The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

PHYSICAL SETTING
CHEMISTRY

Tuesday, June 20, 2017 — 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 statement describes the structure of an atom?

(1) The nucleus contains positively charged electrons.
(2) The nucleus contains negatively charged protons.
(3) The nucleus has a positive charge and is surrounded by negatively charged electrons.
(4) The nucleus has a negative charge and is surrounded by positively charged electrons.

2 Which term is defined as the region in an atom where an electron is most likely to be located?

(1) nucleus
(2) orbital
(3) quanta
(4) spectra

3 What is the number of electrons in an atom of scandium?

(1) 21
(2) 24
(3) 45
(4) 66

4 Which particle has the *least* mass?

(1) a proton
(2) an electron
(3) a helium atom
(4) a hydrogen atom

5 Which electron transition in an excited atom results in a release of energy?

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

6 On the Periodic Table, the number of protons in an atom of an element is indicated by its

(1) atomic mass
(2) atomic number
(3) selected oxidation states
(4) number of valence electrons

7 Which type of formula shows an element symbol for each atom and a line for each bond between atoms?

(1) ionic
(2) structural
(3) empirical
(4) molecular

8 What is conserved during all chemical reactions?

(1) charge
(2) density
(3) vapor pressure
(4) melting point

9 In which type of reaction can two compounds exchange ions to form two different compounds?

(1) synthesis
(2) decomposition
(3) single replacement
(4) double replacement

10 At STP, two 5.0-gram solid samples of different ionic compounds have the same density. These solid samples could be differentiated by their

(1) mass
(2) volume
(3) temperature
(4) solubility in water

11 What is the number of electrons shared between the atoms in an I_2 molecule?

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

12 Which substance has nonpolar covalent bonds?

(1) Cl_2
(2) SO_3
(3) SiO_2
(4) CCl_4

13 Compared to a potassium atom, a potassium ion has

(1) a smaller radius
(2) a larger radius
(3) fewer protons
(4) more protons

14 Which form of energy is associated with the random motion of particles in a gas?

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

15 The average kinetic energy of water molecules *decreases* when

(1) $H_2O(\ell)$ at 337 K changes to $H_2O(\ell)$ at 300. K
(2) $H_2O(\ell)$ at 373 K changes to $H_2O(g)$ at 373 K
(3) $H_2O(s)$ at 200. K changes to $H_2O(s)$ at 237 K
(4) $H_2O(s)$ at 273 K changes to $H_2O(\ell)$ at 273 K

16 The joule is a unit of

(1) concentration
(2) energy
(3) pressure
(4) volume

17 Compared to a sample of helium at STP, the same sample of helium at a higher temperature and a lower pressure

(1) condenses to a liquid
(2) is more soluble in water
(3) forms diatomic molecules
(4) behaves more like an ideal gas

18 A sample of a gas is in a sealed, rigid container that maintains a constant volume. Which changes occur between the gas particles when the sample is heated?

(1) The frequency of collisions increases, and the force of collisions decreases.
(2) The frequency of collisions increases, and the force of collisions increases.
(3) The frequency of collisions decreases, and the force of collisions decreases.
(4) The frequency of collisions decreases, and the force of collisions increases.

19 At STP, which gaseous sample has the same number of molecules as 3.0 liters of $N_2(g)$?

(1) 6.0 L of $F_2(g)$
(2) 4.5 L of $N_2(g)$
(3) 3.0 L of $H_2(g)$
(4) 1.5 L of $Cl_2(g)$

20 Distillation of crude oil from various parts of the world yields different percentages of hydrocarbons. Which statement explains these different percentages?

(1) Each component in a mixture has a different solubility in water.
(2) Hydrocarbons are organic compounds.
(3) The carbons in hydrocarbons may be bonded in chains or rings.
(4) The proportions of components in a mixture can vary.

21 In which 1.0-gram sample are the particles arranged in a crystal structure?

(1) $CaCl_2(s)$
(2) $C_2H_6(g)$
(3) $CH_3OH(\ell)$
(4) $CaI_2(aq)$

22 When a reversible reaction is at equilibrium, the concentration of products and the concentration of reactants must be

(1) decreasing
(2) increasing
(3) constant
(4) equal

23 In chemical reactions, the difference between the potential energy of the products and the potential energy of the reactants is equal to the

(1) activation energy
(2) ionization energy
(3) heat of reaction
(4) heat of vaporization

24 What occurs when a catalyst is added to a chemical reaction?

(1) an alternate reaction pathway with a lower activation energy
(2) an alternate reaction pathway with a higher activation energy
(3) the same reaction pathway with a lower activation energy
(4) the same reaction pathway with a higher activation energy

