

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

**PHYSICAL SETTING  
CHEMISTRY**

Tuesday, June 25, 2019 — 9:15 a.m to 12:15 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.**

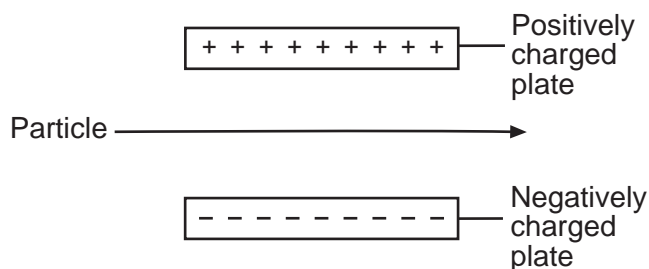
## Part A

### 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*.

- 1 Which particles are found in the nucleus of an argon atom?
- (1) protons and electrons
  - (2) positrons and neutrons
  - (3) protons and neutrons
  - (4) positrons and electrons

- 2 The diagram below represents a particle traveling through an electric field.



An electric field exists between the two plates.

Which particle remains undeflected when passing through this electric field?

- (1) proton
  - (2) electron
  - (3) neutron
  - (4) positron
- 3 The mass of an electron is
- (1) equal to the mass of a proton
  - (2) equal to the mass of a neutron
  - (3) greater than the mass of a proton
  - (4) less than the mass of a neutron
- 4 Compared to the energy of an electron in the second shell of an atom of sulfur, the energy of an electron in the
- (1) first shell is lower
  - (2) first shell is the same
  - (3) third shell is lower
  - (4) third shell is the same

- 5 In the ground state, an atom of which element has seven valence electrons?

- (1) sodium
- (2) phosphorus
- (3) nitrogen
- (4) fluorine

- 6 Which information is sufficient to differentiate a sample of sodium from a sample of silver?

- (1) the mass of each sample
- (2) the volume of each sample
- (3) the reactivity of each sample with water
- (4) the phase of each sample at room temperature

- 7 Graphite and diamond are two forms of solid carbon at STP. These forms have

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

- 8 As the first five elements in Group 14 are considered in order from top to bottom, there are changes in both the

- (1) number of valence shell electrons and number of first shell electrons
- (2) electronegativity values and number of first shell electrons
- (3) number of valence shell electrons and atomic radii
- (4) electronegativity values and atomic radii

- 9 Which statement explains why NaBr is classified as a compound?
- (1) Na and Br are chemically combined in a fixed proportion.
  - (2) Na and Br are both nonmetals.
  - (3) NaBr is a solid at 298 K and standard pressure.
  - (4) NaBr dissolves in H<sub>2</sub>O at 298 K.
- 10 Which two terms represent types of chemical formulas?
- (1) fission and fusion
  - (2) oxidation and reduction
  - (3) empirical and structural
  - (4) endothermic and exothermic
- 11 During all chemical reactions, charge, mass and energy are
- (1) condensed
  - (2) conserved
  - (3) decayed
  - (4) decomposed
- 12 The degree of polarity of a covalent bond between two atoms is determined by calculating the difference in their
- (1) atomic radii
  - (2) melting points
  - (3) electronegativities
  - (4) ionization energies
- 13 Which substance can *not* be broken down by a chemical change?
- (1) ammonia
  - (2) magnesium
  - (3) methane
  - (4) water
- 14 Which statement describes the components of a mixture?
- (1) Each component gains new properties.
  - (2) Each component loses its original properties.
  - (3) The proportions of components can vary.
  - (4) The proportions of components cannot vary.
- 15 Table sugar can be separated from a mixture of table sugar and sand at STP by adding
- (1) sand, stirring, and distilling at 100.°C
  - (2) sand, stirring, and filtering
  - (3) water, stirring, and distilling at 100.°C
  - (4) water, stirring, and filtering
- 16 Which statement describes the particles of an ideal gas, based on the kinetic molecular theory?
- (1) The volume of the particles is considered negligible.
  - (2) The force of attraction between the particles is strong.
  - (3) The particles are closely packed in a regular, repeating pattern.
  - (4) The particles are separated by small distances, relative to their size.
- 17 During which two processes does a substance release energy?
- (1) freezing and condensation
  - (2) freezing and melting
  - (3) evaporation and condensation
  - (4) evaporation and melting
- 18 Based on Table I, which compound dissolves in water by an exothermic process?
- (1) NaCl
  - (2) NaOH
  - (3) NH<sub>4</sub>Cl
  - (4) NH<sub>4</sub>NO<sub>3</sub>
- 19 At STP, which property of a molecular substance is determined by the arrangement of its molecules?
- (1) half-life
  - (2) molar mass
  - (3) physical state
  - (4) percent composition
- 20 Equilibrium can be reached by
- (1) physical changes, only
  - (2) nuclear changes, only
  - (3) both physical changes and chemical changes
  - (4) both nuclear changes and chemical changes
- 21 Which value is defined as the difference between the potential energy of the products and the potential energy of the reactants during a chemical change?
- (1) heat of fusion
  - (2) heat of reaction
  - (3) heat of deposition
  - (4) heat of vaporization

