The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

PHYSICAL SETTING
CHEMISTRY

Wednesday, August 18, 2010 — 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.

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 What is the total number of valence electrons in a calcium atom in the ground state?

(1) 8 (3) 18
(2) 2 (4) 20

2 Which subatomic particles are located in the nucleus of an He-4 atom?

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

3 In the late 1800s, experiments using cathode ray tubes led to the discovery of the

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

4 The atomic mass of titanium is 47.88 atomic mass units. This atomic mass represents the

(1) total mass of all the protons and neutrons in an atom of Ti
(2) total mass of all the protons, neutrons, and electrons in an atom of Ti
(3) weighted average mass of the most abundant isotope of Ti
(4) weighted average mass of all the naturally occurring isotopes of Ti

5 An atom of which element has the largest atomic radius?

(1) Fe (3) Si
(2) Mg (4) Zn

6 Which element requires the *least* amount of energy to remove the most loosely held electron from a gaseous atom in the ground state?

(1) bromine (3) sodium
(2) calcium (4) silver

7 A balanced equation representing a chemical reaction can be written using

(1) chemical formulas and mass numbers
(2) chemical formulas and coefficients
(3) first ionization energies and mass numbers
(4) first ionization energies and coefficients

8 Every water molecule has two hydrogen atoms bonded to one oxygen atom. This fact supports the concept that elements in a compound are

(1) chemically combined in a fixed proportion
(2) chemically combined in proportions that vary
(3) physically mixed in a fixed proportion
(4) physically mixed in proportions that vary

9 The percent composition by mass of nitrogen in NH_4OH (gram-formula mass = 35 grams/mole) is equal to

(1) $\frac{4}{35} \times 100$ (3) $\frac{35}{14} \times 100$

(2) $\frac{14}{35} \times 100$ (4) $\frac{35}{4} \times 100$

10 Which Group 15 element exists as diatomic molecules at STP?

(1) phosphorus (3) bismuth
(2) nitrogen (4) arsenic

11 What is the total number of electrons shared in a double covalent bond?

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

12 Given the balanced equation representing a reaction:

$$Br_2 + \text{energy} \rightarrow Br + Br$$

Which statement describes the energy change and bonds in this reaction?

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

13 Which substance can *not* be broken down by a chemical change?

(1) methane
(2) propanal
(3) tungsten
(4) water

14 Object *A* at 40.°C and object *B* at 80.°C are placed in contact with each other. Which statement describes the heat flow between the objects?

(1) Heat flows from object *A* to object *B*.
(2) Heat flows from object *B* to object *A*.
(3) Heat flows in both directions between the objects.
(4) No heat flow occurs between the objects.

15 Which unit can be used to express the concentration of a solution?

(1) L/s
(2) J/g
(3) ppm
(4) kPa

16 Which formula represents a mixture?

(1) $C_6H_{12}O_6(\ell)$
(2) $C_6H_{12}O_6(s)$
(3) LiCl(aq)
(4) LiCl(s)

17 Which sample has particles with the *lowest* average kinetic energy?

(1) 1.0 g of I_2 at 50.°C
(2) 2.0 g of I_2 at 30.°C
(3) 7.0 g of I_2 at 40.°C
(4) 9.0 g of I_2 at 20.°C

18 Which gas sample at STP has the same total number of molecules as 2.0 liters of $CO_2(g)$ at STP?

(1) 5.0 L of $CO_2(g)$
(2) 2.0 L of $Cl_2(g)$
(3) 3.0 L of $H_2S(g)$
(4) 6.0 L of He(g)

19 Petroleum can be separated by distillation because the hydrocarbons in petroleum are

(1) elements with identical boiling points
(2) elements with different boiling points
(3) compounds with identical boiling points
(4) compounds with different boiling points

20 Which compound is insoluble in water?

(1) KOH
(2) NH_4Cl
(3) Na_3PO_4
(4) $PbSO_4$

21 A gas sample is at 25°C and 1.0 atmosphere. Which changes in temperature and pressure will cause this sample to behave more like an ideal gas?

