

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

**PHYSICAL SETTING
CHEMISTRY**

Wednesday, August 16, 2017 — 8:30 to 11:30 a.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*.

- Which phrase describes an Al atom?
 - a negatively charged nucleus, surrounded by negatively charged electrons
 - a negatively charged nucleus, surrounded by positively charged electrons
 - a positively charged nucleus, surrounded by negatively charged electrons
 - a positively charged nucleus, surrounded by positively charged electrons
- What is the number of electrons in an atom that has 20 protons and 17 neutrons?
 - 37
 - 20
 - 3
 - 17
- The mass of a proton is approximately equal to the mass of
 - an electron
 - a neutron
 - an alpha particle
 - a beta particle
- When a sample of $\text{CO}_2(\text{s})$ becomes $\text{CO}_2(\text{g})$, there is a change in
 - bond type
 - gram-formula mass
 - molecular polarity
 - particle arrangement
- Which properties are characteristic of Group 2 elements at STP?
 - good electrical conductivity and electronegativities less than 1.7
 - good electrical conductivity and electronegativities greater than 1.7
 - poor electrical conductivity and electronegativities less than 1.7
 - poor electrical conductivity and electronegativities greater than 1.7
- Compared to an atom of C-12, an atom of C-14 has a greater
 - number of electrons
 - number of protons
 - atomic number
 - mass number
- Elements that have atoms with stable valence electron configurations in the ground state are found in
 - Group 1
 - Group 8
 - Group 11
 - Group 18
- A magnesium atom that loses two electrons becomes a
 - positive ion with a smaller radius
 - negative ion with a smaller radius
 - positive ion with a larger radius
 - negative ion with a larger radius
- An atom of which element has the strongest attraction for the electrons in a bond?
 - aluminum
 - carbon
 - chlorine
 - lithium
- Which type of matter can *not* be broken down into simpler substances by a chemical change?
 - an element
 - a solution
 - a mixture
 - a compound
- According to Table F, which substance is most soluble in water?
 - AgCl
 - CaCO₃
 - Na₂CO₃
 - SrSO₄

12 Given the equation representing a reaction:



Which statement describes the energy change in this reaction?

- (1) A bond is broken as energy is absorbed.
- (2) A bond is broken as energy is released.
- (3) A bond is formed as energy is absorbed.
- (4) A bond is formed as energy is released.

13 Which sample of matter is a mixture?

- (1) air
- (2) ammonia
- (3) manganese
- (4) water

14 Paper chromatography can separate the components of a mixture of colored dyes because the components have differences in

- (1) decay mode
- (2) thermal conductivity
- (3) ionization energy
- (4) molecular polarity

15 At standard pressure, the boiling point of an unsaturated $\text{NaNO}_3(\text{aq})$ solution increases when

- (1) the solution is diluted with water
- (2) some of the $\text{NaNO}_3(\text{aq})$ solution is removed
- (3) the solution is stirred
- (4) more $\text{NaNO}_3(\text{s})$ is dissolved in the solution

16 Which term identifies a form of energy?

- (1) combustion
- (2) exothermic
- (3) thermal
- (4) electrolytic

17 According to kinetic molecular theory, which statement describes one characteristic of an ideal gas system?

- (1) The distance between gas molecules is smaller than the diameter of one gas molecule.
- (2) The attractive force between two gas molecules is strong.
- (3) The energy of the system decreases as gas molecules collide.
- (4) The straight-line motion of the gas molecules is constant and random.

