The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

PHYSICAL SETTING
CHEMISTRY

Thursday, August 13, 2009 — 12:30 to 3:30 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 Which particle has the *least* mass?

(1) $^{4}_{2}He$
(2) $^{1}_{1}H$
(3) $^{1}_{0}n$
(4) $^{0}_{-1}e$

2 What information is necessary to determine the atomic mass of the element chlorine?

(1) the atomic mass of each artificially produced isotope of chlorine, only
(2) the relative abundance of each naturally occurring isotope of chlorine, only
(3) the atomic mass and the relative abundance of each naturally occurring isotope of chlorine
(4) the atomic mass and the relative abundance of each naturally occurring and artificially produced isotope of chlorine

3 In an atom of argon-40, the number of protons

(1) equals the number of electrons
(2) equals the number of neutrons
(3) is less than the number of electrons
(4) is greater than the number of electrons

4 An electron in a sodium atom moves from the third shell to the fourth shell. This change is a result of the atom

(1) absorbing energy
(2) releasing energy
(3) gaining an electron
(4) losing an electron

5 Which statement describes oxygen gas, $O_2(g)$, and ozone gas, $O_3(g)$?

(1) They have different molecular structures, only.
(2) They have different properties, only.
(3) They have different molecular structures and different properties.
(4) They have the same molecular structure and the same properties.

6 Which statement describes a chemical property of bromine?

(1) Bromine is soluble in water.
(2) Bromine has a reddish-brown color.
(3) Bromine combines with aluminum to produce $AlBr_3$.
(4) Bromine changes from a liquid to a gas at 332 K and 1 atm.

7 An atom of aluminum in the ground state and an atom of gallium in the ground state have the same

(1) mass
(2) electronegativity
(3) total number of protons
(4) total number of valence electrons

8 Which type of matter is composed of two or more elements that are chemically combined in a fixed proportion?

(1) solution
(2) compound
(3) homogeneous mixture
(4) heterogeneous mixture

9 Which type of substance can conduct electricity in the liquid phase but *not* in the solid phase?

(1) ionic compound
(2) molecular compound
(3) metallic element
(4) nonmetallic element

10 Why is a molecule of CO_2 nonpolar even though the bonds between the carbon atom and the oxygen atoms are polar?

(1) The shape of the CO_2 molecule is symmetrical.
(2) The shape of the CO_2 molecule is asymmetrical.
(3) The CO_2 molecule has a deficiency of electrons.
(4) The CO_2 molecule has an excess of electrons.

11 Which formula represents a molecular compound?

(1) HI
(2) KI
(3) KCl
(4) LiCl

12 Which element has the greatest density at STP?

(1) scandium
(2) selenium
(3) silicon
(4) sodium

13 Particles are arranged in a crystal structure in a sample of

(1) $H_2(g)$
(2) $Br_2(\ell)$
(3) Ar(g)
(4) Ag(s)

14 The relatively high boiling point of water is due to water having

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

15 Matter is classified as a

(1) substance, only
(2) substance or as a mixture of substances
(3) homogenous mixture, only
(4) homogenous mixture or as a heterogeneous mixture

16 Which substance can *not* be decomposed by a chemical change?

(1) ammonia
(2) copper
(3) propanol
(4) water

17 A beaker contains both alcohol and water. These liquids can be separated by distillation because the liquids have different

(1) boiling points
(2) densities
(3) particle sizes
(4) solubilities

18 Which term is defined as a measure of the average kinetic energy of the particles in a sample of matter?

(1) activation energy
(2) potential energy
(3) temperature
(4) entropy

19 How do the boiling point and freezing point of a solution of water and calcium chloride at standard pressure compare to the boiling point and freezing point of water at standard pressure?

(1) Both the freezing point and boiling point of the solution are higher.
(2) Both the freezing point and boiling point of the solution are lower.
(3) The freezing point of the solution is higher and the boiling point of the solution is lower.
(4) The freezing point of the solution is lower and the boiling point of the solution is higher.

