The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

PHYSICAL SETTING
CHEMISTRY

Friday, June 21, 2002 — 1:15 to 4:15 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 answer sheet and 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 What is the electron configuration of a sulfur atom in the ground state?

(1) 2–4
(2) 2–6
(3) 2–8–4
(4) 2–8–6

2 The modern model of the atom shows that electrons are

(1) orbiting the nucleus in fixed paths
(2) found in regions called orbitals
(3) combined with neutrons in the nucleus
(4) located in a solid sphere covering the nucleus

3 Which compound contains ionic bonds?

(1) NO
(2) NO_2
(3) CaO
(4) CO_2

4 All the isotopes of a given atom have

(1) the same mass number and the same atomic number
(2) the same mass number but different atomic numbers
(3) different mass numbers but the same atomic number
(4) different mass numbers and different atomic numbers

5 What are two properties of most nonmetals?

(1) high ionization energy and poor electrical conductivity
(2) high ionization energy and good electrical conductivity
(3) low ionization energy and poor electrical conductivity
(4) low ionization energy and good electrical conductivity

6 Which element is classified as a noble gas at STP?

(1) hydrogen
(2) oxygen
(3) neon
(4) nitrogen

7 The percent by mass of hydrogen in NH_3 is equal to

(1) $\frac{17}{1} \times 100$
(2) $\frac{17}{3} \times 100$
(3) $\frac{1}{17} \times 100$
(4) $\frac{3}{17} \times 100$

8 Metallic bonding occurs between atoms of

(1) sulfur
(2) copper
(3) fluorine
(4) carbon

9 Atoms of the same element that have different numbers of neutrons are classified as

(1) charged atoms
(2) charged nuclei
(3) isomers
(4) isotopes

10 Compared to the radius of a chlorine atom, the radius of a chloride ion is

(1) larger because chlorine loses an electron
(2) larger because chlorine gains an electron
(3) smaller because chlorine loses an electron
(4) smaller because chlorine gains an electron

11 Which of the following atoms has the greatest tendency to attract electrons?

(1) barium
(2) beryllium
(3) boron
(4) bromine

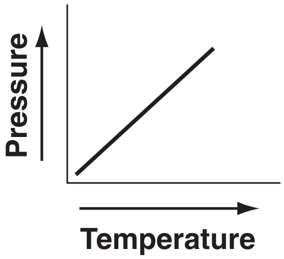
12 Which 5.0-milliliter sample of NH_3 will take the shape of and completely fill a closed 100.0-milliliter container?

(1) $NH_3(s)$
(2) $NH_3(\ell)$
(3) $NH_3(g)$
(4) $NH_3(aq)$

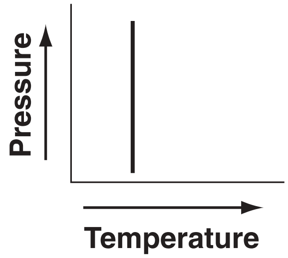
13 The strongest forces of attraction occur between molecules of

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

14 Which graph shows the pressure-temperature relationship expected for an ideal gas?



(1)



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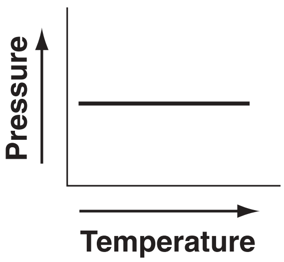

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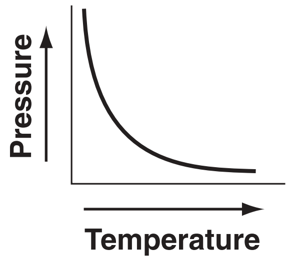


(4)

15 At the same temperature and pressure, which sample contains the same number of moles of particles as 1 liter of $O_2(g)$?

(1) 1 L Ne(g) (3) 0.5 L $SO_2(g)$
(2) 2 L $N_2(g)$ (4) 1 L $H_2O(\ell)$

16 Which change in the temperature of a 1-gram sample of water would cause the greatest increase in the average kinetic energy of its molecules?