25 What is the name of the compound with the formula $CH_3CH_2CH_2NH_2$?

(1) 1-propanol
(2) 1-propanamine
(3) propanal
(4) propanamide

26 Which compound is an isomer of $C_2H_5OC_2H_5$?

(1) CH_3COOH
(2) $C_2H_5COOCH_3$
(3) $C_3H_7COCH_3$
(4) C_4H_9OH

27 Ethanoic acid and 1-butanol can react to produce water and a compound classified as an

(1) aldehyde
(2) amide
(3) ester
(4) ether

28 During an oxidation-reduction reaction, the number of electrons gained is

(1) equal to the number of electrons lost
(2) equal to the number of protons gained
(3) less than the number of electrons lost
(4) less than the number of protons gained

29 Which process requires energy for a nonspontaneous redox reaction to occur?

(1) deposition
(2) electrolysis
(3) alpha decay
(4) chromatography

30 Which pair of compounds represents one Arrhenius acid and one Arrhenius base?

(1) CH_3OH and NaOH
(2) CH_3OH and HCl
(3) HNO_3 and NaOH
(4) HNO_3 and HCl

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 of an atom of neon in an excited state?

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

32 Some information about the two naturally occurring isotopes of gallium is given in the table below.

Natural Abundance of Two Gallium Isotopes

Isotope	Natural Abundance (%)	Atomic Mass (u)
Ga-69	60.11	68.926
Ga-71	39.89	70.925

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

(1) (0.6011)(68.926 u) + (0.3989)(70.925 u)
(2) (60.11)(68.926 u) + (39.89)(70.925 u)
(3) (0.6011)(70.925 u) + (0.3989)(68.926 u)
(4) (60.11)(70.925 u) + (39.89)(68.926 u)

33 A student measures the mass and volume of a sample of copper at room temperature and 101.3 kPa. The mass is 48.9 grams and the volume is 5.00 cubic centimeters. The student calculates the density of the sample. What is the percent error of the student's calculated density?

(1) 7.4%
(2) 8.4%
(3) 9.2%
(4) 10.2%

34 What is the chemical formula for sodium sulfate?

(1) Na_2SO_4
(2) Na_2SO_3
(3) $NaSO_4$
(4) $NaSO_3$

35 Given the balanced equation representing a reaction:

$$2Na(s) + Cl_2(g) \rightarrow 2NaCl(s) + \text{energy}$$

If 46 grams of Na and 71 grams of Cl_2 react completely, what is the total mass of NaCl produced?

(1) 58.5 g
(2) 117 g
(3) 163 g
(4) 234 g

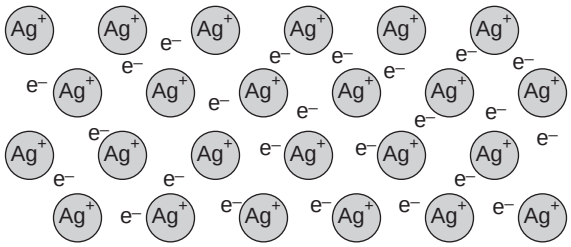
36 Given the balanced equation representing a reaction:

$$2NO + O_2 \rightarrow 2NO_2 + \text{energy}$$

The mole ratio of NO to NO_2 is

(1) 1 to 1
(2) 2 to 1
(3) 3 to 2
(4) 5 to 2

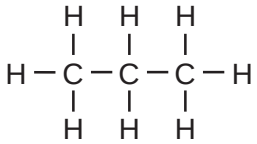
37 The particle diagram below represents a solid sample of silver.



Which type of bonding is present when valence electrons move within the sample?

(1) metallic bonding
(2) hydrogen bonding
(3) covalent bonding
(4) ionic bonding

38 Given the formula representing a molecule:



Which statement explains why the molecule is nonpolar?

(1) Electrons are shared between the carbon atoms and the hydrogen atoms.
(2) Electrons are transferred from the carbon atoms to the hydrogen atoms.
(3) The distribution of charge in the molecule is symmetrical.
(4) The distribution of charge in the molecule is asymmetrical.

