The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

PHYSICAL SETTING
CHEMISTRY

Thursday, August 13, 2015 — 12:30 to 3:30 p.m., only

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

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 *2011 Edition Reference Tables for Physical Setting/Chemistry*. You are to answer *all* questions in all parts of this examination according to the directions provided in this examination booklet.

A separate answer sheet for Part A and Part B–1 has been provided to you. Follow the instructions from the proctor for completing the student information on your answer sheet. Record your answers to the Part A and Part B–1 multiple-choice questions on this separate answer sheet. Record your answers for the questions in Part B–2 and Part C in your separate answer booklet. Be sure to fill in the heading on the front of your answer booklet.

All answers in your answer booklet should be written in pen, except for graphs and drawings, which should be done in pencil. You may use scrap paper to work out the answers to the questions, but be sure to record all your answers on your separate answer sheet or in your answer booklet as directed.

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

Notice. . .

A four-function or scientific calculator and a copy of the *2011 Edition Reference Tables for Physical Setting/Chemistry* must be available for you to use while taking this examination.

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, select the word or expression that, of those given, best completes the statement or answers the question. Record your answer on the separate answer sheet in accordance with the directions on the front page of this booklet. Some questions may require the use of the *2011 Edition Reference Tables for Physical Setting/Chemistry*.

1 Which subatomic particles are paired with their charges?

(1) electron–positive, neutron–negative, proton–neutral
(2) electron–negative, neutron–neutral, proton–positive
(3) electron–negative, neutron–positive, proton–neutral
(4) electron–neutral, neutron–positive, proton–negative

2 In the ground state, an atom of which element has two valence electrons?

(1) Cr (3) Ni
(2) Cu (4) Se

3 The atoms in a sample of an element are in excited states. A bright-line spectrum is produced when these atoms

(1) absorb energy (3) emit energy
(2) absorb positrons (4) emit positrons

4 Which statement describes a concept included in the wave-mechanical model of the atom?

(1) Positrons are located in shells outside the nucleus.
(2) Neutrons are located in shells outside the nucleus.
(3) Protons are located in orbitals outside the nucleus.
(4) Electrons are located in orbitals outside the nucleus.

5 All elements on the modern Periodic Table are arranged in order of increasing

(1) atomic mass
(2) molar mass
(3) number of neutrons per atom
(4) number of protons per atom

6 At STP, which substance is a noble gas?

(1) ammonia (3) neon
(2) chlorine (4) nitrogen

7 At STP, oxygen exists in two forms, $O_2(g)$ and $O_3(g)$. These two forms of oxygen have

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

8 Which statement describes a chemical property of sodium?

(1) Sodium has a melting point of 371 K.
(2) Sodium has a molar mass of 23 grams.
(3) Sodium can conduct electricity in the liquid phase.
(4) Sodium can combine with chlorine to produce a salt.

9 Which term identifies a type of chemical reaction?

(1) decomposition (3) sublimation
(2) distillation (4) vaporization

10 Based on Table S, an atom of which element has the *weakest* attraction for electrons in a chemical bond?

(1) polonium (3) selenium
(2) sulfur (4) tellurium

11 Given the balanced equation:

$$F_2 + \text{energy} \rightarrow F + F$$

Which statement describes what occurs during this reaction?

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

12 Which atoms will bond when valence electrons are transferred from one atom to the other?

(1) O and Se
(2) O and Sr
(3) O and H
(4) O and P

13 Which sample of matter is a mixture?

(1) $Br_2(\ell)$
(2) K(s)
(3) KBr(s)
(4) KBr(aq)

14 According to kinetic molecular theory, collisions between gas particles in a sample of an ideal gas

(1) increase the energy content of the gas sample
(2) produce strong attractive forces between the gas particles
(3) result in a net loss of energy by the gas sample
(4) transfer energy between the gas particles

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

(1) ethane
(2) propanone
(3) silicon
(4) water

16 The temperature of a sample of matter is a measure of the

(1) average potential energy of the particles of the sample
(2) average kinetic energy of the particles of the sample
(3) total nuclear energy of the sample
(4) total thermal energy of the sample

17 Under which conditions of temperature and pressure does a real gas behave most like an ideal gas?

(1) 37 K and 1 atm
(2) 37 K and 8 atm
(3) 347 K and 1 atm
(4) 347 K and 8 atm

18 The ratio of chromium to iron to carbon varies among the different types of stainless steel. Therefore, stainless steel is classified as

(1) a compound
(2) an element
(3) a mixture
(4) a substance

19 Which statement explains why increasing the temperature increases the rate of a chemical reaction, while other conditions remain the same?

(1) The reacting particles have less energy and collide less frequently.
(2) The reacting particles have less energy and collide more frequently.
(3) The reacting particles have more energy and collide less frequently.
(4) The reacting particles have more energy and collide more frequently.

