

2006 U. S. NATIONAL CHEMISTRY OLYMPIAD NATIONAL EXAM PART 1



OLYMPIAD EXAMINATIONS TASK FORCE

Arden P. Zipp, State University of New York, Cortland Chair

Sherry Berman-Robinson, Consolidated High School, IL

William Bond, Snohomish High School, WA

Peter E. Demmin (retired), Amherst Central High School, NY

PA

Marian Dewane, Centennial High School, ID

Kimberly Gardner, United States Air Force Academy, CO,

Preston Hayes, Glenbrook South High School, IL

David W. Hostage, Taft School, CT Adele Mouakad, St. John's School, PR Jane Nagurney, Scranton Preparatory School, Ronald O. Ragsdale, University of Utah, UT

Todd Trout, Lancaster Country Day School, PA

DIRECTIONS TO THE EXAMINER-PART I

Part I of this test is designed to be taken with a Scantron® answer sheet on which the student records his or her responses. Only this Scantron sheet is graded for a score on **Part I**. Testing materials, scratch paper, and the Scantron sheet should be made available to the student only during the examination period. All testing materials including scratch paper should be turned in and kept secure until April 25, 2006, after which tests can be returned to students and their teachers for further study.

Allow time for the student to read the directions, ask questions, and fill in the requested information on the Scantron sheet. The answer sheet must be completed using a pencil, not pen. When the student has completed Part I or after one hour and thirty minutes has elapsed, the student must turn in the Scantron sheet, **Part I** of the testing materials, and all scratch paper.

There are three parts to the National Olympiad Examination. You have the option of administering the three parts in any order, and you are free to schedule rest-breaks between parts.

Part I	60 questions	single-answer multiple-choice	1 hour, 30 minutes
Part II	8 questions	problem-solving, explanations	1 hour, 45 minutes
Part III	2 lab problems	laboratory practical	1 hour, 30 minutes

A periodic table and other useful information are provided on page 2 for student reference. Students should be permitted to use nonprogrammable calculators.

DIRECTIONS TO THE EXAMINEE-PART I

DO NOT TURN THE PAGE UNTIL DIRECTED TO DO SO. Answers to questions in Part I must be entered on a Scantron answer sheet to be scored. Be sure to write your name on the answer sheet; an ID number is already entered for you. Make a record of this ID number because you will use the same number on both Parts II and III. Each item in Part I consists of a question or an incomplete statement that is followed by four possible choices. Select the single choice that best answers the question or completes the statement. Then use a pencil to blacken the space on your answer sheet next to the same letter as your choice. You may write on the examination, but the test booklet will not be used for grading. Scores are based on the number of correct responses. When you complete Part I (or at the end of one hour and 30 minutes), you *must* turn in all testing materials, scratch paper, and your Scantron answer sheet. Do not forget to turn in your U.S. citizenship statement before leaving the testing site today.

ampere atmosphere atomic mass unit atomic molar mass Avogadro constant Celsius temperature centi– prefix coulomb electromotive force energy of activation enthalpy	$AB \\ A \\ atm \\ u \\ A \\ ^{N_A} ^{\circ}C \\ c \\ C \\ E \\ E_a \\ H$	BREVIATIONS AN Faraday constant formula molar mass free energy frequency gas constant gram heat capacity hour joule kelvin kio. profix	D SYMBO F M G v R g C _p h J K	LS molal molar mass mole Planck's constant pressure rate constant retention factor second temperature, K	m M M mol h P k R _f s T t	CONSTANTS $R = 8.314 \text{ J} \cdot \text{mot}^{-1} \cdot \text{K}^{-1}$ $R = 0.0821 \text{ L} \cdot \text{atm} \cdot \text{mot}^{-1} \cdot \text{K}^{-1}$ $1 F = 96,500 \text{ C} \cdot \text{mot}^{-1}$ $1 F = 96,500 \text{ J} \cdot \text{V}^{-1} \cdot \text{mot}^{-1}$ $1 F = 96,500 \text{ J} \cdot \text{V}^{-1} \cdot \text{mot}^{-1}$ $1 F = 96,500 \text{ J} \cdot \text{V}^{-1} \cdot \text{mot}^{-1}$ $h = 6.622 \times 10^{23} \text{ mot}^{-1}$ $h = 6.626 \times 10^{-34} \text{ J} \cdot \text{s}$ $c = 2.998 \times 10^8 \text{ ms}^{-1}$ $0 \ ^\circ\text{C} = 273.15 \text{ K}$
entropy equilibrium constant	H S K	kilo– prefix liter milli– prefix	k L m	volt	V V	1 atm = 760 mmHg
$E = E^{\circ} -$	$\frac{RT}{T} \ln Q$		EQ $K = \int \frac{-\Delta H}{\Delta H}$	UATIONS $\left(\frac{1}{2}\right) + \text{constant}$		$\ln\left(\frac{k_2}{k_2}\right) = \frac{E_a}{E_a}\left(\frac{1}{2} - \frac{1}{2}\right)$

