

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

**PHYSICAL SETTING
CHEMISTRY**

Wednesday, June 22, 2005 — 1:15 to 4:15 p.m., only

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

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

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

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

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

Notice . . .

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

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

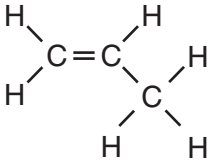
DO NOT OPEN THIS EXAMINATION BOOKLET UNTIL THE SIGNAL IS GIVEN.

Part A

Answer all questions in this part.

Directions (1–33): 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*.

- In the modern wave-mechanical model of the atom, the orbitals are regions of the most probable location of
 - protons
 - neutrons
 - electrons
 - positrons
- Compared to a proton, an electron has
 - a greater quantity of charge and the same sign
 - a greater quantity of charge and the opposite sign
 - the same quantity of charge and the same sign
 - the same quantity of charge and the opposite sign
- Which two notations represent atoms that are isotopes of the same element?
 - $^{121}_{50}\text{Sn}$ and $^{119}_{50}\text{Sn}$
 - $^{121}_{50}\text{Sn}$ and $^{121}_{50}\text{Sn}$
 - $^{19}_8\text{O}$ and $^{19}_9\text{F}$
 - $^{39}_{17}\text{Cl}$ and $^{39}_{19}\text{K}$
- The elements in Period 5 on the Periodic Table are arranged from left to right in order of
 - decreasing atomic mass
 - decreasing atomic number
 - increasing atomic mass
 - increasing atomic number
- Which list of elements contains a metal, a metalloid, and a nonmetal?
 - Zn, Ga, Ge
 - Si, Ge, Sn
 - Cd, Sb, I
 - F, Cl, Br
- An example of a physical property of an element is the element's ability to
 - react with an acid
 - react with oxygen
 - form a compound with chlorine
 - form an aqueous solution
- Which element is malleable and conducts electricity?
 - iron
 - iodine
 - sulfur
 - phosphorus
- At STP, solid carbon can exist as graphite or as diamond. These two forms of carbon have
 - the same properties and the same crystal structures
 - the same properties and different crystal structures
 - different properties and the same crystal structures
 - different properties and different crystal structures
- What is the formula of titanium(II) oxide?
 - TiO
 - TiO₂
 - Ti₂O
 - Ti₂O₃
- Which substance can be decomposed by a chemical change?
 - calcium
 - potassium
 - copper
 - ammonia
- As a chlorine atom becomes a negative ion, the atom
 - gains an electron and its radius increases
 - gains an electron and its radius decreases
 - loses an electron and its radius increases
 - loses an electron and its radius decreases
- Based on Reference Table S, the atoms of which of these elements have the strongest attraction for electrons in a chemical bond?
 - N
 - Na
 - P
 - Pt

- 13 Which terms are used to identify pure substances?
- (1) an element and a mixture
 - (2) an element and a compound
 - (3) a solution and a mixture
 - (4) a solution and a compound
- 14 The solubility of $\text{KClO}_3(s)$ in water increases as the
- (1) temperature of the solution increases
 - (2) temperature of the solution decreases
 - (3) pressure on the solution increases
 - (4) pressure on the solution decreases
- 15 Compared to a 0.1 M aqueous solution of NaCl, a 0.8 M aqueous solution of NaCl has a
- (1) higher boiling point and a higher freezing point
 - (2) higher boiling point and a lower freezing point
 - (3) lower boiling point and a higher freezing point
 - (4) lower boiling point and a lower freezing point
- 16 The kinetic molecular theory assumes that the particles of an ideal gas
- (1) are in random, constant, straight-line motion
 - (2) are arranged in a regular geometric pattern
 - (3) have strong attractive forces between them
 - (4) have collisions that result in the system losing energy
- 17 In which process does a solid change directly into a vapor?
- (1) condensation
 - (2) sublimation
 - (3) deposition
 - (4) solidification
- 18 Which statement must be true about a chemical system at equilibrium?
- (1) The forward and reverse reactions stop.
 - (2) The concentration of reactants and products are equal.
 - (3) The rate of the forward reaction is equal to the rate of the reverse reaction.
 - (4) The number of moles of reactants is equal to the number of moles of product.
- 19 Adding a catalyst to a chemical reaction results in
- (1) a decrease in activation energy and a decrease in the reaction rate
 - (2) a decrease in activation energy and an increase in the reaction rate
 - (3) an increase in activation energy and a decrease in the reaction rate
 - (4) an increase in activation energy and an increase in the reaction rate
- 20 Systems in nature tend to undergo changes toward
- (1) lower energy and lower entropy
 - (2) lower energy and higher entropy
 - (3) higher energy and lower entropy
 - (4) higher energy and higher entropy
- 21 Which element has atoms that can bond with each other to form long chains or rings?
- (1) carbon
 - (2) nitrogen
 - (3) oxygen
 - (4) fluorine
- 22 Which formula represents an unsaturated hydrocarbon?
- (1) C_2H_6
 - (2) C_3H_8
 - (3) C_5H_8
 - (4) C_6H_{14}
- 23 Given the structural formula:
- 
- What is the IUPAC name of this compound?
- (1) propane
 - (2) propene
 - (3) propanone
 - (4) propanal
- 24 What is the oxidation state of nitrogen in NaNO_2 ?
- (1) +1
 - (2) +2
 - (3) +3
 - (4) +4

25 The three isomers of pentane have different

- (1) formula masses
- (2) molecular formulas
- (3) empirical formulas
- (4) structural formulas

26 Where does oxidation occur in an electrochemical cell?

- (1) at the cathode in both an electrolytic cell and a voltaic cell
- (2) at the cathode in an electrolytic cell and at the anode in a voltaic cell
- (3) at the anode in both an electrolytic cell and a voltaic cell
- (4) at the anode in an electrolytic cell and at the cathode in a voltaic cell

27 Which formula represents an electrolyte?

- (1) CH_3OCH_3
- (2) CH_3OH
- (3) CH_3COOH
- (4) $\text{C}_2\text{H}_5\text{CHO}$

