

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

PHYSICAL SETTING CHEMISTRY

Tuesday, August 17, 2004 — 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.

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

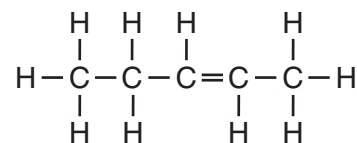
Part A

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*.

- 1 Which of these phrases best describes an atom?
- (1) a positive nucleus surrounded by a hard negative shell
 - (2) a positive nucleus surrounded by a cloud of negative charges
 - (3) a hard sphere with positive particles uniformly embedded
 - (4) a hard sphere with negative particles uniformly embedded
- 2 Which statement is true about a proton and an electron?
- (1) They have the same masses and the same charges.
 - (2) They have the same masses and different charges.
 - (3) They have different masses and the same charges.
 - (4) They have different masses and different charges.
- 3 The atomic mass of an element is the weighted average of the masses of
- (1) its two most abundant isotopes
 - (2) its two least abundant isotopes
 - (3) all of its naturally occurring isotopes
 - (4) all of its radioactive isotopes
- 4 What determines the order of placement of the elements on the modern Periodic Table?
- (1) atomic number
 - (2) atomic mass
 - (3) the number of neutrons, only
 - (4) the number of neutrons and protons
- 5 Which compound contains only covalent bonds?
- (1) NaOH
 - (2) Ba(OH)₂
 - (3) Ca(OH)₂
 - (4) CH₃OH
- 6 At 298 K, oxygen (O₂) and ozone (O₃) have different properties because their
- (1) atoms have different atomic numbers
 - (2) atoms have different atomic masses
 - (3) molecules have different molecular structures
 - (4) molecules have different average kinetic energies
- 7 Which substance represents a compound?
- (1) C(s)
 - (2) Co(s)
 - (3) CO(g)
 - (4) O₂(g)
- 8 All chemical reactions have a conservation of
- (1) mass, only
 - (2) mass and charge, only
 - (3) charge and energy, only
 - (4) mass, charge, and energy
- 9 Which characteristic is a property of molecular substances?
- (1) good heat conductivity
 - (2) good electrical conductivity
 - (3) low melting point
 - (4) high melting point
- 10 Given the Lewis electron-dot diagram:
- $$\begin{array}{c} \text{H} \\ \vdots \\ \text{H} : \text{C} : \text{H} \\ \vdots \\ \text{H} \end{array}$$
- Which electrons are represented by all of the dots?
- (1) the carbon valence electrons, only
 - (2) the hydrogen valence electrons, only
 - (3) the carbon and hydrogen valence electrons
 - (4) all of the carbon and hydrogen electrons

- 11 Which grouping of the three phases of bromine is listed in order from left to right for increasing distance between bromine molecules?
 (1) gas, liquid, solid (3) solid, gas, liquid
 (2) liquid, solid, gas (4) solid, liquid, gas
- 12 Which statement concerning elements is true?
 (1) Different elements must have different numbers of isotopes.
 (2) Different elements must have different numbers of neutrons.
 (3) All atoms of a given element must have the same mass number.
 (4) All atoms of a given element must have the same atomic number.
- 13 At room temperature, the solubility of which solute in water would be most affected by a change in pressure?
 (1) methanol (3) carbon dioxide
 (2) sugar (4) sodium nitrate
- 14 Based on Reference Table I, which change occurs when pellets of solid NaOH are added to water and stirred?
 (1) The water temperature increases as chemical energy is converted to heat energy.
 (2) The water temperature increases as heat energy is stored as chemical energy.
 (3) The water temperature decreases as chemical energy is converted to heat energy.
 (4) The water temperature decreases as heat energy is stored as chemical energy.
- 15 The concept of an ideal gas is used to explain
 (1) the mass of a gas sample
 (2) the behavior of a gas sample
 (3) why some gases are monatomic
 (4) why some gases are diatomic
- 16 Molecules in a sample of $\text{NH}_3(\ell)$ are held closely together by intermolecular forces
 (1) existing between ions
 (2) existing between electrons
 (3) caused by different numbers of neutrons
 (4) caused by unequal charge distribution
- 17 Which process represents a chemical change?
 (1) melting of ice
 (2) corrosion of copper
 (3) evaporation of water
 (4) crystallization of sugar
- 18 At STP, which 4.0-gram zinc sample will react fastest with dilute hydrochloric acid?
 (1) lump (3) powdered
 (2) bar (4) sheet metal
- 19 Which information about a chemical reaction is provided by a potential energy diagram?
 (1) the oxidation states of the reactants and products
 (2) the average kinetic energy of the reactants and products
 (3) the change in solubility of the reacting substances
 (4) the energy released or absorbed during the reaction
- 20 A catalyst works by
 (1) increasing the potential energy of the reactants
 (2) increasing the energy released during a reaction
 (3) decreasing the potential energy of the products
 (4) decreasing the activation energy required for a reaction
- 21 Even though the process is endothermic, snow can sublime. Which tendency in nature accounts for this phase change?
 (1) a tendency toward greater entropy
 (2) a tendency toward greater energy
 (3) a tendency toward less entropy
 (4) a tendency toward less energy
- 22 What is the IUPAC name of the compound with the structural formula shown below?