1			P	ER	IOD	IC	ГАВ	LE	OF	TH	E EI	LEN	IEN	TS			18
1A																	8A
1																	2
Н	2											13	14	15	16	17	He
1.008	2A											3A	4 A	5A	6A	7A	4.003
3	4											5	6	7	8	9	10
Li	Be											В	С	Ν	0	F	Ne
6.941	9.012											10.81	12.01	14.01	16.00	19.00	20.18
11	12											13	14	15	16	17	18
Na	Mg	3	4	5	6	7	8	9	10	11	12	Al	Si	Р	S	Cl	Ar
22.99	24.31	3B	4B	5B	6B	7B	8B	8B	8B	1B	2B	26.98	28.09	30.97	32.07	35.45	39.95
19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Со	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr
39.10	40.08	44.96	47.88	50.94	52.00	54.94	55.85	58.93	58.69	63.55	65.39	69.72	72.61	74.92	78.96	79.90	83.80
37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54
Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	Ι	Xe
85.47	87.62	88.91	91.22	92.91	95.94	(98)	101.1	102.9	106.4	107.9	112.4	114.8	118.7	121.8	127.6	126.9	131.3
55	56	57	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86
Cs	Ba	La	Hf	Та	W	Re	Os	Ir	Pt	Au	Hg	П	Pb	Bi	Ро	At	Rn
132.9	137.3	138.9	178.5	180.9	183.8	186.2	190.2	192.2	195.1	197.0	200.6	204.4	207.2	209.0	(209)	(210)	(222)
87	88	89	104	105	106	107	108	109	110	111	112		114				
Fr	Ra	Ac	Rf	Db	Sg	Bh	Hs	Mt									
(223)	(226)	(227)	(261)	(262)	(263)	(262)	(265)	(266)	(269)	(272)	(277)		(2??)				
		50	50	(0)	(1	(2)	(2)	C 1				(0)	(0)	70	71	-	
		58	59	60	61 D	62	63	64	65	66 D	6/	68	69	70	71		
		Ce	Pr I	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Im	Yb	Lu		
		140.1	140.9	144.2	(145)	150.4	152.0	157.3	158.9	162.5	164.9	167.3	168.9	173.0	175.0		

90	91	92	93	94	95	96	97	98	99	100	101	102	1	8	
Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	Lì	°0, '	
32.0	231.0	238.0	(237)	(244)	(243)	(247)	(247)	(251)	(252)	(257)	(258)	(259)	(262)	4	
,			(=0.1)	(=)	(= : e)	(=)	(=)	(-+-)	(===)	(2017)	(_* *)	()	(= =)	12	×
															4
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DIRECTIONS

- When you have selected your answer to each question, blacken the corresponding space on the answer sheet using pencil. Make a heavy, full mark, but no stray marks. If you decide to change an answer, erase the unwanted mark very
- This is a single use exam, so you may make marks in the test booklet.
- StudentBounty.com There is only one correct answer to each question. Any questions for which more than one response has been blackened with be counted.
- Your score is based solely on the number of questions you answer correctly. It is to your advantage to answer every question.
 - 1. Which substance is NOT paired correctly with its name?
 - (A) baking soda potassium hydrogen tartrate
 - (B) chalk calcium carbonate
 - (C) Epsom salt magnesium sulfate heptahydrate
 - (D) Plaster of Paris calcium sulfate hemihydrate
 - 2. Which acid should be stored in plastic containers rather than in glass ones?
 - (A) hydrofluoric acid (**B**) nitric acid
 - (C) phosphoric acid (D) sulfuric acid
 - 3. Which element does NOT occur as distinct allotropes at temperatures between 0°C and 150°C?