28 When an Arrhenius acid dissolves in water, the only positive ion in the solution is

- (1) H^+
- (2) Li^+
- (3) Na^+
- (4) K^+

29 What is the half-life and decay mode of Rn-222?

- (1) 1.91 days and alpha decay
- (2) 1.91 days and beta decay
- (3) 3.82 days and alpha decay
- (4) 3.82 days and beta decay

30 Which equation represents a transmutation reaction?

- (1) ${}_{92}^{239}\text{U} \rightarrow {}_{92}^{239}\text{U} + {}_0^0\gamma$
- (2) ${}_{6}^{14}\text{C} \rightarrow {}_{7}^{14}\text{N} + {}_{-1}^0\text{e}$
- (3) $\text{C}_3\text{H}_8 + 5\text{O}_2 \rightarrow 3\text{CO}_2 + 4\text{H}_2\text{O}$
- (4) $n\text{C}_2\text{H}_4 \xrightarrow{\text{catalyst}} (-\text{C}_2\text{H}_4-)_n$

31 Which equation represents positron decay?

- (1) ${}_{37}^{87}\text{Rb} \rightarrow {}_{-1}^0\text{e} + {}_{38}^{87}\text{Sr}$
- (2) ${}_{92}^{227}\text{U} \rightarrow {}_{90}^{223}\text{Th} + {}_2^4\text{He}$
- (3) ${}_{13}^{27}\text{Al} + {}_2^4\text{He} \rightarrow {}_{15}^{30}\text{P} + {}_0^1\text{n}$
- (4) ${}_{6}^{11}\text{C} \rightarrow {}_{+1}^0\text{e} + {}_{5}^{11}\text{B}$

32 Which equation represents a fusion reaction?

- (1) $\text{H}_2\text{O}(\text{g}) \rightarrow \text{H}_2\text{O}(\ell)$
- (2) $\text{C}(\text{s}) + \text{O}_2(\text{g}) \rightarrow \text{CO}_2(\text{g})$
- (3) ${}_{1}^2\text{H} + {}_{1}^3\text{H} \rightarrow {}_{2}^4\text{He} + {}_{0}^1\text{n}$
- (4) ${}_{92}^{235}\text{U} + {}_{0}^1\text{n} \rightarrow {}_{56}^{142}\text{Ba} + {}_{36}^{91}\text{Kr} + 3{}_{0}^1\text{n}$

Note that question 33 has only three choices.

33 An electron in an atom moves from the ground state to an excited state when the energy of the electron

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

Part B-1

Answer all questions in this part.

Directions (34–50): 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.

- 34 Which symbol represents a particle that has the same total number of electrons as S^{2-} ?

(1) O^{2-} (3) Se^{2-}
 (2) Si (4) Ar

- 35 The data table below shows elements Xx, Yy, and Zz from the same group on the Periodic Table.

Element	Atomic Mass (atomic mass unit)	Atomic Radius (pm)
Xx	69.7	141
Yy	114.8	?
Zz	204.4	171

What is the most likely atomic radius of element Yy?

(1) 103 pm (3) 166 pm
 (2) 127 pm (4) 185 pm

- 36 Which substance has a chemical formula with the same ratio of metal ions to nonmetal ions as in potassium sulfide?

(1) sodium oxide
 (2) sodium chloride
 (3) magnesium oxide
 (4) magnesium chloride

- 37 The molecular formula of glucose is $C_6H_{12}O_6$. What is the empirical formula of glucose?

(1) CHO (3) $C_6H_{12}O_6$
 (2) CH_2O (4) $C_{12}H_{24}O_{12}$

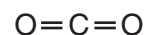
- 38 According to Reference Table F, which of these compounds is the *least* soluble in water?

(1) K_2CO_3 (3) $Ca_3(PO_4)_2$
 (2) $KC_2H_3O_2$ (4) $Ca(NO_3)_2$

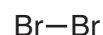
- 39 A sample of a substance containing only magnesium and chlorine was tested in the laboratory and was found to be composed of 74.5% chlorine by mass. If the total mass of the sample was 190.2 grams, what was the mass of the magnesium?

(1) 24.3 g (3) 70.9 g
 (2) 48.5 g (4) 142 g

- 40 Which molecule contains a nonpolar covalent bond?



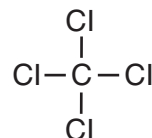
(1)



(3)



(2)



(4)

- 41 According to Reference Table G, which substance forms an unsaturated solution when 80 grams of the substance is dissolved in 100 grams of H_2O at $10^\circ C$?

(1) KI (3) $NaNO_3$
 (2) KNO_3 (4) NaCl

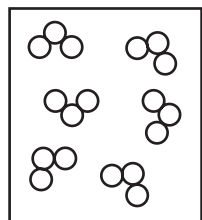
- 42 What is the concentration of a solution, in parts per million, if 0.02 gram of Na_3PO_4 is dissolved in 1000 grams of water?

(1) 20 ppm (3) 0.2 ppm
 (2) 2 ppm (4) 0.02 ppm

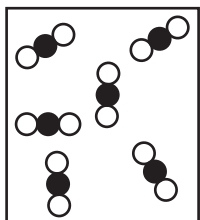
- 43 Given the simple representations for atoms of two elements:

○ = an atom of an element
 ● = an atom of a different element

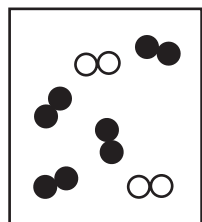
Which particle diagram represents molecules of only one compound in the gaseous phase?



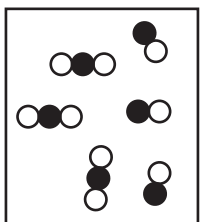
(1)



(3)

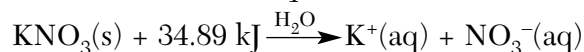


(2)



(4)

- 44 Given the balanced equation:



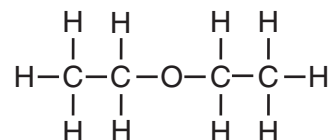
Which statement best describes this process?