20 Under which conditions of temperature and pressure does a sample of neon behave most like an ideal gas?

(1) 100 K and 0.25 atm
(2) 100 K and 25 atm
(3) 400 K and 0.25 atm
(4) 400 K and 25 atm

21 According to the kinetic molecular theory, which statement describes the particles in a sample of an ideal gas?

(1) The force of attraction between the gas particles is strong.
(2) The motion of the gas particles is random and straight-line.
(3) The collisions between the gas particles cannot result in a transfer of energy between the particles.
(4) The separation between the gas particles is smaller than the size of the gas particles themselves.

22 The activation energy of a chemical reaction can be *decreased* by the addition of

(1) a catalyst
(2) an indicator
(3) electrical energy
(4) thermal energy

23 A straight-chain hydrocarbon that has only one double bond in each molecule has the general formula

(1) C_nH_{2n-6}
(2) C_nH_{2n-2}
(3) C_nH_{2n}
(4) C_nH_{2n+2}

24 Why can an increase in temperature lead to more effective collisions between reactant particles and an increase in the rate of a chemical reaction?

(1) The activation energy of the reaction increases.
(2) The activation energy of the reaction decreases.
(3) The number of molecules with sufficient energy to react increases.
(4) The number of molecules with sufficient energy to react decreases.

25 Which reaction results in the production of soap?

(1) esterification
(2) fermentation
(3) polymerization
(4) saponification

26 Which substance is always a product when an Arrhenius acid in an aqueous solution reacts with an Arrhenius base in an aqueous solution?

(1) HBr
(2) H_2O
(3) KBr
(4) KOH

27 Which substance is an electrolyte?

(1) CCl_4
(2) C_2H_6
(3) HCl
(4) H_2O

28 One acid-base theory defines a base as an

(1) H^+ donor
(2) H^+ acceptor
(3) H donor
(4) H acceptor

29 A change in the nucleus of an atom that converts the atom from one element to another element is called

(1) combustion
(2) neutralization
(3) polymerization
(4) transmutation

30 Which particle is emitted from a hydrogen-3 nucleus when it undergoes radioactive decay?

(1) α
(2) β^-
(3) β^+
(4) γ

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 Which electron configuration represents an excited state for a potassium atom?

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

32 A sample of an element is malleable and can conduct electricity. This element could be

(1) H
(2) He
(3) S
(4) Sn

33 Which general trend is demonstrated by the Group 17 elements as they are considered in order from top to bottom on the Periodic Table?

(1) a decrease in atomic radius
(2) a decrease in electronegativity
(3) an increase in first ionization energy
(4) an increase in nonmetallic behavior

34 Which element is a liquid at 758 K and standard pressure?

(1) gold
(2) silver
(3) platinum
(4) thallium

35 Which equation represents a decomposition reaction?

(1) $CaCO_3(s) \rightarrow CaO(s) + CO_2(g)$
(2) $Cu(s) + 2AgNO_3(aq) \rightarrow 2Ag(s) + Cu(NO_3)_2(aq)$
(3) $2H_2(g) + O_2(g) \rightarrow 2H_2O(\ell)$
(4) $KOH(aq) + HCl(aq) \rightarrow KCl(aq) + H_2O(\ell)$

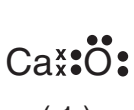
36 A compound has the empirical formula CH_2O and a gram-formula mass of 60. grams per mole. What is the molecular formula of this compound?

(1) CH_2O
(2) $C_2H_4O_2$
(3) C_3H_8O
(4) $C_4H_8O_4$

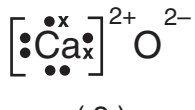
37 Which formula represents strontium phosphate?

(1) $SrPO_4$
(2) Sr_3PO_8
(3) $Sr_2(PO_4)_3$
(4) $Sr_3(PO_4)_2$

38 Which Lewis electron-dot diagram represents calcium oxide?



(1)



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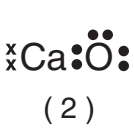

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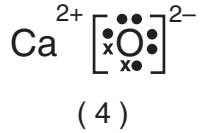


(4)