- (1) 2-pentene (3) 2-pentyne
 (2) 3-pentene (4) 3-pentyne

- 23 Molecules of 1-bromopropane and 2-bromopropane differ in
- (1) molecular formula
 - (2) structural formula
 - (3) number of carbon atoms per molecule
 - (4) number of bromine atoms per molecule
- 24 Which half-reaction correctly represents reduction?
- (1) $\text{Ag} \rightarrow \text{Ag}^+ + \text{e}^-$
 - (2) $\text{F}_2 \rightarrow 2 \text{F}^- + 2\text{e}^-$
 - (3) $\text{Au}^{3+} + 3\text{e}^- \rightarrow \text{Au}$
 - (4) $\text{Fe}^{2+} + \text{e}^- \rightarrow \text{Fe}^{3+}$
- 25 In a redox reaction, how does the total number of electrons lost by the oxidized substance compare to the total number of electrons gained by the reduced substance?
- (1) The number lost is always greater than the number gained.
 - (2) The number lost is always equal to the number gained.
 - (3) The number lost is sometimes equal to the number gained.
 - (4) The number lost is sometimes less than the number gained.
- 26 Which reaction is an example of an oxidation-reduction reaction?
- (1) $\text{AgNO}_3 + \text{KI} \rightarrow \text{AgI} + \text{KNO}_3$
 - (2) $\text{Cu} + 2 \text{AgNO}_3 \rightarrow \text{Cu}(\text{NO}_3)_2 + 2 \text{Ag}$
 - (3) $2 \text{KOH} + \text{H}_2\text{SO}_4 \rightarrow \text{K}_2\text{SO}_4 + 2 \text{H}_2\text{O}$
 - (4) $\text{Ba}(\text{OH})_2 + 2 \text{HCl} \rightarrow \text{BaCl}_2 + 2 \text{H}_2\text{O}$
- 27 Which compound is an Arrhenius base?
- (1) CH_3OH
 - (2) CO_2
 - (3) LiOH
 - (4) NO_2
- 28 The only positive ion found in an aqueous solution of sulfuric acid is the
- (1) hydroxide ion
 - (2) hydronium ion
 - (3) sulfite ion
 - (4) sulfate ion
- 29 Which process uses a volume of solution of known concentration to determine the concentration of another solution?
- (1) distillation
 - (2) substitution
 - (3) transmutation
 - (4) titration
- 30 Which pH change represents a hundredfold increase in the concentration of H_3O^+ ?
- (1) pH 5 to pH 7
 - (2) pH 13 to pH 14
 - (3) pH 3 to pH 1
 - (4) pH 4 to pH 3
- 31 Which radioisotope undergoes beta decay and has a half-life of less than 1 minute?
- (1) Fr-220
 - (2) K-42
 - (3) N-16
 - (4) P-32
- 32 Which set of symbols represents atoms with valence electrons in the same electron shell?
- (1) Ba, Br, Bi
 - (2) Sr, Sn, I
 - (3) O, S, Te
 - (4) Mn, Hg, Cu
- Note that question 33 has only three choices.**
- 33 When compared with the energy of an electron in the first shell of a carbon atom, the energy of an electron in the second shell of a carbon atom is
- (1) less
 - (2) greater
 - (3) 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 What is the total number of electrons found in an atom of sulfur?

- (1) 6 (3) 16
(2) 8 (4) 32

35 Which electron configuration represents the electrons of an atom in an excited state?

- (1) 2–8–1 (3) 2–8–17–6
(2) 2–8–6 (4) 2–8–18–5

36 The nucleus of an atom of cobalt-58 contains

- (1) 27 protons and 31 neutrons
(2) 27 protons and 32 neutrons
(3) 59 protons and 60 neutrons
(4) 60 protons and 60 neutrons

37 Which pair of formulas correctly represents a molecular formula and its corresponding empirical formula?

- (1) C₂H₂ and CH (3) C₄H₆ and CH
(2) C₃H₄ and CH₂ (4) C₅H₈ and C₂H₂

38 Which substance is correctly paired with its type of bonding?

- (1) NaBr—nonpolar covalent
(2) HCl—nonpolar covalent
(3) NH₃—polar covalent
(4) Br₂—polar covalent

39 A gas occupies a volume of 444 mL at 273 K and 79.0 kPa. What is the final kelvin temperature when the volume of the gas is changed to 1880 mL and the pressure is changed to 38.7 kPa?

- (1) 31.5 K (3) 566 K
(2) 292 K (4) 2360 K

40 At STP, which of these substances is most soluble in H₂O?

- (1) CCl₄ (3) HCl
(2) CO₂ (4) N₂

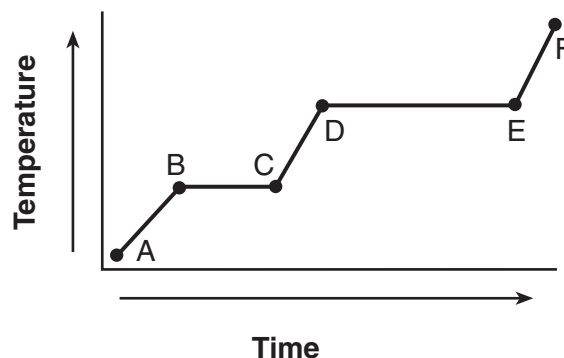
41 Based on intermolecular forces, which of these substances would have the highest boiling point?