20 An open flask is half filled with water at 25°C. Phase equilibrium can be reached after

(1) more water is added to the flask
(2) the flask is stoppered
(3) the temperature is decreased to 15°C
(4) the temperature is increased to 35°C

21 Which formula represents an unsaturated organic compound?

(1) CH_4
(2) C_2H_4
(3) C_3H_8
(4) C_4H_{10}

22 All isomers of octane have the same

(1) molecular formula
(2) structural formula
(3) physical properties
(4) IUPAC name

23 Which formula represents a hydrocarbon?

(1) CH_3I
(2) CH_3NH_2
(3) CH_3CH_3
(4) CH_3OH

24 In a redox reaction, the number of electrons lost is equal to the number of

(1) protons lost
(2) neutrons lost
(3) neutrons gained
(4) electrons gained

25 At which electrode does oxidation occur in a voltaic cell and in an electrolytic cell?

(1) the anode in a voltaic cell and the cathode in an electrolytic cell
(2) the cathode in a voltaic cell and the anode in an electrolytic cell
(3) the anode in both a voltaic cell and an electrolytic cell
(4) the cathode in both a voltaic cell and an electrolytic cell

26 Based on the Arrhenius theory, when potassium hydroxide dissolves in water, the only negative ion in the aqueous solution is

(1) $O^{2-}(aq)$
(2) $OH^{2-}(aq)$
(3) $H^{-}(aq)$
(4) $OH^{-}(aq)$

27 Compared to distilled water, an aqueous salt solution has

(1) better electrical conductivity
(2) poorer electrical conductivity
(3) a lower boiling point at standard pressure
(4) a higher freezing point at standard pressure

28 According to one acid-base theory, water can act as a base because a water molecule can

(1) donate an H^{+} ion
(2) accept an H^{+} ion
(3) donate an H^{-} ion
(4) accept an H^{-} ion

29 Compared to the half-life and decay mode of the nuclide ^{90}Sr, the nuclide ^{226}Ra has

(1) a longer half-life and the same decay mode
(2) a longer half-life and a different decay mode
(3) a shorter half-life and the same decay mode
(4) a shorter half-life and a different decay mode

30 Which net change occurs in a nuclear fusion reaction?

(1) Ionic bonds are broken.
(2) Ionic bonds are formed.
(3) Energy is converted to mass.
(4) Mass is converted to energy.

Part B–1

Answer all questions in this part.

Directions (31–50): For each statement or question, select the word or expression that, of those given, best completes the statement or answers the question. Record your answer in the separate answer sheet in accordance with the directions on the front page of this booklet. Some questions may require the use of the *2011 Edition Reference Tables for Physical Setting/Chemistry.*

31 Which conclusion was drawn from the results of the gold foil experiment?

(1) An atom is electrically neutral.
(2) An atom is mostly empty space.
(3) The nucleus of an atom is negatively charged.
(4) The electrons in an atom are located in specific shells.

32 Which electron configuration represents an atom of magnesium in an excited state?

(1) 2–7–3
(2) 2–7–6
(3) 2–8–2
(4) 2–8–5

33 Which group on the Periodic Table has elements with atoms that tend *not* to bond with atoms of other elements?

(1) Group 1
(2) Group 2
(3) Group 17
(4) Group 18

34 Which group on the Periodic Table has at least one element in each of the three phases of matter at STP?

(1) 1
(2) 2
(3) 17
(4) 18

35 Rubidium and cesium have similar chemical properties because, in the ground state, the atoms of both elements each have

(1) one electron in the outermost shell
(2) two electrons in the outermost shell
(3) one neutron in the nucleus
(4) two neutrons in the nucleus

36 As the first five elements in Group 15 are considered in order of increasing atomic number, first ionization energy

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

37 Which substance in the table below has the strongest intermolecular forces?

Substance	Molar Mass (g/mol)	Boiling Point (kelvins)
HF	20.01	293
HCl	36.46	188
HBr	80.91	207
HI	127.91	237

(1) HF
(2) HCl
(3) HBr
(4) HI

38 Which ion in the ground state has the same electron configuration as an atom of argon in the ground state?

(1) Al^{3+}
(2) O^{2-}
(3) K^{+}
(4) F^{-}

39 What is the number of pairs of electrons shared in a molecule of N_2?

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

40 Which statement explains why a C–O bond is more polar than a F–O bond?

(1) At STP, carbon has a greater density than fluorine.
(2) A carbon atom has more valence electrons than a fluorine atom.
(3) The difference in electronegativity between carbon and oxygen is greater than that between fluorine and oxygen.
(4) The difference in first ionization energy between carbon and oxygen is greater than that between fluorine and oxygen.

41 A mixture consists of sand and an aqueous salt solution. Which procedure can be used to separate the sand, salt, and water from each other?

(1) Evaporate the water, then filter out the salt.
(2) Evaporate the water, then filter out the sand.
(3) Filter out the salt, then evaporate the water.
(4) Filter out the sand, then evaporate the water.

42 An aqueous solution has a mass of 490 grams containing 8.5×10^{-3} gram of calcium ions. The concentration of calcium ions in this solution is

(1) 4.3 ppm
(2) 8.5 ppm
(3) 17 ppm
(4) 34 ppm

43 A sample of hydrogen gas at 2.0 atmospheres and 273 K occupies a volume of 5.0 liters. The gas sample is completely transferred to a 10.0-liter sealed, rigid container. What is the new pressure of the gas sample when the temperature returns to 273 K?

