

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 "1" blank in the J column under IDENTIFICATION NUMBER (to indicate Hour Examination I).
SPECIAL CODES:	Use for course and section number; in positions K-P write in one of the following: <div style="display: flex; justify-content: space-around;"> Dr. Owen 105-001 </div> <div style="display: flex; justify-content: space-around;"> Dr. Yates 105-002, 401(Evening) </div>
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 is necessary to raise 2.23 kg of granite 5.20°C ? The specific heat capacity of sand is $0.79 \text{ J/g}\cdot^{\circ}\text{C}$.

- A. 18 kJ
B. 4.6 kJ
C. 9.2 kJ
D. 13 kJ

2. What is the specific heat capacity of an alloy if 59.3 kJ are required to raise the temperature of 150.0 g of alloy from 298 K to 398 K.

- A. $3.95 \text{ J/g}\cdot^{\circ}\text{C}$
B. $4.38 \text{ J/g}\cdot^{\circ}\text{C}$
C. $2.53 \text{ J/g}\cdot^{\circ}\text{C}$
D. $1.87 \text{ J/g}\cdot^{\circ}\text{C}$

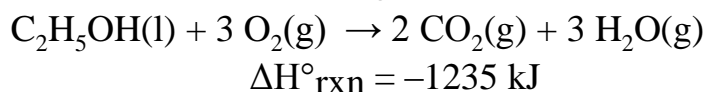
3. If 616 J of work is required to compress gas in a cylinder from 5.0L to 2.0L, what is the external pressure?

- A. 1.0 atm
B. 3.0 atm
C. 2.0 atm
D. 4.0 atm

4. Which of the following processes is endothermic?

- A. the combustion of butane
B. a hot cup of coffee (system) cools on a countertop
C. an atom absorbs a photon
D. the condensation of water vapor (steam) to form water

5. How much heat is released when 751 grams of ethanol ($\text{C}_2\text{H}_5\text{OH}$, molar mass = 46.07 g/mol) reacts with an excess of O_2 according to the balanced chemical equation?

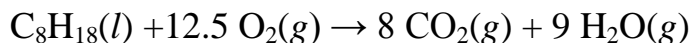


- A. $-3.01 \times 10^4 \text{ kJ}$
B. $-2.01 \times 10^4 \text{ kJ}$
C. $2.01 \times 10^4 \text{ kJ}$
D. $-4.01 \times 10^4 \text{ kJ}$
-

6. Which reaction correctly illustrates the standard enthalpy of formation of NaHCO_3 ?

- A. $\text{Na}(s) + \text{H}_2(g) + \text{C}(s) + \text{O}_2(g) \rightarrow \text{NaHCO}_3(s)$
- B. $\text{Na}^+(aq) + \text{H}_2\text{O}(l) + \text{CO}_2(g) \rightarrow \text{NaHCO}_3(s)$
- C. $\text{Na}(s) + 1/2 \text{H}_2(g) + \text{C}(s) + 3/2 \text{O}_2(g) \rightarrow \text{NaHCO}_3(s)$
- D. $\text{Na}(s) + 2 \text{H}(g) + \text{C}(s) + 3 \text{O}(g) \rightarrow \text{NaHCO}_3(s)$

7. Use the enthalpies of formation (provided in the table) to calculate the $\Delta H^\circ_{\text{rxn}}$ of the reaction:



Given:

Substance	ΔH_f° (kJ/mol)
$\text{C}_8\text{H}_{18}(l)$	-250.1
$\text{H}_2\text{O}(g)$	-241.8
$\text{CO}_2(g)$	-393.5

- A. 2537 kJ
- B. -7611 kJ
- C. -2537 kJ
- D. -5074 kJ

8. What is the frequency of the red light emitted from a laser pointer if the wavelength of the emitted radiation is 670 nm?

- A. 3.99×10^{10} Hz
- B. 3.19×10^{14} Hz
- C. 6.70×10^8 Hz
- D. 4.48×10^{14} Hz

9. How many photons are contained in a flash of green light (525 nm) that contains 727 kJ of energy?

- A. 3.82×10^{22} photons
- B. 2.15×10^{22} photons
- C. 5.00×10^{22} photons
- D. 1.92×10^{22} photons

10. The emission spectrum of an element:

- A. is a series of bright lines.
 - B. is continuous.
 - C. can be used to identify the element.
 - D. Both A and C
-