- 22 The effect of a catalyst on a chemical reaction is to provide a new reaction pathway that results in a different
- (1) potential energy of the products
  - (2) heat of reaction
  - (3) potential energy of the reactants
  - (4) activation energy
- 23 Chemical systems in nature tend to undergo changes toward
- (1) lower energy and lower entropy
  - (2) lower energy and higher entropy
  - (3) higher energy and lower entropy
  - (4) higher energy and higher entropy
- 24 The atoms of which element bond to one another in chains, rings, and networks?
- (1) barium
  - (2) carbon
  - (3) iodine
  - (4) mercury
- 25 What is the general formula for the homologous series that includes ethene?
- (1)  $C_nH_{2n}$
  - (2)  $C_nH_{2n-6}$
  - (3)  $C_nH_{2n-2}$
  - (4)  $C_nH_{2n+2}$
- 26 When an F atom becomes an  $F^-$  ion, the F atom
- (1) gains a proton
  - (2) loses a proton
  - (3) gains an electron
  - (4) loses an electron
- 27 Which substance is an Arrhenius base?
- (1)  $HNO_3$
  - (2)  $H_2SO_3$
  - (3)  $Ca(OH)_2$
  - (4)  $CH_3COOH$
- 28 In which type of nuclear reaction do two light nuclei combine to produce a heavier nucleus?
- (1) positron emission
  - (2) gamma emission
  - (3) fission
  - (4) fusion
- 29 Using equal masses of reactants, which statement describes the relative amounts of energy released during a chemical reaction and a nuclear reaction?
- (1) The chemical and nuclear reactions release equal amounts of energy.
  - (2) The nuclear reaction releases half the amount of energy of the chemical reaction.
  - (3) The chemical reaction releases more energy than the nuclear reaction.
  - (4) The nuclear reaction releases more energy than the chemical reaction.
- 30 The ratio of the mass of U-238 to the mass of Pb-206 can be used to
- (1) diagnose thyroid disorders
  - (2) diagnose kidney function
  - (3) date geological formations
  - (4) date once-living things



34 Magnesium and calcium have similar chemical properties because their atoms in the ground state have

- (1) equal numbers of protons and electrons
- (2) equal numbers of protons and neutrons
- (3) two electrons in the first shell
- (4) two electrons in the outermost shell

35 As the elements in Period 2 of the Periodic Table are considered in order from left to right, which property generally *decreases*?

- (1) atomic radius
- (2) electronegativity
- (3) ionization energy
- (4) nuclear charge

36 Given the balanced equation for the reaction of butane and oxygen:



How many moles of carbon dioxide are produced when 5.0 moles of butane react completely?

- (1) 5.0 mol
- (2) 10. mol
- (3) 20. mol
- (4) 40. mol

37 What is the percent composition by mass of nitrogen in the compound  $\text{N}_2\text{H}_4$  (gram-formula mass = 32 g/mol)?

- (1) 13%
- (2) 44%
- (3) 88%
- (4) 93%

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

- (1)  $\text{Ca}^{2+}$
- (2)  $\text{Cl}^-$
- (3)  $\text{Li}^+$
- (4)  $\text{O}^{2-}$

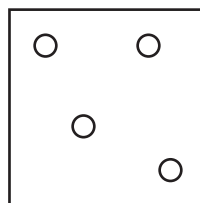
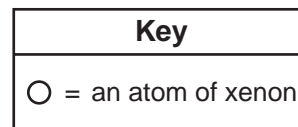
39 The molar masses and boiling points at standard pressure for four compounds are given in the table below.

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

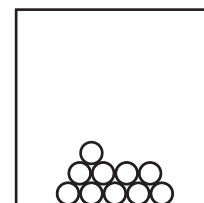
Which compound has the strongest intermolecular forces?

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

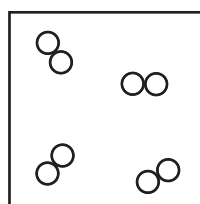
40 Which particle model diagram represents xenon at STP?



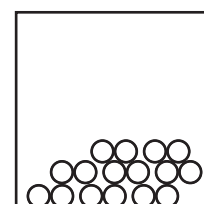
(1)



(3)



(2)



(4)

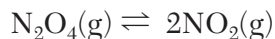
41 What is the amount of heat absorbed when the temperature of 75 grams of water increases from  $20.^{\circ}\text{C}$  to  $35.^{\circ}\text{C}$ ?

- (1) 1100 J
- (2) 4700 J
- (3) 6300 J
- (4) 11 000 J

42 Which sample of HCl(aq) reacts at the fastest rate with a 1.0-gram sample of iron filings?

- (1) 10. mL of 1 M HCl(aq) at 10.°C
- (2) 10. mL of 1 M HCl(aq) at 25°C
- (3) 10. mL of 3 M HCl(aq) at 10.°C
- (4) 10. mL of 3 M HCl(aq) at 25°C

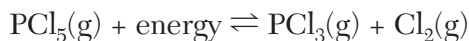
43 Given the equation representing a system at equilibrium:



Which statement describes the concentration of the two gases in this system?

