The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

PHYSICAL SETTING
CHEMISTRY

Wednesday, June 16, 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.

The answers to *all* questions in this examination are to be written in your separate answer booklet. Be sure to fill in the heading on the front of 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 in your answer booklet.

When you have completed the examination, you must sign the statement printed on the first page of your answer booklet, 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 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 in your answer booklet 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 The gold foil experiment led to the conclusion that each atom in the foil was composed mostly of empty space because most alpha particles directed at the foil

(1) passed through the foil
(2) remained trapped in the foil
(3) were deflected by the nuclei in gold atoms
(4) were deflected by the electrons in gold atoms

2 Which subatomic particles are located in the nucleus of a carbon atom?

(1) protons, only
(2) neutrons, only
(3) protons and neutrons
(4) protons and electrons

3 Which part of a helium atom is positively charged?

(1) electron
(2) neutron
(3) nucleus
(4) orbital

4 The mass of a proton is approximately equal to the mass of

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

5 At STP, solid carbon can exist as diamond and graphite. Compared to the molecular structure and chemical properties of diamond, graphite has

(1) a different molecular structure and different properties
(2) a different molecular structure and the same properties
(3) the same molecular structure and different properties
(4) the same molecular structure and the same properties

6 Which Group 14 element is classified as a metal?

(1) carbon
(2) germanium
(3) silicon
(4) tin

7 The light emitted from a flame is produced when electrons in an excited state

(1) absorb energy as they move to lower energy states
(2) absorb energy as they move to higher energy states
(3) release energy as they move to lower energy states
(4) release energy as they move to higher energy states

8 An atom of which element has the greatest attraction for electrons in a chemical bond?

(1) As
(2) Ga
(3) Ge
(4) Se

9 Which formula represents a polar molecule?

(1) H_2
(2) H_2O
(3) CO_2
(4) CCl_4

10 Two categories of compounds are

(1) covalent and molecular
(2) covalent and metallic
(3) ionic and molecular
(4) ionic and metallic

11 Which type of bond is found between atoms of solid cobalt?

(1) nonpolar covalent
(2) polar covalent
(3) metallic
(4) ionic

12 Which equation represents sublimation?

(1) $I_2(s) \rightarrow I_2(g)$
(2) $I_2(s) \rightarrow I_2(\ell)$
(3) $I_2(\ell) \rightarrow I_2(g)$
(4) $I_2(\ell) \rightarrow I_2(s)$

13 Which sample of ethanol has particles with the highest average kinetic energy?

(1) 10.0 mL of ethanol at 25°C
(2) 10.0 mL of ethanol at 55°C
(3) 100.0 mL of ethanol at 35°C
(4) 100.0 mL of ethanol at 45°C

14 The molarity of an aqueous solution of NaCl is defined as the

(1) grams of NaCl per liter of water
(2) grams of NaCl per liter of solution
(3) moles of NaCl per liter of water
(4) moles of NaCl per liter of solution

15 A real gas behaves *least* like an ideal gas under the conditions of

(1) low temperature and low pressure
(2) low temperature and high pressure
(3) high temperature and low pressure
(4) high temperature and high pressure

16 Which sample of matter can be separated into different substances by physical means?

(1) LiCl(aq)
(2) LiCl(s)
(3) $NH_3(g)$
(4) $NH_3(\ell)$

17 At STP, 1.0 liter of helium contains the same total number of atoms as

(1) 1.0 L of Ne
(2) 2.0 L of Kr
(3) 0.5 L of Rn
(4) 1.5 L of Ar

18 Which statement describes the particles of an ideal gas?

(1) The particles move in well-defined, circular paths.
(2) When the particles collide, energy is lost.
(3) There are forces of attraction between the particles.
(4) The volume of the particles is negligible.

19 A chemical reaction between iron atoms and oxygen molecules can only occur if

(1) the particles are heated
(2) the atmospheric pressure decreases
(3) there is a catalyst present
(4) there are effective collisions between the particles

20 Given the equation representing a phase change at equilibrium:

$$H_2O(s) \rightleftharpoons H_2O(\ell)$$

Which statement describes this equilibrium?

(1) The $H_2O(s)$ melts faster than the $H_2O(\ell)$ freezes.
(2) The $H_2O(\ell)$ freezes faster than the $H_2O(s)$ melts.
(3) The mass of $H_2O(s)$ must equal the mass of $H_2O(\ell)$.
(4) The mass of $H_2O(\ell)$ and the mass of $H_2O(s)$ each remain constant.

