

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

**PHYSICAL SETTING
CHEMISTRY**

Wednesday, January 29, 2014 — 1:15 to 4:15 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, record on your separate answer sheet the *number* of the word or expression that, of those given, best completes the statement or answers the question. Some questions may require the use of the *2011 Edition Reference Tables for Physical Setting/Chemistry*.

- | | |
|--|---|
| <p>1 What is the approximate mass of a proton?
(1) 1 u (3) 1 g
(2) 0.0005 u (4) 0.0005 g</p> <p>2 An electron in a sodium atom gains enough energy to move from the second shell to the third shell. The sodium atom becomes
(1) a positive ion
(2) a negative ion
(3) an atom in an excited state
(4) an atom in the ground state</p> <p>3 Which particle has <i>no</i> charge?
(1) electron (3) positron
(2) neutron (4) proton</p> <p>4 Which quantity represents the number of protons in an atom?
(1) atomic number
(2) oxidation number
(3) number of neutrons
(4) number of valence electrons</p> <p>5 The element sulfur is classified as a
(1) metal (3) nonmetal
(2) metalloid (4) noble gas</p> <p>6 The elements in Group 2 have similar chemical properties because each atom of these elements has the same
(1) atomic number
(2) mass number
(3) number of electron shells
(4) number of valence electrons</p> | <p>7 What is formed when two atoms of bromine bond together?
(1) a monatomic molecule
(2) a diatomic molecule
(3) a heterogeneous mixture
(4) a homogeneous mixture</p> <p>8 Gold can be flattened into an extremely thin sheet. The malleability of gold is due to the
(1) radioactive decay mode of the isotope Au-198
(2) proton-to-neutron ratio in an atom of gold
(3) nature of the bonds between gold atoms
(4) reactivity of gold atoms</p> <p>9 Which term represents the attraction one atom has for the electrons in a bond with another atom?
(1) electronegativity
(2) electrical conductivity
(3) first ionization energy
(4) mechanical energy</p> <p>10 Salt water is classified as a
(1) compound because the proportion of its atoms is fixed
(2) compound because the proportion of its atoms can vary
(3) mixture because the proportion of its components is fixed
(4) mixture because the proportion of its components can vary</p> <p>11 Which substance can <i>not</i> be broken down by a chemical change?
(1) ammonia (3) ethane
(2) arsenic (4) propanal</p> |
|--|---|

- 12 Some physical properties of two samples of iodine-127 at two different temperatures are shown in the table below.

Selected Physical Properties of Iodine-127 Samples at 1 atm

Sample	Sample Temperature (K)	Description	Density (g/cm ³)
1	298	dark-gray crystals	4.933
2	525	dark-purple gas	0.006

These two samples are two different

- (1) mixtures
(2) substances
(3) phases of matter
(4) isotopes of iodine

- 13 Powdered iron is magnetic, but powdered sulfur is *not*. What occurs when they form a mixture in a beaker at room temperature?
- (1) The iron retains its magnetic properties.
(2) The iron loses its metallic properties.
(3) The sulfur gains magnetic properties.
(4) The sulfur gains metallic properties.
- 14 Which property is a measure of the average kinetic energy of the particles in a sample of matter?
- (1) mass
(2) density
(3) pressure
(4) temperature
- 15 According to the kinetic molecular theory, which statement describes the particles of an ideal gas?
- (1) The gas particles are arranged in a regular pattern.
(2) The force of attraction between the gas particles is strong.
(3) The gas particles are hard spheres in continuous circular motion.
(4) The collisions of the gas particles may result in the transfer of energy.
- 16 The concentration of a solution can be expressed in
- (1) milliliters per minute
(2) parts per million
(3) grams per kelvin
(4) joules per gram
- 17 Two hydrogen atoms form a hydrogen molecule when
- (1) one atom loses a valence electron to the other atom
(2) one atom shares four electrons with the other atom
(3) the two atoms collide and both atoms gain energy
(4) the two atoms collide with sufficient energy to form a bond
- 18 Which type of formula represents the simplest whole-number ratio of atoms of the elements in a compound?
- (1) molecular formula
(2) condensed formula
(3) empirical formula
(4) structural formula
- 19 The coefficients in a balanced chemical equation represent
- (1) the mass ratios of the substances in the reaction
(2) the mole ratios of the substances in the reaction
(3) the total number of electrons in the reaction
(4) the total number of elements in the reaction
- 20 Systems in nature tend to undergo changes toward
- (1) lower energy and higher entropy
(2) lower energy and lower entropy
(3) higher energy and higher entropy
(4) higher energy and lower entropy

