The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

PHYSICAL SETTING
CHEMISTRY

Wednesday, January 28, 2004 — 9:15 a.m. to 12:15 p.m., only

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

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

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

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

When you have completed the examination, you must sign the statement printed at the end of your separate answer sheet, indicating that you had no unlawful knowledge of the questions or answers prior to the examination and that you have neither given nor received assistance in answering any of the questions during the examination. Your answer sheet and answer booklet cannot be accepted if you fail to sign this declaration.

Notice. . .

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

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

Part A

Answer all questions in this part.

Directions (1–31): 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 A neutral atom contains 12 neutrons and 11 electrons. The number of protons in this atom is

(1) 1
(2) 11
(3) 12
(4) 23

2 Isotopes of an element must have different

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

3 Which element is a noble gas?

(1) krypton
(2) chlorine
(3) antimony
(4) manganese

4 On the present Periodic Table of the Elements, the elements are arranged according to increasing

(1) number of oxidation states
(2) number of neutrons
(3) atomic mass
(4) atomic number

5 What is a property of most metals?

(1) They tend to gain electrons easily when bonding.
(2) They tend to lose electrons easily when bonding.
(3) They are poor conductors of heat.
(4) They are poor conductors of electricity.

6 What is the correct formula for iron (III) phosphate?

(1) FeP
(2) Fe_3P_2
(3) $FePO_4$
(4) $Fe_3(PO_4)_2$

7 The bond between Br atoms in a Br_2 molecule is

(1) ionic and is formed by the sharing of two valence electrons
(2) ionic and is formed by the transfer of two valence electrons
(3) covalent and is formed by the sharing of two valence electrons
(4) covalent and is formed by the transfer of two valence electrons

8 The amount of energy required to remove the outermost electron from a gaseous atom in the ground state is known as

(1) first ionization energy
(2) activation energy
(3) conductivity
(4) electronegativity

9 What occurs when an atom of chlorine and an atom of hydrogen become a molecule of hydrogen chloride?

(1) A chemical bond is broken and energy is released.
(2) A chemical bond is broken and energy is absorbed.
(3) A chemical bond is formed and energy is released.
(4) A chemical bond is formed and energy is absorbed.

10 Which molecule is nonpolar?

(1) H_2O
(2) NH_3
(3) CO
(4) CO_2

11 Which must be a mixture of substances?

(1) solid
(2) liquid
(3) gas
(4) solution

12 A bottle of rubbing alcohol contains both 2-propanol and water. These liquids can be separated by the process of distillation because the 2-propanol and water

(1) have combined chemically and retain their different boiling points
(2) have combined chemically and have the same boiling point
(3) have combined physically and retain their different boiling points
(4) have combined physically and have the same boiling point

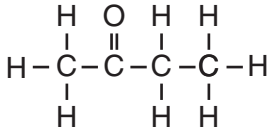
13 Compared to pure water, an aqueous solution of calcium chloride has a

(1) higher boiling point and higher freezing point
(2) higher boiling point and lower freezing point
(3) lower boiling point and higher freezing point
(4) lower boiling point and lower freezing point

14 Under which conditions does a real gas behave most like an ideal gas?

(1) at low temperatures and high pressures
(2) at low temperatures and low pressures
(3) at high temperatures and high pressures
(4) at high temperatures and low pressures

15 What is the IUPAC name of the compound with the following structural formula?



(1) propanone
(2) propanal
(3) butanone
(4) butanal

16 Which statement best explains the role of a catalyst in a chemical reaction?

(1) A catalyst is added as an additional reactant and is consumed but not regenerated.
(2) A catalyst limits the amount of reactants used.
(3) A catalyst changes the kinds of products produced.
(4) A catalyst provides an alternate reaction pathway that requires less activation energy.

17 Given the reaction at equilibrium:

$$H_2(g) + Br_2(g) \rightleftharpoons 2\ HBr(g)$$

The rate of the forward reaction is

(1) greater than the rate of the reverse reaction
(2) less than the rate of the reverse reaction
(3) equal to the rate of the reverse reaction
(4) independent of the rate of the reverse reaction

18 Which statement best explains why most atomic masses on the Periodic Table are decimal numbers?

(1) Atomic masses are determined relative to an H–1 standard.
(2) Atomic masses are determined relative to an O–16 standard.
(3) Atomic masses are a weighted average of the naturally occurring isotopes.
(4) Atomic masses are an estimated average of the artificially produced isotopes.

