The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

PHYSICAL SETTING
CHEMISTRY

Thursday, January 28, 2010 — 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 (1–30): For *each* statement or question, write on the separate answer sheet the *number* of the word or expression that, of those given, best completes the statement or answers the question. Some questions may require the use of the *Reference Tables for Physical Setting/Chemistry*.

1 Which two particles have opposite charges?

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

2 Which statement describes how an atom in the ground state becomes excited?

(1) The atom absorbs energy, and one or more electrons move to a higher electron shell.
(2) The atom absorbs energy, and one or more electrons move to a lower electron shell.
(3) The atom releases energy, and one or more electrons move to a higher electron shell.
(4) The atom releases energy, and one or more electrons move to a lower electron shell.

3 An element that has a low first ionization energy and good conductivity of heat and electricity is classified as a

(1) metal
(2) metalloid
(3) nonmetal
(4) noble gas

4 The chemical properties of calcium are most similar to the chemical properties of

(1) Ar
(2) K
(3) Mg
(4) Sc

5 Which element is a liquid at STP?

(1) argon
(2) bromine
(3) chlorine
(4) sulfur

6 Which statement describes a chemical property of aluminum?

(1) Aluminum is malleable.
(2) Aluminum reacts with sulfuric acid.
(3) Aluminum conducts an electric current.
(4) Aluminum has a density of 2.698 g/cm^3 at STP.

7 Which element has an atom in the ground state with a total of three valence electrons?

(1) aluminum
(2) lithium
(3) phosphorus
(4) scandium

8 Which substance can be broken down by chemical means?

(1) magnesium
(2) manganese
(3) mercury
(4) methanol

9 The gram-formula mass of NO_2 is defined as the mass of

(1) one mole of NO_2
(2) one molecule of NO_2
(3) two moles of NO
(4) two molecules of NO

10 In which type of reaction do two or more substances combine to produce a single substance?

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

11 Which formula represents a nonpolar molecule?

(1) HCl
(2) H_2O
(3) NH_3
(4) CH_4

12 Which symbol represents an atom in the ground state with the most stable valence electron configuration?

(1) B
(2) O
(3) Li
(4) Ne

13 Which element has an atom with the greatest tendency to attract electrons in a chemical bond?

(1) carbon
(2) chlorine
(3) silicon
(4) sulfur

14 The nitrogen atoms in a molecule of N_2 share a total of

(1) one pair of electrons
(2) one pair of protons
(3) three pairs of electrons
(4) three pairs of protons

15 An ionic compound is formed when there is a reaction between the elements

(1) strontium and chlorine
(2) hydrogen and chlorine
(3) nitrogen and oxygen
(4) sulfur and oxygen

16 Which compound has both ionic and covalent bonding?

(1) $CaCO_3$
(2) CH_2Cl_2
(3) CH_3OH
(4) $C_6H_{12}O_6$

17 The liquids hexane and water are placed in a test tube. The test tube is stoppered, shaken, and placed in a test tube rack. The liquids separate into two distinct layers because hexane and water have different

(1) formula masses
(2) molecular polarities
(3) pH values
(4) specific heats

18 Which statement describes the particles of an ideal gas based on the kinetic molecular theory?

(1) The gas particles are relatively far apart and have negligible volume.
(2) The gas particles are in constant, nonlinear motion.
(3) The gas particles have attractive forces between them.
(4) The gas particles have collisions without transferring energy.

19 Under which conditions of temperature and pressure would a 1-liter sample of a real gas behave most like an ideal gas?

(1) 100 K and 0.1 atm
(2) 100 K and 10 atm
(3) 500 K and 0.1 atm
(4) 500 K and 10 atm

20 Which type of energy is associated with the random motion of the particles in a sample of gas?

(1) chemical energy
(2) electromagnetic energy
(3) nuclear energy
(4) thermal energy

21 The particles in which sample of LiCl(s) have the same average kinetic energy as the particles in a 2.0-mole sample of $H_2O(\ell)$ at 25°C?

(1) 1.0 mol at 75°C
(2) 2.0 mol at 50.°C
(3) 3.0 mol at 25°C
(4) 4.0 mol at 0°C

22 Which rigid cylinder contains the same number of gas molecules at STP as a 2.0-liter rigid cylinder containing $H_2(g)$ at STP?