- 21 Which formula represents an organic compound?
(1) CaH_2 (3) H_2O_2
(2) C_4H_8 (4) P_2O_5
- 22 Which class of organic compounds contains nitrogen?
(1) aldehyde (3) amine
(2) alcohol (4) ether
- 23 Which term identifies a type of organic reaction?
(1) deposition (3) esterification
(2) distillation (4) sublimation
- 24 Which compound is classified as a hydrocarbon?
(1) butanal (3) 2-butanol
(2) butyne (4) 2-butanone
- 25 In an oxidation-reduction reaction, the number of electrons lost is
(1) equal to the number of electrons gained
(2) equal to the number of protons gained
(3) less than the number of electrons gained
(4) less than the number of protons gained
- 26 Which substance is an electrolyte?
(1) $\text{C}_6\text{H}_{12}\text{O}_6(\text{s})$ (3) $\text{NaOH}(\text{s})$
(2) $\text{C}_2\text{H}_5\text{OH}(\ell)$ (4) $\text{H}_2(\text{g})$
- 27 Which energy conversion must occur in an operating electrolytic cell?
(1) electrical energy to chemical energy
(2) electrical energy to nuclear energy
(3) chemical energy to electrical energy
(4) chemical energy to nuclear energy
- 28 Which compound yields H^+ ions as the only positive ions in an aqueous solution?
(1) KOH (3) CH_3OH
(2) NaOH (4) CH_3COOH
- 29 Which statement describes the relative masses of two different particles?
(1) A neutron has less mass than a positron.
(2) A beta particle has less mass than a neutron.
(3) An alpha particle has less mass than a positron.
(4) An alpha particle has less mass than a beta particle.
- 30 Which term represents a type of nuclear reaction?
(1) condensation
(2) vaporization
(3) single replacement
(4) natural transmutation
-

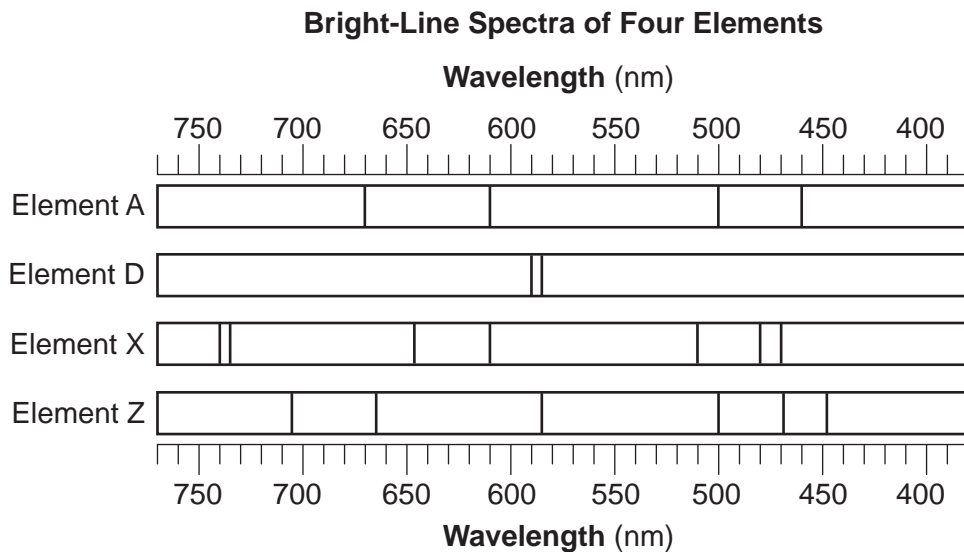
Part B-1

Answer all questions in this part.

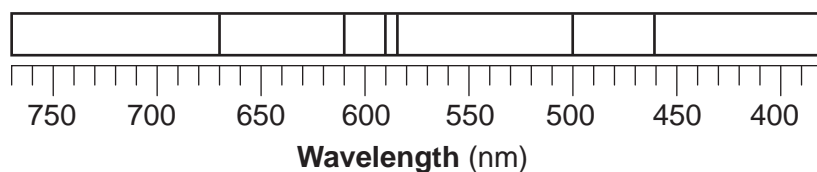
Directions (31–50): For *each* statement or question, record on your separate answer sheet the *number* of the word or expression that, of those given, best completes the statement or answers the question. Some questions may require the use of the *2011 Edition Reference Tables for Physical Setting/Chemistry*.

