The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

PHYSICAL SETTING
CHEMISTRY

Thursday, August 16, 2007 — 12:30 to 3:30 p.m., only

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

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

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

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

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

Notice. . .

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

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

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

Part A

Answer all questions in this part.

Directions (1–30): For *each* statement or question, write on the separate answer sheet the *number* of the word or expression that, of those given, best completes the statement or answers the question. Some questions may require the use of the *Reference Tables for Physical Setting/Chemistry*.

1 What was concluded about the structure of the atom as the result of the gold foil experiment?

(1) A positively charged nucleus is surrounded by positively charged particles.
(2) A positively charged nucleus is surrounded by mostly empty space.
(3) A negatively charged nucleus is surrounded by positively charged particles.
(4) A negatively charged nucleus is surrounded by mostly empty space.

2 An atom is electrically neutral because the

(1) number of protons equals the number of electrons
(2) number of protons equals the number of neutrons
(3) ratio of the number of neutrons to the number of electrons is 1:1
(4) ratio of the number of neutrons to the number of protons is 2:1

3 How do the energy and the most probable location of an electron in the third shell of an atom compare to the energy and the most probable location of an electron in the first shell of the same atom?

(1) In the third shell, an electron has more energy and is closer to the nucleus.
(2) In the third shell, an electron has more energy and is farther from the nucleus.
(3) In the third shell, an electron has less energy and is closer to the nucleus.
(4) In the third shell, an electron has less energy and is farther from the nucleus.

4 Which element is a solid at STP and a good conductor of electricity?

(1) iodine (3) nickel
(2) mercury (4) sulfur

5 Which element has both metallic and nonmetallic properties?

(1) Rb (3) Si
(2) Rn (4) Sr

6 The carbon atoms in graphite and the carbon atoms in diamond have different

(1) atomic numbers
(2) atomic masses
(3) electronegativities
(4) structural arrangements

7 Atoms of which element have the greatest tendency to gain electrons?

(1) bromine (3) fluorine
(2) chlorine (4) iodine

8 Which statement describes a chemical property of the element magnesium?

(1) Magnesium is malleable.
(2) Magnesium conducts electricity.
(3) Magnesium reacts with an acid.
(4) Magnesium has a high boiling point.

9 Matter that is composed of two or more different elements chemically combined in a fixed proportion is classified as

(1) a compound (3) a mixture
(2) an isotope (4) a solution

10 Given the balanced equation representing a reaction:

$$2CO(g) + O_2(g) \rightarrow 2CO_2(g)$$

What is the mole ratio of $CO(g)$ to $CO_2(g)$ in this reaction?

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

11 Given the balanced equation representing a reaction:

$$H^+(aq) + OH^-(aq) \rightarrow H_2O(\ell) + 55.8\ kJ$$

In this reaction there is conservation of

(1) mass, only
(2) mass and charge, only
(3) mass and energy, only
(4) mass, charge, and energy

12 Which polyatomic ion contains the greatest number of oxygen atoms?

(1) acetate
(2) carbonate
(3) hydroxide
(4) peroxide

13 Which formula represents an ionic compound?

(1) H_2
(2) CH_4
(3) CH_3OH
(4) NH_4Cl

14 An ion of which element has a larger radius than an atom of the same element?

(1) aluminum
(2) chlorine
(3) magnesium
(4) sodium

15 Which statement must be true when solution equilibrium occurs?

(1) The solution is at STP.
(2) The solution is supersaturated.
(3) The concentration of the solution remains constant.
(4) The masses of the dissolved solute and the undissolved solute are equal.

16 Which liquid has the highest vapor pressure at 75°C?

(1) ethanoic acid
(2) ethanol
(3) propanone
(4) water

17 What is the total number of different elements present in NH_4NO_3?

(1) 7
(2) 9
(3) 3
(4) 4

18 Which sample of matter is a single substance?

(1) air
(2) ammonia gas
(3) hydrochloric acid
(4) salt water

19 At STP, which sample contains the same number of molecules as 11.2 liters of $CO_2(g)$ at STP?

(1) 5.6 L of $NO_2(g)$
(2) 7.5 L of $H_2(g)$
(3) 11.2 L of $N_2(g)$
(4) 22.4 L of $CO(g)$

20 A sample of gas is held at constant pressure. Increasing the kelvin temperature of this gas sample causes the average kinetic energy of its molecules to

(1) decrease and the volume of the gas sample to decrease
(2) decrease and the volume of the gas sample to increase
(3) increase and the volume of the gas sample to decrease
(4) increase and the volume of the gas sample to increase

21 Given the balanced equation representing a reaction:

$$Cl_2(g) \rightarrow Cl(g) + Cl(g)$$

What occurs during this change?

(1) Energy is absorbed and a bond is broken.
(2) Energy is absorbed and a bond is formed.
(3) Energy is released and a bond is broken.
(4) Energy is released and a bond is formed.

