


Chemistry 12  
 Exam I Form A  
 July 8, 2005

Name \_\_\_\_\_  
 Section \_\_\_\_\_  
 Student No. \_\_\_\_\_

**IMPORTANT:** On the scantron (answer sheet), you **MUST** clearly fill your **name**, your **student number**, **section number**, and **test form** (white cover = test form A; yellow cover = test form B). Use a #2 pencil.

**PENNSTATE** University Testing Services Form 5CH94



NAME \_\_\_\_\_

COURSE \_\_\_\_\_

DATE \_\_\_\_\_

**Print:**  
 Name \_\_\_\_\_  
 Course \_\_\_\_\_  
 Date \_\_\_\_\_

\* USE A NO. 2 PENCIL ONLY.  
 \* MARK ONLY ONE ANSWER FOR EACH ITEM.

STUDENT NUMBER	SEC. NO	BOOK NO.	SCORE
0 0 0 0 0 0 0 0 0 0	0 0 0	0 0 0 0	0 0 0
1 1 1 1 1 1 1 1 1 1	1 1 1	1 1 1 1	1 1 1
2 2 2 2 2 2 2 2 2 2	2 2 2	2 2 2 2	2 2 2
3 3 3 3 3 3 3 3 3 3	3 3 3	3 3 3 3	3 3 3
4 4 4 4 4 4 4 4 4 4	4 4 4	4 4 4 4	4 4 4
5 5 5 5 5 5 5 5 5 5	5 5 5	5 5 5 5	5 5 5
6 6 6 6 6 6 6 6 6 6	6 6 6	6 6 6 6	6 6 6
7 7 7 7 7 7 7 7 7 7	7 7 7	7 7 7 7	7 7 7
8 8 8 8 8 8 8 8 8 8	8 8 8	8 8 8 8	8 8 8
9 9 9 9 9 9 9 9 9 9	9 9 9	9 9 9 9	9 9 9

TEST FORM	A B C D E F G H I J
SPECIAL CODE	1 2 3 4

**Code:**  
 Student Number \_\_\_\_\_  
 Section Number \_\_\_\_\_  
 Test Form \_\_\_\_\_

There are 29 questions on this exam. Check that you have done all of the problems and filled in the first 29 bubbles on the scantron. Your score will be reported in percents (max 100%).

**Exam policy**

- Calculators with text-programmable memory **are not** allowed.
- Relevant data and formulas, including the periodic table, are attached at the end of this exam.
- Your grade will be based only on what is on the scantron form.
- The answer key will be posted on the web after the exam (under "News").

**Hints**

- As you read the question, underline or circle key words to highlight them for yourself. Avoid errors from "mis-reading" the question.
- Pay attention to units and magnitudes (decimal places) of numbers obtained from calculations.
- There is no penalty for guessing.

## Chemistry 12 Exam 1

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1. A cube of an unknown metal measures 1.61 mm on one side. The mass of the cube is 36mg. Which of the following is most likely the unknown metal?

Metal	Density (g/cm <sup>3</sup> )
rhodium	12.4
copper	8.96
niobium	8.57
vanadium	6.11
zirconium	6.51

(Note: since this is experimental data. Do not expect an "exact" result but rather one that is correct within the accuracy as given by the significant figures.)

- A. copper
  - B. rhodium
  - C. niobium
  - D. vanadium
  - E. zirconium
2. Which pair of atoms constitutes a pair of isotopes of the same element

- A.  ${}^{14}_6X$        ${}^{14}_7X$
- B.  ${}^{14}_6X$        ${}^{12}_6X$
- C.  ${}^{17}_9X$        ${}^{17}_8X$
- D.  ${}^{19}_{10}X$        ${}^{19}_9X$
- E.  ${}^{20}_{10}X$        ${}^{21}_{11}X$

3. In the symbol below, X = \_\_\_\_\_ ?



- A. N
- B. C
- C. Al
- D. K
- E. Not enough information to determine

4. Magnesium reacts with a certain element to form a compound with the general formula of  $MgX$ . What would the most likely formula be for the compound formed between potassium and element X?