21 A molecule of an organic compound contains at least one atom of

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

22 In a chemical reaction, the difference between the potential energy of the products and the potential energy of the reactants is equal to the

(1) activation energy
(2) entropy of the system
(3) heat of fusion
(4) heat of reaction

23 A carbon-carbon triple bond is found in a molecule of

(1) butane
(2) butanone
(3) butene
(4) butyne

24 Which statement describes one characteristic of an operating electrolytic cell?

(1) It produces electrical energy.
(2) It requires an external energy source.
(3) It uses radioactive nuclides.
(4) It undergoes a spontaneous redox reaction.

25 Which compound when dissolved in water is an Arrhenius acid?

(1) CH_3OH
(2) HCl
(3) NaCl
(4) NaOH

26 An acid can be defined as an

(1) H^+ acceptor
(2) H^+ donor
(3) OH^- acceptor
(4) OH^- donor

27 Which nuclear emission has no charge and no mass?

(1) alpha particle
(2) beta particle
(3) gamma ray
(4) positron

28 During which process can 10.0 milliliters of a 0.05 M HCl(aq) solution be used to determine the unknown concentration of a given volume of NaOH(aq) solution?

(1) evaporation
(2) distillation
(3) filtration
(4) titration

29 Which radioisotope is matched with its decay mode?

(1) H-3 and γ
(2) K-42 and β^+
(3) N-16 and α
(4) P-32 and β^-

30 Which reaction is accompanied by the release of the greatest amount of energy?

(1) combustion of 10. g of propane
(2) electrolysis of 10. g of water
(3) nuclear fission of 10. g of uranium
(4) oxidation of 10. g of iron

Part B–1

Answer all questions in this part.

Directions (31–50): For *each* statement or question, write in your answer booklet 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 The total number of protons, electrons, and neutrons in each of four different atoms are shown in the table below.

Subatomic Particles in Four Different Atoms

Atom	Total Number of Protons	Total Number of Electrons	Total Number of Neutrons
A	6	6	7
D	6	6	8
X	7	7	8
Z	8	8	9

Which two atoms are isotopes of the same element?

(1) *A* and *D*
(2) *A* and *Z*
(3) *X* and *D*
(4) *X* and *Z*

32 Which Lewis electron-dot diagram represents an atom in the ground state for a Group 13 element?

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

33 Which element forms a compound with chlorine with the general formula *M*Cl?

(1) Rb
(2) Ra
(3) Re
(4) Rn

34 A sample of an element has a mass of 34.261 grams and a volume of 3.8 cubic centimeters. To which number of significant figures should the calculated density of the sample be expressed?

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

35 Which characteristics both generally *decrease* when the elements in Period 3 on the Periodic Table are considered in order from left to right?

(1) nonmetallic properties and atomic radius
(2) nonmetallic properties and ionization energy
(3) metallic properties and atomic radius
(4) metallic properties and ionization energy

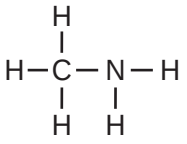
36 Which formula is both a molecular and an empirical formula?

(1) $C_6H_{12}O_6$
(2) $C_2H_4O_2$
(3) C_3H_8O
(4) C_4H_8

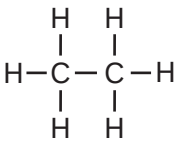
37 An atom of argon in the ground state tends *not* to bond with an atom of a different element because the argon atom has

(1) more protons than neutrons
(2) more neutrons than protons
(3) a total of two valence electrons
(4) a total of eight valence electrons

38 Which formula represents a molecule having a nonpolar covalent bond?



(1)



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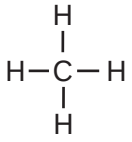

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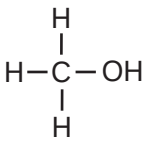
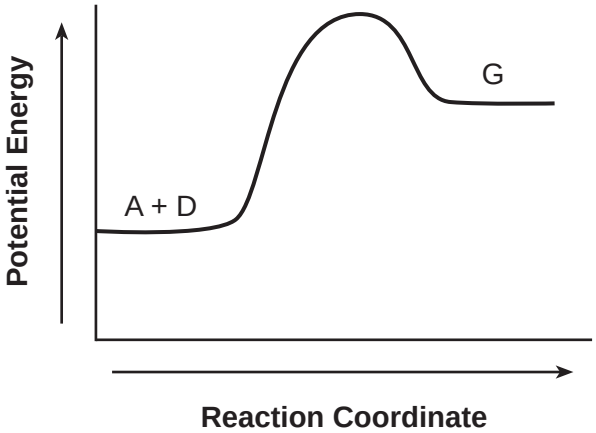