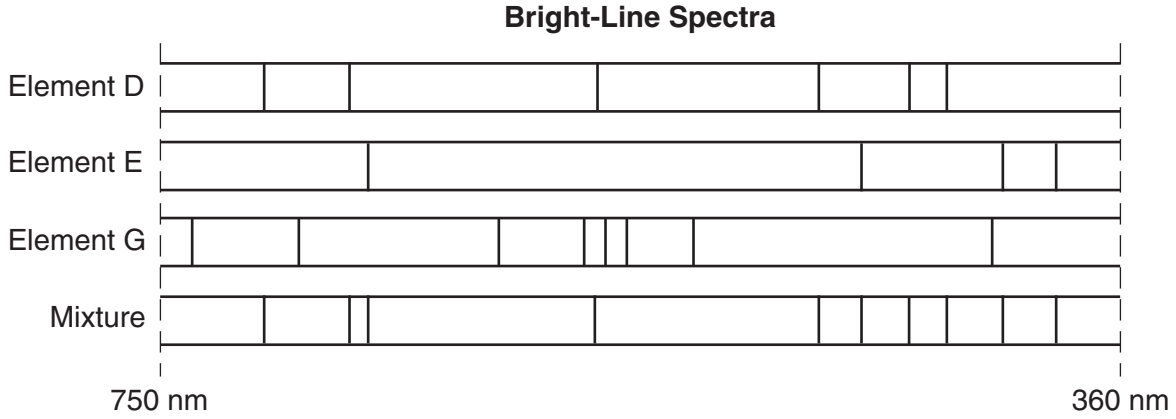
39 Which statement describes the transfer of heat energy that occurs when an ice cube is added to an insulated container with 100 milliliters of water at 25°C?

(1) Both the ice cube and the water lose heat energy.
(2) Both the ice cube and the water gain heat energy.
(3) The ice cube gains heat energy and the water loses heat energy.
(4) The ice cube loses heat energy and the water gains heat energy.

40 What is the mass of NH_4Cl that must dissolve in 200. grams of water at 50.°C to make a saturated solution?

(1) 26 g
(2) 42 g
(3) 84 g
(4) 104 g

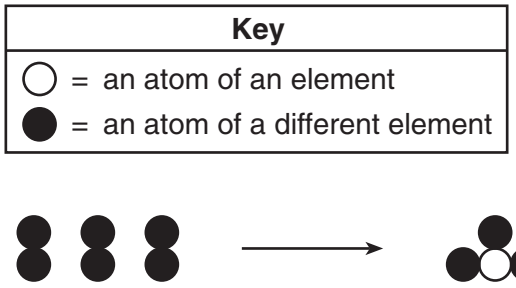
41 Given the bright-line spectra of three elements and the spectrum of a mixture formed from at least two of these elements:



Which elements are present in this mixture?

(1) *E* and *D*, only
(2) *E* and *G*, only
(3) *D* and *G*, only
(4) *D*, *E*, and *G*

42 Given the balanced particle-diagram equation:



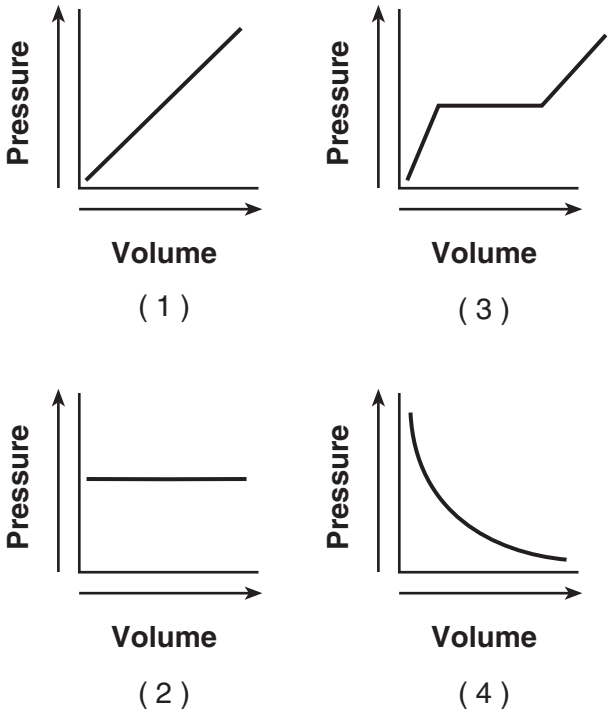
Which statement describes the type of change and the chemical properties of the product and reactants?

