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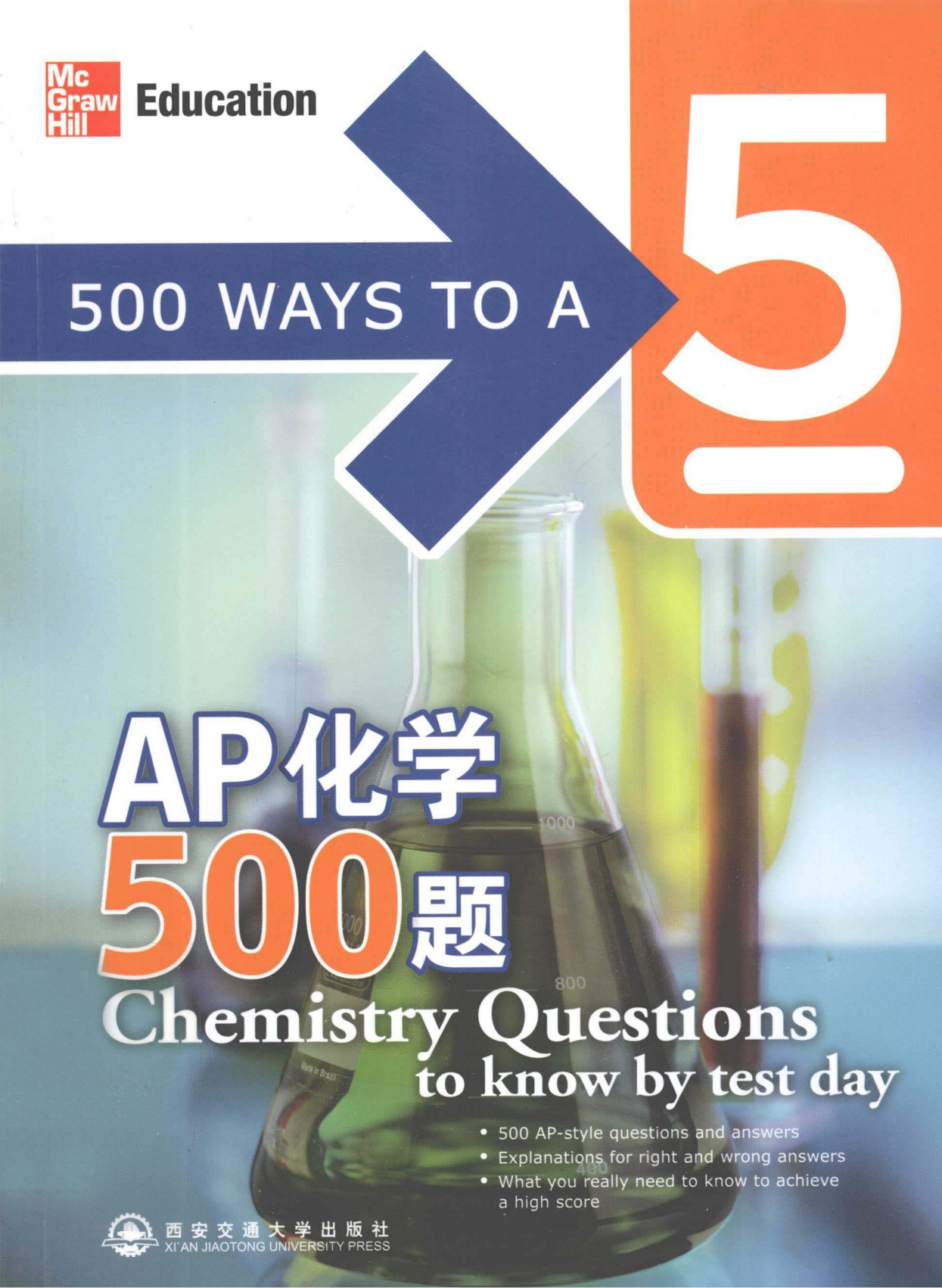

AP化学500题

Chemistry Questions to know by test day

- 500 AP-style questions and answers
- Explanations for right and wrong answers
- What you really need to know to achieve a high score

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AP项目（Advanced Placement Program）始于1955年，由美国大学理事会（the College Board）主持，是在高中阶段开设的具有大学水平的课程，即大学预修课程。AP课程目前设有22个门类、37个学科，已在美国15000多所高中开设。它可以使有余力、有能力、成绩优秀的高中生有机会先修部分美国大学基础课程以获得大学学分，因此吸引了很多成绩优秀的学生选修。目前，已有40多个国家的近3600所大学把AP学分作为其入学参考标准，其中包括哈佛大学、耶鲁大学、牛津大学、剑桥大学等世界知名大学。

