FOR TEACHERS ONLY

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

PHYSICAL SETTING/CHEMISTRY

Friday, June 16, 2023 — 1:15 to 4:15 p.m., only

RATING GUIDE

Directions to the Teacher:

Refer to the directions on page 2 before rating student papers.

Updated information regarding the rating of this examination may be posted on the New York State Education Department's web site during the rating period. Check this web site at: https://www.nysed.gov/state-assessment/high-school-regents-examinations and select the link "Scoring Information" for any recently posted information regarding this examination. This site should be checked before the rating process for this examination begins and several times throughout the Regents Examination period.

Directions to the Teacher

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

At least two science teachers must participate in the scoring of the Part B–2 and Part C open-ended questions on a student's paper. Each of these teachers should be responsible for scoring a selected number of the open-ended questions on each answer paper. No one teacher is to score more than approximately one-half of the open-ended questions on a student's answer paper. Teachers may not score their own students' answer papers.

Students' responses must be scored strictly according to the 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. Do not attempt to correct the student's work by making insertions or changes of any kind. On the student's separate answer sheet, for each question, record the number of credits earned and the teacher's assigned rater/scorer letter.

Fractional credit is *not* allowed. Only whole-number credit may be given for a response. If the student gives more than one answer to a question, only the first answer should be rated. Units need not be given when the wording of the questions allows such omissions.

For hand scoring, raters should enter the scores earned in the appropriate boxes printed on the separate answer sheet. Next, the rater should add these scores and enter the total in the box labeled "Total Raw Score." Then the student's raw score should be converted to a scale score by using the conversion chart that will be posted on the Department's web site at: https://www.nysed.gov/state-assessment/high-school-regents-examinations on Friday, June 16, 2023. The student's scale score should be entered in the box labeled "Scale Score" on the student's answer sheet. The scale score is the student's final examination score.

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

Because scale scores corresponding to raw scores in the conversion chart may change from one administration to another, it is crucial that, for each administration, the conversion chart provided for that administration be used to determine the student's final score.

Part B–2

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

51 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

An electron in the first shell of a Tc atom has less energy than an electron in the third shell.

The third shell electron has greater energy.

The electron in the first shell has less.

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

Atoms of technetium have 43 protons, but can have different numbers of neutrons.

The Tc atoms have the same number of protons, but can have a different number of neutrons.

same number of p, different number of n

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

$$\frac{(1.00\text{ atm})(0.250\text{ L})}{273\text{ K}} = \frac{(1.00\text{ atm})V_2}{298\text{ K}}$$

$$(.250)(298) = (273)V_2$$

$$x = \frac{(.25)(298)}{273}$$

$$\frac{0.250\text{ L}}{273\text{ K}} = \frac{V_2}{298\text{ K}}$$

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

Decrease the pressure.

lower

any pressure less than 1.00 atm

55 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

from the candle flame to the beaker of water

from the flame to the beaker.

from the candle flame to the water

from candle to water

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

(120.0 g)(4.18 J/g•K)(86.0°C − 23.0°C)

(120.0 g)(4.18 J/g•K)(359 K − 296 K)

(120)(4.2)(63)

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

The water molecules move faster as the temperature increases.

The water molecules collide more often and hit harder as the temperature increases.

The average kinetic energy of the molecules increases.

Molecular motion increases.

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

The rate of the forward reaction is the same as the rate of the reverse reaction.

The rates are equal.

equal

same

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

Increasing the pressure favors the forward reaction.

Equilibrium shifts to the right.

Equilibrium shifts to the side with fewer moles of gas, $N_2O_4(g)$.

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

The entropy of the dinitrogen tetroxide in the gaseous phase is higher than the entropy of the liquid dinitrogen tetroxide.

The entropy at 15°C is less than at 25°C.

The entropy of the N_2O_4 is greater at 25°C.

greater in gas

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

from 0 to +2

from zero to positive two

from Cu^0 to Cu^{2+}

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

Copper is more active than silver.

Silver is less active than copper.

Cu is above Ag on Table *J*.

Note: Do *not* allow credit for Cu is more active than Ag^+.

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

$Ag^+(aq) + e^- \rightarrow Ag(s)$

$Ag^+ + e^- \rightarrow Ag$

$2Ag^+ + 2e^- \rightarrow 2Ag$

Note: Do *not* allow credit for the e without the minus sign (−).

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

titration

volumetric analysis

Note: Do *not* allow credit for neutralization.

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

$M_A(15.0\ mL) = (0.11\ M)(18.2\ mL)$

$$\frac{(0.11\ M)(18.2\ mL)}{15.0\ mL}$$

$$x = \frac{(.11)(18.2)}{15}$$

Part C

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

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

Zn, Ga, In

gallium, indium, zinc

67 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

Atoms of gallium and indium each have three valence electrons.

Atoms of Ga and In have the same number of electrons in their outermost shells.

same number of valence e^-

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

The density of He is lower than the density of tellurium.

Tellurium is more dense.

Helium is a gas, so it is less dense.

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

Indium atoms have 5 shells of electrons; gallium atoms have only 4 shells of electrons.

Indium has one more electron shell than gallium.

The In has more shells.

70 [1] Allow 1 credit for 22.2% *or* for any value from 22% to 22.24%, inclusive.