(1) The equation represents a physical change, with the product and reactants having different chemical properties.
(2) The equation represents a physical change, with the product and reactants having identical chemical properties.
(3) The equation represents a chemical change, with the product and reactants having different chemical properties.
(4) The equation represents a chemical change, with the product and reactants having identical chemical properties.

43 Which quantity of heat is equal to 200. joules?

(1) 20.0 kJ
(2) 2.00 kJ
(3) 0.200 kJ
(4) 0.0200 kJ

44 Which graph represents the relationship between pressure and volume for a sample of an ideal gas at constant temperature?



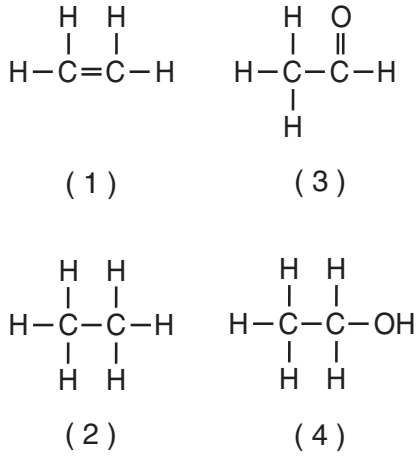
45 The entropy of a sample of H_2O increases as the sample changes from a

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

46 Ethanol and dimethyl ether have different chemical and physical properties because they have different

(1) functional groups
(2) molecular masses
(3) numbers of covalent bonds
(4) percent compositions by mass

47 Which formula represents an unsaturated hydrocarbon?



48 What is the oxidation state of nitrogen in the compound NH_4Br?

(1) –1
(2) +2
(3) –3
(4) +4

49 A student completes a titration by adding 12.0 milliliters of NaOH(aq) of unknown concentration to 16.0 milliliters of 0.15 M HCl(aq). What is the molar concentration of the NaOH(aq)?

(1) 0.11 M
(2) 0.20 M
(3) 1.1 M
(4) 5.0 M

50 What is the half-life of a radioisotope if 25.0 grams of an original 200.-gram sample of the isotope remains unchanged after 11.46 days?

(1) 2.87 d
(2) 3.82 d
(3) 11.46 d
(4) 34.38 d

Part B–2

Answer all questions in this part.

Directions (51–63): 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.*

51 Identify the element in Period 3 of the Periodic Table that reacts with oxygen to form an ionic compound represented by the formula X_2O. [1]

52 Given the balanced equation representing a reaction:

$$2C_2H_6 + 7O_2 \rightarrow 4CO_2 + 6H_2O$$

Determine the total number of moles of oxygen that react completely with 8.0 moles of C_2H_6. [1]

53 On the potential energy diagram *in your answer booklet*, draw an arrow to represent the activation energy of the forward reaction. [1]

54 Describe the electrons in an atom of carbon in the ground state. Your response must include:

- the charge of an electron [1]
- the location of electrons based on the wave-mechanical model [1]
- the total number of electrons in a carbon atom [1]

55 Determine the mass of 5.20 moles of C_6H_{12} (gram-formula mass = 84.2 grams/mole). [1]

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

A 1.0-gram strip of zinc is reacted with hydrochloric acid in a test tube. The unbalanced equation below represents the reaction.

$$Zn(s) + HCl(aq) \rightarrow H_2(g) + ZnCl_2(aq)$$

56 Balance the equation *in your answer booklet* for the reaction of zinc and hydrochloric acid, using the smallest whole-number coefficients. [1]

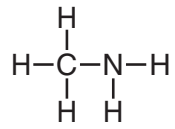
57 Explain, using information from Reference Table *F*, why the symbol (aq) is used to describe the product $ZnCl_2$. [1]

58 Explain, in terms of collision theory, why using 1.0 gram of powdered zinc, instead of the 1.0-gram strip of zinc, would have increased the rate of the reaction. [1]

Base your answers to questions 59 through 63 on the information below.

Bond energy is the amount of energy required to break a chemical bond. The table below gives a formula and the carbon-nitrogen bond energy for selected nitrogen compounds.

