The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

PHYSICAL SETTING
CHEMISTRY

Thursday, January 27, 2011 — 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 An orbital is a region of space where there is a high probability of finding

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

2 Which statement matches a subatomic particle with its charge?

(1) A neutron has a negative charge.
(2) A proton has a negative charge.
(3) A neutron has no charge.
(4) A proton has no charge.

3 An atom of any element must contain

(1) an equal number of protons and neutrons
(2) an equal number of protons and electrons
(3) more electrons than neutrons
(4) more electrons than protons

4 Which statement compares the masses of two subatomic particles?

(1) The mass of an electron is greater than the mass of a proton.
(2) The mass of an electron is greater than the mass of a neutron.
(3) The mass of a proton is greater than the mass of an electron.
(4) The mass of a proton is greater than the mass of a neutron.

5 The bright-line spectrum of sodium is produced when energy is

(1) absorbed as electrons move from higher to lower electron shells
(2) absorbed as electrons move from lower to higher electron shells
(3) released as electrons move from higher to lower electron shells
(4) released as electrons move from lower to higher electron shells

6 The valence electrons of a germanium atom in the ground state are located in the

(1) first shell
(2) second shell
(3) third shell
(4) fourth shell

7 The elements on the Periodic Table are arranged in order of increasing

(1) atomic mass
(2) atomic number
(3) first ionization energy
(4) selected oxidation state

8 Which list of elements contains a metal, a metalloid, a nonmetal, and a noble gas?

(1) Be, Si, Cl, Kr
(2) C, N, Ne, Ar
(3) K, Fe, B, F
(4) Na, Zn, As, Sb

9 The two forms of oxygen, $O_2(g)$ and $O_3(g)$, have

(1) different molecular structures and identical properties
(2) different molecular structures and different properties
(3) identical molecular structures and identical properties
(4) identical molecular structures and different properties

10 The sum of the atomic masses of the atoms in one molecule of $C_3H_6Br_2$ is called the

(1) formula mass
(2) isotopic mass
(3) percent abundance
(4) percent composition

11 What is the total number of electron pairs shared between the two atoms in an O_2 molecule?

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

12 When an atom of lithium loses an electron, the atom becomes a

(1) negative ion with a radius smaller than the radius of the atom
(2) negative ion with a radius larger than the radius of the atom
(3) positive ion with a radius smaller than the radius of the atom
(4) positive ion with a radius larger than the radius of the atom

13 Given the balanced equation representing a reaction:

$$2NaCl \rightarrow 2Na + Cl_2$$

To break the bonds in NaCl, the reactant must

(1) absorb energy
(2) create energy
(3) destroy energy
(4) release energy

14 A molecular compound is formed when a chemical reaction occurs between atoms of

(1) chlorine and sodium
(2) chlorine and yttrium
(3) oxygen and hydrogen
(4) oxygen and magnesium

15 Which substance can *not* be broken down by chemical means?

(1) ammonia
(2) antimony
(3) methane
(4) water

16 Which two physical properties allow a mixture to be separated by chromatography?

(1) hardness and boiling point
(2) density and specific heat capacity
(3) malleability and thermal conductivity
(4) solubility and molecular polarity

17 The solubility of KCl(s) in water depends on the

(1) pressure on the solution
(2) rate of stirring
(3) size of the KCl sample
(4) temperature of the water

18 Which sample of water contains particles having the highest average kinetic energy?

(1) 25 mL of water at 95°C
(2) 45 mL of water at 75°C
(3) 75 mL of water at 75°C
(4) 95 mL of water at 25°C

19 Under which conditions of temperature and pressure does carbon dioxide gas behave most like an ideal gas?

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

20 Which process results in a chemical change?

(1) tearing tin foil
(2) melting an iron bar
(3) crushing an aluminum can
(4) burning magnesium ribbon

21 For a chemical reaction, the heat of reaction is equal to the

(1) potential energy of the reactants, only
(2) potential energy of the products, only
(3) potential energy of the products plus the potential energy of the reactants
(4) potential energy of the products minus the potential energy of the reactants