(4)

39 Which compound has the *lowest* vapor pressure at 50°C?

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

40 Given the potential energy diagram and equation representing the reaction between substances *A* and *D*:



A + D ⟶ G

According to Table *I*, substance *G* could be

(1) HI(g)
(2) $H_2O(g)$
(3) $CO_2(g)$
(4) $C_2H_6(g)$

41 A sample of gas confined in a cylinder with a movable piston is kept at constant pressure. The volume of the gas doubles when the temperature of the gas is changed from

(1) 400. K to 200. K
(2) 200. K to 400. K
(3) 400.°C to 200.°C
(4) 200.°C to 400.°C

42 According to Table *F*, which compound is soluble in water?

(1) barium phosphate
(2) calcium sulfate
(3) silver iodide
(4) sodium perchlorate

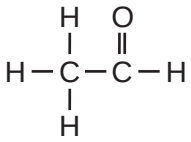
43 Given the equation representing a system at equilibrium:

$$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g) + \text{energy}$$

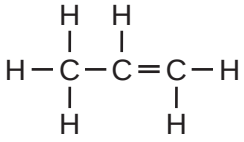
Which changes occur when the temperature of this system is *decreased*?

(1) The concentration of $H_2(g)$ increases and the concentration of $N_2(g)$ increases.
(2) The concentration of $H_2(g)$ decreases and the concentration of $N_2(g)$ increases.
(3) The concentration of $H_2(g)$ decreases and the concentration of $NH_3(g)$ decreases.
(4) The concentration of $H_2(g)$ decreases and the concentration of $NH_3(g)$ increases.

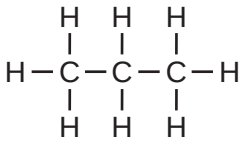
44 Which formula represents an unsaturated hydrocarbon?



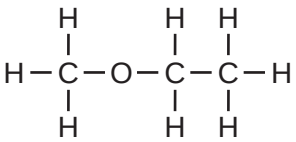
(1)



(3)



(2)



(4)

45 Which half-reaction equation represents the reduction of an iron(II) ion?

(1) $Fe^{2+} \rightarrow Fe^{3+} + e^-$
(2) $Fe^{2+} + 2e^- \rightarrow Fe$
(3) $Fe^{3+} + e^- \rightarrow Fe^{2+}$
(4) $Fe \rightarrow Fe^{2+} + 2e^-$

46 Which metal is more active than H_2?

(1) Ag
(2) Au
(3) Cu
(4) Pb

47 Given the balanced ionic equation representing the reaction in an operating voltaic cell:

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

The flow of electrons through the external circuit in this cell is from the

(1) Cu anode to the Zn cathode
(2) Cu cathode to the Zn anode
(3) Zn anode to the Cu cathode
(4) Zn cathode to the Cu anode

48 Which laboratory test result can be used to determine if KCl(s) is an electrolyte?

(1) pH of KCl(aq)
(2) pH of KCl(s)
(3) electrical conductivity of KCl(aq)
(4) electrical conductivity of KCl(s)

49 Which compound is produced when HCl(aq) is neutralized by $Ca(OH)_2(aq)$?

(1) $CaCl_2$
(2) CaH_2
(3) HClO
(4) $HClO_2$

50 Which nuclides are used to date the remains of a once-living organism?

(1) C-14 and C-12
(2) Co-60 and Co-59
(3) I-131 and Xe-131
(4) U-238 and Pb-206

Part B–2

Answer all questions in this part.

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

51 What is the total number of electron pairs shared between the carbon atom and one of the oxygen atoms in a carbon dioxide molecule? [1]

52 Explain, in terms of subatomic particles, why the radius of a chloride ion is larger than the radius of a chlorine atom. [1]

53 Explain, in terms of valence electrons, why the bonding in magnesium oxide, MgO, is similar to the bonding in barium chloride, $BaCl_2$. [1]

Base your answers to questions 54 and 55 on the information below.

An atom in an excited state has an electron configuration of 2-7-2.

54 Explain, in terms of subatomic particles, why this excited atom is electrically neutral. [1]

55 Write the electron configuration of this atom in the ground state. [1]

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

Glycine, NH_2CH_2COOH, is an organic compound found in proteins. Acetamide, CH_3CONH_2, is an organic compound that is an excellent solvent. Both glycine and acetamide consist of the same four elements, but the compounds have different functional groups.

56 In the space *in your answer booklet*, calculate the gram-formula mass of glycine. Your response must include *both* a numerical setup and the calculated result. [2]

57 Identify *one* functional group in a glycine molecule. [1]

58 In the space *in your answer booklet*, draw a structural formula for acetamide. [1]

Base your answers to questions 59 through 61 on the information below.

