The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

PHYSICAL SETTING
CHEMISTRY

Wednesday, January 29, 2003 — 9:15 a.m. to 12:15 p.m., only

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.

Your answer booklet for Part B–2 and Part C is stapled in the center of this examination booklet. Open the examination booklet, carefully remove your answer booklet, and close the examination booklet. Then fill in the heading 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 your 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, 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 statement best describes electrons?

(1) They are positive subatomic particles and are found in the nucleus.
(2) They are positive subatomic particles and are found surrounding the nucleus.
(3) They are negative subatomic particles and are found in the nucleus.
(4) They are negative subatomic particles and are found surrounding the nucleus.

2 During a flame test, ions of a specific metal are heated in the flame of a gas burner. A characteristic color of light is emitted by these ions in the flame when the electrons

(1) gain energy as they return to lower energy levels
(2) gain energy as they move to higher energy levels
(3) emit energy as they return to lower energy levels
(4) emit energy as they move to higher energy levels

3 In which list are the elements arranged in order of increasing atomic mass?

(1) Cl, K, Ar
(2) Fe, Co, Ni
(3) Te, I, Xe
(4) Ne, F, Na

4 In which compound does chlorine have the highest oxidation number?

(1) $NaClO$
(2) $NaClO_2$
(3) $NaClO_3$
(4) $NaClO_4$

5 Which event must *always* occur for a chemical reaction to take place?

(1) formation of a precipitate
(2) formation of a gas
(3) effective collisions between reacting particles
(4) addition of a catalyst to the reaction system

6 Which Group of the Periodic Table contains atoms with a stable outer electron configuration?

(1) 1
(2) 8
(3) 16
(4) 18

7 From which of these atoms in the ground state can a valence electron be removed using the *least* amount of energy?

(1) nitrogen
(2) carbon
(3) oxygen
(4) chlorine

8 What is the percent by mass of oxygen in H_2SO_4? [formula mass = 98]

(1) 16%
(2) 33%
(3) 65%
(4) 98%

9 An atom of carbon-12 and an atom of carbon-14 differ in

(1) atomic number
(2) mass number
(3) nuclear charge
(4) number of electrons

10 The strength of an atom's attraction for the electrons in a chemical bond is the atom's

(1) electronegativity
(2) ionization energy
(3) heat of reaction
(4) heat of formation

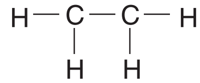
11 Which type or types of change, if any, can reach equilibrium?

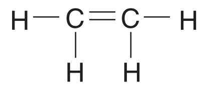
(1) a chemical change, only
(2) a physical change, only
(3) both a chemical and a physical change
(4) neither a chemical nor a physical change

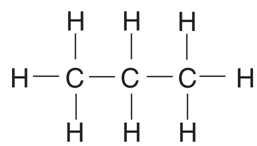
12 An increase in the average kinetic energy of a sample of copper atoms occurs with an increase in

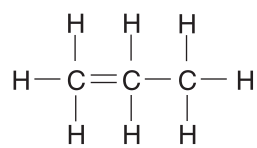
(1) concentration
(2) temperature
(3) pressure
(4) volume

13 The empirical formula of a compound is CH_2. Which molecular formula is correctly paired with a structural formula for this compound?

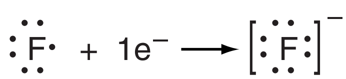
(1) C_2H_4 

(2) C_2H_4 

(3) C_3H_8 

(4) C_3H_8 

14 Given the equation:



This equation represents the formation of a

(1) fluoride ion, which is smaller in radius than a fluorine atom
(2) fluoride ion, which is larger in radius than a fluorine atom
(3) fluorine atom, which is smaller in radius than a fluoride ion
(4) fluorine atom, which is larger is radius than a fluoride ion

15 The high electrical conductivity of metals is primarily due to

(1) high ionization energies
(2) filled energy levels
(3) mobile electrons
(4) high electronegativities

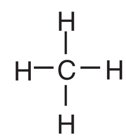
16 One similarity between all mixtures and compounds is that both

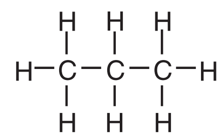
(1) are heterogeneous
(2) are homogeneous
(3) combine in a definite ratio
(4) consist of two or more substances

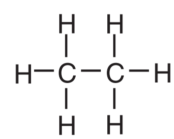
17 Which phase change results in the release of energy?

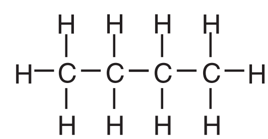
(1) $H_2O(s) \rightarrow H_2O(\ell)$
(2) $H_2O(s) \rightarrow H_2O(g)$
(3) $H_2O(\ell) \rightarrow H_2O(g)$
(4) $H_2O(g) \rightarrow H_2O(\ell)$

18 Which compound has an isomer?

(1) 

(3) 

(2) 

(4) 

19 What occurs when NaCl(s) is added to water?

(1) The boiling point of the solution increases, and the freezing point of the solution decreases.
(2) The boiling point of the solution increases, and the freezing point of the solution increases.
(3) The boiling point of the solution decreases, and the freezing point of the solution decreases.
(4) The boiling point of the solution decreases, and the freezing point of the solution increases.