(1) 1.0-L cylinder of $O_2(g)$
(2) 2.0-L cylinder of $CH_4(g)$
(3) 1.5-L cylinder of $NH_3(g)$
(4) 4.0-L cylinder of He(g)

23 Hydrogen bonding is a type of

(1) strong covalent bond
(2) weak ionic bond
(3) strong intermolecular force
(4) weak intermolecular force

24 The data collected from a laboratory titration are used to calculate the

(1) rate of a chemical reaction
(2) heat of a chemical reaction
(3) concentration of a solution
(4) boiling point of a solution

25 When one compound dissolves in water, the only positive ion produced in the solution is $H_3O^+(aq)$. This compound is classified as

(1) a salt
(2) a hydrocarbon
(3) an Arrhenius acid
(4) an Arrhenius base

26 Which nuclear emission has the greatest mass and the *least* penetrating power?

(1) an alpha particle
(2) a beta particle
(3) a neutron
(4) a positron

27 Which radioisotope has an atom that emits a particle with a mass number of 0 and a charge of +1?

(1) ^{3}H
(2) ^{16}N
(3) ^{19}Ne
(4) ^{239}Pu

28 In which type of reaction do two lighter nuclei combine to form one heavier nucleus?

(1) combustion
(2) reduction
(3) nuclear fission
(4) nuclear fusion

29 For which compound is the process of dissolving in water exothermic?

(1) NaCl
(2) NaOH
(3) NH_4Cl
(4) NH_4NO_3

30 Which quantities must be equal for a chemical reaction at equilibrium?

(1) the activation energies of the forward and reverse reactions
(2) the rates of the forward and reverse reactions
(3) the concentrations of the reactants and products
(4) the potential energies of the reactants and products

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 Which formula represents copper(I) oxide?

(1) CuO
(2) CuO_2
(3) Cu_2O
(4) Cu_2O_2

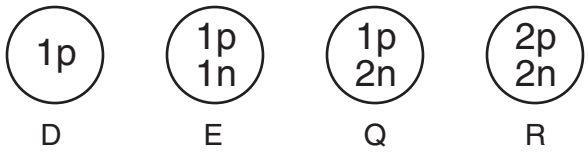
32 At STP, a 7.49-gram sample of an element has a volume of 1.65 cubic centimeters. The sample is most likely

(1) Ta
(2) Tc
(3) Te
(4) Ti

33 Which element, represented by *X*, reacts with fluorine to produce the compound XF_2?

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

34 Each diagram below represents the nucleus of a different atom.



Which diagrams represent nuclei of the same element?

(1) *D* and *E*, only
(2) *D*, *E*, and *Q*
(3) *Q* and *R*, only
(4) *Q*, *R*, and *E*

35 As atomic number increases within Group 15 on the Periodic Table, atomic radius

(1) decreases, only
(2) increases, only
(3) decreases, then increases
(4) increases, then decreases

36 Given the balanced equation representing a reaction:

$$CaO(s) + CO_2(g) \rightarrow CaCO_3(s) + \text{heat}$$

What is the total mass of CaO(s) that reacts completely with 88 grams of $CO_2(g)$ to produce 200. grams of $CaCO_3(s)$?

(1) 56 g
(2) 88 g
(3) 112 g
(4) 288 g

37 What is the empirical formula of a compound that has a carbon-to-hydrogen ratio of 2 to 6?

(1) CH_3
(2) C_2H_6
(3) C_3H
(4) C_6H_2

38 Given the balanced equation representing a reaction:

$$H_2(g) + Cl_2(g) \rightarrow 2HCl(g) + \text{energy}$$

Which statement describes the energy changes in this reaction?

(1) Energy is absorbed as bonds are formed, only.
(2) Energy is released as bonds are broken, only.
(3) Energy is absorbed as bonds are broken, and energy is released as bonds are formed.
(4) Energy is absorbed as bonds are formed, and energy is released as bonds are broken.

39 Which solution has the highest boiling point at standard pressure?

(1) 0.10 M KCl(aq)
(2) 0.10 M K_2SO_4(aq)
(3) 0.10 M K_3PO_4(aq)
(4) 0.10 M KNO_3(aq)

40 What is the molarity of 1.5 liters of an aqueous solution that contains 52 grams of lithium fluoride, LiF, (gram-formula mass = 26 grams/mole)?

(1) 1.3 M
(2) 2.0 M
(3) 3.0 M
(4) 0.75 M

41 What occurs when a 35-gram aluminum cube at 100.°C is placed in 90. grams of water at 25°C in an insulated cup?

(1) Heat is transferred from the aluminum to the water, and the temperature of the water decreases.
(2) Heat is transferred from the aluminum to the water, and the temperature of the water increases.
(3) Heat is transferred from the water to the aluminum, and the temperature of the water decreases.
(4) Heat is transferred from the water to the aluminum, and the temperature of the water increases.

42 Which temperature is equal to 120. K?

(1) –153°C
(2) –120.°C
(3) +293°C
(4) +393°C

43 A rigid cylinder contains a sample of gas at STP. What is the pressure of this gas after the sample is heated to 410 K?

(1) 1.0 atm
(2) 0.50 atm
(3) 0.67 atm
(4) 1.5 atm

44 Given the balanced equation representing a phase change:

$$C_6H_4Cl_2(s) + \text{energy} \rightarrow C_6H_4Cl_2(g)$$

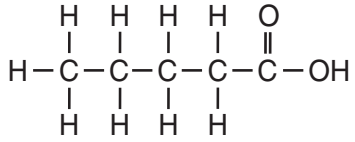
Which statement describes this change?

