

1000 Practices for AP Chemistry

AP 化学

过关心练1000题

1000道AP习题 直击考试新趋势

完全覆盖 AP考试大纲 范围

英文解析详尽, 重点知识 深入剖析

一线名师 助力留学成功

- 美国本科预修课程
- 降低大学受教育成本
- 为高中生**减免**大学学分
- **缩短**大学受教育时间

李玉枝 主编

中国石化出版社

[HTTP://WWW.SINOPEC-PRESS.COM](http://www.sinopec-press.com)

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内容提要

本书依据 AP 化学考试大纲对各知识点学习比重的要求来进行题目编写，主要分为：原子理论、化学键、核化学、物质的状态、化学反应、有机化学、化学实验，这七大部分，知识点涵盖全面，基础与拔高兼顾，每道练习题目都配有答案和详细的试题讲解。本书适用于 AP 化学考试复习中的各个阶段，通过本书的练习，广大考生能够快速掌握 AP 化学考试特点和应试技巧，并能够在短时间内迅速提高自己的应试能力。

图书在版编目 (CIP) 数据

AP 化学过关必练 1000 题 / 李玉技主编. —北京:
中国石化出版社, 2014. 8
ISBN 978-7-5114-2959-9

I. ①A… II. ①李… III. ①化学-高等学校-入学考试-美国-习题集-汉、英 IV. ①06-44

中国版本图书馆 CIP 数据核字(2014)第 180208 号

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中国石化出版社出版发行

地址：北京市东城区安定门外大街 58 号

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读者服务部电话：(010)84289974

<http://www.sinopec-press.com>

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北京科信印刷有限公司印刷

全国各地新华书店经销

*

787×1092 毫米 16 开本 15 印张 361 千字

2014 年 10 月第 1 版 2014 年 10 月第 1 次印刷

定价：40.00 元

◀ 前言

据美国大学理事会的年度报告,申请顶尖名校的学生向大学招生办提供了平均 4~5 门 AP(Advanced Placement)成绩,而 AP 成绩在所有录取因素中以 80.3% 的影响力居第一位。因此,在 SAT 和 TOEFL 成绩的基础上,AP 成绩成了步入名校竞争的新项目。随着中国学生留学大潮的涌来,加上 AP 课程在中国本土的开设,AP 考试成为时下最时髦的留学考试之一。

AP 化学是 AP 考试中的重要组成部分。AP 化学的主要内容有:元素周期性、固体和液体、气体、化学反应、化学计量学、化学热力学、溶液、酸和碱、化学反应平衡、电化学、核化学和有机化学等。AP 化学考试分为两部分,第一部分为选择题,共有 75 个题;第二部分为简答题,共有 3~6 个题。除基础知识外,包含大量的理解、综合性题目,特别强调学生应充分准备,且不要期望全答对,不应因题目的广泛而放弃 AP 化学考试。

AP 登陆中国的时间还不长,因而适合中国考生的 AP 教材还较少。国外一些经典的 AP 教材如巴朗、普林斯顿和皮尔森等书,对一些英语基础较为薄弱的中国考生来说还不太易懂。因此我们经过多年考察、对比、分析、研究之后,总结出了一套适合中国考生的学习方案,并按照此方案编写了本书,现将本书特点介绍如下:

1. 本书题目涵盖 AP 化学考试科目的所有知识点、考试题型,严格以最新考试大纲规定的核心知识点为准,没有超纲题、偏题、怪题,旨在帮助考生更快地掌握 AP 考试的架构。

2. 题目设计包括基础题和实战题。基础题主要是为学习完化学课程的考生设定,通过练习,可以加强其对教材内容的理解与认识;而实战题则严格以考试真题的内容、格式和难度为准,与命题思路和要求相吻合,可以为考生在做模拟试卷之前提供一些对真题模式的认知。