(1) decreased temperature and increased pressure
(2) decreased temperature and decreased pressure
(3) increased temperature and increased pressure
(4) increased temperature and decreased pressure

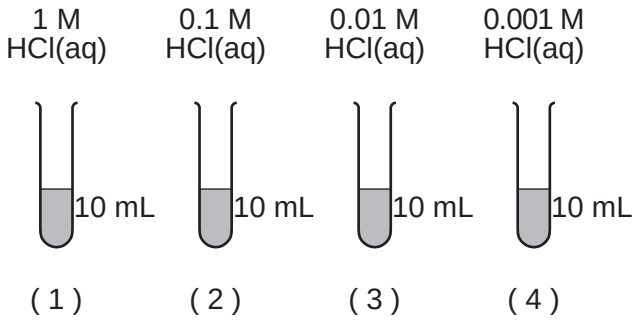
22 The isotopes K-37 and K-42 have the same

(1) decay mode
(2) bright-line spectrum
(3) mass number for their atoms
(4) total number of neutrons in their atoms

23 Which element is present in all organic compounds?

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

24 Each of four test tubes contains a different concentration of HCl(aq) at 25°C. A 1-gram cube of Zn is added to each test tube. In which test tube is the reaction occurring at the fastest rate?



25 Which energy conversion occurs during the operation of an electrolytic cell?

(1) chemical energy to electrical energy
(2) electrical energy to chemical energy
(3) nuclear energy to electrical energy
(4) electrical energy to nuclear energy

26 Which compound is an Arrhenius acid?

(1) CaO
(2) HCl
(3) K_2O
(4) NH_3

27 Based on the results of testing colorless solutions with indicators, which solution is most acidic?

(1) a solution in which bromthymol blue is blue
(2) a solution in which bromcresol green is blue
(3) a solution in which phenolphthalein is pink
(4) a solution in which methyl orange is red

28 According to one acid-base theory, water acts as an acid when an H_2O molecule

(1) accepts an H^+
(2) donates an H^+
(3) accepts an H^-
(4) donates an H^-

29 In which type of reaction is an atom of one element converted to an atom of a different element?

(1) decomposition
(2) neutralization
(3) saponification
(4) transmutation

30 Which nuclide is listed with its half-life and decay mode?

(1) K-37, 1.24 h, α
(2) N-16, 7.2 s, β^-
(3) Rn-222, 1.6×10^3 y, α
(4) U-235, 7.1×10^8 y, β^-

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 table below shows the number of subatomic particles in atom *X* and in atom *Z*.

Subatomic Particles in Two Atoms

Atom	Number of Protons	Number of Neutrons	Number of Electrons
X	6	6	6
Z	6	7	6

Atom *X* and atom *Z* are isotopes of the element

(1) aluminum
(2) carbon
(3) magnesium
(4) nitrogen

32 The greatest composition by mass in an atom of $^{17}_{8}O$ is due to the total mass of its

(1) electrons
(2) neutrons
(3) positrons
(4) protons

33 The bond between which two atoms is most polar?

(1) Br and Cl
(2) Br and F
(3) I and Cl
(4) I and F

34 In the formula $X_2(SO_4)_3$, the *X* represents a metal. This metal could be located on the Periodic Table in

(1) Group 1
(2) Group 2
(3) Group 13
(4) Group 14

35 At STP, which element is solid, brittle, and a poor conductor of electricity?

(1) Al
(2) K
(3) Ne
(4) S

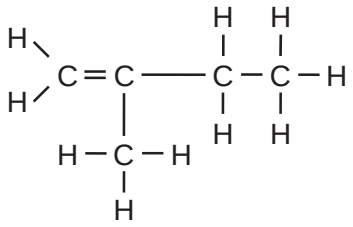
36 Given the balanced equation representing a reaction:

$$2NaCl(\ell) \rightarrow 2Na(\ell) + Cl_2(g)$$

A 1170.-gram sample of $NaCl(\ell)$ completely reacts, producing 460. grams of $Na(\ell)$. What is the total mass of $Cl_2(g)$ produced?

(1) 355 g
(2) 710. g
(3) 1420. g
(4) 1630. g

37 Given the formula representing a hydrocarbon:



The molecular formula and the empirical formula for this hydrocarbon are

(1) C_5H_{10} and CH_2
(2) C_5H_{10} and CH_3
(3) C_4H_8 and CH_2
(4) C_4H_8 and CH_3

38 Which element forms an ionic compound when it reacts with lithium?

(1) K (3) Kr
(2) Fe (4) Br

39 Given the formula representing a molecule:

$$H-C\equiv C-H$$

The molecule is

(1) symmetrical and polar
(2) symmetrical and nonpolar
(3) asymmetrical and polar
(4) asymmetrical and nonpolar

40 Which compound has both ionic and covalent bonds?

(1) CO_2 (3) NaI
(2) CH_3OH (4) Na_2CO_3

41 A cylinder with a movable piston contains a sample of gas having a volume of 6.0 liters at 293 K and 1.0 atmosphere. What is the volume of the sample after the gas is heated to 303 K, while the pressure is held at 1.0 atmosphere?