- A.  $K_2X$
- B.  $KX_2$
- C.  $K_2X_3$
- D.  $K_2X_2$
- E.  $KX$

5. Which of the following compounds would you expect to be ionic?

- A.  $H_2O$
- B.  $CO_2$
- C.  $SrCl_2$
- D.  $SO_2$
- E.  $H_2S$

6. A red photon has a wavelength of 725 nm. How much energy would a mole of red photons have?

- A.  $7.25 \times 10^{-9}$  kJ
- B.  $4.56 \times 10^{-46}$  kJ
- C.  $6.05 \times 10^{-3}$  kJ
- D. 165 kJ
- E. 227 kJ

7. Which one of the following transitions in the Bohr hydrogen atom results in the emission of the highest-energy photon?

- A.  $n = 1 \longrightarrow n = 6$
- B.  $n = 6 \longrightarrow n = 2$
- C.  $n = 6 \longrightarrow n = 3$
- D.  $n = 3 \longrightarrow n = 6$
- E.  $n = 1 \longrightarrow n = 4$

8. How many p-orbitals are occupied in a Ne atom?

- A. 5
- B. 6
- C. 1
- D. 3
- E. 2

9. An electron **cannot** have the quantum numbers




- A.  $n = 6, l = 1, m_l = 0$
- B.  $n = 3, l = 2, m_l = 3$
- C.  $n = 3, l = 2, m_l = -2$
- D.  $n = 1, l = 0, m_l = 0$
- E.  $n = 3, l = 2, m_l = 1$

10. A tin atom has 50 electrons. Electrons in the \_\_\_\_ subshell experience the lowest effective nuclear charge.




- A. 1s
- B. 3p
- C. 3d
- D. 5s
- E. 5p

11. Which electron configuration denotes an atom in its ground state?




A. 

1s	2s	2p
		



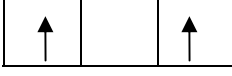
B. 

1s	2s	2p
		



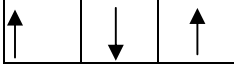
C. 

1s	2s	2p
		

D. 

1s	2s	2p
		

E. 

1s	2s	2p
		

12. Which one of the following configurations depicts an excited carbon atom?

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

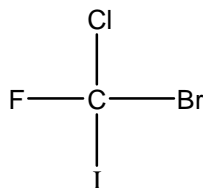
13. Of the compounds below, \_\_\_\_\_ has the smallest ionic separation.

- A. KF
- B.  $K_2S$
- C. RbCl
- D.  $SrBr_2$
- E. RbF

14. Which equation correctly represents the process associated with the electron affinity of calcium?

- A.  $Ca(g) + e^- \rightarrow Ca^-(g)$
- B.  $Ca(g) \rightarrow Ca^+(g) + e^-$
- C.  $Ca(g) \rightarrow Ca^-(g) + e^-$
- D.  $Ca^-(g) \rightarrow Ca(g) + e^-$
- E.  $Ca^+(g) + e^- \rightarrow Ca(g)$

15. In the molecule below, which atom has the largest potential negative charge?



- A. Cl
- B. F
- C. Br
- D. I
- E. C

16. Which one of the following statements is false?
- A. The gold foil experiment performed in Rutherford's lab led to the discovery of the atomic nucleus.
  - B. Cathode rays are electrons.
  - C. The charge on the electron was determined in the Milliken oil drop experiment.
  - D. The characteristics of cathode rays depend on the material from which they originate.
  - E. In Thompson's plum-pudding model of the atom, mass is spread essentially uniformly throughout the atom.

17. In which of the ions do all X—O bonds (X indicates the central atom) have the same length?

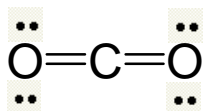
(i)  $\text{NO}_3^-$       (ii)  $\text{SO}_3^{2-}$       (iii)  $\text{SO}_4^{2-}$       (iv)  $\text{BrO}_3^-$

- A. (iii) and (iv)
- B. all
- C. (i) and (ii)
- D. (ii) and (iv)
- E. (ii), (iii), and (iv)