Selected Nitrogen Compounds

Compound	Formula	Carbon-Nitrogen Bond Energy (kJ/mol)
hydrogen cyanide	H—C≡N	890.
isocyanic acid	H—N=C=O	615
methanamine		293

59 Describe, in terms of electrons, the type of bonding between the carbon atom and the nitrogen atom in a molecule of methanamine. [1]

60 Identify the noble gas that has atoms in the ground state with the same electron configuration as the nitrogen in a molecule of isocyanic acid. [1]

61 State the relationship between the number of electrons in a carbon-nitrogen bond and carbon-nitrogen bond energy. [1]

62 Explain, in terms of charge distribution, why a molecule of hydrogen cyanide is polar. [1]

63 A 3.2-gram sample of air contains 0.000 74 gram of hydrogen cyanide. Determine the concentration, in parts per million, of the hydrogen cyanide in this sample. [1]

Part C

Answer all questions in this part.

Directions (64–81): 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*.

64 Based on data collected during a laboratory investigation, a student determined an experimental value of 322 joules per gram for the heat of fusion of H_2O. Calculate the student's percent error. Your response must include a correct numerical setup and the calculated result. [2]

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

A student used blue litmus paper and phenolphthalein paper as indicators to test the pH of distilled water and five aqueous household solutions. Then the student used a pH meter to measure the pH of the distilled water and each solution. The results of the student's work are recorded in the table below.

Testing Results

Liquid Tested	Color of Blue Litmus Paper	Color of Phenolphthalein Paper	Measured pH Value Using a pH Meter
2% milk	blue	colorless	6.4
distilled water	blue	colorless	7.0
household ammonia	blue	pink	11.5
lemon juice	red	colorless	2.3
tomato juice	red	colorless	4.3
vinegar	red	colorless	3.3

65 Identify the liquid tested that has the *lowest* hydronium ion concentration. [1]

66 Explain, in terms of the pH range for color change on Reference Table *M*, why litmus is *not* appropriate to differentiate the acidity levels of tomato juice and vinegar. [1]

67 Based on the measured pH values, identify the liquid tested that is 10 times more acidic than vinegar. [1]

Base your answers to questions 68 through 72 on the information below.

Biodiesel is an alternative fuel for vehicles that use petroleum diesel. Biodiesel is produced by reacting vegetable oil with CH_3OH. Methyl palmitate, $C_{15}H_{31}COOCH_3$, a compound found in biodiesel, is made from soybean oil. One reaction of methyl palmitate with oxygen is represented by the balanced equation below.

$$2C_{15}H_{31}COOCH_3 + 49O_2 \rightarrow 34CO_2 + 34H_2O + \text{energy}$$

68 Write an IUPAC name for the compound that reacts with vegetable oil to produce biodiesel. [1]

69 Explain, in terms of *both* atoms and molecular structure, why there is no isomer of CH_3OH. [1]

70 Identify the class of organic compounds to which methyl palmitate belongs. [1]

71 Identify the type of organic reaction represented by the balanced equation. [1]

72 State evidence from the balanced equation that indicates the reaction is exothermic. [1]

Base your answers to questions 73 through 76 on the information below.

In a laboratory investigation, a student constructs a voltaic cell with iron and copper electrodes. Another student constructs a voltaic cell with zinc and iron electrodes. Testing the cells during operation enables the students to write the balanced ionic equations below.

Cell with iron and copper electrodes: $Cu^{2+}(aq) + Fe(s) \rightarrow Cu(s) + Fe^{2+}(aq)$

Cell with zinc and iron electrodes: $Fe^{2+}(aq) + Zn(s) \rightarrow Fe(s) + Zn^{2+}(aq)$

73 State evidence from the balanced equation for the cell with iron and copper electrodes that indicates the reaction in the cell is an oxidation-reduction reaction. [1]

74 Identify the particles transferred between Fe^{2+} and Zn during the reaction in the cell with zinc and iron electrodes. [1]

75 Write a balanced half-reaction equation for the reduction that takes place in the cell with zinc and iron electrodes. [1]

76 State the relative activity of the three metals used in these two voltaic cells. [1]

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

A method used by ancient Egyptians to obtain copper metal from copper(I) sulfide ore was heating the ore in the presence of air. Later, copper was mixed with tin to produce a useful alloy called bronze.