20 Which radioisotope is a beta emitter?

(1) ^{90}Sr
(3) ^{37}K
(2) ^{220}Fr
(4) ^{238}U

21 When a mixture of water, sand, and salt is filtered, what passes through the filter paper?

(1) water, only
(2) water and sand, only
(3) water and salt, only
(4) water, sand, and salt

22 A hydrate is a compound that includes water molecules within its crystal structure. During an experiment to determine the percent by mass of water in a hydrated crystal, a student found the mass of the hydrated crystal to be 4.10 grams. After heating to constant mass, the mass was 3.70 grams. What is the percent by mass of water in this crystal?

(1) 90.%
(2) 11%
(3) 9.8%
(4) 0.40%

23 Which of these 1 M solutions will have the highest pH?

(1) NaOH
(2) CH_3OH
(3) HCl
(4) NaCl

24 Which physical property makes it possible to separate the components of crude oil by means of distillation?

(1) melting point
(2) conductivity
(3) solubility
(4) boiling point

25 In saturated hydrocarbons, carbon atoms are bonded to each other by

(1) single covalent bonds, only
(2) double covalent bonds, only
(3) alternating single and double covalent bonds
(4) alternating double and triple covalent bonds

26 Which formula correctly represents the product of an addition reaction between ethene and chlorine?

(1) CH_2Cl_2
(2) CH_3Cl
(3) $C_2H_4Cl_2$
(4) C_2H_3Cl

27 When a neutral atom undergoes oxidation, the atom's oxidation state

(1) decreases as it gains electrons
(2) decreases as it loses electrons
(3) increases as it gains electrons
(4) increases as it loses electrons

28 Given the equation:

$$C(s) + H_2O(g) \rightarrow CO(g) + H_2(g)$$

Which species undergoes reduction?

(1) C(s)
(2) H^+
(3) C^{2+}
(4) $H_2(g)$

29 Which equation is an example of artificial transmutation?

(1) ${}^{9}_{4}Be + {}^{4}_{2}He \rightarrow {}^{12}_{6}C + {}^{1}_{0}n$
(2) $U + 3\ F_2 \rightarrow UF_6$
(3) $Mg(OH)_2 + 2\ HCl \rightarrow 2\ H_2O + MgCl_2$
(4) $Ca + 2\ H_2O \rightarrow Ca(OH)_2 + H_2$

30 Which species can conduct an electric current?

(1) NaOH(s)
(2) $CH_3OH(aq)$
(3) $H_2O(s)$
(4) HCl(aq)

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 According to Table *N*, which radioactive isotope is best for determining the actual age of Earth?

(1) ^{238}U (3) ^{60}Co
(2) ^{90}Sr (4) ^{14}C

32 Given the following solutions:

Solution *A*: pH of 10
Solution *B*: pH of 7
Solution *C*: pH of 5

Which list has the solutions placed in order of increasing H^+ concentration?

(1) *A, B, C* (3) *C, A, B*
(2) *B, A, C* (4) *C, B, A*

33 Which statement explains why nuclear waste materials may pose a problem?

(1) They frequently have short half-lives and remain radioactive for brief periods of time.
(2) They frequently have short half-lives and remain radioactive for extended periods of time.
(3) They frequently have long half-lives and remain radioactive for brief periods of time.
(4) They frequently have long half-lives and remain radioactive for extended periods of time.

34 A compound whose water solution conducts electricity and turns phenolphthalein pink is

(1) HCl (3) NaOH
(2) $HC_2H_3O_2$ (4) CH_3OH

35 Which of the following solids has the highest melting point?

(1) $H_2O(s)$ (3) $SO_2(s)$
(2) $Na_2O(s)$ (4) $CO_2(s)$

36 Hydrogen has three isotopes with mass numbers of 1, 2, and 3 and has an average atomic mass of 1.00794 amu. This information indicates that

(1) equal numbers of each isotope are present
(2) more isotopes have an atomic mass of 2 or 3 than of 1
(3) more isotopes have an atomic mass of 1 than of 2 or 3
(4) isotopes have only an atomic mass of 1

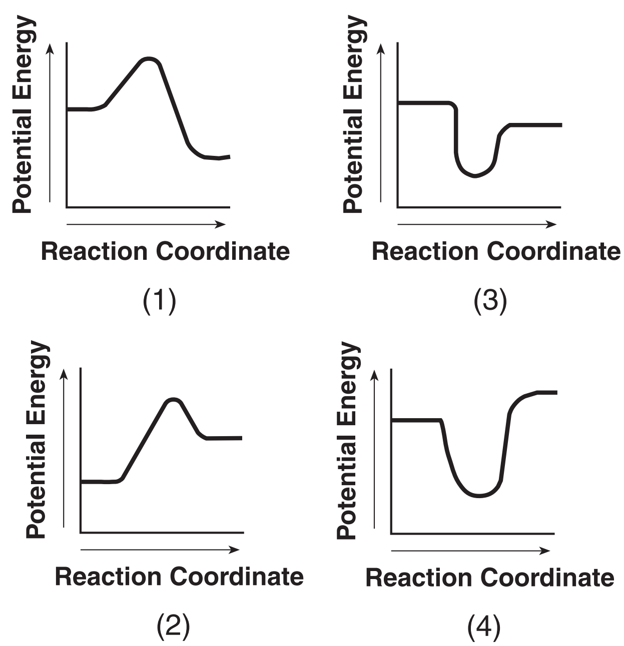
37 Which list of elements contains *two* metalloids?

