2) They have different molecular structures.
(3) They have different oxidation numbers.
(4) They have different electronegativities.

5 Which statement is true about oxidation and reduction in an electrochemical cell?

(1) Both occur at the anode.
(2) 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.

6 A compound is made up of iron and oxygen, only. The ratio of iron ions to oxide ions is 2:3 in this compound. The IUPAC name for this compound is

(1) triiron dioxide
(2) iron(II) oxide
(3) iron(III) oxide
(4) iron trioxide

7 Which process is a chemical change?

(1) melting of ice
(2) boiling of water
(3) subliming of ice
(4) decomposing of water

8 Which substance contains bonds that involved the transfer of electrons from one atom to another?

(1) CO_2
(2) NH_3
(3) KBr
(4) Cl_2

9 What is the total number of pairs of electrons shared in a molecule of N_2?

(1) one pair
(2) two pairs
(3) three pairs
(4) four pairs

10 Which formula represents a nonpolar molecule containing polar covalent bonds?

(1) H_2O
(2) CCl_4
(3) NH_3
(4) H_2

11 The degree of polarity of a chemical bond in a molecule of a compound can be predicted by determining the difference in the

(1) melting points of the elements in the compound
(2) densities of the elements in the compound
(3) electronegativities of the bonded atoms in a molecule of the compound
(4) atomic masses of the bonded atoms in a molecule of the compound

12 Which statement best describes the shape and volume of an aluminum cylinder at STP?

(1) It has a definite shape and a definite volume.
(2) It has a definite shape and no definite volume.
(3) It has no definite shape and a definite volume.
(4) It has no definite shape and no definite volume.

13 Which two substances can *not* be broken down by chemical change?

(1) C and CuO
(2) C and Cu
(3) CO_2 and CuO
(4) CO_2 and Cu

14 Which compound is insoluble in water?

(1) $BaSO_4$
(2) $CaCrO_4$
(3) $KClO_3$
(4) Na_2S

15 A sample of a gas is contained in a closed rigid cylinder. According to kinetic molecular theory, what occurs when the gas inside the cylinder is heated?

(1) The number of gas molecules increases.
(2) The number of collisions between gas molecules per unit time decreases.
(3) The average velocity of the gas molecules increases.
(4) The volume of the gas decreases.

16 Which statement best describes how a catalyst increases the rate of a reaction?

(1) The catalyst provides an alternate reaction pathway with a higher activation energy.
(2) The catalyst provides an alternate reaction pathway with a lower activation energy.
(3) The catalyst provides the same reaction pathway with a higher activation energy.
(4) The catalyst provides the same reaction pathway with a lower activation energy.

17 The compounds 2-butanol and 2-butene both contain

(1) double bonds, only
(2) single bonds, only
(3) carbon atoms
(4) oxygen atoms

18 The data table below gives the temperature and pressure of four different gas samples, each in a 2-liter container.

Temperature and Pressure of Gas Samples

Gas Sample	Temperature (K)	Pressure (atm)
He	300.	1.20
Ne	300.	1.00
CO_2	200.	1.20
CH_4	300.	1.00

Which two gas samples contain the same total number of particles?

(1) CH_4 and CO_2
(2) CH_4 and Ne
(3) He and CO_2
(4) He and Ne

19 A chemical reaction is at equilibrium. Compared to the rate of the forward reaction, the rate of the reverse reaction is

(1) faster and more reactant is produced
(2) faster and more product is produced
(3) the same and the reaction has stopped
(4) the same and the reaction continues in both directions

20 Which organic compound is a saturated hydrocarbon?

(1) ethyne
(2) ethene
(3) ethanol
(4) ethane

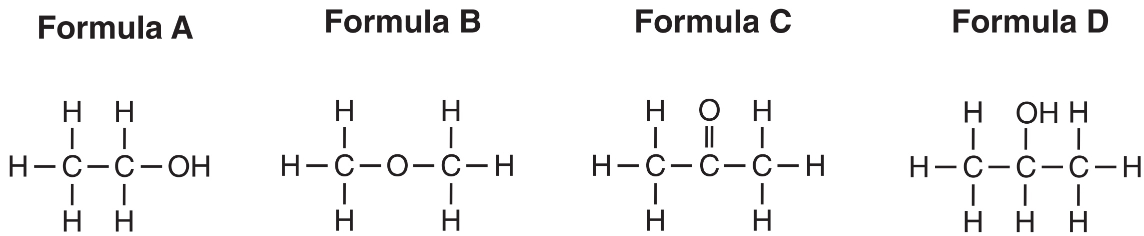
21 A substance is classified as an electrolyte because

(1) it has a high melting point
(2) it contains covalent bonds
(3) its aqueous solution conducts an electric current
(4) its aqueous solution has a pH value of 7

22 Half-reactions can be written to represent all

(1) double-replacement reactions
(2) neutralization reactions
(3) fission and fusion reactions
(4) oxidation and reduction reactions

23 Given the structural formulas:



Which two formulas represent compounds that are isomers of each other?

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

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24 Given the balanced equation representing a redox reaction:

$$2Al + 3Cu^{2+} \rightarrow 2Al^{3+} + 3Cu$$

Which statement is true about this reaction?

(1) Each Al loses $2e^-$ and each Cu^{2+} gains $3e^-$.
(2) Each Al loses $3e^-$ and each Cu^{2+} gains $2e^-$.
(3) Each Al^{3+} gains $2e^-$ and each Cu loses $3e^-$.
(4) Each Al^{3+} gains $3e^-$ and each Cu loses $2e^-$.

