

University of Kentucky

Department of Chemistry

READ THESE DIRECTIONS CAREFULLY BEFORE STARTING THE EXAMINATION!

It is *extremely* important that you fill in the answer sheet EXACTLY as indicated, otherwise your answer sheet may not be processed; ALL entries are to be made on SIDE 1 of the answer sheet. Use a #2 pencil (or softer); fill in the circles completely and firmly. Erasures must be complete. Use only the following categories:

NAME:	Print your name starting at the first space, LAST NAME first, then a space, followed by your FIRST NAME, then another space, followed by your MIDDLE INITIAL. Fill in the <u>correct</u> circles below your printed name corresponding to the letters of your name; for the spaces, fill in the top blank circle.														
STUDENT NUMBER:	This is VERY IMPORTANT! Under IDENTIFICATION NUMBER, put in your 8 DIGIT STUDENT ID NUMBER (do not use the 9 at the beginning of your number) beginning in column A and continuing through column H, column I will be blank, (do NOT use column J at this time); be sure to fill in the correct circles (a common error to be avoided is mistaking "0" for "1").														
TEST FORM:	Fill in the "3" blank in the J column under IDENTIFICATION NUMBER (to indicate Hour Examination III).														
SPECIAL CODES:	Use for course and section number; in positions K-P write in one of the following: <table style="margin-left: 40px;"> <tr> <td>Dr. Richards</td> <td>Sections 001-009, put 105111</td> </tr> <tr> <td>Dr. Lynn</td> <td>Sections 010-018, put 105222</td> </tr> <tr> <td>Dr. Soult</td> <td>Sections 019-027 (MWF 1:00 PM), put 105333</td> </tr> <tr> <td>Dr. Soult</td> <td>Sections 046-054 (TR 2:00 PM), put 105666</td> </tr> <tr> <td>Dr. Woodrum</td> <td>Sections 028-036, put 105444</td> </tr> <tr> <td>Dr. DeRouchey</td> <td>Sections 037-045, put 105555</td> </tr> <tr> <td>Dr. Sunahori</td> <td>Sections 401-409, put 105777</td> </tr> </table>	Dr. Richards	Sections 001-009, put 105111	Dr. Lynn	Sections 010-018, put 105222	Dr. Soult	Sections 019-027 (MWF 1:00 PM), put 105333	Dr. Soult	Sections 046-054 (TR 2:00 PM), put 105666	Dr. Woodrum	Sections 028-036, put 105444	Dr. DeRouchey	Sections 037-045, put 105555	Dr. Sunahori	Sections 401-409, put 105777
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SIGNATURE:	You MUST sign the examination answer sheet (bubble sheet) on the line directly above your printed name. Use your legal signature.														

Answering Questions:

Starting with answer "1" on SIDE 1, fill in the circle indicating the one best answer for each of the **30 questions** in this examination. Your score is the sum of the appropriate credit for each response. On the day following the examination, an examination key will be posted on Blackboard.

Grading and Reporting:

The examination scores will be posted in Blackboard as soon as possible after the examination. If an error has occurred in scoring your answers, inform your instructor within 48 hours of the posting of your score.

BE SURE THAT YOUR TEST HAS 30 QUESTIONS, A PERIODIC TABLE, AND ONE SHEET OF SCRATCH PAPER. You may NOT use your own scratch paper during this examination. Cell phones, computer, and pagers are to be turned off and out of sight during the exam.

1. How much heat (in kilojoules) is required to increase the temperature of a 5.00 kg block of silver by 4.50 °C? The specific heat capacity of silver is 0.235 (J/g·°C).

- A. 5.290k J
B. 0.261 kJ
C. 2.590k J
D. 5.625 kJ

2. If a 1.0 kg granite rock is heated to 200 °C and then dropped into a cooking pot containing 5.00×10^2 mL of tea at 25 °C, what is the final temperature of the tea? Specific heat capacities: granite = 0.790 J/g °C and tea = 4.18 J/g °C. Assume the density of tea is 1.00 g/mL.

