

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 test 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 <b><u>VERY IMPORTANT!</u></b> Under IDENTIFICATION NUMBER, put in your <b>8 DIGIT STUDENT ID NUMBER (do not use the 9 at the beginning of your number)</b> 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: auto; margin-right: auto;"> <tr> <td>Dr. Woodrum</td> <td>105-001, 105-002</td> </tr> <tr> <td>Mr. Harris</td> <td>105-003, 105-006</td> </tr> <tr> <td>Dr. Ades</td> <td>105-004</td> </tr> <tr> <td>Dr. Knecht</td> <td>105-005</td> </tr> <tr> <td>Dr. Testa</td> <td>105-008, 105-009</td> </tr> <tr> <td>Dr. Guzman</td> <td>105-401</td> </tr> </table>	Dr. Woodrum	105-001, 105-002	Mr. Harris	105-003, 105-006	Dr. Ades	105-004	Dr. Knecht	105-005	Dr. Testa	105-008, 105-009	Dr. Guzman	105-401
Dr. Woodrum	105-001, 105-002												
Mr. Harris	105-003, 105-006												
Dr. Ades	105-004												
Dr. Knecht	105-005												
Dr. Testa	105-008, 105-009												
Dr. Guzman	105-401												
SIGNATURE:	You <b><u>MUST</u></b> 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 **33 questions** in this examination. Your score is the sum of the appropriate credit for each response. The day after the examination is finished, 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 been made in scoring your answers, tell your instructor within 48 hours of the posting of your score.

**BE SURE THAT YOUR TEST HAS 33 QUESTIONS, A PERIODIC TABLE, AND ONE SHEET OF SCRATCH PAPER.** You may NOT use your own scratch paper during this examination. Cell phones and pagers are to be turned off and out of sight during the exams.



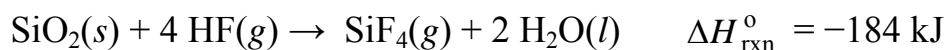
---

5. Based upon your understanding of combustion reactions, which one of the following statements is true?

- A. Combustion reactions are exothermic and enthalpy change is positive.
- B. Combustion reactions are exothermic and enthalpy change is negative.
- C. Combustion reactions are endothermic and enthalpy change is positive.
- D. Combustion reactions are endothermic and enthalpy change is negative.

---

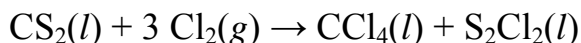
6. According to the following thermochemical equation, what mass of HF (in grams) must react in order to produce 345 kJ of energy? Assume that SiO<sub>2</sub> is in excess.



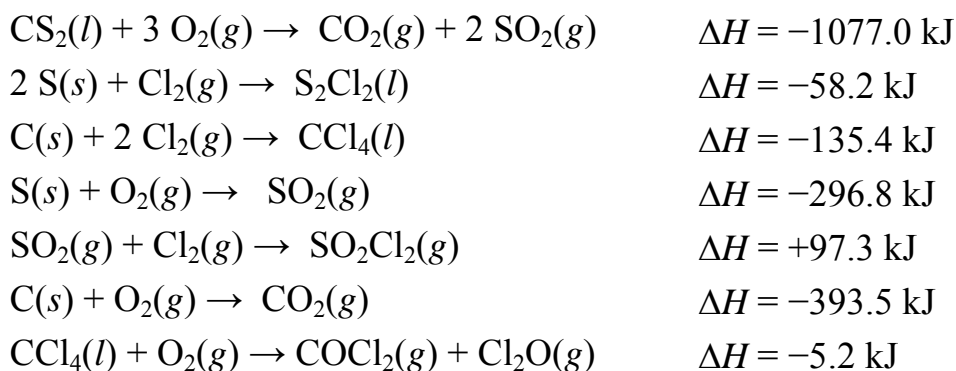
- A. 42.7 g
- B. 37.5 g
- C. 150. g
- D. 107 g

---

7. What is  $\Delta H_{\text{rxn}}$  for the reaction:



Use appropriate data from the following set of reactions and their given  $\Delta H$  values.



- A. -1868.8 kJ
  - B. -580.3 kJ
  - C. -1270.6 kJ
  - D. -283.5 kJ
-

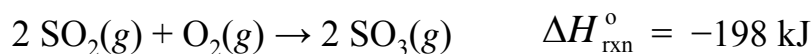
---

8. Which chemical equation listed below has an enthalpy change equal to the standard enthalpy of formation of  $\text{CH}_4(g)$ ?

- A.  $\text{CO}(g) + 3 \text{H}_2(g) \rightarrow \text{CH}_4(g) + \text{H}_2\text{O}(g)$ .
- B.  $\text{C}(s, \text{graphite}) + 2 \text{H}_2(g) \rightarrow \text{CH}_4(g)$ .
- C.  $\text{C}(s, \text{diamond}) + 2 \text{H}_2(g) \rightarrow \text{CH}_4(g)$ .
- D.  $\text{C}(g, \text{graphite}) + 2 \text{H}_2\text{O}(g) \rightarrow \text{CH}_4(g) + \text{O}_2(g)$ .