(1) 9.0 L (3) 5.8 L
(2) 6.2 L (4) 4.0 L

42 What is the minimum amount of heat required to completely melt 20.0 grams of ice at its melting point?

(1) 20.0 J (3) 6680 J
(2) 83.6 J (4) 45 200 J

43 As the temperature of a chemical reaction in the gas phase is increased, the rate of the reaction increases because

(1) fewer particle collisions occur
(2) more effective particle collisions occur
(3) the required activation energy increases
(4) the concentration of the reactants increases

44 The entropy of a sample of CO_2 increases as the CO_2 changes from

(1) gas to liquid (3) liquid to solid
(2) gas to solid (4) solid to gas

45 Which two factors must be equal when a chemical reaction reaches equilibrium?

(1) the concentration of the reactants and the concentration of the products
(2) the number of reactant particles and the number of product particles
(3) the rate of the forward reaction and the rate of the reverse reaction
(4) the mass of the reactants and the mass of the products

46 Which formula represents an unsaturated hydrocarbon?

(1) C_5H_{12} (3) C_7H_{16}
(2) C_6H_{14} (4) C_8H_{14}

47 The reaction between an organic acid and an alcohol produces

(1) an aldehyde (3) an ether
(2) a ketone (4) an ester

48 Which balanced equation represents a redox reaction?

(1) $AgNO_3(aq) + NaCl(aq) \rightarrow AgCl(s) + NaNO_3(aq)$
(2) $H_2CO_3(aq) \rightarrow H_2O(\ell) + CO_2(g)$
(3) $NaOH(aq) + HCl(aq) \rightarrow NaCl(aq) + H_2O(\ell)$
(4) $Mg(s) + 2HCl(aq) \rightarrow MgCl_2(aq) + H_2(g)$

49 A solution with a pH of 2.0 has a hydronium ion concentration ten times greater than a solution with a pH of

(1) 1.0 (3) 3.0
(2) 0.20 (4) 20.

50 Which isotope is used to treat cancer?

(1) C-14 (3) Co-60
(2) U-238 (4) Pb-206

Part B–2

Answer all questions in this part.

Directions (51–63): Record your answers in the spaces provided in your answer booklet. Some questions may require the use of the *Reference Tables for Physical Setting/Chemistry.*

51 *In your answer booklet*, write an electron configuration for a silicon atom in an excited state. [1]

Base your answers to questions 52 and 53 on the information below.

Densities of Group 14 Elements

Element	Density at STP (g/cm^3)
C	3.51
Si	2.33
Ge	5.32
Sn	7.31
Pb	11.35

52 Identify *one* element from this table for *each* type of element: metal, metalloid, and nonmetal. [1]

53 Calculate the volume of a tin block that has a mass of 95.04 grams at STP. Your response must include *both* a numerical setup and the calculated result. [2]

Base your answers to questions 54 through 56 on the elements in Group 2 on the Periodic Table.

54 State the general trend in first ionization energy for the elements in Group 2 as these elements are considered in order from top to bottom in the group. [1]

55 State, in terms of the number of electron shells, why the radius of a strontium atom in the ground state is larger than the radius of a magnesium atom in the ground state. [1]

56 Explain, in terms of atomic structure, why the elements in Group 2 have similar chemical properties. [1]

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

Heat is added to a sample of liquid water, starting at 80.°C, until the entire sample is a gas at 120.°C. This process, occurring at standard pressure, is represented by the balanced equation below.

$$H_2O(\ell) + \text{heat} \rightarrow H_2O(g)$$

57 In the box *in your answer booklet*, using the key, draw a particle diagram to represent *at least five* molecules of the product of this physical change at 120.°C. [2]

58 On the diagram *in your answer booklet*, complete the heating curve for this physical change. [1]

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

In the gold foil experiment, a thin sheet of gold was bombarded with alpha particles. Almost all the alpha particles passed straight through the foil. Only a few alpha particles were deflected from their original paths.

