The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

PHYSICAL SETTING
CHEMISTRY

Tuesday, June 17, 2008 — 1:15 to 4:15 p.m., only

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

Your answer sheet for Part A and Part B–1 is the last page of this examination booklet. Turn to the last page and fold it along the perforations. Then, slowly and carefully, tear off your answer sheet and fill in the heading.

The answers to the questions in Part B–2 and Part C are to be written in your separate answer booklet. Be sure to fill in the heading on the front of your answer booklet.

Record the number of your choice for each Part A and Part B–1 multiple-choice question on your separate answer sheet. Write your answers to the Part B–2 and Part C questions in your answer booklet. All work 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 and in your answer booklet.

When you have completed the examination, you must sign the statement printed at the end of 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 *Reference Tables for Physical Setting/Chemistry* must be available for you to use while taking this examination.

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

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, write on the 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 *Reference Tables for Physical Setting/Chemistry*.

1 An atom in the ground state has seven valence electrons. This atom could be an atom of which element?

(1) calcium
(2) fluorine
(3) oxygen
(4) sodium

2 What is the total number of electrons in an atom of potassium?

(1) 18
(2) 19
(3) 20
(4) 39

3 A proton has a charge that is opposite the charge of

(1) an alpha particle
(2) a neutron
(3) an electron
(4) a positron

4 Which conclusion was a direct result of the gold foil experiment?

(1) An atom is mostly empty space with a dense, positively charged nucleus.
(2) An atom is composed of at least three types of subatomic particles.
(3) An electron has a positive charge and is located inside the nucleus.
(4) An electron has properties of both waves and particles.

5 Which statement identifies the element arsenic?

(1) Arsenic has an atomic number of 33.
(2) Arsenic has a melting point of 84 K.
(3) An atom of arsenic in the ground state has eight valence electrons.
(4) An atom of arsenic in the ground state has a radius of 146 pm.

6 Which element has an atom with the greatest attraction for electrons in a chemical bond?

(1) As
(2) Bi
(3) N
(4) P

7 Given the balanced equation representing a reaction:

$$H^+(aq) + OH^-(aq) \rightarrow H_2O(\ell) + \text{energy}$$

In this reaction there is conservation of

(1) mass, only
(2) mass and charge, only
(3) charge and energy, only
(4) charge, energy, and mass

8 Which statement describes the composition of potassium chlorate, $KClO_3$?

(1) The proportion by mass of elements combined in potassium chlorate is fixed.
(2) The proportion by mass of elements combined in potassium chlorate varies.
(3) Potassium chlorate is composed of four elements.
(4) Potassium chlorate is composed of five elements.

9 As a bond between a hydrogen atom and a sulfur atom is formed, electrons are

(1) shared to form an ionic bond
(2) shared to form a covalent bond
(3) transferred to form an ionic bond
(4) transferred to form a covalent bond

10 Atoms of which element can bond to each other to form chains, rings, and networks?

(1) carbon
(2) fluorine
(3) hydrogen
(4) oxygen

11 Which formula represents a polar molecule?

(1) Br_2
(2) CO_2
(3) CH_4
(4) NH_3

12 Two solid samples each contain sulfur, oxygen, and sodium, only. These samples have the same color, melting point, density, and reaction with an aqueous barium chloride solution. It can be concluded that the two samples are the same

(1) compound
(2) element
(3) mixture
(4) solution

13 Which equation represents a physical change?

(1) $H_2O(s) + 6.01\ kJ \rightarrow H_2O(\ell)$
(2) $2H_2(g) + O_2(g) \rightarrow 2H_2O(g) + 483.6\ kJ$
(3) $H_2(g) + I_2(g) + 53.0\ kJ \rightarrow 2HI(g)$
(4) $N_2(g) + 2O_2(g) + 66.4\ kJ \rightarrow 2NO_2(g)$

14 Which liquid has the *lowest* vapor pressure at 65°C?

(1) ethanoic acid
(2) ethanol
(3) propanone
(4) water

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

(1) ammonia
(2) argon
(3) methane
(4) water

16 In which sample is the average kinetic energy of the particles greatest?

(1) 10. mL of HCl(aq) at 25°C
(2) 15 mL of HCl(aq) at 20.°C
(3) 10. mL of $H_2O(\ell)$ at 35°C
(4) 15 mL of $H_2O(\ell)$ at 30.°C

17 A thermometer is in a beaker of water. Which statement best explains why the thermometer reading initially increases when LiBr(s) is dissolved in the water?

(1) The entropy of the LiBr(aq) is greater than the entropy of the water.
(2) The entropy of the LiBr(aq) is less than the entropy of the water.
(3) The dissolving of the LiBr(s) in water is an endothermic process.
(4) The dissolving of the LiBr(s) in water is an exothermic process.

18 Which process increases the potential energy of the particles of a sample?

(1) condensation
(2) deposition
(3) solidification
(4) vaporization

19 Which sample at STP has the same number of molecules as 5 liters of $NO_2(g)$ at STP?

(1) 5 grams of $H_2(g)$
(2) 5 liters of $CH_4(g)$
(3) 5 moles of $O_2(g)$
(4) 5×10^{23} molecules of $CO_2(g)$

20 Under which conditions of temperature and pressure does oxygen gas behave *least* like an ideal gas?

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

21 How is a chemical reaction affected by the addition of a catalyst?

(1) The activation energy decreases.
(2) The heat of reaction increases.
(3) The number of collisions between particles decreases.
(4) The potential energy of the reactants increases.