22 A molecule of butane and a molecule of 2-butene both have the same total number of

(1) carbon atoms
(2) hydrogen atoms
(3) single bonds
(4) double bonds

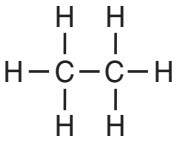
23 Which general formula represents the homologous series of hydrocarbons that includes the compound l-heptyne?

(1) C_nH_{2n-6}
(2) C_nH_{2n-2}
(3) C_nH_{2n}
(4) C_nH_{2n+2}

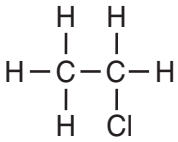
24 Which two compounds are isomers of each other?

(1) CH_3CH_2COOH and $CH_3COOCH_2CH_3$
(2) CH_3CH_2CHO and CH_3COCH_3
(3) $CH_3CHBrCH_3$ and $CH_2BrCHBrCH_3$
(4) $CH_3CHOHCH_3$ and $CH_3CHOHCH_2OH$

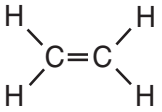
25 Which formula represents an unsaturated hydrocarbon?



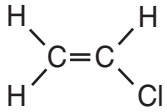
(1)



(3)



(2)



(4)

26 Which formula represents a hydronium ion?

(1) H_3O^+ (3) OH^-

(2) NH_4^+ (4) HCO_3^-

27 Which compound is an Arrhenius acid?

(1) H_2SO_4 (3) NaOH

(2) KCl (4) NH_3

28 What is the decay mode of ^{37}K?

(1) β^- (3) γ

(2) β^+ (4) α

29 Which nuclear emission has the greatest penetrating power?

(1) alpha particle (3) gamma radiation

(2) beta particle (4) positron

30 What is the mass number of an alpha particle?

(1) 1 (3) 0

(2) 2 (4) 4

Part B–1

Answer all questions in this part.

Directions (31–50): For *each* statement or question, write on the separate answer sheet the *number* of the word or expression that, of those given, best completes the statement or answers the question. Some questions may require the use of the *Reference Tables for Physical Setting/Chemistry*.

31 What is the net charge on an ion that has 9 protons, 11 neutrons, and 10 electrons?

(1) 1+ (3) 1–
(2) 2+ (4) 2–

32 Which two particles make up most of the mass of a hydrogen-2 atom?

(1) electron and neutron
(2) electron and proton
(3) proton and neutron
(4) proton and positron

33 Which statement explains why sulfur is classified as a Group 16 element?

(1) A sulfur atom has 6 valence electrons.
(2) A sulfur atom has 16 neutrons.
(3) Sulfur is a yellow solid at STP.
(4) Sulfur reacts with most metals.

34 How do the atomic radius and metallic properties of sodium compare to the atomic radius and metallic properties of phosphorus?

(1) Sodium has a larger atomic radius and is more metallic.
(2) Sodium has a larger atomic radius and is less metallic.
(3) Sodium has a smaller atomic radius and is more metallic.
(4) Sodium has a smaller atomic radius and is less metallic.

35 A compound has a molar mass of 90. grams per mole and the empirical formula CH_2O. What is the molecular formula of this compound?

(1) CH_2O (3) $C_3H_6O_3$
(2) $C_2H_4O_2$ (4) $C_4H_8O_4$

36 At standard pressure, a certain compound has a low boiling point and is insoluble in water. At STP, this compound most likely exists as

(1) ionic crystals
(2) metallic crystals
(3) nonpolar molecules
(4) polar molecules

37 The table below shows mass and volume data for four samples of substances at 298 K and 1 atmosphere.

Masses and Volumes of Four Samples

Sample	**Mass** (g)	**Volume** (mL)
A	30.	60.
B	40.	50.
C	45	90.
D	90.	120.

Which two samples could consist of the same substance?

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

38 Which group on the Periodic Table of the Elements contains elements that react with oxygen to form compounds with the general formula X_2O?

(1) Group 1 (3) Group 14
(2) Group 2 (4) Group 18

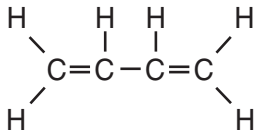
39 An unsaturated solution is formed when 80. grams of a salt is dissolved in 100. grams of water at 40.°C. This salt could be

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

40 Which kelvin temperature is equal to 56°C?

(1) –329 K
(2) –217 K
(3) 217 K
(4) 329 K

41 Given the formula of a substance:



What is the total number of shared electrons in a molecule of this substance?

(1) 22
(2) 11
(3) 9
(4) 6

42 Given the balanced equation representing the reaction occurring in a voltaic cell:

$$Zn(s) + Pb^{2+}(aq) \rightarrow Zn^{2+}(aq) + Pb(s)$$

In the completed external circuit, the electrons flow from

(1) Pb(s) to Zn(s)
(2) $Pb^{2+}(aq)$ to $Zn^{2+}(aq)$
(3) Zn(s) to Pb(s)
(4) $Zn^{2+}(aq)$ to $Pb^{2+}(aq)$