- 31 Which ion has the *smallest* radius?
(1) O^{2-} (3) Se^{2-}
(2) S^{2-} (4) Te^{2-}
- 32 Equal amounts of ethanol and water are mixed at room temperature and at 101.3 kPa. Which process is used to separate ethanol from the mixture?
(1) distillation (3) filtration
(2) reduction (4) ionization
- 33 A sample of a substance has these characteristics:
- melting point of 984 K
 - hard, brittle solid at room temperature
 - poor conductor of heat and electricity as a solid
 - good conductor of electricity as a liquid or in an aqueous solution
- This sample is classified as
(1) a metallic element
(2) a radioactive element
(3) a molecular compound
(4) an ionic compound
- 34 Given the balanced equation representing a reaction:
- $$N_2 + \text{energy} \rightarrow N + N$$
- Which statement describes this reaction?
(1) Bonds are broken, and the reaction is endothermic.
(2) Bonds are broken, and the reaction is exothermic.
(3) Bonds are formed, and the reaction is endothermic.
(4) Bonds are formed, and the reaction is exothermic.
- 35 When lithium reacts with bromine to form the compound LiBr, each lithium atom
(1) gains one electron and becomes a negatively charged ion
(2) gains three electrons and becomes a negatively charged ion
(3) loses one electron and becomes a positively charged ion
(4) loses three electrons and becomes a positively charged ion
- 36 A beaker with water and the surrounding air are all at 24°C. After ice cubes are placed in the water, heat is transferred from
(1) the ice cubes to the air
(2) the beaker to the air
(3) the water to the ice cubes
(4) the water to the beaker
- 37 A sample of chlorine gas is at 300. K and 1.00 atmosphere. At which temperature and pressure would the sample behave more like an ideal gas?
(1) 0 K and 1.00 atm
(2) 150. K and 0.50 atm
(3) 273 K and 1.00 atm
(4) 600. K and 0.50 atm
- 38 When a sample of a gas is heated in a sealed, rigid container from 200. K to 400. K, the pressure exerted by the gas is
(1) decreased by a factor of 2
(2) increased by a factor of 2
(3) decreased by a factor of 200.
(4) increased by a factor of 200.

39 The bright-line spectra produced by four elements are represented in the diagram below.



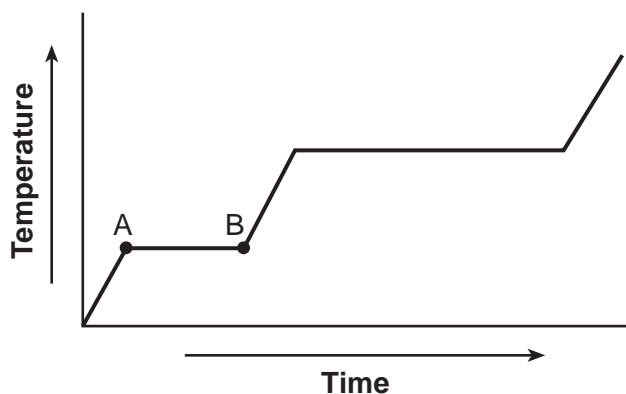
Given the bright-line spectrum of a mixture formed from two of these elements:



Which elements are present in this mixture?

- | | |
|---------------------------|---------------------------|
| (1) <i>A</i> and <i>D</i> | (3) <i>Z</i> and <i>D</i> |
| (2) <i>A</i> and <i>X</i> | (4) <i>Z</i> and <i>X</i> |

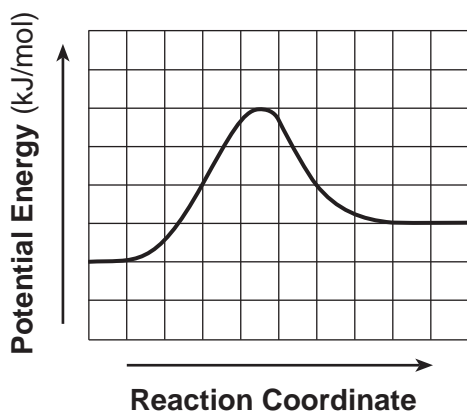
40 The graph below represents the relationship between time and temperature as heat is added at a constant rate to a sample of a substance.