22 Systems in nature tend to undergo changes toward

(1) lower energy and less disorder
(2) lower energy and more disorder
(3) higher energy and less disorder
(4) higher energy and more disorder

23 What can be concluded if an ion of an element is *smaller* than an atom of the same element?

(1) The ion is negatively charged because it has fewer electrons than the atom.
(2) The ion is negatively charged because it has more electrons than the atom.
(3) The ion is positively charged because it has fewer electrons than the atom.
(4) The ion is positively charged because it has more electrons than the atom.

24 Which class of organic compounds has molecules that contain nitrogen atoms?

(1) alcohol
(2) amine
(3) ether
(4) ketone

25 Which two compounds have the same molecular formula but different chemical and physical properties?

(1) CH_3CH_2Cl and CH_3CH_2Br
(2) CH_3CHCH_2 and $CH_3CH_2CH_3$
(3) CH_3CHO and CH_3COCH_3
(4) CH_3CH_2OH and CH_3OCH_3

26 Which half-reaction equation represents the reduction of a potassium ion?

(1) $K^+ + e^- \rightarrow K$
(2) $K + e^- \rightarrow K^+$
(3) $K^+ \rightarrow K + e^-$
(4) $K \rightarrow K^+ + e^-$

27 According to the Arrhenius theory, an acid is a substance that

(1) changes litmus from red to blue
(2) changes phenolphthalein from colorless to pink
(3) produces hydronium ions as the only positive ions in an aqueous solution
(4) produces hydroxide ions as the only negative ions in an aqueous solution

28 Which type of reaction occurs when a high-energy particle collides with the nucleus of an atom, converting that atom to an atom of a different element?

(1) addition
(2) neutralization
(3) substitution
(4) transmutation

29 Which particle is emitted when an atom of ^{85}Kr spontaneously decays?

(1) an alpha particle
(2) a beta particle
(3) a neutron
(4) a proton

30 What is a problem commonly associated with nuclear power facilities?

(1) A small quantity of energy is produced.
(2) Reaction products contribute to acid rain.
(3) It is impossible to control nuclear fission.
(4) It is difficult to dispose of wastes.

Part B–1

Answer all questions in this part.

Directions (31–50): For *each* statement or question, write on the 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 *Reference Tables for Physical Setting/Chemistry*.

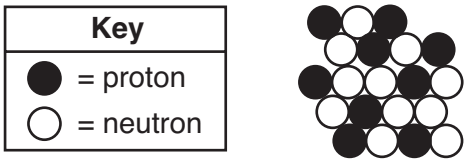
31 The wave-mechanical model of the atom is required to explain the

(1) mass number and atomic number of an atom
(2) organization of atoms in a crystal
(3) radioactive nature of some atoms
(4) spectra of elements with multielectron atoms

32 Magnesium and calcium have similar chemical properties because an atom of each element has the same total number of

(1) electron shells
(2) valence electrons
(3) neutrons
(4) protons

33 The diagram below represents the nucleus of an atom.



What are the atomic number and mass number of this atom?

(1) The atomic number is 9 and the mass number is 19.
(2) The atomic number is 9 and the mass number is 20.
(3) The atomic number is 11 and the mass number is 19.
(4) The atomic number is 11 and the mass number is 20.

34 A barium atom attains a stable electron configuration when it bonds with

(1) one chlorine atom
(2) two chlorine atoms
(3) one sodium atom
(4) two sodium atoms

35 A student measures the mass and volume of a piece of aluminum. The measurements are 25.6 grams and 9.1 cubic centimeters. The student calculates the density of the aluminum. What is the percent error of the student's calculated density of aluminum?

(1) 1%
(2) 2%
(3) 3%
(4) 4%

36 Given the balanced equation representing a reaction:

$$2H_2 + O_2 \rightarrow 2H_2O$$

What is the total mass of water formed when 8 grams of hydrogen reacts completely with 64 grams of oxygen?

(1) 18 g
(2) 36 g
(3) 56 g
(4) 72 g

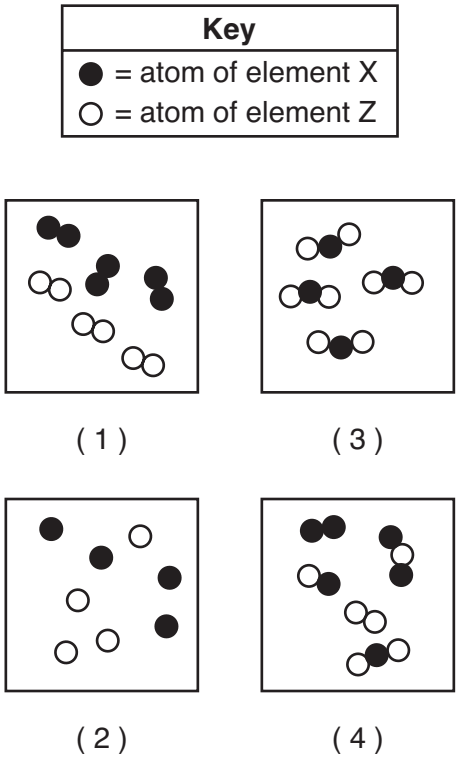
37 Which compound contains both ionic and covalent bonds?

(1) ammonia
(2) methane
(3) sodium nitrate
(4) potassium chloride

38 An iron bar at 325 K is placed in a sample of water. The iron bar gains energy from the water if the temperature of the water is

(1) 65 K
(2) 45 K
(3) 65°C
(4) 45°C

39 Which particle model diagram represents only one compound composed of elements *X* and Z?



40 Given the balanced equation representing a reaction:

$$Cu + S \rightarrow CuS + \text{energy}$$

Which statement explains why the energy term is written to the right of the arrow?