- (1) He (3) CH₄
(2) O₂ (4) NH₃

42 How much heat energy must be absorbed to completely melt 35.0 grams of H₂O(s) at 0°C?

- (1) 9.54 J (3) 11 700 J
(2) 146 J (4) 79 100 J

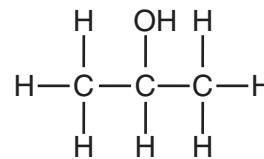
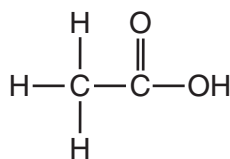
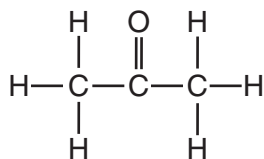
43 The graph below represents the uniform heating of a substance, starting below its melting point, when the substance is solid.



Which line segments represent an increase in average kinetic energy?

- (1) \overline{AB} and \overline{BC} (3) \overline{BC} and \overline{DE}
(2) \overline{AB} and \overline{CD} (4) \overline{DE} and \overline{EF}

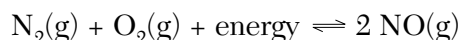
44 Given the three organic structural formulas shown below:



Which organic-compound classes are represented by these structural formulas, as shown from left to right?

- (1) ester, organic acid, ketone
(2) ester, aldehyde, organic acid
(3) ketone, aldehyde, alcohol
(4) ketone, organic acid, alcohol

45 Given the reaction at equilibrium:



Which change will result in a *decrease* in the amount of NO(g) formed?

- (1) decreasing the pressure
(2) decreasing the concentration of $\text{N}_2(\text{g})$
(3) increasing the concentration of $\text{O}_2(\text{g})$
(4) increasing the temperature

46 Given the equation:



Which molecule is represented by X?

- (1) C_2H_4 (3) C_3H_6
(2) C_2H_6 (4) C_3H_8

47 Which metal reacts spontaneously with a solution containing zinc ions?

- (1) magnesium (3) copper
(2) nickel (4) silver

48 Which statement correctly describes a solution with a pH of 9?

- (1) It has a higher concentration of H_3O^+ than OH^- and causes litmus to turn blue.
(2) It has a higher concentration of OH^- than H_3O^+ and causes litmus to turn blue.
(3) It has a higher concentration of H_3O^+ than OH^- and causes methyl orange to turn yellow.
(4) It has a higher concentration of OH^- than H_3O^+ and causes methyl orange to turn red.

49 How many days are required for 200. grams of radon-222 to decay to 50.0 grams?

- (1) 1.91 days (3) 7.64 days
(2) 3.82 days (4) 11.5 days

50 A student calculates the density of an unknown solid. The mass is 10.04 grams, and the volume is 8.21 cubic centimeters. How many significant figures should appear in the final answer?

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

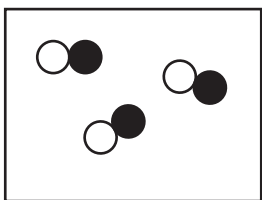
Part B-2

Answer all questions in this part.

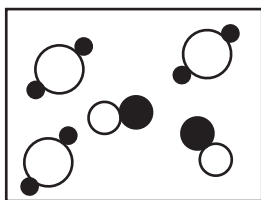
Directions (51–65): Record your answers in the spaces provided in your answer booklet. Some questions may require the use of the *Reference Tables for Physical Setting/Chemistry*.

- 51 In the 19th century, Dmitri Mendeleev predicted the existence of a then unknown element X with a mass of 68. He also predicted that an oxide of X would have the formula X_2O_3 . On the modern Periodic Table, what is the group number and period number of element X ? [1]
- 52 Given the equation: $2 H_2(g) + O_2(g) \rightarrow 2 H_2O(g)$
If 8.0 moles of O_2 are completely consumed, what is the total number of moles of H_2O produced? [1]
- 53 In the space provided *in your answer booklet*, show a correct numerical setup for determining how many liters of a 1.2 M solution can be prepared with 0.50 mole of $C_6H_{12}O_6$. [1]

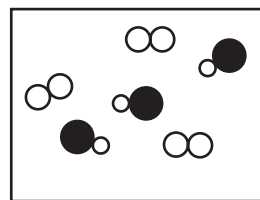
Base your answers to questions 54 through 57 on the particle diagrams below. Samples A, B, and C contain molecules at STP.



A



B



C

- 54 Explain why the average kinetic energy of sample B is equal to the average kinetic energy of sample C. [1]
- 55 Explain, in terms of the *composition*, why sample A represents a pure substance. [1]
- 56 Explain why sample C could represent a mixture of fluorine and hydrogen chloride. [1]
- 57 Contrast sample A and sample B, in terms of *compounds and mixtures*. Include both sample A and sample B in your answer. [1]
-

Base your answers to questions 58 through 60 on the electronegativity values and atomic numbers of fluorine, chlorine, bromine, and iodine that are listed on Reference Table S.