(1) 1°C to 10°C (3) 50°C to 60°C
(2) 10°C to 1°C (4) 60°C to 50°C

17 Which compound is classified as a hydrocarbon?

(1) ethane (3) chloroethane
(2) ethanol (4) ethanoic acid

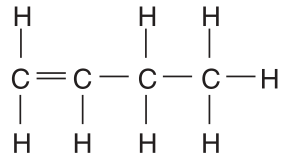
18 Given the reaction:

$$Mg(s) + 2\ H^+(aq) + 2\ Cl^-(aq) \rightarrow$$
$$Mg^{2+}(aq) + 2\ Cl^-(aq) + H_2(g)$$

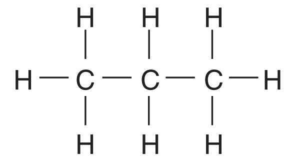
Which species undergoes oxidation?

(1) Mg(s) (3) $Cl^-(aq)$
(2) $H^+(aq)$ (4) $H_2(g)$

19 Which formula is an isomer of butane?



(1)



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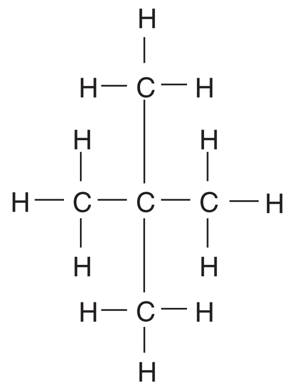

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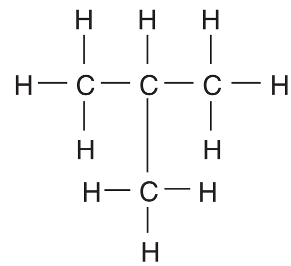


(4)

20 Which particles are gained and lost during a redox reaction?

(1) electrons (3) neutrons
(2) protons (4) positrons

21 What is the oxidation number of chromium in $K_2Cr_2O_7$?

(1) +12 (3) +3
(2) +2 (4) +6

22 Which process requires an external power source?

(1) neutralization (3) fermentation
(2) synthesis (4) electrolysis

23 A substance that conducts an electrical current when dissolved in water is called

(1) a catalyst (3) a nonelectrolyte
(2) a metalloid (4) an electrolyte

24 Which product of nuclear decay has mass but no charge?

(1) alpha particles (3) gamma rays
(2) neutrons (4) beta positrons

25 Given the reaction:

$HCl(aq) + LiOH(aq) \rightarrow HOH(\ell) + LiCl(aq)$

The reaction is best described as

(1) neutralization
(2) synthesis
(3) decomposition
(4) oxidation-reduction

26 Which ion is produced when an Arrhenius base is dissolved in water?

(1) H^+, as the only positive ion in solution
(2) H_3O^+, as the only positive ion in solution
(3) OH^-, as the only negative ion in solution
(4) H^-, as the only negative ion in solution

27 The change that is undergone by an atom of an element made radioactive by bombardment with high-energy protons is called

(1) natural transmutation
(2) artificial transmutation
(3) natural decay
(4) radioactive decay

Note that questions 28 through 30 have only three choices.

28 As ice melts at standard pressure, its temperature remains at 0°C until it has completely melted. Its potential energy

(1) decreases
(2) increases
(3) remains the same

29 As a sample of the radioactive isotope ^{131}I decays, its half-life

(1) decreases
(2) increases
(3) remains the same

30 As an atom becomes an ion, its mass number

(1) decreases
(2) increases
(3) remains the same

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 In which shell are the valence electrons of the elements in Period 2 found?

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

32 Which of the following Group 15 elements has the greatest metallic character?

(1) nitrogen
(2) phosphorus
(3) antimony
(4) bismuth

33 The number of neutrons in the nucleus of an atom can be determined by

(1) adding the atomic number to the mass number
(2) subtracting the atomic number from the mass number
(3) adding the mass number to the atomic mass
(4) subtracting the mass number from the atomic number

34 A compound has a gram formula mass of 56 grams per mole. What is the molecular formula for this compound?

(1) CH_2
(2) C_2H_4
(3) C_3H_6
(4) C_4H_8

35 Given the equilibrium reaction at STP:

$$N_2O_4(g) \rightleftharpoons 2\ NO_2(g)$$

Which statement correctly describes this system?