- (1) It is endothermic and entropy increases.
 - (2) It is endothermic and entropy decreases.
 - (3) It is exothermic and entropy increases.
 - (4) It is exothermic and entropy decreases.
- 45 A 1.0-gram piece of zinc reacts with 5 milliliters of HCl(aq). Which of these conditions of concentration and temperature would produce the greatest rate of reaction?
- (1) 1.0 M HCl(aq) at 20.°C
 - (2) 1.0 M HCl(aq) at 40.°C
 - (3) 2.0 M HCl(aq) at 20.°C
 - (4) 2.0 M HCl(aq) at 40.°C

- 46 At STP, fluorine is a gas and iodine is a solid. This observation can be explained by the fact that fluorine has

- (1) weaker intermolecular forces of attraction than iodine
- (2) stronger intermolecular forces of attraction than iodine
- (3) lower average kinetic energy than iodine
- (4) higher average kinetic energy than iodine

- 47 Given the structural formula:

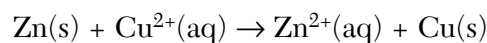


The compound represented by this formula can be classified as an

- (1) organic acid
 - (2) ether
 - (3) ester
 - (4) aldehyde
- 48 Sulfuric acid, $\text{H}_2\text{SO}_4(\text{aq})$, can be used to neutralize barium hydroxide, $\text{Ba}(\text{OH})_2(\text{aq})$. What is the formula for the salt produced by this neutralization?

- (1) BaS
- (2) BaSO_2
- (3) BaSO_3
- (4) BaSO_4

- 49 Given the balanced ionic equation:



Which equation represents the oxidation half-reaction?

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

- 50 In which solution will thymol blue indicator appear blue?

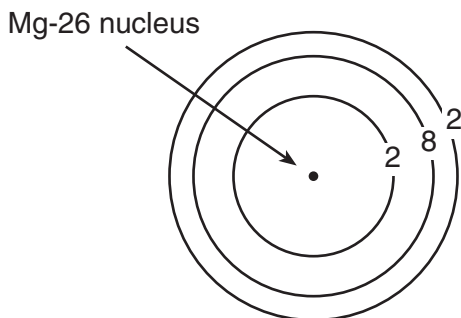
- (1) 0.1 M CH_3COOH
- (2) 0.1 M KOH
- (3) 0.1 M HCl
- (4) 0.1 M H_2SO_4

Part B-2

Answer all questions in this part.

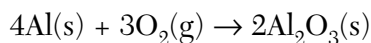
Directions (51–64): Record your answers in the spaces provided in your answer booklet. Some questions may require the use of the *Reference Tables for Physical Setting/Chemistry*.

Base your answers to questions 51 and 52 on the diagram below, which represents an atom of magnesium-26 in the ground state.



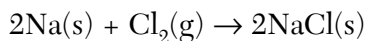
- 51 What is the total number of valence electrons in an atom of Mg-26 in the ground state? [1]
- 52 On the diagram *in your answer booklet*, write an appropriate number of electrons in *each* shell to represent a Mg-26 atom in an excited state. Your answer may include additional shells. [1]

-
- 53 Explain, in terms of atomic structure, why germanium is chemically similar to silicon. [1]
- 54 Given the balanced equation:



What is the total number of moles of $\text{O}_2(g)$ that must react completely with 8.0 moles of $\text{Al}(s)$ in order to form $\text{Al}_2\text{O}_3(s)$? [1]

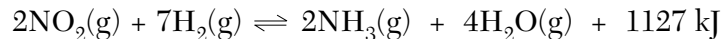
Base your answers to questions 55 and 56 on the balanced equation below.



- 55 In the box *in your answer booklet*, draw a Lewis electron-dot diagram for a molecule of chlorine, Cl_2 . [1]
- 56 Explain, in terms of electrons, why the bonding in NaCl is ionic. [1]

Base your answers to questions 57 and 58 on the information below.

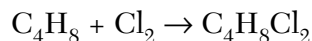
Given the reaction at equilibrium:



- 57 On the diagram *in your answer booklet*, complete the potential energy diagram for the forward reaction. Be sure your drawing shows the activation energy and the potential energy of the products. [2]
- 58 Explain, in terms of Le Chatelier's principle, why the concentration of $\text{NH}_3(\text{g})$ *decreases* when the temperature of the equilibrium system increases. [1]
-

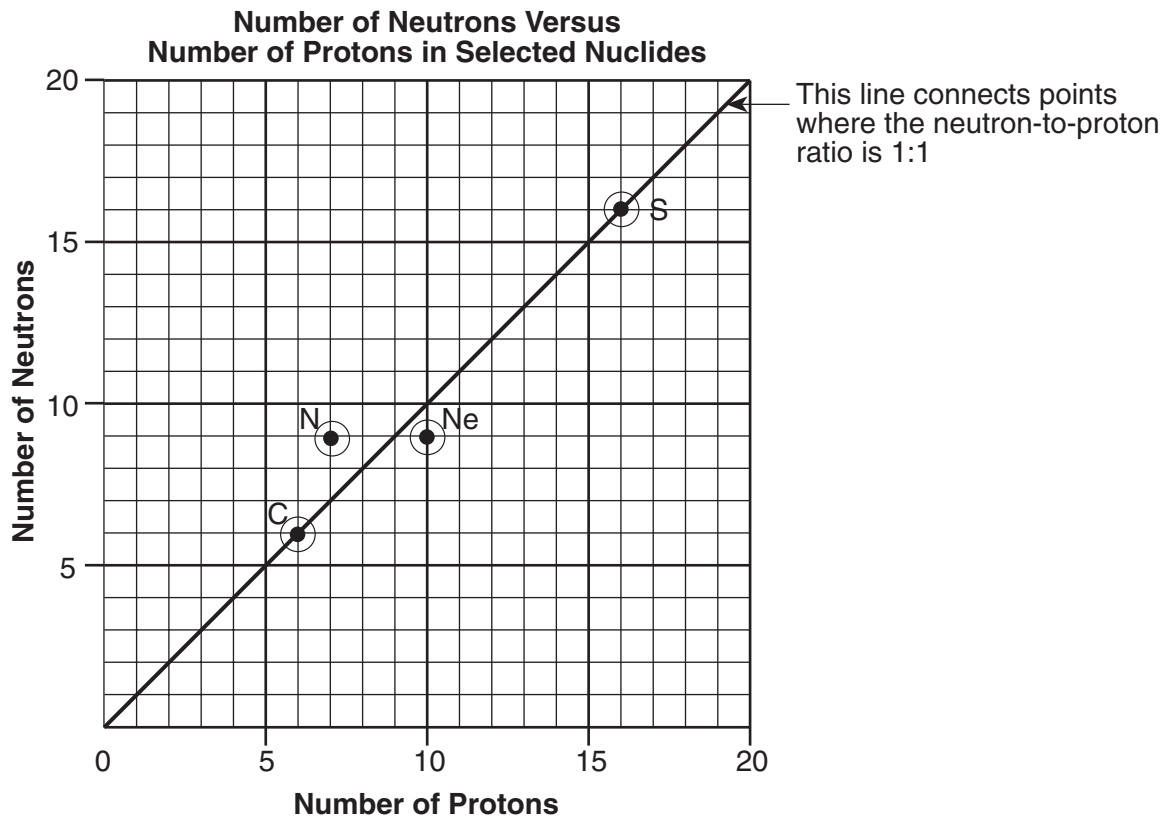
Base your answers to questions 59 and 60 on the information below.