美国每年约有200万高中毕业生，他们都要参加美国高考SAT和AP课程的考试。美国高中生会在11年级时完成SAT考试，在12年级（高中最后一年）完成两件大事：第一，根据SAT的考试成绩申请大学和奖学金；第二，选修AP课程，并进行备考。在高中选修AP课程和通过AP考试不仅是对学生能力和学业水平的证明，还可以使学生：1. 在申请大学时具有很大的优势。美国大学把学生在AP考试中的表现作为衡量其是否能够胜任大学学习的依据。从美国大学录取顾问委员会公布的影响大学录取因素的比较分析可以看出，AP成绩以80.3%的影响力位居第一，因为它向学校充分展示了学生的才智、专长及学习能力。2. 进入大学后，可以获得大学学分，免修同类课程，提早选修更高级的课程或跳级。3. 提前毕业。4. 节省大学学费。在美国，初等教育是免费的，但高等教育是收费的。选修的AP课程越多，免修的大学课程也就越多，节省的学费也就越多。另外，对中国学生而言，除了可以获得美国大学学分、省时省钱外，还可以在国内提前适应美国大学课程。

AP考试成绩的评定为5分制，满分5分表示极为优秀，4分为优秀，3分相当于合格，即可为大多数学校所接受，2分为可能有资格，1分则不予推荐。AP考试在每年5月份举行一次，为期两周。每门课程的考试时间约为2～3个小时，考试费用为每科1000元人民币或1400元港币左右。

更多信息可查询以下网站：

AP考试官网：http://www.collegeboard.com

AP国内报名网站：http://apchina.net.cn

香港考务局报名网址：https://www2.hkeaa.edu.hk

为满足国内考生对AP考试资料日益增长的需求，我们从美国知名教育出版公司McGraw-Hill引进了本系列AP考试丛书，分别为《AP微观/宏观经济学500题》、《AP统计学500题》、《AP美国历史500题》、《AP物理500题》和《AP化学500题》。本书为其中的《AP化学500题》，由对AP考试有着深入研究的专家精编500道选择题，题型和难度与AP考试真题相当，全面涵盖课程精华内容。每道题均给出准确答案和详尽解析。本书中丰富的习题不但是教材内容的必要补充，还能使考生通过习题演练夯实课程基础内容，把握考试的重要信息。

或许你已经修了几门AP课程，在考前几周的冲刺阶段，需要通过做一些习题来进行最后的全面复习；或许你拖延到考试前才开始着手复习。无论你以何种形式备考，都会从本书这500道题目的练习中大有收获，因为这些题目的内容、形式、难度都与AP考试真题保持高度一致。对于考前几周的备考，本书的习题和解析是首选材料。

正所谓“熟能生巧”。如果你能完成本书练习并认真参阅解析，相信你可以掌握足够的技巧，建立充分的自信，并最终取得理想的成绩。祝你好运！

更多信息可查询以下网站：

AP考试官网：http://www.collegeboard.com

AP国内报名网站：http://apchina.net.cn

香港考务局报名网址：https://www2.hkeaa.edu.hk

为满足国内考生对AP考试资料日益增长的需求，我们从美国知名教育出版公司McGraw-Hill引进了本系列AP考试丛书，分别为《AP微观/宏观经济学500题》、《AP统计学500题》、《AP美国历史500题》、《AP物理500题》和《AP化学500题》。本书为其中的《AP化学500题》，由对AP考试有着深入研究的专家精编500道选择题，题型和难度与AP考试真题相当，全面涵盖课程精华内容。每道题均给出准确答案和详尽解析。本书中丰富的习题不但是教材内容的必要补充，还能使考生通过习题演练夯实课程基础内容，把握考试的重要信息。

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Congratulations! You've taken a big step toward AP success by purchasing *500 AP Chemistry Questions to Know by Test Day*. We are here to help you take the next step and earn a high score on your AP Exam so you can earn college credits and get into the college or university of your choice.

This book gives you 500 AP-style multiple-choice questions that cover all the most essential course material. Each question has a detailed answer explanation. These questions will give you valuable independent practice to supplement both your regular textbook and the groundwork you are already covering in your AP classroom. This and the other books in this series were written by expert AP teachers who know your exam inside and out and can identify crucial exam information and questions that are most likely to appear on the test.