(1) The compound CuS is composed of two metals.
(2) The compound CuS is composed of two nonmetals.
(3) Energy is absorbed as the bonds in CuS form.
(4) Energy is released as the bonds in CuS form.

41 A 1.0-gram sample of which element will uniformly fill a closed 2.0-liter container at STP?

(1) antimony
(2) sulfur
(3) tellurium
(4) xenon

42 Given the balanced equation representing a reaction:

$$C_3H_8(g) + 5O_2(g) \rightarrow 3CO_2(g) + 4H_2O(g)$$

What is the total number of moles of $O_2(g)$ required for the complete combustion of 1.5 moles of $C_3H_8(g)$?

(1) 0.30 mol
(2) 1.5 mol
(3) 4.5 mol
(4) 7.5 mol

43 A sample of gas occupies a volume of 50.0 milliliters in a cylinder with a movable piston. The pressure of the sample is 0.90 atmosphere and the temperature is 298 K. What is the volume of the sample at STP?

(1) 41 mL
(2) 49 mL
(3) 51 mL
(4) 55 mL

44 Which solution has the *lowest* freezing point?

(1) 10. g of KI dissolved in 100. g of water
(2) 20. g of KI dissolved in 200. g of water
(3) 30. g of KI dissolved in 100. g of water
(4) 40. g of KI dissolved in 200. g of water

45 Which 1-mole sample has the *least* entropy?

(1) $Br_2(s)$ at 266 K
(2) $Br_2(\ell)$ at 266 K
(3) $Br_2(\ell)$ at 332 K
(4) $Br_2(g)$ at 332 K

46 At 20.°C, a 1.2-gram sample of Mg ribbon reacts rapidly with 10.0 milliliters of 1.0 M HCl(aq). Which change in conditions would have caused the reaction to proceed more slowly?

(1) increasing the initial temperature to 25°C
(2) decreasing the concentration of HCl(aq) to 0.1 M
(3) using 1.2 g of powdered Mg
(4) using 2.4 g of Mg ribbon

47 Which general formula represents the compound CH_3CH_2CCH?

(1) C_nH_n
(2) C_nH_{2n}
(3) C_nH_{2n-2}
(4) C_nH_{2n+2}

48 Which compound dissolves in water to form an aqueous solution that can conduct an electric current?

(1) CCl_4 (3) CH_3COOH

(2) C_2H_5OH (4) CH_4

49 Given the equation representing a reaction at equilibrium:

$$NH_3(g) + H_2O(\ell) \rightleftharpoons NH_4^+(aq) + OH^-(aq)$$

The H^+ acceptor for the forward reaction is

(1) $H_2O(\ell)$ (3) $NH_4^+(aq)$

(2) $NH_3(g)$ (4) $OH^-(aq)$

50 An original sample of K-40 has a mass of 25.00 grams. After 3.9×10^9 years, 3.125 grams of the original sample remains unchanged. What is the half-life of K-40?

(1) 1.3×10^9 y (3) 3.9×10^9 y

(2) 2.6×10^9 y (4) 1.2×10^{10} y

Part B–2

Answer all questions in this part.

Directions (51–64): Record your answers in the spaces provided in your answer booklet. Some questions may require the use of the *Reference Tables for Physical Setting/Chemistry.*

Base your answers to questions 51 and 52 on the information below.

In a titration, 15.65 milliliters of a KOH(aq) solution exactly neutralized 10.00 milliliters of a 1.22 M HCl(aq) solution.

51 Complete the equation *in your answer booklet* for the titration reaction by writing the formula of *each* product. [1]

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

Base your answers to questions 53 through 55 on the information below.

A 150.-gram liquid sample of stearic acid, $C_{17}H_{35}COOH$, is cooled at a constant rate. The temperature of the sample is recorded at 2-minute intervals in the data table below.

Cooling Data for Stearic Acid

Time (min)	**Temperature** (°C)
0	75.0
2	72.0
4	69.3
6	69.3
8	69.3
10.	69.3
12	65.0

53 Identify the physical change occurring during the time interval 4 minutes to 10. minutes. [1]

54 On the grid *in your answer booklet*:

- Mark an appropriate scale on the axis labeled "Temperature (°C)." [1]
- Plot the data from the data table. Circle and connect the points. [1]

55 Determine the gram-formula mass of stearic acid. [1]

Base your answers to questions 56 through 58 on the information below.

An unsaturated solution is made by completely dissolving 20.0 grams of $NaNO_3$ in 100.0 grams of water at 20.0°C.

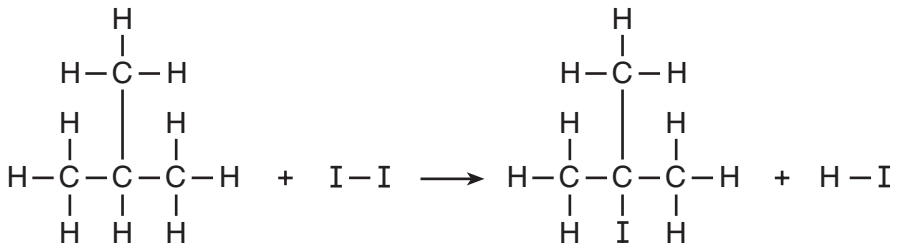
56 In the space *in your answer booklet*, show a correct numerical setup for calculating the number of moles of $NaNO_3$ (gram-formula mass = 85.0 grams per mole) used to make this unsaturated solution. [1]

57 Determine the minimum mass of $NaNO_3$ that must be added to this unsaturated solution to make a saturated solution at 20.0°C. [1]

58 Identify *one* process that can be used to recover the $NaNO_3$ from the unsaturated solution. [1]

Base your answers to questions 59 through 61 on the information below.