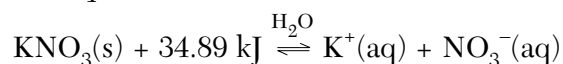
- 58 On the grid provided *in your answer booklet*, mark an appropriate scale on the axis labeled “Electronegativity.” An appropriate scale is one that allows a trend to be seen. [1]
- 59 On the same grid, plot the electronegativity and atomic number data from Reference Table S. Circle and connect the points. [1]

Example: 

- 60 Explain, in terms of *electronegativity*, why the H–F bond is expected to be more polar than the H–I bond. [1]
-
- 61 What is the gram-formula mass of $(\text{NH}_4)_2\text{CO}_3$? Use atomic masses rounded to the nearest whole number. [1]
- 62 In the space provided *in your answer booklet*, show a correct numerical setup for calculating the number of moles of CO_2 (gram-formula mass = 44 g/mol) present in 11 grams of CO_2 . [1]

Base your answers to questions 63 and 64 on the information below.

Given the equilibrium equation at 298 K:



- 63 Describe, in terms of *LeChatelier’s principle*, why an increase in temperature increases the solubility of KNO_3 . [1]
- 64 The equation indicates that KNO_3 has formed a saturated solution. Explain, in terms of *equilibrium*, why the solution is saturated. [1]
-
- 65 In the space provided *in your answer booklet*, draw the structural formula for butanoic acid. [1]
-

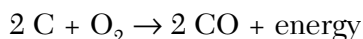
Part C

Answer all questions in this part.

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

Base your answers to questions 66 through 69 on the information below, which describes the smelting of iron ore, and on your knowledge of chemistry.

In the smelting of iron ore, Fe_2O_3 is reduced in a blast furnace at high temperature by a reaction with carbon monoxide. Crushed limestone, CaCO_3 , is also added to the mixture to remove impurities in the ore. The carbon monoxide is formed by the oxidation of carbon (coke), as shown in the reaction below:



Liquid iron flows from the bottom of the blast furnace and is processed into different alloys of iron.

- 66 Balance the equation for the reaction of Fe_2O_3 and CO in *your answer booklet*, using the smallest whole-number coefficients. [1]
- 67 Using the set of axes provided in *your answer booklet*, sketch a potential energy diagram for the reaction of carbon and oxygen that produces carbon monoxide. [1]
- 68 What is the oxidation number of carbon in CaCO_3 ? [1]
- 69 Convert the melting point of iron metal to degrees Celsius. [1]
-

Base your answers to questions 70 through 72 on the information below.

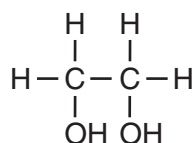
Potassium ions are essential to human health. The movement of dissolved potassium ions, $\text{K}^+(\text{aq})$, in and out of a nerve cell allows that cell to transmit an electrical impulse.

- 70 What is the total number of electrons in a potassium ion? [1]
- 71 Explain, in terms of *atomic structure*, why a potassium ion is smaller than a potassium atom. [1]
- 72 What property of potassium ions allows them to transmit an electrical impulse? [1]
-

Base your answers to questions 73 through 75 on the information below.

Ethene (common name ethylene) is a commercially important organic compound. Millions of tons of ethene are produced by the chemical industry each year. Ethene is used in the manufacture of synthetic fibers for carpeting and clothing, and it is widely used in making polyethylene. Low-density polyethylene can be stretched into a clear, thin film that is used for wrapping food products and consumer goods. High-density polyethylene is molded into bottles for milk and other liquids.

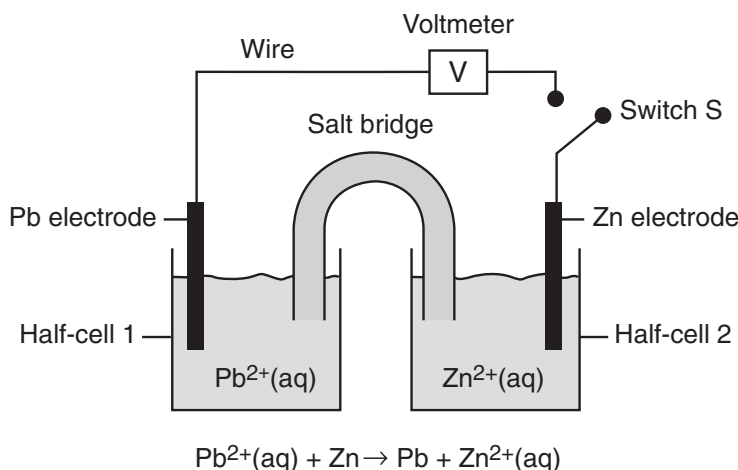
Ethene can also be oxidized to produce ethylene glycol, which is used in antifreeze for automobiles. The structural formula for ethylene glycol is:



At standard atmospheric pressure, the boiling point of ethylene glycol is 198°C, compared to ethene that boils at -104°C.

- 73 Identify the type of organic reaction by which ethene (ethylene) is made into polyethylene. [1]
- 74 According to the information in the reading passage, state *two* consumer products manufactured from ethene. [1]
- 75 Explain, in terms of *bonding*, why ethene is an unsaturated hydrocarbon. [1]
-

Base your answers to questions 76 through 78 on the diagram below, which represents a voltaic cell at 298 K and 1 atm.