(A)	phosphorus	(B)	silicon
(C)	sulfur	(D)	tin

4. Which gas is odorless?

(A)	CH_4	(B) HCl	(C) NH_3	$(\mathbf{D}) \mathbf{O}_3$

- 5. Which technique is preferred for delivering a solid into a pre-weighed beaker for weighing?
 - (A) Transfer more of the reagent than is needed to the beaker. Return the excess to the bottle with a spatula.
 - (B) Transfer the desired amount of solid from the reagent bottle by holding the neck of the open bottle over the beaker and tapping the bottle. Then weigh the beaker and solid.
 - (C) Weigh a spatula, scoop the desired amount of solid from the bottle, transfer it to the beaker and reweigh the spatula.
 - (D) Weigh a piece of filter paper, tap the neck of the bottle to transfer solid to the filter paper, weigh the filter paper and transfer the solid to the beaker.
- 6. Bronze is an alloy of
 - (A) copper and tin (B) copper and zinc
 - (C) nickel and tin (D) nickel and zinc

- 7. What is the molarity of KI in a solution that is 5.00% KI by mass and has a density of $1.038 \text{ g} \cdot \text{cm}^{-3}$?
 - (A) 0.0301 M (**B**) 0.313 M
 - (C) 0.500 M (D) 0.625 M
- **8.** What is the concentration of the solution that results from mixing 40.0 mL of 0.200 M HCl with 60.0 mL of 0.100 M NaOH? (You may assume the volumes are additive.)
 - (A) 0.150 M NaCl
 - (B) 0.0200 M NaCl and 0.0200 M HCl
 - (C) 0.0200 M NaCl and 0.0600 M HCl
 - (D) 0.0600 M NaCl and 0.0200 M HCl

9.	Mole fractions are	I.	freezing point depression
	typically used to	II.	osmotic pressure
	calculate which	Ш.	vapor pressure
	properties for solutions co	ontain	ing nonvolatile solutes?

- (A) I only (B) III only
- (C) I and II only (**D**) II and III only
- **10.** An unknown anion in solution is to be identified by adding Ag^+ and Ba^{2+} ions to separate portions of it. Which anion would produce the results listed for it? (+ indicates the presence of a precipitate)

		Ag^+	Ba^{2+}	
(A)	carbonate	+	_	
(B)	hydroxide	_	+	
(C)	iodide	+	_	
(D)	sulfide	_	-	
A 1.	0 L portion	of a 0.30	m soluti	ion of whi

11. A ch of the following would be most effective at removing ice from a sidewalk?

(A)	$C_6H_{12}O_6$	(B)	NaB
(A)	$C_{6} I_{12} O_{6}$	(D)	Ivar

(C) KNO_3 (**D**) $CaCl_2$ 12. $C_6H_6 + Br_2$ r $C_6H_5Br + HBr$ In an experiment to prepare bromobenzene according to the equation, a student reacted 20.0 g of C_6H_6 with 0.310 mol of bromine. If 28.0 g of C_6H_5Br was obtained, what was the percentage yield?

(A) 31.5 **(B)** 40.3 (C) 57.6 **(D)** 69.7

13. When the substances are **I.** $CH_3(CH_2)_3CH_3$ arranged in order of increasing **II.** $CH_3CH_2CH(CH_3)_2$ boiling points, which Ш. $C(CH_3)_4$ order is correct?

$\mathbf{A}) \mathbf{I} < \mathbf{II} < \mathbf{III}$	(B)	II < III < I

- (C) III < II < I $(\mathbf{D}) \quad III < I < II$
- **14.** A 225 mL sample of H_2 is Vapor Pressure at 25 °C collected over water at H₂O 24 mmHg 25 °C and 735 mmHg pressure. Which expression represents the set-up to find the volume of dry H₂ at 0 °C

and 1 atmosphere? (A) $V = \frac{225 \times (735 - 24) \times 273}{760 \times 298}$

(B)
$$V = \frac{225 \times 760 \times 298}{(735 - 24) \times 273}$$

(C)
$$V = \frac{225 \times 273 \times 760}{(735 + 24) \times 298}$$

(D)
$$V = \frac{225 \times (735 + 24) \times 298}{760 \times 273}$$

for the 15. What is $?H_{v}$ substance w pressure is r the diagram?