59 State *one* conclusion about atomic structure based on the observation that almost all alpha particles passed straight through the foil. [1]

60 Explain, in terms of charged particles, why some of the alpha particles were deflected. [1]

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

Some Properties of Three Compounds at Standard Pressure

Compound	Boiling Point (°C)	Solubility in 100. Grams of H_2O at 20.°C (g)
ammonia	–33.2	56
methane	–161.5	0.002
hydrogen chloride	–84.9	72

61 Convert the boiling point of hydrogen chloride at standard pressure to kelvins. [1]

62 Explain, in terms of molecular polarity, why hydrogen chloride is more soluble than methane in water at 20.°C and standard pressure. [1]

63 Explain, in terms of intermolecular forces, why ammonia has a higher boiling point than the other compounds in the table. [1]

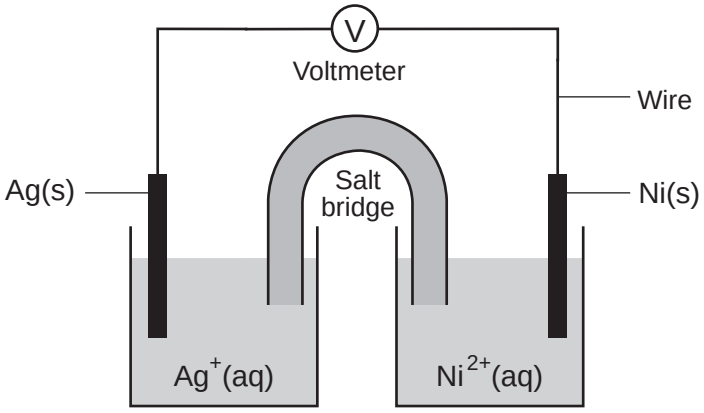
Part C

Answer all questions in this part.

Directions (64–81): 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 64 through 66 on the information below.

The diagram below represents an operating voltaic cell at 298 K and 1.0 atmosphere in a laboratory investigation. The reaction occurring in the cell is represented by the balanced ionic equation below.



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

64 Identify the anode in this cell. [1]

65 Determine the total number of moles of $Ni^{2+}(aq)$ ions produced when 4.0 moles of $Ag^+(aq)$ ions completely react in this cell. [1]

66 Write a balanced half-reaction equation for the reduction that occurs in this cell. [1]

Base your answers to questions 67 through 69 on the information below.

Gasoline is a mixture composed primarily of hydrocarbons such as isooctane, which is also known as 2,2,4-trimethylpentane.

Gasoline is assigned a number called an octane rating. Gasoline with an octane rating of 87 performs the same as a mixture that consists of 87% isooctane and 13% heptane.

An alternative fuel, E-85, can be used in some automobiles. This fuel is a mixture of 85% ethanol and 15% gasoline.

67 State the octane rating of a gasoline sample that performs the same as a mixture consisting of 92% isooctane and 8% heptane. [1]

68 In the space *in your answer booklet*, draw a structural formula for a molecule of 2,2,4-trimethylpentane. [1]

69 Identify the functional group in a molecule of ethanol in the alternative fuel E-85. [1]

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

Hydrogen peroxide, H_2O_2, is a water-soluble compound. The concentration of an aqueous hydrogen peroxide solution that is 3% by mass H_2O_2 is used as an antiseptic. When the solution is poured on a small cut in the skin, H_2O_2 reacts according to the balanced equation below.

$$2H_2O_2 \rightarrow 2H_2O + O_2$$

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

71 Calculate the total mass of H_2O_2 in 20.0 grams of an aqueous H_2O_2 solution that is used as an antiseptic. Your response must include *both* a numerical setup and the calculated result. [2]

72 Determine the gram-formula mass of H_2O_2. [1]

Base your answers to questions 73 and 74 on the information below.

The catalytic converter in an automobile changes harmful gases produced during fuel combustion to less harmful exhaust gases. In the catalytic converter, nitrogen dioxide reacts with carbon monoxide to produce nitrogen and carbon dioxide. In addition, some carbon monoxide reacts with oxygen, producing carbon dioxide in the converter. These reactions are represented by the balanced equations below.