- 76 In which half-cell will oxidation occur when switch S is closed? [1]
- 77 Write the balanced half-reaction equation that will occur in half-cell 1 when switch S is closed. [1]
- 78 Describe the direction of electron flow between the electrodes when switch S is closed. [1]
-

Base your answers to questions 79 through 81 on the information and data table below.

Indigestion may be caused by excess stomach acid (hydrochloric acid). Some products used to treat indigestion contain magnesium hydroxide. The magnesium hydroxide neutralizes some of the stomach acid.

The amount of acid that can be neutralized by three different brands of antacids is shown in the data table below.

Antacid Brand	Mass of Antacid Tablet (g)	Volume of HCl(aq) Neutralized (mL)
X	2.00	25.20
Y	1.20	18.65
Z	1.75	22.50

79 Based on Reference Table *F*, describe the solubility of magnesium hydroxide in water. [1]

80 In the space provided *in your answer booklet*, show a correct numerical setup for calculating the milliliters of HCl(aq) neutralized per gram of antacid tablet for *each* brand of antacid. [1]

81 Which antacid brand neutralizes the most acid per gram of antacid tablet? [1]

Base your answers to questions 82 through 85 on the reading passage below and on your knowledge of chemistry.

A Glow in the Dark, and Scientific Peril

The [Marie and Pierre] Curies set out to study radioactivity in 1898. Their first accomplishment was to show that radioactivity was a property of atoms themselves. Scientifically, that was the most important of their findings, because it helped other researchers refine their understanding of atomic structure.

More famous was their discovery of polonium and radium. Radium was the most radioactive substance the Curies had encountered. Its radioactivity is due to the large size of the atom, which makes the nucleus unstable and prone to decay, usually to radon and then lead, by emitting particles and energy as it seeks a more stable configuration.

Marie Curie struggled to purify radium for medical uses, including early radiation treatment for tumors. But radium's bluish glow caught people's fancy, and companies in the United States began mining it and selling it as a novelty: for glow-in-the-dark light pulls, for instance, and bogus cure-all patent medicines that actually killed people.

What makes radium so dangerous is that it forms chemical bonds in the same way as calcium, and the body can mistake it for calcium and absorb it into the bones. Then, it can bombard cells with radiation at close range, which may cause bone tumors or bone-marrow damage that can give rise to anemia or leukemia.

— Denise Grady, *The New York Times*, October 6, 1998

- 82 State one risk associated with the use of radium. [1]
- 83 Using Reference Table N, complete the equation provided *in your answer booklet* for the nuclear decay of $^{226}_{88}\text{Ra}$. Include *both* atomic number and mass number for *each* particle. [1]
- 84 Using information from the Periodic Table, explain why radium forms chemical bonds in the same way as calcium does. [1]
- 85 If a scientist purifies 1.0 gram of radium-226, how many years must pass before only 0.50 gram of the original radium-226 sample remains unchanged? [1]
-

Tear Here

The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

PHYSICAL SETTING CHEMISTRY

Tuesday, August 17, 2004 — 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 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

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PHYSICAL SETTING CHEMISTRY

Tuesday, August 17, 2004 — 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	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 Group _____ and Period _____		51 <input type="text"/>
52 _____ mol		52 <input type="text"/>
53		53 <input type="text"/>