3. 题目难度适当,区分度好,分章节进行练习,可以作为考生教材学习的配套习题集,而不像模拟试题那样将所有内容混合在一起,不必学完所有内容再做题。

4. 所有题目都配备完整详细的习题答案,其解题步骤也以真题为准,可以让考生在做题时形成一定的做题习惯,从而在考试中思路清晰,一举拿到高分。

俗话说“熟能生巧”,如果你练习了本书提供的所有习题,就能掌握一些考试的解题技巧,从而在考试中能够应对自如。

最后,预祝所有使用本书的考生都能取得 AP 化学的理想成绩,并由此顺利踏上您的升学之路。

编者

◉ 目录 ◻

第一章 原子理论	(1)
第一节 原子结构	(1)
第二节 原子序数与质量数	(4)
第三节 同位素	(6)
第四节 电子能级	(8)
第五节 元素周期表	(13)
第二章 化学键	(18)
第三章 核化学	(25)
第四章 物质的状态	(28)
第一节 气体	(28)
第二节 液体和固体	(37)
第三节 溶液	(47)
第五章 化学反应	(57)
第一节 酸碱反应	(57)
第二节 沉淀反应	(64)
第三节 氧化还原反应和电化学	(67)
第四节 化学计量学	(82)
第五节 化学平衡	(89)
第六节 化学反应动力学	(98)
第七节 化学反应热力学	(107)
第六章 有机化学	(120)
第七章 化学实验	(128)
参考答案	
第一章 原子理论	(136)
第一节 原子结构	(136)
第二节 原子序数与质量数	(137)
第三节 同位素	(138)
第四节 电子能级	(140)
第五节 元素周期表	(143)

第二章 化学键	(146)
第三章 核化学	(152)
第四章 物质状态	(155)
第一节 气体	(155)
第二节 液体和固体	(162)
第三节 溶液	(168)
第五章 化学反应	(176)
第一节 酸碱反应	(176)
第二节 沉淀反应	(182)
第三节 氧化还原反应和电化学	(184)
第四节 化学计量学	(194)
第五节 化学平衡	(200)
第六节 化学反应动力学	(207)
第七节 化学反应热力学	(213)
第六章 有机化学	(222)
第七章 化学实验	(229)

第一章 原子理论

第一节 原子结构

基础题

- Which of the following is the best definition of an atom?
 - The smallest particle of an element.
 - The basic building block of an element.
 - The smallest part of an element that can take part in a chemical change.
 - The smallest part of an element which can ever exist.
- Which of the following statements concerning atoms is **INCORRECT**?
 - All atoms are made up of protons, neutrons and electrons.
 - An atom is mostly empty space, occupied by electrons.
 - Most of the mass of an atom is in its nucleus.
 - Electrons of the atom move around the nucleus, just like planets move around the sun.
- Which of the following statements concerning nucleus is correct?
 - All atoms of the same element must have the same number of protons and neutrons in their nuclei.
 - The nucleus of oxygen atom is about 8×1837 times heavier than the rest of the atom.
 - The nucleus is about 1/100 the size of

the atom.

- The nucleus of a certain element is different from that of any other element.
- A certain atom contains 63 protons. How many electrons and neutrons does it have?

Number of electrons	Number of neutrons
A. 63	63
B. 63	unpredictable
C. unpredictable	63
D. unpredictable	unpredictable
 - Atoms are electrically neutral because
 - any atom has equal numbers of protons and electrons.
 - any atom has equal numbers of protons and neutrons.
 - neutrons are neutral.
 - electrons are gained or lost to balance the electric charge.

实战题(选择)

Questions 6 through 9 refer to atoms of the following elements.

- | | |
|--------------|-----------|
| A. Beryllium | B. Boron |
| C. Carbon | D. Oxygen |
| E. Fluorine | |
- In the ground state, has two electrons in one (and only one) of the p orbitals.