22 Given the equation representing a system at equilibrium:

$$2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$$

At equilibrium, the concentration of

(1) $SO_2(g)$ must equal the concentration of $SO_3(g)$
(2) $SO_2(g)$ must be constant
(3) $O_2(g)$ must equal the concentration of $SO_2(g)$
(4) $O_2(g)$ must be decreasing

23 The two isomers of butane have different

(1) formula masses
(2) empirical formulas
(3) molecular formulas
(4) structural formulas

24 An oxidation-reduction reaction involves the

(1) sharing of electrons
(2) sharing of protons
(3) transfer of electrons
(4) transfer of protons

25 Which energy change occurs in an operating voltaic cell?

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

26 Which compound is an electrolyte?

(1) butene
(2) propane
(3) dimethyl ether
(4) methanoic acid

27 According to the Arrhenius theory, a base reacts with an acid to produce

(1) ammonia and methane
(2) ammonia and a salt
(3) water and methane
(4) water and a salt

28 What is one benefit associated with a nuclear fission reaction?

(1) The products are not radioactive.
(2) Stable isotopes are used as reactants.
(3) There is no chance of biological exposure.
(4) A large amount of energy is produced.

29 Which balanced equation represents a fusion reaction?

(1) $^{235}_{92}U + {}^{1}_{0}n \rightarrow {}^{93}_{36}Kr + {}^{140}_{56}Ba + 3{}^{1}_{0}n$

(2) $^{2}_{1}H + {}^{3}_{1}H \rightarrow {}^{4}_{2}He + {}^{1}_{0}n$

(3) $^{14}_{7}N + {}^{4}_{2}He \rightarrow {}^{17}_{8}O + {}^{1}_{1}H$

(4) $^{226}_{88}Ra \rightarrow {}^{222}_{86}Rn + {}^{4}_{2}He$

30 Which radioisotope emits alpha particles?

(1) Fe-53
(2) Sr-90
(3) Au-198
(4) Pu-239

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

(1) 2-1
(2) 2-7-4
(3) 2-8-7
(4) 2-4

32 What is the total number of neutrons in an atom of O-18?

(1) 18
(2) 16
(3) 10
(4) 8

33 What is the net charge of an ion that has 8 protons, 9 neutrons, and 10 electrons?

(1) 1+
(2) 2+
(3) 1–
(4) 2–

34 Which element is malleable and a good conductor of electricity at STP?

(1) argon
(2) carbon
(3) iodine
(4) silver

35 Which element has chemical properties that are most similar to the chemical properties of sodium?

(1) beryllium
(2) calcium
(3) lithium
(4) magnesium

36 If an element, *X*, can form an oxide that has the formula X_2O_3, then element *X* would most likely be located on the Periodic Table in the same group as

(1) Ba
(2) Cd
(3) In
(4) Na

37 What is the total mass of KNO_3 that must be dissolved in 50. grams of H_2O at 60.°C to make a saturated solution?

(1) 32 g
(2) 53 g
(3) 64 g
(4) 106 g

38 Which statement describes the general trends in electronegativity and metallic properties as the elements in Period 2 are considered in order of increasing atomic number?

(1) Both electronegativity and metallic properties decrease.
(2) Both electronegativity and metallic properties increase.
(3) Electronegativity decreases and metallic properties increase.
(4) Electronegativity increases and metallic properties decrease.

39 Which balanced equation represents a single-replacement reaction?

(1) $Mg + 2AgNO_3 \rightarrow Mg(NO_3)_2 + 2Ag$
(2) $2Mg + O_2 \rightarrow 2MgO$
(3) $MgCO_3 \rightarrow MgO + CO_2$
(4) $MgCl_2 + 2AgNO_3 \rightarrow 2AgCl + Mg(NO_3)_2$

40 Given the balanced equation representing a reaction:

$$Fe(s) + 2HCl(aq) \rightarrow FeCl_2(aq) + H_2(g)$$

This reaction occurs more quickly when powdered iron is used instead of a single piece of iron of the same mass because the powdered iron

(1) acts as a better catalyst than the single piece of iron
(2) absorbs less energy than the single piece of iron
(3) has a greater surface area than the single piece of iron
(4) is more metallic than the single piece of iron

41 The temperature of a sample of water changes from 10°C to 20°C when the sample absorbs 418 joules of heat. What is the mass of the sample?