(1) It is endothermic, and entropy decreases.
(2) It is endothermic, and entropy increases.
(3) It is exothermic, and entropy decreases.
(4) It is exothermic, and entropy increases.

45 In a biochemical reaction, an enzyme acts as a catalyst, causing the

(1) activation energy of the reaction to decrease
(2) potential energy of the reactants to decrease
(3) kinetic energy of the reactants to increase
(4) heat of reaction to increase

46 Given the formula for an organic compound:



This compound is classified as an

(1) aldehyde
(2) amine
(3) ester
(4) organic acid

47 Butanal and butanone have different chemical and physical properties primarily because of differences in their

(1) functional groups
(2) molecular masses
(3) molecular formulas
(4) number of carbon atoms per molecule

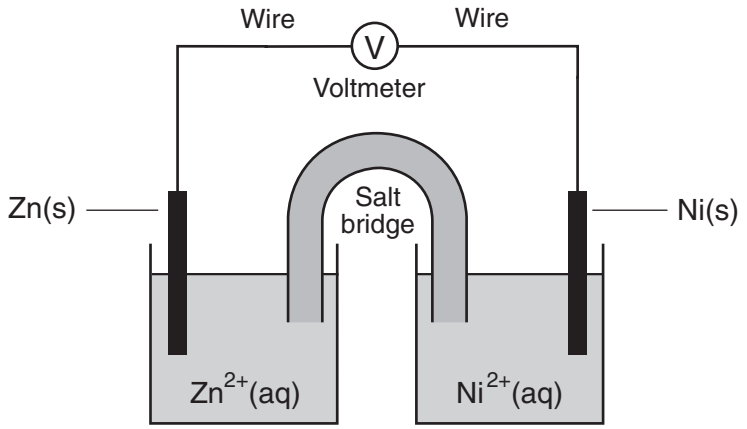
48 Which salt is produced when sulfuric acid and calcium hydroxide react completely?

(1) CaH_2
(2) CaO
(3) CaS
(4) $CaSO_4$

49 Which radioisotope is used to treat thyroid disorders?

(1) Co-60
(2) I-131
(3) C-14
(4) U-238

50 The diagram below represents an operating electrochemical cell and the balanced ionic equation for the reaction occurring in the cell.



$$Zn(s) + Ni^{2+}(aq) \longrightarrow Zn^{2+}(aq) + Ni(s)$$

Which statement identifies the part of the cell that conducts electrons and describes the direction of electron flow as the cell operates?

(1) Electrons flow through the salt bridge from the Ni(s) to the Zn(s).
(2) Electrons flow through the salt bridge from the Zn(s) to the Ni(s).
(3) Electrons flow through the wire from the Ni(s) to the Zn(s).
(4) Electrons flow through the wire from the Zn(s) to the Ni(s).

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 Based on Table *G*, determine the total mass of NH_3 that must be dissolved in 200. grams of water to produce a saturated solution at 20.°C. [1]

52 Determine the total time that must elapse until only ¼ of an original sample of the radioisotope Rn-222 remains unchanged. [1]

Base your answers to questions 53 through 55 on the information below.

A phase change for carbon dioxide that occurs spontaneously at 20.°C and 1.0 atmosphere is represented by the balanced equation below.

$$CO_2(s) + \text{energy} \rightarrow CO_2(g)$$

53 Write the name of this phase change. [1]

54 Describe what happens to the potential energy of the CO_2 molecules as this phase change occurs. [1]

55 *In your answer booklet,* use the key to draw *at least five* molecules in the box to represent CO_2 after this phase change is completed. [1]

Base your answers to questions 56 and 57 on the information below.

The dissolving of solid lithium bromide in water is represented by the balanced equation below.

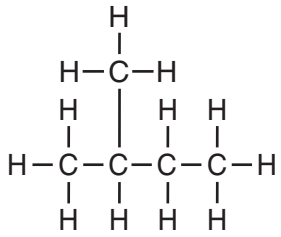
$$LiBr(s) \xrightarrow{H_2O} Li^+(aq) + Br^-(aq)$$

56 Calculate the total mass of LiBr(s) required to make 500.0 grams of an aqueous solution of LiBr that has a concentration of 388 parts per million. Your response must include *both* a correct numerical setup and the calculated result. [2]

57 Based on Table *F*, identify *one* ion that reacts with Br^- ions in an aqueous solution to form an insoluble compound. [1]

Base your answers to questions 58 through 60 on the information below.

The formula below represents a hydrocarbon.



58 Identify the homologous series to which this hydrocarbon belongs. [1]

59 Explain, in terms of carbon-carbon bonds, why this hydrocarbon is saturated. [1]

60 In the space *in your answer booklet,* draw a structural formula for *one* isomer of this hydrocarbon. [1]

Base your answers to questions 61 through 63 on the information below.