Heat is added to a 200.-gram sample of $H_2O(s)$ to melt the sample at 0°C. Then the resulting $H_2O(\ell)$ is heated to a final temperature of 65°C.

59 Determine the total amount of heat required to completely melt the sample. [1]

60 In the space *in your answer booklet*, show a numerical setup for calculating the total amount of heat required to raise the temperature of the $H_2O(\ell)$ from 0°C to its final temperature. [1]

61 Compare the amount of heat required to vaporize a 200.-gram sample of $H_2O(\ell)$ at its boiling point to the amount of heat required to melt a 200.-gram sample of $H_2O(s)$ at its melting point. [1]

Base your answers to questions 62 through 64 on the information below.

When a uranium-235 nucleus absorbs a slow-moving neutron, different nuclear reactions may occur. One of these possible reactions is represented by the complete, balanced equation below.

Equation 1: $^{235}_{92}U + ^{1}_{0}n \rightarrow ^{92}_{36}Kr + ^{142}_{56}Ba + 2^{1}_{0}n + \text{energy}$

For this reaction, the sum of the masses of the products is slightly less than the sum of the masses of the reactants. Another possible reaction of U-235 is represented by the incomplete, balanced equation below.

Equation 2: $^{235}_{92}U + ^{1}_{0}n \rightarrow ^{92}_{38}Sr + \_\_\_\_\_ + 2^{1}_{0}n + \text{energy}$

62 Identify the type of nuclear reaction represented by equation 1. [1]

63 Write a notation for the missing product in equation 2. [1]

64 Determine the half-life of krypton-92 if only 6.0 milligrams of an original 96.0-milligram sample remains unchanged after 7.36 seconds. [1]

Part C

Answer all questions in this part.

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

Base your answers to questions 65 through 68 on the information below.

In a laboratory, a student makes a solution by completely dissolving 80.0 grams of $KNO_3(s)$ in 100.0 grams of hot water. The resulting solution has a temperature of 60.°C. The room temperature in the laboratory is 22°C.

65 Classify, in terms of saturation, the type of solution made by the student. [1]

66 Compare the boiling point of the solution at standard pressure to the boiling point of water at standard pressure. [1]

67 Describe the direction of heat flow between the solution made by the student and the air in the laboratory. [1]

68 Describe a laboratory procedure that can be used to recover the solid solute from the aqueous solution. [1]

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

At room temperature, a reaction occurs when $KIO_3(aq)$ is mixed with $NaHSO_3(aq)$ that contains a small amount of starch. The colorless reaction mixture turns dark blue after a period of time that depends on the concentration of the reactants.

In a laboratory, 12 drops of a 0.02 M $NaHSO_3(aq)$ solution containing starch were placed in each of six test tubes. A different number of drops of 0.02 M $KIO_3(aq)$ and enough water to maintain a constant volume were added to each test tube and the time for the dark-blue color to appear was measured. The data were recorded in the table below.

Data Table

Test Tube	A	B	C	D	E	F
Number of Drops of 0.02 M KIO_3(aq)	2	4	6	8	10	12
Time for Dark-Blue Color to Appear (s)	210.	88	49	39	33	27

69 On the grid *in your answer booklet:*

- Mark an appropriate scale on the axis labeled "Time (s)." [1]
- Plot the data from the data table. Circle and connect the points. [1]

70 State how increasing the number of drops of 0.02 M $KIO_3(aq)$ used in the reaction affects the rate of reaction. [1]

71 Identify *one* factor, other than the concentration of the reactants, that would affect the rate of this reaction. [1]

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

The Solvay process is a multistep industrial process used to produce washing soda, $Na_2CO_3(s)$. In the last step of the Solvay process, $NaHCO_3(s)$ is heated to 300°C, producing washing soda, water, and carbon dioxide. This reaction is represented by the balanced equation below.

$$2NaHCO_3(s) + \text{heat} \rightarrow Na_2CO_3(s) + H_2O(g) + CO_2(g)$$

72 Write the IUPAC name for washing soda. [1]

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

74 State evidence that indicates the entropy of the products is greater than the entropy of the reactant. [1]

75 Determine the total mass of washing soda produced if 3360. kilograms of $NaHCO_3$ reacts completely to produce 360. kilograms of H_2O and 880. kilograms of CO_2. [1]

Base your answers to questions 76 through 79 on the information below.