Reaction 1: $2NO_2(g) + 4CO(g) \rightarrow N_2(g) + 4CO_2(g) + 1198.4\ kJ$

Reaction 2: $2CO(g) + O_2(g) \rightarrow 2CO_2(g) + 566.0\ kJ$

73 The potential energy diagram *in your answer booklet* represents reaction 1 without a catalyst. On the same diagram, draw a dashed line to indicate how potential energy changes when the reaction is catalyzed in the converter. [1]

74 Determine the oxidation number of carbon in *each* carbon compound in reaction 2. Your response must include *both* the sign and value of *each* oxidation number. [1]

Base your answers to questions 75 through 78 on the information below.

In one trial of an investigation, 50.0 milliliters of HCl(aq) of an unknown concentration is titrated with 0.10 M NaOH(aq). During the titration, the total volume of NaOH(aq) added and the corresponding pH value of the reaction mixture are measured and recorded in the table below.

Titration Data

Total Volume of NaOH(aq) Added (mL)	**pH Value of Reaction Mixture**
10.0	1.6
20.0	2.2
24.0	2.9
24.9	3.9
25.1	10.1
26.0	11.1
30.0	11.8

75 On the grid *in your answer booklet*, plot the data from the table. Circle and connect the points. [1]

76 Determine the total volume of NaOH(aq) added when the reaction mixture has a pH value of 7.0. [1]

77 Write a balanced equation that represents this neutralization reaction. [1]

78 In another trial, 40.0 milliliters of HCl(aq) is completely neutralized by 20.0 milliliters of this 0.10 M NaOH(aq). Calculate the molarity of the titrated acid in this trial. Your response must include *both* a numerical setup and the calculated result. [2]

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

The radioisotope uranium-238 occurs naturally in Earth's crust. The disintegration of this radioisotope is the first in a series of spontaneous decays.

The sixth decay in this series produces the radioisotope radon-222. The decay of radon-222 produces the radioisotope polonium-218 that has a half life of 3.04 minutes. Eventually, the stable isotope lead-206 is produced by the alpha decay of an unstable nuclide.

79 Explain, in terms of electron configuration, why atoms of the radioisotope produced by the sixth decay in the U-238 disintegration series do not readily react to form compounds. [1]

80 Complete the nuclear equation *in your answer booklet* for the decay of the unstable nuclide that produces Pb-206, by writing a notation for the missing nuclide. [1]

81 Determine the original mass of a sample of Po-218, if 0.50 milligram of the sample remains unchanged after 12.16 minutes. [1]

PS/CHEMISTRY

The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

PHYSICAL SETTING
CHEMISTRY

Wednesday, August 18, 2010 — 12:30 to 3:30 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 Metal: _____