(1) 1.0 atm
(2) 2.0 atm
(3) 3.0 atm
(4) 4.0 atm

44 Given the equation for a system at equilibrium:

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

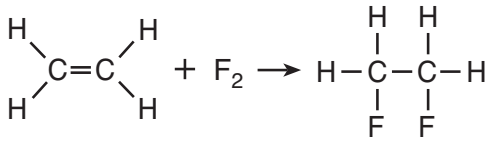
If only the concentration of $N_2(g)$ is increased, the concentration of

(1) $NH_3(g)$ increases
(2) $NH_3(g)$ remains the same
(3) $H_2(g)$ increases
(4) $H_2(g)$ remains the same

45 A hydrocarbon molecule has seven carbon atoms in a straight chain. There is a double bond between the third carbon atom and the fourth carbon atom in the chain. The IUPAC name for this hydrocarbon is

(1) 3-heptyne
(2) 4-heptyne
(3) 3-heptene
(4) 4-heptene

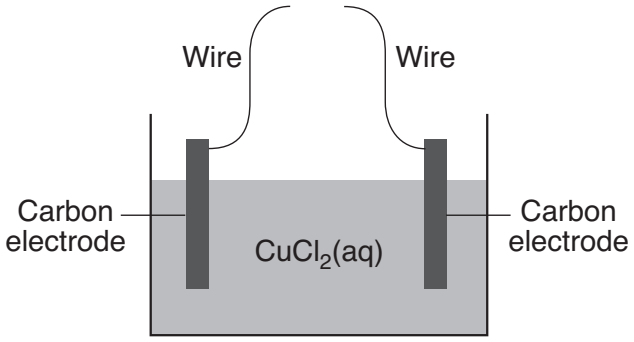
46 Given the balanced equation representing a reaction:



Which type of reaction is represented by this equation?

(1) addition
(2) fermentation
(3) polymerization
(4) substitution

47 Given the diagram representing an incomplete electrochemical cell:



Solid copper will be deposited on one of the carbon electrodes when the wires are connected to

(1) each other
(2) a battery
(3) a switch
(4) a voltmeter

48 What is the volume of 0.30 M NaOH(aq) needed to completely neutralize 15.0 milliliters of 0.80 M HCl(aq)?

(1) 3.6 mL
(2) 5.6 mL
(3) 20. mL
(4) 40. mL

49 Which equation represents a spontaneous transmutation?

(1) $Ca(s) + 2H_2O(\ell) \rightarrow Ca(OH)_2(aq) + H_2(g)$

(2) $2KClO_3(s) \rightarrow 2KCl(s) + 3O_2(g)$

(3) ${}^{239}_{94}Pu + 2{}^{1}_{0}n \rightarrow {}^{241}_{95}Am + {}^{0}_{-1}e$

(4) ${}^{37}_{20}Ca \rightarrow {}^{37}_{19}K + {}^{0}_{+1}e$

50 Which particle has two neutrons?

(1) ${}^{1}_{0}n$

(2) ${}^{1}_{1}H$

(3) ${}^{2}_{1}H$

(4) ${}^{4}_{2}He$

Part B–2

Answer all questions in this part.

Directions (51–65): Record your answers in the spaces provided in the separate answer booklet. Some questions may require the use of the *2011 Edition Reference Tables for Physical Setting/Chemistry*.

51 Determine the vapor pressure of ethanol at 90.°C. [1]

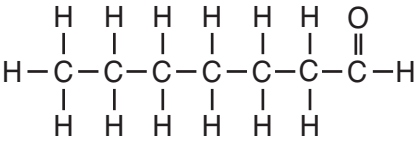
52 Explain, in terms of particle arrangement, why a sample of solid NaCl has *less* entropy than a sample of aqueous NaCl. [1]

53 Determine the molecular formula for a compound that has the empirical formula CH_2O and a molar mass of 120. grams per mole. [1]

54 A student drew the Lewis electron-dot diagram below to represent sodium chloride.

Explain why this diagram is *not* an accurate representation for the bonding in NaCl. [1]

55 Given the formula for heptanal:



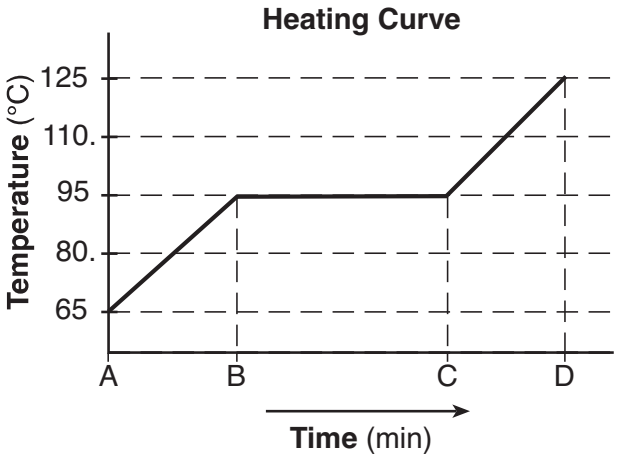
Determine the gram-formula mass of heptanal. [1]

56 Compare the mass of a proton to the mass of an electron. [1]

57 In nature, 1.07% of the atoms in a carbon sample are C-13 atoms. In the space *in your answer booklet*, show a numerical setup for calculating the number of C-13 atoms in a sample containing 3.28×10^{24} atoms of carbon. [1]

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

A sample of a substance is a liquid at 65°C. The sample is heated uniformly to 125°C. The heating curve for the sample at standard pressure is shown below.



58 Determine the boiling point of the sample at standard pressure. [1]

59 State what happens to the potential energy of the particles of the sample during time interval BC. [1]

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

A sample of nitric acid contains both H_3O^+ ions and NO_3^- ions. This sample has a pH value of 1.