(1) Si, Ge, Po, Pb (3) Si, P, S, Cl
(2) As, Bi, Br, Kr (4) Po, Sb, I, Xe

38 Given the reaction:

$$S(s) + O_2(g) \rightarrow SO_2(g) + \text{energy}$$

Which diagram best represents the potential energy changes for this reaction?



39 A chemist performs the same tests on two homogeneous white crystalline solids, *A* and *B*. The results are shown in the table below.

	Solid A	Solid B
Melting Point	High, 801°C	Low, decomposes at 186°C
Solubility in H_2O (grams per 100.0 g H_2O at 0°C)	35.7	3.2
Electrical Conductivity (in aqueous solution)	Good conductor	Nonconductor

The results of these tests suggest that

(1) both solids contain only ionic bonds
(2) both solids contain only covalent bonds
(3) solid *A* contains only covalent bonds and solid *B* contains only ionic bonds
(4) solid *A* contains only ionic bonds and solid *B* contains only covalent bonds

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40 Solubility data for four different salts in water at 60°C are shown in the table below.

Salt	Solubility in Water at 60°C
A	10 grams / 50 grams H_2O
B	20 grams / 60 grams H_2O
C	30 grams / 120 grams H_2O
D	40 grams/ 80 grams H_2O

Which salt is most soluble at 60°C?

(1) *A* (3) *C*
(2) *B* (4) *D*

41 Which phase change represents a *decrease* in entropy?

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

42 Given the equation:

$$2\ C_2H_2(g) + 5\ O_2(g) \rightarrow 4\ CO_2(g) + 2\ H_2O(g)$$

How many moles of oxygen are required to react completely with 1.0 mole of C_2H_2?

(1) 2.5 (3) 5.0
(2) 2.0 (4) 10

43 A student intended to make a salt solution with a concentration of 10.0 grams of solute per liter of solution. When the student's solution was analyzed, it was found to contain 8.90 grams of solute per liter of solution. What was the percent error in the concentration of the solution?

(1) 1.10% (3) 11.0%
(2) 8.90% (4) 18.9%

44 What is the molarity of a solution of NaOH if 2 liters of the solution contains 4 moles of NaOH?

(1) 0.5 M (3) 8 M
(2) 2 M (4) 80 M

45 A gas occupies a volume of 40.0 milliliters at 20°C. If the volume is increased to 80.0 milliliters at constant pressure, the resulting temperature will be equal to

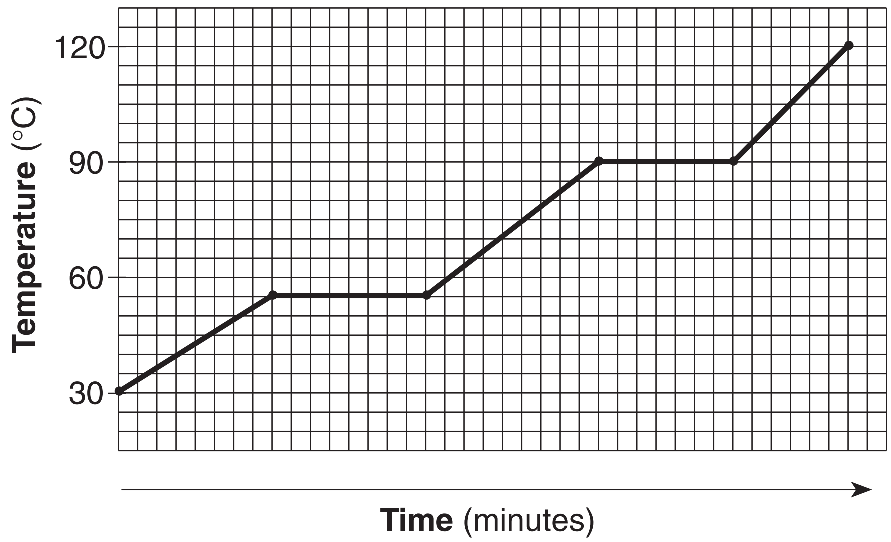
(1) $20°C \times \frac{80.0\ mL}{40.0\ mL}$ (3) $293\ K \times \frac{80.0\ mL}{40.0\ mL}$

(2) $20°C \times \frac{40.0\ mL}{80.0\ mL}$ (4) $293\ K \times \frac{40.0\ mL}{80.0\ mL}$

46 According to Reference Table *J*, which of these metals will react most readily with 1.0 M HCl to produce $H_2(g)$?

(1) Ca (3) Mg
(2) K (4) Zn

47 The graph below represents the heating curve of a substance that starts as a solid below its freezing point.



What is the melting point of this substance?