10.	substance who pressure is rep the diagram?	se vapor resented b	y : I≣ f	5
	(A) 4.8 kJ·mol	1	(B)	33 kJ·mol ⁻¹
	(C) $44 \text{ kJ} \cdot \text{mol}^2$		(D)	$50 \text{ kJ} \cdot \text{mol}^{-1}$
16.	What occurs	L Dis	persion fo	orces are overcome.
	when liquid	II. Dip	ole-dipole	e forces are overcome.
	CH_2F_2	III. Cov	alent bor	nds are broken.
	evaporates?			
	(A) II only		(B)	III only

(D) I, II and III

(C) I and II only

(A) II only

StudentBounty.com 17. In the van der Waals equation for rea are introduced for both the pressure and of the Ideal Gas Equation. Identify the orig correction factors and specify whether each is subtracted from the corresponding term.

(A)	attractive forces /	
	subtracted	

(B) attractive forces / added

Pressure

- (C) molecular size / subtracted
- (D) molecular size / added
- **18.** The structure of a unit cell of an oxide of niobium is depicted here. Niobiums are dark and oxygens are light. What is the empirical formula of this compound?

(A) NbO



 (\mathbf{D}) Nb₂O₃

(C) NbO_3

molecular size / subtracted

attractive forces / added

attractive forces / subtracted

19. For a reaction that is exothermic and non-spontaneous at

(**B**) NbO₂

25 °C, which quantity must be positive?

(A)	?E°	(B)	?G°	(C)	?H°	(D)	?S°

- **20.** Use the thermochemical data given to calculate $? H_{f}^{\circ}$ for $N_2O_5(g)$ in kJ·mol⁻¹. $N_2(g) + O_2(g) r 2NO(g)$ $H^{\circ} = +180.5 \text{ kJ}$ $2NO(g) + O_2(g) r 2NO_2(g)$ $H^{\circ} = -114.1 \text{ kJ}$ $4NO_2(g) + O_2(g) r 2N_2O_5(g)$ $H^{\circ} = -110.2 \text{ kJ}$ (A) -332.8 **(B)** -43.8 (C) 11.3 **(D)** 22.6
- **21.** Bromine boils at 59°C with $?H^{\circ}_{vap} = 29.6 \text{ kJ} \cdot \text{mol}^{-1}$. What is the value of \mathbf{S}°_{vap} in J·mol⁻¹·K⁻¹?
 - (A) 11.2 **(B)** 89.2 (C) 501 **(D)** 1750
- **22.** The K_{sp} of calcium fluoride is 3.2×10^{-11} . Calculate the ?G° $(in kJ \cdot mol^{-1})$ for the dissolving of solid calcium fluoride at 25°C.

(A) 2.18 **(B)** 5.02 (C) 26.0 **(D)** 59.9

23. For which exothermic reaction is ?E more negative than ?H?

- (A) $Br_2(l) r Br_2(g)$
- (B) $2C(s) + O_2(g) r 2CO(g)$
- (C) $H_2(g) + F_2(g) r 2HF(g)$
- (D) $2SO_2(g) + O_2(g) r 2SO_2(g)$
- 24. For a reaction at 25°C, ?G = 12.7 kJ when the reaction quotient, Q = 10.0. What is the value of $?G^{\circ}$ for this reaction?

(A) -12.1 kJ ((B)	7.0 kJ
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- (C) 18.4 kJ (D) 37.5 kJ
- **25.** How can the rate of reaction at a specific time be determined from a graph of concentration against time?
 - (A) concentration at that time divided by the time
 - (B) logarithm of the concentration divided by the time
 - (C) absolute value of the slope of the graph at that time
 - (D) logarithm of the slope divided by the time
- **26.** The rate constant for the radioactive decay of C-11 is 0.0341 min⁻¹. How long will it take for a sample of C-11 to decrease to 1/4 of its original activity?

(A)	20.3 min	(B)	29.3 min
()		(

- (C) 40.6 min (D) 58.6 min
- 27. If a reaction A r B has the rate law $k[A]^2$, which graph produces a straight line?