77 Calculate the density of a 129.5-gram sample of bronze that has a volume of 14.8 cubic centimeters. Your response must include a correct numerical setup and the calculated result. [2]

78 Convert the melting point of the metal obtained from copper(I) sulfide ore to degrees Celsius. [1]

79 A 133.8-gram sample of bronze was 10.3% tin by mass. Determine the total mass of tin in the sample. [1]

Base your answers to questions 80 and 81 on the information below.

Scientists are investigating the production of energy using hydrogen-2 nuclei (deuterons) and hydrogen-3 nuclei (tritons). The balanced equation below represents one nuclear reaction between two deuterons.

$$^{2}_{1}\mathrm{H} + {}^{2}_{1}\mathrm{H} \rightarrow {}^{3}_{2}\mathrm{He} + {}^{1}_{0}\mathrm{n} + 5.23 \times 10^{-13}\ \mathrm{J}$$

80 State, in terms of subatomic particles, how a deuteron differs from a triton. [1]

81 Identify the type of nuclear reaction represented by the equation. [1]

Tear Here

The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

PHYSICAL SETTING
CHEMISTRY

Thursday, August 13, 2009 — 12:30 to 3:30 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

Tear Here

Tear Here

PS/CHEMISTRY

The University of the State of New York

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CHEMISTRY

Thursday, August 13, 2009 — 12:30 to 3:30 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	15	
C	20	

Total Written Test Score (Maximum Raw Score: 85) ☐

Final Score (from conversion chart) ☐

Raters' Initials:

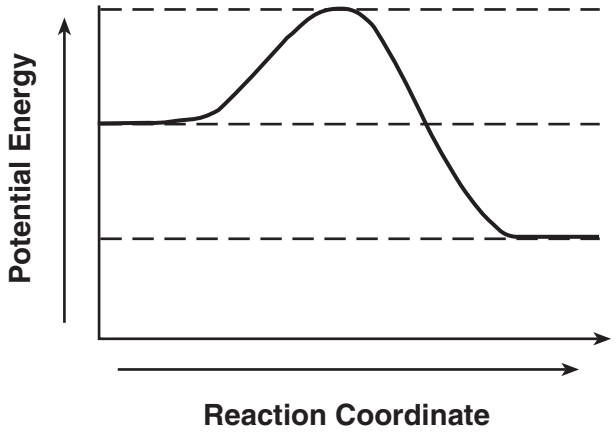
Rater 1 . . . . . **Rater 2** . . . . . .

Part B–2

51 _____

52 _____ **mol**

53



For Raters Only

51 ☐

52 ☐

53 ☐

For Raters Only

54 _____

_____ **54** ☐

_____

55 _____ **g** **55** ☐

56 _____ $Zn(s)$ + _____ $HCl(aq)$ → _____ $H_2(g)$ + _____ $ZnCl_2(aq)$ **56** ☐

57 _____

_____ **57** ☐

_____

58 _____

_____ **58** ☐

_____

[2]

For Raters Only

59 _____

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60 _____

61 _____

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62 _____

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63 _____ **ppm**

59 ☐

60 ☐

61 ☐

62 ☐

63 ☐

☐

Total Score for Part B–2

Part C

For Raters Only

64

64 ☐

_____ %

65 _____ **65** ☐

66 _____

_____ **66** ☐

_____

67 _____ **67** ☐

For Raters Only

68 _____ **68** ☐

69 _____ **69** ☐

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70 _____ **70** ☐

71 _____ **71** ☐

72 _____ **72** ☐

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73 _____ **73** ☐

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74 _____ **74** ☐

75 _____ **75** ☐

76 _____ **76** ☐

_____

For Raters Only

77

77

_____ **g/cm^3**

78 _____ **°C** **78**

79 _____ **g** **79**

80 _____ **80**

_____

81 _____ **81**

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

Thursday, August 13, 2009 — 12:30 to 3:30 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	4	11	1	21	2	31	2	41	1
2	3	12	2	22	1	32	4	42	3
3	1	13	4	23	3	33	2	43	3
4	1	14	1	24	3	34	4	44	4
5	3	15	2	25	4	35	1	45	3
6	3	16	2	26	2	36	2	46	1
7	4	17	1	27	3	37	4	47	1
8	2	18	3	28	2	38	4	48	3
9	1	19	4	29	4	39	3	49	2
10	1	20	3	30	2	40	4	50	2