60 Write a name of the positive ion present in this sample. [1]

61 What is the color of methyl orange after it is added to this sample? [1]

Base your answers to questions 62 through 65 on the information below and on your knowledge of chemistry.

One fission reaction for U-235 is represented by the balanced nuclear equation below.

$$^{235}_{92}\mathrm{U} + {}^{1}_{0}\mathrm{n} \rightarrow {}^{140}_{54}\mathrm{Xe} + {}^{94}_{38}\mathrm{Sr} + 2{}^{1}_{0}\mathrm{n}$$

Both radioisotopes produced by this fission reaction undergo beta decay. The half-life of Xe-140 is 13.6 seconds and the half-life of Sr-94 is 1.25 minutes.

62 Explain, in terms of *both* reactants and products, why the reaction represented by the nuclear equation is a fission reaction. [1]

63 Complete the equation *in your answer booklet* for the decay of Xe-140 by writing a notation for the missing product. [1]

64 Determine the time required for an original 24.0-gram sample of Sr-94 to decay until only 1.5 grams of the sample remains unchanged. [1]

65 On the diagram *in your answer booklet*, draw an arrow to represent the path of an emitted beta particle in the electric field between two oppositely charged metal plates. [1]

Part C

Answer all questions in this part.

Directions (66–85): Record your answers in the spaces provided in the separate answer booklet. Some questions may require the use of the *2011 Edition Reference Tables for Physical Setting/Chemistry*.

Base your answers to questions 66 through 68 on the information below and on your knowledge of chemistry.

The two naturally occurring isotopes of antimony are Sb-121 and Sb-123. The table below shows the atomic mass and percent natural abundance for these isotopes.

Naturally Occurring Isotopes of Antimony

Isotope	Atomic Mass (u)	Natural Abundance (%)
Sb-121	120.90	57
Sb-123	122.90	43

Antimony and sulfur are both found in the mineral stibnite, Sb_2S_3. To obtain antimony, stibnite is roasted (heated in air), producing oxides of antimony and sulfur. The unbalanced equation below represents one of the reactions that occurs during the roasting.

$$Sb_2S_3(s) + O_2(g) \rightarrow Sb_2O_3(s) + SO_2(g)$$

66 Determine the percent composition by mass of antimony in stibnite (gram-formula mass = 340. g/mol). [1]

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

68 Complete the balancing of the equation *in your answer booklet* for the roasting of stibnite, using the smallest whole-number coefficients. [1]

Base your answers to questions 69 through 72 on the information below and on your knowledge of chemistry.

In a laboratory investigation, ammonium chloride was dissolved in water. Laboratory procedures and corresponding observations made by a student during the investigation are shown in the table below.

Dissolving $NH_4Cl(s)$ in $H_2O(\ell)$

Procedure	Observation
1. Measure the temperature of 10.0 milliliters (10.0 grams) of $H_2O(\ell)$ in a test tube.	1. The temperature of the $H_2O(\ell)$ was 25.8°C.
2. Add 5.0 grams of the solute, $NH_4Cl(s)$, to the $H_2O(\ell)$.	2. The $NH_4Cl(s)$ settled to the bottom of the test tube.
3. Stir the contents of the test tube for 4 minutes.	3. A small amount of $NH_4Cl(s)$ remained at the bottom of the test tube.
4. Measure the temperature of the $NH_4Cl(aq)$ solution.	4. The temperature of the solution was 11.2°C.

69 Identify *two* types of bonds in the solute. [1]

70 State evidence from the investigation that indicates the $NH_4Cl(aq)$ solution is saturated. [1]

71 State evidence from the investigation that indicates the process of dissolving the $NH_4Cl(s)$ in water is endothermic. [1]

72 State the observation that would be made if procedure 3 is repeated with the original temperature of the $H_2O(\ell)$ at 98°C. [1]

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

Coal is a fuel consisting primarily of carbon. In an open system, the carbon that burns completely in air produces carbon dioxide and heat. This reaction is represented by the balanced equation below.

$$C(s) + O_2(g) \rightarrow CO_2(g) + \text{heat}$$

73 *In your answer booklet*, use the key to draw *at least five* particles in the box to represent the phase of the product. [1]

74 On the potential energy diagram *in your answer booklet*, draw a double-headed arrow (↕) to indicate the interval that represents the heat of reaction. [1]

Base your answers to questions 75 and 76 on the information below and on your knowledge of chemistry.

During the winter months, icy roads pose a threat to motorists and can lead to accidents. A mixture of sand and sodium chloride, NaCl, can be spread on roads to make winter driving safer.

One New York town requires that a mixture of sand and salt used on residential roads should contain 25% or less of NaCl by mass. A 10.0-gram sample of a mixture of sand and NaCl was analyzed and found to contain 3.3 grams of NaCl.

75 State, in terms of freezing point, why sodium chloride is part of the mixture put on icy roads. [1]

76 Explain, in terms of composition by mass, why the mixture from which the analyzed sample was taken should *not* be used on residential roads of the town. [1]

Base your answers to questions 77 and 78 on the information below and on your knowledge of chemistry.

In a laboratory investigation, a solution that contains 13.2 grams of $Pb(NO_3)_2$ reacts completely with a solution that contains 12.0 grams of NaI, producing 18.4 grams of PbI_2 and an undetermined mass of a second product, $NaNO_3$. This reaction is represented by the balanced equation below.