43 Which balanced equation represents a redox reaction?

(1) $CuCO_3(s) \rightarrow CuO(s) + CO_2(g)$
(2) $2KClO_3(s) \rightarrow 2KCl(s) + 3O_2(g)$
(3) $AgNO_3(aq) + KCl(aq) \rightarrow AgCl(s) + KNO_3(aq)$
(4) $H_2SO_4(aq) + 2KOH(aq) \rightarrow K_2SO_4(aq) + 2H_2O(\ell)$

44 Given the unbalanced ionic equation:

$$3Mg + \_\_\_\_ Fe^{3+} \rightarrow 3Mg^{2+} + \_\_\_\_ Fe$$

When this equation is balanced, both Fe^{3+} and Fe have a coefficient of

(1) 1, because a total of 6 electrons is transferred
(2) 2, because a total of 6 electrons is transferred
(3) 1, because a total of 3 electrons is transferred
(4) 2, because a total of 3 electrons is transferred

45 A student collects the materials and equipment below to construct a voltaic cell.

- two 250-mL beakers
- wire and a switch
- one strip of magnesium
- one strip of copper
- 125 mL of 0.20 M $Mg(NO_3)_2(aq)$
- 125 mL of 0.20 M $Cu(NO_3)_2(aq)$

Which additional item is required for the construction of the voltaic cell?

(1) an anode
(2) a battery
(3) a cathode
(4) a salt bridge

46 Given the balanced equation representing a reaction:

$$Zn(s) + 2HCl(aq) \rightarrow H_2(g) + ZnCl_2(aq)$$

Which set of reaction conditions produces $H_2(g)$ at the fastest rate?

(1) a 1.0-g lump of Zn(s) in 50. mL of 0.5 M HCl(aq) at 20.°C
(2) a 1.0-g lump of Zn(s) in 50. mL of 0.5 M HCl(aq) at 30.°C
(3) 1.0 g of powdered Zn(s) in 50. mL of 1.0 M HCl(aq) at 20.°C
(4) 1.0 g of powdered Zn(s) in 50. mL of 1.0 M HCl(aq) at 30.°C

47 The table below shows the color of the indicators methyl orange and litmus in two samples of the same solution.

Results of Acid-Base Indicator Tests

Indicator	Color Result from the Indicator Test
methyl orange	yellow
litmus	red

Which pH value is consistent with the indicator results?

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

48 What is the pH of a solution that has a hydronium ion concentration 100 times greater than a solution with a pH of 4?

(1) 5
(2) 2
(3) 3
(4) 6

49 Which nuclear equation represents a natural transmutation?

(1) ${}^{9}_{4}\mathrm{Be} + {}^{1}_{1}\mathrm{H} \rightarrow {}^{6}_{3}\mathrm{Li} + {}^{4}_{2}\mathrm{He}$
(2) ${}^{27}_{13}\mathrm{Al} + {}^{4}_{2}\mathrm{He} \rightarrow {}^{30}_{15}\mathrm{P} + {}^{1}_{0}\mathrm{n}$
(3) ${}^{14}_{7}\mathrm{N} + {}^{4}_{2}\mathrm{He} \rightarrow {}^{17}_{8}\mathrm{O} + {}^{1}_{1}\mathrm{H}$
(4) ${}^{235}_{92}\mathrm{U} \rightarrow {}^{231}_{90}\mathrm{Th} + {}^{4}_{2}\mathrm{He}$

50 A nuclear fission reaction and a nuclear fusion reaction are similar because both reactions

(1) form heavy nuclides from light nuclides
(2) form light nuclides from heavy nuclides
(3) release a large amount of energy
(4) absorb a large amount of energy

Part B–2

Answer all questions in this part.

Directions (51–66): 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 What is the oxidation number of nitrogen in NO(g)? [1]

52 Write an electron configuration for an atom of aluminum-27 in an excited state. [1]

53 What color is bromcresol green after it is added to a sample of NaOH(aq)? [1]

Base your answers to questions 54 through 56 on the information below.

The accepted values for the atomic mass and percent natural abundance of each naturally occurring isotope of silicon are given in the data table below.

Naturally Occurring Isotopes of Silicon

Isotope	**Atomic Mass** (atomic mass units)	**Percent Natural Abundance** (%)
Si-28	27.98	92.22
Si-29	28.98	4.69
Si-30	29.97	3.09