(1) 1 g
(2) 10 g
(3) 100 g
(4) 1000 g

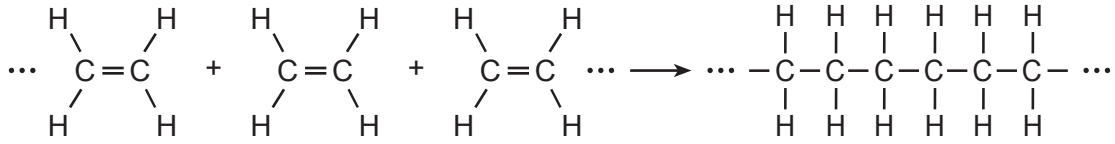
42 Given the reaction at 101.3 kilopascals and 298 K:

hydrogen gas + iodine gas → hydrogen iodide gas

This reaction is classified as

(1) endothermic, because heat is absorbed
(2) endothermic, because heat is released
(3) exothermic, because heat is absorbed
(4) exothermic, because heat is released

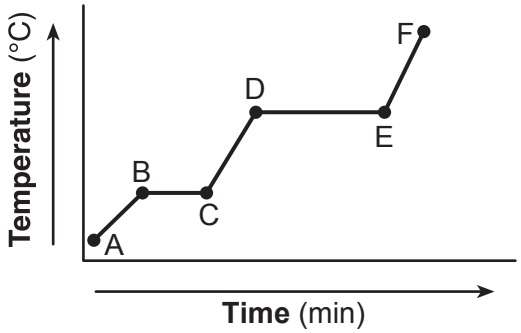
43 Given the equation:



Which type of reaction is represented by this equation?

(1) combustion
(2) esterification
(3) polymerization
(4) substitution

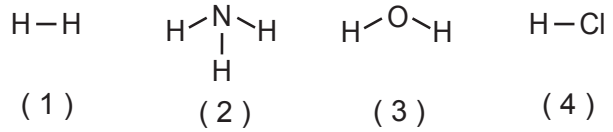
44 The graph below represents the uniform heating of a sample of a substance starting as a solid below its melting point.



Which statement describes what happens to the energy of the particles of the sample during time interval *DE*?

(1) Average kinetic energy increases, and potential energy remains the same.
(2) Average kinetic energy decreases, and potential energy remains the same.
(3) Average kinetic energy remains the same, and potential energy increases.
(4) Average kinetic energy remains the same, and potential energy decreases.

45 Which molecule has a nonpolar covalent bond?



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

46 Given the equation representing a reaction at equilibrium:

$$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$$

What occurs when the concentration of $H_2(g)$ is increased?

(1) The equilibrium shifts to the left, and the concentration of $N_2(g)$ decreases.
(2) The equilibrium shifts to the left, and the concentration of $N_2(g)$ increases.
(3) The equilibrium shifts to the right, and the concentration of $N_2(g)$ decreases.
(4) The equilibrium shifts to the right, and the concentration of $N_2(g)$ increases.

47 Which ionic equation is balanced?

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

48 The table below gives information about four aqueous solutions at standard pressure.

Four Aqueous Solutions

Aqueous Solution	Concentration (M)	Solute
A	2.0	$BaCl_2$
B	2.0	$NaNO_3$
C	1.0	$C_6H_{12}O_6$
D	1.0	K_2SO_3

Which list of solutions is arranged in order from highest boiling point to lowest boiling point?