(1) 30°C
(2) 55°C
(3) 90°C
(4) 120°C

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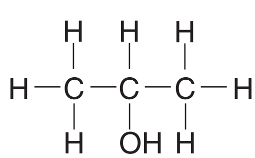
48 Given the unbalanced equation:

$$\_\_Fe_2O_3 + \_\_CO \rightarrow \_\_Fe + \_\_CO_2$$

When the equation is correctly balanced using the *smallest* whole-number coefficients, what is the coefficient of CO?

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

49 Which type of organic compound is represented by the structural formula shown below?



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

50 Given the system at equilibrium:

$$N_2O_4(g) + 58.1\ kJ \rightleftharpoons 2\ NO_2(g)$$

What will be the result of an increase in temperature at constant pressure?

(1) The equilibrium will shift to the left, and the concentration of $NO_2(g)$ will decrease.
(2) The equilibrium will shift to the left, and the concentration of $NO_2(g)$ will increase.
(3) The equilibrium will shift to the right, and the concentration of $NO_2(g)$ will decrease.
(4) The equilibrium will shift to the right, and the concentration of $NO_2(g)$ will increase.

Part B–2

Answer all questions in this part.

Directions (51–61): 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 In the boxes provided *in your answer booklet:*

a Draw *two* different compounds, one in each box, using the representations for atoms of element *X* and element Z given below. [1]

Atom of element *X* = ○
Atom of element Z = ●

b Draw a mixture of these two compounds. [1]

52 At equilibrium, nitrogen, hydrogen, and ammonia gases form a mixture in a sealed container. The data table below gives some characteristics of these substances.

Data Table

Gas	Boiling Point	Melting Point	Solubility in Water
Nitrogen	–196°C	–210°C	insoluble
Hydrogen	–252°C	–259°C	insoluble
Ammonia	–33°C	–78°C	soluble

Describe how to separate ammonia from hydrogen and nitrogen. [1]

Base your answers to questions 53 through 55 on the diagram of a voltaic cell provided *in your answer booklet* and on your knowledge of chemistry.

53 On the diagram provided *in your answer booklet,* indicate with one or more arrows the direction of electron flow through the wire. [1]

54 Write an equation for the half-reaction that occurs at the zinc electrode. [1]

55 Explain the function of the salt bridge. [1]

---

56 Given the nuclear equation:

$$^{235}_{92}U + ^{1}_{0}n \rightarrow ^{142}_{56}Ba + ^{91}_{36}Kr + 3^{1}_{0}n + \text{energy}$$

a State the type of nuclear reaction represented by the equation. [1]

b The sum of the masses of the products is slightly less than the sum of the masses of the reactants. Explain this loss of mass. [1]

c This process releases greater energy than an ordinary chemical reaction does. Name another type of nuclear reaction that releases greater energy than an ordinary chemical reaction. [1]

Base your answers to questions 57 through 60 on the information below.

Each molecule listed below is formed by sharing electrons between atoms when the atoms within the molecule are bonded together.

Molecule *A*: Cl_2
Molecule *B*: CCl_4
Molecule *C*: NH_3

57 In the box provided *in your answer booklet,* draw the electron-dot (Lewis) structure for the NH_3 molecule. [1]

58 Explain why CCl_4 is classified as a nonpolar molecule. [1]

59 Explain why NH_3 has stronger intermolecular forces of attraction than Cl_2. [1]

60 Explain how the bonding in KCl is different from the bonding in molecules *A, B,* and *C*. [1]

---

61 How is the bonding between carbon atoms different in unsaturated hydrocarbons and saturated hydrocarbons? [1]

Part C

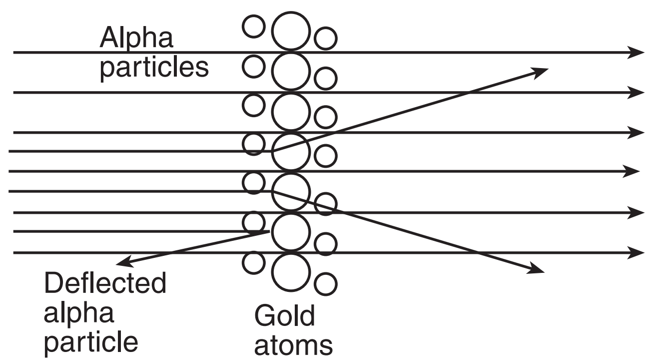
Answer all questions in this part.

Directions (62–74): 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 62 through 64 on the information and diagram below.

One model of the atom states that atoms are tiny particles composed of a uniform mixture of positive and negative charges. Scientists conducted an experiment where alpha particles were aimed at a thin layer of gold atoms.

Most of the alpha particles passed directly through the gold atoms. A few alpha particles were deflected from their straight-line paths. An illustration of the experiment is shown below.



62 Most of the alpha particles passed directly through the gold atoms undisturbed. What does this evidence suggest about the structure of the gold atoms? [1]

63 A few of the alpha particles were deflected. What does this evidence suggest about the structure of the gold atoms? [1]

64 How should the original model be revised based on the results of this experiment? [1]

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

When cola, a type of soda pop, is manufactured, $CO_2(g)$ is dissolved in it.