The hydrocarbon 2-methylpropane reacts with iodine as represented by the balanced equation below. At standard pressure, the boiling point of 2-methylpropane is lower than the boiling point of 2-iodo-2-methylpropane.



2-methylpropane 2-iodo-2-methylpropane

59 To which class of organic compounds does this organic product belong? [1]

60 Explain, in terms of bonding, why the hydrocarbon 2-methylpropane is saturated. [1]

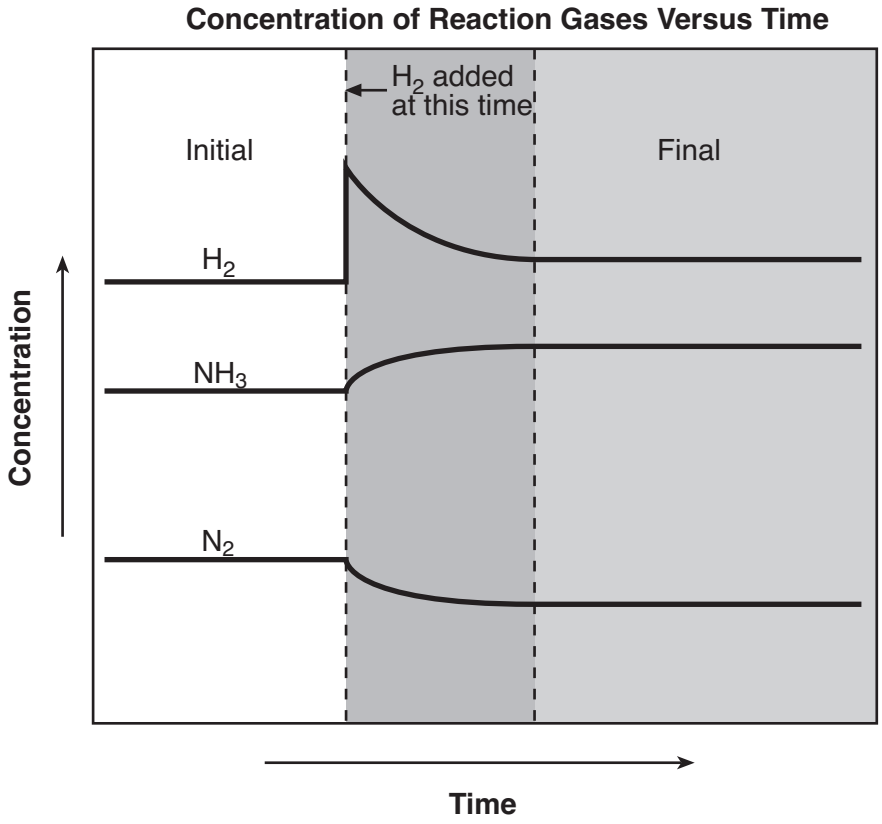
61 Explain the difference in the boiling points of 2-methylpropane and 2-iodo-2-methylpropane in terms of *both* molecular polarity and intermolecular forces. [2]

Base your answers to questions 62 through 64 on the information below.

Nitrogen gas, hydrogen gas, and ammonia gas are in equilibrium in a closed container at constant temperature and pressure. The equation below represents this equilibrium.

$$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$$

The graph below shows the initial concentration of each gas, the changes that occur as a result of adding $H_2(g)$ to the system, and the final concentrations when equilibrium is reestablished.



62 What information on the graph indicates that the system was initially at equilibrium? [1]

63 Explain, in terms of LeChatelier's principle, why the final concentration of $NH_3(g)$ is greater than the initial concentration of $NH_3(g)$. [1]

64 Explain, in terms of collision theory, why the concentration of $H_2(g)$ begins to *decrease* immediately after more $H_2(g)$ is added to the system. [1]

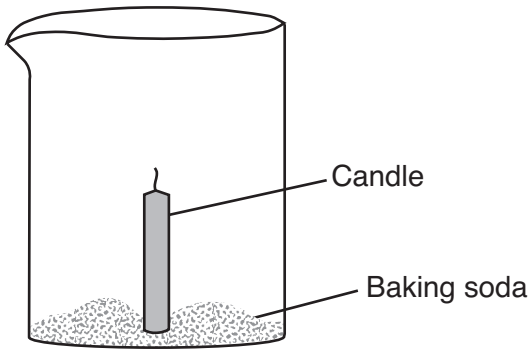
Part C

Answer all questions in this part.

Directions (65–79): Record your answers in the spaces provided in your answer booklet. Some questions may require the use of the *Reference Tables for Physical Setting/Chemistry*.

Base your answers to questions 65 through 67 on the information below.

An unlit candle is secured to the bottom of a 200-milliliter glass beaker. Baking soda (sodium hydrogen carbonate) is added around the base of the candle as shown below.



The candle is lit and dilute ethanoic acid is poured down the inside of the beaker. As the acid reacts with the baking soda, bubbles of CO_2 gas form. After a few seconds, the air in the beaker is replaced by 0.20 liter of CO_2 gas, causing the candle flame to go out. The density of CO_2 gas is 1.8 grams per liter at room temperature.