You might be the kind of student who takes several AP courses and needs to study extra questions a few weeks before the exam for a final review. Or you might be the kind of student who puts off preparing until the last weeks before the exam. No matter what your preparation style is, you will surely benefit from reviewing these 500 questions that closely parallel the content, format, and degree of difficulty of the questions on the actual AP exam. These questions and their answer explanations are the ideal last-minute study tool for those final few weeks before the test.

Remember the old saying "Practice makes perfect." If you practice with all the questions and answers in this book, we are certain you will build the skills and confidence needed to do great on the exam. Good luck!

—Editors of McGraw-Hill Education

Mina Lebitz has a BS in biology from the State University of New York at Albany and an MS in nutritional biochemistry from Rutgers University. She has more than 16 years of teaching experience at both the high school and college level. Ms. Lebitz received the *New York Times*' Teachers Who Make a Difference award in 2003 during her tenure at Brooklyn Technical High School and was the senior science tutor at one of the most prestigious tutoring and test prep agencies in the United States. Currently, she is doing research, writing, and assisting students in reaching their academic goals, while continuing to learn everything she can about science. Her website is www.idigdarwin.com.

The AP Chemistry exam has a multiple-choice section during which you are not allowed to use a calculator. In this section, you can round fairly generously to solve problems faster. However, do not round generously in the free-response problems. Calculators are allowed for most of the free-response section so you're expected to be precise in your calculations (and obey the rules for significant figures).

The questions in this book cover the material for both the free-response and multiple-choice sections of the AP Chemistry exam. Some calculations are best done with a calculator, but all of them can be done without one. In the multiple-choice section of the AP Chemistry exam, there will never be a problem that requires the correct answer from a different question to solve. To cover all the material related to the exam in this book, topics from free-response questions have been adapted into multiple-choice style questions. This required that some questions occur in groups referring to a common experiment or data set. These questions may rely on answers from other questions.

CONTENTS

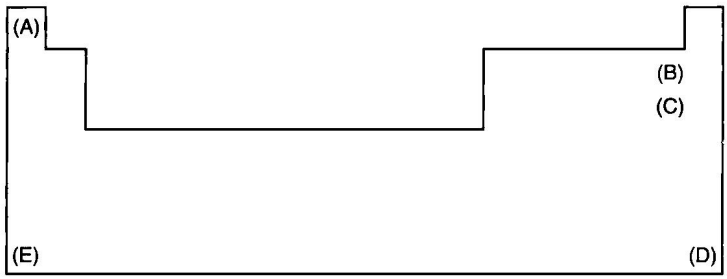
CHAPTER 1

Atomic Theory and Structure

1. Which of the following shows the correct number of protons, neutrons, and electrons in a neutral cadmium-112 atom?

	Protons	Neutrons	Electrons
(A)	48	48	48
(B)	48	64	48
(C)	48	64	64
(D)	64	48	64
(E)	112	48	112

Questions 2–7 refer to the following diagram of the periodic table.



2. Reacts violently with water at 298 K

3. Highest first ionization energy

4. Highest electronegativity

5. Highest electron affinity

6. Largest atomic radius

7. Most metallic character

8. The atomic mass of bromine is 79.904. Given that the only two naturally occurring isotopes are ^{79}Br and ^{81}Br, the abundance of ^{79}Br isotope is approximately:
(A) 20 percent
(B) 40 percent
(C) 50 percent
(D) 80 percent
(E) 99 percent

9. The atomic mass of Sr is 87.62. Given that there are only three naturally occurring isotopes of strontium,^{86}Sr, ^{87}Sr, and ^{88}Sr, which of the following must be true?
(A) ^{86}Sr is the most abundant isotope.
(B) ^{87}Sr is the most abundant isotope.
(C) ^{88}Sr is the most abundant isotope.
(D) ^{86}Sr is the least abundant isotope.
(E) The isotopes ^{87}Sr and ^{88}Sr occur in approximately equal amounts.

10. Which of the following properties generally *decreases* from left to right across a period (from potassium to bromine)?
(A) Electronegativity
(B) Electron affinity
(C) Atomic number
(D) Atomic radius
(E) Maximum value of oxidation number

11. All of the following statements describe the elements of the group 1 alkali metals (not including hydrogen) *except*:
(A) Their reactivity increases with increasing period number.
(B) They have low first ionization energies.
(C) They react violently with water to form strong acids.
(D) They have strong metallic character.
(E) They are all silver solids at 1 atm and 298 K.