11. What is the wavelength of a car (1521 kg) traveling at 67 m/s?

- A. 5.4×10^{-39} m C. 7.3×10^{-39} m
B. 6.5×10^{-39} m D. 9.7×10^{-39} m
-

12. Which of the following statements is **true**?

- A. We can never determine the exact location and speed of an electron at the same time.
B. Different orbitals in a given atom have different sizes and shapes.
C. Atoms are roughly spherical because, when all of the different shaped orbitals are overlapped, they take on a spherical shape.
D. All of the above are true.
-

13. Which of the following statements is **false** regarding the principal quantum number, n ?

- A. n describes the overall size of an electronic orbital.
B. n describes the overall shape of an electronic orbital.
C. n is describes the overall energy of an electronic orbital.
D. The principal quantum number is an integer value.
-

14. What is the maximum number of electrons in d orbitals in any shell?

- A. 6 C. 10
B. 14 D. 18
-

15. How many orbitals in the $n = 2$ energy level can have an m_l value of +1?

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

16. What is the final value of n for an electronic transition in a hydrogen atom, if the electron starts in the $n = 2$ energy level and the atom absorbs a photon of light with a frequency of 4.57×10^{14} Hz ?

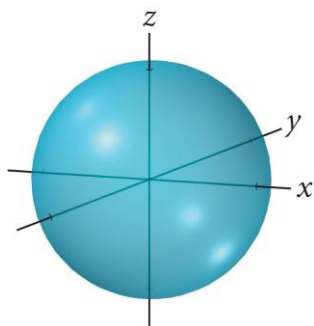
- A. 1
B. 3

- C. 4
D. 5

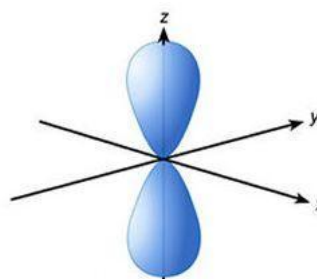
17. Which one of the following could have the following quantum numbers:

$$n=4, l=3$$

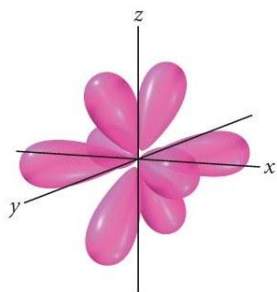
A.



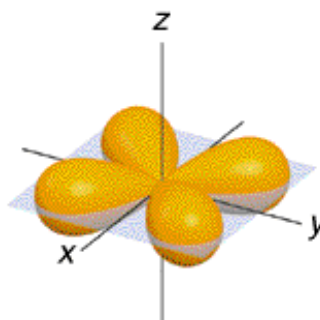
C.



B.



D.



18. The spin quantum number, m_s , was introduced as a result of the discovery of:

- A. the Heisenberg uncertainty principle.
B. the Aufbau principle.
C. Hund's rule.
D. the Pauli exclusion principle.
-

19. Which of the following statements is **true** concerning the Pauli exclusion principle?

- A. Any two electrons can have the same four quantum numbers.
- B. Each orbital can have a maximum of two electrons with opposing spin.
- C. All electrons in an atom must have different combinations of quantum numbers.
- D. Hydrogen is the first element where the Pauli exclusion principle is applied.

20. Which of the following statements is **true**?

- A. An orbital that penetrates into the region occupied by core electrons is more shielded from the nuclear charge than an orbital that does not penetrate and, therefore, has a lower energy.
- B. It is possible for two electrons in the same atom to have identical values for all four quantum numbers.
- C. Two electrons in the same orbital can have the same spin.
- D. None of the above.

21. What is the electron configuration for krypton?

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

22. A neutral oxygen atom has how many core electrons?

- A. 2
- B. 6
- C. 4
- D. 8

23. What is the electron configuration for copper?

- A. $[\text{Ar}]4s^1 3d^{10}$
 - B. $[\text{Ar}]3s^1 2d^{10}$
 - C. $[\text{Ar}]4s^2 3d^9$
 - D. $[\text{Ar}]3s^2 2d^9$
-

29. The production of hydrogen gas utilizing solar energy results from the decomposition of what compound?

A. Methane

C. Water

B. Octane

D. Coal

30. Which of the following represents the change in electronic configuration that is associated with the first ionization energy of calcium?

A. $[\text{Ar}] 4s^1 4p^1 \rightarrow [\text{Ar}] 4s^1 + e^-$

C. $[\text{Ar}] 4s^2 \rightarrow [\text{Ar}] 4s^1 + e^-$

B. $[\text{Ar}] 4s^2 \rightarrow [\text{Ar}] 4s^1 4p^1$

D. $[\text{Ar}] 4s^2 + e^- \rightarrow [\text{Ar}] 4s^2 4p^1$

CHE 105 SP 2013 Exam 3 key

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