7. Has the largest atomic radius.
8. Has the largest value of the first ionization energy.
9. Has the smallest second ionization energy.
10. The determination that atoms have small, dense nuclei is attributed to
 A. Rutherford. B. Becquerel.
 C. Einstein. D. Dalton.
 E. Bohr.
11. Which of the following statements about copper are correct?
 I. Copper consists of copper atoms only.
 II. Cu is the atomic symbol for a copper atom.
 III. Cu is the chemical symbol for the element copper.
 A. I and II only.
 B. I and III only.
 C. II and III only.
 D. I, II and III.
 E. II only.
12. The nuclei of all atoms (except hydrogen) consist of
 I. electrons.
 II. neutrons.
 III. protons.
 Which of the following is correct?
 A. I only.
 B. II only.
 C. I and III only.
 D. II and III only.
 E. I and II only.
13. Which of the following have approximately the same mass as a helium atom (with 2 protons, 2 neutrons and 2 electrons)?
 I. 4 protons
 II. 4 neutrons
 III. 4 hydrogen atoms (each with 1 proton and 1 electron)
 A. I and II only.
 B. I and III only.
 C. II and III only.
 D. I, II and III.
 E. III only.
14. Which of the following is closest in mass to a proton?
 A. Alpha particle. B. Positron.
 C. Neutron. D. Electron.
 E. Hydrogen molecule.
15. The reactivity and chemical behavior of an atom is governed by many factors. The most important factor is
 A. the number of protons in the atom's nucleus.
 B. the number of neutrons in the atom's nucleus.
 C. the number of protons and neutrons in the atom's nucleus.
 D. the ratio of protons to neutrons in the atom's nucleus.
 E. the number of electrons in the atom's valence shell
16. Which of the following was not a conclusion of Rutherford's gold foil experiment?
 A. The atom is mainly empty space.
 B. The nucleus has a negative charge.
 C. The atom has a dense nucleus.
 D. Alpha particles can pass through a thin sheet of gold foil.
 E. All of the above are correct regarding the gold foil experiment.
17. Which of the following would not be attracted or deflected while traveling through an electric field?
 I. Gamma ray
 II. Beta particle

III. Neutron

- A. I only.
- B. II only.
- C. I and II only.
- D. I and III only.
- E. I, II and III.

18. What is the ratio of the rate of effusion of hydrogen gas to that of helium gas?

- A. 1.41.
- B. 2.00.
- C. 4.00.
- D. 0.50.
- E. 1.00.

For the next three problems below, one or more of the following responses will apply; each response may be used more than once or not at all in these questions.

- I. Rydberg equation
- II. Heisenberg uncertainty principle
- III. Hund's rule
- IV. Pauli exclusion principle
- V. Bohr model

19. Our inability to precisely know the position and momentum of a subatomic particle is summarized by

- A. I
- B. II
- C. III
- D. IV
- E. V

20. In filling the atom with electrons, the rule(s) that must be considered are

- A. I and III
- B. II and V
- C. III and IV
- D. IV
- E. III

21. The best tool to use to calculate the ionization energy of a hydrogen atom is

- A. I
- B. II
- C. III
- D. IV
- E. V

22. Which of the following principles is NOT part of Dalton's atomic theory?

- A. Atoms are the smallest, indivisible particles in nature.
- B. Chemical reactions are simple rearrangements of atoms.
- C. Atoms follow the law of multiple proportions.
- D. Each atom of an element is identical to every other atom of that element.
- E. All matter is composed of atoms.

23. Which is true of the $^{243}\text{Am}^{3+}$ ion?

Protons	Electrons	Neutrons
A. 95	92	243
B. 95	98	243
C. 95	95	148
D. 95	92	148
E. 92	95	148

24. Which of the following is not part of the Atomic Theory?

- A. Compounds are made up of combinations of atoms.
- B. All atoms of a given element are alike.
- C. All matter is composed of atoms.
- D. A chemical reaction involves the rearrangement of atoms.
- E. The atom is mainly empty space.

25. Which of the following pairs of substances can be broken down chemically?

- A. Ammonia and iron.
- B. Helium and argon.
- C. Methane and water.
- D. Potassium and lithium.
- E. Water and carbon.

第二节 原子序数与质量数

基础题

Questions 26~28 refer to an element E , the nucleus of an atom of which contains 39 protons and 50 neutrons.