- (1) The concentration of  $\text{N}_2\text{O}_4(\text{g})$  must be less than the concentration of  $\text{NO}_2(\text{g})$ .
- (2) The concentration of  $\text{N}_2\text{O}_4(\text{g})$  must be greater than the concentration of  $\text{NO}_2(\text{g})$ .
- (3) The concentration of  $\text{N}_2\text{O}_4(\text{g})$  and the concentration of  $\text{NO}_2(\text{g})$  must be equal.
- (4) The concentration of  $\text{N}_2\text{O}_4(\text{g})$  and the concentration of  $\text{NO}_2(\text{g})$  must be constant.

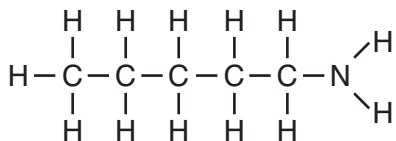
44 Given the equation representing a system at equilibrium:



Which change will cause the equilibrium to shift to the right?

- (1) adding a catalyst
- (2) adding more  $\text{PCl}_3(\text{g})$
- (3) increasing the pressure
- (4) increasing the temperature

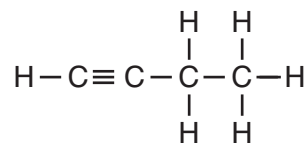
45 Given the formula representing a molecule:



A chemical name for this compound is

- (1) pentanone
- (2) 1-pentanol
- (3) 1-pentanamine
- (4) pentanamide

46 Given the formula of a compound:



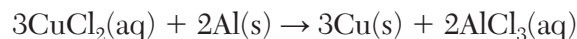
This compound is classified as an

- (1) aldehyde
- (2) alkene
- (3) alkyne
- (4) alcohol

47 Which equation represents fermentation?

- (1)  $\text{C}_2\text{H}_4 + \text{H}_2\text{O} \rightarrow \text{CH}_3\text{CH}_2\text{OH}$
- (2)  $\text{C}_2\text{H}_4 + \text{HCl} \rightarrow \text{CH}_3\text{CH}_2\text{Cl}$
- (3)  $\text{C}_6\text{H}_{12}\text{O}_6 \rightarrow 2\text{CH}_3\text{CH}_2\text{OH} + 2\text{CO}_2$
- (4)  $2\text{CH}_3\text{CHO} \rightarrow \text{C}_3\text{H}_5\text{CHO} + \text{H}_2\text{O}$

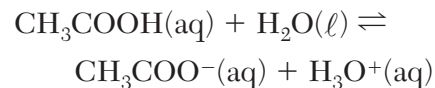
48 Given the equation representing a reaction:



The oxidation number of copper changes from

- (1) +1 to 0
- (2) +2 to 0
- (3) +2 to +1
- (4) +6 to +3

49 Given the equation representing a reversible reaction:



According to one acid-base theory, the two  $\text{H}^+$  donors in the equation are

- (1)  $\text{CH}_3\text{COOH}$  and  $\text{H}_2\text{O}$
- (2)  $\text{CH}_3\text{COOH}$  and  $\text{H}_3\text{O}^+$
- (3)  $\text{CH}_3\text{COO}^-$  and  $\text{H}_2\text{O}$
- (4)  $\text{CH}_3\text{COO}^-$  and  $\text{H}_3\text{O}^+$

50 Which nuclear equation represents a spontaneous decay?

- (1)  ${}^{222}_{86}\text{Rn} \rightarrow {}^{218}_{84}\text{Po} + {}^4_2\text{He}$
- (2)  ${}^{27}_{13}\text{Al} + {}^4_2\text{He} \rightarrow {}^{30}_{15}\text{P} + {}^1_0\text{n}$
- (3)  ${}^{235}_{92}\text{U} + {}^1_0\text{n} \rightarrow {}^{139}_{56}\text{Ba} + {}^{94}_{36}\text{Kr} + 3{}^1_0\text{n}$
- (4)  ${}^7_3\text{Li} + {}^1_1\text{H} \rightarrow {}^4_2\text{He} + {}^4_2\text{He}$

## 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*.

51 Draw a structural formula for methanal. [1]

Base your answers to questions 52 through 54 on the information below and on your knowledge of chemistry.

The atomic mass and natural abundance of the naturally occurring isotopes of hydrogen are shown in the table below.

**Naturally Occuring Isotopes of Hydrogen**

Isotope	Common Name of Isotope	Atomic Mass (u)	Natural Abundance (%)
H-1	protium	1.0078	99.9885
H-2	deuterium	2.0141	0.0115
H-3	tritium	3.0160	negligible

The isotope H-2, also called deuterium, is usually represented by the symbol “D.” Heavy water forms when deuterium reacts with oxygen, producing molecules of  $D_2O$ .

52 Explain, in terms of subatomic particles, why atoms of H-1, H-2, and H-3 are each electrically neutral. [1]

53 Determine the formula mass of heavy water,  $D_2O$ . [1]

54 Based on Table N, identify the decay mode of tritium. [1]

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

At 23°C, 85.0 grams of  $\text{NaNO}_3(\text{s})$  are dissolved in 100. grams of  $\text{H}_2\text{O}(\ell)$ .