25 Which conversion of energy always occurs in a voltaic cell?

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

26 The compound NaOH(s) dissolves in water to yield

(1) hydroxide ions as the only negative ions
(2) hydroxide ions as the only positive ions
(3) hydronium ions as the only negative ions
(4) hydronium ions as the only positive ions

27 Which equation represents a neutralization reaction?

(1) $4Fe(s) + 3O_2(g) \rightarrow 2Fe_2O_3(s)$
(2) $2H_2(g) + O_2(g) \rightarrow 2H_2O(\ell)$
(3) $HNO_3(aq) + KOH(aq) \rightarrow KNO_3(aq) + H_2O(\ell)$
(4) $AgNO_3(aq) + KCl(aq) \rightarrow KNO_3(aq) + AgCl(s)$

28 Which notation of a radioisotope is correctly paired with the notation of its emission particle?

(1) ^{37}Ca and $^{4}_{2}He$
(2) ^{235}U and $^{0}_{+1}e$
(3) ^{16}N and $^{1}_{1}p$
(4) ^{3}H and $^{0}_{-1}e$

29 Atoms of one element are converted to atoms of another element through

(1) fermentation
(2) oxidation
(3) polymerization
(4) transmutation

30 An atom of potassium-37 and an atom of potassium-42 differ in their total number of

(1) electrons
(2) neutrons
(3) protons
(4) positrons

Part B–1

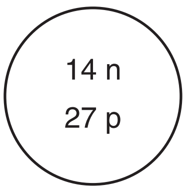
Answer all questions in this part.

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*.

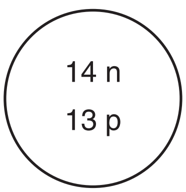
31 What is the mass number of an atom that has six protons, six electrons, and eight neutrons?

(1) 6
(2) 12
(3) 14
(4) 20

32 Which diagram represents the nucleus of an atom of ${}^{27}_{13}Al$?



(1)



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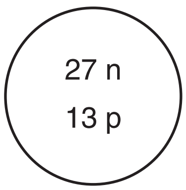
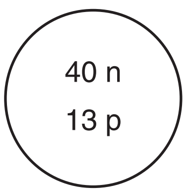


(3)



(4)

33 A student constructs a model for comparing the masses of subatomic particles. The student selects a small, metal sphere with a mass of 1 gram to represent an electron. A sphere with which mass would be most appropriate to represent a proton?

(1) 1 g
(2) $\frac{1}{2}$ g
(3) $\frac{1}{2000}$ g
(4) 2000 g

34 Based on electronegativity values, which type of elements tends to have the greatest attraction for electrons in a bond?

(1) metals
(2) metalloids
(3) nonmetals
(4) noble gases

35 Which list of elements from Group 2 on the Periodic Table is arranged in order of increasing atomic radius?

(1) Be, Mg, Ca
(2) Ca, Mg, Be
(3) Ba, Ra, Sr
(4) Sr, Ra, Ba

36 Which half-reaction shows conservation of charge?

(1) $Cu + e^- \rightarrow Cu^+$
(2) $Cu^{2+} + 2e^- \rightarrow Cu$
(3) $Cu^+ \rightarrow Cu + e^-$
(4) $Cu^{2+} \rightarrow Cu + 2e^-$

37 The percent composition by mass of magnesium in $MgBr_2$ (gram-formula mass = 184 grams/mole) is equal to

(1) $\frac{24}{184} \times 100$
(2) $\frac{160.}{184} \times 100$
(3) $\frac{184}{24} \times 100$
(4) $\frac{184}{160.} \times 100$

38 Given the balanced equation:

$$CaCO_3(s) + 2HCl(aq) \rightarrow$$
$$CaCl_2(aq) + H_2O(\ell) + CO_2(g)$$

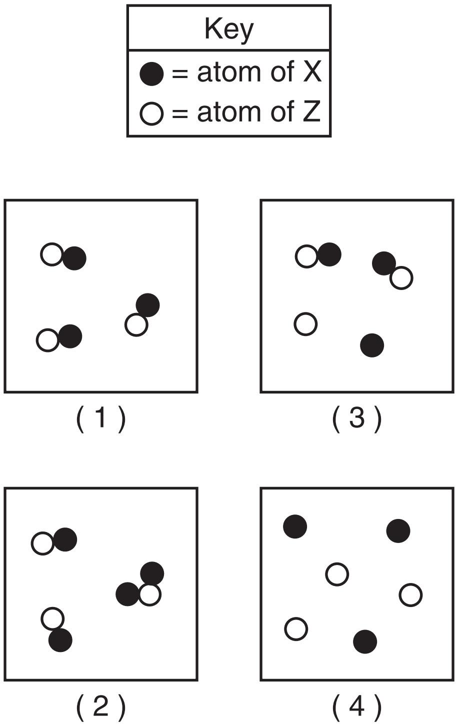
What is the total number of moles of CO_2 formed when 20. moles of HCl is completely consumed?

(1) 5.0 mol
(2) 10. mol
(3) 20. mol
(4) 40. mol

39 What amount of heat is required to completely melt a 29.95-gram sample of $H_2O(s)$ at 0°C?

(1) 334 J
(2) 2260 J
(3) 1.00×10^3 J
(4) 1.00×10^4 J

40 Which particle diagram represents a mixture of element *X* and element *Z*, only?



41 An unsaturated aqueous solution of NH_3 is at 90.°C in 100. grams of water. According to Reference Table *G*, how many grams of NH_3 could this unsaturated solution contain?