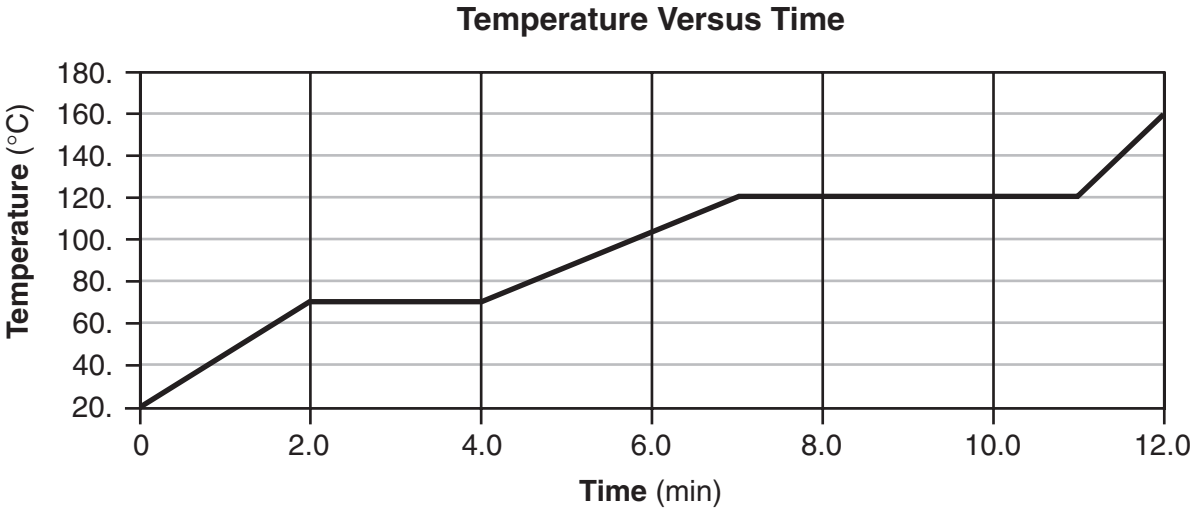
54 Determine the total number of neutrons in an atom of Si-29. [1]

55 In the space *in your answer booklet*, show a correct numerical setup for calculating the atomic mass of Si. [1]

56 A scientist calculated the percent natural abundance of Si-30 in a sample to be 3.29%. Determine the percent error for this value. [1]

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

The temperature of a sample of a substance is increased from 20.°C to 160.°C as the sample absorbs heat at a constant rate of 15 kilojoules per minute at standard pressure. The graph below represents the relationship between temperature and time as the sample is heated.



57 What is the boiling point of this sample? [1]

58 *In your answer booklet*, use the key to draw *at least nine* particles in the box, showing the correct particle arrangement of this sample during the first minute of heating. [1]

59 What is the total time this sample is in the liquid phase, only? [1]

60 Determine the total amount of heat required to completely melt this sample at its melting point. [1]

Base your answers to questions 61 through 63 on the reaction represented by the balanced equation below.

$$2H_2(g) + O_2(g) \rightarrow 2H_2O(\ell) + 571.6\ kJ$$

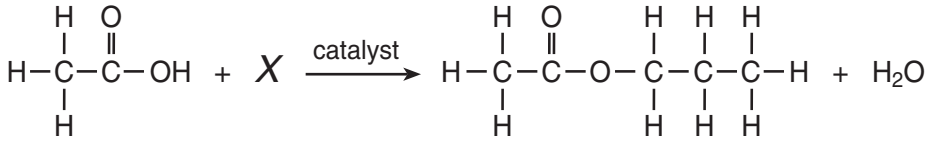
61 Identify the information in this equation that indicates the reaction is exothermic. [1]

62 On the axes *in your answer booklet*, draw a potential energy diagram for the reaction represented by this equation. [1]

63 Explain why the entropy of the system *decreases* as the reaction proceeds. [1]

Base your answers to questions 64 through 66 on the information below.

The incomplete equation below represents an esterification reaction. The alcohol reactant is represented by *X*.



64 On the structural formula *in your answer booklet*, circle the acid functional group, only. [1]

65 Write an IUPAC name for the reactant represented by its structural formula in this equation. [1]

66 In the space *in your answer booklet*, draw the structural formula for the alcohol represented by *X*. [1]

Part C

Answer all questions in this part.

Directions (67–84): 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 67 through 69 on the information below.

Elements with atomic numbers 112 and 114 have been produced and their IUPAC names are pending approval. However, an element that would be put between these two elements on the Periodic Table has not yet been produced. If produced, this element will be identified by the symbol Uut until an IUPAC name is approved.

67 In the space *in your answer booklet*, draw a Lewis electron-dot diagram for an atom of Uut. [1]

68 Determine the charge of an Uut nucleus. Your response must include *both* the numerical value and the sign of the charge. [1]

69 Identify *one* element that would be chemically similar to Uut. [1]

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

Rust on an automobile door contains $Fe_2O_3(s)$. The balanced equation representing one of the reactions between iron in the door of the automobile and oxygen in the atmosphere is given below.

$$4Fe(s) + 3O_2(g) \rightarrow 2Fe_2O_3(s)$$

70 Identify the type of chemical reaction represented by this equation. [1]

71 Determine the gram-formula mass of the product of this reaction. [1]

72 Write the IUPAC name for Fe_2O_3. [1]

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

A hydrate is a compound that has water molecules within its crystal structure. The formula for the hydrate $CuSO_4 \bullet 5H_2O(s)$ shows that there are five moles of water for every one mole of $CuSO_4(s)$. When $CuSO_4 \bullet 5H_2O(s)$ is heated, the water within the crystals is released, as represented by the balanced equation below.

$$CuSO_4 \bullet 5H_2O(s) \rightarrow CuSO_4(s) + 5H_2O(g)$$

A student first masses an empty crucible (a heat-resistant container). The student then masses the crucible containing a sample of $CuSO_4 \bullet 5H_2O(s)$. The student repeatedly heats and masses the crucible and its contents until the mass is constant. The student's recorded experimental data and calculations are shown below.