(1) The forward and reverse reaction rates are equal.
(2) The forward and reverse reaction rates are both increasing.
(3) The concentrations of N_2O_4 and NO_2 are equal.
(4) The concentrations of N_2O_4 and NO_2 are both increasing.

36 What is the total number of oxygen atoms in the formula $MgSO_4 \bullet 7\ H_2O$? [The • represents seven units of H_2O attached to one unit of $MgSO_4$.]

(1) 11
(2) 7
(3) 5
(4) 4

37 Given the reaction:

$$6\ CO_2 + 6\ H_2O \rightarrow C_6H_{12}O_6 + 6\ O_2$$

What is the total number of moles of water needed to make 2.5 moles of $C_6H_{12}O_6$?

(1) 2.5
(2) 6.0
(3) 12
(4) 15

38 A student calculated the percent by mass of water in a hydrate as 14.2%. A hydrate is a compound that contains water as part of its crystal structure. If the accepted value is 14.7%, the student's percent error was

(1) $\frac{0.5}{14.2} \times 100$
(2) $\frac{14.7}{14.2} \times 100$
(3) $\frac{0.5}{14.7} \times 100$
(4) $\frac{14.2}{14.7} \times 100$

39 Which of the following ions has the *smallest* radius?

(1) F^-
(2) Cl^-
(3) K^+
(4) Ca^{2+}

40 According to Reference Table *G*, which solution is saturated at 30°C?

(1) 12 grams of $KClO_3$ in 100 grams of water
(2) 12 grams of $KClO_3$ in 200 grams of water
(3) 30 grams of NaCl in 100 grams of water
(4) 30 grams of NaCl in 200 grams of water

41 The gram formula mass of NH_4Cl is

(1) 22.4 g/mole
(2) 28.0 g/mole
(3) 53.5 g/mole
(4) 95.5 g/mole

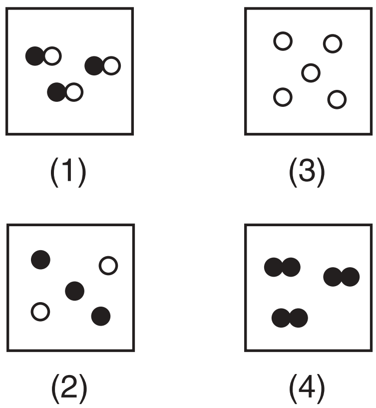
42 What is the molarity of a solution that contains 0.50 mole of NaOH in 0.50 liter of solution?

(1) 1.0 M
(2) 2.0 M
(3) 0.25 M
(4) 0.50 M

43 Given:

● = particle X
○ = particle Y

Which diagram represents a mixture?



44 Which process is accompanied by a *decrease* in entropy?

(1) boiling of water
(2) condensing of water vapor
(3) subliming of iodine
(4) melting of ice

45 If 5.0 milliliters of a 0.20 M HCl solution is required to neutralize exactly 10. milliliters of NaOH, what is the concentration of the base?

(1) 0.10 M
(2) 0.20 M
(3) 0.30 M
(4) 0.40 M

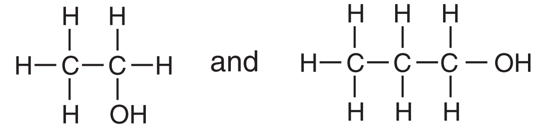
46 Exactly how much time must elapse before 16 grams of potassium-42 decays, leaving 2 grams of the original isotope?