(1) 5 g
(2) 10. g
(3) 15 g
(4) 20. g

42 How many total moles of KNO_3 must be dissolved in water to make 1.5 liters of a 2.0 M solution?

(1) 0.50 mol
(2) 2.0 mol
(3) 3.0 mol
(4) 1.3 mol

43 Which statement explains why low temperature and high pressure are required to liquefy chlorine gas?

(1) Chlorine molecules have weak covalent bonds.
(2) Chlorine molecules have strong covalent bonds.
(3) Chlorine molecules have weak intermolecular forces of attraction.
(4) Chlorine molecules have strong intermolecular forces of attraction.

44 Given the balanced equation representing a reaction:

$$CH_4(g) + 2O_2(g) \rightarrow 2H_2O(g) + CO_2(g) + \text{heat}$$

Which statement is true about energy in this reaction?

(1) The reaction is exothermic because it releases heat.
(2) The reaction is exothermic because it absorbs heat.
(3) The reaction is endothermic because it releases heat.
(4) The reaction is endothermic because it absorbs heat.

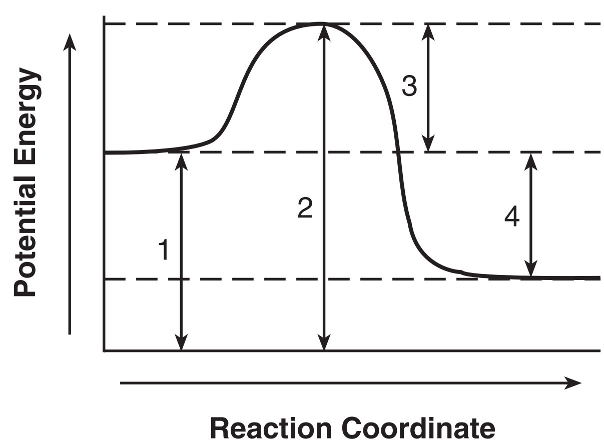
45 Given the reaction at equilibrium:

$$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g) + 91.8 \text{ kJ}$$

What occurs when the concentration of $H_2(g)$ is increased?

(1) The rate of the forward reaction increases and the concentration of $N_2(g)$ decreases.
(2) The rate of the forward reaction decreases and the concentration of $N_2(g)$ increases.
(3) The rate of the forward reaction and the concentration of $N_2(g)$ both increase.
(4) The rate of the forward reaction and the concentration of $N_2(g)$ both decrease.

46 Given the potential energy diagram for a reaction:



Which interval on this diagram represents the difference between the potential energy of the products and the potential energy of the reactants?

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

47 Based on bond type, which compound has the highest melting point?

(1) CH_3OH (3) $CaCl_2$
(2) C_6H_{14} (4) CCl_4

48 A 100.00-gram sample of naturally occurring boron contains 19.78 grams of boron-10 (atomic mass = 10.01 atomic mass units) and 80.22 grams of boron-11 (atomic mass = 11.01 atomic mass units). Which numerical setup can be used to determine the atomic mass of naturally occurring boron?

(1) $(0.1978)(10.01) + (0.8022)(11.01)$

(2) $(0.8022)(10.01) + (0.1978)(11.01)$

(3) $\dfrac{(0.1978)(10.01)}{(0.8022)(11.01)}$

(4) $\dfrac{(0.8022)(10.01)}{(0.1978)(11.01)}$

49 Which list of the phases of H_2O is arranged in order of increasing entropy?

(1) ice, steam, and liquid water
(2) ice, liquid water, and steam
(3) steam, liquid water, and ice
(4) steam, ice, and liquid water

50 Solution *A* has a pH of 3 and solution *Z* has a pH of 6. How many times greater is the hydronium ion concentration in solution *A* than the hydronium ion concentration in solution *Z*?

(1) 100 (3) 3
(2) 2 (4) 1000

Part B–2

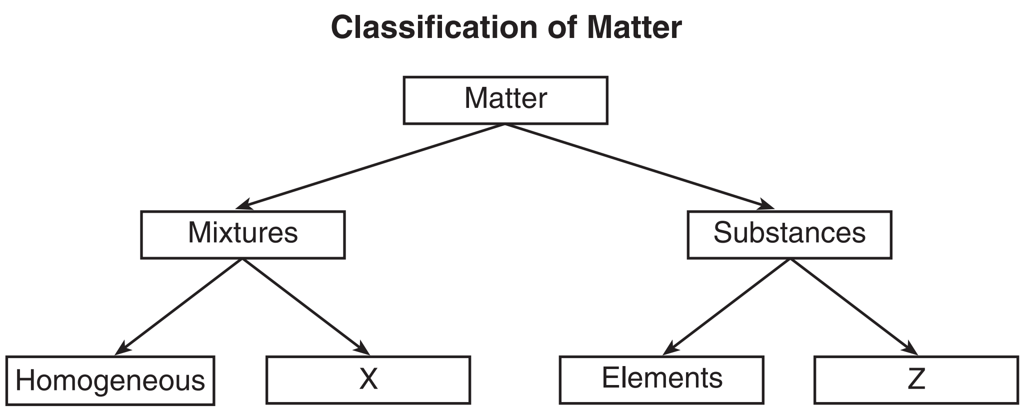
Answer all questions in this part.

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 In the space *in your answer booklet,* draw a Lewis electron-dot diagram for a sulfur atom in the ground state. [1]

52 Explain, in terms of electron configuration, why selenium and sulfur have similar chemical properties. [1]

Base your answers to questions 53 through 56 on the diagram below concerning the classification of matter.



53 What type of mixture is represented by *X*? [1]

54 What type of substance is represented by *Z*? [1]

55 Explain, in terms of particle arrangement, why NaCl(aq) is a homogeneous mixture. [1]

56 Given a mixture of sand and water, state *one* process that can be used to separate water from the sand. [1]

Base your answers to questions 57 through 60 on the information below.