Metalloid: _____ **52** ☐

Nonmetal: _____

53

53 ☐

_____ **cm^3**

54 _____

_____ **54** ☐

55 _____

_____ **55** ☐

56 _____

_____ **56** ☐

_____

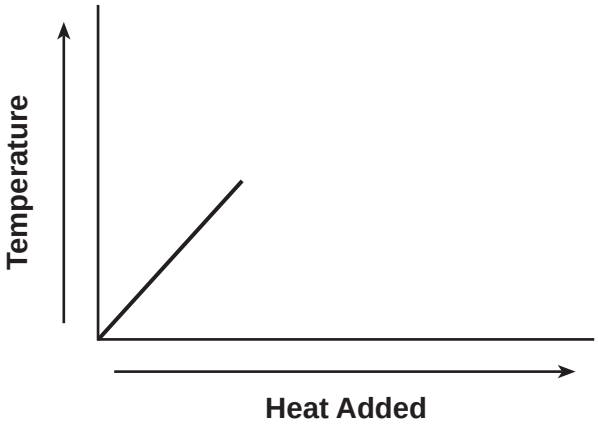
For Raters Only

57

Key
● = atom of hydrogen
○ = atom of oxygen

57

58



58

59 _____

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59

60 _____

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60

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61 _____ **K**

62 _____

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_____

63 _____

_____

_____

For Raters Only

61 ☐

62 ☐

63 ☐

☐

Total Score for Part B–2

Part C

For Raters Only

64 _____ | **64** ☐

65 _____ **mol** | **65** ☐

66 _____ | **66** ☐

67 _____ | **67** ☐

68 | **68** ☐

69 _____ | **69** ☐

70 _____ | **70** ☐

71 | **71** ☐

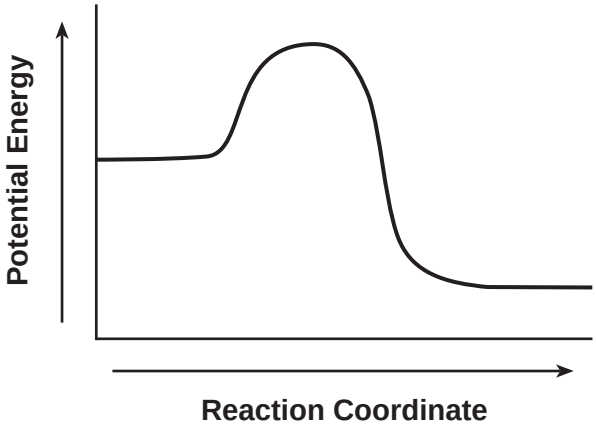
_____ **g**

72 _____ **g/mol** | **72** ☐

[OVER]

For Raters Only

73



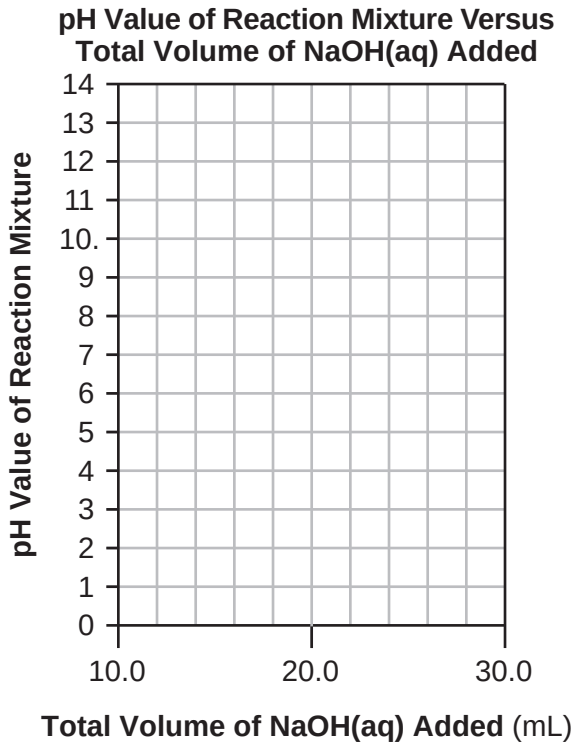
73 ☐

74 CO: _____

CO_2: _____

74 ☐

75



75 ☐

76 _____ **mL**

76 ☐

For Raters Only

77 _____ **77** ☐

78 **78** ☐

_____ **M**

79 _____ **79** ☐

_____

_____

80 _____ → $^{4}_{2}\mathrm{He} + {}^{206}_{82}\mathrm{Pb}$ **80** ☐

81 _____ **mg** **81** ☐

☐

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

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, August 18, 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:

2-7-5

1-8-5

2-8-3-1

52 [1] Allow 1 credit for a response indicating *one* metal, *one* metalloid, and *one* nonmetal.

Metal: tin *or* Sn *or* lead *or* Pb

Metalloid: silicon *or* Si *or* germanium *or* Ge

Nonmetal: carbon *or* C

53 [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:

$$7.31\ \text{g/cm}^3 = \frac{95.04\ \text{g}}{V}$$

$$\frac{95.04}{7.31}$$

- Allow 1 credit for 13.0 cm^3 *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.

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

As atomic number increases, first ionization energy decreases.

First ionization energy decreases.

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

A strontium atom in the ground state has two more electron shells than a magnesium atom in the ground state.

An Mg atom has fewer electron shells.

56 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

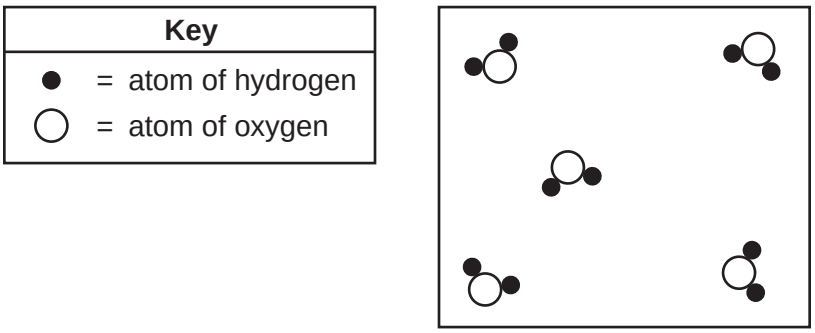
In the ground state, an atom of each element has two valence electrons.