19 All organic compounds must contain the element

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

20 Which of the following compounds has the highest boiling point?

(1) H_2O
(2) H_2S
(3) H_2Se
(4) H_2Te

21 The functional group —COOH is found in

(1) esters
(2) aldehydes
(3) alcohols
(4) organic acids

22 Which of these elements is the best conductor of electricity?

(1) S
(2) N
(3) Br
(4) Ni

23 Given the reaction:

$$2\ Al(s) + Fe_2O_3(s) \xrightarrow{heat} Al_2O_3(s) + 2\ Fe(s)$$

Which species undergoes reduction?

(1) Al
(2) Fe
(3) Al^{3+}
(4) Fe^{3+}

24 Which energy transformation occurs when an electrolytic cell is in operation?

(1) chemical energy → electrical energy
(2) electrical energy → chemical energy
(3) light energy → heat energy
(4) light energy → chemical energy

25 Which of these pH numbers indicates the highest level of acidity?

(1) 5
(2) 8
(3) 10
(4) 12

26 According to the Arrhenius theory, when a base dissolves in water it produces

(1) CO_3^{2-} as the only negative ion in solution
(2) OH^- as the only negative ion in solution
(3) NH_4^+ as the only positive ion in solution
(4) H^+ as the only positive ion in solution

27 Which compound is an electrolyte?

(1) $C_6H_{12}O_6$
(2) CH_3OH
(3) $CaCl_2$
(4) CCl_4

28 Which equation represents a spontaneous nuclear decay?

(1) $C + O_2 \rightarrow CO_2$
(2) $H_2CO_3 \rightarrow CO_2 + H_2O$
(3) $^{27}_{13}Al + {}^{4}_{2}He \rightarrow {}^{30}_{15}P + {}^{1}_{0}n$
(4) $^{90}_{38}Sr \rightarrow {}^{0}_{-1}e + {}^{90}_{39}Y$

29 The stability of an isotope is based on its

(1) number of neutrons, only
(2) number of protons, only
(3) ratio of neutrons to protons
(4) ratio of electrons to protons

Note that questions 30 and 31 have only three choices.

30 As the temperature of a substance *decreases,* the average kinetic energy of its particles

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

31 When an atom of phosphorus becomes a phosphide ion (P^{3-}), the radius

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

Part B–1

Answer all questions in this part.

Directions (32–50): 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*.

32 The data table below represents the properties determined by the analysis of substances *A*, *B*, *C*, and *D*.

Substance	Melting Point (°C)	Boiling Point (°C)	Conductivity
A	−80	−20	none
B	20	190	none
C	320	770	as solid
D	800	1250	in solution

Which substance is an ionic compound?

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

33 What is the total number of electrons in a Cr^{3+} ion?

(1) 18
(2) 21
(3) 24
(4) 27

34 As the atoms of the Group 17 elements in the ground state are considered from top to bottom, each successive element has

(1) the same number of valence electrons and similar chemical properties
(2) the same number of valence electrons and identical chemical properties
(3) an increasing number of valence electrons and similar chemical properties
(4) an increasing number of valence electrons and identical chemical properties

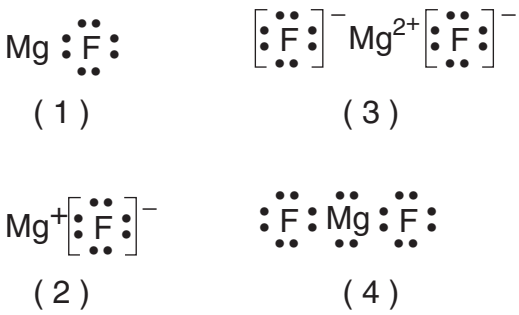
35 Which solution when mixed with a drop of bromthymol blue will cause the indicator to change from blue to yellow?

(1) 0.1 M HCl
(2) 0.1 M NH_3
(3) 0.1 M CH_3OH
(4) 0.1 M NaOH

36 What is the empirical formula of a compound with the molecular formula N_2O_4?

(1) NO
(2) NO_2
(3) N_2O
(4) N_2O_3

37 What is the correct Lewis electron-dot structure for the compound magnesium fluoride?



38 Given the reaction:

$$Mg(s) + 2\,AgNO_3(aq) \rightarrow Mg(NO_3)_2(aq) + 2\,Ag(s)$$

Which type of reaction is represented?