18 The temperature of a substance is a measure of the

- (1) average kinetic energy of its particles
- (2) average potential energy of its particles
- (3) ionization energy of its particles
- (4) activation energy of its particles

19 A real gas behaves most like an ideal gas at

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

20 A reaction is most likely to occur when the colliding particles have proper orientation and

- (1) mass
- (2) volume
- (3) half-life
- (4) energy

21 At STP, a 12.0-liter sample of $\text{CH}_4(\text{g})$ has the same total number of molecules as

- (1) 6.0 L of $\text{H}_2(\text{g})$ at STP
- (2) 12.0 L of $\text{CO}_2(\text{g})$ at STP
- (3) 18.0 L of $\text{HCl}(\text{g})$ at STP
- (4) 24.0 L of $\text{O}_2(\text{g})$ at STP

22 At standard pressure, during which physical change does the potential energy decrease?

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

23 Which equation represents a chemical equilibrium?

- (1) $\text{N}_2(\ell) \rightleftharpoons \text{N}_2(\text{g})$
- (2) $2\text{NO}_2(\text{g}) \rightleftharpoons \text{N}_2\text{O}_4(\text{g})$
- (3) $\text{CO}_2(\text{s}) \rightleftharpoons \text{CO}_2(\text{g})$
- (4) $\text{NH}_3(\ell) \rightleftharpoons \text{NH}_3(\text{g})$

24 The amount of randomness of the atoms in a system is an indication of the

- (1) entropy of the system
- (2) polarity of the system
- (3) excited state of the atoms
- (4) ground state of the atoms

- 25 When a sample of Ca(s) loses 1 mole of electrons in a reaction with a sample of $\text{O}_2(\text{g})$, the oxygen
- (1) loses 1 mole of electrons
 - (2) loses 2 moles of electrons
 - (3) gains 1 mole of electrons
 - (4) gains 2 moles of electrons
- 26 Which reaction occurs at the anode of an electrochemical cell?
- (1) oxidation
 - (2) reduction
 - (3) neutralization
 - (4) transmutation
- 27 Which substance is an electrolyte?
- (1) CCl_4
 - (2) $\text{C}_6\text{H}_{12}\text{O}_6$
 - (3) SiO_2
 - (4) H_2SO_4
- 28 In which process does a heavy nucleus split into two lighter nuclei?
- (1) titration
 - (2) fission
 - (3) electrolysis
 - (4) neutralization
- 29 Which process converts mass into energy?
- (1) distillation of ethanol
 - (2) filtration of a mixture
 - (3) fusion of hydrogen atoms
 - (4) ionization of cesium atoms
- 30 Which radioisotope is used to determine the age of once-living organisms?
- (1) carbon-14
 - (2) cobalt-60
 - (3) iodine-131
 - (4) uranium-238
-

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

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

32 The table below gives the atomic mass and the abundance of the two naturally occurring isotopes of bromine.

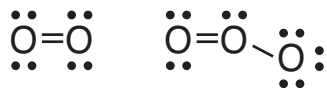
Naturally Occurring Isotopes of Bromine

Isotopes	Atomic Mass (u)	Natural Abundance (%)
Br-79	78.92	50.69
Br-81	80.92	49.31

Which numerical setup can be used to calculate the atomic mass of the element bromine?

- (1) $(78.92 \text{ u})(50.69) + (80.92 \text{ u})(49.31)$
 (2) $(78.92 \text{ u})(49.31) + (80.92 \text{ u})(50.69)$
 (3) $(78.92 \text{ u})(0.5069) + (80.92 \text{ u})(0.4931)$
 (4) $(78.92 \text{ u})(0.4931) + (80.92 \text{ u})(0.5069)$

33 Given the formulas of two substances:



These diagrams represent substances that have

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

34 What is the chemical formula of titanium(II) oxide?

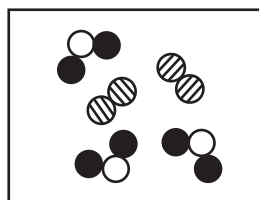
- (1) TiO (3) TiO₂
 (2) Ti₂O (4) Ti₂O₃

35 Which equation shows conservation of mass and energy for a reaction at 101.3 kPa and 298 K?

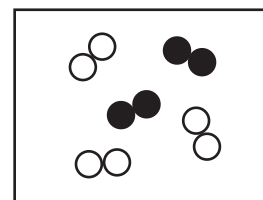
- (1) $2\text{H}_2(\text{g}) + \text{O}_2(\text{g}) \rightarrow 2\text{H}_2\text{O}(\text{g}) + 483.6 \text{ kJ}$
 (2) $2\text{H}_2(\text{g}) + \text{O}_2(\text{g}) \rightarrow 2\text{H}_2\text{O}(\ell) + 285.8 \text{ kJ}$
 (3) $\text{H}_2(\text{g}) + \text{O}_2(\text{g}) \rightarrow \text{H}_2\text{O}(\text{g}) + 483.6 \text{ kJ}$
 (4) $\text{H}_2(\text{g}) + \text{O}_2(\text{g}) \rightarrow \text{H}_2\text{O}(\ell) + 285.8 \text{ kJ}$