During interval *AB*, which energy change occurs for the particles in this sample?

- (1) The potential energy of the particles increases.
- (2) The potential energy of the particles decreases.
- (3) The average kinetic energy of the particles increases.
- (4) The average kinetic energy of the particles decreases.

- 41 Given the potential energy diagram for a reversible chemical reaction:

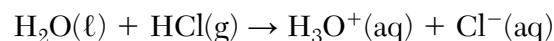


Each interval on the axis labeled “Potential Energy (kJ/mol)” represents 10. kilojoules per mole. What is the activation energy of the forward reaction?

- (1) 10. kJ/mol (3) 40. kJ/mol
 (2) 30. kJ/mol (4) 60. kJ/mol
- 42 Which condensed structural formula represents an unsaturated compound?
- (1) $\text{CH}_3\text{CHCHCH}_3$ (3) CH_3CH_3
 (2) $\text{CH}_3\text{CH}_2\text{CH}_3$ (4) CH_4
- 43 Which element reacts spontaneously with 1.0 M $\text{HCl}(\text{aq})$ at room temperature?
- (1) copper (3) silver
 (2) gold (4) zinc
- 44 Given the balanced ionic equation:
- $$3\text{Pb}^{2+}(\text{aq}) + 2\text{Cr}(\text{s}) \rightarrow 3\text{Pb}(\text{s}) + 2\text{Cr}^{3+}(\text{aq})$$
- What is the number of moles of electrons gained by 3.0 moles of lead ions?
- (1) 5.0 mol (3) 3.0 mol
 (2) 2.0 mol (4) 6.0 mol
- 45 What is the amount of heat energy released when 50.0 grams of water is cooled from 20.0°C to 10.0°C ?
- (1) $5.00 \times 10^2 \text{ J}$ (3) $1.67 \times 10^5 \text{ J}$
 (2) $2.09 \times 10^3 \text{ J}$ (4) $1.13 \times 10^6 \text{ J}$

- 46 What occurs at one of the electrodes in both an electrolytic cell and a voltaic cell?
- (1) Oxidation occurs as electrons are gained at the cathode.
 (2) Oxidation occurs as electrons are lost at the anode.
 (3) Reduction occurs as electrons are gained at the anode.
 (4) Reduction occurs as electrons are lost at the cathode.

- 47 Given the balanced equation representing a reaction:



According to one acid-base theory, the $\text{H}_2\text{O}(\ell)$ molecules

- (1) accept H^+ ions (3) donate H^+ ions
 (2) accept OH^- ions (4) donate OH^- ions
- 48 When an atom of the unstable isotope Na-24 decays, it becomes an atom of Mg-24 because the Na-24 atom spontaneously releases
- (1) an alpha particle (3) a neutron
 (2) a beta particle (4) a positron
- 49 Which balanced equation represents nuclear fusion?
- (1) ${}^3_1\text{H} \rightarrow {}^3_2\text{He} + {}^0_{-1}\text{e}$
 (2) ${}^{235}_{92}\text{U} \rightarrow {}^{231}_{90}\text{Th} + {}^4_2\text{He}$
 (3) ${}^2_1\text{H} + {}^2_1\text{H} \rightarrow {}^4_2\text{He}$
 (4) ${}^{235}_{92}\text{U} + {}^1_0\text{n} \rightarrow {}^{90}_{38}\text{Sr} + {}^{143}_{54}\text{Xe} + 3{}^1_0\text{n}$
- 50 Which reaction releases the greatest amount of energy per kilogram of reactants?
- (1) ${}^1_0\text{n} + {}^{235}_{92}\text{U} \rightarrow {}^{141}_{56}\text{Ba} + {}^{92}_{36}\text{Kr} + 3{}^1_0\text{n}$
 (2) $2\text{C} + \text{H}_2 \rightarrow \text{C}_2\text{H}_2$
 (3) $\text{C}_3\text{H}_8(\text{g}) + 5\text{O}_2(\text{g}) \rightarrow 3\text{CO}_2(\text{g}) + 4\text{H}_2\text{O}(\ell)$
 (4) $\text{NaOH}(\text{aq}) + \text{HCl}(\text{aq}) \rightarrow \text{NaCl}(\text{aq}) + \text{H}_2\text{O}(\ell)$

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 *2011 Edition Reference Tables for Physical Setting/Chemistry*.

Base your answers to questions 51 through 54 on the information below and on your knowledge of chemistry.