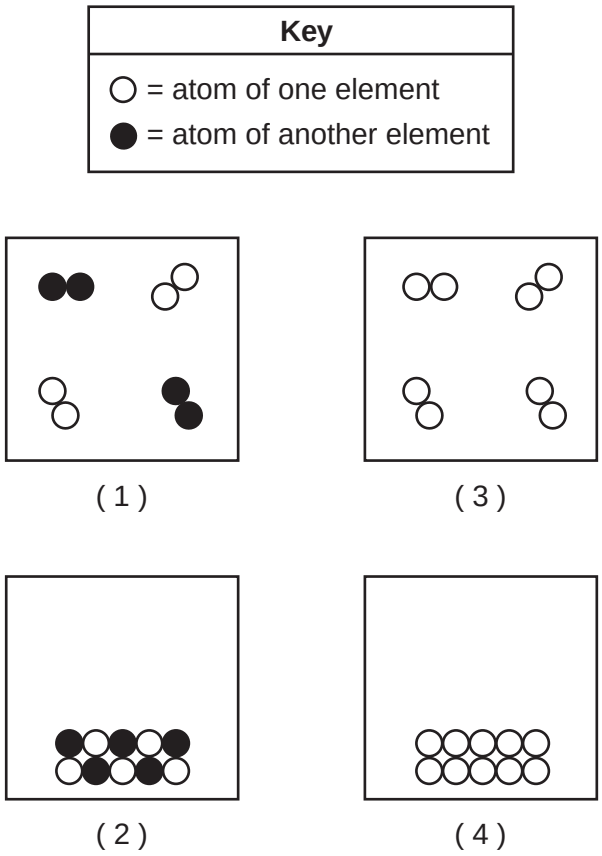
39 A solid sample of a compound and a liquid sample of the same compound are each tested for electrical conductivity. Which test conclusion indicates that the compound is ionic?

(1) Both the solid and the liquid are good conductors.
(2) Both the solid and the liquid are poor conductors.
(3) The solid is a good conductor, and the liquid is a poor conductor.
(4) The solid is a poor conductor, and the liquid is a good conductor.

40 Which statement explains why 10.0 mL of a 0.50 M $H_2SO_4(aq)$ solution exactly neutralizes 5.0 mL of a 2.0 M NaOH(aq) solution?

(1) The moles of $H^+(aq)$ equal the moles of $OH^-(aq)$.
(2) The moles of $H_2SO_4(aq)$ equal the moles of NaOH(aq).
(3) The moles of $H_2SO_4(aq)$ are greater than the moles of NaOH(aq).
(4) The moles of $H^+(aq)$ are greater than the moles of $OH^-(aq)$.

41 Which particle diagram represents *one* substance in the gas phase?



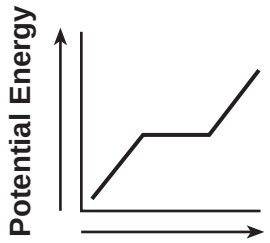
42 Given the equation representing a chemical reaction at equilibrium in a sealed, rigid container:

$$H_2(g) + I_2(g) + \text{energy} \rightleftharpoons 2HI(g)$$

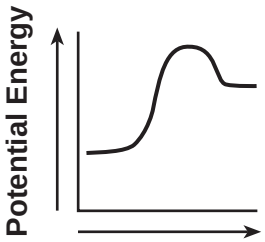
When the concentration of $H_2(g)$ is increased by adding more hydrogen gas to the container at constant temperature, the equilibrium shifts

(1) to the right, and the concentration of HI(g) decreases
(2) to the right, and the concentration of HI(g) increases
(3) to the left, and the concentration of HI(g) decreases
(4) to the left, and the concentration of HI(g) increases

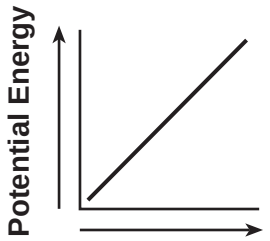
43 Which diagram represents the potential energy changes during an exothermic reaction?



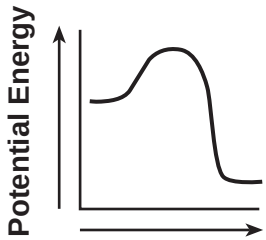
(1)



(3)



(2)



(4)

44 Which compound is classified as an ether?

(1) CH_3CHO
(2) CH_3OCH_3
(3) CH_3COCH_3
(4) CH_3COOCH_3

45 Given the equation representing a reversible reaction:

$$HCO_3^-(aq) + H_2O(\ell) \rightleftharpoons H_2CO_3(aq) + OH^-(aq)$$

Which formula represents the H^+ acceptor in the forward reaction?