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

39 Which equation shows conservation of both mass and charge?

(1) $Cl_2 + Br^- \rightarrow Cl^- + Br_2$

(2) $Cu + 2\ Ag^+ \rightarrow Cu^{2+} + Ag$

(3) $Zn + Cr^{3+} \rightarrow Zn^{2+} + Cr$

(4) $Ni + Pb^{2+} \rightarrow Ni^{2+} + Pb$

40 The volume of a gas is 4.00 liters at 293 K and constant pressure. For the volume of the gas to become 3.00 liters, the Kelvin temperature must be equal to

(1) $\frac{3.00 \times 293}{4.00}$ (3) $\frac{3.00 \times 4.00}{293}$

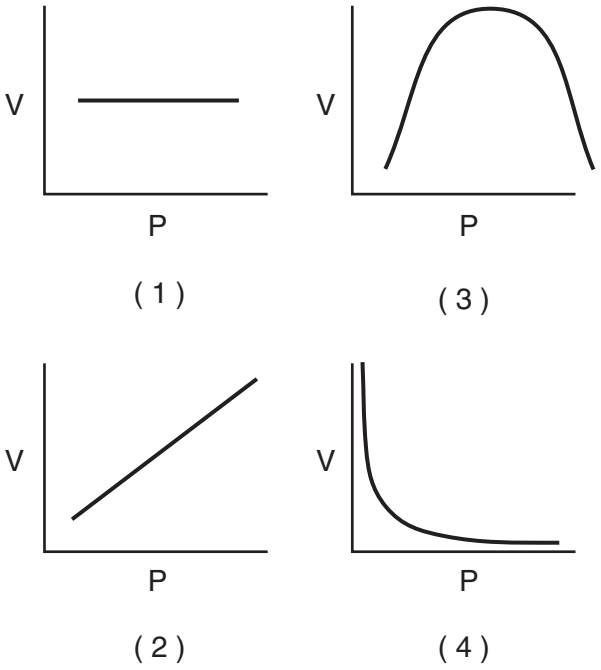
(2) $\frac{4.00 \times 293}{3.00}$ (4) $\frac{293}{3.00 \times 4.00}$

41 What is the molarity of a solution containing 20 grams of NaOH in 500 milliliters of solution?

(1) 1 M (3) 0.04 M

(2) 2 M (4) 0.5 M

42 Which graph best represents the pressure-volume relationship for an ideal gas at constant temperature?



43 Given the equation:

$$C_2H_6 + Cl_2 \rightarrow C_2H_5Cl + HCl$$

This reaction is best described as

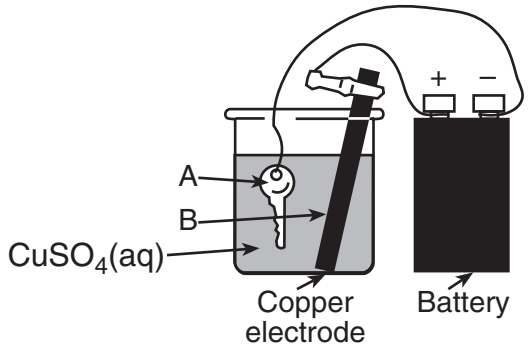
(1) addition involving a saturated hydrocarbon

(2) addition involving an unsaturated hydrocarbon

(3) substitution involving a saturated hydrocarbon

(4) substitution involving an unsaturated hydrocarbon

44 The diagram below shows a key being plated with copper in an electrolytic cell.



Given the reduction reaction for this cell:

$$Cu^{2+}(aq) + 2e^- \rightarrow Cu(s)$$

This reduction occurs at

(1) *A*, which is the anode

(2) *A*, which is the cathode

(3) *B*, which is the anode

(4) *B*, which is the cathode

45 A student neutralized 16.4 milliliters of HCl by adding 12.7 milliliters of 0.620 M KOH. What was the molarity of the HCl acid?

(1) 0.168 M (3) 0.620 M

(2) 0.480 M (4) 0.801 M

46 Nuclear fusion *differs* from nuclear fission because nuclear fusion reactions

(1) form heavier isotopes from lighter isotopes

(2) form lighter isotopes from heavier isotopes

(3) convert mass to energy

(4) convert energy to mass

47 After 32 days, 5 milligrams of an 80-milligram sample of a radioactive isotope remains unchanged. What is the half-life of this element?

(1) 8 days
(2) 2 days
(3) 16 days
(4) 4 days

48 Which electron configuration represents an atom of chlorine in an excited state?

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

Note that questions 49 and 50 have only three choices.

49 As each successive element in Group 15 of the Periodic Table is considered in order of increasing atomic number, the atomic radius

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

50 Given the equation:

$$KNO_3(s) \xrightarrow{H_2O(\ell)} KNO_3(aq)$$

As $H_2O(\ell)$ is added to$KNO_3(s)$ to form $KNO_3(aq)$, the entropy of the system

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

Part B–2

Answer all questions in this part.