- 55 Convert the temperature of the  $\text{NaNO}_3(\text{s})$  to kelvins. [1]
- 56 Based on Table G, determine the additional mass of  $\text{NaNO}_3(\text{s})$  that must be dissolved to saturate the solution at 23°C. [1]
- 57 State what happens to the boiling point and freezing point of the solution when the solution is diluted with an additional 100. grams of  $\text{H}_2\text{O}(\ell)$ . [1]
- 

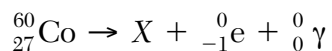
Base your answers to questions 58 through 61 on the information below and on your knowledge of chemistry.

A 200.-milliliter sample of  $\text{CO}_2(\text{g})$  is placed in a sealed, rigid cylinder with a movable piston at 296 K and 101.3 kPa.

- 58 State a change in temperature and a change in pressure of the  $\text{CO}_2(\text{g})$  that would cause it to behave more like an ideal gas. [1]
- 59 Determine the volume of the sample of  $\text{CO}_2(\text{g})$  if the temperature and pressure are changed to 336 K and 152.0 kPa. [1]
- 60 State, in terms of *both* the frequency and force of collisions, what would result from decreasing the temperature of the original sample of  $\text{CO}_2(\text{g})$ , at constant volume. [1]
- 61 Compare the mass of the original 200.-milliliter sample of  $\text{CO}_2(\text{g})$  to the mass of the  $\text{CO}_2(\text{g})$  sample when the cylinder is adjusted to a volume of 100. milliliters. [1]
-

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

Cobalt-60 is an artificial isotope of Co-59. The incomplete equation for the decay of cobalt-60, including beta and gamma emissions, is shown below.



- 62 Explain, in terms of *both* protons and neutrons, why Co-59 and Co-60 are isotopes of cobalt. [1]
- 63 Compare the penetrating power of the beta and gamma emissions. [1]
- 64 Complete the nuclear equation, *in your answer booklet*, for the decay of cobalt-60 by writing a notation for the missing product. [1]
- 65 Based on Table N, determine the total time required for an 80.00-gram sample of cobalt-60 to decay until only 10.00 grams of the sample remain unchanged. [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 69 on the information below and on your knowledge of chemistry.

During a laboratory activity, appropriate safety equipment was used and safety procedures were followed. A laboratory technician heated a sample of solid  $\text{KClO}_3$  in a crucible to determine the percent composition by mass of oxygen in the compound. The unbalanced equation and the data for the decomposition of solid  $\text{KClO}_3$  are shown below.



#### Lab Data and Calculated Results

Object or Material	Mass (g)
empty crucible and cover	22.14
empty crucible, cover, and $\text{KClO}_3$	24.21
$\text{KClO}_3$	2.07
crucible, cover, and KCl after heating	23.41
KCl	?
$\text{O}_2$	0.80

- 66 Write a chemical name for the compound that decomposed. [1]
- 67 Based on the lab data, show a numerical setup to determine the number of moles of  $\text{O}_2$  produced. Use 32 g/mol as the gram-formula mass of  $\text{O}_2$ . [1]
- 68 Based on the lab data, determine the mass of KCl produced in the reaction. [1]
- 69 Balance the equation *in your answer booklet* for the decomposition of  $\text{KClO}_3$ , using the smallest whole-number coefficients. [1]
-

Base your answers to questions 70 through 73 on the information below and on your knowledge of chemistry.

A bottled water label lists the ions dissolved in the water. The table below lists the mass of some ions dissolved in a 500.-gram sample of the bottled water.

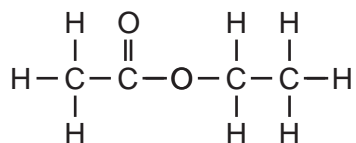
**Ions in 500. g of Bottled Water**

<b>Ion Formula</b>	<b>Mass (g)</b>
Ca <sup>2+</sup>	0.040
Mg <sup>2+</sup>	0.013
Na <sup>+</sup>	0.0033
SO <sub>4</sub> <sup>2-</sup>	0.0063
HCO <sub>3</sub> <sup>-</sup>	0.180

- 70 State the number of significant figures used to express the mass of hydrogen carbonate ions in the table above. [1]
- 71 Based on Table F, write the formula of the ion in the bottled water table that would form the *least* soluble compound when combined with the sulfate ion. [1]
- 72 Show a numerical setup for calculating the parts per million of the Na<sup>+</sup> ions in the 500.-gram sample of the bottled water. [1]
- 73 Compare the radius of a Mg<sup>2+</sup> ion to the radius of a Mg atom. [1]
-

Base your answers to questions 74 through 77 on the information below and on your knowledge of chemistry.