26. What is the atomic number of the element E ?

A. 39. B. 50.

C. 89.

D. It cannot be determined unless the name of E is given.

27. What is the number of electrons in an atom of E ?

A. 11. B. 39.

C. 50. D. 89.

28. What is the mass number of the E atom?

A. 39. B. 50.

C. 89. D. 128.

Questions 29~30 refer to the following atoms:

A. ${}_{94}^{239}\text{Q}$ B. ${}_{93}^{239}\text{X}$

C. ${}_{92}^{235}\text{Y}$ D. ${}_{90}^{234}\text{Z}$

29. Which atom has the largest number of electrons?

30. Which atom has the largest number of neutrons?

31. The relative isotopic mass of ${}_{17}^{37}\text{Cl}$ is

A. 37. B. 17. C. 35.5.

D. unknown unless the percentage abundance of ${}_{17}^{37}\text{Cl}$ is given.

32. The relative isotopic mass of ${}^{40}\text{Ca}$ is

A. 40 B. 40.1 C. 20

D. unknown unless the atomic number of calcium is also given.

33. From the full atomic symbol ${}_{6}^{13}\text{C}$, it can be deduced that

A. any carbon atom has 6 protons and 7

neutrons.

B. the relative *atomic mass* of carbon is 12.

C. the relative *isotopic mass* of ${}_{6}^{13}\text{C}$ is 13.

D. an atom of the ${}_{6}^{13}\text{C}$ isotope contains 13 electrons.

34. The element oxygen has a relative atomic mass of 16.0. Which of the following is true?

A. The average mass of an oxygen atom is 16.0 units on the ${}^{12}\text{C} = 12.000\,00$ scale.

B. Each atom of oxygen weighs 16.0g.

C. The sum of protons and neutrons in every oxygen atom is 16.

D. The density of oxygen is 16.0g dm^{-3} at room conditions.

35. Calcium has a relative atomic mass of 40.1. It is *not* a whole number because

A. mass of electrons has also been taken into account.

B. there are fractional protons.

C. there are fractional neutrons.

D. isotopes of calcium exist.

实战题(选择)

36. Atoms of the *same* element must have the same

I. atomic number.

II. number of electrons.

III. number of neutrons.

Which of the following is correct?

A. I and II only.

B. I and III only.

C. II and III only.

D. I, II and III.

E. III only.

37. Which of the following concerning an atom can be determined if its atomic number is known?

- I . Number of protons
- II . Number of electrons
- III . Number of neutrons

- A. I and II only.
- B. I and III only.
- C. II and III only.
- D. I , II and III .
- E. I only.

38. The atomic number and mass number of an aluminium atom are 13 and 27 respectively. Its nucleus contains

- A. 27 neutrons and 13 protons.
- B. 13 neutrons and 27 protons.
- C. 13 neutrons and 14 protons.
- D. 14 neutrons and 13 protons.
- E. 14 neutrons and 27 protons.

39. The atomic number of an element X is 17. An atom of X has a mass number of 37. The atom has

Electrons	Protons	Neutrons
A. 20	20	17
B. 17	17	20
C. 17	20	17
D. 37	17	20
E. 37	20	17

40. Which of the following combinations of atomic number and mass number can represent an atom with 92 electrons and 143 neutrons?

Atomic number	Mass number
A. 92	327
B. 92	235
C. 143	327
D. 143	235
E. 92	143

41. Which of the following correctly describes the atomic structure of an atom

${}_{92}^{239}\text{U}$?

Protons	Electrons	Neutrons
A. 146	92	92
B. 92	146	146
C. 146	146	92
D. 92	92	146
E. 92	146	92

42. The mass of one atom of the ${}^2_1\text{H}$ isotope is

- A. 2g.
- B. 2.
- C. 3.34×10^{-24} g.
- D. 3.34×10^{-24} .
- E. 2×10^{-24} .

43. What is the number of protons and neutrons in an atom with mass number 89 and atomic number 39?

- A. 50 protons and 50 neutrons.
- B. 50 protons and 39 neutrons.
- C. 39 protons and 89 neutrons.
- D. 39 protons and 50 neutrons.
- E. 39 protons and 39 neutrons.

44. Twenty-five percent of element X exists as ${}^{210}\text{X}$ and 75 percent of it exists as ${}^{214}\text{X}$.

What is the atomic weight of element X in amu?

- A. 85.
- B. 211.
- C. 212.
- D. 213.
- E. 214.

45. How many electrons does a ${}^{37}\text{Cl}$ ion with a charge of -1 contain?

- A. 16.
- B. 17.
- C. 18.
- D. 37.
- E. 38.