- A. 30.5 °C
B. 108 °C
C. 57.4 °C
D. 158 °C

3. How much work (in J) is done when a cylinder expands from 2.50 L to 3.80 L under an external pressure of 3.00 atm?

- A. -395 J
B. -1.14×10^3 J
C. -3.85
D. -3.85×10^{-2} J

4. Which one of the following reactions is an exothermic reaction?

- A. Ice cubes are melted.
B. Natural gas is burned on a stove.
C. Water is boiled.
D. Dry ice is evaporated.
-

8. What is the frequency associated with light with a wavelength of 642 nm?

- A. 4.67×10^5 Hz
B. 4.67×10^{14} Hz
C. 4.67×10^{-4} Hz
D. 4.67×10^4 Hz

9. DVD players use lasers that emit red light with a wavelength of 650 nm to read and write data. What is the energy of a mole of photons of the light?

- A. 3.50×10^{-19} J
B. 8.65×10^{-31} J
C. 4.32×10^4 J
D. 1.84×10^5 J

10. The discrete lines in the emission spectrum of hydrogen results from which of the following?

- A. Electrons transitioning between states
B. Radioactive decay
C. Clockwise rotation about the nucleus
D. Ionization

11. What speed must an electron travel to have a de Broglie wavelength of 30.0 pm? The mass of an electron is 9.109×10^{-31} kg.

- A. 3.00×10^8 m/s
B. 4.19×10^4 m/s
C. 2.42×10^7 m/s
D. 9.98×10^6 m/s
-

12. In an experiment, three different colors of light (orange, green, violet) are shined upon a metal surface. The following observations were made:

- 1) no photoelectrons were observed
- 2) photoelectrons with kinetic energies of 155 kJ/mol were observed
- 3) photoelectrons with kinetic energies of 55 kJ/mol were observed

Match the observation with the color of light.

- A. 1) violet; 2) orange; 3) green
- B. 1) green; 2) violet; 3) orange
- C. 1) orange; 2) green; 3) violet
- D. 1) orange; 2) violet; 3) green

13. What happens to the energy of an electron in an orbital as the principle quantum number n becomes larger?

- A. The energy decreases (becomes more negative).
- B. The energy remains constant.
- C. The energy increases (becomes less negative).
- D. Not enough information is provided to answer the question.

14. If $n = 2$, what are the possible angular momentum quantum numbers.?

- | | |
|---------------|-------------------|
| A. $l = 0, 1$ | C. $l = 0, 1$ |
| B. $l = 1, 2$ | D. $l = -1, 0, 1$ |

15. How many orbitals in the $n = 3$ energy level can have an m_l value of 0?

- | | |
|------|------|
| A. 1 | C. 3 |
| B. 2 | D. 5 |
-

16. One of the lines of the emission spectrum of hydrogen occurs at 397 nm. It results from the transition from an excited state to the $n = 2$ level. What is the principal quantum number of the upper level?

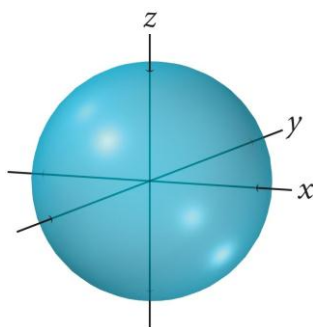
- A. 4
B. 5

- C. 7
D. 9

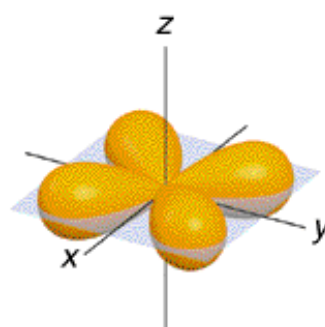
17. Which one of the following could have the following quantum numbers:

$$n = 4, l = 2$$

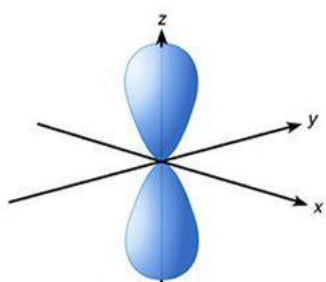
A.