The number of electrons in the outermost shell of each atom is the same.

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

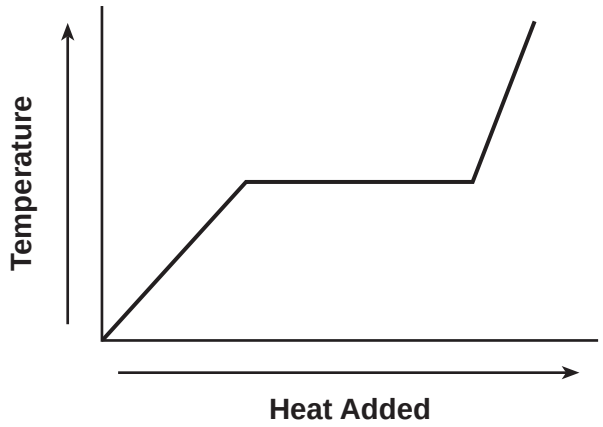
- Allow 1 credit for *at least five* water molecules.
- Allow 1 credit for all the particles drawn to represent the gas phase.

Example of a 2-credit response:



58 [1] Allow 1 credit for drawing a line horizontally to represent the phase change and extending the line with a positive slope to represent the gas phase, only.

Example of a 1-credit response:



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

Atoms are mostly empty space.

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

Alpha particles are positive and are repelled by the nucleus that is also positive.

Both protons and alpha particles are positively charged so they repel each other.

Protons and alpha particles have the same charge.

61 [1] Allow 1 credit for 188 K. Significant figures do *not* need to be shown.

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

Molecules of CH_4 are nonpolar, but molecules of HCl and H_2O are both polar.

Hydrogen chloride and water are both polar.

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

Ammonia has stronger intermolecular forces than either methane or hydrogen chloride.

Ammonia has hydrogen bonding.

Part C

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

64 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

Ni(s)

the nickel electrode

Note: Do *not* allow credit for $Ni^{2+}(aq)$.

65 [1] Allow 1 credit for 2.0 mol. Significant figures do *not* need to be shown.

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

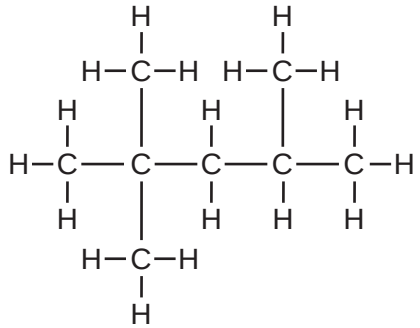
$Ag^+ + e^- \rightarrow Ag$

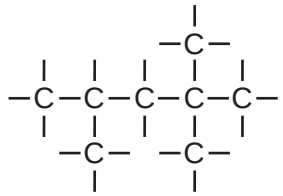
$2Ag^+ + 2e^- \rightarrow 2Ag$

67 [1] Allow 1 credit for 92.

68 [1] Allow 1 credit.

Examples of 1-credit responses:





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

−OH

alcohol

hydroxyl

Note: Do *not* allow credit for hydroxide or OH^-.

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

decomposition

redox

71 [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:

$$3 = \frac{x}{20.0\ \text{g}} \times 100$$

(20)(0.03)

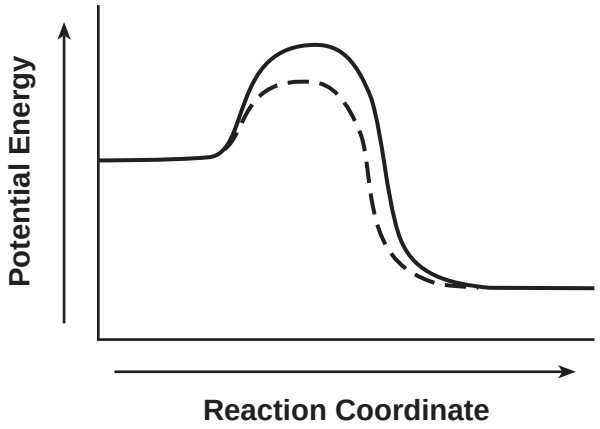
- Allow 1 credit for 0.6 g *or* for a response consistent with the student's numerical setup. Significant figures do *not* need to be shown.