Data and calculation before heating:

mass of $CuSO_4 \bullet 5H_2O(s)$ and crucible	21.37 g
– mass of crucible	19.24 g
mass of $CuSO_4 \bullet 5H_2O(s)$	2.13 g

Data and calculation after heating to a constant mass:

mass of $CuSO_4(s)$ and crucible	20.61 g
– mass of crucible	19.24 g
mass of $CuSO_4(s)$	1.37 g

Calculation to determine the mass of water:

mass of $CuSO_4 \bullet 5H_2O(s)$	2.13 g
– mass of $CuSO_4(s)$	1.37 g
mass of $H_2O(g)$	0.76 g

73 Identify the total number of significant figures recorded in the calculated mass of $CuSO_4 \bullet 5H_2O(s)$. [1]

74 In the space *in your answer booklet*, use the student's data to show a correct numerical setup for calculating the percent composition by mass of water in the hydrate. [1]

75 Explain why the sample in the crucible must be heated until the constant mass is reached. [1]

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

The equilibrium equation below is related to the manufacture of a bleaching solution. In this equation, $Cl^-(aq)$ means that chloride ions are surrounded by water molecules.

$$Cl_2(g) + 2OH^-(aq) \rightleftharpoons OCl^-(aq) + Cl^-(aq) + H_2O(\ell)$$

76 *In your answer booklet*, use the key to draw *two* water molecules in the box, showing the correct orientation of each water molecule toward the chloride ion. [1]

77 Explain, in terms of collision theory, why increasing the concentration of $Cl_2(g)$ increases the concentration of $OCl^-(aq)$ in this equilibrium system. [1]

Base your answers to questions 78 through 80 on the information below.

In a laboratory activity, 0.500 mole of NaOH(s) is completely dissolved in distilled water to form 400. milliliters of NaOH(aq). This solution is then used to titrate a solution of $HNO_3(aq)$.

78 Identify the negative ion produced when the NaOH(s) is dissolved in distilled water. [1]

79 In the space *in your answer booklet*, calculate the molarity of the NaOH(aq). Your response must include *both* a correct numerical setup and the calculated result. [2]

80 *In your answer booklet*, complete the equation representing this titration reaction by writing the formulas of the products. [1]

Base your answers to questions 81 and 82 on the information below.

The fossilized remains of a plant were found at a construction site. The fossilized remains contain $\frac{1}{16}$ the amount of carbon-14 that is present in a living plant.

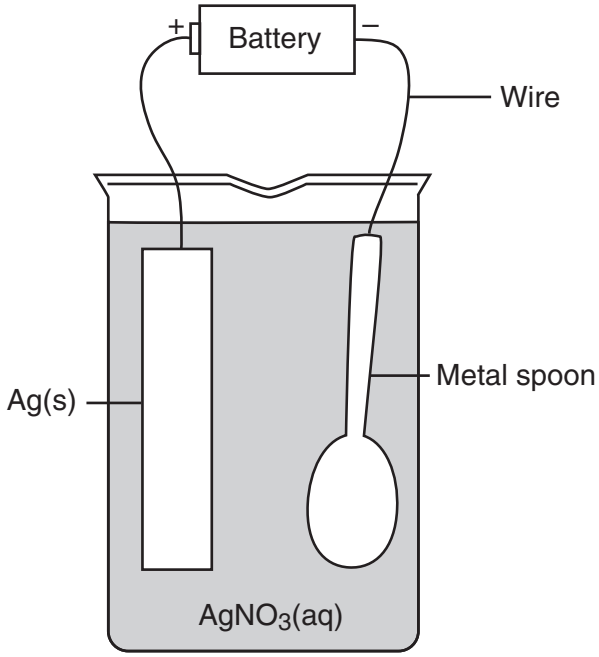
81 Determine the approximate age of these fossilized remains. [1]

82 Complete the nuclear equation *in your answer booklet* for the decay of C-14. Your response must include the atomic number, the mass number, and the symbol of the missing particle. [1]

Base your answers to questions 83 and 84 on the information below.

Electroplating is an electrolytic process used to coat metal objects with a more expensive and less reactive metal. The diagram below shows an electroplating cell that includes a battery connected to a silver bar and a metal spoon. The bar and spoon are submerged in $AgNO_3(aq)$.

An Electroplating Cell



83 Explain why $AgNO_3$ is a better choice than AgCl for use in this electrolytic process. [1]

84 Explain the purpose of the battery in this cell. [1]

Tear Here

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REGENTS HIGH SCHOOL EXAMINATION

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CHEMISTRY

Thursday, August 16, 2007 — 12:30 to 3:30 p.m., only

ANSWER SHEET

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

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

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

Part A

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

Part A Score

Part B–1

31	41 .....
32	42 .....
33	43 .....
34	44 .....
35	45 .....
36	46 .....
37	47 .....
38	48 .....
39	49 .....
40	50 .....