(1) $HCO_3^-(aq)$
(2) $H_2O(\ell)$
(3) $H_2CO_3(aq)$
(4) $OH^-(aq)$

46 What is the mass of an original 5.60-gram sample of iron-53 that remains unchanged after 25.53 minutes?

(1) 0.35 g
(2) 0.70 g
(3) 1.40 g
(4) 2.80 g

47 Given the equation representing a nuclear reaction:

$$^1_1H + X \rightarrow {}^6_3Li + {}^4_2He$$

The particle represented by X is

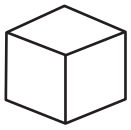
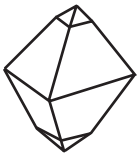
(1) ^9_4Li
(2) ^9_4Be
(3) $^{10}_5Be$
(4) $^{10}_6C$

48 Fission and fusion reactions both release energy. However, only fusion reactions

(1) require elements with large atomic numbers
(2) create radioactive products
(3) use radioactive reactants
(4) combine light nuclei

49 The chart below shows the crystal shapes and melting points of two forms of solid phosphorus.

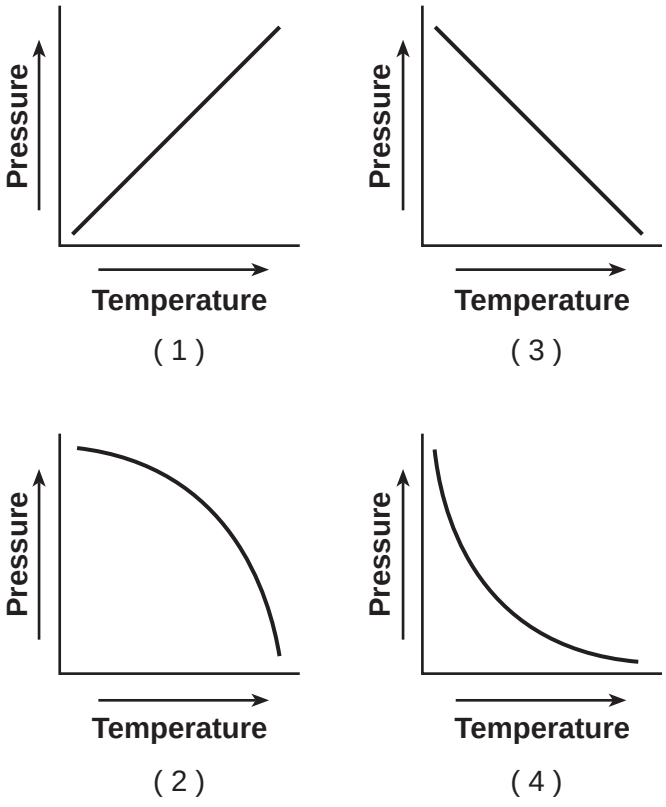
Two Forms of Phosphorus

Form of Phosphorus	Crystal Shape	Melting Point (°C)
white	cubic 	44
black	orthorhombic 	610

Which phrase describes the two forms of phosphorus?

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

50 Which graph shows the relationship between pressure and Kelvin temperature for an ideal gas at constant volume?



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

The elements in Group 17 are called halogens. The word "halogen" is derived from Greek and means "salt former."

51 State the trend in electronegativity for the halogens as these elements are considered in order of increasing atomic number. [1]

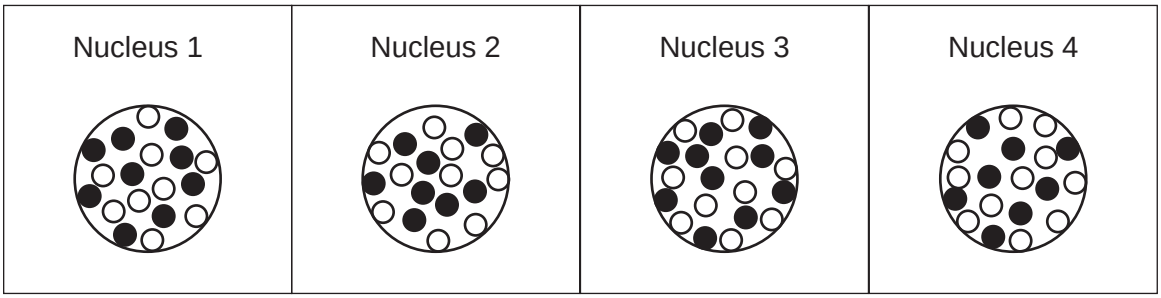
52 Identify the type of chemical bond that forms when potassium reacts with bromine to form a salt. [1]

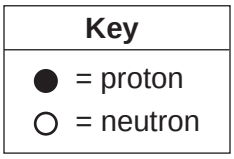
53 Based on Table *F*, identify *one* ion that reacts with iodide ions in an aqueous solution to form an insoluble compound. [1]

Base your answers to questions 54 through 57 on the information below and on your knowledge of chemistry.