Directions (51–62): Record your answers in the spaces provided in your answer booklet. Some questions may require the use of the *Reference Tables for Physical Setting/Chemistry.*

Base your answers to questions 51 and 52 on the unbalanced equation provided *in your answer booklet.*

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

52 *a* Using your balanced equation, show a correct numerical setup for calculating the total number of moles of $H_2O(g)$ produced when 5.0 moles of $O_2(g)$ are completely consumed. Use the space provided *in your answer booklet.* [1]

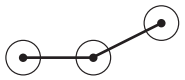
b Record your answer. [1]

Base your answers to questions 53 through 55 on the data table provided *in your answer booklet.*

53 *In your answer booklet,* record the electronegativity for the elements with atomic numbers 11 through 17. [1]

54 On the grid provided *in your answer booklet,* mark an appropriate scale on the axis labeled "Electronegativity." [1]

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

Example: 

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

A student uses 200 grams of water at a temperature of 60°C to prepare a saturated solution of potassium chloride, KCl.

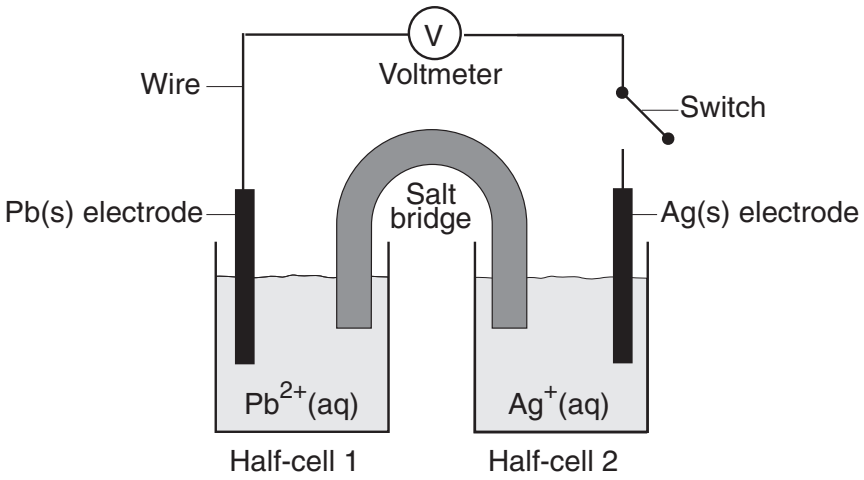
56 Identify the solute in this solution. [1]

57 According to Reference Table *G,* how many grams of KCl must be used to create this saturated solution? [1]

58 This solution is cooled to 10°C and the excess KCl precipitates (settles out). The resulting solution is saturated at 10°C. How many grams of KCl precipitated out of the original solution? [1]

Base your answers to questions 59 through 61 on the diagram of the voltaic cell below.

Voltaic Cell



$$2\,Ag^{+}(aq) + Pb(s) \longrightarrow Pb^{2+}(aq) + 2\,Ag(s)$$

59 When the switch is closed, in which half-cell does oxidation occur? [1]

60 When the switch is closed, state the direction that electrons will flow through the wire. [1]

61 *Based on the given equation,* write the balanced half-reaction that occurs in half-cell 1. [1]

62 In the space provided *in your answer booklet,* draw a Lewis electron-dot structure for an atom of phosphorus. [1]

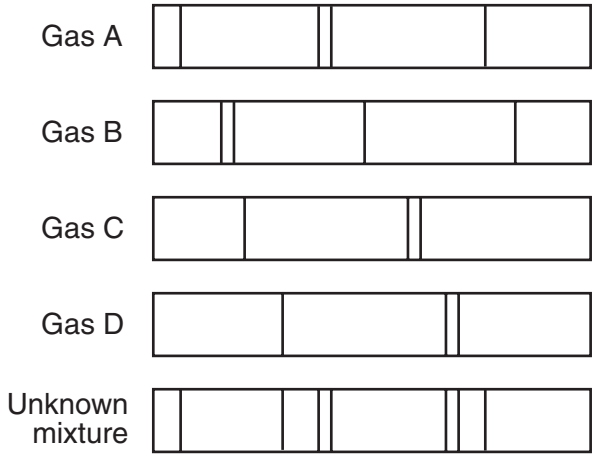
Part C

Answer all questions in this part.

Directions (63–81): 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 63 and 64 on the information and the bright-line spectra represented below.

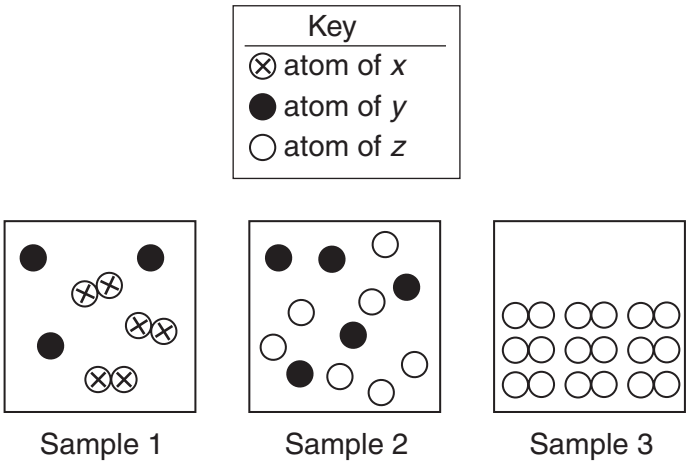
Many advertising signs depend on the production of light emissions from gas-filled glass tubes that are subjected to a high-voltage source. When light emissions are passed through a spectroscope, bright-line spectra are produced.