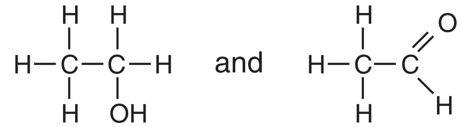
(1) 8 × 12.4 hours
(2) 2 × 12.4 hours
(3) 3 × 12.4 hours
(4) 4 × 12.4 hours

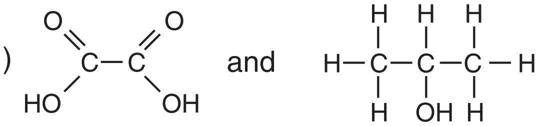
47 Which mass measurement contains four significant figures?

(1) 0.086 g
(2) 0.431 g
(3) 1003 g
(4) 3870 g

48 Which pair of compounds are alcohols?

(1) 

(2) 

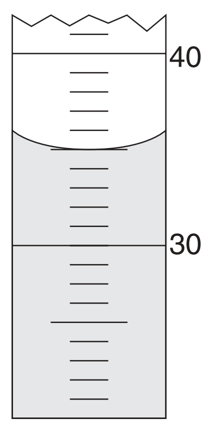
(3) 

(4) 

49 The process of joining many small molecules into larger molecules is called

(1) neutralization
(2) polymerization
(3) saponification
(4) substitution

50 The diagram below represents a portion of a 100-milliliter graduated cylinder.



What is the reading of the meniscus?

(1) 35.0 mL
(2) 36.0 mL
(3) 44.0 mL
(4) 45.0 mL

Part B–2

Answer all questions in this part.

Directions (51–57): 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 box provided *in your answer booklet,* draw the electron-dot (Lewis) structure of an atom of calcium. [1]

52 In the box provided *in your answer booklet,* draw the electron-dot (Lewis) structure of an atom of chlorine. [1]

53 In the box provided *in your answer booklet,* draw the electron-dot (Lewis) structure of calcium chloride. [2]

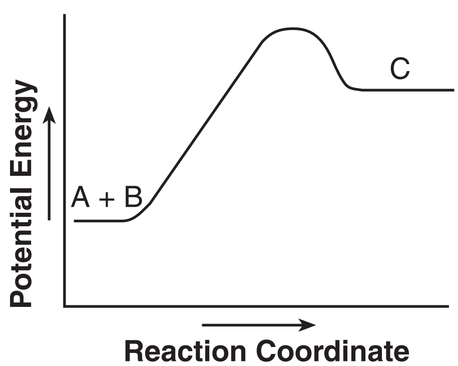
54 A student is given two beakers, each containing an equal amount of clear, odorless liquid. One solution is acidic and the other is basic.

a State *two* safe methods of distinguishing the acid solution from the base solution. [2]

b For *each* method, state the results of both the testing of the acid solution *and* the testing of the base solution. [2]

Base your answers to questions 55 and 56 on the information and diagram below, which represent the changes in potential energy that occur during the given reaction.

Given the reaction: $A + B \rightarrow C$



55 Does the diagram illustrate an exothermic or an endothermic reaction? State one reason, in terms of energy, to support your answer. [2]

56 On the diagram provided *in your answer booklet,* draw a dashed line to indicate a potential energy curve for the reaction if a catalyst is added. [1]

57 Given the reaction at equilibrium:

$$N_2(g) + 3\ H_2(g) \rightleftharpoons 2\ NH_3(g) + 92.05\ kJ$$

a State the effect on the number of moles of $N_2(g)$ if the temperature of the system is increased. [1]

b State the effect on the number of moles of $H_2(g)$ if the pressure on the system is increased. [1]

c State the effect on the number of moles of $NH_3(g)$ if a catalyst is introduced into the reaction system. Explain why this occurs. [2]

Part C

Answer all questions in this part.

Directions (58–75): 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 58 through 60 on the information below.

In the modern model of the atom, each atom is composed of three major subatomic (or fundamental) particles.

58 Name the subatomic particles contained in the nucleus of the atom. [1]

59 State the charge associated with *each* type of subatomic particle contained in the nucleus of the atom. [1]

60 What is the net charge of the nucleus? [1]

Base your answers to questions 61 through 63 on the information below.