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

72 [1] Allow 1 credit for 34 g/mol. Significant figures do *not* need to be shown.

73 [1] Allow 1 credit.

Example of a 1-credit response:

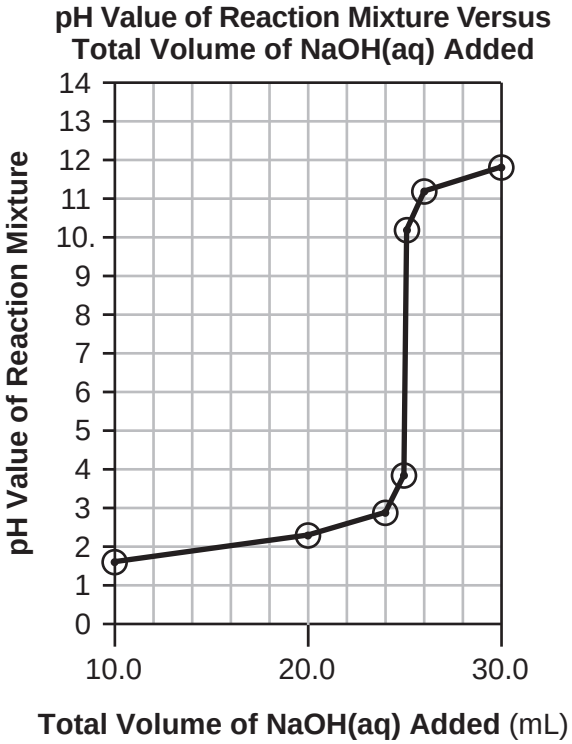


Note: Do *not* allow credit if the potential energy of the reactants or products is changed.

74 [1] Allow 1 credit for a response indicating +2 for carbon in CO and +4 for carbon in CO_2.

75 [1] Allow 1 credit for correctly plotting all seven points ± 0.3 grid space. Plotted points do *not* need to be circled or connected.

Example of a 1-credit response:



76 [1] Allow 1 credit for 25.0 mL ± 0.6 mL *or* for a response consistent with the student's graph. Significant figures do *not* need to be shown.

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

$NaOH(aq) + HCl(aq) \rightarrow NaCl(aq) + H_2O(\ell)$

$HCl + NaOH \rightarrow NaCl + H_2O$

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

$H_3O^+ + OH^- \rightarrow 2H_2O$

78 [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:

$(M)(40.0\ mL) = (0.10\ M)(20.0\ mL)$

$\frac{(0.1)(20)}{40}$

- Allow 1 credit for 0.050 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.

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

Radon-222 atoms have a complete outer shell of electrons and tend not to bond.

There are eight valence electrons in a radon atom.

octet in valence shell

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

$^{210}_{84}Po$

^{210}Po

Po-210

81 [1] Allow 1 credit for 8.00 mg. Significant figures do *not* need to be shown.

Regents Examination in Physical Setting/Chemistry

August 2010

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

The *Chart for Determining the Final Examination Score for the August 2010 Regents Examination in Physical Setting/Chemistry* will be posted on the Department's web site http://www.emsc.nysed.gov/osa/ on Wednesday, August 18, 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

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

University of the State of New York
State Education Department

Regents Examination in Physical Setting/Chemistry
August 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	58	17	36
82	94	60	71	38	57	16	35
81	93	59	71	37	56	15	33
80	91	58	70	36	55	14	32
79	90	57	69	35	55	13	30
78	88	56	69	34	54	12	29
77	87	55	68	33	53	11	27
76	86	54	67	32	52	10	25
75	85	53	67	31	52	9	23
74	84	52	66	30	51	8	21
73	83	51	66	29	50	7	19
72	82	50	65	28	49	6	17
71	81	49	64	27	48	5	14
70	80	48	64	26	47	4	12
69	79	47	63	25	46	3	9
68	78	46	62	24	45	2	6
67	77	45	62	23	44	1	3
66	76	44	61	22	43	0	0
65	75	43	60	21	41		
64	74	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.