The atomic and ionic radii for sodium and chlorine are shown in the table below.

Atomic and Ionic Radii

Particle	**Radius** (pm)
Na atom	190.
Na^+ ion	102
Cl atom	97
Cl^- ion	181

61 Write the ground state electron configuration for the ion that has a radius of 181 picometers. [1]

62 Convert the radius of an Na^+ ion to meters. [1]

63 Explain, in terms of atomic structure, why the radius of an Na atom is larger than the radius of an Na^+ ion. [1]

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

The nucleus of one boron atom has five protons and four neutrons.

64 Determine the total number of electrons in the boron atom. [1]

65 Determine the total charge of the boron nucleus. [1]

Part C

Answer all questions in this part.

Directions (66–84): 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 66 through 68 on the information below.

At STP, iodine, I_2, is a crystal, and fluorine, F_2, is a gas. Iodine is soluble in ethanol, forming a tincture of iodine. A typical tincture of iodine is 2% iodine by mass.

66 Compare the strength of the intermolecular forces in a sample of I_2 at STP to the strength of the intermolecular forces in a sample of F_2 at STP. [1]

67 In the space *in your answer booklet,* draw a Lewis electron-dot diagram for a molecule of I_2. [1]

68 Determine the total mass of I_2 in 25 grams of this typical tincture of iodine. [1]

Base your answers to questions 69 through 71 on the information below.

In a laboratory investigation, magnesium reacts with hydrochloric acid to produce hydrogen gas and magnesium chloride. This reaction is represented by the unbalanced equation below.

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

69 State, in terms of the relative activity of elements, why this reaction is spontaneous. [1]

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

71 Write a balanced half-reaction equation for the oxidation that occurs. [1]

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

An experiment is performed to determine how concentration affects the rate of reaction. In each of four trials, equal volumes of solution *A* and solution *B* are mixed while temperature and pressure are held constant. The concentration of solution *B* is held constant, but the concentration of solution *A* is varied. The concentration of solution *A* and the time for the reaction to go to completion for each trial are recorded in the data table below.

Data Table

Trial	Concentration of Solution A (M)	Reaction Time (s)
1	0.0200	4.5
2	0.0150	7.0
3	0.0100	12.0
4	0.0050	20.0

72 Describe the relationship between the concentration of solution *A* and the time for the reaction to go to completion. [1]

73 On the grid *in your answer booklet*, mark an appropriate scale on the axis labeled "Reaction Time (s)." [1]

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

75 Identify *one* factor, other than the concentration of the solutions, that can affect the rate of this reaction. [1]

Base your answers to questions 76 through 78 on the information below.

Carbon has three naturally occurring isotopes, C-12, C-13, and C-14. Diamond and graphite are familiar forms of solid carbon. Diamond is one of the hardest substances known, while graphite is a very soft substance. Diamond has a rigid network of bonded atoms. Graphite has atoms bonded in thin layers that are held together by weak forces.

Recent experiments have produced new forms of solid carbon called fullerenes. One fullerene, C_{60}, is a spherical, cagelike molecule of carbon.

76 Determine *both* the total number of protons and the total number of neutrons in an atom of the naturally occurring carbon isotope with the largest mass number. [1]

77 Identify the type of bonding in a fullerene molecule. [1]

78 State, in terms of the arrangement of atoms, the difference in hardness between diamond and graphite. [1]

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

Hydrocarbons and fissionable nuclei are among the sources used for the production of energy in the United States. A chemical reaction produces much less energy than a nuclear reaction per mole of reactant.

The balanced chemical equation below represents the reaction of one molecule of a hydrocarbon with two molecules of oxygen.

Chemical equation: $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O + 1.48 \times 10^{-18}\ J$

The nuclear equation below represents one of the many possible reactions for one fissionable nucleus. In this equation, *X* represents a missing product.

Nuclear equation: ${}^{1}_{0}n + {}^{235}_{92}U \rightarrow {}^{89}_{36}Kr + X + 3{}^{1}_{0}n + 3.36 \times 10^{-11}\ J$

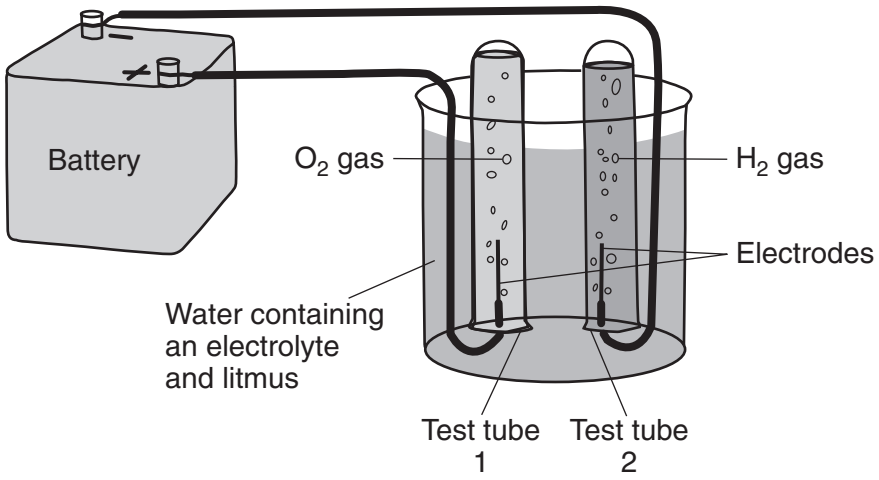
79 Identify the type of organic reaction represented by the chemical equation. [1]