Testing of an unknown solid shows that it has the properties listed below.

(1) low melting point
(2) nearly insoluble in water
(3) nonconductor of electricity
(4) relatively soft solid

61 State the type of bonding that would be expected in the particles of this substance. [1]

62 Explain in terms of attractions between particles why the unknown solid has a low melting point. [1]

63 Explain why the particles of this substance are nonconductors of electricity. [1]

Base your answers to questions 64 through 66 on the information below.

A hot pack contains chemicals that can be activated to produce heat. A cold pack contains chemicals that feel cold when activated.

64 Based on energy flow, state the type of chemical change that occurs in a hot pack. [1]

65 A cold pack is placed on an injured leg. Indicate the direction of the flow of energy between the leg and the cold pack. [1]

66 What is the Law of Conservation of Energy? Describe how the Law of Conservation of Energy applies to the chemical reaction that occurs in the hot pack. [2]

Base your answers to questions 67 through 69 on the table below, which shows the electronegativity of selected elements of Period 2 of the Periodic Table.

Element	Atomic Number	Electronegativity (g/mL)
Beryllium	4	1.6
Boron	5	2.0
Carbon	6	2.6
Fluorine	9	4.0
Lithium	3	1.0
Oxygen	8	3.4

67 On the grid provided *in your answer booklet,* set up a scale for electronegativity on the y-axis. Plot the data by drawing a best-fit line. [2]

68 Using the graph, predict the electronegativity of nitrogen. [1]

69 For these elements, state the trend in electronegativity in terms of atomic number. [1]

Base your answers to questions 70 through 75 on the following redox reaction, which occurs spontaneously in an electrochemical cell.

$$Zn + Cr^{3+} \rightarrow Zn^{2+} + Cr$$

70 Write the half-reaction for the reduction that occurs. [1]

71 Write the half-reaction for the oxidation that occurs. [1]

72 *In your answer booklet,* balance the equation using the *smallest* whole-number coefficients. [1]

73 Which species loses electrons and which species gains electrons? [1]

74 Which half-reaction occurs at the cathode? [1]

75 State what happens to the number of protons in a Zn atom when it changes to Zn^{2+} as the redox reaction occurs. [1]

Tear Here

The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

PHYSICAL SETTING CHEMISTRY

Friday, June 21, 2002 — 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			Part B–1	
1	11	21	31	41 ....
2	12	22	32	42 ....
3	13	23	33	43 ....
4	14	24	34	44 ....
5	15	25	35	45 ....
6	16	26	36	46 ....
7	17	27	37	47 ....
8	18	28	38	48 ....
9	19	29	39	49 ....
10	20	30	40	50 ....
		Part A Score		**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

The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

PHYSICAL SETTING
CHEMISTRY

Friday, June 21, 2002 — 1:15 to 4:15 p.m., only

ANSWER BOOKLET

☐ Male

Student . . . . Sex: ☐ 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

For Raters Only

51 ☐

52 ☐

53 ☐

For Raters Only

54 ***a*** Method one: ______________________________ **54 *a*** [ ]

Method two: ______________________________

b Results of method one: ______________________________

______________________________ ***b*** [ ]

Results of method two: ______________________________

____

55 ______________________________

Reason: ______________________________ **55** [ ]

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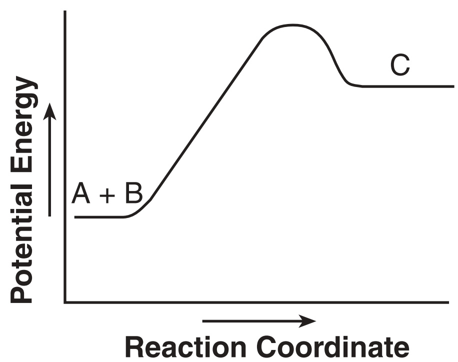
56



56 [ ]

57 ***a*** ______________________________ **57 *a*** [ ]

b ______________________________ ***b*** [ ]

c ______________________________

______________________________ ***c*** [ ]

____

[ ]