Part B–1 Score

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

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

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

Signature

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PHYSICAL SETTING
CHEMISTRY

Thursday, August 16, 2007 — 12:30 to 3:30 p.m., only

ANSWER BOOKLET

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

Teacher . . . . . .

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

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

Part	Maximum Score	Student's Score
A	30	
B–1	20	
B–2	16	
C	19	

Total Written Test Score (Maximum Raw Score: 85)

Final Score (from conversion chart)

Raters' Initials:

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

Part B–2

For Raters Only

51 _____ **51**

52 _____ **52**

53 _____ **53**

For Raters Only

54 _____ **54**

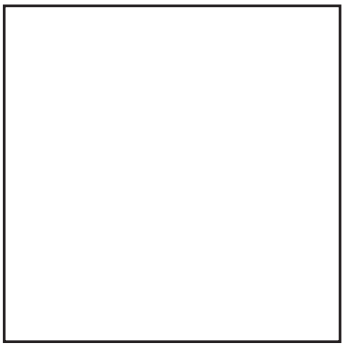
55 **55**

56 _____ **%** **56**

57 _____ **°C** **57**

58

Key
◯ = particle of the substance



58

59 _____ **min** **59**

60 _____ **kJ** **60**

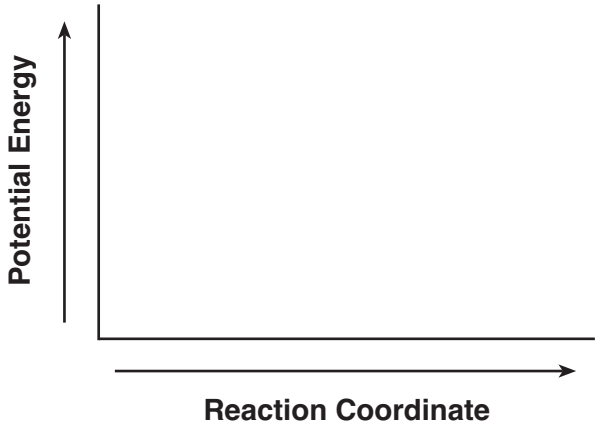
For Raters Only

61 _____

_____

61 ☐

62



62 ☐

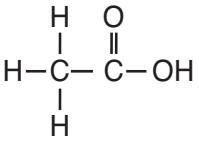
63 _____

_____

_____

63 ☐

64



64 ☐

65 _____

65 ☐

66

66 ☐

☐

Total Score for Part B–2

Part C

For Raters Only

67

67

68 _____ **68**

69 _____ **69**

70 _____ **70**

71 _____ **g/mol** **71**

72 _____ **72**

For Raters Only

73 _____ **73** ☐

74 **74** ☐

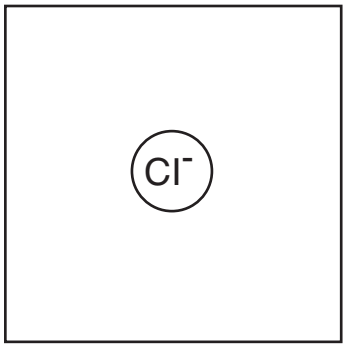
75 _____

_____ **75** ☐

_____

76

Key
● = hydrogen atom
○ = oxygen atom
●○ = water molecule



76 ☐

77 _____

_____ **77** ☐

_____

For Raters Only

78 _____ **78**

79 **79**

_____ **M**

80 $NaOH(aq) + HNO_3(aq) \rightarrow$ _____ + _____ **80**

81 _____ **y** **81**

82 $^{14}_{6}C \rightarrow {}^{0}_{-1}e +$ _____ **82**

83 _____ **83**

_____

_____

84 _____ **84**

_____

_____

Total Score for Part C

[6]

FOR TEACHERS ONLY

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

PS–CH PHYSICAL SETTING/CHEMISTRY

Thursday, August 16, 2007 — 12:30 to 3:30 p.m., only

SCORING KEY AND RATING GUIDE

Directions to the Teacher:

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

Updated information regarding the rating of this examination may be posted on the New York State Education Department's web site during the rating period. Check this web site http://www.emsc.nysed.gov/osa/ and select the link "Examination Scoring Information" for any recently posted information regarding this examination. This site should be checked before the rating process for this examination begins and several times throughout the Regents examination period.

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

Part A

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

Part B–1

31	3	41	1
32	3	42	3
33	1	43	2
34	1	44	2
35	3	45	4
36	3	46	4
37	2	47	2
38	1	48	2
39	4	49	4
40	4	50	3

Directions to the Teacher

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

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

On the detachable answer sheet for Part A and Part B–1, indicate by means of a 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 Thursday, August 16, 2007. 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 16 credits for this part. The student must answer all questions in this part.

51 [1] Allow 1 credit for +2.

52 [1] Allow 1 credit for an excited state configuration indicating a total of 13 electrons that has no more than 2 electrons in shell 1 and no more than 8 electrons in shell 2. Acceptable responses include, but are not limited to:

2-7-4

1-8-4

2-6-2-3

Note: Do *not* allow credit for the configuration 2-8-3.

53 [1] Allow 1 credit for blue.