18. The chloride of which of the following metals should have the greatest lattice energy?

- A. potassium
- B. rubidium
- C. sodium
- D. lithium
- E. cesium

19. The formal charge on carbon in the molecule below is \_\_\_\_\_.



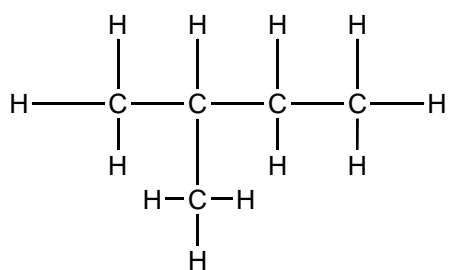
- A. 0
- B. +1
- C. +2
- D. +3
- E. -1

20. How many unpaired electrons are in the ground-state electron configuration of  $^{23}\text{V}$ ?

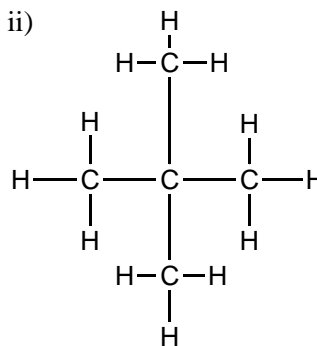
- A. 0
- B. 1
- C. 2
- D. 3
- E. 5

21. Which of the following would **not** be an acceptable structure for  $\text{C}_5\text{H}_{12}$ ?

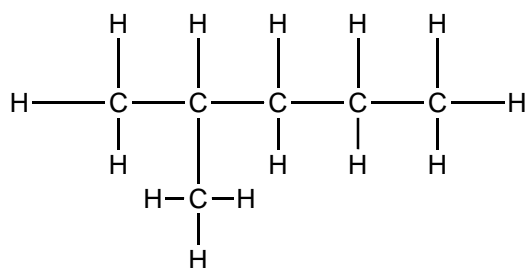
i)



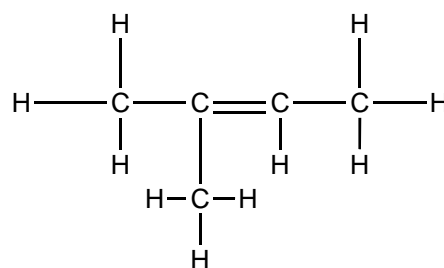
ii)



iii)



iv)



- A. i and iii
- B. i and iv
- C. iii and iv
- D. iii
- E. iv

22. The De Broglie wavelength of several electrons is given below. Which electron is moving the fastest?

- A. 0.122 nm
- B. 0.087 nm
- C. 0.237 nm
- D. 0.073 nm
- E. 0.397 nm

Proceed to next page  $\longrightarrow$

23. Which one of the following is **not** an intensive property?

- A. density
- B. temperature
- C. melting point
- D. mass
- E. boiling point

### Basic Skills

24. The formula for the carbonate ion is \_\_\_\_\_ ?

- A.  $\text{CO}_2^{2-}$
- B.  $\text{CO}_3^{2-}$
- C.  $\text{CO}_3^{3-}$
- D.  $\text{CO}_2^-$
- E.  $\text{CO}^-$

25. Which of the following species has as many electrons as it has neutrons?

- A.  $^1\text{H}$
- B.  $^{40}\text{Ca}^{2+}$
- C.  $^{14}\text{C}$
- D.  $^{19}\text{F}^-$
- E.  $^{14}\text{C}^{2+}$

26. Of the elements below, \_\_\_\_\_ has the largest **first** ionization energy?

- A. Li
- B. K
- C. Na
- D. H
- E. Rb

27. Which isoelectronic series is correctly arranged in order of increasing radius?

- A.  $\text{K}^+ < \text{Ca}^{2+} < \text{S}^{2-} < \text{Cl}^-$
- B.  $\text{Cl}^- < \text{S}^{2-} < \text{K}^+ < \text{Ca}^{2+}$
- C.  $\text{Ca}^{2+} < \text{S}^{2-} < \text{K}^+ < \text{Cl}^-$
- D.  $\text{Ca}^{2+} < \text{K}^+ < \text{S}^{2-} < \text{Cl}^-$
- E.  $\text{Ca}^{2+} < \text{K}^+ < \text{Cl}^- < \text{S}^{2-}$

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28. What is the electron configuration for the  $\text{Fe}^{2+}$  ion?

- A.  $[\text{Ar}] 3d^6$
- B.  $[\text{Ar}] 4s^2 3d^4$
- C.  $[\text{Ar}] 3d^8$
- D.  $[\text{Ar}] 4s^2 3d^8$
- E.  $[\text{Ar}] 4s^6 3d^2$

29. The ion  $\text{NO}^-$  has \_\_\_\_\_ valence electrons?

- A. 15
- B. 14
- C. 16
- D. 10
- E. 12

**Form A**

1. C
2. B
3. B
4. A
5. C
6. D
7. B
8. D
9. B
10. E
11. D
12. A
13. A
14. A
15. B
16. D
17. B
18. D
19. A
20. D
21. C
22. D
23. D
24. B
25. D
26. D
27. E
28. A
29. E