The diagrams below represent four different atomic nuclei.

Four Atomic Nuclei





54 Identify the element that has atomic nuclei represented by nucleus 1. [1]

55 Determine the mass number of the nuclide represented by nucleus 2. [1]

56 Explain why nucleus 2 and nucleus 4 represent the nuclei of two different isotopes of the same element. [1]

57 Identify the nucleus above that is found in an atom that has a stable valence electron configuration. [1]

Base your answers to questions 58 through 60 on the information below and on your knowledge of chemistry.

The equation below represents a chemical reaction at 1 atm and 298 K.

$$2H_2(g) + O_2(g) \rightarrow 2H_2O(g)$$

58 State the change in energy that occurs in order to break the bonds in the hydrogen molecules. [1]

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

60 Compare the strength of attraction for electrons by a hydrogen atom to the strength of attraction for electrons by an oxygen atom within a water molecule. [1]

Base your answers to questions 61 through 63 on the information below and on your knowledge of chemistry.

- A test tube contains a sample of solid stearic acid, an organic acid.
- Both the sample and the test tube have a temperature of 22.0°C.
- The stearic acid melts after the test tube is placed in a beaker with 320. grams of water at 98.0°C.
- The temperature of the liquid stearic acid and water in the beaker reaches 74.0°C.

61 Identify the element in stearic acid that makes it an organic compound. [1]

62 State the direction of heat transfer between the test tube and the water when the test tube was placed in the water. [1]

63 Show a numerical setup for calculating the amount of thermal energy change for the water in the beaker. [1]

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

A nuclear reaction is represented by the equation below.

$$^{3}_{1}H \rightarrow ^{3}_{2}He + ^{0}_{-1}e$$

64 Identify the decay mode of hydrogen-3. [1]

65 Explain why the equation represents a transmutation. [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.

A technician recorded data for two properties of Period 3 elements. The data are shown in the table below.

Two Properties of Period 3 Elements

Element	Na	Mg	Al	Si	P	S	Cl	Ar
Ionic Radius (pm)	95	66	51	41	212	184	181	—
Reaction with Cold Water	reacts vigorously	reacts very slowly	no observable reaction	no observable reaction	no observable reaction	no observable reaction	reacts slowly	no observable reaction

66 Identify the element in this table that is classified as a metalloid. [1]

67 State the phase of chlorine at 281 K and 101.3 kPa. [1]

68 State evidence from the technician's data which indicates that sodium is more active than aluminum. [1]

Base your answers to questions 69 through 71 on the information below and on your knowledge of chemistry.

Ammonia, $NH_3(g)$, can be used as a substitute for fossil fuels in some internal combustion engines. The reaction between ammonia and oxygen in an engine is represented by the unbalanced equation below.

$$NH_3(g) + O_2(g) \rightarrow N_2(g) + H_2O(g) + \text{energy}$$

69 Balance the equation *in your answer booklet* for the reaction of ammonia and oxygen, using the smallest whole-number coefficients. [1]

70 Show a numerical setup for calculating the mass, in grams, of a 4.2-mole sample of O_2. Use 32 g/mol as the gram-formula mass of O_2. [1]

71 Determine the new pressure of a 6.40-L sample of oxygen gas at 300. K and 100. kPa after the gas is compressed to 2.40 L at 900. K. [1]

Base your answers to questions 72 through 76 on the information below and on your knowledge of chemistry.

Fruit growers in Florida protect oranges when the temperature is near freezing by spraying water on them. It is the freezing of the water that protects the oranges from frost damage. When $H_2O(\ell)$ at 0°C changes to $H_2O(s)$ at 0°C, heat energy is released. This energy helps to prevent the temperature inside the orange from dropping below freezing, which could damage the fruit. After harvesting, oranges can be exposed to ethene gas, C_2H_4, to improve their color.