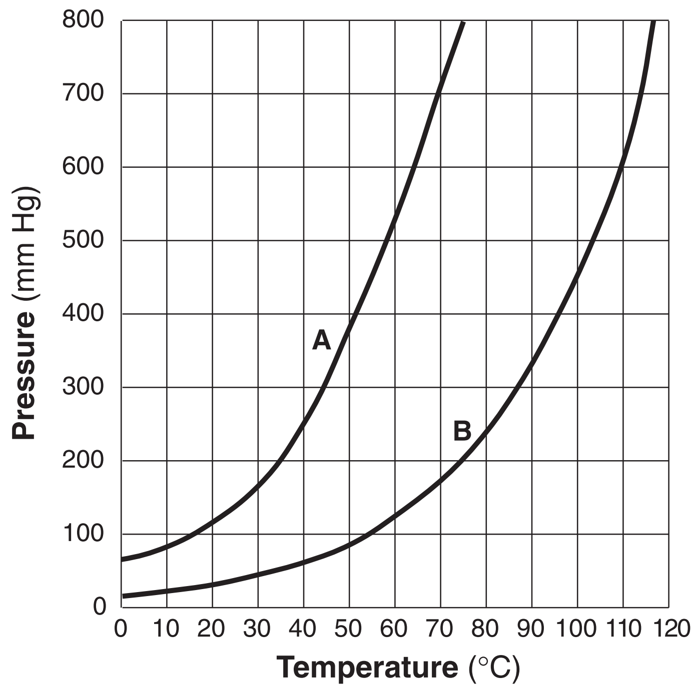
65 A capped bottle of cola contains $CO_2(g)$ under high pressure. When the cap is removed, how does pressure affect the solubility of the dissolved $CO_2(g)$? [1]

66 A glass of cold cola is left to stand 5 minutes at room temperature. How does temperature affect the solubility of the $CO_2(g)$? [1]

67 *a* In the space provided *in your answer booklet,* draw a set of axes and label one of them "Solubility" and the other "Temperature." [1]

b Draw a line to indicate the solubility of $CO_2(g)$ versus temperature on the axes drawn in part *a*. [1]

Base your answers to questions 68 through 70 on the graph below, which shows the vapor pressure curves for liquids *A* and *B*.



68 What is the vapor pressure of liquid *A* at 70°C? Your answer must include correct units. [2]

69 At what temperature does liquid *B* have the same vapor pressure as liquid *A* at 70°C? Your answer must include correct units. [2]

70 Which liquid will evaporate more rapidly? Explain your answer in terms of intermolecular forces. [2]

Base your answers to question 71 through 74 on the information and data table below.

A titration setup was used to determine the unknown molar concentration of a solution of NaOH. A 1.2 M HCl solution was used as the titration standard. The following data were collected.

	Trial 1	Trial 2	Trial 3	Trial 4
Amount of HCl Standard Used	10.0 mL	10.0 mL	10.0 mL	10.0 mL
Initial NaOH Buret Reading	0.0 mL	12.2 mL	23.2 mL	35.2 mL
Final NaOH Buret Reading	12.2 mL	23.2 mL	35.2 mL	47.7 mL

71 Calculate the volume of NaOH solution used to neutralize 10.0 mL of the standard HCl solution in trial 3. Show your work. [2]

72 According to Reference Table *M*, what indicator would be most appropriate in determining the end point of this titration? Give one reason for choosing this indicator. [2]

73 Calculate the average molarity of the unknown NaOH solution for all four trials. Your answer must include the correct number of significant figures and correct units. [3]

74 Explain why it is better to use the average data from multiple trials rather than the data from a single trial to calculate the results of the titration. [1]

Tear Here

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CHEMISTRY

Wednesday, January 29, 2003 — 9:15 a.m. to 12:15 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

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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	14	
C	21	

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

Final Score (from conversion chart) ☐

Raters' Initials:

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

Part B–2

For Raters Only

51 *a* ☐ ☐ — **51*a*** ☐

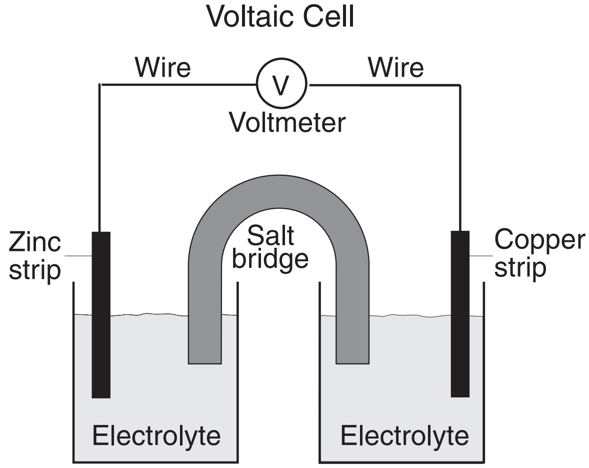
b ☐ — ***b*** ☐

52 ____

____ — **52** ☐

For Raters Only

53



53

54 ______________________________ 54

55 ______________________________ 55

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56 *a* ______________________________ 56*a*

b ______________________________ *b*

____

c ______________________________ *c*

57 57

58 ______________________________

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For Raters Only

59 ______________________________

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60 ______________________________