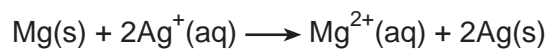
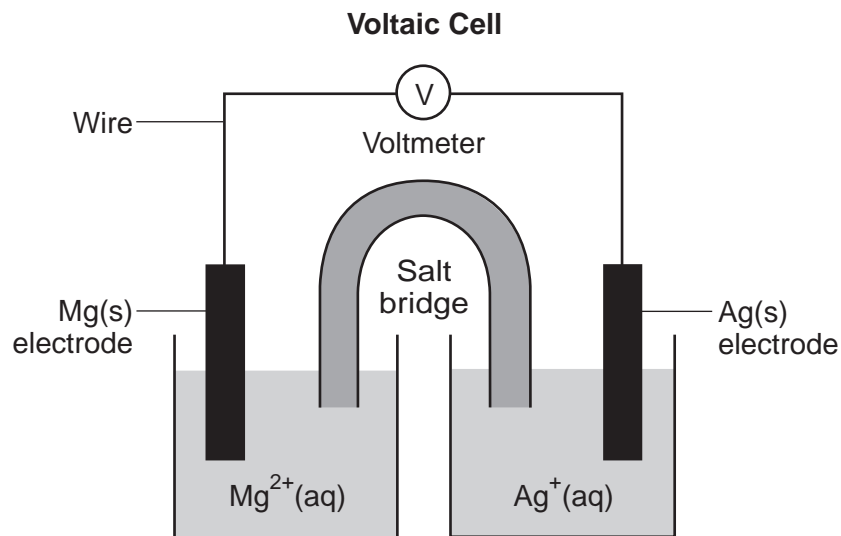
Ethyl ethanoate is used as a solvent for varnishes and in the manufacture of artificial leather. The formula below represents a molecule of ethyl ethanoate.



- 74 Identify the element in ethyl ethanoate that makes it an organic compound. [1]
- 75 Write the empirical formula for this compound. [1]
- 76 Write the name of the class of organic compounds to which this compound belongs. [1]
- 77 Determine the number of electrons shared in the bond between a hydrogen atom and a carbon atom in the molecule. [1]
-

Base your answers to questions 78 through 80 on the information below and on your knowledge of chemistry.

An operating voltaic cell has magnesium and silver electrodes. The cell and the ionic equation representing the reaction that occurs in the cell are shown below.



- 78 State the purpose of the salt bridge in this cell. [1]
- 79 Write a balanced equation for the half-reaction that occurs at the magnesium electrode in this cell. [1]
- 80 Explain, in terms of electrical energy, how electrolysis reactions differ from voltaic cell reactions. [1]
-

Base your answers to questions 81 through 85 on the information below and on your knowledge of chemistry.

In a laboratory investigation, an  $\text{HCl}(\text{aq})$  solution with a pH value of 2 is used to determine the molarity of a  $\text{KOH}(\text{aq})$  solution. A 7.5-milliliter sample of the  $\text{KOH}(\text{aq})$  is exactly neutralized by 15.0 milliliters of the 0.010 M  $\text{HCl}(\text{aq})$ . During this laboratory activity, appropriate safety equipment is used and safety procedures are followed.

- 81 Determine the pH value of a solution that is ten times *less* acidic than the  $\text{HCl}(\text{aq})$  solution. [1]
- 82 State the color of the indicator bromocresol green if it is added to a sample of the  $\text{KOH}(\text{aq})$  solution. [1]
- 83 Complete the equation *in your answer booklet* by writing the chemical formula for *each* product. [1]
- 84 Show a numerical setup for calculating the molarity of the  $\text{KOH}$  solution. [1]
- 85 Explain, in terms of aqueous ions, why 15.0 mL of a 1.0 M  $\text{HCl}(\text{aq})$  solution is a better conductor of electricity than 15.0 mL of a 0.010 M  $\text{HCl}(\text{aq})$  solution. [1]
-

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# PHYSICAL SETTING CHEMISTRY

Tuesday, June 25, 2019 — 9:15 a.m to 12:15 p.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

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53

\_\_\_\_\_ u

54

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55 \_\_\_\_\_ **K**

56 \_\_\_\_\_ **g**

57 Boiling point: \_\_\_\_\_

Freezing point: \_\_\_\_\_

58 Temperature: \_\_\_\_\_

Pressure: \_\_\_\_\_

59 \_\_\_\_\_ **mL**

60 \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

61 \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

62

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63

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65  $\underline{\hspace{2cm}}$  y

**Part C**

66 \_\_\_\_\_

67

68 \_\_\_\_\_ g



70 \_\_\_\_\_

71 \_\_\_\_\_

72

73 \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

74 \_\_\_\_\_

75 \_\_\_\_\_

76 \_\_\_\_\_

77 \_\_\_\_\_

78 \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

79 \_\_\_\_\_

80 \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

81 \_\_\_\_\_

82 \_\_\_\_\_

83  $\text{HCl(aq)} + \text{KOH(aq)} \rightarrow$  \_\_\_\_\_  $+$  \_\_\_\_\_

84

85

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**Regents Examination in Physical Setting/Chemistry – June 2019****Scoring Key: Parts A and B-1 (Multiple-Choice Questions)**