80 On the labeled axes *in your answer booklet,* draw a potential energy diagram for the reaction of the hydrocarbon with oxygen. [1]

81 Write an isotopic notation for the missing product represented by *X* in the nuclear equation. [1]

Base your answers to questions 82 through 84 on the information below.

The diagram below shows a system in which water is being decomposed into oxygen gas and hydrogen gas. Litmus is used as an indicator in the water. The litmus turns red in test tube 1 and blue in test tube 2.



The oxidation and reduction occurring in the test tubes are represented by the balanced equations below.

Test tube 1: $2H_2O(\ell) \rightarrow O_2(g) + 4H^+(aq) + 4e^-$

Test tube 2: $4H_2O(\ell) + 4e^- \rightarrow 2H_2(g) + 4OH^-(aq)$

82 Identify the information in the diagram that indicates this system is an electrolytic cell. [1]

83 Determine the change in oxidation number of oxygen during the reaction in test tube 1. [1]

84 Explain, in terms of the products formed in test tube 2, why litmus turns blue in test tube 2. [1]

Tear Here

The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

PHYSICAL SETTING
CHEMISTRY

Thursday, January 28, 2010 — 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	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 must 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

PS/CHEMISTRY

The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

PHYSICAL SETTING
CHEMISTRY

Thursday, January 28, 2010 — 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	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

51 _____ **g**

52 _____ **d**

53 _____

54 _____

_____

55

Key
◯ = CO_2 molecule

For Raters Only

51 ☐

52 ☐

53 ☐

54 ☐

55 ☐

For Raters Only

56

56

_____ **g**

57 _____ **57**

58 _____ **58**

59 _____

_____ **59**

_____

60

60

61 _____

62 _____ **m**

63 _____

_____

_____

64 _____

65 _____

For Raters Only

61 ☐

62 ☐

63 ☐

64 ☐

65 ☐

☐

Total Score for Part B–2

Part C

For Raters Only

66 _____

_____

66 ☐

67

67 ☐

68 _____ **g**

68 ☐

69 _____

_____

69 ☐

70 _____ $Mg(s)$ + _____ $HCl(aq)$ → _____ $H_2(g)$ + _____ $MgCl_2(aq)$

70 ☐

71 _____

71 ☐

[4]