12. Which of the following elements would be expected to have chemical properties most similar to those of phosphorus?

(A) S
(B) Se
(C) O
(D) As
(E) Si

13. Which of the following pairs are isoelectronic (have the same number of electrons)?

(A) Kr^-, Br^+
(B) F^-, Na^+
(C) Sc, Ti^-
(D) Be^{2+}, Ne
(E) Cs, Ba^{2+}

14. Which of the following ions has the same number of electrons as I^-?

(A) Sr^{2+}
(B) Rb^+
(C) Cs^+
(D) Ba^{2+}
(E) Br^-

15. Which of the following best explains why the F^- ion is smaller than the O^{2-} ion?

(A) F^- has a more massive nucleus than O^{2-}.
(B) F^- has a higher electronegativity than O^{2-}.
(C) F^- has a greater nuclear charge than O^{2-}.
(D) F^- has a greater number of electrons than O^{2-}.
(E) F^- has more nucleons and electrons than O^{2-}.

16. All of the following are true statements about the periodic table *except*:

(A) The reactivity of the group 1 alkali metals increases with increasing period.
(B) The reactivity of the group 17 halogens decreases with increasing period.
(C) The group 1 and 2 metals react with water to form basic solutions.
(D) The group 18 noble gases can exist only as inert, monatomic gases.
(E) All elements with an atomic number equal to or greater than 84 are radioactive.

17. Which of the following lists contains *all* the diatomic, elemental gases at standard temperatures and pressures?

(A) H, N, O
(B) H, N, O, F, Cl
(C) H, N, O, F, Cl, Br, I
(D) H, N, O, Cl, Br, I, Hg, Rn
(E) H, N, O, Cl, He, Ne, Ar, Kr, Xe, Rn

18. As atomic number increases from 11 to 17 in the periodic table, what happens to atomic radius?

(A) It remains constant.
(B) It increases only.
(C) It decreases only.
(D) It increases, then decreases.
(E) It decreases, then increases.

19. The effective nuclear charge experienced by a valence Kr is different than the effective nuclear charge experienced by a valence electron of K. Which of the following accurately illustrates this difference?

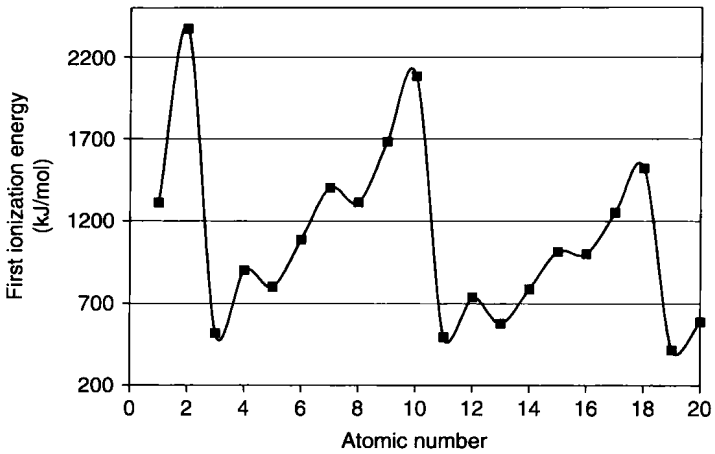
(A) K is a solid while Kr is a gas.
(B) The valence electrons of Kr have a lower first ionization energy than K.
(C) The proton-to-electron ratio is higher for Kr than for K.
(D) Kr has a higher first ionization energy than K.
(E) The valence electrons of Kr experience less shielding by the inner electrons than the valence electrons of K.

Ionization Energies for Element X ($kJ \cdot mol^{-1}$)				
First	Second	Third	Fourth	Fifth
786	1,577	3,228	4,354	16,100

20. Based on the ionization energies for element X listed in the table above, which of the following elements is X most likely to be?

(A) Li
(B) Be
(C) Al
(D) Si
(E) As

Questions 21 and 22 refer to the following graph of first ionization energies.



21. Correct explanations for the large drops in ionization energies between elements of atomic numbers 2 and 3, 10 and 11, and 18 and 19 occurs because, compared to elements 3, 11, and 19, elements 2, 10, and 18 have

I. smaller atomic radii.
II. a greater electron affinity.
III. a greater effective nuclear charge.

(A) I only
(B) II only
(C) III only
(D) I and III only
(E) I, II, and III

22. Correct explanations for the increases and decreases in ionization energies between elements between atomic numbers 2 and 10 (and 11 and 18) include:

I. There is repulsion of paired electrons in the p^4 configuration.
II. The electrons in a filled s orbital are more effective at shielding the electrons in the p orbitals of the same n than each other.
III. Filled orbitals and subshells are more stable than unfilled orbitals and subshells.