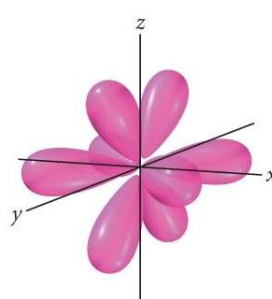
C.



B.



D.



18. If the first 3 quantum numbers of two electrons are the same (i.e. they are in the same orbital), what are the spin quantum numbers for these electrons?

- A. $\frac{1}{2}, \frac{1}{2}$
B. $1, -1$

- C. $-\frac{1}{2}, -\frac{1}{2}$
D. $\frac{1}{2}, -\frac{1}{2}$

19. Which set of quantum numbers is not allowed

- A. $n = 1, l = 0, m_l = 0, m_s = +\frac{1}{2}$
B. $n = 1, l = 0, m_l = 0, m_s = -\frac{1}{2}$

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

20. What is the most accurate approximation of the effective nuclear charge on the valence electrons of silicon?

- A. +1
B. +2
C. +3
D. +4
-

21. Which one of the following elements will be diamagnetic?

- A. carbon
B. magnesium
C. nitrogen
D. chromium
-

22. Which one of the following is the correct electron configuration for the ground state selenium atom?

- A. $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 4d^{10} 4p^4$
B. $[\text{Ar}] 4s^2 3d^{14}$
C. $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^2 4p^4$
D. $1s^2 2s^2 3s^2 3p^6 3d^{10} 4s^2 4p^4$
-

23. What is the electron configuration for chromium?

- A. $[\text{Ar}] 4s^1 3d^5$
B. $[\text{Kr}] 4s^1 3d^5$
C. $[\text{Ar}] 4s^2 3d^4$
D. $[\text{Ar}] 4s^2 4p^4$
-

24. Which one of the following has the smallest atomic radius?

- A. Cl
B. S
C. Se
D. Br
-

25. What is the electron configuration for Cu^{2+} ?

- A. $[\text{Ar}] 4s^1 3d^{10}$
B. $[\text{Ar}] 3d^9$
C. $[\text{Ar}] 4s^2 3d^9$
D. $[\text{Ar}] 4s^2 3d^7$
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26. The following elements easily form either cations or anions. Rank the most common ionic form of these elements in order of increasing size (smallest to largest). *Make sure you are using the ionic form of these elements in your answer.*

Beryllium, Chlorine, Magnesium, Tellurium

- A. Be < Mg < Cl < Te C. Be < Cl < Mg < Te
B. Te < Cl < Be < Mg D. Mg < Be < Cl < Te

-
27. Which one of the following has elements listed in order of increasing first ionization energy?

- A. chlorine, sulfur, oxygen C. fluorine, oxygen, nitrogen
B. potassium, rubidium, cesium D. silicon, phosphorus, oxygen

-
28. For which one of the following atoms is the addition of an electron the most energetically favorable?

- A. Li
B. Al
C. K
D. O

-
29. Which of the following is considered a renewable energy source?

- A. Coal C. Solar
B. Natural Gas D. Petroleum

-
30. Which one of the following would represent a possible set of quantum numbers $[n, l, m_l, m_s]$ for the electron removed to yield the first ionization energy of aluminum?

- A. $[2, 2, 2, \frac{1}{2}]$ C. $[1, 0, 0, \frac{1}{2}]$
B. $[3, 1, -1, \frac{1}{2}]$ D. $[3, 0, 0, \frac{1}{2}]$
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CHE 105 FALL 2012 Exam 3 key

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