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

49 What is the total number of years that must pass before only 25.00 grams of an original 100.0-gram sample of C-14 remains unchanged?

(1) 2865 y
(2) 5730 y
(3) 11 460 y
(4) 17 190 y

50 Which radioisotope is used for diagnosing thyroid disorders?

(1) U-238
(2) Pb-206
(3) I-131
(4) Co-60

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 Explain, in terms of electronegativity difference, why the bond in a molecule of HF is more polar than the bond in a molecule of HI. [1]

52 Explain, in terms of activity, why HCl(aq) reacts with Zn(s), but HCl(aq) does *not* react with Cu(s). [1]

53 Copper has two naturally occurring isotopes. Information about the two isotopes is shown in the table below.

Naturally Occurring Isotopes of Copper

Isotope	Atomic Mass (atomic mass units, u)	Percent Natural Abundance (%)
Cu-63	62.93	69.17
Cu-65	64.93	30.83

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

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

In an experiment, 2.54 grams of copper completely reacts with sulfur, producing 3.18 grams of copper(I) sulfide.

54 Determine the total mass of sulfur consumed. [1]

55 Write the chemical formula of the compound produced. [1]

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

Physical Properties of CF_4 and NH_3 at Standard Pressure

Compound	Melting Point (°C)	Boiling Point (°C)	Solubility in Water at 20.0°C
CF_4	–183.6	–127.8	insoluble
NH_3	–77.7	–33.3	soluble

56 State evidence that indicates NH_3 has stronger intermolecular forces than CF_4. [1]

57 In the space *in your answer booklet*, draw a Lewis electron-dot diagram for CF_4. [1]

Base your answers to questions 58 and 59 on the information below.

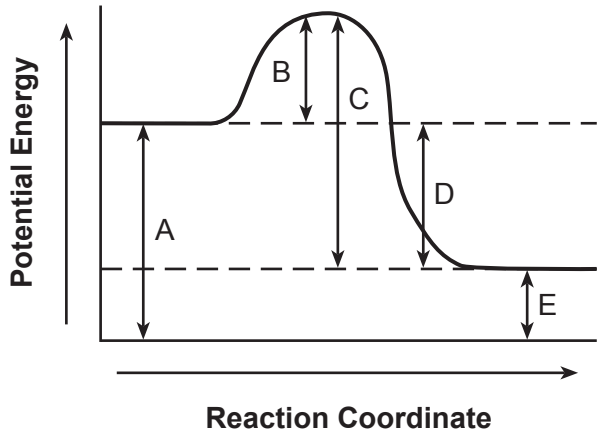
A 2.0-liter aqueous solution contains a total of 3.0 moles of dissolved NH_4Cl at 25°C and standard pressure.

58 Determine the molarity of the solution. [1]

59 Identify the *two* ions present in the solute. [1]

Base your answers to questions 60 and 61 on the information below.

The chemical reaction between methane and oxygen is represented by the potential energy diagram and balanced equation below.



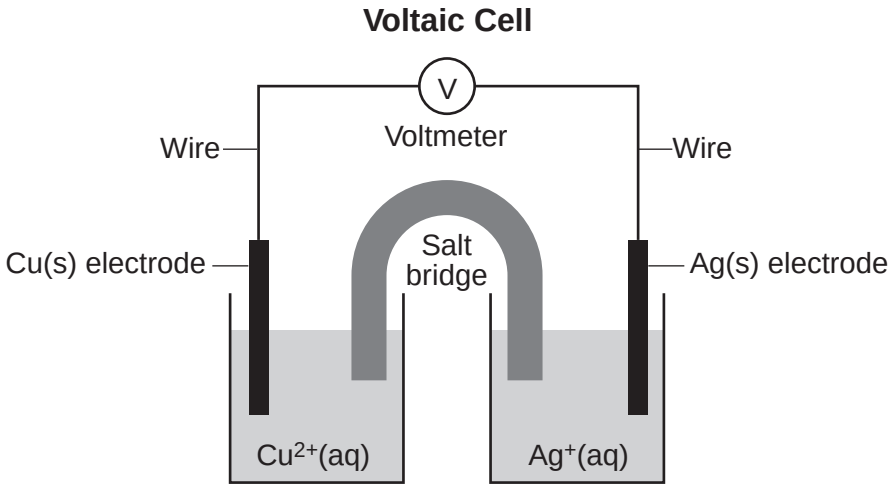
$$CH_4(g) + 2O_2(g) \rightarrow CO_2(g) + 2H_2O(\ell) + 890.4\ kJ$$