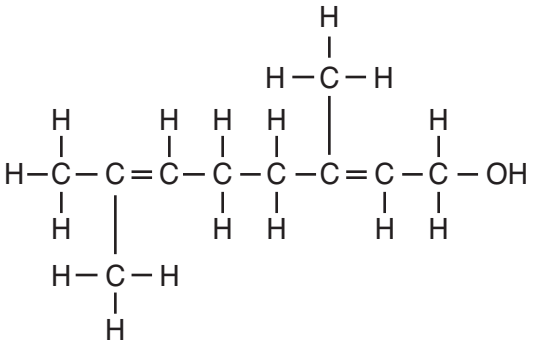
$$Pb(NO_3)_2 + 2NaI \rightarrow PbI_2 + 2NaNO_3$$

77 Identify the compound produced that is insoluble in water. [1]

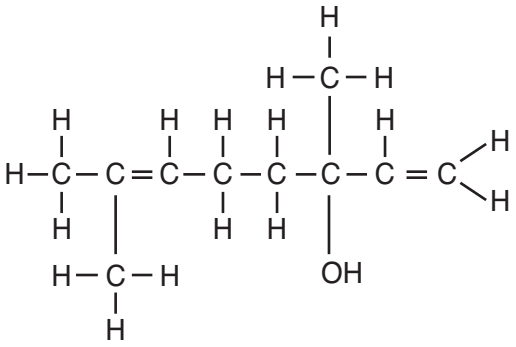
78 Determine the mass of $NaNO_3$ produced. [1]

Base your answers to questions 79 and 80 on the information below and on your knowledge of chemistry.

Two organic compounds, geraniol and linalool, can be represented by the molecular formula $C_{10}H_{18}O$. Geraniol has an odor similar to the scent of roses and linalool has an odor similar to the scent of citrus fruits. Both compounds are nearly insoluble in water. The structural formulas of geraniol and linalool are shown below.



Geraniol



Linalool

79 Write the name of the class of organic compound to which both geraniol and linalool belong. [1]

80 Explain, in terms of molecular polarity, why geraniol and linalool are nearly insoluble in water. [1]

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

The gastric juice of the human stomach has a pH value of approximately 1.5. Hydrochloric acid in the gastric juice is necessary for the digestion process. However, excess hydrochloric acid may harm the stomach lining. One type of antacid uses $Mg(OH)_2(s)$ to neutralize excess hydrochloric acid in the stomach. This neutralization is represented by the incomplete equation below.

$$Mg(OH)_2(s) + 2HCl(aq) \rightarrow \_\_\_ (aq) + 2H_2O(\ell)$$

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

82 Describe the changes in *both* the hydrogen ion concentration and the pH of the gastric juice of a human after ingesting this type of antacid. [1]

Base your answers to questions 83 through 85 on the information below and on your knowledge of chemistry.

Early scientists defined oxidation as a chemical reaction in which oxygen combined with another element to produce an oxide of the element. An example of oxidation based on this definition is the combustion of methane. This reaction is represented by the balanced equation below.

Equation 1: $CH_4(g) + 2O_2(g) \rightarrow CO_2(g) + 2H_2O(g)$

The definition of oxidation has since been expanded to include many reactions that do not involve oxygen. An example of oxidation based on this expanded definition is the reaction between magnesium ribbon and powdered sulfur when heated in a crucible. This reaction is represented by the balanced equation below.

Equation 2: $Mg(s) + S(s) \rightarrow MgS(s)$

83 State why early scientists classified the reaction represented by equation 1 as oxidation. [1]

84 Determine the change in oxidation number of carbon in equation 1. [1]

85 Write a balanced half-reaction equation for the oxidation that occurs in the reaction represented by equation 2. [1]

Printed on Recycled Paper

P.S./CHEMISTRY

The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

PHYSICAL SETTING
CHEMISTRY

Thursday, August 13, 2015 — 12:30 to 3:30 p.m., only

ANSWER BOOKLET

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

Teacher . . . . . .

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

Record your answers for Part B–2 and Part C in this booklet.

Part B–2

51 _____ **kPa**

52 _____

_____

_____

53 _____

54 _____

_____

_____

55 _____ **g/mol**

56 _____

_____

_____

57

58 _____ **°C**

59 _____

_____

_____

60 _____

61 _____

62 _____

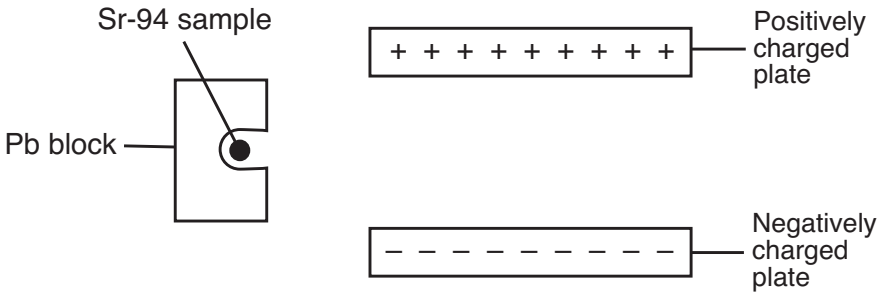
_____

_____

63 $^{140}_{54}\text{Xe} \rightarrow {}^{0}_{-1}\text{e} +$ _____

64 _____ **min**

65



An electric field exists between the two plates.