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60

61 ______________________________

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61

Total Score for Part B–2

Part C

62 ______________________________

____

62

63 ______________________________

____

63

64 ______________________________

____

64

65 ______________________________

____

65

66 ______________________________

____

66

67 ***a*** and ***b***

68 ______________________________

69 ______________________________

70 Liquid: ______

Explanation: ______________________________

____

____

71

______________________________ **mL**

72 Indicator: ______________________________

Reason: ______________________________

____

____

73

____

74 ______________________________

____

____

For Raters Only

67*a* ☐

b ☐

68 ☐

69 ☐

70 ☐

71 ☐

72 ☐

73 ☐

74 ☐

☐

Total Score for Part C

FOR TEACHERS ONLY

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

PS–CH

PHYSICAL SETTING/CHEMISTRY

Wednesday, January 29, 2003 — 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 3 before rating student papers.

Part A and Part B–1
Allow 1 credit for each correct response.

Part A

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

Part B–1

31	1	41	2
32	1	42	1
33	4	43	3
34	3	44	2
35	2	45	3
36	3	46	2
37	1	47	2
38	1	48	3
39	4	49	2
40	4	50	4

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 Administering and 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 checkmark 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 printed at the end of this Scoring Key and Rating Guide. 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.

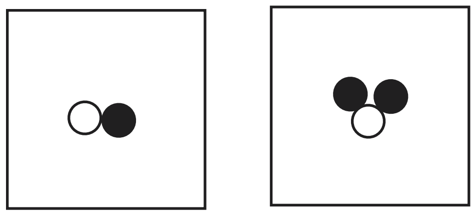
All student answer papers that receive a scaled score of 60 through 64 **must** be scored a second time. For the second scoring, a different committee of teachers may score the student's paper or the original committee may score the paper, except that no teacher may score the same open-ended questions 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 in the scoring key for that administration be used to determine the student's final score. The chart in this scoring key is usable only for this administration of the examination.

Part B–2

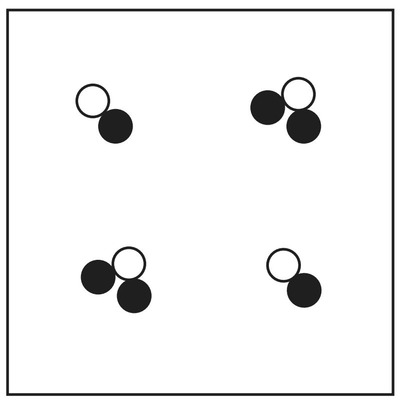
Allow a total of 14 credits for this part. The student must answer all questions in this part.

51 [2] ***a*** Allow 1 credit for correctly drawing two different compounds. At least *two* different particles must be touching in each drawing and there must be different combinations drawn of touching atoms. Acceptable responses include, but are not limited to, these examples:



Note: No specific bond angle is necessary.

b Allow 1 credit for correctly drawing a mixture of the *two* kinds of particles drawn in part ***a*****.** There must be at least *one* drawing of *each* particle. Acceptable responses include, but are not limited to, this example:



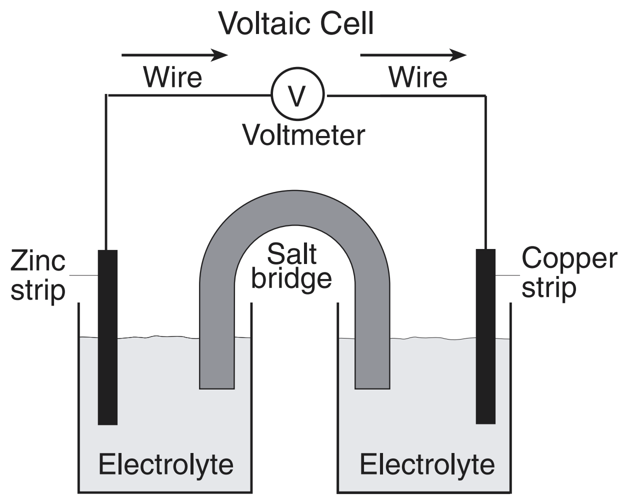
52 [1] Allow 1 credit for a correct response. Acceptable responses include, but are not limited to, these examples:

Lower the temperature to condense ammonia.

Place all three gases in water. Ammonia will dissolve (is soluble).

distillation

53 [1]



Allow 1 credit for a correct response. All arrows must be drawn in the correct direction from zinc toward copper through the wire.

54 [1] Allow 1 credit for $\mathbf{Zn^0 \rightarrow Zn^{2+} + 2e^-}$ or $\mathbf{Zn^0 - 2e^- \rightarrow Zn^{2+}}$. Zn instead of Zn^0 is acceptable. Indicating states is acceptable but not required for credit.