46. Which of the following are correct about the subatomic particles found in ${}^{37}\text{Cl}^{1-}$?

- I . 21 neutrons
- II . 17 protons
- III . 16 electrons

- A. II only. B. III only.
 C. I and II only. D. I and III only.
 E. II and III only.
47. What is the molar mass of $\text{Ca}_3(\text{PO}_4)_2$?
 A. 310 grams/mole.
 B. 154 grams/mole.
 C. 67 grams/mole.
 D. 83 grams/mole.
 E. 115 grams/mole.
48. Of the statements below, which holds true for the elements found in

- Na_2HPO_4 ?
- A. The total molar mass is 71 grams/mole.
 B. The percent by mass of oxygen is 45%.
 C. The percent by mass of sodium is 16%.
 D. The percent by mass of phosphorus is 44%.
 E. The percent by mass of hydrogen is 13%.

第三节 同位素

基础题

49. Which pair of atoms are isotopes of the same element? (The atomic symbols are not shown.)
 A. ${}^1_6\text{C}$ and ${}^1_7\text{N}$ B. ${}^{226}_{90}\text{Po}$ and ${}^{227}_{91}\text{Ac}$
 C. ${}^{226}_{92}\text{Po}$ and ${}^{226}_{92}\text{Pb}$ D. ${}^{235}_{92}\text{U}$ and ${}^{238}_{92}\text{U}$
50. Different isotopes of an element have the same
 A. mass.
 B. mass number.
 C. number of neutrons.
 D. chemical properties.
51. What would a ${}^{13}\text{N}$ atom become if one of its protons changes to a neutron?
 A. ${}^{13}\text{O}$. B. ${}^{14}\text{O}$.
 C. ${}^{13}\text{C}$. D. ${}^{14}\text{C}$.
52. Copper consists of two isotopes: ${}^{63}\text{Cu}$ and ${}^{65}\text{Cu}$. The relative atomic mass of copper is 63.5. Which of the following statements is/are correct?
 I. The relative abundance of the two isotopes is about the same.
 II. The two isotopes have different numbers of protons.
 III. The two isotopes have different

numbers of neutrons.

- A. II only.
 B. III only.
 C. I and II only.
 D. II and III only.
53. The relative atomic mass of a certain element X is 39.1. X has 2 isotopes ${}^{39}\text{X}$ and ${}^Y\text{X}$ with relative abundance of 90% and 10% respectively. What is the value of Y?
 A. 40. B. 41.
 C. 42. D. 43.

实战题(选择)

54. Choose the group that does not contain isotopes of the same element.

	Number of protons	Number of neutrons
A. Atom I	18	18
Atom II	18	19
B. Atom I	25	30
Atom II	25	31
C. Atom I	37	42
Atom II	37	41
D. Atom I	82	126
Atom II	82	128

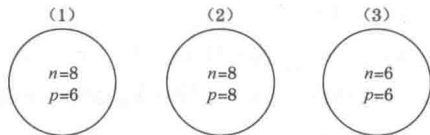
- E. Atom I 18 18
Atom II 17 18

55. Natural oxygen consists of three isotopes of mass numbers 16, 17 and 18 respectively. Which of the following statements concerning the three isotopes are correct?

- I. The isotope oxygen - 18 has 18 electrons in its atom.
II. The isotope oxygen - 17 has 9 neutrons in its atom.
III. The isotope oxygen - 16 is the most abundant isotope among the three.

- A. I and II only.
B. I and III only.
C. II and III only.
D. I, II and III only.
E. II only.

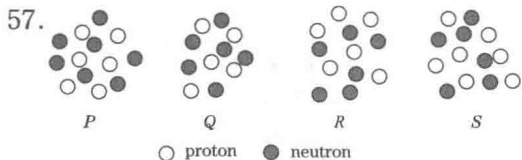
56. The circle shown below represent the nuclei of three atoms:



(n = number of neutrons;
 p = number of protons)

Which of the above are nuclei of atoms which are isotopes of one another?

- A. I and II only.
B. I and III only.
C. II and III only.
D. I, II and III.
E. III only.



The above figure shows the nuclei of four atoms P , Q , R and S . Which two atoms are isotopes?

- A. P and R . B. P and S .
C. Q and R . D. Q and S .
E. P and Q .