72 Write the empirical formula for ethene. [1]

73 Explain, in terms of bonding, why the hydrocarbon ethene is classified as unsaturated. [1]

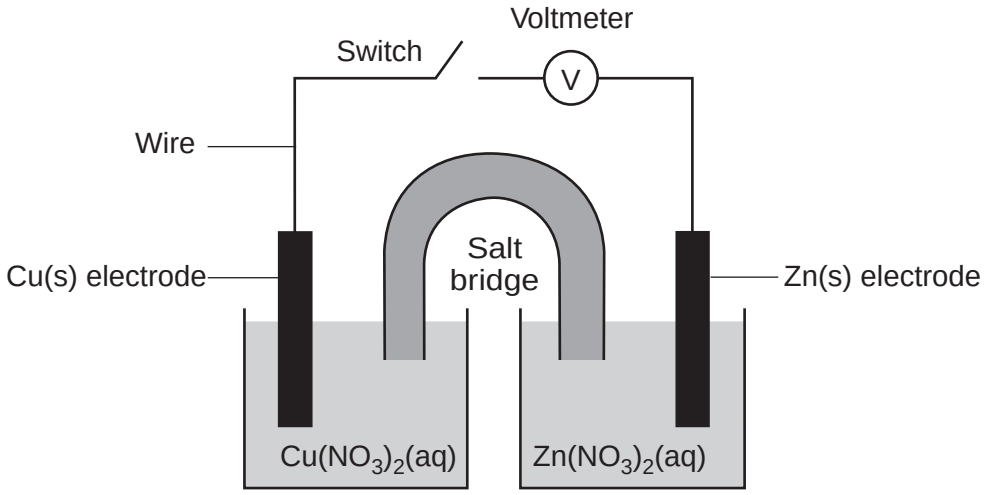
74 Determine the gram-formula mass of ethene. [1]

75 Explain, in terms of particle arrangement, why the entropy of the water *decreases* when the water freezes. [1]

76 Determine the quantity of heat released when 2.00 grams of $H_2O(\ell)$ freezes at 0°C. [1]

Base your answers to questions 77 through 80 on the information below and on your knowledge of chemistry.

A student constructs an electrochemical cell during a laboratory investigation. When the switch is closed, electrons flow through the external circuit. The diagram and ionic equation below represent this cell and the reaction that occurs.



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

77 State the form of energy that is converted to electrical energy in the operating cell. [1]

78 State, in terms of the Cu(s) electrode and the Zn(s) electrode, the direction of electron flow in the external circuit when the cell operates. [1]

79 Write a balanced equation for the half-reaction that occurs in the Cu half-cell when the cell operates. [1]

80 State what happens to the mass of the Cu electrode and the mass of the Zn electrode in the operating cell. [1]

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

A solution is made by dissolving 70.0 grams of $KNO_3(s)$ in 100. grams of water at 50.°C and standard pressure.

81 Show a numerical setup for calculating the percent by mass of KNO_3 in the solution. [1]

82 Determine the number of additional grams of KNO_3 that must dissolve to make this solution saturated. [1]

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

Vinegar is a commercial form of acetic acid, $HC_2H_3O_2(aq)$. One sample of vinegar has a pH value of 2.4.

83 Explain, in terms of particles, why $HC_2H_3O_2(aq)$ can conduct an electric current. [1]

84 State the color of bromthymol blue indicator in a sample of the commercial vinegar. [1]

85 State the pH value of a sample that has ten times *fewer* hydronium ions than an equal volume of a vinegar sample with a pH value of 2.4. [1]

P.S./CHEMISTRY

The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

PHYSICAL SETTING
CHEMISTRY

Tuesday, June 20, 2017 — 9:15 a.m. to 12:15 p.m., only

ANSWER BOOKLET

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

Teacher . . . . . .

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

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

Part B–2

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Part C

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_____

_____

69 _____ $NH_3(g)$ + _____ $O_2(g)$ → _____ $N_2(g)$ + _____ $H_2O(g)$ + energy

70

71 _____ **kPa**

72 _____

73 _____

_____

_____

74 _____ **g/mol**

75 _____

_____

_____

76 _____ **J**

77 _____

78 _____

_____

_____

79 _____

80 Cu electrode: _____

Zn electrode: _____

81

82 _____ **g**

83 _____

_____

_____

84 _____

85 _____

P.S./CHEMISTRY

FOR TEACHERS ONLY

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

P.S.–CH PHYSICAL SETTING/CHEMISTRY

Tuesday, June 20, 2017 — 9:15 a.m. to 12:15 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 . . . . . **3**	9 . . . . . **4**	17 . . . . . **4**	25 . . . . . **2** . . . . .
2 . . . . . **2**	10 . . . . . **4**	18 . . . . . **2**	26 . . . . . **4** . . . . .
3 . . . . . **1**	11 . . . . . **2**	19 . . . . . **3**	27 . . . . . **3** . . . . .
4 . . . . . **2**	12 . . . . . **1**	20 . . . . . **4**	28 . . . . . **1** . . . . .
5 . . . . . **4**	13 . . . . . **1**	21 . . . . . **1**	29 . . . . . **2** . . . . .
6 . . . . . **2**	14 . . . . . **4**	22 . . . . . **3**	30 . . . . . **3** . . . . .
7 . . . . . **2**	15 . . . . . **1**	23 . . . . . **3**	
8 . . . . . **1**	16 . . . . . **2**	24 . . . . . **1**	