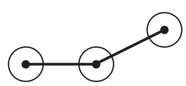
An investigation was conducted to study the effect of the concentration of a reactant on the total time needed to complete a chemical reaction. Four trials of the same reaction were performed. In each trial the initial concentration of the reactant was different. The time needed for the chemical reaction to be completed was measured. The data for each of the four trials are shown in the table below.

Reactant Concentration and Reaction Time

Trial	Initial Concentration (M)	Reaction Time (s)
1	0.020	11
2	0.015	14
3	0.010	23
4	0.005	58

57 On the grid *in your answer booklet,* mark an appropriate scale on the axis labeled "Reaction Time (s)." An appropriate scale is one that allows a trend to be seen. [1]

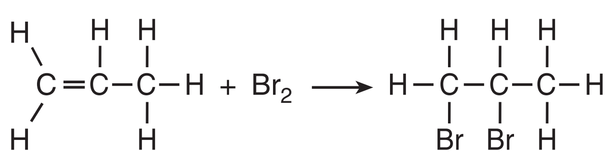
58 On the same grid, plot the data from the data table. Circle and connect the points. [1]

Example: 

59 State the effect of the concentration of the reactant on the rate of the chemical reaction. [1]

60 In a different experiment involving the same reaction, it was found that an increase in temperature increased the rate of the reaction. Explain this result in terms of collision theory. [1]

Base your answers to questions 61 through 63 on the equation below, which represents an organic compound reacting with bromine.



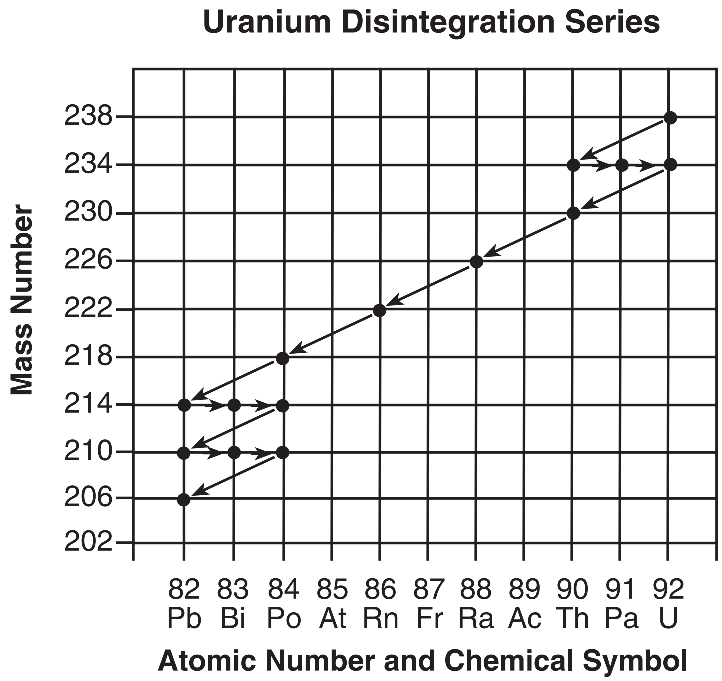
61 What is the IUPAC name for the organic compound that reacts with Br_2? [1]

62 What type of organic reaction is represented by this equation? [1]

63 What is the gram-formula mass of the product in this reaction? [1]

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

A U-238 atom decays to a Pb-206 atom through a series of steps. Each point on the graph below represents a nuclide and each arrow represents a nuclear decay mode.



64 Based on this graph, what particle is emitted during the nuclear decay of a Po-218 atom? [1]

65 Explain why the U-238 disintegration series ends with the nuclide Pb-206. [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 and 67 on the information below.

Some radioisotopes used as tracers make it possible for doctors to see the images of internal body parts and observe their functions. The table below lists information about three radioisotopes and the body part each radioisotope is used to study.

Medical Uses of Some Radioisotopes

Radioisotope	Half-life	Decay Mode	Body Part
^{24}Na	15 hours	beta	circulatory system
^{59}Fe	44.5 days	beta	red blood cells
^{131}I	8.1 days	beta	thyroid

66 Complete the equation *in your answer booklet* for the nuclear decay of the radioisotope used to study red blood cells. Include *both* the atomic number and the mass number for *each* missing particle. [1]

67 It could take up to 60. hours for a radioisotope to be delivered to the hospital from the laboratory where it is produced. What fraction of an original sample of ^{24}Na remains unchanged after 60. hours? [1]

Base your answers to questions 68 through 71 on the information below.

A metal, *M,* was obtained from a compound in a rock sample. Experiments have determined that the element is a member of Group 2 on the Periodic Table of the Elements.

68 What is the phase of element *M* at STP? [1]

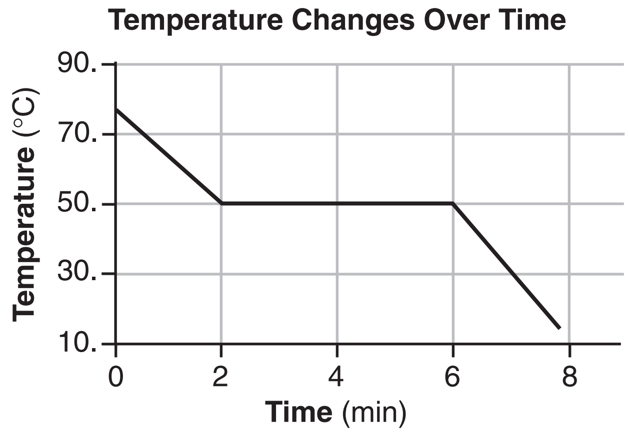
69 Explain, in terms of electrons, why element *M* is a good conductor of electricity. [1]

70 Explain why the radius of a positive ion of element *M* is *smaller* than the radius of an atom of element *M*. [1]

71 Using the symbol *M* for the element, write the chemical formula for the compound that forms when element *M* reacts with iodine. [1]

Base your answers to questions 72 through 75 on the information below.