Total Score for Part B–2

For Raters Only

Part C

58 ______________________________________ 58

59 ______________________________________ 59

____

60 ____________________ 60

61 ____________________ 61

62 ______________________________________ 62

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63 ______________________________________ 63

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64 ____________________ 64

65 ______________________________________ 65

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66 ______________________________________ 66

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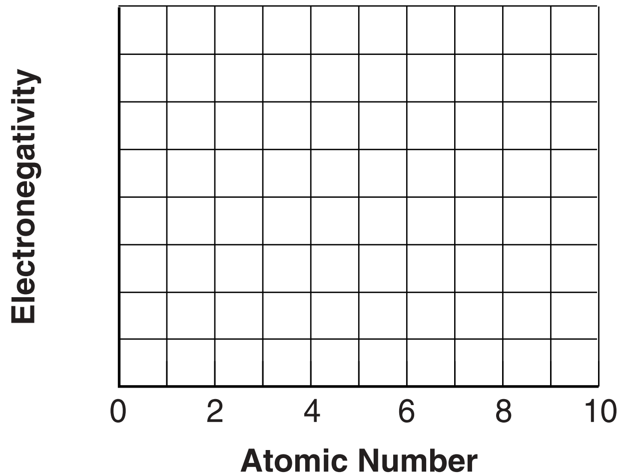
For Raters Only

67



67

68 ______________________________ **68**

69 ______________________________ **69**

70 ______________________________ **70**

71 ______________________________ **71**

72 **__Zn + __Cr^{3+} → __Zn^{2+} + __Cr** **72**

73 ______________________ loses electrons. **73**

______________________ gains electrons.

74 ______________________________ **74**

75 ______________________________ **75**

____

Total Score for Part C

THE STATE EDUCATION DEPARTMENT / THE UNIVERSITY OF THE STATE OF NEW YORK / ALBANY, NY 12234

Office of State Assessment
Tel. (518) 474-5099
Fax (518) 474-1989

ERRATA SHEET

Notice to Teachers

Physical Setting/Chemistry Regents Examination
Scoring Key and Rating Guide

Friday, June 21, 2002—1:15 p.m.

This information pertains to the scoring of questions 39, 70, 71, 73, and 74 of the June 2002 Physical Setting/Chemistry Regents Examination. In addition to the answers provided in the Scoring Key and Rating Guide, credit may also be awarded as described below:

- For question **39**, students who selected choice 4 should be given credit. Students who selected choice 1, the correct answer provided in the Scoring Key, should also be given credit.

- If a student mistakenly provided a correct oxidation half-reaction for question **70** and a correct reduction half-reaction for question **71**, the student should be given no credit for question 70 but should be awarded one credit for question 71.

- Acceptable answers to question **73** include, but are not limited to, those listed in the Rating Guide and those listed below:
    - Zinc (***not*** zinc ion) loses electrons and chromium ion (***not*** chromium) gains electrons.
    - The species being oxidized loses electrons and the species being reduced gains electrons
    - Answers equivalent to the examples above.

- Allow credit for responses to question **74** that are consistent with those given in the Rating Guide or for a response that is consistent with the student's response to question 70.

Please communicate this information to all persons responsible for hand or machine-scoring the student answer sheets.

FOR TEACHERS ONLY

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

PS–CH

PHYSICAL SETTING/CHEMISTRY

Friday, June 21, 2002 — 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.

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

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

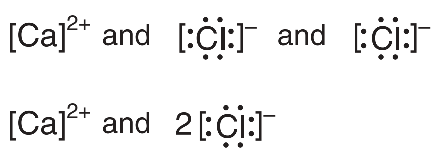
Allow a total of 15 credits for this part. The student must answer all questions in this part.

51 [1] Allow 1 credit for a correct response. Acceptable responses include, but are not limited to, this example:

Ca:

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

53 [2] Allow 2 credits for a correct response. Acceptable responses include, but are not limited to, these examples:



Allow only 1 credit if one of the ion charges is incorrect or if the number of chloride ions is incorrect.