Given the reaction between 1-butene and chlorine gas:



- 59 Which type of chemical reaction is represented by this equation? [1]
- 60 In the space *in your answer booklet*, draw the structural formula of the product 1,2-dichlorobutane. [1]
-

Base your answers to questions 61 through 64 on the information below, which relates the numbers of neutrons and protons for specific nuclides of C, N, Ne, and S.



- 61 Using the point plotted on the graph for neon, complete the table *in your answer booklet*. [1]
- 62 Explain, in terms of atomic particles, why S-32 is a stable nuclide. [1]
- 63 Using the point plotted on the graph for nitrogen, what is the neutron-to-proton ratio of this nuclide? [1]
- 64 Based on Reference Table N, complete the decay equation for N-16 *in your answer booklet*. [1]
-

Part C

Answer all questions in this part.

Directions (65–83): Record your answers in the spaces provided in your answer booklet. Some questions may require the use of the *Reference Tables for Physical Setting/Chemistry*.

- 65 In the early 1900s, experiments were conducted to determine the structure of the atom. One of these experiments involved bombarding gold foil with alpha particles. Most alpha particles passed directly through the foil. Some, however, were deflected at various angles. Based on this alpha particle experiment, state *two* conclusions that were made concerning the structure of an atom. [2]

Base your answers to questions 66 through 70 on the information below.

A substance is a solid at 15°C. A student heated a sample of the solid substance and recorded the temperature at one-minute intervals in the data table below.

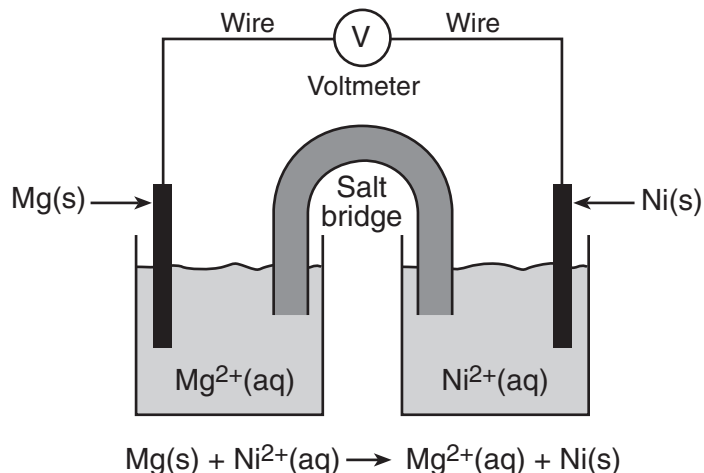
Time (min)	0	1	2	3	4	5	6	7	8	9	10	11	12
Temperature (°C)	15	32	46	53	53	53	53	53	53	53	53	60	65

- 66 On the grid *in your answer booklet*, mark an appropriate scale on the axis labeled “Temperature (°C).” An appropriate scale is one that allows a trend to be seen. [1]
- 67 Plot the data from the data table. Circle and connect the points. [1]

Example: 

- 68 Based on the data table, what is the melting point of this substance? [1]
- 69 What is the evidence that the average kinetic energy of the particles of this substance is increasing during the first three minutes? [1]
- 70 The heat of fusion for this substance is 122 joules per gram. How many joules of heat are needed to melt 7.50 grams of this substance at its melting point? [1]
-

Base your answers to questions 71 through 73 on the diagram of a voltaic cell and the balanced ionic equation below.



- 71 What is the total number of moles of electrons needed to completely reduce 6.0 moles of $\text{Ni}^{2+}(\text{aq})$ ions? [1]
- 72 Identify *one* metal from Reference Table J that is more easily oxidized than Mg(s) . [1]
- 73 Explain the function of the salt bridge in the voltaic cell. [1]
-

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

Acid rain is a problem in industrialized countries around the world. Oxides of sulfur and nitrogen are formed when various fuels are burned. These oxides dissolve in atmospheric water droplets that fall to earth as acid rain or acid snow.

While normal rain has a pH between 5.0 and 6.0 due to the presence of dissolved carbon dioxide, acid rain often has a pH of 4.0 or lower. This level of acidity can damage trees and plants, leach minerals from the soil, and cause the death of aquatic animals and plants.

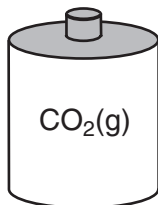
If the pH of the soil is too low, then quicklime, CaO , can be added to the soil to increase the pH. Quicklime produces calcium hydroxide when it dissolves in water.