The diagram below represents three elements in Group 13 and three elements in Period 3 and their relative positions on the Periodic Table.

Al	Si	P
Ga		
In		

Some elements in the solid phase exist in different forms that vary in their physical properties. For example, at room temperature, red phosphorus has a density of 2.16 g/cm^3 and white phosphorus has a density of 1.823 g/cm^3 .

- 51 Identify the element from the diagram that will react with chlorine to form a compound with the general formula XCl_4 . [1]
- 52 Consider the Period 3 elements in the diagram in order of increasing atomic number. State the trend in electronegativity for these elements. [1]
- 53 Compare the number of atoms per cubic centimeter in red phosphorus with the number of atoms per cubic centimeter in white phosphorus. [1]
- 54 Identify *one* element from the diagram that will combine with phosphorus in the same ratio of atoms as the ratio in aluminum phosphide. [1]
-

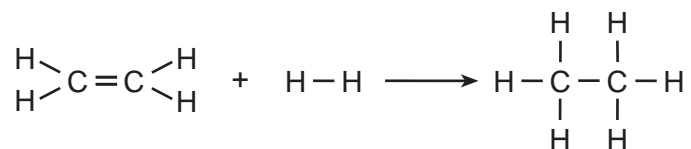
Base your answers to questions 55 through 57 on the information below and on your knowledge of chemistry.

The compounds KNO_3 and NaNO_3 are soluble in water.

- 55 Compare the entropy of 30. grams of solid KNO_3 at $20.^\circ\text{C}$ with the entropy of 30. grams of KNO_3 dissolved in 100. grams of water at $20.^\circ\text{C}$. [1]
- 56 Explain why the total thermal energy of a sample containing 22.2 grams of NaNO_3 dissolved in 200. grams of water at $20.^\circ\text{C}$ is greater than the total thermal energy of a sample containing 11.1 grams of NaNO_3 dissolved in 100. grams of water at $20.^\circ\text{C}$. [1]
- 57 Compare the boiling point of a NaNO_3 solution at standard pressure to the boiling point of water at standard pressure. [1]
-

Base your answers to questions 58 through 61 on the information below and on your knowledge of chemistry.

Ethene and hydrogen can react at a faster rate in the presence of the catalyst platinum. The equation below represents a reaction between ethene and hydrogen.



- 58 Determine the molar mass of the product. [1]
- 59 State the number of electrons shared between the carbon atoms in one molecule of the reactant ethene. [1]
- 60 Explain, in terms of activation energy, why the catalyzed reaction occurs at a faster rate. [1]
- 61 Explain why the reaction is classified as an addition reaction. [1]
-

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

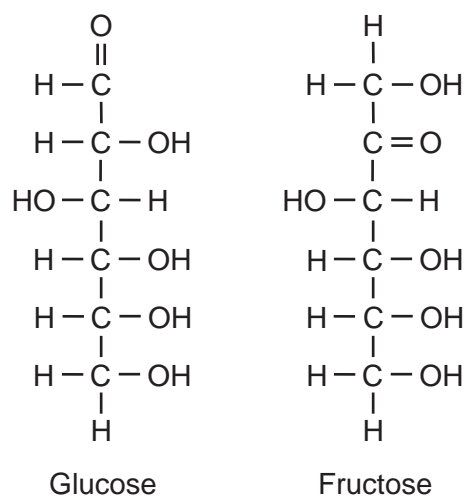
In a titration, 50.0 milliliters of 0.026 M HCl(aq) is neutralized by 38.5 milliliters of KOH(aq).

62 In the space *in your answer booklet*, show a numerical setup for calculating the molarity of the KOH(aq). [1]

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

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

Table sugar, sucrose, is a combination of two simple sugars, glucose and fructose. The formulas below represent these simple sugars.



64 Identify the functional group that appears more than once in the fructose molecule. [1]

65 Explain, in terms of atoms and molecular structure, why glucose and fructose are isomers of each other. [1]

Part C

Answer all questions in this part.

Directions (66–85): Record your answers in the spaces provided in your 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 70 on the information below and on your knowledge of chemistry.

Baking soda, NaHCO_3 , can be commercially produced during a series of chemical reactions called the Solvay process. In this process, $\text{NH}_3(\text{aq})$, $\text{NaCl}(\text{aq})$, and other chemicals are used to produce $\text{NaHCO}_3(\text{s})$ and $\text{NH}_4\text{Cl}(\text{aq})$.