54 [1] Allow 1 credit for 15 *or* fifteen.

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

$(27.98)(0.9222) + (28.98)(0.0469) + (29.97)(0.0309)$

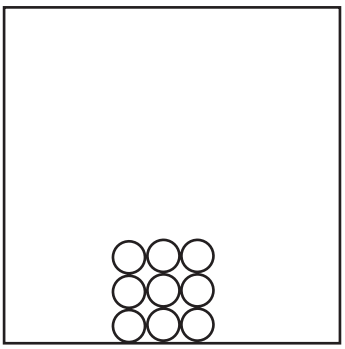
$$\frac{(27.98)(92.22) + (28.98)(4.69) + (29.97)(3.09)}{100}$$

56 [1] Allow 1 credit for 6.5%. Significant figures do *not* need to be shown.

57 [1] Allow 1 credit for 120.°C ± 2°C.

58 [1] Allow 1 credit.

Example of a 1-credit response:



59 [1] Allow 1 credit for 3.0 min ± 0.2 min. Significant figures do *not* need to be shown.

60 [1] Allow 1 credit for 30. kJ ± 3 kJ. Significant figures do *not* need to be shown.

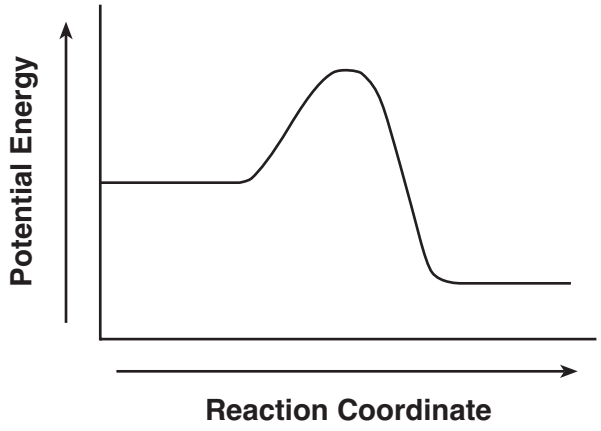
61 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

Heat term is on the right side of the equation.

The 571.6 kJ is a product.

62 [1] Allow 1 credit.

Example of a 1-credit response:



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

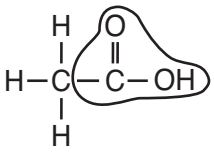
A liquid is formed from gases.

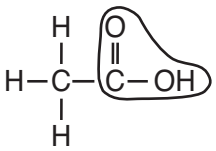
A compound is formed from its elements.

The number of gas particles in the system decreases.

64 [1] Allow 1 credit.

Examples of a 1-credit response:





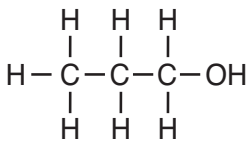
65 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

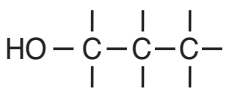
ethanoic acid

acetic acid

66 [1] Allow 1 credit.

Examples of a 1-credit response:



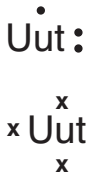


Part C

Allow a total of 19 credits for this part. The student must answer all questions in this part.

67 [1] Allow 1 credit. Positions of the three dots can vary.

Examples of a 1-credit response:



68 [1] Allow 1 credit for +113.

69 [1] Allow 1 credit for any element in Group 13. Acceptable responses include, but are not limited to:

Tl

boron

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

synthesis

redox

oxidation

71 [1] Allow 1 credit for 160. g/mol. Significant figures do *not* need to be shown.

72 [1] Allow 1 credit for iron(III) oxide.

73 [1] Allow 1 credit for 3 *or* three.

74 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

$$\% \ H_2O = \frac{0.76\ g}{2.13\ g} \times 100$$

$$\frac{0.76}{2.13} \times 100$$

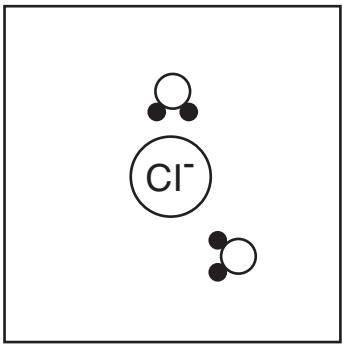
75 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

Until the sample reaches a constant mass, the student cannot be sure that all the water has been removed.

to make sure all of the water is heated out of the sample

76 [1] Allow 1 credit. Acceptable responses must show *at least two* water molecules with *at least one* hydrogen atom of each water molecule facing toward the chloride ion.

Example of a 1-credit response:



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

The concentration of $OCl^-(aq)$ increases because there will be a greater number of effective collisions between the $Cl_2(g)$ and the $OH^-(aq)$.

more collisions between $Cl_2(g)$ and $OH^-(aq)$

78 [1] Allow 1 credit for OH^- *or* hydroxide ion.