- 74 Balance the neutralization equation *in your answer booklet*, using the smallest whole-number coefficients. [1]
- 75 A sample of wet soil has a pH of 4.0. After the addition of quicklime, the H^+ ion concentration of the soil is $\frac{1}{100}$ of the original H^+ ion concentration of the soil. What is the new pH of the soil sample? [1]
- 76 Samples of acid rain are brought to a laboratory for analysis. Several titrations are performed and it is determined that a 20.0-milliliter sample of acid rain is neutralized with 6.50 milliliters of 0.010 M NaOH . What is the molarity of the H^+ ions in the acid rain? [1]
-

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

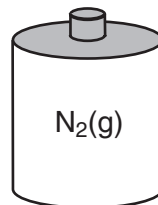
Cylinder A contains 22.0 grams of $\text{CO}_2(\text{g})$ and cylinder B contains $\text{N}_2(\text{g})$. The volumes, pressures, and temperatures of the two gases are indicated under each cylinder.

Cylinder A



$V = 12.3 \text{ L}$
 $P = 1.0 \text{ atm}$
 $T = 300. \text{ K}$

Cylinder B



$V = 12.3 \text{ L}$
 $P = 1.0 \text{ atm}$
 $T = 300. \text{ K}$

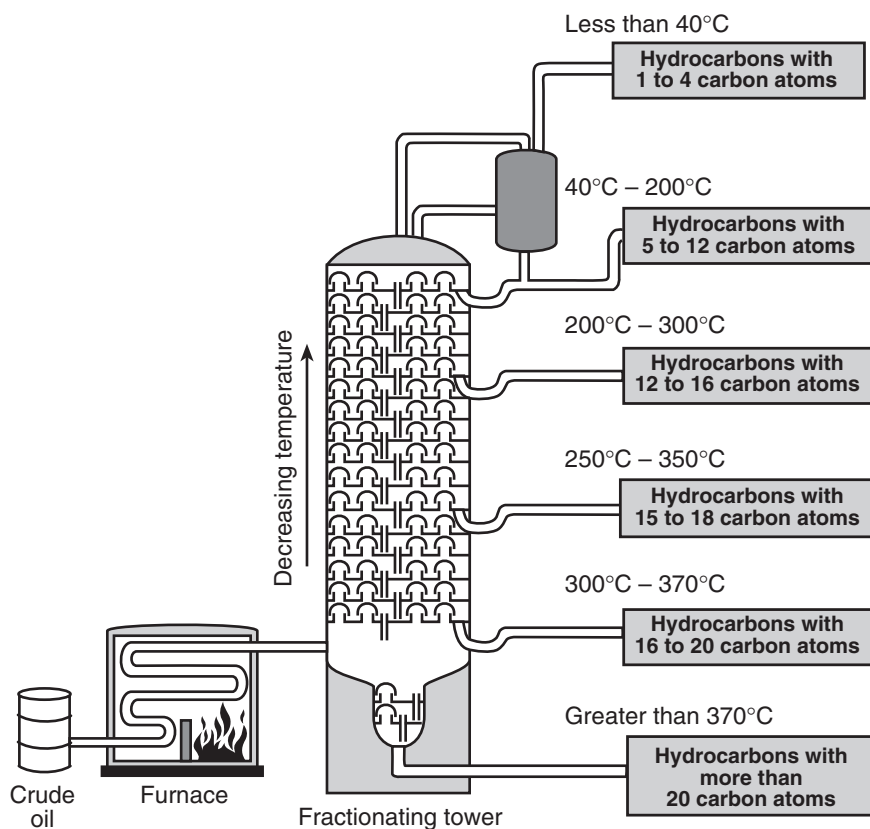
- 77 What is the total number of moles of $\text{CO}_2(\text{g})$ in cylinder A? [1]
- 78 Explain why the number of molecules of $\text{N}_2(\text{g})$ in cylinder B is the same as the number of molecules of $\text{CO}_2(\text{g})$ in cylinder A. [1]
- 79 The temperature of the $\text{CO}_2(\text{g})$ is increased to 450. K and the volume of cylinder A remains constant. In the space *in your answer booklet*, show a correct numerical setup for calculating the new pressure of the $\text{CO}_2(\text{g})$ in cylinder A. [1]
-

Base your answers to questions 80 through 83 on the information and diagram below and on your knowledge of chemistry.

Crude oil is a mixture of many hydrocarbons that have different numbers of carbon atoms. The use of a fractionating tower allows the separation of this mixture based on the boiling points of the hydrocarbons.

To begin the separation process, the crude oil is heated to about 400°C in a furnace, causing many of the hydrocarbons of the crude oil to vaporize. The vaporized mixture is pumped into a fractionating tower that is usually more than 30 meters tall. The temperature of the tower is highest at the bottom. As vaporized samples of hydrocarbons travel up the tower, they cool and condense. The liquid hydrocarbons are collected on trays and removed from the tower. The diagram below illustrates the fractional distillation of the crude oil and the temperature ranges in which the different hydrocarbons condense.

Distillation of Crude Oil



- 80 State the trend between the boiling point of the hydrocarbons contained in the crude oil and the number of carbon atoms in these molecules. [1]
- 81 Describe the relationship between the strength of the intermolecular forces and the number of carbon atoms in the different hydrocarbon molecules. [1]
- 82 Write an IUPAC name of *one* saturated hydrocarbon that leaves the fractionating tower at *less than* 40°C . [1]
- 83 How many hydrogen atoms are present in one molecule of octane? [1]

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The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

PHYSICAL SETTING CHEMISTRY

Wednesday, June 22, 2005 — 1:15 to 4:15 p.m., only

ANSWER SHEET

Student Sex: Male Female Grade

Teacher School

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

Part A

- 1 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 32
11 22 33

Part A Score

[Box for Part A Score]

Part B-1

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

Part B-1 Score

[Box for Part B-1 Score]

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

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

I do hereby affirm, at the close of this examination, that I had no unlawful knowledge of the questions or answers prior to the examination and that I have neither given nor received assistance in answering any of the questions during the examination.