**For Raters
Only**

54

54

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56

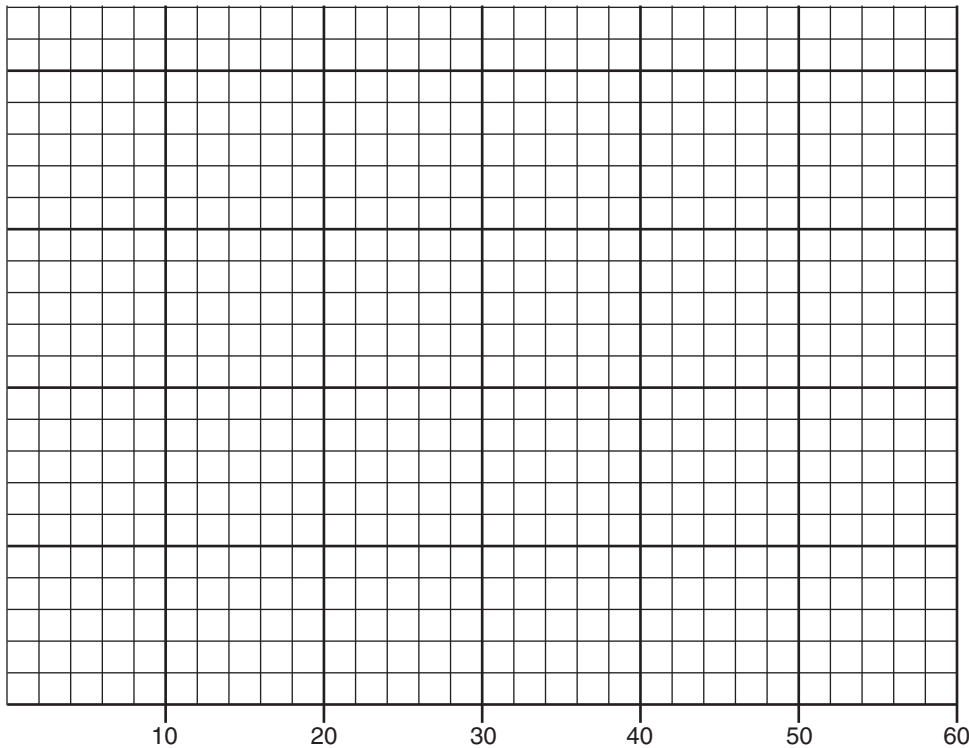
57

57

For Raters
Only

58 and 59

Electronegativity



58

59

60 _____

60

61 _____ g/mol

61

62

62

**For Raters
Only**

63

63

64

64

65

65

**Total Score
for Part B-2**

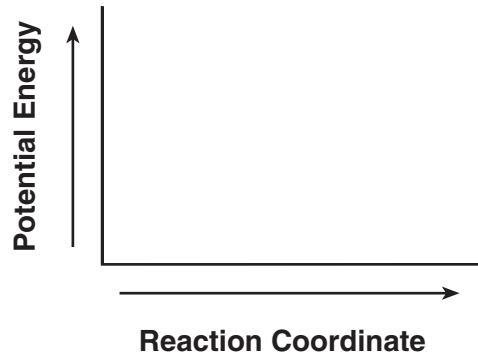
Part C

For Raters Only



66

67



67

68 _____

68

69 _____ $^{\circ}\text{C}$

69

70 _____ electrons

70

71 _____

71

72 _____

72

73 _____

73

74 _____ and _____

74

75 _____

75

FOR TEACHERS ONLY

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

PS-CH

PHYSICAL SETTING/CHEMISTRY

Tuesday, August 17, 2004 — 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. 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 2	12 4	23 2	34 3	43 2
2 4	13 3	24 3	35 3	44 4
3 3	14 1	25 2	36 1	45 2
4 1	15 2	26 2	37 1	46 2
5 4	16 4	27 3	38 3	47 1
6 3	17 2	28 2	39 3	48 2
7 3	18 3	29 4	40 3	49 3
8 4	19 4	30 3	41 4	50 3
9 3	20 4	31 3	42 3	
10 3	21 1	32 2		
11 4	22 1	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 check mark each incorrect or omitted answer. In the box provided at the end of each part, record the number of questions the student answered correctly for that part.

At least two science teachers must participate in the scoring of each student's responses to the Part B–2 and Part C open-ended questions. Each of these teachers should be responsible for scoring a selected number of the open-ended questions on each answer paper. No one teacher is to score 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 Tuesday, August 17, 2004. 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 15 credits for this part. The student must answer all questions in this part.

51 [1] Allow 1 credit for Group **13** and Period **4**.

52 [1] Allow 1 credit for **16** or **16.0**.

53 [1] Allow 1 credit for a correct numerical setup. Units do *not* need to be shown. Acceptable responses include, but are not limited to, these examples:

$$1.2 \text{ M} = \frac{0.50 \text{ mole}}{x}$$

$$1.2 = \frac{0.50}{x}$$

$$0.50 \text{ mol} \times \frac{1 \text{ L}}{1.2 \text{ mol}}$$

$$\frac{1.2 \text{ mole}}{1 \text{ L}} = \frac{.5 \text{ mole}}{x}$$

54 [1] Allow 1 credit for a correct response. Acceptable responses include, but are not limited to, these examples:

Both samples are at the same temperature.

Samples *B* and *C* are both at 273 K (or at 0°C).

both at STP

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

Sample *A* has only one type of molecule.

All particles are the same.

not a mixture

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

Sample *C* represents a diatomic element and a compound.

shows an element and a compound mixed



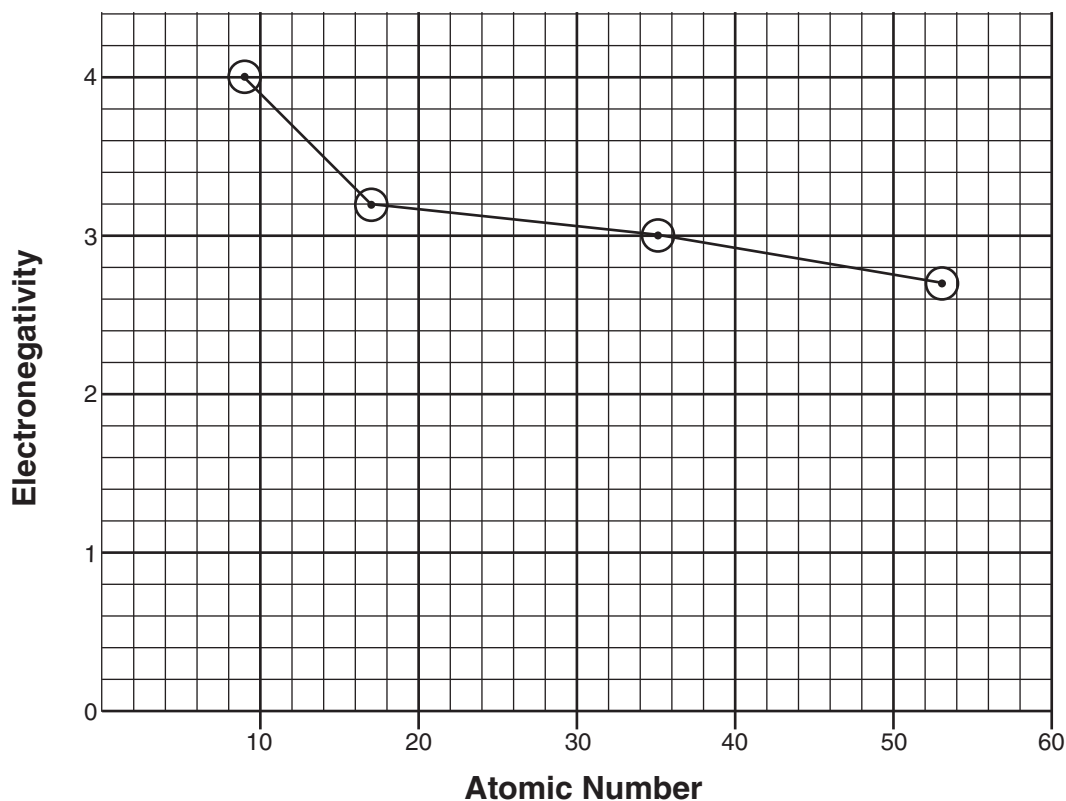
- 57** [1] Allow 1 credit for a correct response. Acceptable responses include, but are not limited to, these examples:

Particles in sample *A* show molecules of a compound whereas particles in sample *B* show two compounds as a mixture.

A – compound, *B* – mixture

A – 1 compound, *B* – 2 compounds

- 58** and **59** An example of a correct response is shown below.



- 58** [1] Allow 1 credit for marking an appropriate scale. An appropriate scale is one that allows a trend to be seen.

- 59** [1] Allow 1 credit for plotting all the points correctly (± 0.3 grid space). Plotted points do *not* need to be circled or connected.

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

The difference in electronegativity for the H–F bond is 1.9 and the electronegativity difference for the H–I bond is 0.6. The difference for H–F is greater and therefore H–F is more polar.

H–F is more polar because F is more electronegative than I.

- 61** [1] Allow 1 credit for **96**.

- 62** [1] Allow 1 credit for a correct numerical setup. Units do *not* need to be shown. Acceptable responses include, but are not limited to, these examples:

$$11 \text{ g} \times \frac{1 \text{ mole}}{44 \text{ g}}$$

$$\frac{11}{44}$$

- 63** [1] Allow 1 credit for a correct response. Do *not* allow credit for answers only citing Reference Table G. Acceptable responses include, but are not limited to, these examples:

Increasing the temperature favors the forward, endothermic reaction.

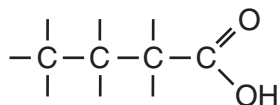
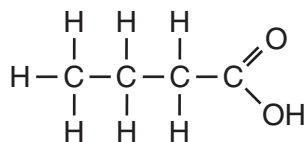
Adding heat shifts the reaction to the right.

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

The rate of dissolving KNO_3 is equal to the rate of recrystallizing KNO_3 .

The KNO_3 is going into the solution at the same rate it precipitates out of the solution.

- 65** [1] Allow 1 credit for a correct response. Acceptable responses include, but are not limited to, these examples:

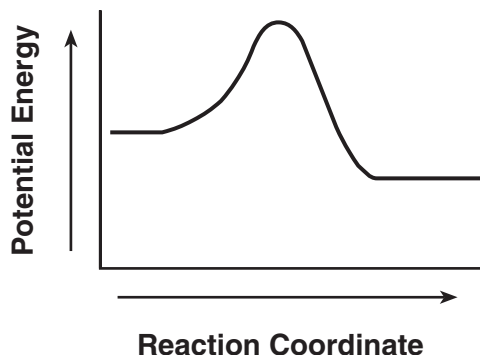


Part C

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

66 [1] Allow 1 credit for $\underline{\quad}$ Fe_2O_3 + $\underline{3}$ $\text{CO} \rightarrow \underline{2}$ $\text{Fe} + \underline{3}$ CO_2 . Allow credit even if the coefficient “1” is written in front of Fe_2O_3 .

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



68 [1] Allow 1 credit for **+4** or **4**.

69 [1] Allow 1 credit for **1535**.

70 [1] Allow 1 credit for **18**.

71 [1] Allow 1 credit for a correct response. Acceptable responses include, but are not limited to, these examples:

potassium atom 2-8-8-1 and potassium ion 2-8-8

The K^+ ion has only three electron shells.

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

charge

mobility

size

- 73** [1] Allow 1 credit for a correct response. Acceptable responses include, but are not limited to, these examples:
- polymerization
 - addition polymerization
 - synthesis
 - addition
- 74** [1] Allow 1 credit for *two* correct responses. The responses must be two *different* consumer products. Acceptable responses include, but are not limited to, these examples:
- synthetic fibers
 - clothing
 - carpeting
 - antifreeze (ethylene glycol)
 - food wrap
 - plastic bottles
 - high-density polyethylene
 - low-density polyethylene
- 75** [1] Allow 1 credit for a correct response. Acceptable responses include, but are not limited to, these examples:
- has a carbon-carbon double bond
 - Two carbons share four electrons.
 - $C = C$
- 76** [1] Allow 1 credit for a correct response. Acceptable responses include, but are not limited to, these examples:
- 2
 - Zn
 - anode
 - right

- 77 [1] Allow 1 credit for a correct response. Acceptable responses include, but are not limited to, this example:



or

Allow 1 credit for a response consistent with the student's answer to question 76.