Examination	Date	Question Number	Scoring Key	Question Type	Credit	Weight
Physical Setting/Chemistry	June '19	1	3	MC	1	1
Physical Setting/Chemistry	June '19	2	3	MC	1	1
Physical Setting/Chemistry	June '19	3	4	MC	1	1
Physical Setting/Chemistry	June '19	4	1	MC	1	1
Physical Setting/Chemistry	June '19	5	4	MC	1	1
Physical Setting/Chemistry	June '19	6	3	MC	1	1
Physical Setting/Chemistry	June '19	7	1	MC	1	1
Physical Setting/Chemistry	June '19	8	4	MC	1	1
Physical Setting/Chemistry	June '19	9	1	MC	1	1
Physical Setting/Chemistry	June '19	10	3	MC	1	1
Physical Setting/Chemistry	June '19	11	2	MC	1	1
Physical Setting/Chemistry	June '19	12	3	MC	1	1
Physical Setting/Chemistry	June '19	13	2	MC	1	1
Physical Setting/Chemistry	June '19	14	3	MC	1	1
Physical Setting/Chemistry	June '19	15	4	MC	1	1
Physical Setting/Chemistry	June '19	16	1	MC	1	1
Physical Setting/Chemistry	June '19	17	1	MC	1	1
Physical Setting/Chemistry	June '19	18	2	MC	1	1
Physical Setting/Chemistry	June '19	19	3	MC	1	1
Physical Setting/Chemistry	June '19	20	3	MC	1	1
Physical Setting/Chemistry	June '19	21	2	MC	1	1
Physical Setting/Chemistry	June '19	22	4	MC	1	1
Physical Setting/Chemistry	June '19	23	2	MC	1	1
Physical Setting/Chemistry	June '19	24	2	MC	1	1
Physical Setting/Chemistry	June '19	25	1	MC	1	1
Physical Setting/Chemistry	June '19	26	3	MC	1	1
Physical Setting/Chemistry	June '19	27	3	MC	1	1
Physical Setting/Chemistry	June '19	28	4	MC	1	1
Physical Setting/Chemistry	June '19	29	4	MC	1	1
Physical Setting/Chemistry	June '19	30	3	MC	1	1
Physical Setting/Chemistry	June '19	31	2	MC	1	1
Physical Setting/Chemistry	June '19	32	4	MC	1	1
Physical Setting/Chemistry	June '19	33	3	MC	1	1
Physical Setting/Chemistry	June '19	34	4	MC	1	1
Physical Setting/Chemistry	June '19	35	1	MC	1	1
Physical Setting/Chemistry	June '19	36	3	MC	1	1
Physical Setting/Chemistry	June '19	37	3	MC	1	1
Physical Setting/Chemistry	June '19	38	4	MC	1	1
Physical Setting/Chemistry	June '19	39	1	MC	1	1
Physical Setting/Chemistry	June '19	40	1	MC	1	1
Physical Setting/Chemistry	June '19	41	2	MC	1	1
Physical Setting/Chemistry	June '19	42	4	MC	1	1
Physical Setting/Chemistry	June '19	43	4	MC	1	1
Physical Setting/Chemistry	June '19	44	4	MC	1	1
Physical Setting/Chemistry	June '19	45	3	MC	1	1
Physical Setting/Chemistry	June '19	46	3	MC	1	1
Physical Setting/Chemistry	June '19	47	3	MC	1	1
Physical Setting/Chemistry	June '19	48	2	MC	1	1
Physical Setting/Chemistry	June '19	49	2	MC	1	1
Physical Setting/Chemistry	June '19	50	1	MC	1	1

**Scoring Key: Parts B-2 and C (Constructed-Response Questions)**

Examination	Date	Question Number	Scoring Key	Question Type	Credit	Weight
Physical Setting/Chemistry	June '19	51	-	CR	1	1
Physical Setting/Chemistry	June '19	52	-	CR	1	1
Physical Setting/Chemistry	June '19	53	-	CR	1	1
Physical Setting/Chemistry	June '19	54	-	CR	1	1
Physical Setting/Chemistry	June '19	55	-	CR	1	1
Physical Setting/Chemistry	June '19	56	-	CR	1	1
Physical Setting/Chemistry	June '19	57	-	CR	1	1
Physical Setting/Chemistry	June '19	58	-	CR	1	1
Physical Setting/Chemistry	June '19	59	-	CR	1	1
Physical Setting/Chemistry	June '19	60	-	CR	1	1
Physical Setting/Chemistry	June '19	61	-	CR	1	1
Physical Setting/Chemistry	June '19	62	-	CR	1	1
Physical Setting/Chemistry	June '19	63	-	CR	1	1
Physical Setting/Chemistry	June '19	64	-	CR	1	1
Physical Setting/Chemistry	June '19	65	-	CR	1	1
Physical Setting/Chemistry	June '19	66	-	CR	1	1
Physical Setting/Chemistry	June '19	67	-	CR	1	1
Physical Setting/Chemistry	June '19	68	-	CR	1	1
Physical Setting/Chemistry	June '19	69	-	CR	1	1
Physical Setting/Chemistry	June '19	70	-	CR	1	1
Physical Setting/Chemistry	June '19	71	-	CR	1	1
Physical Setting/Chemistry	June '19	72	-	CR	1	1
Physical Setting/Chemistry	June '19	73	-	CR	1	1
Physical Setting/Chemistry	June '19	74	-	CR	1	1
Physical Setting/Chemistry	June '19	75	-	CR	1	1
Physical Setting/Chemistry	June '19	76	-	CR	1	1
Physical Setting/Chemistry	June '19	77	-	CR	1	1
Physical Setting/Chemistry	June '19	78	-	CR	1	1
Physical Setting/Chemistry	June '19	79	-	CR	1	1
Physical Setting/Chemistry	June '19	80	-	CR	1	1
Physical Setting/Chemistry	June '19	81	-	CR	1	1
Physical Setting/Chemistry	June '19	82	-	CR	1	1
Physical Setting/Chemistry	June '19	83	-	CR	1	1
Physical Setting/Chemistry	June '19	84	-	CR	1	1
Physical Setting/Chemistry	June '19	85	-	CR	1	1