36 Which two particle diagrams each represent a sample of one substance?

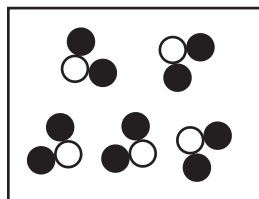
Key
○ = atom of oxygen
● = atom of hydrogen
⊖ = atom of chlorine



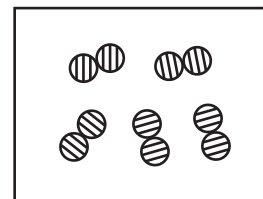
I



III



II



IV

- (1) I and II
 (2) I and III

- (3) II and III
 (4) II and IV

37 According to Table G, which substance forms an unsaturated solution when 80. grams of the substance are stirred into 100. grams of H₂O at 10.°C?

- (1) KNO₃ (3) NH₃
 (2) KI (4) NaCl

38 What is the concentration of AgCl in an aqueous solution that contains 1.2×10^{-3} gram of AgCl in 800. grams of the solution?

- (1) 1.2 ppm (3) 7.2 ppm
 (2) 1.5 ppm (4) 9.6 ppm

39 A sample of gas is in a rigid cylinder with a movable piston. The pressure of the gas is kept constant. If the Kelvin temperature of the gas is doubled, the volume of the gas is

- (1) halved (3) tripled
 (2) doubled (4) unchanged

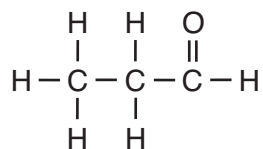
40 What is the amount of heat required to completely melt a 200.-gram sample of H₂O(s) at STP?

- (1) 334 J (3) 66 800 J
 (2) 836 J (4) 452 000 J

41 As a 15.1-gram sample of a metal absorbs 48.75 J of heat, its temperature increases 25.0 K. What is the specific heat capacity of the metal?

- (1) 0.129 J/g•K (3) 3.23 J/g•K
 (2) 1.95 J/g•K (4) 7.74 J/g•K

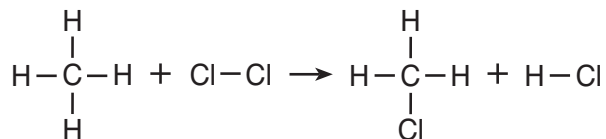
42 Given the formula:



What is a chemical name of this compound?

- (1) propane (3) propanol
 (2) propanal (4) propanone

43 Given the equation representing a reaction:



Which type of reaction is represented by this equation?

- (1) addition (3) polymerization
 (2) esterification (4) substitution

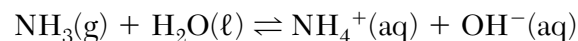
44 Atoms of which element react spontaneously with Mg²⁺(aq)?

- (1) chromium (3) iron
 (2) barium (4) zinc

45 In a titration, 5.0 mL of a 2.0 M NaOH(aq) solution exactly neutralizes 10.0 mL of an HCl(aq) solution. What is the concentration of the HCl(aq) solution?

- (1) 1.0 M (3) 10. M
 (2) 2.0 M (4) 20. M

46 Given the equation representing a reaction at equilibrium:



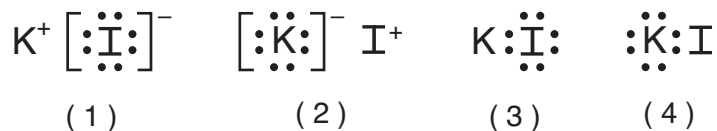
If an acid is defined as an H⁺ donor, what is the acid in the forward reaction?