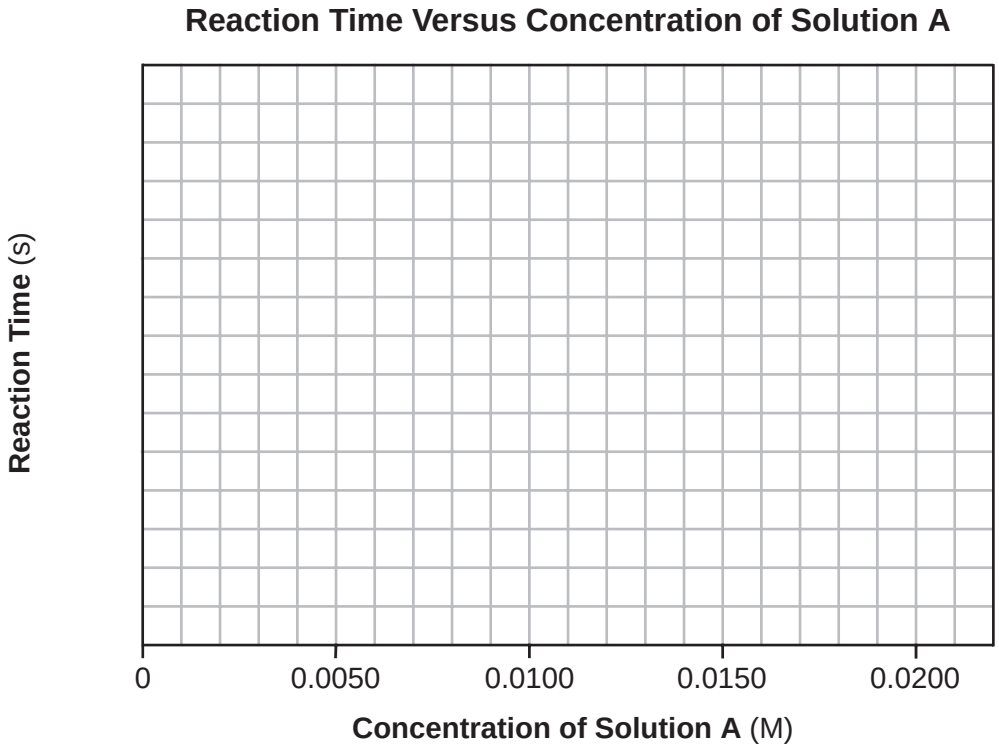
For Raters Only

72 _____

_____

72 ☐

73 and 74



73 ☐

74 ☐

75 _____ 75 ☐

76 Protons: _____ 76 ☐

Neutrons: _____

77 _____ 77 ☐

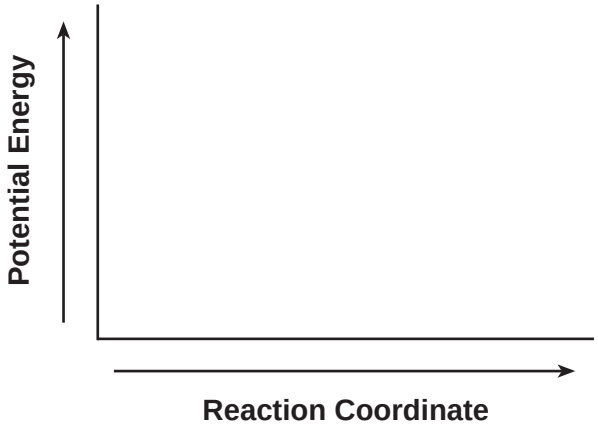
78 _____ 78 ☐

_____

For Raters Only

79 _____ 79 ☐

80 80 ☐



81 _____ 81 ☐

82 _____ 82 ☐

_____

83 From _____ to _____ 83 ☐

84 _____ 84 ☐

_____

_____

☐

Total Score for Part C

PS/CHEMISTRY

FOR TEACHERS ONLY

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

PS–CH PHYSICAL SETTING/CHEMISTRY

Thursday, January 28, 2010 — 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. 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						Part B–1			
1	2	11	4	21	3	31	3	41	2
2	1	12	4	22	2	32	4	42	1
3	1	13	2	23	3	33	3	43	4
4	3	14	3	24	3	34	2	44	2
5	2	15	1	25	3	35	2	45	1
6	2	16	1	26	1	36	3	46	4
7	1	17	2	27	3	37	1	47	1
8	4	18	1	28	4	38	3	48	4
9	1	19	3	29	2	39	3	49	2
10	1	20	4	30	2	40	1	50	4

Directions to the Teacher

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

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

On the detachable answer sheet for Part A and Part B–1, indicate by means of a 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 scale score by using the conversion chart that will be posted on the Department's web site http://www.emsc.nysed.gov/osa/ on Thursday, January 28, 2010. The student's scale score should be entered in the labeled box on the student's answer booklet. The scale score is the student's final examination score.

All student answer papers that receive a scale 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 scale 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 112 g ± 3 g.

52 [1] Allow 1 credit for 7.64 d.

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

sublimation

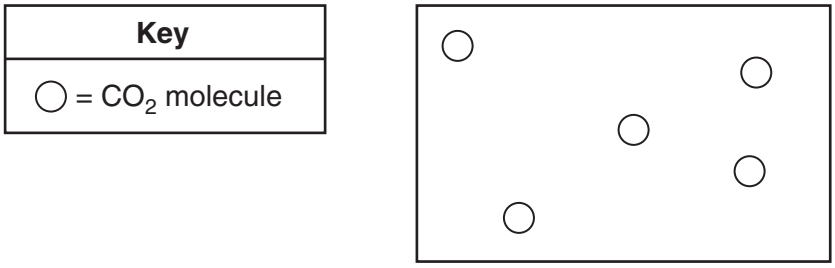
54 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

The potential energy of the CO_2 molecules increases.

The CO_2(g) molecules have more potential energy than the CO_2(s) molecules.

55 [1] Allow 1 credit.

Example of a 1-credit response:



56 [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:

$$388 \text{ ppm} = \frac{\text{grams of LiBr}}{500.0 \text{ g of solution}} \times 1\,000\,000$$

$$\frac{388}{10^6} = \frac{x}{500}$$

- Allow 1 credit for 0.194 g *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.

57 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

Ag^+

Hg_2^{2+}

lead(II)

58 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

alkane

C_nH_{2n+2}

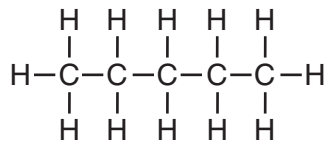
59 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

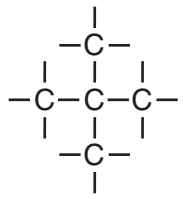
All of the carbon-carbon bonds are single covalent bonds.

There are only single bonds between the carbon atoms.

60 [1] Allow 1 credit.