Signature

Tear Here

Tear Here

Tear Here

PHYSICAL SETTING CHEMISTRY

Wednesday, June 22, 2005 — 1:15 to 4:15 p.m., only

ANSWER BOOKLET

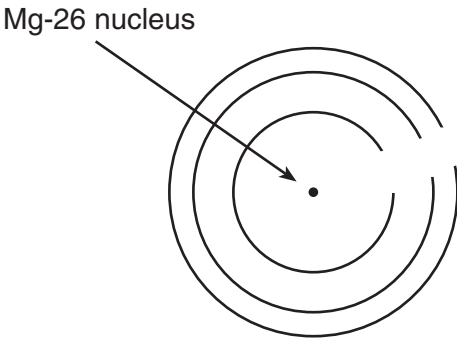
Student Sex: Male Female

Teacher

School Grade

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

Part	Maximum Score	Student's Score
A	33	
B-1	17	
B-2	15	
C	20	
Total Written Test Score (Maximum Raw Score: 85)		<input type="text"/>
Final Score (from conversion chart)		<input type="text"/>
Raters' Initials:		
Rater 1		Rater 2

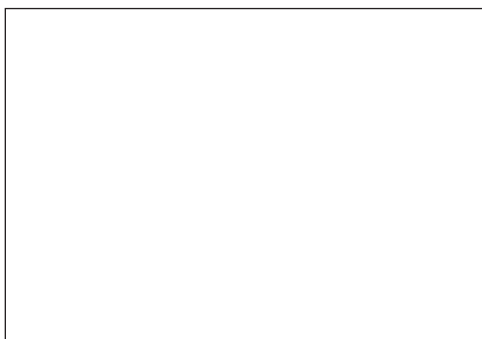
Part B-2		For Raters Only
51 _____		51 <input type="text"/>
52		52 <input type="text"/>
53 _____		53 <input type="text"/>

For Raters
Only

54 _____ mol

54

55

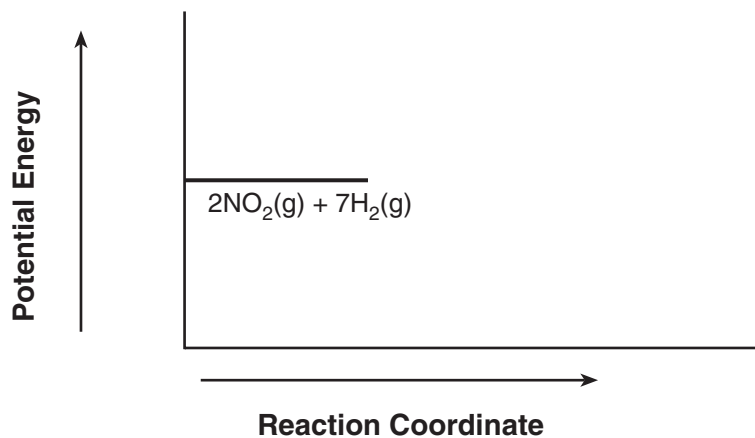


55

56

56

57



57

58

58

For Raters
Only

59 _____

59

60

60

61

Element	Number of Protons	Number of Neutrons	Mass Number	Nuclide
C	6	6	12	C-12
N	7	9	16	N-16
Ne	10			
S	16	16	32	S-32

61

62 _____

62

63 _____

63

64 ${}^{16}_7\text{N} \rightarrow$ _____ + _____

64

Total Score
for Part B-2

Part C

For Raters Only

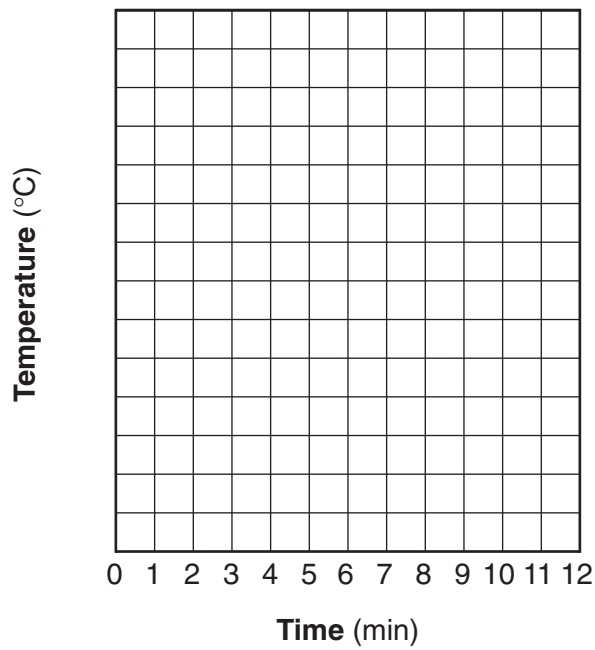
65 Conclusion 1: _____

Conclusion 2: _____

65

66 and 67

Heating Curve



66

67

68 _____ °C

68

**For Raters
Only**

69 _____

69

70 _____ J

70

71 _____ mol

71

72 _____

72

73 _____

73

74 _____ HNO_3 + _____ $\text{Ca(OH)}_2 \rightarrow$ _____ $\text{Ca(NO}_3)_2$ + _____ H_2O

74

75 _____

75

76 _____ M

76

**For Raters
Only**

77 _____ mol

77

78 _____

78

79

79

80 _____

80

81 _____

81

82 _____

82

83 _____

83

**Total Score
for Part C**

FOR TEACHERS ONLY

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

PS-CH

PHYSICAL SETTING/CHEMISTRY

Wednesday, June 22, 2005 — 1:15 to 4:15 p.m., only

SCORING KEY AND RATING GUIDE

Directions to the Teacher:

Refer to the directions on page 3 before rating student papers.

Updated information regarding the rating of this examination may be posted on the New York State Education Department's web site during the rating period. Visit the site <http://www.emsc.nysed.gov/osa/> and select the link "Latest Information" for any recently posted information regarding this examination. This site should be checked before the rating process for this examination begins and at least one more time before the final scores for the examination are recorded.