65 Write the chemical formula for baking soda. [1]

66 In the space *in your answer booklet*, draw a structural formula for the acid that was poured into the beaker. [1]

67 Calculate the mass of the CO_2 gas that replaced the air in the beaker. Your response must include *both* a correct numerical setup and the calculated result. [2]

Base your answers to questions 68 through 71 on the information below.

The health of fish depends on the amount of oxygen dissolved in the water. A dissolved oxygen (DO) concentration between 6 parts per million and 8 parts per million is best for fish health. A DO concentration greater than 1 part per million is necessary for fish survival.

Fish health is also affected by water temperature and concentrations of dissolved ammonia, hydrogen sulfide, chloride compounds, and nitrate compounds. Most freshwater fish thrive in water with a pH between 6.5 and 8.5.

A student's fish tank contains fish, green plants, and 3800 grams of fish-tank water with 2.7×10^{-2} gram of dissolved oxygen. Phenolphthalein tests colorless and bromthymol blue tests blue in samples of the fish-tank water.

68 Based on the test results for the indicators phenolphthalein and bromthymol blue, what is the pH range of the fish-tank water? [1]

69 When the fish-tank water has a pH of 8.0, the hydronium ion concentration is 1.0×10^{-8} mole per liter. What is the hydronium ion concentration when the water has a pH of 7.0? [1]

70 State how an increase in the temperature of the fish-tank water affects the solubility of oxygen in the water. [1]

71 Determine if the DO concentration in the fish tank is healthy for fish. Your response must include:

- a correct numerical setup to calculate the DO concentration in the water in parts per million [1]
- the calculated result [1]
- a statement using your calculated result that tells why the DO concentration in the water is or is not healthy for fish [1]

Base your answers to questions 72 and 73 on the information below.

The Balmer series refers to the visible bright lines in the spectrum produced by hydrogen atoms. The color and wavelength of each line in this series are given in the table below.

Balmer Series for Hydrogen

Color	**Wavelength** (nm)
red	656.3
blue green	486.1
blue	434.1
violet	410.2

72 On the diagram *in your answer booklet*, draw *four* vertical lines to represent the Balmer series. [1]

73 Explain, in terms of *both* subatomic particles and energy states, how the Balmer series is produced. [1]

Base your answers to questions 74 through 76 on the information below.

A flashlight can be powered by a rechargeable nickel-cadmium battery. In the battery, the anode is Cd(s) and the cathode is $NiO_2(s)$. The unbalanced equation below represents the reaction that occurs as the battery produces electricity. When a nickel-cadmium battery is recharged, the reverse reaction occurs.

$$Cd(s) + NiO_2(s) + H_2O(\ell) \rightarrow Cd(OH)_2(s) + Ni(OH)_2(s)$$

74 Balance the equation *in your answer booklet* for the reaction that produces electricity, using the smallest whole-number coefficients. [1]

75 Determine the change in oxidation number for the element that makes up the anode in the reaction that produces electricity. [1]

76 Explain why Cd would be above Ni if placed on Table *J*. [1]

Base your answers to questions 77 through 79 on the information below.

A battery-operated smoke detector produces an alarming sound when its electrical sensor detects smoke particles. Some ionizing smoke detectors contain the radioisotope americium-241, which undergoes alpha decay and has a half-life of 433 years. The emitted alpha particles ionize gas molecules in the air. As a result, an electric current flows through the detector. When smoke particles enter the detector, the flow of ions is interrupted, causing the alarm to sound.

77 Complete the nuclear equation *in your answer booklet* for the decay of Am-241. Your response must include the symbol, mass number, and atomic number for *each* product. [2]

78 State *one* scientific reason why Am-241 is a more appropriate radioactive source than Fr-220 in an ionizing smoke detector. [1]

79 Explain, in terms of particle behavior, why smoke particles cause the detector alarm to sound. [1]

Tear Here

The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

PHYSICAL SETTING
CHEMISTRY

Tuesday, June 17, 2008 — 1:15 to 4:15 p.m., only

ANSWER SHEET

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

Teacher ..... School .....

Record your answers to Part A and Part B–1 on this answer sheet.

Part A

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

Part A Score

Part B–1

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

Part B–1 Score

Write your answers to Part B–2 and Part C in your answer booklet.

The declaration below should be signed when you have completed the examination.

I do hereby affirm, at the close of this examination, that I had no unlawful knowledge of the questions or answers prior to the examination and that I have neither given nor received assistance in answering any of the questions during the examination.

Signature

Tear Here

PS/CHEMISTRY

The University of the State of New York

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PHYSICAL SETTING
CHEMISTRY

Tuesday, June 17, 2008 — 1:15 to 4:15 p.m., only

ANSWER BOOKLET

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

Teacher . . . . . .

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

Answer all questions in Part B–2 and Part C. Record your answers in this booklet.

Part	Maximum Score	Student's Score
A	30	
B–1	20	
B–2	16	
C	19	

Total Written Test Score (Maximum Raw Score: 85)

Final Score (from conversion chart)

Raters' Initials:

Rater 1 . . . . . Rater 2 . . . . . .