Examples of 1-credit responses:





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

2-8-8

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

1.02×10^{-10} m

0.000 000 000 102 m

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

A sodium atom loses the electron in its outer shell, causing the radius of the ion to be smaller than the radius of the atom.

An Na atom has three electron shells, but an Na^+ ion has only two electron shells.

64 [1] Allow 1 credit for five *or* 5.

65 [1] Allow 1 credit for +5.

Part C

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

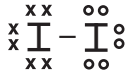
66 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

At STP, the intermolecular forces in I_2 are stronger than in F_2.

weaker intermolecular forces in F_2

67 [1] Allow 1 credit.

Examples of 1-credit responses:



68 [1] Allow 1 credit for 0.5 g.

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

Magnesium is more active than hydrogen.

H_2 is less active than Mg.

70 [1] Allow 1 credit for _____ Mg(s) + __2__ HCl(aq) → _____ H_2(g) + _____ $MgCl_2$(aq).

Allow credit even if the coefficient "1" is written in front of Mg(s), H_2(g), and/or $MgCl_2$(aq).

71 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

$Mg \rightarrow Mg^{2+} + 2e^-$

72 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

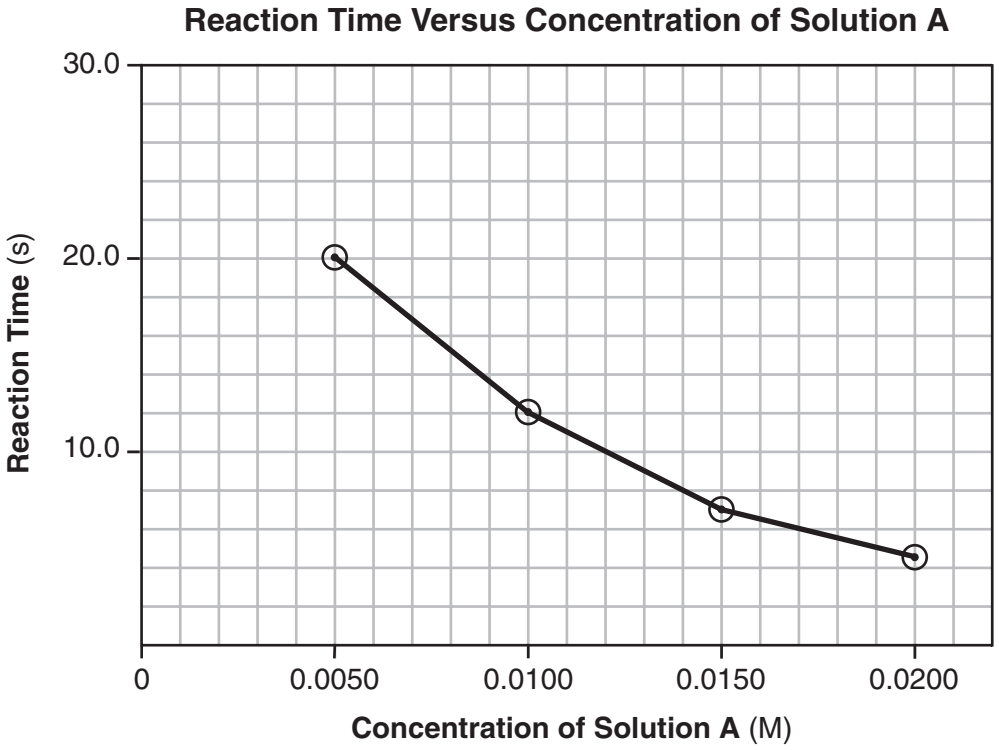
As the concentration of solution *A* was decreased, the time for the reaction to go to completion increased.

As the concentration of *A* is decreased, the rate of reaction decreases.

73 [1] Allow 1 credit for marking an appropriate scale on the axis labeled "Reaction Time (s)." An appropriate scale is linear and allows a trend to be seen.

74 [1] Allow 1 credit for correctly plotting all four points ± 0.3 grid space. Plotted points do *not* need to be circled or connected.

Example of a 2-credit response for questions 73 and 74:



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

temperature

addition of a catalyst

76 [1] Allow 1 credit for 6 *or* six protons and 8 *or* eight neutrons.

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

nonpolar covalent

covalent

a network of covalent bonds

78 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

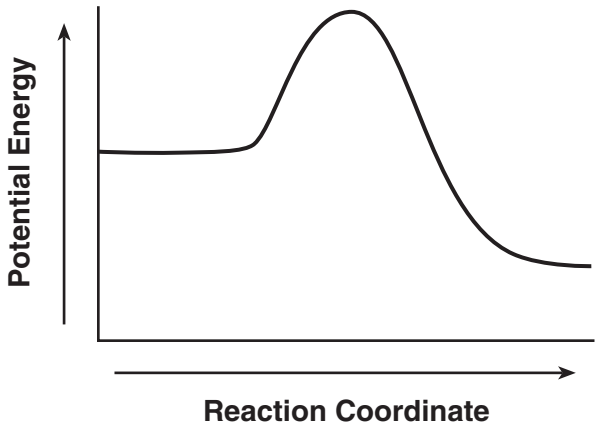
Diamond has atoms bonded strongly in a three-dimensional network. Graphite has atoms that are held weakly between layers.