60 Which potential energy interval in the diagram represents the activation energy of the forward reaction? [1]

61 Explain, in terms of collision theory, why a lower concentration of oxygen gas *decreases* the rate of this reaction. [1]

Base your answers to questions 62 and 63 on the information below.

The diagram and balanced ionic equation below represent a voltaic cell with copper and silver electrodes and the reaction that occurs when the cell is operating.



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

62 Describe the direction of electron flow in the external circuit in this operating cell. [1]

63 State the purpose of the salt bridge in this voltaic cell. [1]

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

A 20.0-milliliter sample of HCl(aq) is completely neutralized by 32.0 milliliters of 0.50 M KOH(aq).

64 Calculate the molarity of the HCl(aq). Your response must include *both* a numerical setup and the calculated result. [2]

65 According to the data, to what number of significant figures should the calculated molarity of the HCl(aq) be expressed? [1]

Part C

Answer all questions in this part.

Directions (66–83): 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 66 through 68 on the information below.

In the early 1800s, John Dalton proposed an atomic theory that was based on experimental observations made by several scientists. Three concepts of Dalton's atomic theory are stated below.

Statement *A*: Atoms are indivisible and cannot be destroyed or broken down into smaller parts.

Statement *B*: Atoms of one element cannot be changed into atoms of another element.

Statement *C*: All atoms of one element have the same mass.

66 Explain, in terms of particles, why statement *A* is no longer accepted. [1]

67 The decay of N-16 is represented by the balanced equation below.

$$^{16}_{7}\mathrm{N} \rightarrow {}^{0}_{-1}\mathrm{e} + {}^{16}_{8}\mathrm{O}$$

State evidence that indicates statement *B* is *not* always true. [1]

68 Explain, in terms of particles in the atoms of an element, why statement *C* is *false*. [1]

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

A tablet of one antacid contains citric acid, $H_3C_6H_5O_7$, and sodium hydrogen carbonate, $NaHCO_3$. When the tablet dissolves in water, bubbles of CO_2 are produced. This reaction is represented by the incomplete equation below.

$$H_3C_6H_5O_7(aq) + 3NaHCO_3(aq) \rightarrow Na_3C_6H_5O_7(aq) + 3CO_2(g) + 3 \_\_\_\_\_ (\ell)$$

69 Complete the equation *in your answer booklet* by writing the formula of the missing product. [1]

70 State evidence that a chemical reaction occurred when the tablet was placed in the water. [1]

71 Determine the total number of moles of sodium hydrogen carbonate that will completely react with 0.010 mole of citric acid. [1]

Base your answers to questions 72 through 74 on the information below.

Cold packs are used to treat minor injuries. Some cold packs contain $NH_4NO_3(s)$ and a small packet of water at room temperature before activation. To activate this type of cold pack, the small packet must be broken to mix the water and $NH_4NO_3(s)$. The temperature of this mixture decreases to approximately 2°C and remains at this temperature for 10 to 15 minutes.

72 State the direction of heat flow that occurs when the activated cold pack is applied to the body. [1]

73 Identify *both* types of bonds in the $NH_4NO_3(s)$. [1]

74 Identify the type of mixture formed when the $NH_4NO_3(s)$ is completely dissolved in the water. [1]

Base your answers to questions 75 through 77 on the information below.