Note: Allow credit even if brackets are not present.

54 [4] ***a*** Allow 2 credits, 1 credit for *each* of two correct responses. Acceptable responses include, but are not limited to, these examples:

Test with an indicator.

Use pH paper.

Check for reactivity.

b Allow 2 credits, 1 credit for *each* of two correct responses. Acceptable responses include, but are not limited to, these examples:

The base will turn phenolphthalein pink; the acid will not.

The acid will turn blue litmus paper red, and the base will turn red litmus paper blue.

Bromthymol blue will turn yellow in the acid and blue in the base.

The acid will react with an active metal like magnesium; the base will not.

The acid will have a pH less than 7; the base will have a pH greater than 7.

55 [2] Allow 1 credit for **endothermic.**

and

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

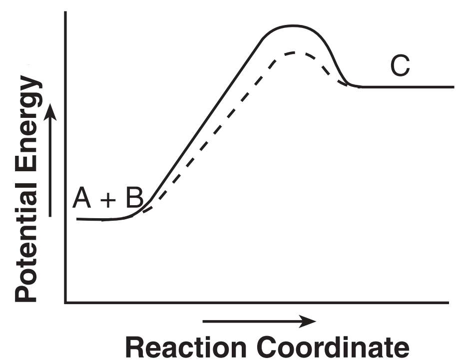
PE of product *C* is greater than PE of reactants *A* and *B*.

Product C absorbed energy and is at a higher PE than reactants *A* and *B*.

or

Allow 1 credit for a response that is consistent with the student's answer of exothermic.

56 [1]



Allow 1 credit if the student indicates that the catalyst lowers the activation energy without changing the potential energy of the reactants (*A* + *B*) or the product (*C*).

Note: Do *not* allow credit if the potential energy of the products or the reactants is changed.

57 [4] ***a*** Allow 1 credit for a response that indicates that the number of moles of $N_2(g)$ increases or more $N_2(g)$ is made.

b Allow 1 credit for a response that indicates that the number of moles of $H_2(g)$ decreases, less $H_2(g)$ is made, or more $H_2(g)$ is consumed.

c Allow 1 credit for a response that indicates that there is no effect on the production of $NH_3(g)$ or that the number of moles remains the same.

and

Allow 1 credit for a response that is consistent with the effect stated by the student. Acceptable responses include, but are not limited to, these examples:

A catalyst increases the rate of both the forward and the reverse reactions equally.

The equilibrium point is reached faster.

A catalyst does not affect the concentrations of reactants or products.

Part C

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

58 [1] Allow 1 credit for **protons and neutrons.** The response must have both protons and neutrons to receive credit.

59 [1] Allow 1 credit for a response that indicates that protons are positively charged (+) and neutrons have no charge (0). Both charges must be correct to receive credit.

or

Allow credit for a response that is consistent with the student's answer to question 58.

60 [1] Allow 1 credit for **positive** or **+**.

61 [1] Allow 1 credit for **covalent** or **molecular** or **nonpolar covalent.**

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

The intermolecular attractions between the particles of the solid are weak.

weak intermolecular attractions

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

There are no freely moving charged particles.

64 [1] Allow 1 credit for **exothermic.**

65 [1] Allow 1 credit for a correct response. Acceptable responses include, but are not limited to, these examples:

Energy flows from the injured leg to the cold pack.

Heat flows from the higher temperature (the leg) to the lower temperature (the cold pack).

The cold pack absorbs heat energy from the injured leg.

66 [2] Allow 1 credit for an accurate definition of the Law of Conservation of Energy. Acceptable responses include, but are not limited to, these examples:

Within all chemical interactions, energy is conserved.