Part B–2

51 $HCl(aq) + KOH(aq) \rightarrow$ _____ + _____

52

For Raters Only

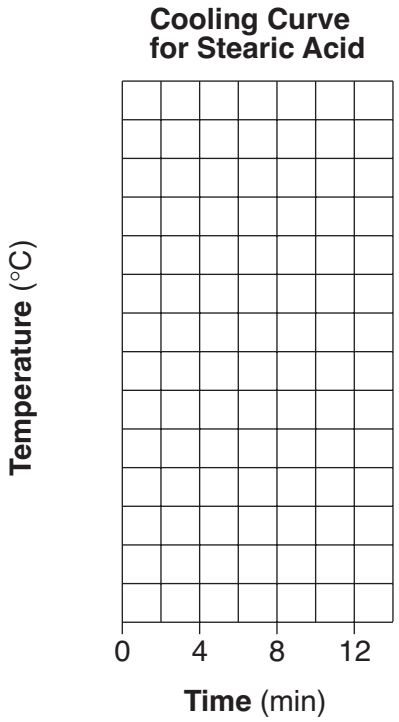
51

52

For Raters Only

53 _____ 53

54



54

55 _____ g/mol 55

56

56

57 _____ g 57

58 _____ 58

For Raters Only

59 _____

59 ☐

60 _____

60 ☐

61 Molecular polarity: _____

Intermolecular forces: _____

61 ☐

62 _____

62 ☐

63 _____

63 ☐

64 _____

64 ☐

Total Score for Part B–2

Part C

For Raters Only

65 _____ **65** ☐

66 **66** ☐

67 **67** ☐

_____ **g**

For Raters Only

68 pH between _____ and _____ **68**

69 _____ **mol/L** **69**

70 _____ **70**

_____

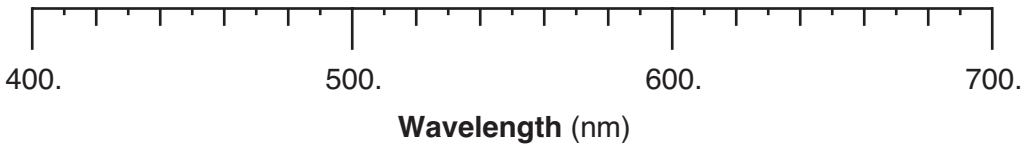
71 **71**

_____ **ppm**

_____

_____

72



72

73 _____ **73**

_____

_____

For Raters Only

74 _____ $Cd(s)$ + _____ $NiO_2(s)$ + _____ $H_2O(\ell)$ $\rightarrow$ _____ $Cd(OH)_2(s)$ + _____ $Ni(OH)_2(s)$ **74** ☐

75 From _____ to _____ **75** ☐

76 _____

_____ **76** ☐

_____

77 $^{241}_{95}Am \rightarrow$ _____ + _____ **77** ☐

78 _____

_____ **78** ☐

79 _____

_____ **79** ☐

_____

☐

Total Score for Part C

PS/CHEMISTRY

FOR TEACHERS ONLY

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

PS–CH PHYSICAL SETTING/CHEMISTRY

Tuesday, June 17, 2008 — 1:15 to 4:15 p.m., only

SCORING KEY AND RATING GUIDE

Directions to the Teacher:

Refer to the directions on page 3 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 http://www.emsc.nysed.gov/osa/ and select the link "Examination 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						Part B–1			
1	2	11	4	21	1	31	4	41	4
2	2	12	1	22	2	32	2	42	4
3	3	13	1	23	3	33	2	43	1
4	1	14	1	24	2	34	2	44	3
5	1	15	2	25	4	35	4	45	1
6	3	16	3	26	1	36	4	46	2
7	4	17	4	27	3	37	3	47	3
8	1	18	4	28	4	38	3	48	3
9	2	19	2	29	2	39	3	49	2
10	1	20	2	30	4	40	4	50	1

Directions to the Teacher

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

Use only *red* ink or *red* pencil in rating Regents papers. Do *not* correct the student's work by making insertions or changes of any kind.

On the detachable answer sheet for Part A and Part B–1, indicate by means of a check mark each incorrect or omitted answer. In the box provided at the end of each part, record the number of questions the student answered correctly for that part.

At least two science teachers must participate in the scoring of each student's responses to the Part B–2 and Part C open-ended questions. 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 all the open-ended questions on a student's answer paper.

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. Complete sentences are *not* required. Phrases, diagrams, and symbols may be used. In the student's answer booklet, record the number of credits earned for each answer in the box printed to the right of the answer lines or spaces for that question.

Fractional credit is *not* allowed. Only whole-number credit may be given to a response. Units need not be given when the wording of the questions allows such omissions.

Raters should enter the scores earned for Part A, Part B–1, Part B–2, and Part C on the appropriate lines in the box printed on the answer booklet and then should add these four scores and enter the total in the box labeled "Total Written Test Score." Then, the student's raw score should be converted to a scaled score by using the conversion chart that will be posted on the Department's web site http://www.emsc.nysed.gov/osa/ on Tuesday, June 17, 2008. The student's scaled score should be entered in the labeled box on the student's answer booklet. The scaled score is the student's final examination score.

All student answer papers that receive a scaled score of 60 through 64 **must** be scored a second time. For the second scoring, a different committee of teachers may score the student's paper or the original committee may score the paper, except that no teacher may score the same open-ended questions that he/she scored in the first rating of the paper. The school principal is responsible for assuring that the student's final examination score is based on a fair, accurate, and reliable scoring of the student's answer paper.