Key
MC = Multiple-choice question
CR = Constructed-response question

The chart for determining students' final examination scores for the **June 2019 Regents Examination in Physical Setting/Chemistry** will be posted on the Department's web site at <http://www.p12.nysed.gov/assessment/> on the day of the examination. Conversion charts provided for the previous administrations of the Physical Setting/Chemistry examination must NOT be used to determine students' final scores for this administration.

# FOR TEACHERS ONLY

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

## PHYSICAL SETTING/CHEMISTRY

Tuesday, June 25, 2019 — 9:15 a.m. to 12:15 p.m., only

### 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.

## 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*.

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 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. Do not attempt to correct the student’s work by making insertions or changes of any kind. 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 Tuesday, June 25, 2019. 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.**

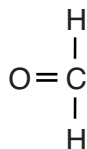
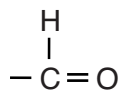
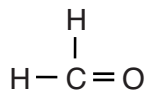
Because scale scores corresponding to raw scores in the conversion chart may change from one administration to another, it is crucial that, for each administration, the conversion chart provided for that administration be used to determine the student’s final score.

**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.

**Examples of 1-credit responses:**



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

The single proton in each nucleus has a charge of +1. The single electron in each atom has a charge of -1. The net charge is 0.

Each atom has one proton and one electron.

Each atom has an equal number of protons and electrons.

The total charge of the subatomic particles is zero.

**53** [1] Allow 1 credit for 20. u *or* for any value from 19.999 u to 20.03 u, inclusive.

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

$\beta^-$

${}^0_{-1}\beta$

${}^0_{-1}e$

beta

beta decay

beta particle

**55** [1] Allow 1 credit for 296 K.

**56** [1] Allow 1 credit for any value from 4.0 g to 6.0 g, inclusive.

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

Boiling point: decreases  
Freezing point: increases

Boiling point: becomes lower  
Freezing point: becomes higher

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

Temperature: increase  
Pressure: decrease

Temperature: higher  
Pressure: lower

Temperature: any temperature above 296 K  
Pressure: any pressure lower than 101.3 kPa

**59** [1] Allow 1 credit for 151 mL *or* any value from 151 mL to 151.4 mL, inclusive.

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

The frequency and force of collisions would both decrease.

There would be fewer collisions, and the collisions would not be as hard.

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

The mass stays the same.

Mass remains constant.

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

Both atoms have 27 protons, but Co-59 atoms each have 32 neutrons and Co-60 atoms each have 33 neutrons.

same number of protons, different number of neutrons

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

The gamma radiation has more penetrating power than the beta emission.

The  $\beta^-$  is less penetrating than  $\gamma$ .

Gamma emissions have greater penetrating power.

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



Ni-60

nickel-60



**65** [1] Allow 1 credit for 15.813 y. Significant figures do *not* need to be shown.

### 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 potassium chlorate.

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

$$\frac{0.80 \text{ g}}{32 \text{ g/mol}}$$

$$\frac{0.80}{32}$$

$$.8\text{g} \times \frac{1 \text{ mol}}{32 \text{ g}}$$

$$\frac{1 \text{ mol}}{32 \text{ g}} = \frac{x \text{ mol}}{0.80 \text{ g}}$$

68 [1] Allow 1 credit for 1.27 g.

69 [1] Allow 1 credit for 2  $\text{KClO}_3(\text{s}) \rightarrow$  2  $\text{KCl}(\text{s}) +$  3  $\text{O}_2(\text{g})$ .

70 [1] Allow 1 credit for 3 *or* three.

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



**Note:** Do *not* allow credit for Ca *or* calcium.



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

$$\frac{0.0033 \text{ g}}{500. \text{ g}} \times 1\,000\,000$$

$$\frac{0.0033(10^6)}{500}$$

$$\frac{3300}{500}$$

$$\frac{0.0033}{500} = \frac{x}{10^6}$$

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

The  $\text{Mg}^{2+}$  ion has a smaller radius than an Mg atom.

The Mg atom is larger.

74 [1] Allow 1 credit for C *or* carbon.

75 [1] Allow 1 credit for  $\text{C}_2\text{H}_4\text{O}$ . The order of the elements may vary.

76 [1] Allow 1 credit for ester *or* esters.

77 [1] Allow 1 credit for 2 *or* two *or* 1 pair.

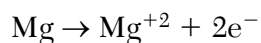
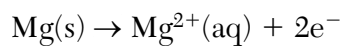
78 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

The salt bridge allows ions to migrate between the half-cells.