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 Thursday, August 13, 2009. 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 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:

Na

sodium

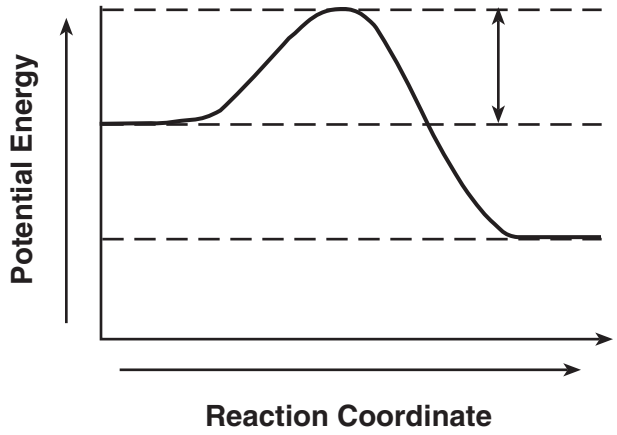
element 11

52 [1] Allow 1 credit. Significant figures do *not* need to be shown. Acceptable responses include, but are not limited to:

28 mol

53 [1] Allow 1 credit.

Example of a 1-credit response:



54 [3] Allow a maximum of 3 credits, allocated as follows:

- Allow 1 credit for stating that an electron has a negative charge.
- Allow 1 credit for stating that electrons are located in orbitals or regions of most probable location.
- Allow 1 credit for stating that a carbon atom has six electrons.

55 [1] Allow 1 credit. Significant figures do *not* need to be shown. Acceptable responses include, but are not limited to:

438 g

437.8 g

56 [1] Allow 1 credit for _____ Zn(s) + __2__ HCl(aq) → _____ H_2(g) + _____ $ZnCl_2$(aq).

Allow credit even if the coefficient "1" is written in front of Zn(s), H_2(g), and/or $ZnCl_2$(aq).

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

The product $ZnCl_2$ is soluble in water.

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

The greater surface area in powdered zinc would have resulted in more frequent collisions between the zinc atoms and the hydrogen ions in the HCl(aq).

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

The structural formula for methanamine shows electrons being shared, so the bond is covalent.

Electrons are shared in the bond.

covalent bonding due to shared electrons

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

Ne

neon

element 10

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

As the number of shared electrons in a carbon-nitrogen bond increases, the bond energy increases.

Less energy is required to break a single carbon-nitrogen bond than to break a triple carbon-nitrogen bond.

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

The molecule has an asymmetrical charge distribution.

The molecule has an unequal distribution of charge.

63 [1] Allow 1 credit. Significant figures do *not* need to be shown. Acceptable responses include, but are not limited to:

230 ppm

2.31×10^2 ppm

Part C

Allow a total of 20 credits for this part. The student must answer all questions in this part.

64 [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:

$$\frac{322 \text{ J/g} - 334 \text{ J/g}}{334 \text{ J/g}} \times 100$$

$$\frac{12}{334} \times 100$$

- Allow 1 credit for a correct response *or* for a response consistent with the student's numerical setup. Significant figures do *not* need to be shown. Acceptable responses include, but are not limited to:

  –3.6%

  4%

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

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

household ammonia

$NH_3(aq)$

66 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

Because litmus changes color in a pH range of 5.5 to 8.2, litmus cannot be used to differentiate between a pH of 3.3 and 4.3.

Litmus is red for all pH values below 5.5.

67 [1] Allow 1 credit for lemon juice.

68 [1] Allow 1 credit for methanol *or* methyl alcohol.

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

With only one carbon atom bonded to one oxygen atom, there can be no rings or chains with branches in the molecular structure.

There are too few atoms to create a different molecular structure.

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

ester

esters

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

combustion

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

The balanced equation shows energy as a product of the reaction.

Energy is on the right side of the arrow.

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

The oxidation number of Cu^{2+} changes to 0.

Iron's oxidation state changes from zero to +2.

Oxidation numbers change during the reaction because electrons are transferred.

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

electrons

e^-

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

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

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

Zinc is more reactive than iron, and iron is more reactive than copper.