The graph below shows a compound being cooled at a constant rate starting in the liquid phase at 75°C and ending at 15°C.



72 What is the freezing point of the compound, in degrees Celsius? [1]

73 State what is happening to the average kinetic energy of the particles of the sample between minute 2 and minute 6. [1]

74 A different experiment was conducted with another sample of the same compound starting in the solid phase. The sample was heated at a constant rate from 15°C to 75°C. On the graph *in your answer booklet,* draw the resulting heating curve. [1]

75 What kelvin temperature is equal to 15°C? [1]

Base your answers to questions 76 and 77 on the information below.

Using burets, a student titrated a sodium hydroxide solution of unknown concentration with a standard solution of 0.10 M hydrochloric acid. The data are recorded in the table below.

Titration Data

Solution	HCl(aq)	NaOH(aq)
Initial Buret Reading (mL)	15.50	5.00
Final Buret Reading (mL)	25.00	8.80

76 Determine *both* the total volume of HCl(aq) and the total volume of NaOH(aq) used in the titration. [1]

77 In the space *in your answer booklet,* show a correct numerical setup for calculating the molarity of the sodium hydroxide solution. [1]

Base your answers to questions 78 and 79 on the information below.

Many esters have distinctive odors, which lead to their widespread use as artificial flavorings and fragrances. For example, methyl butanoate has an odor like pineapple and ethyl methanoate has an odor like raspberry.

78 In the space *in your answer booklet,* draw a structural formula for the ester that has an odor like pineapple. [1]

79 What is a chemical name for the alcohol that reacts with methanoic acid to produce the ester that has an odor like raspberry? [1]

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

Three bottles of liquids labeled 1, 2, and 3 were found in a storeroom. One of the liquids is known to be drain cleaner. Drain cleaners commonly contain KOH or NaOH. The pH of each liquid at 25°C was determined with a pH meter. The table below shows the test results.

pH Test Results

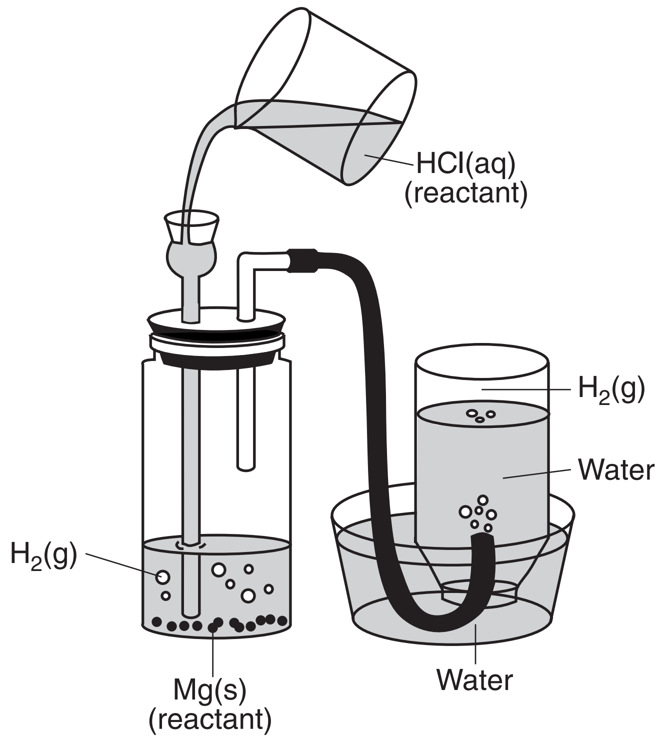
Bottle	pH of Liquid
1	3.8
2	7.0
3	12.8

80 Explain how the pH results in this table enable a student to correctly conclude that bottle 3 contains the drain cleaner. [1]

81 Explain, in terms of the pH values, why thymol blue is *not* a suitable indicator to distinguish between the contents of bottle 1 and bottle 2. [1]

Base your answers to questions 82 through 85 on the information below.

A student places a 2.50-gram sample of magnesium metal in a bottle and fits the bottle with a 2-hole stopper as shown in the diagram. Hydrochloric acid is added to the bottle, causing a reaction. As the reaction proceeds, hydrogen gas travels through the tubing to an inverted bottle filled with water, displacing some of the water in the bottle.



82 Balance the equation *in your answer booklet* for the reaction of magnesium and hydrochloric acid, using the smallest whole-number coefficients. [1]

83 Identify the type of chemical reaction that occurs when magnesium reacts with hydrochloric acid. [1]

84 In the space *in your answer booklet,* show a correct numerical setup for calculating the number of moles of magnesium used in the experiment. [1]

85 Based on Reference Table *J*, explain why Ag(s) will *not* react with HCl(aq) to generate H_2(g). [1]

Tear Here

The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

PHYSICAL SETTING
CHEMISTRY

Wednesday, August 16, 2006 — 12:30 to 3:30 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

☐

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

☐

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

The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

PHYSICAL SETTING CHEMISTRY

Wednesday, August 16, 2006 — 12:30 to 3:30 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)		
Final Score (from conversion chart)		

Raters' Initials:

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

Part B–2

For Raters Only

51

51 ☐

52 ____

____

____

52 ☐

For Raters Only

53 ______________________ 53

54 ______________________ 54

55 ____

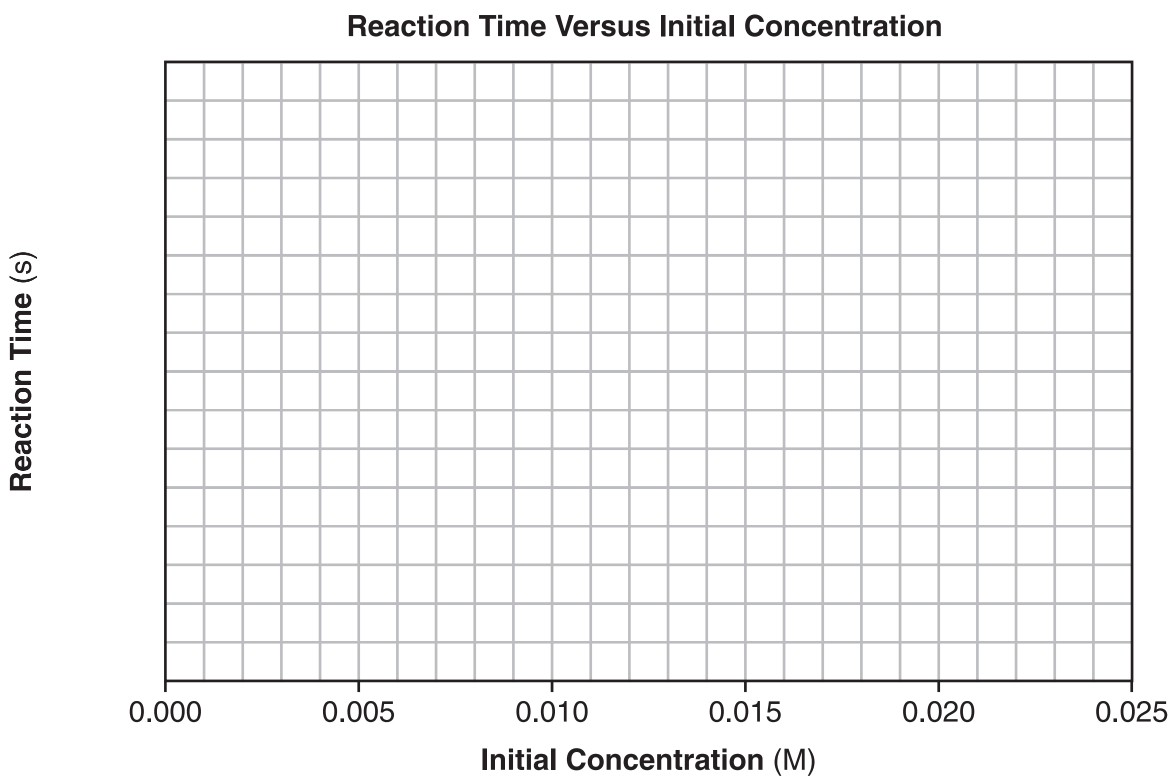
____ 55

____

56 ____

____ 56

57 and **58**



57

58

For Raters Only

59 ______________________________

______________________________ 59

60 ______________________________

______________________________ 60

____

61 ____________________ 61

62 ____________________ 62

63 ____________ g/mol 63

64 ____________________ 64

65 ______________________________

______________________________ 65

____

Total Score for Part B–2

Part C

66 $^{59}_{26}Fe \rightarrow$ ________ + ________

67 ____________

68 ____________________

69 ____

____

____

70 ____

____

____

71 ____________

72 ____________ °C

73 ____

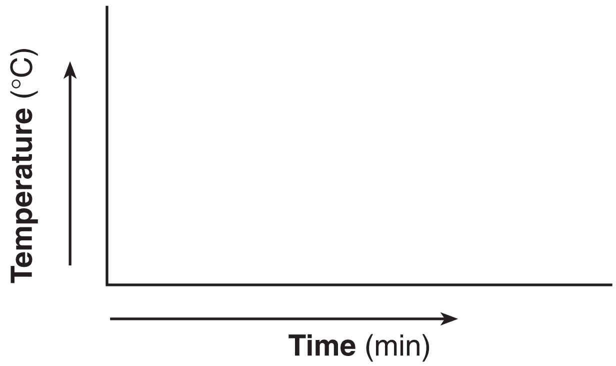
____

For Raters Only

66	
67	
68	
69	
70	
71	
72	
73	

For Raters Only

74



74

75 ______________________ K

75

76 ______________________ mL HCl(aq) and ______________________ mL NaOH(aq)

76

77

77

78

78

79 ______________________________________

79

80 ______________________________

____

____

81 ______________________________

____

____

82 ______ $Mg(s)$ + ______ $HCl(aq) \rightarrow$ ______ $MgCl_2(aq)$ + ______ $H_2(g)$

83 ______________________________

84

85 ______________________________

____

____

For Raters Only

80

81

82

83

84

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, August 16, 2006 — 12:30 to 3:30 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

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

Part B–1

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

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

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

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

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

Raters should enter the scores earned for Part A, Part B–1, Part B–2, and Part C on the appropriate lines in the box printed on the answer booklet and then should add these four scores and enter the total in the box labeled "Total Written Test Score." Then, the student's raw score should be converted to a scaled score by using the conversion chart that will be posted on the Department's web site http://www.emsc.nysed.gov/osa/ on Wednesday, August 16, 2006. 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.

Examples of a 1-credit response:

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

An atom of each element has six electrons in its outer shell.

same number of valence electrons

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

heterogeneous

nonuniform

54 [1] Allow 1 credit for compound or compounds.