- (1) OH⁻(aq) (3) NH₃(g)
 (2) H₂O(ℓ) (4) NH₄⁺(aq)

47 Compared to a solution with a pH value of 7, a solution with a thousand times greater hydronium ion concentration has a pH value of

- (1) 10 (3) 3
 (2) 7 (4) 4

48 Which Lewis electron-dot diagram represents the bonding in potassium iodide?



49 The table below shows properties of two compounds at standard pressure.

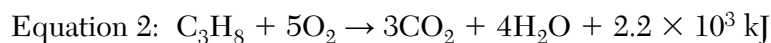
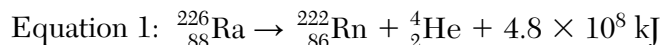
Selected Properties of Two Compounds

Compound	Melting Point (°C)	Boiling Point (°C)	Electrical Conductivity
1	775	1935	good as a liquid or in an aqueous solution
2	-112.1	46	poor as a liquid

Which statement classifies the two compounds?

- (1) Both compounds are ionic.
- (2) Both compounds are molecular.
- (3) Compound 1 is ionic, and compound 2 is molecular.
- (4) Compound 1 is molecular, and compound 2 is ionic.

50 Given two balanced equations, each representing a reaction:



Which statement compares the energy terms in these two equations?

- (1) Equation 1 shows 2.2×10^5 times more energy being absorbed.
 - (2) Equation 2 shows 2.2×10^5 times more energy being absorbed.
 - (3) Equation 1 shows 2.2×10^5 times more energy being released.
 - (4) Equation 2 shows 2.2×10^5 times more energy being released.
-

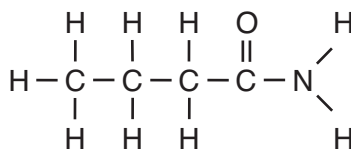
Part B-2

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 and 52 on the information below and on your knowledge of chemistry.

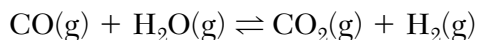
The formula below represents a molecule of butanamide.



- 51 State the type of chemical bond between a hydrogen atom and the nitrogen atom in the molecule. [1]
- 52 Explain, in terms of charge distribution, why a molecule of butanamide is polar. [1]
-

Base your answers to questions 53 and 54 on the information below and on your knowledge of chemistry.

An equilibrium system in a sealed, rigid container is represented by the equation below.



- 53 Compare the rate of the forward reaction to the rate of the reverse reaction at equilibrium. [1]
- 54 State the effect on the concentrations of $\text{H}_2\text{O(g)}$ and $\text{CO}_2\text{(g)}$ when more $\text{H}_2\text{(g)}$ is added to the system. [1]
-

Base your answers to questions 55 through 58 on the information below and on your knowledge of chemistry.

The table below contains selected information about chlorine and two compounds containing chlorine. One piece of information is missing for each of the substances in the table.

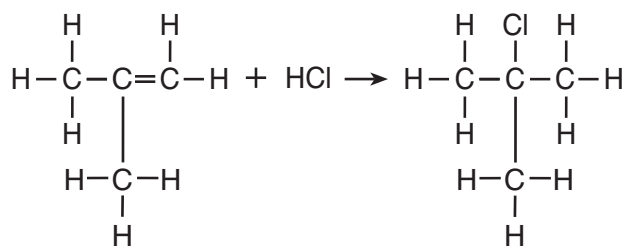
Chlorine and Two Compounds Containing Chlorine

Name	Formula	Molar Mass (g/mol)	Phase at STP
chlorine	Cl ₂	71	?
calcium chloride	CaCl ₂	?	solid
1,2-dichloroethene	?	97	liquid

- 55 Identify the phase of the chlorine at STP. [1]
- 56 Determine the molar mass for calcium chloride. [1]
- 57 The liquid compound has an empirical formula of CHCl. Write the molecular formula for this compound. [1]
- 58 Explain, in terms of electrons, why the compound containing calcium and chlorine is classified as an ionic compound. [1]
-

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

The equation below represents the reaction between 2-methylpropene and hydrogen chloride gas.