Part A and Part B-1

Allow 1 credit for each correct response.

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

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 that will be posted on the Department's web site <http://www.emsc.nysed.gov/osa/> on Wednesday, June 22, 2005. 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.

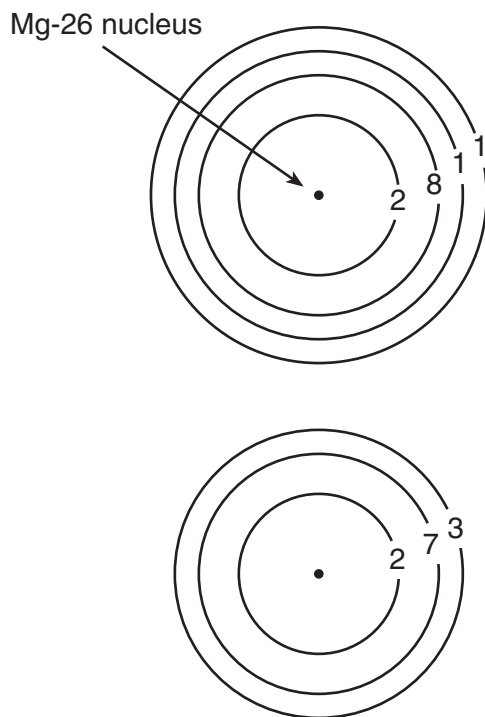
Because scaled scores corresponding to raw scores in the conversion chart may change from one examination to another, it is crucial that for each administration, the conversion chart provided for that administration be used to determine the student's final score.

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 for 2 or two.

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



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

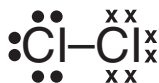
Germanium atoms and silicon atoms both have the same number of valence electrons.

4 valence e^- in each

same number of valence electrons

54 [1] Allow 1 credit for 6.0 or 6 or six. Significant figures do *not* need to be shown.

- 55 [1] Allow 1 credit for a correct response. Acceptable responses include, but are not limited to:



- 56 [1] Allow 1 credit for a correct response. Acceptable responses include, but are not limited to:

The sodium atom transfers its one valence electron to the chlorine atom.



Metal loses e^- to nonmetal.

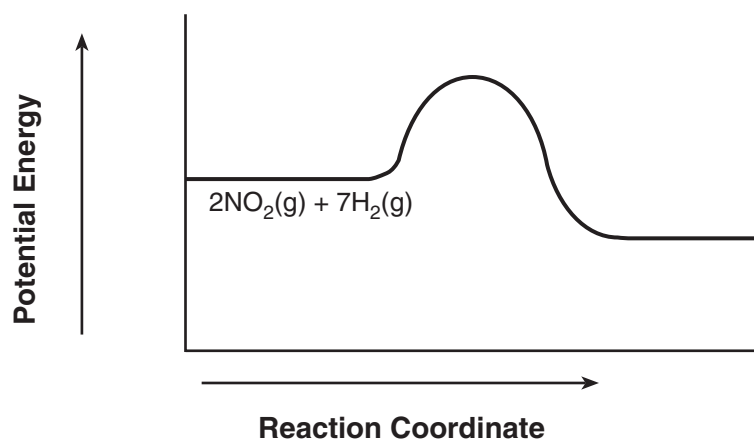
- 57 [2] Allow a maximum of 2 credits, allocated as follows:

Allow 1 credit for showing a peak that is higher than the beginning and the end of the curve.

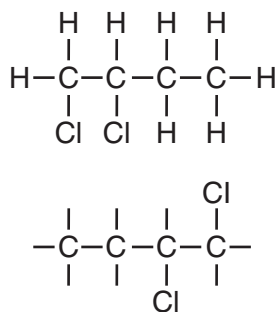
and

Allow 1 credit for showing that the PE of products is lower than the PE of reactants.

Acceptable responses include, but are not limited to:



- 58 [1] Allow 1 credit for a correct response. Acceptable responses include, but are not limited to:
 An increase in temperature favors the endothermic (reverse) reaction, consuming more $\text{NH}_3(\text{g})$.
 temperature \uparrow , reaction shifts left
- 59 [1] Allow 1 credit for a correct response. Acceptable responses include, but are not limited to:
 addition
 chlorination
 halogenation
 redox
 synthesis
- 60 [1] Allow 1 credit for a correct response. Acceptable responses include, but are not limited to:



- 61 [1] Allow 1 credit for all *three* correct responses shown below.

Element	Number of Protons	Number of Neutrons	Mass Number	Nuclide
C	6	6	12	C-12
N	7	9	16	N-16
Ne	10	9	19	Ne-19 or ^{19}Ne
S	16	16	32	S-32

- 62** [1] Allow 1 credit for a correct response. Acceptable responses include, but are not limited to:

The neutron-to-proton ratio causes the nuclide to be stable.

The nuclide has an equal number of neutrons and protons.

because of neutron-proton ratio

- 63** [1] Allow 1 credit for a correct response. Acceptable responses include, but are not limited to:

9:7

$\frac{9}{7}$

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

${}_{-1}^0\text{e} + {}_8^{16}\text{O}$

$\beta^{-} + {}_8^{16}\text{O}$

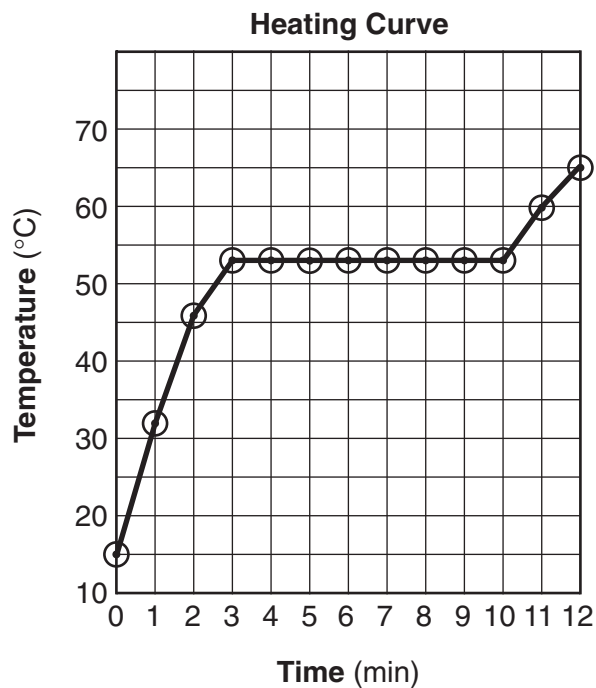
Part C

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

- 65** [2] Allow a maximum of 2 credits, 1 credit for *each* correct conclusion. Acceptable conclusions include, but are not limited to:

- The nucleus is small.
- The nucleus is positively charged.
- The atom is mostly empty space.
- The nucleus is dense.