63 Identify the *two* gases in the unknown mixture. [2]

64 Explain the production of an emission spectrum in terms of the *energy states of an electron.* [1]

Base your answers to questions 65 through 67 on the particle diagrams below, which show atoms and/or molecules in three different samples of matter at STP.



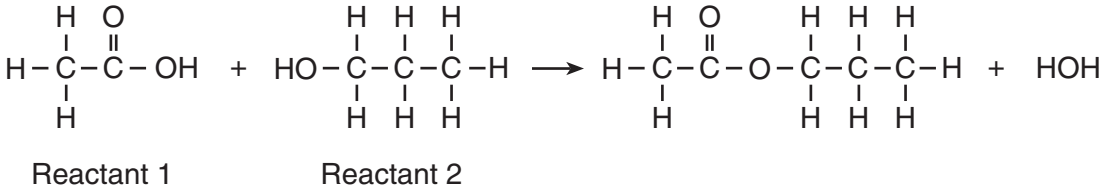
65 Which sample represents a pure substance? [1]

66 When two atoms of *y* react with one atom of *z*, a compound forms. Using the number of atoms shown in sample 2, what is the maximum number of molecules of this compound that can be formed? [1]

67 Explain why ⊗⊗ does *not* represent a compound. [1]

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

Many artificial flavorings are prepared using the type of organic reaction shown below.



68 What is the name of this organic reaction? [1]

69 To what class of organic compounds does reactant 2 belong? [1]

70 In the space provided *in your answer booklet,* draw the structural formula of an isomer of reactant 2. [1]

Base your answers to questions 71 through 74 on the article below, the *Reference Tables for Physical Setting/Chemistry,* and your knowledge of chemistry.

Radioactivity at home

You may be surprised to learn that you do not need to visit a nuclear power plant or a hospital X-ray laboratory to find sources of radioactivity. They are all around us. In fact, it is likely that you'll find a few at home. Your front porch may incorporate cinder blocks or granite blocks. Both contain uranium. Walk through the front door, look up, and you'll see a smoke detector that owes its effectiveness to the constant source of alpha particle emissions from Americium-241. As long as the gases remain ionized within the shielded container, electricity flows, and all is calm. When smoke enters the chamber, it neutralizes the charges on these ions. In the absence of these ions, the circuit breaks and the alarm goes off.

Indicator lights on your appliances may use Krypton-85; electric blankets, promethium-147; and fluorescent lights, thorium-229. Even the food we eat is radioactive. The more potassium-rich the food source, the more potassium-40—a radioactive isotope that makes up about 0.01% of the natural supply of this mineral—is present. Thus, brazil nuts, peanuts, bananas, potatoes, and flour, all rich in potassium, are radiation sources.

—*Chem Matters*
April 2000

71 Write the equation for the alpha decay that occurs in a smoke detector containing Americium-241 (Am-241). [2]

72 How is the radioactive decay of Krypton-85 different from the radioactive decay of Americium-241? [1]

73 State one benefit or useful application of radioactivity *not* mentioned in this article. [1]

74 State one risk or danger associated with radioactivity. [1]

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

Gypsum is a mineral that is used in the construction industry to make drywall (sheetrock). The chemical formula for this hydrated compound is $CaSO_4 \bullet 2\ H_2O$. A hydrated compound contains water molecules within its crystalline structure. Gypsum contains 2 moles of water for each 1 mole of calcium sulfate.

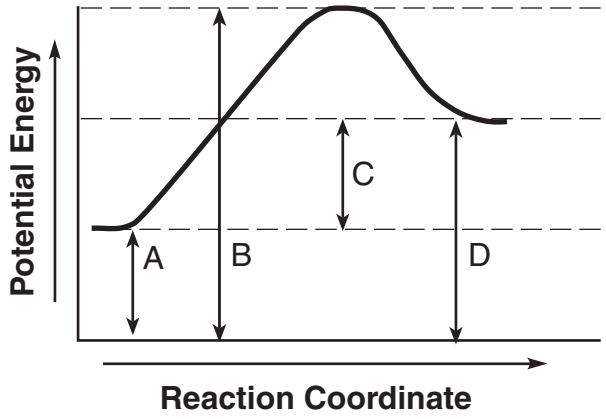
75 What is the gram formula mass of $CaSO_4 \bullet 2\ H_2O$? [1]

76 *a* In the space provided *in your answer booklet,* show a correct numerical setup for calculating the percent composition by mass of water in this compound. [1]

b Record your answer. [1]

Base your answers to questions 77 through 79 on the information and potential energy diagram below.