- 59 Explain, in terms of chemical bonds, why the hydrocarbon is unsaturated. [1]
- 60 Identify the class of organic compounds to which the product belongs. [1]
-

Base your answers to questions 61 through 65 on the information below and on your knowledge of chemistry.

Many scientists made observations of the elements that led to the modern Periodic Table. In 1829, Dobereiner found groups of three elements that have similar properties and called each of these groups a triad. Dobereiner noticed a relationship between the atomic masses of the elements in each triad. Triad 1, shown in the table below, consists of sulfur, selenium, and tellurium. The middle element, selenium, has an atomic mass that is close to the sum of the atomic masses of sulfur and tellurium, divided by 2.

For example: $\frac{32 \text{ u} + 128 \text{ u}}{2} = 80. \text{ u}$, which is close to the 79 u value in the table.

The other triads shown in the table below demonstrate the same mathematical relationship.

Dobereiner's Triads

Triad	Triad	Dobereiner's Atomic Masses (u)
1	sulfur selenium tellurium	32 79 128
2	calcium strontium barium	40. 88 137
3	chlorine bromine iodine	35.5 80. 127
4	lithium sodium potassium	7 23 39

- 61 Identify the triad that contains a metalloid. [1]
- 62 Explain, in terms of electrons, why the elements in triad 2 have similar chemical properties. [1]
- 63 State the trend in first ionization energy as the elements in triad 3 are considered in order of increasing atomic number. [1]
- 64 Compare the volume of a 100.-gram sample of the first element in triad 4 to the volume of a 100.-gram sample of the third element in triad 4 when both samples are at room temperature. [1]
- 65 Show a numerical setup that demonstrates Dobereiner's mathematical relationship for triad 2. [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 68 on the information below and on your knowledge of chemistry.

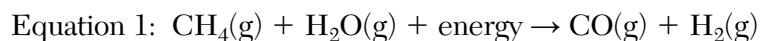
Wood is mainly cellulose, a polymer produced by plants. One use of wood is as a fuel in campfires, fireplaces, and wood furnaces. The molecules of cellulose are long chains of repeating units. Each unit of the chain can be represented as $C_6H_{10}O_5$. The balanced equation below represents a reaction that occurs when $C_6H_{10}O_5$ is burned in air.



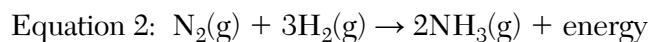
- 66 State evidence from the equation that this reaction is exothermic. [1]
- 67 Explain, in terms of substances in the reaction, why the equation represents a chemical change. [1]
- 68 Show a numerical setup for calculating the percent composition by mass of carbon in $C_6H_{10}O_5$ (gram-formula mass = 162.1 g/mol). [1]
-

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

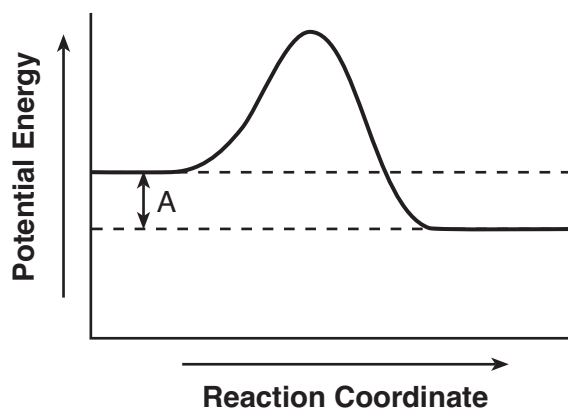
Millions of tons of ammonia are produced each year for use as fertilizer to increase food production. Most of the hydrogen needed to produce ammonia comes from methane gas reacting with steam. This reaction, which occurs in a container under controlled conditions, is shown below in unbalanced equation 1.



The reaction that produces ammonia is represented by balanced equation 2, shown below. A catalyst can be used to increase the rate of the reaction.