- 66** and **67** An example of an acceptable response is shown below.



- 66** [1] Allow 1 credit for marking an appropriate scale. An appropriate scale is one that allows a trend to be seen.

- 67** [1] Allow 1 credit for plotting all the points correctly (± 0.3 grid space). Plotted points do *not* need to be circled or connected.

- 68** [1] Allow 1 credit for 53°C.

- 69** [1] Allow 1 credit for a correct response. Acceptable responses include, but are not limited to:
- The temperature of the substance is increasing.
 temperature ↑
 positive slope for this section of graph
- 70** [1] Allow 1 credit for 915 J. Significant figures do *not* need to be shown.
- 71** [1] Allow 1 credit for 12 mol or 12.0 mol or twelve mol. Significant figures do *not* need to be shown.
- 72** [1] Allow 1 credit for the symbol or name of *one* of the following metals from Reference Table J:
- | | |
|----|----|
| Li | Ba |
| Rb | Sr |
| K | Ca |
| Cs | Na |
- 73** [1] Allow 1 credit for a correct response. Acceptable responses include, but are not limited to:
- The salt bridge allows ions to flow between the half-cells.
 maintains electrical neutrality
 prevents polarization
- 74** [1] Allow 1 credit for $\underline{2}$ HNO₃ + ___ Ca(OH)₂ → ___ Ca(NO₃)₂ + $\underline{2}$ H₂O. Allow credit even if the coefficient 1 is written in front of Ca(OH)₂ and Ca(NO₃)₂.
- 75** [1] Allow 1 credit for 6.0 or 6 or six. Significant figures do *not* need to be shown.
- 76** [1] Allow 1 credit for a correct response. Significant figures do *not* need to be shown. Acceptable responses include, but are not limited to:
- 0.0033 M
 3.25 × 10⁻³ M
- 77** [1] Allow 1 credit for 0.500 mol. Significant figures do *not* need to be shown.

- 78** [1] Allow 1 credit for a correct response. Acceptable responses include, but are not limited to:
 Equal volumes of two gases at the same temperature and pressure contain equal number of particles.
 both gases — same conditions

- 79** [1] Allow 1 credit for a correct numerical setup. Acceptable responses include, but are not limited to:

$$\frac{(1.0 \text{ atm})(12.3 \text{ L})}{(300 \text{ K})} = \frac{(P_2)(12.3 \text{ L})}{(450 \text{ K})}$$

$$\frac{1}{300} = \frac{x}{450}$$

$$\frac{450}{300}$$

- 80** [1] Allow 1 credit for a correct response. Acceptable responses include, but are not limited to:
 As the number of carbon atoms in these molecules increases, the boiling point increases.
 carbon atoms ↓, boiling point ↓

- 81** [1] Allow 1 credit for a correct response. Acceptable responses include, but are not limited to:
 The intermolecular forces are weaker for molecules that have fewer carbon atoms.
 greater number of carbon atoms, stronger intermolecular forces

- 82** [1] Allow 1 credit for a correct response. Acceptable responses include, but are not limited to:
 methane
 ethane
 propane
 methyl propane
 butane

- 83** [1] Allow 1 credit for 18 or eighteen.

The *Chart for Determining the Final Examination Score for the June 2005 Regents Examination in Physical Setting/Chemistry* will be posted on the Department's web site <http://www.emsc.nysed.gov/osa/> on Wednesday, June 22, 2005. 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.

Map to Core Curriculum

June 2005 Physical Setting/ Chemistry			
Question Numbers			
Key Ideas	Part A	Part B	Part C
Standard 1			
Math Key Idea 1		63	66,67,68,79
Math Key Idea 2			81
Math Key Idea 3		39,42	78
Sci. Inq. Key Idea 1		56,62	78
Sci. Inq. Key Idea 2			
Sci. Inq. Key Idea 3		36,38,43,45,53, 57,61	65,72,80,82,83
Eng. Des. Key Idea 1			
Standard 2			
Key Idea 1			
Key Idea 2			
Standard 6			
Key Idea 1			
Key Idea 2		52	
Key Idea 3			75
Key Idea 4		58	
Key Idea 5			
Standard 7			
Key Idea 1			
Key Idea 2			
Standard 4 Process Skills			
Key Idea 3		34,35,37,41,47, 48,49,50,51,52, 53,54,58,59,60, 64	71,73,74,76,77,79
Key Idea 4		44,57	68,69,70
Key Idea 5		40,46,55	
Standard 4			
Key Idea 3	1,2,3,4,5,6,7,9, 10,13,14,15,16, 18,19,20,21,22, 23,24,25,26,27, 28,31,33	34,35,36,37,38, 39,41,42,43,45, 47,48,49,50,51, 52,53,54,58,59, 60,61,62,63	65,71,72,73,74, 75,76,77,78,79, 80,82,83
Key Idea 4	17,29,31,32	44,57,64	66,67,68,69,70
Key Idea 5	8,11,12,23,30	34,40,46,55,56	81
Reference Tables			
2002 Edition	2,3,4,5,7,9,10, 11,12,14,21,22, 23,24,25,27,29, 30,31	34,35,36,38,39, 40,41,42,44,47, 48,50,51,53,55, 56,60,61,63,64	65,70,72,76,79, 82,83