In liquid water, an equilibrium exists between $H_2O(\ell)$ molecules, $H^+(aq)$ ions, and $OH^-(aq)$ ions. A person experiencing acid indigestion after drinking tomato juice can ingest milk of magnesia to reduce the acidity of the stomach contents. Tomato juice has a pH value of 4. Milk of magnesia, a mixture of magnesium hydroxide and water, has a pH value of 10.

76 Complete the equation *in your answer booklet* for the equilibrium that exists in liquid water. [1]

77 Compare the hydrogen ion concentration in tomato juice to the hydrogen ion concentration in milk of magnesia. [1]

78 Identify the negative ion found in milk of magnesia. [1]

79 What is the color of thymol blue indicator when placed in a sample of milk of magnesia? [1]

Base your answers to questions 80 through 83 on the information below.

Two sources of copper are cuprite, which has the IUPAC name copper(I) oxide, and malachite, which has the formula $Cu_2CO_3(OH)_2$. Copper is used in home wiring and electric motors because it has good electrical conductivity. Other uses of copper not related to its electrical conductivity include coins, plumbing, roofing, and cooking pans. Aluminum is also used for cooking pans.

At room temperature, the electrical conductivity of a copper wire is 1.6 times greater than an aluminum wire with the same length and cross-sectional area. At room temperature, the heat conductivity of copper is 1.8 times greater than the heat conductivity of aluminum. At STP, the density of copper is 3.3 times greater than the density of aluminum.

80 Write the chemical formula of cuprite. [1]

81 Determine the oxidation number of oxygen in the carbonate ion found in malachite. [1]

82 Identify *one* physical property of copper that makes it a good choice for uses that are *not* related to electrical conductivity. [1]

83 Identify *one* physical property of aluminum that could make it a better choice than copper for a cooking pan. [1]

PS/CHEMISTRY

The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

PHYSICAL SETTING
CHEMISTRY

Wednesday, June 16, 2010 — 1:15 to 4:15 p.m., only

ANSWER BOOKLET

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

Teacher . . . . .

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

Answer all questions in this examination. Record your answers in this booklet.

Part	Maximum Score	Student's Score
A	30	
B–1	20	
B–2	15	
C	20	

Total Written Test Score (Maximum Raw Score: 85)

Final Score (from conversion chart)

Raters' Initials:

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

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

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

Part B–2

For Raters Only

51 _____ **51** ☐

52 _____

_____ **52** ☐

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53 _____

_____ **53** ☐

_____

54 _____

_____ **54** ☐

_____

55 _____ **55** ☐

For Raters Only

56

56

_____ **g/mol**

57 _____

57

58

58

59 _____ **J**

59

60

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61 _____

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63 _____

64 _____ **s**

For Raters Only

62 ☐

63 ☐

64 ☐

☐

Total Score for Part B–2

Part C

65 _____

66 _____

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68 _____

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For Raters Only

65 ☐

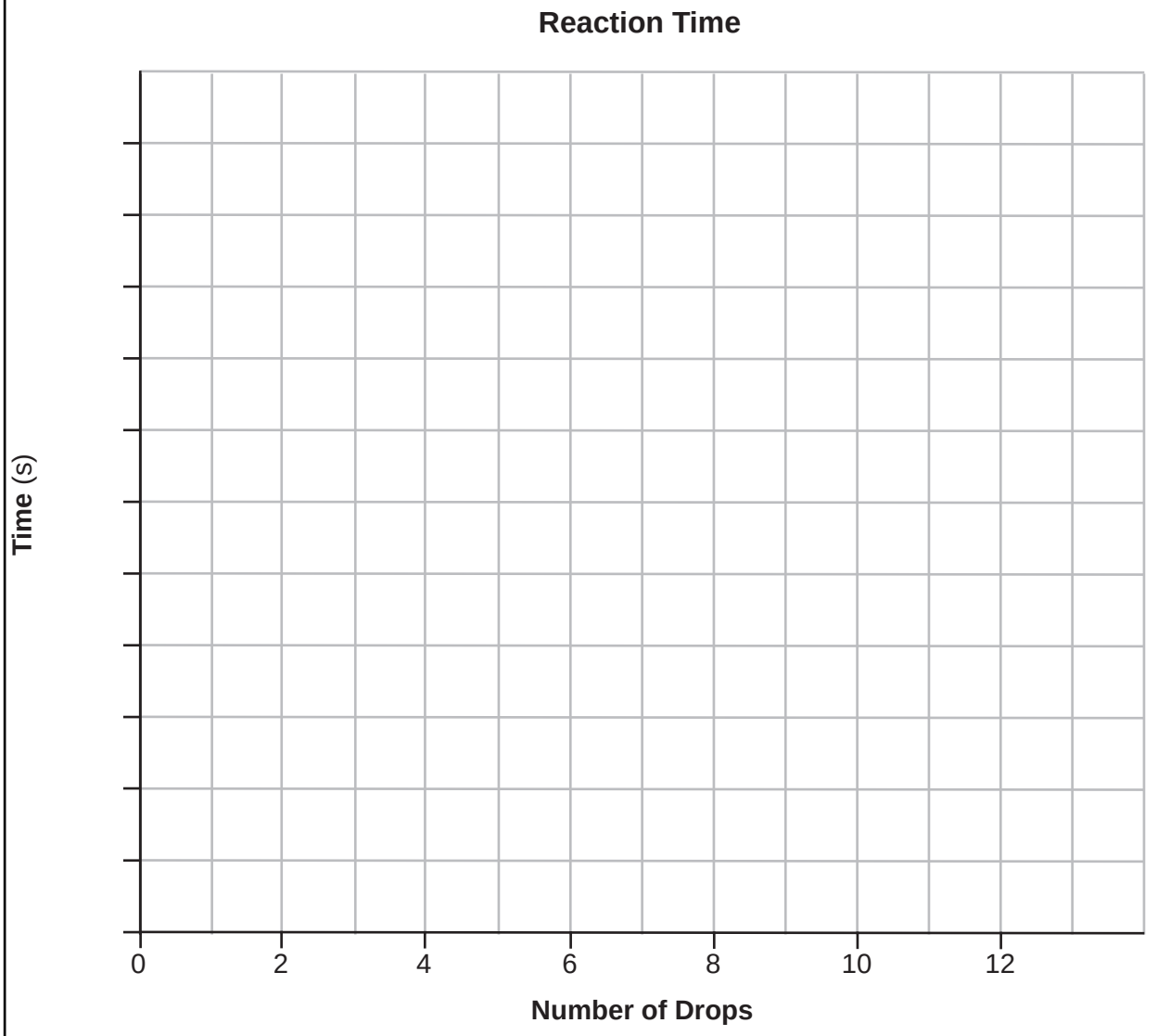
66 ☐

67 ☐

68 ☐

For Raters Only

69



69 ☐

70 _____

_____

70 ☐

71 _____

71 ☐

For Raters Only

72 _____ **72** ☐

73 _____ **73** ☐

74 _____ **74** ☐

_____

75 _____ **kg** **75** ☐

76 _____ $(\ell) \rightleftharpoons$ _____ (aq) + _____ (aq) **76** ☐

77 _____ **77** ☐

_____

78 _____ **78** ☐

79 _____ **79** ☐

80 _____ **80** ☐

81 _____ **81** ☐

82 _____ **82** ☐

83 _____ **83** ☐

_____

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

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

Directions to the Teacher

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

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 Wednesday, June 16, 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. On the front of the student's answer booklet, raters must enter their initials on the lines next to "Rater 1" or "Rater 2."

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 15 credits for this part. The student must answer all questions in this part.

51 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

2

two

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

A Cl^- ion has 18 electrons and 17 protons, so there is less attraction by the nucleus for the electron shells, allowing the electron shells to expand.

The radius of Cl^- is larger because the nucleus can't hold 18 electrons as close as it can hold 17 electrons.

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

The bonding in each compound involves a transfer of valence electrons from the metal to the nonmetal.

Both metals lose all of their valence electrons.

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

The number of protons equals the number of electrons.

The atom has 11 protons and 11 electrons.

55 [1] Allow 1 credit for 2-8-1.

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:

  (1)(14.0 g/mol) + (2)(12.0 g/mol) + (2)(16.0 g/mol) + (5)(1.0 g/mol)

  (1)(14) + (5)(1) + (2)(12) + (2)(16)

- Allow 1 credit for 75.0 g/mol *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.

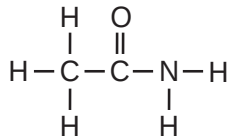
57 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

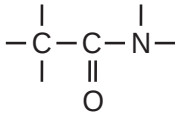
amine

— COOH

58 [1] Allow 1 credit.

Examples of 1-credit responses:





59 [1] Allow 1 credit. Significant figures do *not* need to be shown. Acceptable responses include, but are not limited to:

66 800 J

6.68×10^4 J

60 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

$q = (200.\ g)(4.18\ J/g\bullet°C)(65°C)$

$(200)(4.18)(65)$

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

The heat necessary to vaporize 200 grams of water is about seven times larger than the heat necessary to melt 200 grams of ice.