The salt bridge prevents polarization of the half-cells.

maintains electrical neutrality of the solutions

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



Note: Do *not* allow credit for e without the (−) sign.

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

Electrical energy is required for electrolytic reactions, while voltaic cell reactions produce electricity.

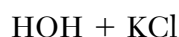
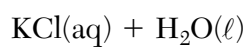
Voltaic cells produce electrical energy, and electrolytic cells use electrical energy.

Electrolysis reactions require an external source of electricity.

**81** [1] Allow 1 credit for 3 *or* three.

**82** [1] Allow 1 credit for blue.

**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:

$$\frac{(0.010 \text{ M})(15.0 \text{ mL})}{7.5 \text{ mL}}$$

$$(0.010 \text{ M})(15.0 \text{ mL}) = M_{\text{B}} (7.5 \text{ mL})$$

$$\frac{(0.01)(15)}{7.5}$$

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

The 1.0 M solution has a greater concentration of mobile ions than the 0.010 M solution.

The 0.010 M solution has fewer mobile ions.

The 1.0 M solution has more aqueous ions.

## Regents Examination in Physical Setting/Chemistry

June 2019

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

**The *Chart for Determining the Final Examination Score for the June 2019 Regents Examination in Physical Setting/Chemistry* will be posted on the Department's web site at: <http://www.p12.nysed.gov/assessment/> on Tuesday, June 25, 2019. 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

<b>June 2019 Physical Setting/Chemistry</b>			
<b>Question Numbers</b>			
Key Ideas/Performance Indicators	Part A	Part B	Part C
<b>Standard 1</b>			
Math Key Idea 1		55	67, 70, 72, 77, 84
Math Key Idea 2		56	69
Math Key Idea 3		33, 37, 41, 48, 53, 59, 65	66, 68, 75, 81, 83
Science Inquiry Key Idea 1		40, 52, 57, 58, 60, 61, 62, 63, 64	66, 71, 73, 74, 78, 80, 82, 85
Science Inquiry Key Idea 2			
Science Inquiry Key Idea 3		31, 42, 45, 48, 49, 50, 54, 56, 57, 58, 60	66, 67, 69, 73, 75, 77, 79, 83, 85
Engineering Design Key Idea 1			
<b>Standard 2</b>			
Key Idea 1			
Key Idea 2			
Key Idea 3			
<b>Standard 6</b>			
Key Idea 1			78
Key Idea 2		33, 40, 51	76
Key Idea 3			81
Key Idea 4		43, 44	
Key Idea 5			
<b>Standard 7</b>			
Key Idea 1			
Key Idea 2			
<b>Standard 4 Process Skills</b>			
Key Idea 3		31, 32, 34, 35, 36, 40, 43, 44, 45, 46, 47, 51, 53, 55, 56, 59, 62	67, 69, 72, 75, 79, 80, 82, 83, 84, 85
Key Idea 4		41, 64, 65	
Key idea 5		38, 39	
<b>Standard 4</b>			
Key Idea 3	1, 2, 3, 4, 5, 6, 8, 9, 10, 11, 13, 14, 15, 16, 19, 20, 22, 23, 24, 25, 26, 27	31, 32, 33, 34, 35, 36, 37, 40, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 55, 56, 57, 58, 59, 60, 61, 62, 63	66, 67, 68, 69, 70, 71, 72, 74, 75, 76, 78, 79, 80, 81, 82, 83, 84, 85
Key Idea 4	17, 18, 21, 28, 30	41, 54, 64, 65	
Key Idea 5	7, 12, 29	38, 39	73, 77
<b>Reference Tables</b>			
2011 Edition	2, 3, 8, 10, 13, 18, 25, 27	32, 34, 35, 36, 37, 38, 40, 41, 45, 46, 51, 52, 53, 54, 55, 56, 59, 60, 62, 63, 64, 65	66, 67, 71, 72, 74, 76, 77, 82, 83, 84

## Regents Examination in Physical Setting/Chemistry – June 2019

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

Raw Score	Scale Score	Raw Score	Scale Score	Raw Score	Scale Score	Raw Score	Scale Score
85	100	63	74	41	59	19	39
84	98	62	73	40	58	18	37
83	96	61	72	39	57	17	36
82	94	60	72	38	57	16	35
81	93	59	71	37	56	15	33
80	91	58	70	36	55	14	32
79	90	57	69	35	54	13	30
78	89	56	69	34	54	12	28
77	87	55	68	33	53	11	27
76	86	54	67	32	52	10	25
75	85	53	67	31	51	9	23
74	84	52	66	30	50	8	21
73	83	51	66	29	49	7	19
72	82	50	65	28	49	6	17
71	81	49	64	27	48	5	14
70	80	48	63	26	47	4	12
69	79	47	63	25	46	3	9
68	78	46	62	24	45	2	6
67	77	45	62	23	43	1	3
66	76	44	61	22	42	0	0
65	75	43	60	21	41		
64	75	42	60	20	40		

To determine the student's final examination score, find the student's total test raw score in the column labeled "Raw Score" and then locate the scale score that corresponds to that raw score. The scale score is the student's final examination score. Enter this score in the space labeled "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.