Part C

66 _____ **%**

67

68 _2_ $Sb_2S_3(s)$ + _____ $O_2(g)$ →_____ $Sb_2O_3(s)$ + _____ $SO_2(g)$

69 _____ and _____

70 _____

_____

_____

71 _____

_____

_____

72 _____

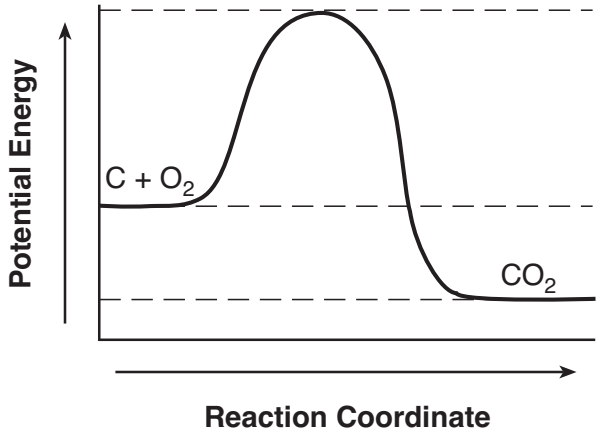
_____

_____

73

Key
○●○ = a CO_2 molecule

74



75 _____

_____

_____

76 _____

_____

_____

77 _____

78 _____ **g**

79 _____

80 _____

_____

_____

81 $Mg(OH)_2(s) + 2HCl(aq) \rightarrow$ _____ $(aq) + 2H_2O(\ell)$

82 Hydrogen ion concentration: _____

pH: _____

83 _____

_____

_____

84 From _____ to _____

85 _____

Printed on Recycled Paper

P.S./CHEMISTRY

FOR TEACHERS ONLY

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

P.S.–CH PHYSICAL SETTING/CHEMISTRY

Thursday, August 13, 2015 — 12:30 to 3:30 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 at: http://www.p12.nysed.gov/assessment/ and select the link "Scoring Information" for any recently posted information regarding this examination. This site should be checked before the rating process for this examination begins and several times throughout the Regents Examination period.

Part A and Part B–1

Allow 1 credit for each correct response.

Part A

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

Part B–1

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

Directions to the Teacher

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

Do not attempt to correct the student's work by making insertions or changes of any kind. If the student's responses for the multiple-choice questions are being hand scored prior to being scanned, the scorer must be careful not to make any marks on the answer sheet except to record the scores in the designated score boxes. Marks elsewhere on the answer sheet will interfere with the accuracy of the scanning.

Allow 1 credit for each correct response.

At least two science teachers must participate in the scoring of the Part B–2 and Part C open-ended questions on a student's paper. 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 more than approximately one-half of the open-ended questions on a student's answer paper. Teachers may not score their own students' answer papers.

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. On the student's separate answer sheet, for each question, record the number of credits earned and the teacher's assigned rater/scorer letter.

Fractional credit is *not* allowed. Only whole-number credit may be given for a response. If the student gives more than one answer to a question, only the first answer should be rated. Units need not be given when the wording of the questions allows such omissions.

For hand scoring, raters should enter the scores earned in the appropriate boxes printed on the separate answer sheet. Next, the rater should add these scores and enter the total in the box labeled "Total Raw 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 at: http://www.p12.nysed.gov/assessment/ on Thursday, August 13, 2015. The student's scale score should be entered in the box labeled "Scale Score" on the student's answer sheet. The scale score is the student's final examination score.

Schools are not permitted to rescore any of the open-ended questions on this exam after each question has been rated once, regardless of the final exam score. Schools are required to ensure that the raw scores have been added correctly and that the resulting scale score has been determined accurately.

Because scale scores corresponding to raw scores in the conversion chart may change from one administration 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 for any value from 148 kPa to 152 kPa, inclusive.

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

Solid NaCl has less entropy because the particles have a more ordered arrangement than aqueous NaCl.

NaCl(aq) is a mixture that contains water molecules and ions moving more randomly.

Particle arrangement in NaCl(s) is less random.

53 [1] Allow 1 credit for $C_4H_8O_4$. The order of the elements can vary.

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

Ion charges are not shown.

No electron transfer is shown in the diagram.

The student's diagram represents a molecular compound.

55 [1] Allow 1 credit for 114 g/mol. Significant figures do *not* need to be shown.

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

The mass of a proton is greater than the mass of an electron.

An electron has less mass.

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

number of atoms of C-13 = $(0.0107)(3.28 \times 10^{24}$ atoms of carbon)

$(1.07\%)(3.28 \times 10^{24})$

$(1.07 \times 10^{-2})(3.28 \times 10^{24})$

58 [1] Allow 1 credit for any value from 94°C to 96°C, inclusive.

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

The potential energy of the particles increases during the interval BC.

The particles of the sample gain potential energy.

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

hydronium ion

hydronium

hydrogen ion

hydrogen

61 [1] Allow 1 credit for red.

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

The $^{235}_{92}U$ nucleus splits into two smaller nuclei.

One large atom is broken down into smaller atoms.