79 [2] Allow a maximum of 2 credits, allocated as follows:

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

$$\text{molarity} = \frac{\text{moles of solute}}{\text{liters of solution}} = \frac{0.500 \text{ mol NaOH}}{0.400 \text{ L solution}}$$

$$\frac{0.5}{0.4}$$

- Allow 1 credit for 1.25 M *or* for a response consistent with the student's numerical setup. Significant figures do *not* need to be shown.

Note: Do *not* allow credit for a numerical setup and calculated result that are not related to the concept assessed by the question.

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

$NaOH(aq) + HNO_3(aq) \rightarrow NaNO_3(aq) + H_2O(\ell)$

$NaOH(aq) + HNO_3(aq) \rightarrow HOH + NaNO_3$

81 [1] Allow 1 credit for 22 920 y. Significant figures do *not* need to be shown.

82 [1] Allow 1 credit for $^{14}_{7}N$.

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

Silver nitrate produces more ions than silver chloride in water.

$AgNO_3$ readily dissolves in H_2O; AgCl dissolves only slightly in H_2O.

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

The battery provides the electrical energy necessary for the reaction to occur.

Regents Examination in Physical Setting/Chemistry

August 2007

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

The *Chart for Determining the Final Examination Score for the August 2007 Regents Examination in Physical Setting/Chemistry* will be posted on the Department's web site http://www.emsc.nysed.gov/osa/ on Thursday, August 16, 2007. Conversion charts provided for previous administrations of the Regents Examination in Physical Setting/Chemistry must NOT be used to determine students' final scores for this administration.

Submitting Teacher Evaluations of the Test to the Department

Suggestions and feedback from teachers provide an important contribution to the test development process. The Department provides an online evaluation form for State assessments. It contains spaces for teachers to respond to several specific questions and to make suggestions. Instructions for completing the evaluation form are as follows:

1. Go to www.emsc.nysed.gov/osa/exameval.
2. Select the test title.
3. Complete the required demographic fields.
4. Complete each evaluation question and provide comments in the space provided.
5. Click the SUBMIT button at the bottom of the page to submit the completed form.

Map to Core Curriculum

August 2007 Physical Setting/Chemistry			
Question Numbers			
Key Ideas/Performance Indicators	Part A	Part B	Part C
Standard 1			
Math Key Idea 1		37, 40, 56	73, 74, 79, 81
Math Key Idea 2			
Math Key Idea 3		31, 37, 40, 51, 60	71, 79, 81
Science Inquiry Key Idea 1		41, 46	83, 84
Science Inquiry Key Idea 2		45	
Science Inquiry Key Idea 3		37, 44, 47, 63, 64, 65	68, 69, 72, 75, 78, 80, 83
Engineering Design Key Idea 1			
Standard 2			
Key Idea 1			
Key Idea 2			
Standard 6			
Key Idea 1		61	
Key Idea 2			76
Key Idea 3		48	
Key Idea 4			
Key Idea 5		62	
Standard 7			
Key Idea 1			
Key Idea 2			
Standard 4 Process Skills			
Key Idea 3		32, 33, 34, 35, 36, 38, 39, 42, 43, 44, 45, 46, 47, 49, 52, 53, 54, 55, 58, 63, 66	67, 70, 71, 77, 79, 80
Key Idea 4		57, 59, 60, 61, 62	82
Key Idea 5		41	
Standard 4			
Key Idea 3	1, 2, 3, 4, 5, 7, 8, 9, 10, 11, 15, 17, 18, 19, 20, 22, 23, 24, 25, 26, 27, 29, 30	32, 33, 34, 35, 37, 38, 39, 42, 43, 44, 45, 46, 47, 48, 51, 52, 53, 54, 55, 56, 58, 63, 64, 65, 66	67, 68, 69, 70, 71, 72, 73, 74, 75, 77, 78, 79, 80, 83, 84
Key Idea 4	28	40, 50, 57, 59, 60, 61, 62	81, 82
Key Idea 5	6, 12, 13, 14, 16, 21	31, 36, 41, 49, 50	76
Reference Tables			
2002 Edition	4, 5, 7, 11, 12, 16, 22, 23, 25, 26, 27, 28, 30	31, 33, 34, 39, 40, 47, 52, 53, 54, 64, 65, 66	67, 68, 69, 71, 72, 78, 79, 80, 82, 83

University of the State of New York
State Education Department

Regents Examination in Physical Setting / Chemistry
August 2007

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	75	41	60	19	40
84	98	62	74	40	59	18	38
83	97	61	74	39	59	17	37
82	95	60	73	38	58	16	36
81	94	59	72	37	57	15	34
80	93	58	71	36	56	14	33
79	91	57	71	35	56	13	31
78	90	56	70	34	55	12	29
77	89	55	69	33	54	11	27
76	88	54	69	32	53	10	25
75	86	53	68	31	52	9	24
74	85	52	67	30	52	8	21
73	84	51	67	29	51	7	19
72	83	50	66	28	50	6	17
71	82	49	66	27	49	5	15
70	81	48	65	26	48	4	12
69	80	47	64	25	47	3	9
68	79	46	63	24	46	2	6
67	78	45	63	23	45	1	3
66	78	44	62	22	43	0	0
65	77	43	61	21	42		
64	76	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 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.