- 78 [1] Allow 1 credit for a correct response indicating direction. Acceptable responses include, but are not limited to, these examples:

from anode to cathode

Zn electrode to Pb electrode

to the left

from half-cell 2 to half-cell 1

– to +

or

Allow 1 credit for a response consistent with the student's answer to question 76.

- 79 [1] Allow 1 credit for a correct response. Acceptable responses include, but are not limited to, these examples:

insoluble

not soluble

- 80 [1] Allow 1 credit for a correct numerical setup. Correct numerical substitutions must be shown for all three brands. Units do *not* need to be shown. Acceptable responses include, but are not limited to, these examples:

$$X: \frac{25.20 \text{ mL}}{2.00 \text{ g}}$$

$$Y: \frac{18.65 \text{ mL}}{1.20 \text{ g}}$$

$$Z: \frac{22.50 \text{ mL}}{1.75 \text{ g}}$$

- 81 [1] Allow 1 credit for **Y**.

or

Allow 1 credit for a response consistent with the student's setup for brands X, Y, and Z in question 80.

- 82** [1] Allow 1 credit for a correct response. Acceptable responses include, but are not limited to, these examples:

cause bone tumors

damage bone marrow

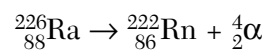
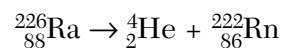
can cause leukemia or anemia

radioactive

DNA damage

death

- 83** [1] Allow 1 credit for a correct response. Acceptable responses include, but are not limited to, these examples:



- 84** [1] Allow 1 credit for a correct response. Acceptable responses include, but are not limited to, these examples:

Radium and calcium are both located in Group 2 on the Periodic Table.

same family

2 valence electrons

- 85** [1] Allow 1 credit for **1600**.

The *Chart for Determining the Final Examination Score for the August 2004 Regents Examination in Physical Setting/Chemistry* will be posted on the Department's web site <http://www.emsc.nysed.gov/osa/> on Tuesday, August 17, 2004. 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

August 2004 Physical Setting/Chemistry			
Question Numbers			
Key Ideas	Part A	Part B	Part C
Standard 1			
Math Key Idea 1		42,50,58,59,60	69,80
Math Key Idea 2			
Math Key Idea 3			80,81
Sci. Inq. Key Idea 1		54	71,75,84
Sci. Inq. Key Idea 2			
Sci. Inq. Key Idea 3			68,85
Eng. Des. Key Idea 1			
Standard 2			
Key Idea 1			79
Key Idea 2			
Standard 6			
Key Idea 1			
Key Idea 2			
Key Idea 3			
Key Idea 4			
Key Idea 5			
Standard 7			
Key Idea 1			74,80,81,82
Key Idea 2			
Standard 4 Process Skills			
Key Idea 3		34,35,36,37,39, 40,44,45,46,47, 48,51,52,53,55, 56,57,61,62,63, 64,65	66,70,73,76, 77,78,83
Key Idea 4		43,49	67,85
Key Idea 5		38,41	72
Standard 4			
Key Idea 3	1,2,3,4,7,8,9,11, 12,13,15,17,18, 20,21,22,23,24, 25,26,27,28,29, 30,32,33	34,35,36,37,39, 40,44,45,46,47, 48,50,51,52,53, 55,56,57,58,59, 61,62,63,64,65	66,68,72,73, 74,75,76,77, 78,79,80,81, 84
Key Idea 4	14,19,31	42,43,49,54	67,69,82,83,85
Key Idea 5	5,6,9,10,16	38,40,41,60	70,71,72
Reference Tables			
2002 Edition	2,4,7,10,14, 27,31,32	34,35,36,38,39, 40,41,42,44,47, 48,49,50,51,53, 58,59,60,61,62	68,69,70,75, 79,83,84,85

Regents Examination in Physical Setting / Chemistry August 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	76	41	60	19	40
84	99	62	75	40	60	18	39
83	97	61	74	39	59	17	37
82	96	60	74	38	58	16	36
81	95	59	73	37	58	15	34
80	93	58	72	36	57	14	33
79	92	57	71	35	56	13	31
78	91	56	71	34	55	12	29
77	90	55	70	33	54	11	28
76	89	54	69	32	54	10	26
75	88	53	69	31	53	9	24
74	86	52	68	30	52	8	22
73	85	51	67	29	51	7	19
72	84	50	67	28	50	6	17
71	83	49	66	27	49	5	15
70	82	48	65	26	48	4	12
69	81	47	64	25	47	3	9
68	80	46	64	24	46	2	6
67	79	45	63	23	45	1	3
66	79	44	62	22	44	0	0
65	78	43	62	21	43		
64	77	42	61	20	41		

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 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. The chart above is usable only for this administration of the physical setting / chemistry examination.