To reduce production costs, $\text{NH}_3(\text{aq})$ is recovered from $\text{NH}_4\text{Cl}(\text{aq})$ through a different series of reactions. This series of reactions can be summarized by the overall reaction represented by the unbalanced equation below.



- 66 Write a chemical name for baking soda. [1]
- 67 Determine the percent composition by mass of carbon in baking soda (gram-formula mass = 84 grams per mole). [1]
- 68 State the color of bromcresol green in a sample of $\text{NH}_3(\text{aq})$. [1]
- 69 Determine the mass of NH_4Cl that must be dissolved in 100. grams of H_2O to produce a saturated solution at $70.^\circ\text{C}$. [1]
- 70 Balance the equation *in your answer booklet* for the overall reaction used to recover $\text{NH}_3(\text{aq})$, using the smallest whole-number coefficients. [1]
-

Base your answers to questions 71 through 75 on the information below and on your knowledge of chemistry.

Rubbing alcohol is a product available at most pharmacies and supermarkets. One rubbing alcohol solution contains 2-propanol and water. The boiling point of 2-propanol is 82.3°C at standard pressure.

- 71 Explain, in terms of electronegativity differences, why a C – O bond is more polar than a C – H bond. [1]
- 72 Identify a strong intermolecular force of attraction between an alcohol molecule and a water molecule in the solution. [1]
- 73 Determine the vapor pressure of water at a temperature equal to the boiling point of the 2-propanol. [1]
- 74 Explain, in terms of charge distribution, why a molecule of the 2-propanol is a polar molecule. [1]
- 75 In the space *in your answer booklet*, draw a structural formula for the 2-propanol. [1]
-

Base your answers to questions 76 and 77 on the information below and on your knowledge of chemistry.

Silver-plated utensils were popular before stainless steel became widely used to make eating utensils. Silver tarnishes when it comes in contact with hydrogen sulfide, H₂S, which is found in the air and in some foods. However, stainless steel does *not* tarnish when it comes in contact with hydrogen sulfide.

- 76 In the space *in your answer booklet*, draw a Lewis electron-dot diagram for the compound that tarnishes silver. [1]
- 77 In the ground state, an atom of which noble gas has the same electron configuration as the sulfide ion in Ag₂S? [1]
-

Base your answers to questions 78 through 81 on the information below and on your knowledge of chemistry.

Common household bleach is an aqueous solution containing hypochlorite ions. A closed container of bleach is an equilibrium system represented by the equation below.



- 78 Compare the rate of the forward reaction to the rate of the reverse reaction for this system. [1]
- 79 State the change in oxidation number for chlorine when the $\text{Cl}_2(\text{g})$ changes to $\text{Cl}^-(\text{aq})$ during the forward reaction. [1]
- 80 Explain why the container must be closed to maintain equilibrium. [1]
- 81 State the effect on the concentration of the ClO^- ion when there is a *decrease* in the concentration of the OH^- ion. [1]
-

Base your answers to questions 82 through 85 on the information below and on your knowledge of chemistry.

Iodine has many isotopes, but only iodine-127 is stable and is found in nature. One radioactive iodine isotope, I-108, decays by alpha particle emission. Iodine-131 is also radioactive and has many important medical uses.

- 82 Determine the number of neutrons in an atom of I-127. [1]
- 83 Explain, in terms of protons and neutrons, why I-127 and I-131 are different isotopes of iodine. [1]
- 84 Complete the equation *in your answer booklet* for the nuclear decay of I-108. [1]
- 85 Determine the total time required for an 80.0-gram sample of I-131 to decay until only 1.25 grams of the sample remains unchanged. [1]
-