71 [1] Allow 1 credit for $\_4\_\ NH_3(g) + \_5\_\ O_2(g) \rightarrow \_4\_\ NO(g) + \_6\_\ H_2O(g)$ + heat.

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

14.0067 g/mol + 2(15.9994) g/mol

2(16.0 g/mol) + 14.0 g/mol

14 + 32

73 [1] Allow 1 credit for 2.0 mol *or* 2 mol.

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

CO_2 : nonpolar molecule

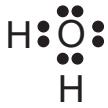
H_2O : polar molecule

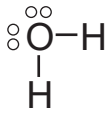
CO_2 : nonpolar

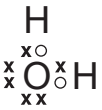
H_2O : polar

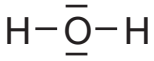
75 [1] Allow 1 credit.

Examples of 1-credit responses:









Note: Do *not* allow credit for •—• *or* •—• *or* —• for a bond, because each • represents one electron and each — represents two electrons.

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

The oxygen atom has a greater strength of attraction for electrons than the carbon atom in the bond between them.

The carbon atom has a weaker strength of attraction for the bonded electrons.

Carbon has an electronegativity value of 2.6, which is lower than oxygen's electronegativity value of 3.4.

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

Carbon and oxygen are nonmetals; the nonmetal atoms share electrons, producing a molecular compound.

The nonmetals C and O form covalent bonds with each other and produce molecular compounds.

Carbon dioxide is a molecular compound because it is composed of two nonmetals.

78 [1] Allow 1 credit for CH_2O. The order of the elements may vary.

79 [1] Allow 1 credit for alcohol *or* alcohols.

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

Ethene is classified as an unsaturated hydrocarbon because each molecule of ethene contains a carbon-to-carbon double bond.

There is a C=C bond in each molecule.

Ethene molecules contain a multiple carbon-carbon bond.

Two more hydrogen atoms can be added to the double-bonded carbon atoms.

81 [1] Allow 1 credit for C *or* carbon.

82 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

lemon juice

lemon

83 [1] Allow 1 credit for yellow.

84 [1] Allow 1 credit for H_2O *or* HOH.

85 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

The hydronium ion concentration and hydroxide ion concentration in the distilled water are equal.

The hydronium ion and hydroxide ion concentrations in the distilled water are both equal to 1×10^{-7} M.

concentration of $H_3O^+(aq)$ = concentration of $OH^-(aq)$

equal

same

Regents Examination in Physical Setting/Chemistry

June 2023

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

The *Chart for Determining the Final Examination Score for the June 2023 Regents Examination in Physical Setting/Chemistry* will be posted on the Department's web site at: https://www.nysed.gov/state-assessment/high-school-regents-examinations on Friday, June 16, 2023. 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 https://www.surveymonkey.com/r/8LNLLDW.
2. Select the test title.
3. Complete the required demographic fields.
4. Complete each evaluation question and provide comments in the space provided.
5. Click the SUBMIT button at the bottom of the page to submit the completed form.

Map to Core Curriculum

June 2023 Physical Setting/Chemistry			
Question Numbers			
Key Ideas/Performance Indicators	Part A	Part B	Part C
Standard 1			
Math Key Idea 1		32, 53,56, 65	70, 72
Math Key Idea 2		39, 41, 44	71, 73
Math Key Idea 3		33, 34, 36, 37, 42, 43, 48, 50, 61	70, 73, 78
Science Inquiry Key Idea 1		35, 41, 45, 46, 51, 52, 54, 55, 57, 58, 59, 60, 64	66, 71,76, 77, 78, 80, 82, 84, 85
Science Inquiry Key Idea 2			
Science Inquiry Key Idea 3		31, 36, 38, 39, 40, 41, 45, 46, 47, 49, 57, 58, 59, 60, 61	66, 71, 76, 77, 78, 80, 82, 84, 85
Engineering Design Key Idea 1			
Standard 2			
Key Idea 1			
Key Idea 2			
Key Idea 3			
Standard 6			
Key Idea 1		55	
Key Idea 2		31, 34, 40, 45, 63	75
Key Idea 3			
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, 37, 38, 40, 41, 42, 43, 45, 53, 58, 59, 60, 62, 63, 65	66, 67, 69, 71, 72, 73, 77, 78, 79, 82, 83, 84, 85
Key Idea 4		44, 48, 56, 57	
Key idea 5			75
Standard 4			
Key Idea 3	1, 2, 3, 4, 5, 7, 8, 9, 13, 14, 15, 19, 20, 21, 22, 23, 24, 25, 26, 27	31, 32, 33, 34, 35, 36, 37, 38, 40, 41, 42, 43, 45, 46, 47, 51, 52, 53, 54, 58, 59, 60, 61, 62, 63, 64, 65	66, 67, 68, 69, 70, 71, 72, 73, 78, 79, 81, 82, 83, 84, 85
Key Idea 4	16, 18, 28, 30	44, 48, 49, 55, 56, 57	
Key Idea 5	6, 10, 11, 12, 17, 29	39, 50	74, 75, 76, 77, 80
Reference Tables			
2011 Edition	2, 7, 8, 9, 15, 17, 20, 25, 28	31, 32, 33, 34, 35, 36, 37, 39, 40, 41, 42, 43, 45, 48, 51, 52, 53, 56, 61, 62, 63, 65	66, 67, 68, 69, 70, 72, 74, 75, 76, 77, 79, 80, 81, 83, 84