Part B–1

31 . . . . . **3**	36 . . . . . **1**	41 . . . . . **3**	46 . . . . . **2** . . . . .
32 . . . . . **1**	37 . . . . . **1**	42 . . . . . **2**	47 . . . . . **2** . . . . .
33 . . . . . **3**	38 . . . . . **3**	43 . . . . . **4**	48 . . . . . **4** . . . . .
34 . . . . . **1**	39 . . . . . **4**	44 . . . . . **2**	49 . . . . . **3** . . . . .
35 . . . . . **2**	40 . . . . . **1**	45 . . . . . **1**	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 Tuesday, June 20, 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:

As atomic number increases, electronegativity decreases.

Electronegativity decreases.

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

ionic bond

ionic

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

Hg_2^{2+}

Pb^{2+}

mercury(I) ion

silver

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

fluorine

F

F_2

55 [1] Allow 1 credit for 18.

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

Both have 8 protons, but nucleus 2 has 10 neutrons while nucleus 4 has 11 neutrons.

equal in protons, unequal in neutrons

same atomic number, but different mass number

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

nucleus 3

3

neon

Ne

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

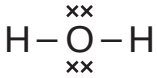
Energy is absorbed when bonds are broken.

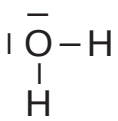
Breaking the bond in H_2 is endothermic.

PE increases.

59 [1] Allow 1 credit.

Examples of 1-credit responses:





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

The oxygen atom has a stronger attraction for electrons than a hydrogen atom.

The electronegativity of oxygen is 3.4 and hydrogen is 2.2.

The H atom has a weaker attraction for electrons.

61 [1] Allow 1 credit for C *or* carbon.

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

Heat is transferred from the water to the test tube.

The test tube absorbs thermal energy from the water.

Stearic acid gained heat from the water.

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

(320. g)(4.18 J/g•K)(98.0°C − 74.0°C)

(320. g)(4.18 J/g•K)(347 K − 371 K)

(320)(4.18)(24)

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

β^-

beta decay

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

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

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

Hydrogen-3 is converted to helium-3.

One element is changed into a different element.

Atomic number changes.

The number of protons in the nucleus changed.

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 Si *or* silicon.

67 [1] Allow 1 credit for gas *or* (g).

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

Sodium reacts vigorously with cold water, but aluminum has no observable reaction.

Only the Na has an observable reaction.

69 [1] Allow 1 credit for $\underline{\quad 4 \quad}\ NH_3(g) + \underline{\quad 3 \quad}\ O_2(g) \rightarrow \underline{\quad 2 \quad}\ N_2(g) + \underline{\quad 6 \quad}\ H_2O(g)$ + energy

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

$$4.2 \text{ mol} = \frac{x}{32 \text{ g/mol}}$$

$$(4.2 \text{ mol})\left(\frac{32 \text{ g}}{1 \text{ mol}}\right)$$

$(32)(4.2)$

71 [1] Allow 1 credit for 800. kPa. Significant figures do *not* need to be shown.

72 [1] Allow 1 credit for CH_2. The order of the elements may vary.

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

Ethene is classified as an unsaturated hydrocarbon because each molecule contains a double bond.

There is a C = C bond in each molecule.

More hydrogen atoms can be bonded to this hydrocarbon.

A C_2H_4 molecule has a multiple carbon-carbon bond.

74 [1] Allow 1 credit for any value from 28 g/mol to 28.1 g/mol, inclusive.

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

The arrangement of the $H_2O(\ell)$ molecules is more random than the $H_2O(s)$ molecules.

The molecules in ice have a rigid, orderly arrangement.

76 [1] Allow 1 credit for 668 J *or* –668 J.

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

chemical potential energy

chemical

potential

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

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

The e^- flow is from Zn to Cu.

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

$Cu^{2+}(aq) + 2e^- \rightarrow Cu(s)$

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

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

Cu electrode: mass increases
Zn electrode: mass decreases

Cu electrode: increases
Zn electrode: decreases

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

$$\frac{70.0\text{ g}}{100.\text{ g} + 70.0\text{ g}} \times 100$$

$$\frac{70(100)}{170}$$

$$\frac{70}{170} = \frac{x}{100}$$

82 [1] Allow 1 credit for any value from 12 g to 16 g, inclusive.

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

The $HC_2H_3O_2(aq)$ has ions in water, which are mobile.