Energy is conserved in all changes except nuclear reactions.

heat (energy) lost = heat (energy) gained

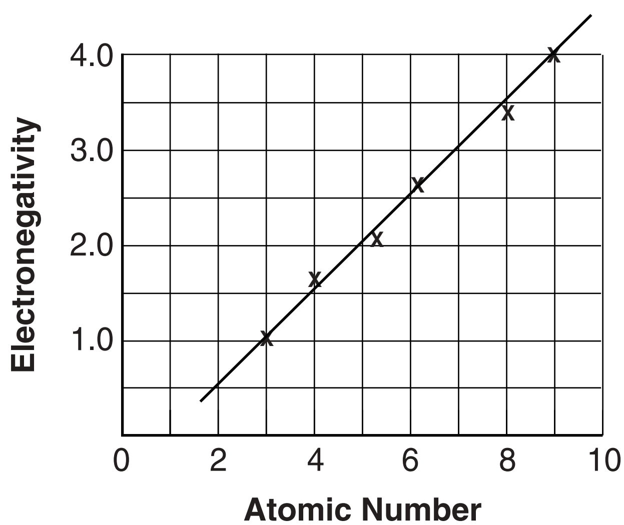
and

Allow 1 credit for an accurate explanation of how the law applies to the chemical reaction in the hot pack. Acceptable responses include, but are not limited to, these examples:

The energy released from the hot pack is equal to the energy absorbed by the surroundings.

The total energy of the system (the hot pack) is equal to the total energy of the surroundings. Everything else is constant.

67 [2]



Allow 1 credit for a correct y-axis scale.

and

Allow 1 credit if at least five of the six points are plotted and connected correctly.

68 [1] Allow 1 credit for **the electronegativity of nitrogen is 3.0** (±0.2).

or

Allow 1 credit for a response that is consistent with the plotted data on the student's graph (±0.2).

69 [1] Allow 1 credit for a correct response. Acceptable responses include, but are not limited to, this example:

Atomic number increases—electronegativity increases.

70 [1] Allow 1 credit for a correct response. Acceptable responses include, but are not limited to, these examples:

$Cr^{3+} + 3e^- \rightarrow Cr$

$2\ Cr^{3+} + 6e^- \rightarrow 2\ Cr$

71 [1] Allow 1 credit for a correct response. Acceptable responses include, but are not limited to, these examples:

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

$3\ Zn \rightarrow 3\ Zn^{2+} + 6e^-$

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

$3\ Zn - 6e^- \rightarrow 3\ Zn^{2+}$

72 [1] Allow 1 credit for $\underline{\ \mathbf{3}\ }\,Zn + \underline{\ \mathbf{2}\ }\,Cr^{3+} \rightarrow \underline{\ \mathbf{3}\ }\,Zn^{2+} + \underline{\ \mathbf{2}\ }\,Cr$.

All coefficients must be correct to receive credit.

73 [1] Allow 1 credit if the response indicates that Zn (*not* Zn^{2+}) loses electrons and Cr^{3+} (*not* Cr) gains electrons. Both parts must be correct to receive credit.

74 [1] Allow 1 credit for **$6e^- + 2\ Cr^{3+} \rightarrow 2\ Cr$** or **reduction** or **chromium half-reaction** or **$Cr^{3+} + 3e^- \rightarrow Cr$.**

75 [1] Allow 1 credit for a response that indicates that the number of protons remains the same or is unaffected.

Regents Examination in Physical Setting/Chemistry
June 2002
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	71	41	56	19	36
84	98	62	70	40	55	18	35
83	96	61	69	39	55	17	33
82	94	60	68	38	54	16	32
81	93	59	68	37	53	15	30
80	91	58	67	36	53	14	29
79	90	57	66	35	52	13	27
78	88	56	66	34	51	12	26
77	87	55	65	33	50	11	24
76	85	54	64	32	50	10	22
75	84	53	64	31	49	9	20
74	82	52	63	30	48	8	18
73	81	51	62	29	47	7	16
72	80	50	62	28	46	6	14
71	79	49	61	27	45	5	12
70	78	48	60	26	44	4	10
69	77	47	60	25	43	3	7
68	76	46	59	24	42	2	5
67	75	45	59	23	41	1	3
66	74	44	58	22	40	0	0
65	73	43	57	21	39		
64	72	42	57	20	37		

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

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