(A)	1/[A] vs time	(B)	ln[A] vs time
(C)	$[A]^2$ vs time	(D)	1/ln[A] vs time

- **28.** Two unimolecular reactions, I and II, have the same rate constant at 25 °C but E_a for reaction I is larger than E_a for reaction II. Which statement about these two reactions is correct?
 - (A) $k_{\text{reaction I}}$ is the same as $k_{\text{reaction II}}$ at all temperatures.
 - (B) $k_{\text{reaction I}}$ is larger than $k_{\text{reaction II}}$ at lower temperatures but smaller at higher temperatures.
 - (C) $k_{\text{reaction I}}$ is smaller than $k_{\text{reaction II}}$ at lower temperatures but larger at higher temperatures.
 - **(D)** $k_{\text{reaction I}}$ is larger than $k_{\text{reaction II}}$ at temperatures both lower and higher than 25 °C.

29. According to the reaction profile given, which reaction step is rate-determining in the forward direction?

(C) III:



(A)	Ιr Π		(B)	II r III	

r II	(D)	III r IV

30. For the reaction; $2H_2(g) + 2NO(g) r N_2(g) + 2H_2O(g)$, rate = k[H₂][NO]². This mechanism has been proposed: step 1 H₂ + NO r H₂O + N step 2 N + NO r N₂ + O step 3 O + H₂ r H₂O

Which statement about this rate law and mechanism is correct?

- (A) This mechanism is consistent with the rate law IF step 1 is the rate determining step.
- (B) This mechanism is consistent with the rate law IF step 2 is the rate determining step.
- (C) This mechanism is consistent with the rate law IF step 3 is the rate determining step.
- (D) This mechanism can not be consistent with the rate law, regardless of which step is rate-determining.
- 31. C(s) + CO₂(g) s 2CO(g)
 If this system is at equilibrium, which change(s) will alter the value of K_p?

 31. C(s) + CO₂(g) s 2CO(g)
 I. raising the temperature II. adding solid C
 - (A) I only (B) II only
 - (C) I and III only (D) II and III only
- **32.** A 0.10 M solution of a weak acid is 5.75% ionized. What is the K_a value for this acid?

(A) 3.3×10^{-3}	(B)	3.5×10^{-4}
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- (C) 4.2×10^{-5} (D) 3.3×10^{-5}
- **33.** Which base is most suitable to prepare a buffer solution with a pH = 11.00?
 - (A) ammonia ($K_b = 1.8 \times 10^{-5}$)
 - (**B**) aniline ($K_b = 4.0 \times 10^{-10}$)
 - (C) methylamine ($K_b = 4.4 \times 10^{-4}$)
 - **(D)** pyridine $(K_b = 1.7 \times 10^{-9})$

34.	Calculate the pH of	of H ₂ C	H ₂ CO ₃ Acid Ionization Constants		
	a 0.10 M solution		K _{1a}	4.4×10^{-7}	
	of H_2CO_3 .		K _{2a}	4.7×10^{-11}	
	(A) 3.68 (B) 5.76	(C) 7.36	(D) 9.34	

35. Which saturated solution has the highest [OH⁻]?

- (A) aluminum hydroxide ($K_{sp} = 1.8 \times 10^{-32}$)
- (**B**) calcium hydroxide ($K_{sp} = 8.0 \times 10^{-6}$)
- (C) iron(II) hydroxide ($K_{sp} = 1.6 \times 10^{-14}$)
- **(D)** magnesium hydroxide ($K_{sp} = 1.2 \times 10^{-11}$)

36. Consider these mixtures:

Mixture I.	100 mL of 0.006 M Pb(NO ₃) ₂ plus 50 mL			
	of 0.003 M NaBr			
Mixture II.	100 mL of 0.008 M Pb(1	NO ₃) ₂ plus 1	00 mL of	
	0.006 M NaBr			
Which statement is correct?		ŀ	sp	
		PbBr ₂	6.6×10 ⁻⁶	

- (A) A precipitate will not form in either mixture.
- (B) A precipitate will form only in mixture I.
- (C) A precipitate will form only in mixture II.
- (D) A precipitate will form in both mixtures.
- 37. The equation for one of the half-reactions in a lead storage battery is:

 $PbO_2 + 4H^+ + SO_4^{2-} + 2e^- r PbSO_4 + 2H_2O$ What happens to the properties of the electrolyte as this cell discharges?