55 [1] Allow 1 credit for a correct response. Acceptable responses include, but are not limited to, these examples:

migration of ions

maintains neutrality

prevents polarization

56 [3] ***a*** Allow 1 credit for **fission.**

b Allow 1 credit for a correct response. Acceptable responses include, but are not limited to, this example:

The mass is converted to energy.

c Allow 1 credit for a correct response. Acceptable responses include, but are not limited to, these examples:

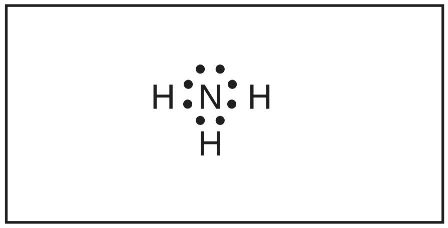
fusion

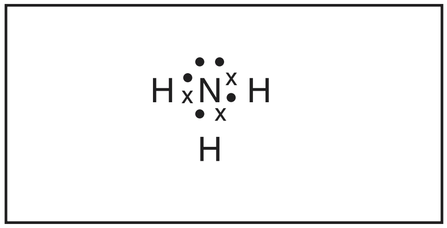
nuclear decay

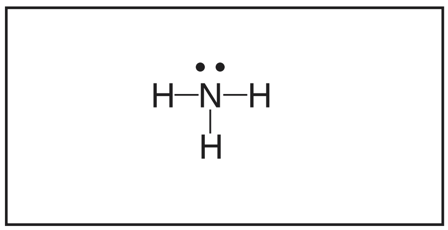
radioactive decay

natural transmutation

57 [1] Allow 1 credit for a correct response. Pairs of dots and/or *X*s or single dashes are acceptable for any shared pair. Acceptable responses include, but are not limited to, these examples:







Note: Accept a correct structure in any rotational orientation.

58 [1] Allow 1 credit for a correct response. Acceptable responses include, but are not limited to, these examples:

The molecule is symmetrical in shape and/or charge.

Electrons are evenly distributed.

All polar covalent dipoles cancel — no dipole moments.

no dipoles

59 [1] Allow 1 credit for a correct response. Acceptable responses include, but are not limited to, these examples:

NH_3 has polar molecules that attract each other.

NH_3 has an unshared pair of electrons around the center atom.

NH_3 is capable of hydrogen bonding.

unequal distribution of electrons — in strong attraction

60 [1] Allow 1 credit for a correct response. Acceptable responses include, but are not limited to, these examples:

KCl — ionic bond; *A*, *B*, *C* — no ionic bonds

Atoms do not share electrons when bonding.

There is a transfer of electrons from K to Cl.

KCl forms by electrostatic attraction.

Bonding involves a metal with a nonmetal.

61 [1] Allow 1 credit for a correct response that refers to both saturated and unsaturated compounds. Acceptable responses include, but are not limited to, these examples:

Unsaturated hydrocarbons — double or triple bonds (multiple bonds) and saturated hydrocarbons — all single bonds

An unsaturated hydrocarbon has at least one multiple covalent bond between carbon atoms, and a saturated hydrocarbon has single covalent bonds between carbon atoms.

Unsaturated hydrocarbons have more than one shared pair of electrons between carbon atoms, and saturated hydrocarbons have only one shared pair of electrons between carbon atoms.

Part C

Allow a total of 21 credits for this part. The student must answer all questions in this part.

62 [1] Allow 1 credit for a correct response. Acceptable responses include, but are not limited to, these examples:

The atom is mostly empty space.

The volume of the atom is mostly unoccupied.

63 [1] Allow 1 credit for a correct response. Acceptable responses include, but are not limited to, these examples:

Alpha particles were deflected by the positively charged nucleus.

nucleus — charged

64 [1] Allow 1 credit for a correct response. Acceptable responses include, but are not limited to, these examples:

The atom has a positively charged nucleus; negative electrons surround the outside.

The positive charges are in the nucleus; electrons are not mixed in the nucleus.

nucleus smaller than atom

65 [1] Allow 1 credit for a correct response. A reference to solubility and pressure must be in the answer. Acceptable responses include, but are not limited to, this example:

Solubility of CO_2(g) decreases with a decrease in pressure.

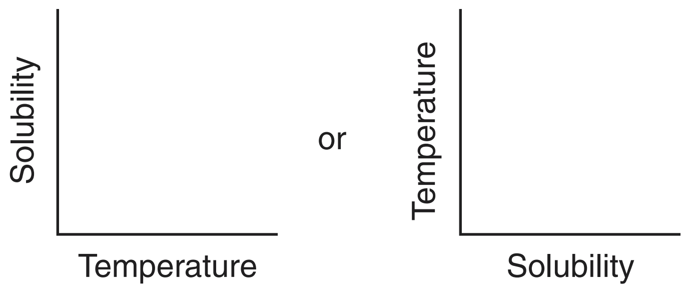
Note: Do *not* allow credit for “Soda goes flat.”

66 [1] Allow 1 credit for a correct response. A reference to solubility and temperature must be in the answer. Acceptable responses include, but are not limited to, this example:

Solubility decreases as temperature increases.

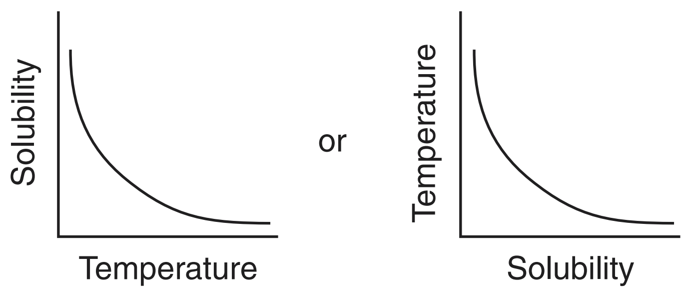
Note: Do *not* allow credit for “Soda goes flat.”