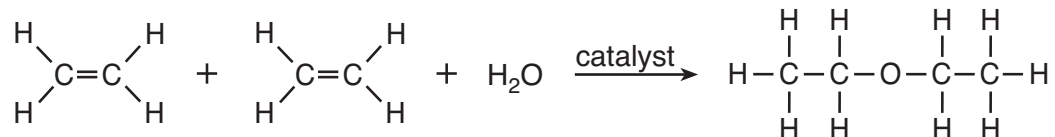
A potential energy diagram for equation 2 is shown below.



- 69 Balance equation 1 *in your answer booklet*, using the smallest whole-number coefficients. [1]
- 70 Explain, in terms of collision theory, why an increase in temperature increases the rate of reaction between methane gas and steam. [1]
- 71 State what is represented by interval A on the potential energy diagram. [1]
- 72 Determine the number of moles of hydrogen gas required to react completely with 50.0 moles of nitrogen gas in the production of ammonia. [1]
-

Base your answers to questions 73 through 77 on the information below and on your knowledge of chemistry.

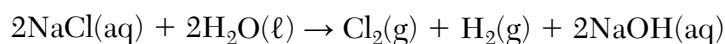
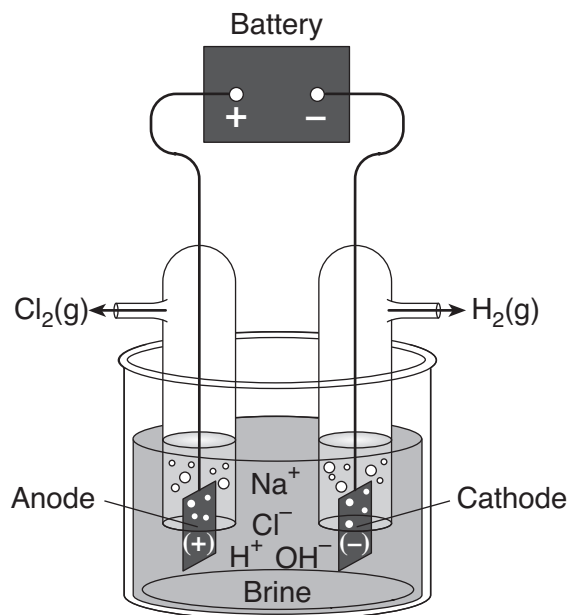
Diethyl ether is used as a laboratory and industrial solvent. The boiling point of diethyl ether at standard pressure is 34.6°C. The equation below represents a reaction that produces diethyl ether.



- 73 Identify the element in diethyl ether that allows it to be classified as an organic compound. [1]
- 74 State the number of electrons shared between the carbon atoms in one molecule of the organic reactant. [1]
- 75 State why the reaction is classified as a synthesis reaction. [1]
- 76 Explain, in terms of the strength of intermolecular forces, why the boiling point of diethyl ether at standard pressure is *lower* than the boiling point of water at standard pressure. [1]
- 77 Draw a structural formula for an isomer of the product that has the same functional group. [1]
-

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

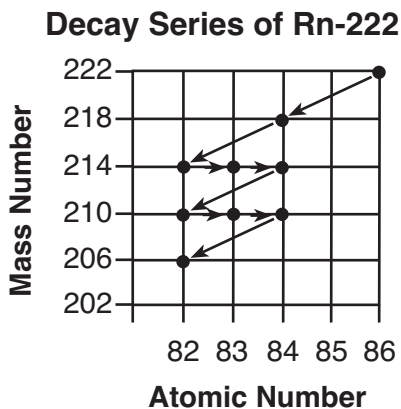
The electrolysis of brine, a concentrated aqueous sodium chloride solution, produces three important industrial chemicals: chlorine gas, hydrogen gas, and sodium hydroxide. The diagram and equation below represent a brine electrolysis cell. Before the battery is connected, the pH value of the brine solution is 7.0.