It takes more heat to vaporize the same amount of $H_2O(\ell)$.

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

fission

transmutation

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

$^{142}_{54}Xe$

xenon-142

64 [1] Allow 1 credit for 1.84 s. Significant figures do *not* need to be shown.

Part C

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

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

The solution made by the student is unsaturated.

unsaturated

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

The boiling point of the solution at standard pressure is higher than the boiling point of water at standard pressure.

Water boils at a lower temperature.

67 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

Heat flows from the solution to the air in the laboratory.

The air gains heat from the solution.

68 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

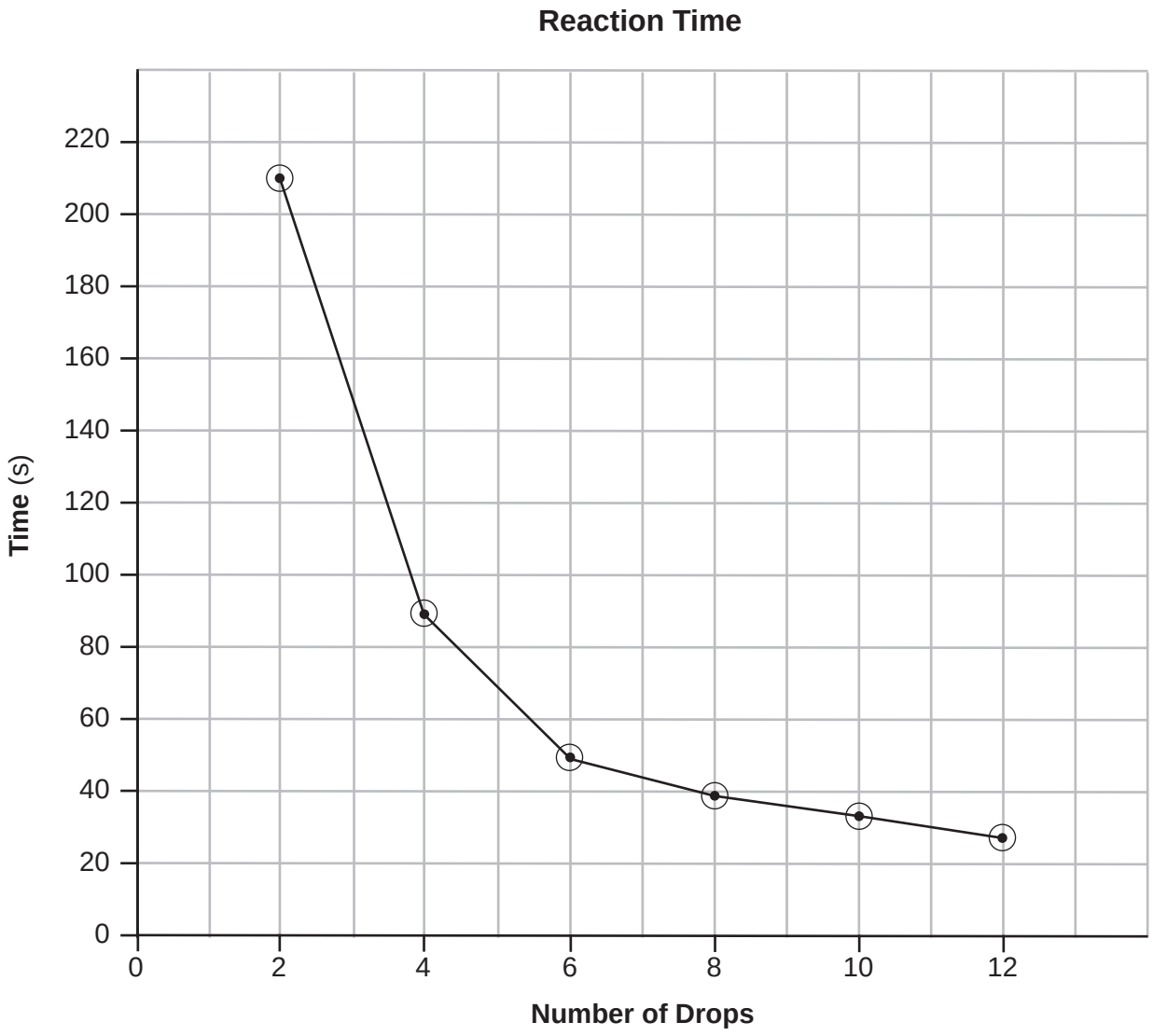
Gently heat the solution to evaporate the water until only solid KNO_3 remains.

Boil off the water.