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

$^{140}_{55}Cs$

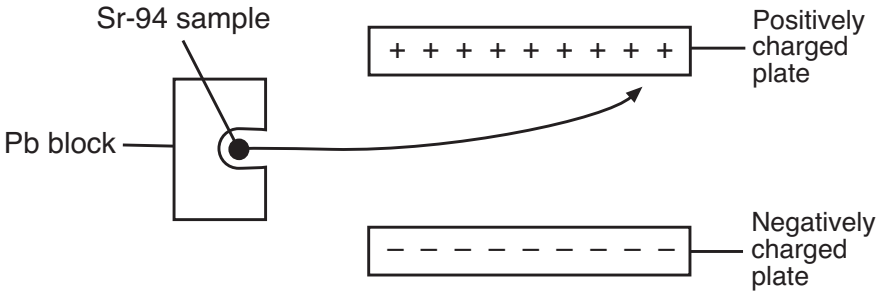
cesium-140

Cs-140

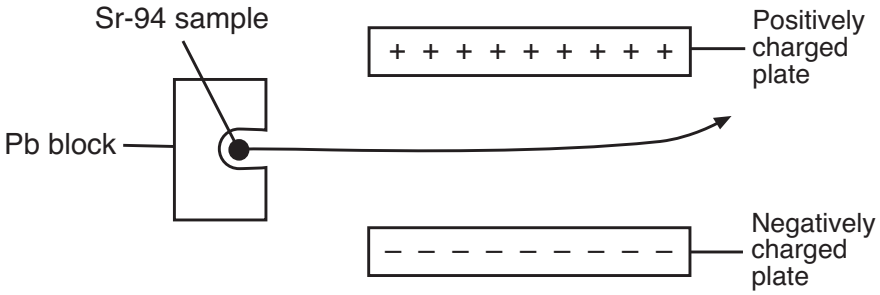
64 [1] Allow 1 credit for 5.00 min. Significant figures do *not* need to be shown.

65 [1] Allow 1 credit.

Examples of 1-credit responses:



An electric field exists between the two plates.



An electric field exists between the two plates.

Part C

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

66 [1] Allow 1 credit for 71.6% *or* any value from 71.55% to 72%, inclusive.

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

$(0.57)(120.90\ \text{u}) + (0.43)(122.90\ \text{u})$

$\frac{(57)(120.9) + (43)(122.9)}{100}$

$(57\%)(120.9) + (43\%)(122.9)$

68 [1] Allow 1 credit for $\underline{2}\ Sb_2S_3(s) + \underline{9}\ O_2(g) \rightarrow \underline{2}\ Sb_2O_3(s) + \underline{6}\ SO_2(g)$.

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

ionic bonds and polar covalent bonds

covalent and ionic

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

The solution is saturated because some $NH_4Cl(s)$ remained undissolved at the bottom of the test tube after stirring the contents of the test tube for 4 minutes.

Not all NH_4Cl dissolved.

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

The dissolving of $NH_4Cl(s)$ is endothermic because the temperature of the solution is lower than the temperature of the water.

The water temperature was 25.8°C and the solution temperature was 11.2°C.

The temperature decreased during the dissolving.

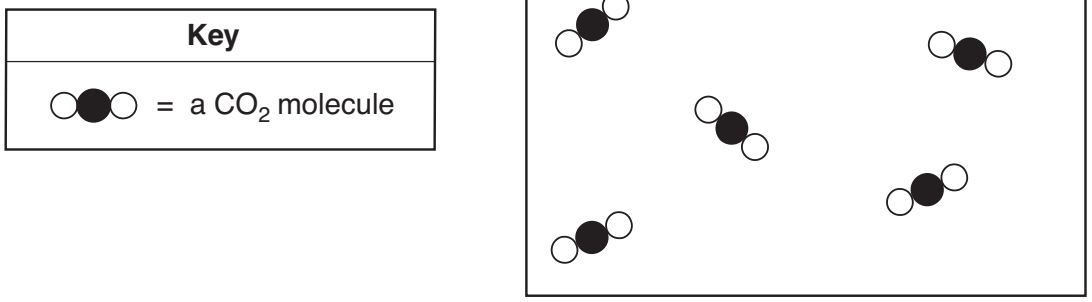
72 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

No solute remained in the bottom of the test tube.

No $NH_4Cl(s)$ observed after the stirring.

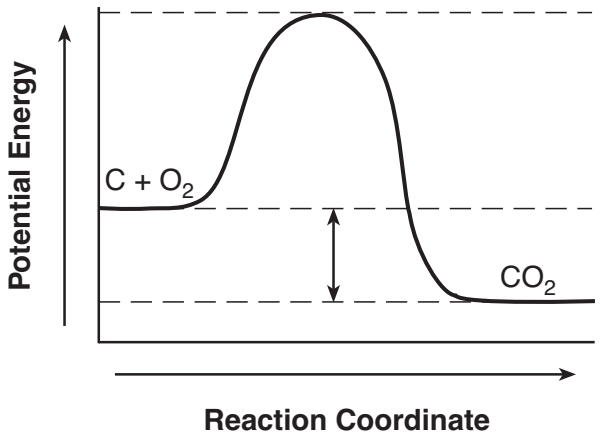
73 [1] Allow 1 credit.

Example of 1-credit response:



74 [1] Allow 1 credit.

Example of 1-credit response:



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

A NaCl solution has a lower freezing point than water.