58. Silver consists of two isotopes ^{107}Ag and ^{109}Ag , in approximately equal ratio. Deduce the approximate relative atomic mass of silver.

- A. 107 B. 108
C. 109 D. 216
E. 217

59. Gallium consists of two isotopes. The following lists the relative abundance of these two isotopes.

Isotope	Relative abundance
$^{69}_{31}\text{Ga}$	60.0%
$^{71}_{31}\text{Ga}$	40.0%

The relative atomic mass of gallium (correct to 1 decimal place) is

- A. 69.8g B. 69.8
C. 70.0g D. 70.0
E. 71.0g

60. Which statement below is inconsistent with the concept of isotopes?

- A. Each element is composed of atoms.
B. All atoms of an element are identical.
C. The atoms of different elements have different chemical and physical properties.
D. The combining of elements leads to the formation of compounds.
E. In a compound, the kinds and numbers of atoms are constant.

61. Bromine has just two major isotopes giving it an atomic mass of 79.904 amu. Based on this information, which of the following statements can explain the atomic mass value?

- A. The isotope, Br-81, is more common than Br-79.
B. Br-79 and Br-81 exist in about equal

proportions.

- C. Br-78 is about twice as abundant as Br-81.
- D. Br-82 is more abundant than Br-79.
- E. The two major isotopes of Br have 45 and 46 neutrons.
62. Which statement is inconsistent with the concept of isotopes of the same elements?
- A. Isotopes have the same number of protons.
- B. Isotopes have the same atomic number.
- C. Isotopes differ in mass number.
- D. Isotopes differ in number of neutrons present.
- E. Isotopes differ in their nuclear charge.
63. Substance X has three common isotopes: X-48, X-49, and X-51. If the relative abundances of these isotopes are 42%, 38%, and 20%, respectively, what is the atomic mass of substance X?
- A. 49.33. B. 48.62.
- C. 50.67. D. 48.98.
- E. 49.67.

64. There are three common isotopes of naturally occurring magnesium as indicated in the table below.

Isotope	Mass (amu)	Percent Abundance
Mg-24	24.0	79.0%
Mg-25	25.0	10.0%
Mg-26	26.0	11.0%

Using the information above, calculate the average atomic mass of magnesium.

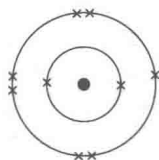
65. The two stable isotopes of chlorine have masses of 34.969 amu and 36.966 amu.
- A. What are the mass numbers of the two isotopes of chlorine?
- B. Calculate the % abundance of the lighter isotope.
- C. How many types of molecules with different masses exist in a sample of chlorine gas if the sample exists entirely as diatomic molecules? Explain your answer.
- D. Calculate the mass of the chlorine molecule having the largest molecular mass.
- E. What is the mass of the most abundant molecule?

第四节 电子能级

基础题

66. Two atoms X and Y have atomic numbers n and $(n + 1)$ respectively. It can be deduced that
- A. Y has 1 more electron shell than X.
- B. Y has 1 more electron than X.
- C. Y has 1 more neutron than X.
- D. if X has atomic mass of A_r , Y must have an atomic mass of $A_r + 1$.

67. The electron diagram of a certain atom (with 10 neutrons) is shown below.



- A. ${}_{9}^{19}\text{F}$ B. ${}_{19}^9\text{F}$
- C. ${}_{7}^{17}\text{N}$ D. ${}_{17}^7\text{N}$
68. The electronic arrangement of an atom ${}_{9}^{19}\text{X}$ (X is not a chemical symbol) is

A. 2, 8, 9 B. 2, 8, 8, 1

C. 2, 7

D. unknown, unless the name of the element is given.

69. In one of the following groupings, all three atoms have the same number of electrons in the outermost shell. Which is the grouping?