69 [2] Allow a maximum of 2 credits, allocated as follows:

- Allow 1 credit for marking an appropriate scale on the axis labeled "Time (s)." An appropriate scale is linear and allows a trend to be seen.
- Allow 1 credit for correctly plotting all six points ± 0.3 grid space. Plotted points do *not* need to be circled or connected.

Example of a 2-credit response:



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

Increasing the number of drops of $KIO_3(aq)$ increases the rate of reaction.

The reaction takes less time if more drops of KIO_3 are used.

The reaction occurs faster.

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

the temperature of the reactants

a catalyst

72 [1] Allow 1 credit for sodium carbonate.

73 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

decomposition

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

The products of the reaction include two gases, while the reactant is a solid. The gases have greater entropy than the solid.

The $NaHCO_3(s)$ reacts to produce $H_2O(g)$ and $CO_2(g)$ that have greater disorder.

75 [1] Allow 1 credit for 2120. kg. Significant figures do *not* need to be shown.

76 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

$\underline{H_2O}(\ell) \rightleftharpoons \underline{H^+}(aq) + \underline{OH^-}(aq)$

$\underline{2H_2O}(\ell) \rightleftharpoons \underline{OH^-}(aq) + \underline{H_3O^+}(aq)$

$\underline{\text{water}}(\ell) \rightleftharpoons \underline{\text{hydrogen ion}}(aq) + \underline{\text{hydroxide ion}}(aq)$

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

The H^+ ion concentration in tomato juice is 10^6 times greater.

The hydrogen ion concentration in tomato juice is greater than that in milk of magnesia.

Milk of magnesia has a lower concentration of H_3O^+ ions.

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

$OH^-(aq)$

OH^-

hydroxide ion

79 [1] Allow 1 credit for blue.

80 [1] Allow 1 credit for Cu_2O.

81 [1] Allow 1 credit for –2.

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

Copper is very malleable.

good conductor of heat

high melting point

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

An aluminum pan has less mass than a copper pan of the same size because aluminum is less dense.

Aluminum is less dense than copper.

A Cu pan would weigh more.

Regents Examination in Physical Setting/Chemistry

June 2010

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

The *Chart for Determining the Final Examination Score for the June 2010 Regents Examination in Physical Setting/Chemistry* will be posted on the Department's web site http://www.emsc.nysed.gov/osa/ on Wednesday, June 16, 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

June 2010 Physical Setting/Chemistry			
Question Numbers			
K l a /P a c l ca	Pa A	Pa B	Pa C
Standard 1			
Ma K l a 1		34, 41, 59, 60, 64	65, 69
Ma K l a 2		33, 36, 39	70
Ma K l a 3		41, 56, 59, 60, 64	75, 80, 81
Sc c l K l a 1		37, 49, 52, 53, 54, 61	66, 71, 77, 82, 83
Sc c l K l a 2		48	68, 83
Sc c l K l a 3		31, 35, 40, 42, 43, 47, 51, 54, 55, 57, 62	72, 73, 74, 78, 80, 81, 82
E D K l a 1			
Standard 2			
K l a 1		42	
K l a 2			
K l a 3			
Standard 6			
K l a 1			67
K l a 2		32, 51	76
K l a 3			77
K l a 4			
K l a 5			70
Standard 7			
K l a 1			83
K l a 2			
Standard 4 Process Skills			
K l a 3		32, 33, 35, 36, 41, 43, 45, 46, 47, 49, 55, 56, 58	65, 66, 73, 74, 75, 76, 79
K l a 4		40, 44, 50, 59, 60, 61, 63, 64	
K a 5		38, 53	
Standard 4			
K l a 3	1, 2, 3, 4, 5, 6, 7, 14, 15, 16, 17, 18, 19, 20, 22, 24, 25, 26, 27, 28	31, 33, 34, 35, 36, 41, 42, 43, 44, 45, 46, 47, 48, 49, 54, 55, 56, 57, 58	65, 66, 67, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83
K l a 4	12, 13, 21, 29	39, 40, 50, 59, 60, 61, 62, 63, 64	67
K l a 5	5, 8, 9, 10, 11, 23, 30	32, 37, 38, 51, 52, 53	
Reference Tables			
2002 E	4, 6, 8, 11, 14, 23, 25, 27, 29	32, 33, 35, 37, 39, 40, 41, 42, 44, 46, 49, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 63, 64	65, 72, 78, 79, 80, 81, 83

University of the State of New York
State Education Department

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

To determine the student's final examination score, find the student's total test raw score in the column labeled "Raw Score" and then locate the 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.