- 78 Explain, in terms of energy, why this cell is an electrolytic cell. [1]
- 79 Explain, in terms of ions, why the aqueous solution in the cell conducts an electric current. [1]
- 80 State the oxidation number of oxygen in the aqueous product. [1]
- 81 Compare the pH value of the solution before the battery is connected to the pH value of the solution after the cell operates for 20 minutes. [1]
-

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

The isotope Rn-222 is produced by the decay of uranium in Earth's crust. Some of this isotope leaks into basements of homes in areas where the ground is more porous. An atom of Rn-222 decays to an atom of Pb-206 through a series of steps as shown on the graph below.



- 82 Determine the number of neutrons in an atom of Pb-214. [1]
- 83 Complete the nuclear equation *in your answer booklet* for the decay of Po-218 by writing a notation for the missing product. [1]
- 84 Determine the fraction of an original sample of Rn-222 that remains unchanged after 7.646 days. [1]
- 85 Explain, in terms of elements, why the decay of Bi-210 is considered a transmutation. [1]
-

PHYSICAL SETTING CHEMISTRY

Wednesday, August 16, 2017 — 8:30 to 11:30 a.m., only

ANSWER BOOKLET

Student

Teacher

School Grade

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

Part B–2

51 _____

52 _____

53 _____

54 H₂O(g): _____

CO₂(g): _____

55 _____

56 _____ g/mol

57 _____

58 _____

59 _____

60 _____

61

62

63

64

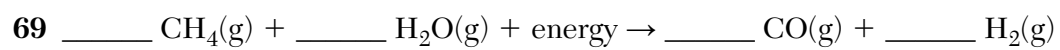
65

Part C

66

67

68



70

71

72 _____ mol

73

74

75

76

77

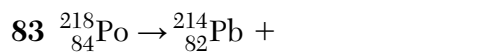
78

79

80

81

82



84

85

FOR TEACHERS ONLY

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

P.S.–CH PHYSICAL SETTING/CHEMISTRY

Wednesday, August 16, 2017 — 8:30 to 11:30 a.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 3	9 3	17 4	25 3
2 2	10 1	18 1	26 1
3 2	11 3	19 1	27 4
4 4	12 4	20 4	28 2
5 1	13 1	21 2	29 3
6 4	14 4	22 2	30 1
7 4	15 4	23 2	
8 1	16 3	24 1	
Part B–1			
31 4	36 4	41 1	46 2
32 3	37 2	42 2	47 4
33 4	38 2	43 4	48 1
34 1	39 2	44 2	49 3
35 1	40 3	45 1	50 3

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, August 16, 2017. 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:

polar covalent bond

covalent

polar covalent

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

The butanamide molecule has an asymmetrical distribution of charge.

The molecule has an unequal charge distribution.

53 [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.

The rates are the same.

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

H₂O(g): increases/higher

CO₂(g): decreases/lower

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

gas

(g)

56 [1] Allow 1 credit for 111 g/mol *or* any value from 110. g/mol to 111.1 g/mol, inclusive.

57 [1] Allow 1 credit for C₂H₂Cl₂. The order of the elements may vary.

58 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

Electrons are transferred from the metal to the nonmetal.

Calcium loses electrons and chlorine gains electrons.

Electrons were transferred.

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

The hydrocarbon has a double carbon-carbon bond.

The molecule has a C=C bond.

There is a multiple bond.

More H atoms could be bonded with this hydrocarbon.

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

halide

halocarbons

alkyl halide

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

Triad 1

S, Se, Te

sulfur, selenium, tellurium

sulfur triad

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

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

An atom of each element has the same number of electrons in the outermost shell.

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

As the atomic number increases, the first ionization energy decreases.

The first ionization energy decreases.

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

The volume of the 100.-gram lithium sample is 187 cm^3 and the volume of the 100.-gram potassium sample is 112 cm^3 .

The volume of the K sample is approximately 75 cm^3 less than the Li sample.

The volume of the Li sample is larger.

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

$$\frac{40. \text{ u} + 137 \text{ u}}{2}$$

$$\frac{40 + 137}{2}$$

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:

The heat released by the reaction is represented on the right side of the equation.

The energy term appears on the product side of the equation.

Heat is released.

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

The products of the reaction are different substances than the reactants.