A. O, F, Ne. B. Li, Na, Al.

C. Be, Mg, Ca. D. H, He, K.

实战题(选择)

Questions 70~73

A. $1s^2 2s^2 2p^6 3s^2 3p^6$

B. $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2$

C. $1s^2 2s^2 2p^6 3s^2 3p^6 4s^1$

D. $1s^2$

E. $1s^2 2s^2 2p^6 3p^1$

70. The electron configuration for calcium ion

71. The electron configuration for an excited atom

72. The electron configuration for potassium in the ground state

73. The electron configuration for the noble gas with the highest first ionization energy

74. The ground-state configuration of Fe^{2+} is which of the following?

A. $1s^2 2s^2 2p^6 3s^2 3p^6 3d^5 4s^1$.

B. $1s^2 2s^2 2p^6 3s^2 3p^6 3d^6$.

C. $1s^2 2s^2 2p^6 3s^2 3p^6 3d^6 4s^2$.

D. $1s^2 2s^2 2p^6 3s^2 3p^6 3d^8 4s^2$.

E. $1s^2 2s^2 2p^6 3s^2 3p^6 3d^4 4s^2$.

75. Which of the following contains only atoms that are diamagnetic in their ground state?

A. Kr, Ca, and P.

B. Cl, Mg, and Cd.

C. Ar, K, and Ba.

D. He, Sr, and C.

E. Ne, Be, and Zn.

76. A valence electron from an arsenic atom might have an electron with the following set of quantum numbers in the ground state.

A. $n = 4; l = 1; m_l = 0; m_s = +\frac{1}{2}$

B. $n = 4; l = 1; m_l = 2; m_s = -\frac{1}{2}$

C. $n = 3; l = 1; m_l = 0; m_s = +\frac{1}{2}$

D. $n = 5; l = 1; m_l = -1; m_s = -\frac{1}{2}$

E. $n = 4; l = 2; m_l = +1; m_s = +\frac{1}{2}$

77. In the ground state the highest-energy electron of a rubidium atom might have which of the following sets of quantum numbers?

A. $n = 5; l = 0; m_l = 1; m_s = +\frac{1}{2}$.

B. $n = 5; l = 1; m_l = 1; m_s = +\frac{1}{2}$.

C. $n = 4; l = 0; m_l = 0; m_s = +\frac{1}{2}$.

D. $n = 5; l = 0; m_l = 0; m_s = +\frac{1}{2}$.

E. $n = 6; l = 0; m_l = 0; m_s = +\frac{1}{2}$.

78. What is the maximum number of electrons that the fourth electron shell of an atom can hold?

A. 8. B. 18.

C. 28. D. 32.

E. 36.

79. The number of electrons in the first 3 shells of an atom of gold (atomic number 79) add up to

A. 10. B. 18.

C. 28. D. 79.

E. 81.

80. Which of the following is the electronic arrangement of an element with atomic number 15?

- A. 2, 8, 5. B. 2, 10, 3.
 C. 2, 2, 8, 3. D. 2, 8, 2, 3.
 E. 2, 8, 4, 1.

81. An element X has the electronic arrangement of 2, 8, 18, 32, 18, 6. What is the atomic number of X ?

- A. 6. B. 18.
 C. 82. D. 84.
 E. 86.

82. The electron configuration $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^1$ represents an atom of the element

- A. Br. B. Co.
 C. Cd. D. Ga.
 E. Mg.

83. The electron configuration for an atom of the element Tc is

- A. $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^2 4p^5 5s^2 5p^6$.
 B. $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^2 4p^3 5s^2 4d^5$.
 C. $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^2 4p^3$.
 D. $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{15}$.
 E. $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^2 4p^6 5s^2 4d^5$.

84. A neutral species whose electron configuration is $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^2 4p^6 4d^{10} 5s^2 5p^6$ is

- A. highly reactive.
 B. a positively charged ion.
 C. a noble gas.
 D. a transition metal.
 E. a lanthanide element.

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

- A. $1s^2 2s^2 2p^6$.
 B. $1s^2 2s^2 2p^6 3s^2$.
 C. $1s^2 2s^2 2p^5 3s^2 3p^2$.
 D. $1s^2 2s^2 2p^6 3s^1 3p^1$.

E. $1s^2 2s^2 2p^6 3s^1 3p^2$.

86. Which of the following atoms has the largest second ionization energy?

- A. Silicon, Si. B. Calcium, Ca.
 C. Chlorine, Cl. D. Iron, Fe.
 E. Sodium, Na.

87. In a hydrogen atom, when an electron jumps from an excited energy state to a more stable energy state,

- A. electromagnetic radiation is emitted by the atom.
 B. electromagnetic radiation is absorbed by the atom.
 C. the atom becomes a positively charged ion.
 D. the atom becomes a negatively charged ion.
 E. the atom undergoes nuclear decay.