Chemical cold packs are often used to reduce swelling after an athletic injury. The diagram represents the potential energy changes when a cold pack is activated.



77 Which lettered interval on the diagram represents the potential energy of the products? [1]

78 Which lettered interval on the diagram represents the heat of reaction? [1]

79 Identify a reactant listed in Reference Table *I* that could be mixed with water for use in a chemical cold pack. [1]

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

Calcium hydroxide is commonly known as agricultural lime and is used to adjust the soil pH. Before the lime was added to a field, the soil pH was 5. After the lime was added, the soil underwent a 100-fold decrease in hydronium ion concentration.

80 What is the new pH of the soil in the field? [1]

81 According to Reference Table *F*, calcium hydroxide is soluble in water. Identify another hydroxide compound that contains a Group 2 element and is also soluble in water. [1]

Tear Here

The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

PHYSICAL SETTING
CHEMISTRY

Wednesday, January 28, 2004 — 9:15 a.m. to 12:15 p.m., only

ANSWER SHEET

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

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

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

Part A

1	12	23 .....
2	13	24 .....
3	14	25 .....
4	15	26 .....
5	16	27 .....
6	17	28 .....
7	18	29 .....
8	19	30 .....
9	20	31 .....
10	21	
11	22	

Part A Score ☐

Part B–1

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

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

Tear Here

Tear Here

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CHEMISTRY

Wednesday, January 28, 2004 — 9:15 a.m. to 12:15 p.m., only

ANSWER BOOKLET

Student ..... Sex: ☐ Male ☐ Female

Teacher .....

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

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

Part	Maximum Score	Student's Score
A	31	
B–1	19	
B–2	13	
C	22	

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 _____ $C_5H_{12}(g)$ + _____ $O_2(g)$ → _____ $CO_2(g)$ + _____ $H_2O(g)$ **51** ☐

52 ***a***

52*a* ☐

b _____ **mol H_2O** ***b*** ☐

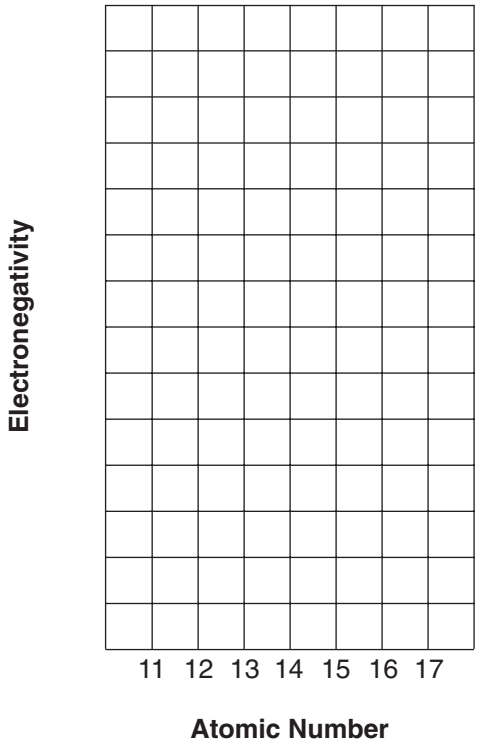
For Raters Only

53

Atomic Number	Electronegativity
11	
12	
13	
14	
15	
16	
17	

53 ☐

54 and 55



54 ☐

55 ☐

For Raters Only

56 _____ **56** ☐

57 _____ **grams** **57** ☐

58 _____ **grams** **58** ☐

59 _____ **59** ☐

60 _____ **60** ☐

61 _____ **61** ☐

62 **62** ☐

☐

Total Score for Part B–2

Part C

For Raters Only

63 _____ and _____ **63** ☐

64 _____ **64** ☐

_____

_____

65 _____ **65** ☐

66 _____ **66** ☐

67 _____ **67** ☐

_____

68 _____ **68** ☐

69 _____ **69** ☐

70 **70** ☐

For Raters Only

71 _____ **71** ☐

72 _____ **72** ☐

_____

73 _____ **73** ☐

_____

74 _____ **74** ☐

_____

75 _____ **g/mol** **75** ☐

76 ***a***

76*a* ☐

b _____ **%** ***b*** ☐

77 _____

78 _____

79 _____

80 _____

81 _____

For Raters Only

77 ☐

78 ☐

79 ☐

80 ☐

81 ☐

☐

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, January 28, 2004 — 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 3 before rating student papers.