FP of the salt water on the road $< 0°C$

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

The sample is greater than 25% NaCl by mass.

The ratio by mass of sand to NaCl in the sample is 2 to 1.

The mass of the salt is too great.

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

PbI_2

lead(II) iodide

78 [1] Allow 1 credit for 6.8 g. Significant figures do *not* need to be shown.

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

alcohol

alcohols

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

Molecules of the organic compounds are mostly nonpolar due to the large hydrocarbon part of each molecule, and water molecules are polar.

The polar effect of the –OH group is insignificant compared to the nonpolar part of each organic molecule.

Water molecules are polar. Geraniol and linalool molecules are primarily nonpolar.

81 [1] Allow 1 credit for $MgCl_2(aq)$.

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

Hydrogen ion concentration: decreases/lower

pH: increases/higher

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

Oxides are formed.

A substance reacts with oxygen.

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

from -4 to $+4$

from negative four to four

85 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

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

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

Regents Examination in Physical Setting/Chemistry

August 2015

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

The *Chart for Determining the Final Examination Score for the August 2015 Regents Examination in Physical Setting/Chemistry* will be posted on the Department's web site at: http://www.p12.nysed.gov/assessment/ on Thursday, August 13, 2015. 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

August 2015 Physical Setting/Chemistry			
Question Numbers			
Key Ideas/Performance Indicators	Part A	Part B	Part C
Standard 1			
Math Key Idea 1		48, 51, 58, 64	
Math Key Idea 2			72, 82, 85
Math Key Idea 3		48, 53, 57, 64	66, 67, 68, 70, 78, 84
Science Inquiry Key Idea 1		39, 40, 56, 59, 60, 61, 62	69, 75, 77
Science Inquiry Key Idea 2		47	
Science Inquiry Key Idea 3		45, 49, 54, 61, 62	66, 71, 73, 76, 77, 78, 80, 83, 84
Engineering Design Key Idea 1			
Standard 2			
Key Idea 1			71
Key Idea 2			
Key Idea 3			
Standard 6			
Key Idea 1			
Key Idea 2		47, 54, 65	83
Key Idea 3		57	82
Key Idea 4		44	
Key Idea 5			
Standard 7			
Key Idea 1			
Key Idea 2			
Standard 4 Process Skills			
Key Idea 3		31, 32, 33, 34, 35, 36, 41,42, 43, 44, 46, 48, 50, 52, 53, 55, 61	67, 68, 70, 72, 73, 78, 79, 80, 81, 85
Key Idea 4		59, 63, 64	71, 74
Key Idea 5		37, 38, 54	
Standard 4			
Key Idea 3	1, 2, 3, 4, 5, 6, 8, 9, 13, 14, 15, 17, 18, 19, 20, 22, 23, 24, 25, 26, 27, 28	31, 32, 33, 34, 35, 36, 41, 42, 43, 44, 45, 46, 47, 48, 50, 52, 53, 55, 56, 57, 60, 61, 65	66, 67, 68, 70, 72, 73, 75, 76, 77, 78, 79, 81, 82, 83, 84, 85
Key Idea 4	16, 29	49, 59, 62, 63, 64	71, 74
Key Idea 5	7, 10, 11, 12, 21, 30	37, 38, 39 40, 51, 54, 58	69, 80
Reference Tables			
2011 Edition	1, 2, 5, 10, 12, 15, 23, 29	32, 33, 34, 35, 36, 38, 39, 43, 45, 48, 50, 53, 54, 55, 60, 64	66, 69, 72, 77, 79, 81, 84, 85

Regents Examination in Physical Setting/Chemistry – August 2015

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

Raw Score	Scale Score
85	**100**
84	**98**
83	**96**
82	**95**
81	**93**
80	**92**
79	**91**
78	**89**
77	**88**
76	**87**
75	**86**
74	**85**
73	**83**
72	**82**
71	**81**
70	**80**
69	**79**
68	**78**
67	**78**
66	**77**
65	**76**
64	**75**
63	**74**

Raw Score	Scale Score
62	**73**
61	**73**
60	**72**
59	**71**
58	**70**
57	**70**
56	**69**
55	**68**
54	**67**
53	**67**
52	**66**
51	**66**
50	**65**
49	**64**
48	**63**
47	**63**
46	**62**
45	**61**
44	**61**
43	**60**
42	**59**
41	**58**
40	**58**

Raw Score	Scale Score
39	**57**
38	**56**
37	**55**
36	**55**
35	**54**
34	**53**
33	**52**
32	**51**
31	**50**
30	**50**
29	**49**
28	**48**
27	**47**
26	**46**
25	**45**
24	**43**
23	**42**
22	**41**
21	**40**
20	**39**
19	**37**
18	**36**
17	**35**

Raw Score	Scale Score
16	**33**
15	**32**
14	**30**
13	**28**
12	**27**
11	**25**
10	**23**
9	**21**
8	**19**
7	**17**
6	**15**
5	**13**
4	**11**
3	**8**
2	**6**
1	**3**
0	**0**

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 "Scale Score" on the student's answer sheet.

Schools are not permitted to rescore any of the open-ended questions on this exam after each question has been rated once, regardless of the final exam score. Schools are required to ensure that the raw scores have been added correctly and that the resulting scale score has been determined accurately.

Because scale scores corresponding to raw scores in the conversion chart change from one administration 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.