The chemical properties of the reactants and the products are different.

Bonds are broken in the reactants and new bonds are formed in the products.

Different substances are formed.

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

$$\frac{6(12.011 \text{ g/mol})}{162.1 \text{ g/mol}} \times 100$$

$$\frac{(12 \text{ g/mol})(6)(100)}{162.1 \text{ g/mol}}$$

$$\frac{72.066}{162.1} \times 100$$

69 [1] Allow 1 credit for _____ CH₄(g) + _____ H₂O(g) + energy → _____ CO(g) + 3 H₂(g)

Allow credit even if the coefficient “1” is written in front of CH₄(g), H₂O(g), and/or CO(g).

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

An increase in temperature causes a greater number of effective collisions between methane and water molecules to occur.

A greater number of collisions per second make the reaction rate faster.

More molecules collide with sufficient energy.

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

Interval A represents the heat of reaction.

Interval A represents the difference between the potential energy of the products and the potential energy of the reactants.



72 [1] Allow 1 credit for 150. mol. Significant figures do *not* need to be shown.

73 [1] Allow 1 credit for carbon *or* C.

74 [1] Allow 1 credit for 4 *or* four *or* 2 pairs.

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

The reaction has two reactants that become one product.

Three molecules become one molecule.

Two substances form one.

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

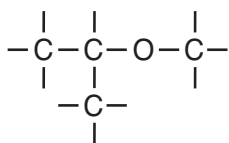
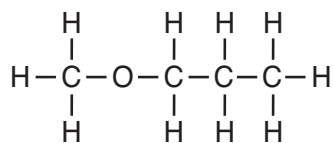
Diethyl ether has weaker intermolecular forces than water.

Water has stronger intermolecular forces.

Water has stronger IMF's due to its hydrogen bonding.

77 [1] Allow 1 credit.

Examples of 1-credit responses:



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

Electrical energy is required to cause a non-spontaneous chemical change.

The battery supplies the electricity needed for the reaction to occur.

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

The solution contains mobile ions.

The solution has ions that can move.

The $\text{Na}^+(\text{aq})$ and $\text{Cl}^-(\text{aq})$ move freely.

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

-2

2-

negative two

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

The pH starts at 7 and then increases.

The pH value of the solution before the battery is connected is lower than the pH value of the solution after the cell operates.

As the cell operates, the pH value of the solution goes up.

82 [1] Allow 1 credit for 132.

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



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

$$\frac{1}{4}$$

0.2500

25%

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

Bi-210 has an atomic number of 83 and becomes Po-210 with an atomic number of 84.

The number of protons in the nucleus changes when the bismuth isotope decays.

A different element forms.

Regents Examination in Physical Setting/Chemistry

August 2017

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

The *Chart for Determining the Final Examination Score for the August 2017 Regents Examination in Physical Setting/Chemistry* will be posted on the Department's web site at: <http://www.p12.nysed.gov/assessment/> on Wednesday, August 16, 2017. 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 2017 Physical Setting/Chemistry

Question Numbers

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

Regents Examination in Physical Setting/Chemistry – August 2017

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

Raw Score	Scale Score	Raw Score	Scale Score	Raw Score	Scale Score	Raw Score	Scale Score
85	100	63	74	41	59	19	38
84	98	62	73	40	58	18	37
83	96	61	72	39	57	17	36
82	95	60	72	38	56	16	34
81	93	59	71	37	56	15	33
80	92	58	70	36	55	14	31
79	90	57	69	35	54	13	30
78	89	56	69	34	53	12	28
77	88	55	68	33	53	11	26
76	87	54	67	32	52	10	24
75	85	53	67	31	51	9	22
74	84	52	66	30	50	8	20
73	83	51	66	29	49	7	18
72	82	50	65	28	48	6	16
71	81	49	64	27	47	5	14
70	80	48	63	26	46	4	11
69	79	47	63	25	45	3	9
68	78	46	62	24	44	2	6
67	77	45	61	23	43	1	3
66	76	44	61	22	42	0	0
65	76	43	60	21	41		
64	75	42	59	20	39		

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.