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

Part A

1 . . . 2	12 . . . 3	23 . . . 4
2 . . . 2	13 . . . 2	24 . . . 2
3 . . . 1	14 . . . 4	25 . . . 1
4 . . . 4	15 . . . 3	26 . . . 2
5 . . . 2	16 . . . 4	27 . . . 3
6 . . . 3	17 . . . 3	28 . . . 4
7 . . . 3	18 . . . 3	29 . . . 3
8 . . . 1	19 . . . 3	30 . . . 1
9 . . . 3	20 . . . 1	31 . . . 2
10 . . . 4	21 . . . 4	
11 . . . 4	22 . . . 4	

Part B–1

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

Directions to the Teacher

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

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

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

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

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

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

Raters should enter the scores earned for Part A, Part B–1, Part B–2, and Part C on the appropriate lines in the box printed on the answer booklet and then should add these four scores and enter the total in the box labeled "Total Written Test Score." Then, the student's raw score should be converted to a scaled score by using the conversion chart printed at the end of this Scoring Key and Rating Guide. The student's scaled score should be entered in the labeled box on the student's answer booklet. The scaled score is the student's final examination score.

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

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

Part B–2

Allow a total of 13 credits for this part. The student must answer all questions in this part.

51 [1] Allow 1 credit for ____ $C_5H_{12}(g)$ + __**8**__ $O_2(g) \rightarrow$ __**5**__ $CO_2(g)$ + __**6**__ $H_2O(g)$. Allow credit even if the coefficient "1" is written in front of $C_5H_{12}(g)$.

52 [2] ***a*** Allow 1 credit for a correct numerical setup. Acceptable responses include, but are not limited to, these examples:

$$\frac{8\ O_2}{6\ H_2O} = \frac{5.0\ O_2}{X\ H_2O}$$

$$\frac{5\ \text{moles}\ O_2}{8} = \frac{X\ \text{moles}\ H_2O}{6}$$

$$5\ \text{mol}\ O_2 \times \frac{6\ \text{mol}\ H_2O}{8\ \text{mol}\ O_2}$$

or

Allow 1 credit for a numerical setup consistent with the student's response to question 51.

b Allow 1 credit for **3.75** or **3.8**.

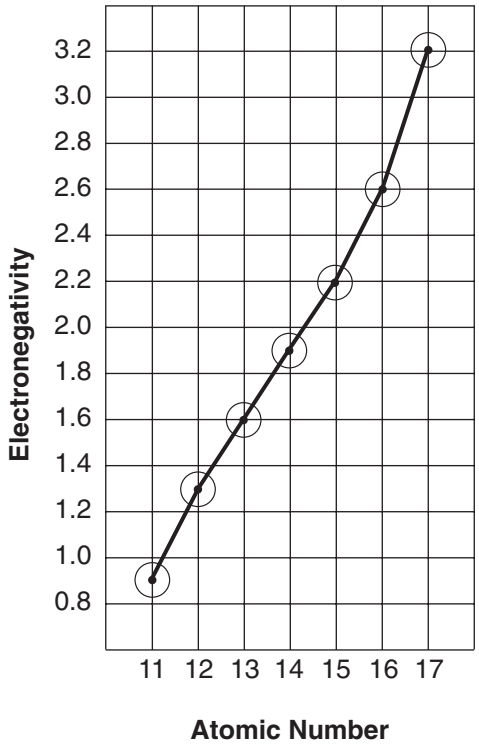
or

Allow 1 credit for a response consistent with the student's numerical setup for question 52*a*.

53 [1] Allow 1 credit for *at least six* correctly listed electronegativities as shown below.

Atomic Number	Electronegativity
11	**0.9** or **.9**
12	**1.3**
13	**1.6**
14	**1.9**
15	**2.2**
16	**2.6**
17	**3.2**

54 and **55** An example of an acceptable response is shown below.



54 [1] Allow 1 credit for a correctly scaled *y*-axis.

55 [1] Allow 1 credit for correctly plotting (±0.3 grid space) and connecting the points. Allow credit even if the points are not circled.

56 [1] Allow 1 credit for **KCl** or **potassium chloride.**

57 [1] Allow 1 credit for **90** (±2).

58 [1] Allow 1 credit for **30** (±2).

or

Allow 1 credit for a response consistent with the student's answer to question 57.

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

half-cell 1

Pb

left

lead

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

from the Pb electrode to the Ag electrode

left to right

cell 1 → cell 2

Note: Allow credit for "right to left" or for its equivalent *only* if it is consistent with the student's response to question 59.

Do *not* allow credit for a response that indicates that electrons flow through the salt bridge.

61 [1] Allow 1 credit for $\mathbf{Pb(s) \rightarrow Pb^{2+}(aq) + 2e^-}$. Allow credit even if the labels (s) and (aq) are not included.