(A) I only
(B) II only
(C) III only
(D) I and II only
(E) I, II, and III

23. Which of the following chemical species is correctly ordered from smallest to largest radius?

(A) $P < S < Cl$
(B) $Ne < Ar < Kr$
(C) $F < O < O^{2-}$
(D) $K < K^{+} < Rb$
(E) $Na^{+} < Mg^{2+} < Na$

24. Which of the following electron configurations represents an atom in an excited state?

(A) $1s^2 2s^2 2p^5$
(B) $1s^2 2s^2 2p^5 3s^2$
(C) $1s^2 2s^2 2p^6 3s^1$
(D) $1s^2 2s^2 2p^6 3s^2 3p^5$
(E) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^1$

Questions 25–28 refer to the ground state atoms of the following elements:

(A) Ga
(B) Tc
(C) C
(D) S
(E) N

25. This atom contains exactly one unpaired electron.

26. This atom contains exactly two unpaired electrons.

27. This atom contains exactly two electrons in the highest occupied energy sublevel.

28. This element is radioactive.

Questions 29–35 refer to the following:

(A) $\underline{\uparrow\downarrow}$

(B) $\underline{\uparrow\downarrow}\ \ \underline{\uparrow\downarrow}\ \ \underline{\uparrow}\ \ \underline{\ }\ \ \underline{\ }$

(C) $\underline{\uparrow\downarrow}\ \ \underline{\uparrow\downarrow}\ \ \underline{\uparrow\downarrow}\ \ \underline{\uparrow\downarrow}\ \ \underline{\uparrow\downarrow}\ \ \underline{\uparrow}$

(D) $\underline{\uparrow\downarrow}\ \ \underline{\uparrow}\ \ \underline{\uparrow\downarrow}\ \ \underline{\uparrow\downarrow}\ \ \underline{\uparrow\downarrow}\ \ \underline{\uparrow\downarrow}$

(E) $\underline{\uparrow\downarrow}\ \ \underline{\uparrow\downarrow}\ \ \underline{\uparrow}\ \ \underline{\uparrow}\ \ \underline{\uparrow}$

29. A highly reactive, ground state metal

30. Highest first ionization energy

31. An atom in the excited state

32. An atom that forms a trigonal planar molecule when saturated with hydrogen

33. Has exactly five valence electrons

34. The most abundant element in Earth's atmosphere

35. A chemically unreactive atom

Questions 36–42 refer to the following:

(A) $\underline{\ }\ \ \underline{\uparrow}$

(B) $\underline{\uparrow\downarrow}\ \ \underline{\uparrow\downarrow}$

(C) $\underline{\uparrow\downarrow}\ \ \underline{\uparrow\downarrow}\ \ \underline{\uparrow\downarrow}\ \ \underline{\uparrow\downarrow}\ \ \underline{\uparrow\downarrow}$

(D) $\underline{\uparrow\downarrow}\ \ \underline{\uparrow\downarrow}\ \ \underline{\uparrow\downarrow}\ \ \underline{\uparrow\downarrow}\ \ \underline{\uparrow\downarrow}\ \ \underline{\uparrow}$

(E) [Ar] $\underline{\uparrow\downarrow}\ \ \underline{\uparrow\downarrow}\ \ \underline{\uparrow\downarrow}\ \ \underline{\uparrow}\ \ \underline{\uparrow}\ \ \underline{\uparrow}$

36. An atom in the excited state

37. An atom whose aqueous cation is colored

38. A chemically unreactive atom

39. An atom that forms an alkaline solution and hydrogen gas when combined with water

40. An atom with the highest second ionization energy

41. An atom that forms colored compounds

42. A highly reactive metal

43. Which of the following is the most accurate interpretation of Rutherford's experiment in which he bombarded gold foil with alpha particles?

(A) Electrons are arranged in shells of increasing energy around the nucleus of an atom.
(B) The volume of an atom is mostly empty space with the positive charges concentrated in a dense nucleus.
(C) Protons and neutrons are more massive than electrons but take up less space.
(D) Atoms are made of subatomic particles of different charges and masses.
(E) Discrete emissions spectrum lines are produced because only certain energy states of electrons are allowed.

44. All of the halogens in their element form at 25°C and 1 atm are:

(A) Gases
(B) Colorless
(C) Odorless
(D) Negatively charged
(E) Diatomic molecules

Questions 45–49 refer to the following choices:

(A) Alkali metals
(B) Noble gases
(C) Halogens
(D) Transition elements
(E) Actinides

45. The most likely to form anions

46. Their monovalent cations form clear solutions

47. Have the highest ionization energies in a given period