Because scaled scores corresponding to raw scores in the conversion chart may change from one examination 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 16 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:

H_2O + KCl

KCl(aq)+ HOH(ℓ)

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

(1.22 M)(10.00 mL) = M_B(15.65 mL)

$\frac{(1.22)(10)}{15.65}$

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

solidification

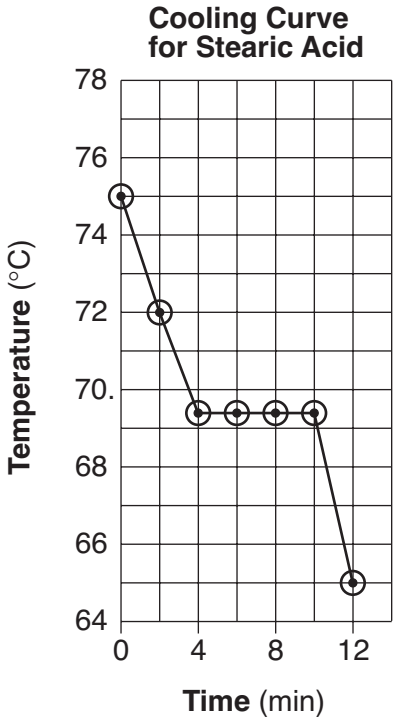
freezing

crystallization

54 [2] Allow a maximum of 2 credits, allocated as follows:

- Allow 1 credit for marking an appropriate scale on the axis labeled "Temperature (°C)." An appropriate scale is linear and allows a trend to be seen.
- Allow 1 credit for plotting all seven points correctly ± 0.3 grid space. Plotted points do *not* need to be circled or connected.

Example of a 2-credit response:



55 [1] Allow 1 credit for 284 g/mol. Significant figures do *not* need to be shown.

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

$$20.0\,\text{g} \times \frac{1\,\text{mol}}{85.0\,\text{g}}$$

$$\frac{20}{85}$$

57 [1] Allow 1 credit for 68 g ± 1 g.

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

evaporation of the water

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

halide

halocarbon

alkyl halide

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

A 2-methylpropane molecule has only single carbon-carbon bonds.

There are only single bonds in methylpropane.

no multiple bonds between carbon atoms

61 [2] Allow a maximum of 2 credits, allocated as follows:

- Allow 1 credit for correctly describing the molecular polarities. Acceptable responses include, but are not limited to:

  The molecules of 2-iodo-2-methylpropane are more polar than the molecules of 2-methylpropane.

- Allow 1 credit for correctly describing the intermolecular forces. Acceptable responses include, but are not limited to:

  There are stronger intermolecular forces between molecules of 2-iodo-2-methylpropane.

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

The initial concentration of each gas is constant.

Concentrations stay the same.

Note: Do *not* allow credit for a response stating the rate of the forward reaction equals the rate of the reverse reaction *or* for stating the concentrations are equal.

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

The stress of adding $H_2(g)$ shifts the reaction to the right, producing $NH_3(g)$.

The reaction shifts to the right to relieve the stress.

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

Adding $H_2(g)$ causes more collisions between $H_2(g)$ molecules and $N_2(g)$ molecules. Therefore, more $H_2(g)$ reacts, reducing the $H_2(g)$ concentration.

More collisions between H_2 and N_2 produce NH_3, so more H_2 is used up.

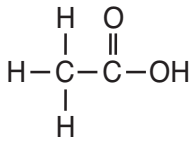
Part C

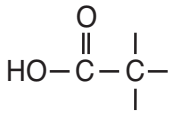
Allow a total of 19 credits for this part. The student must answer all questions in this part.

65 [1] Allow 1 credit for $NaHCO_3$.

66 [1] Allow 1 credit.

Examples of 1-credit responses:





67 [2] Allow a maximum of 2 credits, allocated as follows:

- Allow 1 credit for a correct numerical setup. Acceptable responses include, but are not limited to:

  $m = Vd = (0.20\ \text{L})(1.8\ \text{g/L})$

  (0.2)(1.8)

- Allow 1 credit for 0.36 g *or* for a response consistent with the student's numerical setup. Significant figures do *not* need to be shown.

Note: Do *not* allow credit for a numerical setup and calculated result that are not related to the concept assessed by the question.

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

7.6 and 8.2

8.1 and 7.7

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

1×10^{-7} mol/L

0.000 000 1 mol/L

10^{-7} mol/L

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

When the temperature of the water increases, oxygen is less soluble.

Oxygen is less soluble in warmer water.

71 [3] Allow a maximum of 3 credits, allocated as follows:

- Allow 1 credit for a correct numerical setup.
- Allow 1 credit for 7.1 ppm *or* for a response consistent with the student's numerical setup. Significant figures do *not* need to be shown.
- Allow 1 credit for a statement indicating the DO concentration in the water is healthy for fish to survive, based on the calculated result.

or

Allow 1 credit for a response consistent with the student's calculated result.

Note: Do *not* allow credit for a numerical setup and calculated result that are not related to the concept assessed by the question.

Example of a 3-credit response:

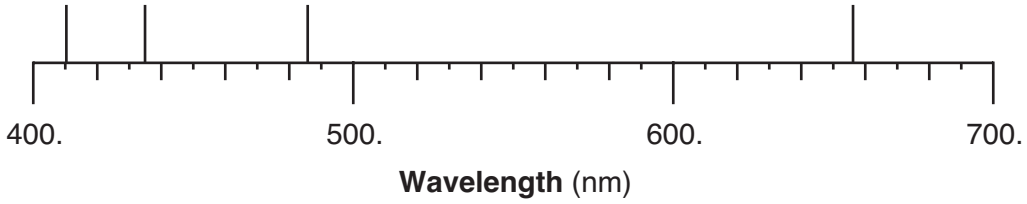
$$\text{ppm} = \frac{2.7 \times 10^{-2}}{3800\,\text{g}} \times 10^{6}$$

7.1 ppm

The water is healthy for fish because the DO is 7.1 ppm, which is within the range of DO concentrations best for fish.