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

The water molecules, sodium ions, and chloride ions are uniformly mixed together.

All particles distribute evenly.

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

Evaporate the water.

Decant the water.

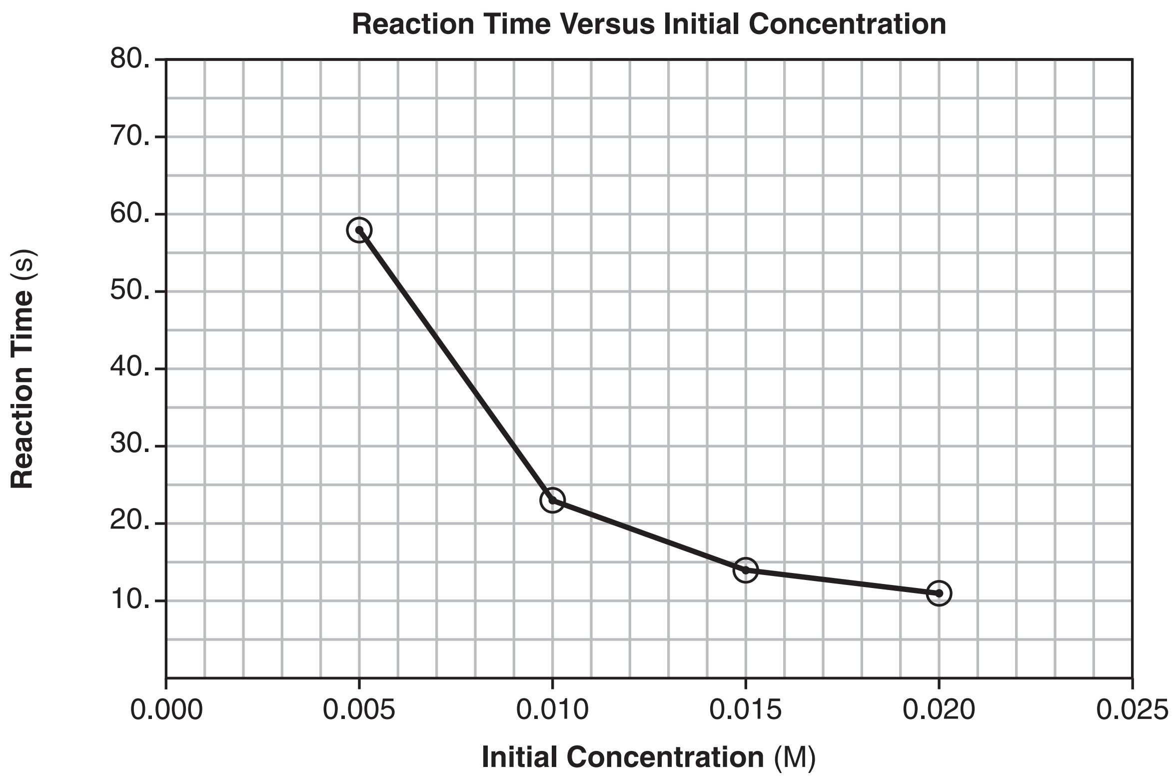
filtration

57 [1] Allow 1 credit for marking an appropriate scale. An appropriate scale is linear and allows a trend to be seen.

58 [1] Allow 1 credit for plotting all four points correctly ± 0.3 grid space. Plotted points do *not* need to be circled or connected.

57 and **58**

Example of a 2-credit graph for questions 57 and 58:



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

As concentration of the reactant decreases, the rate of the reaction decreases.

As concentration increases, the rate of reaction increases.

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

The greater the kinetic energy of the reactant particles, the greater the frequency and effectiveness of the collisions.

Increasing the temperature causes more collisions.

more effective collisions

61 [1] Allow 1 credit for propene.

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

addition

halogenation

bromination

63 [1] Allow 1 credit. Significant figures do *not* need to be shown. Acceptable responses include, but are not limited to:

202 g/mol

201.9 g/mol

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

${}^{4}_{2}He$

alpha particle

α

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

The nucleus of Pb-206 is stable.

Pb-206 is not radioactive.

If Pb-206 were not stable, it would spontaneously decay.

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:

$${}^{59}_{26}\text{Fe} \rightarrow {}^{0}_{-1}\text{e} + {}^{59}_{27}\text{Co}$$

$${}^{59}_{26}\text{Fe} \rightarrow {}^{59}_{27}\text{Co} + {}^{0}_{-1}\beta$$

67 [1] Allow 1 credit. Significant figures do *not* need to be shown. Acceptable responses include, but are not limited to:

$\frac{1}{16}$

0.0625

$6\frac{1}{4}\%$

68 [1] Allow 1 credit for solid.

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

Metals have freely moving valence electrons.

mobile valence electrons

sea of mobile electrons

Electrons are delocalized.

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

The ionic radius is smaller because the atom loses two electrons.

The ion has one less occupied energy level.

71 [1] Allow 1 credit for MI_2.

72 [1] Allow 1 credit for 50.°C ± 2°C.

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

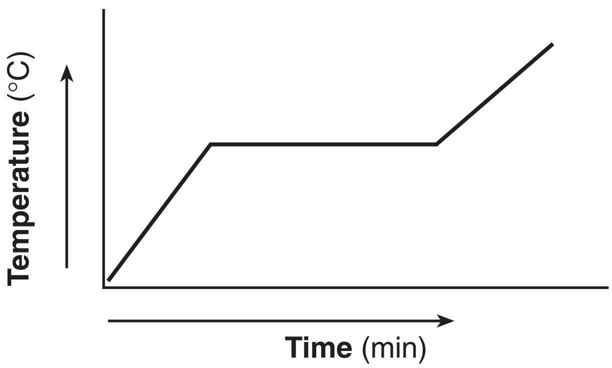
The average kinetic energy of the particles remains the same.