PHYSICAL SETTING CHEMISTRY

Wednesday, January 29, 2014 — 1:15 to 4:15 p.m., only

ANSWER BOOKLET

Male

Student Sex: Female

Teacher

School Grade

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

Part B–2

51 _____

52 _____

53 _____

54 _____

55

56

57

58

_____ g/mol

59

60

61

Part C

66 _____

67 _____ %

68 _____

69 _____ g

70 _____ NH_4Cl + _____ CaO \rightarrow _____ NH_3 + _____ H_2O + _____ CaCl_2

71 _____

72 _____

73 _____ kPa

74 _____

75

76

77 _____

78 _____

79 _____ to _____

80 _____

81 _____

82 _____

83 _____

84 ${}_{53}^{108}\text{I} \rightarrow {}_2^4\text{He} +$ _____

85 _____ d

FOR TEACHERS ONLY

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

P.S.–CH PHYSICAL SETTING/CHEMISTRY

Wednesday, January 29, 2014 — 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 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 1	9 1	17 4	25 1
2 3	10 4	18 3	26 3
3 2	11 2	19 2	27 1
4 1	12 3	20 1	28 4
5 3	13 1	21 2	29 2
6 4	14 4	22 3	30 4
7 2	15 4	23 3	
8 3	16 2	24 2	
Part B-1			
31 1	36 3	41 3	46 2
32 1	37 4	42 1	47 1
33 4	38 2	43 4	48 2
34 1	39 1	44 4	49 3
35 3	40 1	45 2	50 1

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 Wednesday, January 29, 2014. 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. Acceptable responses include, but are not limited to:

Si

silicon

element 14

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

As atomic number increases, the electronegativity increases.

Electronegativity increases.

from lower to higher

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

White phosphorus has fewer atoms per cm^3 .

Red has more.

Note: Do *not* allow credit for a response that only indicates the number of atoms per cm^3 in red phosphorus is different from the number of atoms per cm^3 in white phosphorus.

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

Ga

indium

element 31

element 49

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

The entropy of $\text{KNO}_3(\text{s})$ is less than the entropy of $\text{KNO}_3(\text{aq})$.

The $\text{KNO}_3(\text{aq})$ is more disordered.

The solution is more random than the solid.

Note: Do *not* allow credit for a response that only indicates the entropies are different.

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

Both samples are at $20.^\circ\text{C}$, but the larger sample has more matter.

The larger sample has twice as many particles.

The total thermal energy is directly proportional to the masses of the samples.

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

The boiling point of the NaNO_3 solution is higher than the boiling point of water.

lower for H_2O

58 [1] Allow 1 credit for 30 g/mol, 30. g/mol, *or* for any value from 30.06 g/mol to 30.1 g/mol, inclusive.

59 [1] Allow 1 credit for 4 *or* four.

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

The catalyzed reaction pathway has a lower activation energy than the original reaction.

Less energy is needed.

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

Hydrogen atoms are added to the ethene molecule at the site of the carbon-carbon double bond to form a single molecule.

Two reactants combine to form a single product.

Two substances form one.

Two hydrogen atoms are added at $\text{C}=\text{C}$.

An unsaturated reactant becomes a saturated product.

The reaction is a hydrogenation reaction, which is a type of addition reaction.

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

$$(0.026 \text{ M})(50.0 \text{ mL}) = M_B (38.5 \text{ mL})$$

$$\frac{(0.026)(50)}{38.5}$$

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



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



alcohol

hydroxyl

hydroxy group

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

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

The number of each kind of atom is the same in both, but their structures are not the same.

Their molecular formulas are the same, but their structural arrangement of atoms is different.

same molecular formula but different structural formulas

The only difference is the arrangement of the atoms.

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. Acceptable responses include, but are not limited to:

sodium hydrogen carbonate

sodium bicarbonate

sodium acid carbonate

monosodium carbonate

bicarbonate of soda

67 [1] Allow 1 credit for 14% *or* for any value from 14.28% to 14.3%, inclusive.

68 [1] Allow 1 credit for blue.

69 [1] Allow 1 credit for any value from 61 g to 63 g, inclusive.

70 [1] Allow 1 credit for 2 NH₄Cl + CaO → 2 NH₃ + H₂O + CaCl₂.

Note: Allow credit even if the coefficient “1” is written in front of CaO, H₂O, and/or CaCl₂.

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

There is a greater electronegativity difference in a C–O bond than in a C–H bond.

The C–O bond is more polar because the electronegativity difference for a C–O bond is 0.8, and the electronegativity difference for a C–H bond is 0.4.

The C–H bond has a smaller difference.

The C–O is .8 and the C–H is .4.

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

hydrogen bonding

dipole–dipole

73 [1] Allow 1 credit for any value from 48 kPa to 52 kPa, inclusive.

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

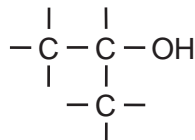
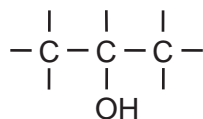
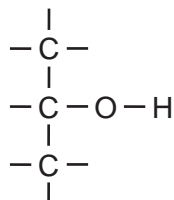
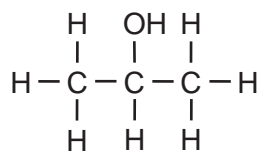
A 2-propanol molecule is polar because it has an asymmetrical distribution of charge.