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

combustion

80 [1] Allow 1 credit.

Example of a 1-credit response:



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

$^{144}_{56}Ba$

barium-144

82 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

A battery is part of the cell and is providing energy that causes the reaction.

Electricity is used to operate the cell.

83 [1] Allow 1 credit for –2 to 0.

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

Litmus turns blue when a sufficient amount of hydroxide ions are produced.

The reaction in test tube 2 produces OH^- ions that make this solution basic. Litmus is blue in a basic solution.

Regents Examination in Physical Setting/Chemistry

January 2010

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

The *Chart for Determining the Final Examination Score for the January 2010 Regents Examination in Physical Setting/Chemistry* will be posted on the Department's web site http://www.emsc.nysed.gov/osa/ on Thursday, January 28, 2010. 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.

Online Submission of 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

January 2010 Physical Setting/Chemistry			
Question Numbers			
Key Ideas/Performance Indicators	Part A	Part B	Part C
Standard 1			
Math Key Idea 1		32, 42, 43, 51, 52, 56, 62	68, 73, 74, 78
Math Key Idea 2			72
Math Key Idea 3		31, 32, 36, 40, 43, 52, 56	68, 70, 81, 83
Science Inquiry Key Idea 1		45, 47, 54, 59	75, 77, 78
Science Inquiry Key Idea 2			
Science Inquiry Key Idea 3		31, 34, 38, 39, 47, 50, 53, 54, 57, 59, 61, 63, 65	69, 70, 77, 80, 82, 83, 84
Engineering Design Key Idea 1			
Standard 2			
Key Idea 1			
Key Idea 2			
Key Idea 3			
Standard 6			
Key Idea 1		38, 41	
Key Idea 2			
Key Idea 3			
Key Idea 4			
Key Idea 5			
Standard 7			
Key Idea 1			
Key Idea 2			
Standard 4 Process Skills			
Key Idea 3		33, 34, 35, 36, 37, 39, 40, 42, 43, 44, 46, 48, 50, 51, 55, 56, 58, 60, 64	68, 69, 70, 71, 76, 79, 82, 84
Key Idea 4		44, 49, 52, 54	80, 81
Key idea 5		38, 61	66, 67, 77, 78
Standard 4			
Key Idea 3	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 17, 18, 19, 22, 24, 25, 26, 27, 30	31, 32, 33, 34, 35, 36, 37, 39, 40, 43, 44, 45, 46, 47, 48, 50, 51, 55, 56, 57, 58, 59, 60, 64, 65	68, 69, 70, 71, 72, 73, 74, 75, 76, 79, 82, 83, 84
Key Idea 4	20, 21, 28, 29	41, 42, 49, 52, 53, 54	80, 81
Key Idea 5	11, 12, 13, 14, 15, 16, 23	61, 62, 63	66, 67, 77, 78
Reference Tables			
2002 Edition	1, 2, 4, 7, 8, 12, 13, 15, 26, 27, 29	31, 32, 34, 35, 39, 42, 43, 46, 47, 50, 51, 52, 57, 58, 61, 63	67, 68, 71, 76, 81, 83, 84

University of the State of New York
State Education Department

Regents Examination in Physical Setting/Chemistry
January 2010

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

Raw Score	Scale Score	Raw Score	Scale Score	Raw Score	Scale Score	Raw Score	Scale Score
85	100	63	74	41	59	19	39
84	98	62	74	40	59	18	37
83	97	61	73	39	58	17	36
82	95	60	72	38	57	16	34
81	93	59	71	37	56	15	33
80	92	58	71	36	56	14	31
79	91	57	70	35	55	13	30
78	89	56	69	34	54	12	28
77	88	55	69	33	53	11	26
76	87	54	68	32	52	10	24
75	86	53	67	31	51	9	22
74	85	52	67	30	51	8	20
73	83	51	66	29	50	7	18
72	82	50	66	28	49	6	16
71	81	49	65	27	48	5	14
70	80	48	64	26	47	4	11
69	80	47	63	25	46	3	9
68	79	46	63	24	45	2	6
67	78	45	62	23	43	1	3
66	77	44	61	22	42	0	0
65	76	43	61	21	41		
64	75	42	60	20	40		

To determine the student's final examination score, find the student's total test raw score in the column labeled "Raw Score" and then locate the scale score that corresponds to that raw score. The scale 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 scale score of 60 through 64 **must** be scored a second time to ensure the accuracy of the score. 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 scale 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 Regents Examination in Physical Setting/Chemistry.