Litharge, PbO, is an ore that can be roasted (heated) in the presence of carbon monoxide, CO, to produce elemental lead. The reaction that takes place during this roasting process is represented by the balanced equation below.

$$PbO(s) + CO(g) \rightarrow Pb(\ell) + CO_2(g)$$

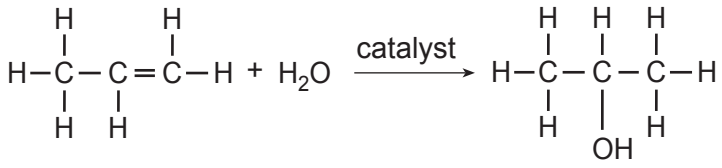
75 Write the balanced equation for the reduction half-reaction that occurs during this roasting process. [1]

76 Determine the oxidation number of carbon in carbon monoxide. [1]

77 Calculate the percent composition by mass of oxygen in litharge (gram-formula mass = 223.2 grams per mole). Your response must include *both* a numerical setup and the calculated result. [2]

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

In one industrial organic reaction, C_3H_6 reacts with water in the presence of a catalyst. This reaction is represented by the balanced equation below.



78 Explain, in terms of bonding, why C_3H_6 is classified as an unsaturated hydrocarbon. [1]

79 Write the IUPAC name for the organic reactant. [1]

80 Identify the class of compound to which the product of the reaction belongs. [1]

Base your answers to questions 81 through 83 on the information below.

A student, wearing chemical safety goggles and a lab apron, is to perform a laboratory test to determine the pH value of two different solutions. The student is given one bottle containing a solution with a pH of 2.0 and another bottle containing a solution with a pH of 5.0. The student is also given six dropping bottles, each containing a different indicator listed in Reference Table *M*.

81 State *one* safety precaution, *not* mentioned in the passage, that the student should take while performing tests on the samples from the bottles. [1]

82 Identify an indicator in Reference Table *M* that would differentiate the two solutions. [1]

83 Compare the hydronium ion concentration of the solution having a pH of 2.0 to the hydronium ion concentration of the other solution given to the student. [1]

PS/CHEMISTRY

The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

PHYSICAL SETTING
CHEMISTRY

Thursday, January 27, 2011 — 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	16	
C	19	

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** ☐

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52 _____

_____ **52** ☐

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53

53 ☐

54 _____ **g** **54** ☐

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For Raters Only

56 _____

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For Raters Only

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Total Score for Part B–2

Part C

For Raters Only

66 _____

_____ **66** ☐

_____

67 _____

_____ **67** ☐

68 _____

_____ **68** ☐

_____

69 $H_3C_6H_5O_7(aq) + 3NaHCO_3(aq) \rightarrow Na_3C_6H_5O_7(aq) + 3CO_2(g) + 3$ _____(ℓ) **69** ☐

70 _____

_____ **70** ☐

71 _____ **mol** **71** ☐

72 _____

_____ **72** ☐

73 _____ and _____ **73** ☐

74 _____ **74** ☐

[5]

For Raters Only

75 _____ **75** ☐

76 _____ **76** ☐

77 **77** ☐

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78 _____ **78** ☐

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79 _____ **79** ☐

80 _____ **80** ☐

81 _____ **81** ☐

82 _____ **82** ☐

83 _____ **83** ☐

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☐

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 27, 2011 — 1:15 to 4:15 p.m., only

SCORING KEY AND RATING GUIDE

Directions to the Teacher:

Refer to the directions on page 2 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.p12.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 . . . . . **4**	11 . . . . . **2**	21 . . . . . **4**	31 . . . . . **2**	41 . . . . . **2** . . . . .
2 . . . . . **3**	12 . . . . . **3**	22 . . . . . **2**	32 . . . . . **3**	42 . . . . . **1** . . . . .
3 . . . . . **2**	13 . . . . . **1**	23 . . . . . **4**	33 . . . . . **4**	43 . . . . . **3** . . . . .
4 . . . . . **3**	14 . . . . . **3**	24 . . . . . **3**	34 . . . . . **4**	44 . . . . . **3** . . . . .
5 . . . . . **3**	15 . . . . . **2**	25 . . . . . **1**	35 . . . . . **3**	45 . . . . . **1** . . . . .
6 . . . . . **4**	16 . . . . . **4**	26 . . . . . **4**	36 . . . . . **3**	46 . . . . . **3** . . . . .
7 . . . . . **2**	17 . . . . . **4**	27 . . . . . **4**	37 . . . . . **2**	47 . . . . . **3** . . . . .
8 . . . . . **1**	18 . . . . . **1**	28 . . . . . **4**	38 . . . . . **4**	48 . . . . . **1** . . . . .
9 . . . . . **2**	19 . . . . . **3**	29 . . . . . **2**	39 . . . . . **1**	49 . . . . . **3** . . . . .
10 . . . . . **1**	20 . . . . . **4**	30 . . . . . **4**	40 . . . . . **3**	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.p12.nysed.gov/osa/ on Thursday, January 27, 2011. 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 16 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:

The electronegativity difference between H and F is greater than the electronegativity difference between H and I.

The difference for HF is 1.9, and the difference for HI is 0.6.

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

Zinc is more active than hydrogen, but copper is less active than hydrogen.

On Table *J*, Zn is above H_2, and Cu is below H_2.

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

$(62.93\text{ u})(0.6917) + (64.93\text{ u})(0.3083)$

$$\frac{(62.93)(69.17) + (64.93)(30.83)}{100}$$

54 [1] Allow 1 credit for 0.64 g.

55 [1] Allow 1 credit for Cu_2S.

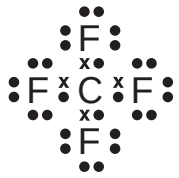
56 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

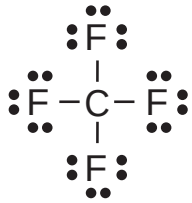
At standard pressure, NH_3 has a higher boiling point than CF_4.

The melting point of CF_4 is lower.

57 [1] Allow 1 credit.

Examples of 1-credit responses:





58 [1] Allow 1 credit for 1.5 M.

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

NH_4^+ and Cl^-

ammonium and chloride

60 [1] Allow 1 credit for *B*.

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

A lower concentration of oxygen gas decreases the number of effective collisions between O_2 molecules and CH_4 molecules.

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

Electrons flow from the copper electrode to the silver electrode through the wires and voltmeter.

The e^- flow is from Cu to Ag in the external circuit.

from anode to cathode

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

The salt bridge allows for the migration of ions between the half-cells.

The salt bridge prevents polarization of the half-cells.

maintains electrical neutrality

64 [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:

$(M_A)(20.0\text{ mL}) = (32.0\text{ mL})(0.50\text{ M})$

$$\frac{32(0.5)}{20}$$

- Allow 1 credit for 0.80 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.

65 [1] Allow 1 credit for 2 *or* two.

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:

Smaller parts of atoms exist, such as protons, neutrons, and electrons.

During some nuclear reactions, unstable atoms can spontaneously decay into smaller particles.

Atoms can lose electrons.

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

An atom of nitrogen (atomic number 7) changed into an atom of oxygen (atomic number 8).

The decay of N-16 atoms produced O-16 atoms.

Radioactive decay results in an element being changed into another element.

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

Atoms of different isotopes of an element have different masses because they have different numbers of neutrons.

Atoms of an element can differ in the number of neutrons and, therefore, masses.

69 [1] Allow 1 credit for H_2O.

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

Bubbles of CO_2 gas were produced.

The reactants and products are different chemicals.

Bonds were broken and bonds were formed.

71 [1] Allow 1 credit for 0.030 mol. Significant figures do *not* need to be shown.

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

Heat flows from the body to the cold pack.

from the area of higher temperature to the area of lower temperature

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

ionic and polar covalent

covalent and ionic

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

homogeneous

solution

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

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

76 [1] Allow 1 credit for +2.