> Density pН

- (A) increases increases
- **(B)** increases decreases
- (C) decreases decreases
- **(D)** decreases increases
- **38.** For the voltaic cell based on this reaction:

 $2Ag^{+}(aq) + Cur Cu^{2+}(aq) + 2Ag$ the concentrations of the aqueous ions and sizes of the electrodes can be changed independently. Which statement is correct?

- (A) Increasing the $[Cu^{2+}]$ two-fold has the cell voltage as increasing the [Ag
- (B) Decreasing the $[Cu^{2+}]$ ten-fold has the same the cell voltage as decreasing the [Ag⁺] by t ratio.
- StudentBounty.com (C) Decreasing the $[Cu^{2+}]$ ten-fold has less effect on the cell voltage than decreasing the $[Ag^+]$ by the same amount.
- (D) Doubling the sizes of the cathode has exactly the same effect on the cell voltage as decreasing the $[Cu^{2+}]$ by a factor of two.
- **39.** $3Ni^{2+} + 2Al r 2Al^{3+} + 3Ni$ $E^{\circ} = 1.41 V$ For the reaction given, which expression gives the value of $?G^{\circ}$ in kJ·mol¹?

(A) -3×96.5	(B) -6×96.5
1.41	1.41
(C) $-3 \times 96.5 \times 1.41$	(D) $-6 \times 96.5 \times 1.41$

40. In which species is the oxidation number for hydrogen different from those in the other three?

(A)	AlH ₃	(B)	H_3AsO_4
(C)	H ₃ PO ₃	(D)	NH ₃

41. A solution Standard Reduction Potential (V) $Ni^{2+}(aq) + 2e^{-}r Ni(s)$ containing -0.236equimolar $\operatorname{Sn}^{2+}(\operatorname{aq}) + 2e^{-} \operatorname{r} \operatorname{Sn}(s)$ -0.141amounts of NiCl₂ $Br_2(aq) + 2e^- r 2Br^-(aq)$ 1.077 and SnBr₂ is $Cl_2(aq) + 2e^- r 2Cl^-(aq)$ 1.360 electrolyzed using

a 9V battery and graphite electrodes. What are the first products formed?

- (A) Ni(s) at cathode, $Cl_2(aq)$ at anode
- (B) Ni(s) at cathode, $Br_2(aq)$ at anode
- (C) Sn(s) at cathode, $Br_2(aq)$ at anode
- (D) Sn(s) at cathode, $Cl_2(aq)$ at anode

42. True stat the syste after the one Fara electricit which of

43. When *l* number

True statements about the system shown after the passage of one Faraday of electricity include which of those given?					
 I. The number of mole the number of moles II. The final [Al³⁺] is gr III. The number of elect the same as the num 	s of Al f of silves reater that rons read ber reac	ormed is greater than r formed. In the final $[Ag^+]$. cting with Al^{3+} ions is ting with Ag^+ ions.			
(A) I only(C) II and III only	(B) (D)	I and III only I, II and III			
When $l = 3$, what are the possible values for the quantum number m_l ?					

(A)	2, 1, 0	(B)	3, 2, 1, 0
(C)	2, 1, 0, -1, -2	(D)	3, 2, 1, 0, -1, -2, -3

44. The first ionization energy of cesium is 6.24×10^{-19} J/atom. What is the minimum frequency of light that is required to ionize a cesium atom?

(A)	$1.06 \times 10^{-15} \text{ s}^{-1}$	(B)	4.13×10 ¹⁴ s ⁻¹
(C)	$9.42 \times 10^{14} \text{ s}^{-1}$	(D)	1.60×10 ¹⁸ s ⁻¹

45. When the isoelectronic ions, Cl^- , S^{2-} and K^+ are arranged in order of increasing size, which order is correct?

(A)	K^+, Cl^-, S^{2-}	(B)	K^{+}, S^{2-}, Cl^{-}
(C)	$S^{2-}, C\Gamma, K^+$	(D)	Cl^{-}, S^{2-}, K^{+}

- 46. Which is most similar for the elements in a group in the periodic table?
 - (A) physical state
 - (B) melting point
 - (C) first ionization energy
 - (D) ground state electron configuration
- 47. How many unpaired electrons are present in a gaseous Co^{3+} ion in its ground state?
 - **(B)** 3 **(D)** 5 (A) 1 **(C)** 4
- **48.** Which nucleus is not radioactive?