The order of decreasing activity is Zn, Fe, Cu.

Copper is least active and zinc is most active.

77 [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:

$$d = \frac{m}{V} = \frac{129.5 \text{ g}}{14.8 \text{ cm}^3}$$

$$\frac{129.5}{14.8}$$

- Allow 1 credit for 8.75 g/cm^3 *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.

78 [1] Allow 1 credit for 1084°C.

79 [1] Allow 1 credit. Significant figures do *not* need to be shown. Acceptable responses include, but are not limited to:

13.8 g

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

A deuteron has one neutron and a triton has two neutrons.

A deuteron has one fewer neutron than a triton.

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

fusion

thermonuclear fusion

Regents Examination in Physical Setting/Chemistry

August 2009

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

The *Chart for Determining the Final Examination Score for the August 2009 Regents Examination in Physical Setting/Chemistry* will be posted on the Department's web site http://www.emsc.nysed.gov/osa/ on Thursday, August 13, 2009. 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 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

August 2009 Physical Setting/Chemistry			
Question Numbers			
Key Ideas	Part A	Part B	Part C
Standard 1			
Math Key Idea 1		40, 43	64, 69, 77
Math Key Idea 2		40, 44, 61	
Math Key Idea 3		36, 37, 48, 49, 52, 63	64, 77, 78, 79
Sci. Inquiry Key Idea 1		58, 59	69, 74, 76
Sci. Inquiry Key Idea 2			
Sci. Inquiry Key Idea 3		31, 32, 33, 34, 37, 42, 46, 48, 51, 57, 62	65, 66, 67, 68, 70, 71, 72, 73, 77
Eng. Design Key Idea 1			
Standard 2			
Key Idea 1		34	78
Key Idea 2		63	
Standard 6			
Key Idea 1		39	
Key Idea 2		38, 42	64
Key Idea 3			65, 67
Key Idea 4			
Key Idea 5			
Standard 7			
Key Idea 1			
Key Idea 2			
Standard 4 Process Skills			
Key Idea 3		31, 32, 33, 35, 36, 40, 41, 45, 46, 47, 48, 49, 51, 52, 54, 55, 56, 58, 63	65, 66, 67, 70, 71, 75, 76, 80
Key Idea 4		50, 53	72, 81
Key Idea 5		38, 59, 60	
Standard 4			
Key Idea 3	1, 2, 3, 4, 6, 7, 8, 12, 13, 15, 16, 17, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28	31, 32, 33, 34, 35, 36, 37, 40, 41, 42, 44, 45, 46, 47, 48, 49, 51, 52, 54, 55, 56, 57, 58, 63	65, 66, 67, 68, 69, 70, 71, 73, 74, 75, 76, 77, 78, 79, 80
Key Idea 4	18, 30	39, 43, 50, 53	64, 72, 81
Key Idea 5	5, 9, 10, 11, 14, 29	38, 59, 60, 61, 62	
Reference Tables			
2002 Edition	1, 2, 3, 7, 11, 12, 23, 30	31, 32, 33, 34, 36, 37, 38, 40, 43, 44, 46, 47, 48, 49, 50, 51, 55, 57, 59, 60, 63	64, 65, 66, 68, 70, 75, 77, 78

University of the State of New York
State Education Department

Regents Examination in Physical Setting/Chemistry
August 2009

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	58	19	38
84	98	62	73	40	58	18	37
83	97	61	72	39	57	17	36
82	95	60	71	38	56	16	35
81	93	59	71	37	55	15	33
80	92	58	70	36	55	14	32
79	90	57	69	35	54	13	30
78	89	56	68	34	53	12	28
77	88	55	68	33	52	11	27
76	87	54	67	32	52	10	25
75	85	53	66	31	51	9	23
74	84	52	66	30	50	8	21
73	83	51	65	29	49	7	19
72	82	50	64	28	48	6	17
71	81	49	64	27	47	5	14
70	80	48	63	26	46	4	12
69	79	47	62	25	45	3	9
68	78	46	62	24	44	2	6
67	77	45	61	23	43	1	3
66	76	44	60	22	42	0	0
65	75	43	60	21	41		
64	74	42	59	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 to ensure the accuracy of the score. 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.