72 [1] Allow 1 credit for all four lines drawn correctly ± 0.3 division. The lines can be drawn above, through, or below the scale.

Example of a 1-credit response:



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

When the electron in an excited hydrogen atom returns from a higher energy state to a lower energy state, a specific amount of energy is emitted.

Light is emitted when the excited electron drops from a higher electron shell to a lower electron shell.

74 [1] Allow 1 credit for ____ $Cd(s)$ + ____ $NiO_2(s)$ + __2__ $H_2O(\ell)$ → ____ $Cd(OH)_2(s)$ + ____ $Ni(OH)_2(s)$.

Note: Allow credit even if the coefficient "1" is written in front of $Cd(s)$, $NiO_2(s)$, $Cd(OH)_2(s)$, and/or $Ni(OH)_2(s)$.

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

from 0 to +2

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

Cadmium oxidizes in the presence of Ni^{4+}.

Cd is more reactive than Ni.

77 [2] Allow a maximum of 2 credits, allocated as follows:

- Allow 1 credit for the decay mode $^{4}_{2}\alpha$ *or* $^{4}_{2}\text{He}$.
- Allow 1 credit for the nuclide $^{237}_{93}\text{Np}$ *or* for a nuclide consistent with the student's response for the decay mode.

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

Am-241 has a longer half-life so the sample emits alpha particles for a longer period of time.

Fr-220 has a much shorter half-life and decays more rapidly.

The half-life of Am-241 is 433 years. The half-life of Fr-220 is only 27.5 s.

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

Smoke particles interrupt the flow of ions required to maintain an electric current.

fewer freely moving charged particles in the detector

Regents Examination in Physical Setting/Chemistry

June 2008

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

The *Chart for Determining the Final Examination Score for the June 2008 Regents Examination in Physical Setting/Chemistry* will be posted on the Department's web site http://www.emsc.nysed.gov/osa/ on Tuesday, June 17, 2008. 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.

Submitting 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 www.emsc.nysed.gov/osa/exameval.
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 2008 Physical Setting/Chemistry			
Question Numbers			
Key Ideas/Performance Indicators	Part A	Part B	Part C
Standard 1			
Math Key Idea 1		35,38,52,54,56	67,71,72
Math Key Idea 2		57	70
Math Key Idea 3		34,35,36,43,44, 50,55,	65,67,71
Science Inquiry Key Idea 1		40,60,61	73,79
Science Inquiry Key Idea 2			
Science Inquiry Key Idea 3		32,34,37,44,46, 47,48,49,53,58, 59,62,63,64	65,71,72,75,76, 78
Engineering Design Key Idea 1			
Standard 2			
Key Idea 1			
Key Idea 2			71,79
Standard 6			
Key Idea 1		38	
Key Idea 2		31,39,40	
Key Idea 3			69
Key Idea 4		63,64	
Key Idea 5			
Standard 7			
Key Idea 1			
Key Idea 2			
Standard 4 Process Skills			
Key Idea 3		33,35,36,38,39, 41,42,43,45,46, 47,48,51,52,55, 56,57,59,60,62, 63,64	66,68,74,76
Key Idea 4		50,58	77
Key Idea 5		61	
Standard 4			
Key Idea 3	1,2,3,4,5,7,8,10, 12,13,15,19,20, 21,22,24,25,26, 27,29	31,32,33,35,36, 39,41,42,43,44, 45,46,47,48,49, 51,52,55,56,57, 59,60,62,63,64	65,66,67,68,69, 70,71,72,73,74, 75,76
Key Idea 4	16,17,18,30	38,50,53,54,58	77,78
Key Idea 5	6,9,11,14,23,28	34,37,40,61	79
Reference Tables			
2002 Edition	1,2,3,6,9,14,17, 24,25,27,28,29	32,36,37,38,41, 43,45,47,48,50, 51,52,55,56,57, 59	65,66,67,68,75, 76,77,78

University of the State of New York
State Education Department

Regents Examination in Physical Setting/Chemistry
June 2008

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	60	19	38
84	98	62	73	40	59	18	37
83	96	61	73	39	58	17	35
82	95	60	72	38	58	16	34
81	93	59	71	37	57	15	32
80	91	58	71	36	56	14	31
79	90	57	70	35	55	13	29
78	89	56	69	34	55	12	27
77	87	55	69	33	54	11	25
76	86	54	68	32	53	10	23
75	85	53	68	31	52	9	22
74	84	52	67	30	51	8	19
73	83	51	66	29	50	7	17
72	82	50	66	28	49	6	15
71	81	49	65	27	48	5	13
70	80	48	64	26	47	4	11
69	79	47	64	25	46	3	8
68	78	46	63	24	45	2	6
67	77	45	62	23	44	1	3
66	76	44	62	22	42	0	0
65	76	43	61	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 "Final Score" on the student's answer sheet.

All student answer papers that receive a scale score of 60 through 64 **must** be scored a second time. For the second scoring, a different committee of teachers may score the student's paper or the original committee may score the paper, except that no teacher may score the same open-ended questions that he/she scored in the first rating of the paper. The school principal is responsible for assuring that the student's final examination score is based on a fair, accurate and reliable scoring of the student's answer paper.

Because scale scores corresponding to raw scores in the conversion chart change from one examination 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 Physical Setting/Chemistry Examination.