88.

Element	First Ionization Energy (kJ/mol)
Lithium	520
Sodium	496
Rubidium	403
Cesium	376

Based on the table above, which of the following is most likely to be the first ionization energy for potassium?

- A. 536 kJ/mol. B. 504 kJ/mol.
 C. 419 kJ/mol. D. 391 kJ/mol.
 E. 358 kJ/mol.

89. A neutral atom has a total of 17 electrons. The electron configuration in the outermost principle energy level will look closest to

- A. $1s^2 2s^2 2p^5$. B. $3s^5 3p^2$.
 C. $s^2 p^5$. D. $s^2 p^8 d^7$.
 E. sp^7 .

90. Which of the following types of electro-

- magnetic radiation has the highest energy?
- A. visible. B. ultraviolet.
C. microwave. D. infrared.
E. X rays.
91. An electron with the four quantum numbers $3, 2, -1, -\frac{1}{2}$ may be an electron in an unfilled sublevel of
- A. Ca. B. Fe.
C. Al. D. Ar.
E. Ag.
92. Which of the following is FALSE?
- A. The 4d orbitals are in the fourth period of the periodic table.
B. The 7s orbitals are in the seventh period of the periodic table.
C. The 4f orbitals are in the sixth period of the periodic table.
D. The 6s orbitals are spherical in shape.
E. The 5p orbitals are dumbbell-shaped.
93. Which of the following is a correct representation of the electron configuration for molybdenum?
- A. $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6 5s^2 4d^4$.
B. $[\text{Ar}]5s^2 4d^4$. C. $[\text{Ar}]5s^1 4d^5$.
D. $[\text{Kr}]5s^1 4d^5$. E. $[\text{Kr}]5s^2 5d^4$.
94. Compound A combines with chlorine as ACl_2 . Which of the following is likely to be its electron configuration?
- A. $1s^2 2s^2 2p^6 3s^1$. B. $1s^2 2s^2 2p^6 3s^2$.
C. $1s^2 2s^1$. D. $1s^2 2s^2 2p^6$.
E. $1s^2 2s^2 2p^6 3s^2 3p^1$.
95. How many electrons can be accommodated in all the atomic orbitals that correspond to the principal quantum number 4?
- A. 2. B. 8.
C. 18. D. 32.
E. 40.
96. Which of the following does NOT represent a possible set of quantum numbers?
- A. $2, 2, 0, \frac{1}{2}$. B. $2, 1, 0, -\frac{1}{2}$.
C. $4, 0, 0, -\frac{1}{2}$. D. $3, 2, 0, \frac{1}{2}$.
E. $4, 3, 1, \frac{1}{2}$.
97. Which of the following only has 1 electron in a *p* orbital?
- A. carbon. B. fluorine.
C. hydrogen. D. nitrogen.
E. aluminum.
98. An energy value of 3.313×10^{-19} joules is needed to break a chemical bond. What is the wavelength of energy needed to break the bond?
- A. 5.00×10^{18} cm.
B. 1.00×10^{15} cm.
C. 2.00×10^5 cm.
D. 6.00×10^{-5} cm.
E. 1.20×10^{-8} cm.
99. What is the electron configuration of tin (Sn) in the ground state in order of filling orbitals from low energy to high energy?
- A. $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6 5s^2 4d^{10} 5p^2$.
B. $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^2 4p^6 4d^{10} 5s^2 5p^2$.
C. $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^2 4p^6 4d^{10} 5s^1 5p^3$.
D. $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^2 4p^6 4d^{10} 5s^2 5p^1$.
E. $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^2 4p^6 4d^{10} 4f^4$.
100. What is the wavelength of light that has a frequency of 6.0×10^{14} Hz?
- A. 2000 nm. B. 500 nm.
C. 200 nm. D. 2.0×10^6 nm.
E. 5.0×10^{-7} nm.
101. A blue line in the atomic emission spectrum of hydrogen has a wavelength of 434 nm. What is the energy of this light per mole of photons?
- A. $(10^6)(6.63)(3.00)(6.02)/(434)$