77 [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:

$$\frac{16.0 \text{ g/mol}}{223.2 \text{ g/mol}} \times 100$$

$$\frac{16(100)}{223.2}$$

- Allow 1 credit for 7.17% *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 response that are not related to the concept assessed by the question.

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

The C_3H_6 is unsaturated because each molecule has a double covalent bond between two of its carbon atoms.

There is a carbon-carbon double bond in each molecule.

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

propene

80 [1] Allow 1 credit for alcohol *or* alcohols.

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

Wear protective gloves.

Avoid spills.

Note: Do *not* allow credit for "wearing goggles" or "wearing an apron."

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

methyl orange

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

The hydronium ion concentration is 1000 times greater in the solution having a pH of 2.0.

The other solution has a lower H^+ ion concentration.

Regents Examination in Physical Setting/Chemistry

January 2011

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

The *Chart for Determining the Final Examination Score for the January 2011 Regents Examination in Physical Setting/Chemistry* will be posted on the Department's web site http://www.p12.nysed.gov/osa/ on Thursday, January 27, 2011. 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 http://www.forms2.nysed.gov/emsc/osa/exameval/reexameval.cfm.
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 2011 Physical Setting/Chemistry			
Question Numbers			
Key Ideas/Performance Indicators	Part A	Part B	Part C
Standard 1			
Math Key Idea 1		64, 65	77
Math Key Idea 2		51	
Math Key Idea 3		33, 49, 54	76
Science Inquiry Key Idea 1		40, 59, 61, 62	74
Science Inquiry Key Idea 2			81, 82
Science Inquiry Key Idea 3		48, 55	73, 78, 79
Engineering Design Key Idea 1			
Standard 2			
Key Idea 1			
Key Idea 2			
Standard 6			
Key Idea 1			72
Key Idea 2			66, 67, 68
Key Idea 3			83
Key Idea 4		46	
Key Idea 5			
Standard 7			
Key Idea 1			71
Key Idea 2			
Standard 4 Process Skills			
Key Idea 3		31, 32, 34, 35, 36, 37, 38, 39, 43, 47, 58, 63	69, 70, 75, 80
Key Idea 4		41, 42, 44, 50, 52, 53, 60	
Key idea 5		45, 56, 57	
Standard 4			
Key Idea 3	1, 2, 3, 4, 5, 6, 7, 8, 10, 15, 16, 17, 19, 20, 22, 23, 24, 25, 26, 27	31, 32, 33, 34, 35, 36, 37, 38, 39, 43, 45, 46, 47, 48, 52, 53, 54, 55, 58, 59, 61, 62, 63, 64, 65	66, 68, 69, 70, 71, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83
Key Idea 4	18, 21, 28, 29, 30	41, 42, 44, 49, 50, 60	72
Key Idea 5	9, 11, 12, 13, 14	45, 51, 56, 57	67, 73
Reference Tables			
2002 Edition		32, 34, 35, 36, 37, 38, 42, 55, 56, 57, 58, 59, 62, 64	66, 68, 75, 76, 77, 79, 82, 83

University of the State of New York
State Education Department

Regents Examination in Physical Setting/Chemistry
January 2011

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	73	41	59	19	38
84	98	62	73	40	58	18	37
83	96	61	72	39	57	17	36
82	94	60	71	38	56	16	34
81	93	59	70	37	56	15	33
80	91	58	70	36	55	14	31
79	90	57	69	35	54	13	30
78	88	56	68	34	53	12	28
77	87	55	68	33	53	11	26
76	86	54	67	32	52	10	24
75	85	53	66	31	51	9	22
74	83	52	66	30	50	8	20
73	82	51	65	29	49	7	18
72	81	50	64	28	48	6	16
71	80	49	64	27	47	5	14
70	79	48	63	26	46	4	11
69	78	47	63	25	45	3	9
68	77	46	62	24	44	2	6
67	77	45	61	23	43	1	3
66	76	44	61	22	42	0	0
65	75	43	60	21	41		
64	74	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.