67 [2] ***a***



Allow 1 credit for a correctly drawn and labeled set of axes.

b



Allow 1 credit for a line that starts toward the top of the y-axis and goes downward toward the right end of the x-axis.

Note: Assume the origin to be zero unless otherwise labeled.

68 [2] Allow 1 credit for **710** (±10).

and

Allow 1 credit for **mm Hg** as the unit.

69 [2] Allow 1 credit for **114** (±2).

and

Allow 1 credit for **°C** as the unit.

70 [2] Allow 1 credit for liquid ***A***.

and

Allow 1 credit for a correct response. Acceptable responses include, but are not limited to, this example:

The higher vapor pressure of liquid *A* indicates that the intermolecular forces between its molecules are weaker, allowing the molecules to escape more readily to the vapor phase.

71 [2] Allow 1 credit for **12** mL or **12.0** mL.

and

Allow 1 credit if the setup is correct, but a computational error is made.

72 [2] Allow 1 credit for **phenolphthalein** or **bromthymol blue** or **litmus.**

and

Allow 1 credit for a correct response. Acceptable responses include, but are not limited to, these examples:

Strong acid and strong base reach an end point at pH = 7.

Phenolphthalein goes from colorless to pink after pH = 7.

Bromthymol blue (or litmus) reaches an intermediate color around pH = 7.

73 [3] Allow 1 credit for **1.01** or **1.0** or **1**.

and

Allow 1 credit for two significant figures consistent with the student's calculated answer.

and

Allow 1 credit for **M** or **moles per liter** or an equivalent as the unit.

74 [1] Allow 1 credit for a correct response. Acceptable responses include, but are not limited to, these examples:

Multiple trials help to cancel out experimental error in each trial.

Each trial involves errors either above or below the true value. Therefore, the average value would contain the least error.

Multiple trials ensure better accuracy of results.

to correct for inconsistencies between trials (in measurement)

Regents Examination in Physical Setting/Chemistry
January 2003
Chart for Converting Total Test Raw Scores to
Final Examination Scores (Scaled Scores)

Raw Score	Scaled Score	Raw Score	Scaled Score	Raw Score	Scaled Score	Raw Score	Scaled Score
85	100	63	74	41	60	19	39
84	98	62	73	40	60	18	38
83	97	61	72	39	59	17	36
82	95	60	72	38	58	16	35
81	93	59	71	37	57	15	33
80	92	58	70	36	57	14	31
79	91	57	70	35	56	13	30
78	89	56	69	34	55	12	28
77	88	55	68	33	54	11	26
76	87	54	68	32	54	10	24
75	85	53	67	31	53	9	22
74	84	52	67	30	52	8	20
73	83	51	66	29	51	7	18
72	82	50	66	28	50	6	15
71	81	49	65	27	49	5	13
70	80	48	64	26	48	4	11
69	79	47	64	25	47	3	8
68	78	46	63	24	46	2	5
67	77	45	63	23	44	1	3
66	76	44	62	22	43	0	0
65	75	43	61	21	42		
64	75	42	61	20	41		

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 scaled score that corresponds to that raw score. The scaled score is the student's final examination score. Enter this score in the space labeled "Final Score" on the student's answer sheet.

Map to Core Curriculum

January 2003 Physical Setting/ Chemistry			
Question Numbers			
Key Ideas	Part A	Part B	Part C
Standard 1			
Math Key Idea 1	8,22	43	71,73
Math Key Idea 2			67
Math Key Idea 3			
Sci. Inq. Key Idea 1		51,57,58,59	62,63,64
Sci. Inq. Key Idea 2			
Sci. Inq. Key Idea 3		39,40	68,69,71,74
Eng. Des. Key Idea 1			
Standard 2			
Key Idea 1			
Key Idea 2			
Standard 6			
Key Idea 1			
Key Idea 2		45	
Key Idea 3			
Key Idea 4		50	
Key Idea 5		38,47	
Standard 7			
Key Idea 1			
Key Idea 2			
Standard 4 Process Skills			
Key Idea 3		33,34,36,37,40,41, 42,44,45,46,48,49, 50,51,52,53,54,55, 56a,61	65,66,71,72,73
Key Idea 4		31,32,38,47,56c	
Key Idea 5		35,39,56b,57,59,60	70
Standard 4			
Key Idea 3	1,2,3,4,5,7,8,9,11,13, 16,18,19,21,22,23,24, 25,26,27,28,30	32,34,36,37,40,41, 42,44,45,46,48,49, 50,51,52,53,61	62,63,64,65,66, 67,71,72,73,74
Key Idea 4	12,17,20	31,33,38,47,56a, 56c	
Key Idea 5	6,10,14,15,29	35,39,56b,57,58, 59,60	68,69,70
Reference Tables			
2002 Edition	3,4,6,7,20	31,37,44,45,46,53	72