The charged particles move freely.

Acetic acid forms moveable ions in aqueous solution.

84 [1] Allow 1 credit for yellow.

85 [1] Allow 1 credit for 3.4.

Regents Examination in Physical Setting/Chemistry

June 2017

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

The *Chart for Determining the Final Examination Score for the June 2017 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 20, 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

June 2017 Physical Setting/Chemistry			
Question Numbers			
Key Ideas/Performance Indicators	Part A	Part B	Part C
Standard 1			
Math Key Idea 1		32, 63	70, 81
Math Key Idea 2			69, 79, 80
Math Key Idea 3		33, 34, 35, 36, 40, 46, 47	71, 72, 74, 76
Science Inquiry Key Idea 1		37, 38, 41, 45, 48, 51, 52, 54, 56, 57, 58, 60, 61, 62, 65	66, 67, 73, 75, 77, 78, 83, 84
Science Inquiry Key Idea 2			
Science Inquiry Key Idea 3		31, 34, 37, 38, 39, 40, 43, 44, 45, 47, 49, 50, 51, 53, 55, 57, 64, 65	66, 68, 69, 72, 77, 78, 79, 80, 84
Engineering Design Key Idea 1			
Standard 2			
Key Idea 1		49	68
Key Idea 2			
Key Idea 3			
Standard 6			
Key Idea 1			
Key Idea 2		33, 41, 50, 54, 59, 62	
Key Idea 3			85
Key Idea 4		42	
Key Idea 5			82
Standard 7			
Key Idea 1			
Key Idea 2			
Standard 4 Process Skills			
Key Idea 3		31, 32, 35, 36, 41, 42, 44, 51, 55, 56	66, 69, 70, 71, 72, 74, 75, 78, 79, 81, 82, 84
Key Idea 4		43, 46, 47, 48, 63	76
Key idea 5		59	
Standard 4			
Key Idea 3	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 17, 18, 19, 20, 21, 22, 24, 25, 26, 27, 28, 29, 30	31, 32, 33, 34, 35, 36, 40, 41, 42, 44, 45, 50, 51, 53, 54, 55, 56, 61	66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 77, 78, 79, 80, 81, 82, 83, 84, 85
Key Idea 4	14, 15, 16, 23	43, 46, 47, 48, 62, 63, 64	76
Key Idea 5	11, 12, 13	37, 38, 39, 49, 52, 57, 58, 59, 60, 65	
Reference Tables			
2011 Edition	3, 4, 6, 7, 11, 12, 13, 25, 27, 30	31, 33, 34, 37, 40, 44, 46, 47, 50, 51, 52, 53, 54, 57, 59, 60, 61, 63, 64	66, 67, 70, 71, 72, 73, 74, 76, 78, 79, 80, 81, 82, 84

The State Education Department / The University of the State of New York

Regents Examination in Physical Setting/Chemistry – June 2017

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

Raw Score	Scale Score
85	**100**
84	**98**
83	**97**
82	**95**
81	**94**
80	**92**
79	**91**
78	**90**
77	**88**
76	**87**
75	**86**
74	**85**
73	**84**
72	**83**
71	**82**
70	**81**
69	**80**
68	**79**
67	**78**
66	**77**
65	**76**
64	**75**

Raw Score	Scale Score
63	**74**
62	**74**
61	**73**
60	**72**
59	**71**
58	**71**
57	**70**
56	**69**
55	**68**
54	**68**
53	**67**
52	**66**
51	**66**
50	**65**
49	**64**
48	**64**
47	**63**
46	**62**
45	**62**
44	**61**
43	**60**
42	**60**

Raw Score	Scale Score
41	**59**
40	**58**
39	**57**
38	**57**
37	**56**
36	**55**
35	**54**
34	**53**
33	**53**
32	**52**
31	**51**
30	**50**
29	**49**
28	**48**
27	**47**
26	**46**
25	**45**
24	**44**
23	**43**
22	**42**
21	**40**
20	**39**

Raw Score	Scale Score
19	**38**
18	**36**
17	**35**
16	**33**
15	**32**
14	**30**
13	**29**
12	**27**
11	**25**
10	**23**
9	**21**
8	**19**
7	**17**
6	**15**
5	**13**
4	**10**
3	**8**
2	**5**
1	**3**
0	**0**

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

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

Because scale scores corresponding to raw scores in the conversion chart change from one administration to another, it is crucial that for each administration the conversion chart provided for that administration be used to determine the student's final score. The chart above is usable only for this administration of the Regents Examination in Physical Setting/Chemistry.