62 [1] Allow 1 credit for  or for any other acceptable arrangement of five dots around the element symbol P.

Part C

Allow a total of 22 credits for this part. The student must answer all questions in this part.

63 [2] Allow 1 credit for ***A***.

and

Allow 1 credit for ***D***.

64 [1] Allow 1 credit for a correct response. Acceptable responses include, but are not limited to, these examples:

Energy is released when an electron falls from a high state (excited) to a low state (ground).

excited state to ground state

high energy to low energy

65 [1] Allow 1 credit for **3**.

66 [1] Allow 1 credit for **2**.

67 [1] Allow 1 credit for a correct response. Acceptable responses include, but are not limited to, these examples:

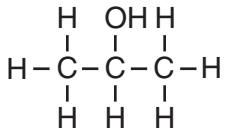
A compound must contain two or more different elements.

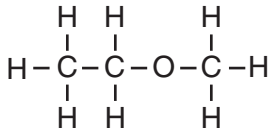
only 1 kind of atom present

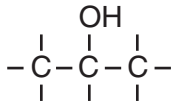
68 [1] Allow 1 credit for **esterification** or **making an ester**.

69 [1] Allow 1 credit for **alcohol**.

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







Note: Do *not* allow credit if the student has placed the —OH group on an end carbon.

71 [2] Allow 1 credit for indicating $^{4}_{2}\text{He}$ or $^{4}_{2}\alpha$ or α on the right side of the arrow.

and

Allow 1 credit for having mass/charge balanced.

Acceptable responses include, but are not limited to, this example:

$^{241}_{95}\text{Am} \rightarrow {}^{4}_{2}\text{He} + {}^{237}_{93}\text{Np}$

72 [1] Allow 1 credit for a correct response. Acceptable responses include, but are not limited to, these examples:

^{85}Kr undergoes beta decay and ^{241}Am undergoes alpha decay.

Decay mode and half-life are different.

half-lives different

73 [1] Allow 1 credit for a correct response. Acceptable responses include, but are not limited to, these examples:

Radioactivity can be used in medical diagnosis and/or treatment.

food irradiation

radioactive dating

74 [1] Allow 1 credit for a correct response. Acceptable responses include, but are not limited to, these examples:

Extensive exposure can make people sick.

contamination of environment

introduction of radioactive materials into the ecosystem

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

172

172.2

76 [2] ***a*** Allow 1 credit for a correct numerical setup. Acceptable responses include, but are not limited to, these examples:

$$\frac{36\text{ g}}{172\text{ g}} \times 100$$

$$\frac{36}{172} = \frac{x}{100}$$

or

Allow 1 credit for a numerical setup consistent with the student's response to question 75.

b Allow 1 credit for a correct response. Significant figures do *not* need to be used. Acceptable responses include, but are not limited to, these examples:

21

20.9

20.93

or

Allow 1 credit for a response consistent with the student's setup. Significant figures do *not* need to be used.

77 [1] Allow 1 credit for ***D***.

78 [1] Allow 1 credit for ***C***.

79 [1] Allow 1 credit for **KNO_3** or **NaCl** or **NH_4Cl** or **NH_4NO_3**, or **potassium nitrate** or **sodium chloride** or **ammonium chloride** or **ammonium nitrate**.

80 [1] Allow 1 credit for **7**.

81 [1] Allow 1 credit for **$Ba(OH)_2$** or **$Sr(OH)_2$** or **barium hydroxide** or **strontium hydroxide**. Allow credit for just barium or strontium.

Regents Examination in Physical Setting/Chemistry
January 2004
Chart for Converting Total Test Raw Scores to Final Examination Scores (Scaled Scores)

Raw Score	Scaled Score	Raw Score	Scaled Score	Raw Score	Scaled Score	Raw Score	Scaled Score
85	100	63	72	41	58	19	39
84	98	62	71	40	58	18	37
83	96	61	70	39	57	17	36
82	95	60	70	38	57	16	34
81	93	59	69	37	56	15	33
80	91	58	68	36	55	14	31
79	90	57	68	35	55	13	29
78	88	56	67	34	54	12	27
77	87	55	67	33	53	11	26
76	85	54	66	32	52	10	24
75	84	53	66	31	51	9	22
74	83	52	65	30	51	8	20
73	82	51	64	29	50	7	17
72	80	50	63	28	49	6	15
71	79	49	63	27	48	5	13
70	78	48	62	26	47	4	10
69	77	47	62	25	46	3	8
68	76	46	61	24	45	2	5
67	75	45	61	23	44	1	3
66	74	44	60	22	42	0	0
65	74	43	60	21	41		
64	73	42	59	20	40		

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

Map to Core Curriculum

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