						ş	i l	
							100	
	(A)	K-38	(B)	K-39	(C)	К-4	3
49.	Wh incr	en the spece easing bor	cies lis nd ang	sted an le, wh	e arran ich ord	igo lei	ed in order r is correct?	Ung
	(A)	H_2Se, H_2Se	S, H ₂ O)	(B)	H_2S, H_2Se, H	
	(C)	H_2S, H_2O	, H ₂ Se	:	(D)	H_2O, H_2S, H_2	Se
50.	Wh exor form	ich terms a thermic for nation of N	are r the MaF(s)'	?	І. П. П.	N F(N	$a(g) r Na^+(g)$ $(g) + e^- r F^-(g)$ $a^+(g) + F^-(g) n$	+ e ⁻ g) c NaF(s)
	(A)	I only			(B)	II only	
	(C)	I and III o	only		(D)	II and III onl	у
51.	Wh	What is the shape of the TeF_5^- anion?						
	(A)	see-saw			(B)	square pyrar	nidal
	(C)	trigonal p	oyrami	idal	(D)	trigonal bipy	ramidal
52.	How many sigma and pi bonds are in maleic acid, HO ₂ CCHCHCO ₂ H?							
	(A)	7 sigma, 2	2 pi		(B)	8 sigma, 3 pi	
	(C)	9 sigma, 1	2 pi		(D)	11 sigma, 3 p	pi
53.	Hov Pt(N	v many iso VH ₃) ₂ Cl ₄ ?	omers	exist f	or the o)C	tahedral comp	pound,
	(A)	1	(B)	2	(C)	3 (D) 4
54.	What (As the second sec	at is the fo sume a Le octet rule.	rmal c wis do	charge ot stru	on the cture in	st i v	ulfur atom in S vhich all atom	SO ₂ ? ns obey
	(A)	+1	(B)	+2	(C)	-1 (D	9) -2
55.	Hov	v many str	uctura	ıl ison	iers are	p	ossible for C ₆	H_{14} ?
	(A)	2	(B)	3	(C)	4 (D)) 5
56.	Wh	ich is an e	ster?					
	(A)	CH ₃ COO	CH ₂ CI	H_3	(B)	(CH ₃) ₃ COOC	$C(CH_3)_3$
	(C)	CH ₃ OCH	3		(D)	(CH ₃) ₃ CCOC	Η
57.	Wh	Which type of reaction is typical of aromatic compounds?						
	(A)	addition						
	(B) free-radical substitution							
	(C)	C) substitution by positively-charged reagents						
	(D)	substitut	substitution by negatively-charged reagents					

58. What is the IUPAC name of $(CH_3)_2$ CHCH=CHCH₃?

- (A) 1,2-methyl-isopropylethene
- (B) 1,1-dimethyl-2-butene
- (C) 1-isopropylpropene
- (D) 4-methyl-2-pentene
- **59.** Which compound can exist in optically active forms?

(A)	CH ₃ CH ₂ CH ₂ CH ₂ OH	(B)	CH ₃ CH ₂ CH(OH)CH ₃
(C)	(CH ₃) ₂ CHCH ₂ OH	(D)	(CH ₃) ₃ COH

60. How many different tripeptides can be formed from the amino acids glycine, alanine and valine if each is used only once in each tripeptide?

(A) 3 (B) 4 (C) 5 (D) 6

END OF PART I



CHEMISTRY OLYMPIAD 2006 National Test, PART I KEY

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Number	Answer	Number	Answer
1	Answer	31	Answei
1.	A		B
2. 3	R	32.	C
З. Д	D A	33.	
	R	35	R
5.	D A	35.	
0. 7	R	30.	A D
/. Q	D	37.	D C
0.	D B	30.	D D
9. 10	B	39. 40	
10.		40.	A C
11.		41.	C C
12.	D C	42.	
13.	C	43.	D
14. 1 <i>5</i>	A	44.	C
15.	C	45.	A
16.	C	46.	D
17.	B	47.	C
18.	A	48.	В
19.	B	49.	A
20.	С	50.	D
21.	В	51.	В
22.	D	52.	D
23.	D	53.	B
24.	В	54.	Α
25.	С	55.	D
26.	С	56.	Α
27.	Α	57.	С
28.	С	58.	D
29.	D	59.	В
30.	В	60.	D
		• •	