The charge distribution is uneven.

The center of positive charge and the center of negative charge do *not* coincide.

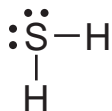
75 [1] Allow 1 credit.

Examples of 1-credit responses:



76 [1] Allow 1 credit. The position of electrons may vary.

Examples of 1-credit responses:



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

Ar

argon

element 18

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

The rate of the forward reaction is equal to the rate of the reverse reaction.

They are the same.

equal

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

0 to -1

0 to 1-

zero to negative one

0 to minus one

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

The container must be closed so that no matter can enter or leave, thus disturbing the equilibrium.

If the container is open, Cl₂ gas escapes.

to keep the concentrations of the reactants and products constant

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

The concentration of the ClO⁻ ion decreases.

[ClO⁻] decreases.

lower ClO⁻ concentration

less ClO⁻

82 [1] Allow 1 credit for 74.

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

I-127 atoms and I-131 atoms have the same number of protons, but different numbers of neutrons.

Both have 53 p, but I-127 has 74 n while I-131 has 78 n.

They have the same atomic number but different mass numbers.

same atomic number but different numbers of neutrons

The only difference is the number of neutrons.

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

$^{104}_{51}\text{Sb}$

^{104}Sb

Sb-104

antimony-104

85 [1] Allow 1 credit for 48 d, 48.0 d, 48.1 d, *or* for any value from 48.12 d to 48.13 d, inclusive.

Regents Examination in Physical Setting/Chemistry

January 2014

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

The *Chart for Determining the Final Examination Score for the January 2014 Regents Examination in Physical Setting/Chemistry* will be posted on the Department's web site at: <http://www.p12.nysed.gov/assessment/> on Wednesday, January 29, 2014. 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 2014 Physical Setting/Chemistry			
Question Numbers			
Key Ideas/Performance Indicators	Part A	Part B	Part C
Standard 1			
Math Key Idea 1		62	69, 73
Math Key Idea 2		59	69, 70, 71, 73
Math Key Idea 3		44, 45, 51, 58	67, 71, 79, 84, 85
Science Inquiry Key Idea 1		35, 40, 53, 55, 56, 57, 59, 60, 64, 65	72, 74, 75, 78, 80, 83
Science Inquiry Key Idea 2			
Science Inquiry Key Idea 3		33, 34, 37, 39, 40, 47, 50, 51, 52, 54, 61, 63	66, 68, 70, 74, 77, 79, 82
Engineering Design Key Idea 1			
Standard 2			
Key Idea 1			
Key Idea 2			
Standard 6			
Key Idea 1		36	
Key Idea 2		38, 65	
Key Idea 3			
Key Idea 4			80, 81
Key Idea 5		40	
Standard 7			
Key Idea 1			
Key Idea 2			
Standard 4 Process Skills			
Key Idea 3		31, 32, 35, 38, 39, 42, 43, 44, 46, 51, 52, 54, 58, 62, 63, 64	68, 69, 70, 75, 78, 81, 82, 83
Key Idea 4		34, 40, 41, 45, 48, 49, 56	84, 85
Key Idea 5			76, 77
Standard 4			
Key Idea 3	1, 2, 3, 4, 5, 6, 10, 11, 12, 13, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29	31, 32, 37, 38, 39, 42, 43, 44, 46, 47, 48, 51, 52, 54, 55, 57, 58, 60, 61, 62, 63, 64, 65	66, 67, 68, 69, 70, 75, 78, 79, 80, 81, 82, 83
Key Idea 4	14, 30	36, 40, 45, 49, 56	84, 85
Key Idea 5	7, 8, 9	33, 34, 35, 41, 50, 53, 59	71, 72, 73, 74, 76, 77
Reference Tables			
2011 Edition	1, 2, 3, 5, 6, 11, 16, 21, 22, 23, 24, 26, 28, 29	31, 35, 38, 42, 43, 45, 48, 50, 51, 52, 53, 54, 57, 58, 59, 62, 63, 64	66, 67, 68, 69, 71, 73, 75, 76, 77, 82, 83, 84, 85

Regents Examination in Physical Setting/Chemistry – January 2014

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

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.