KE remains constant.

no change

74 [1] Allow 1 credit.

Example of a 1-credit response:



75 [1] Allow 1 credit for 288 K.

76 [1] Allow 1 credit. Significant figures do *not* need to be shown. Acceptable responses include, but are not limited to:

9.50 mL HCl(aq) and 3.80 mL NaOH(aq)

9.5 mL HCl(aq) and 3.8 mL NaOH(aq)

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

$(0.10\text{ M})(9.50\text{ mL}) = M_B(3.80\text{ mL})$

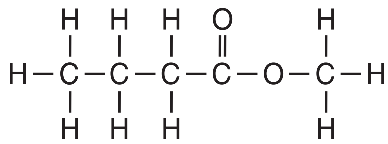
$\frac{(0.1)(9.5)}{3.8}$

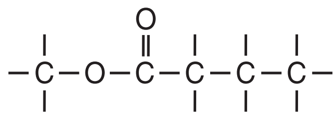
or

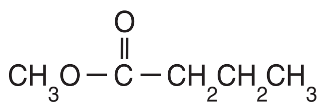
Allow credit for a response consistent with the student's answer to question 76.

78 [1] Allow 1 credit.

Examples of a 1-credit response:







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

ethanol

ethyl alcohol

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

Drain cleaner contains KOH or NaOH, which are bases with a pH value greater than 7.

A pH of 12.8 indicates a base.

A base has a pH above 7.

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

The liquids in bottle 1 and bottle 2 both have a pH below 8, but thymol blue does not change color until the pH value reaches at least 8.0.

The pH range for the thymol blue color change is too high.

82 [1] Allow 1 credit for _____ $Mg(s)$ + __2__ $HCl(aq) \rightarrow$ _____ $MgCl_2(aq)$ + _____ $H_2(g)$. Allow credit even if the coefficient "1" is written in front of $Mg(s)$, $MgCl_2(aq)$, or $H_2(g)$.

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

The reaction is single replacement.

single displacement

redox

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

$$2.50 \text{ g} \times \frac{1 \text{ mol}}{24.3 \text{ g}}$$

$$\frac{2.50}{24}$$

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

Ag is below H_2 in the activity series.

Ag is more difficult to oxidize.

Regents Examination in Physical Setting/Chemistry

August 2006

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

The *Chart for Determining the Final Examination Score for the August 2006 Regents Examination in Physical Setting/Chemistry* will be posted on the Department's web site http://www.emsc.nysed.gov/osa/ on Wednesday, August 16, 2006. 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.
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

August 2006 Physical Setting/ Chemistry			
Question Numbers			
Key Ideas	Part A	Part B	Part C
Standard 1			
Math Key Idea 1		39,42,48,55,57,58	74,75,77,84
Math Key Idea 2		59	
Math Key Idea 3		37,39,42	67,70,76
Sci. Inq. Key Idea 1		43,51,52,55	69,70,81,85
Sci. Inq. Key Idea 2			
Sci. Inq. Key Idea 3	5,23,24	36,40,41,47,48, 53,54,61,64,65	68,71,72,73,74, 79,80,81,82
Eng. Des. Key Idea 1			
Standard 2			
Key Idea 1			
Key Idea 2			
Standard 6			
Key Idea 1			
Key Idea 2		33	
Key Idea 3		50	
Key Idea 4		45	
Key Idea 5		41,46,65	
Standard 7			
Key Idea 1			
Key Idea 2			
Standard 4 Process Skills			
Key Idea 3		33,34,35,38,40, 41,42,45,47,48, 49,51,52,56,60, 61,62,63,64	68,75,76,77,78, 79,80,81,82,83, 84,85
Key Idea 4		39,44,46	66,67,72,73,74
Key Idea 5		43	69
Standard 4			
Key Idea 3	1,2,3,4,5,6,7,12, 13,14,15,16,17, 18,19,20,21,22, 23,24,25,26,27, 30	31,32,33,34,35, 36,37,38,39,40, 41,42,43,45,48, 49,50,52,53,54, 55,56,57,58,59, 60,61,62,63,65	68,71,76,77,78, 79,80,81,82,83, 84,85
Key Idea 4	28	44,46,64	66,67,72,73,74, 75
Key Idea 5	4,8,9,10,11	47,51	69,70
Reference Tables			
2002 Edition	2,5,8,9,10,13, 14,17,20,26, 28,29	34,35,39,41,42, 44,47,51,52,61, 63,64,65	66,67,68,71,75, 77,78,79,84,85

Regents Examination in Physical Setting/Chemistry
August 2006

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	76	41	60	19	38
84	99	62	75	40	59	18	36
83	97	61	74	39	58	17	35
82	96	60	73	38	57	16	33
81	94	59	73	37	56	15	32
80	93	58	72	36	56	14	30
79	92	57	71	35	55	13	28
78	91	56	70	34	54	12	27
77	90	55	70	33	53	11	25
76	88	54	69	32	52	10	23
75	87	53	68	31	51	9	21
74	86	52	67	30	50	8	19
73	85	51	67	29	49	7	17
72	84	50	66	28	48	6	15
71	83	49	66	27	47	5	13
70	82	48	65	26	46	4	10
69	81	47	64	25	45	3	8
68	80	46	63	24	44	2	6
67	79	45	62	23	43	1	3
66	78	44	62	22	42	0	0
65	78	43	61	21	40		
64	77	42	60	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 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.