---

9. Use the  $\Delta H_f^\circ$  and  $\Delta H_{\text{rxn}}^\circ$  information provided below to calculate  $\Delta H_f^\circ$  for  $\text{SO}_3(g)$ .



$$\Delta H_f^\circ \text{ of } \text{SO}_2(g) = -297 \text{ kJ}$$

- A.  $-396 \text{ kJ/mol}$
- B.  $-792 \text{ kJ/mol}$
- C.  $-248 \text{ kJ/mol}$
- D.  $-495 \text{ kJ/mol}$

---

10. Which one of the following is **not true** regarding the wave nature of light?

- A. The amplitude of the wave determines the intensity of the light.
- B. Light is electromagnetic radiation.
- C. Visible light comprises only a small fraction of all the wavelengths of light.
- D. For visible light, the wavelength does not determine the visual color.

---

11. What is the wavelength, in meters, associated with electromagnetic radiation at 4.50 kHz?

- A.  $1.67 \times 10^{-4} \text{ m}$
  - B.  $1.50 \times 10^{-8} \text{ m}$
  - C.  $6.67 \times 10^4 \text{ m}$
  - D.  $6.67 \times 10^7 \text{ m}$
-

---

12. How many photons are contained in a flash of green light (525 nm) that contains 189 kJ of energy?

A.  $5.67 \times 10^{23}$  photons

B.  $4.99 \times 10^{23}$  photons

C.  $2.01 \times 10^{24}$  photons

D.  $1.25 \times 10^{31}$  photons

---

13. What is the wavelength, in nm, of the photon emitted when an electron in the hydrogen atom makes a transition from the energy level  $n = 7$  to the energy level  $n = 4$ ?

A.  $2.17 \times 10^3$  nm

B. 852 nm

C.  $1.10 \times 10^3$  nm

D. 183 nm

---

14. Calculate the wavelength of an electron ( $m = 9.11 \times 10^{-28}$  g) moving at  $3.66 \times 10^6$  m/s.

A.  $5.03 \times 10^9$  m

B.  $1.99 \times 10^{-13}$  m

C.  $1.99 \times 10^{-7}$  m

D.  $1.99 \times 10^{-10}$  m

---

15. How many different values of  $l$  are possible in the third principal energy level?

A. 1

B. 2

C. 3

D. 4

---

16. How many different values of  $m_l$  are possible in the 3d sublevel?

A. 3

B. 2

C. 4

D. 5

---

17. Which of the following is an allowed set of quantum numbers  $[n, l, m_l]$  for a d orbital?

A. [2, 2, -1]

B. [3, 2, -1]

C. [4, 3, -2]

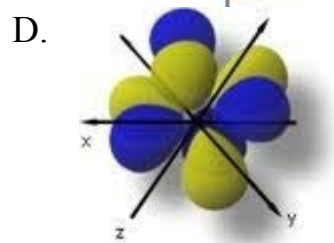
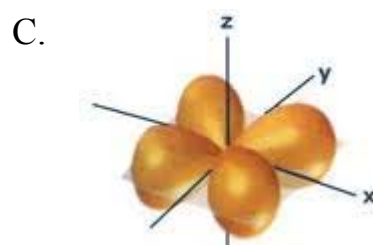
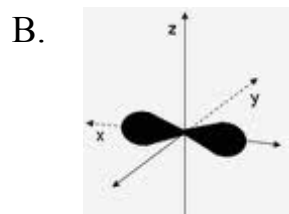
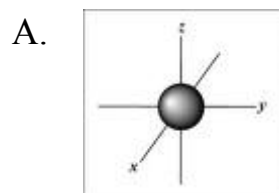
D. [5, 2, -3]

---

---

18. Which one of the following orbitals could have the following quantum numbers:

$$n = 5, l = 2$$



---

19. Which of the following is a possible set of quantum numbers for the last electron added to complete an atom of antimony in its ground state?

A.  $n = 5, l = 1, m_l = 0, m_s = 1/2$

C.  $n = 4, l = 1, m_l = -1, m_s = -1/2$

B.  $n = 5, l = 2, m_l = -1, m_s = 1/2$

D.  $n = 4, l = 3, m_l = 0, m_s = -1/2$

---

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

A. The 3s orbital is lower in energy than the 3p orbitals.

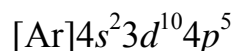
B. The 5f orbitals are higher in energy than the 6p orbitals.

C. The 3d orbitals are lower in energy than the 4s orbital.

D. The 4f orbitals are higher in energy than the 6s orbital.

---

21. Which of the listed elements has the following ground state electron configuration?



A. chlorine

C. selenium

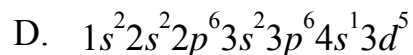
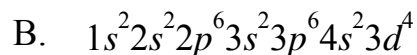
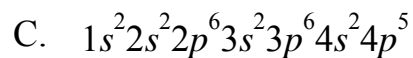
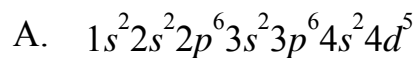
B. krypton

D. bromine

---

---

22. Give the complete ground state electronic configuration for chromium.



23. Which of the following pairs has the atom with the larger atomic radius listed first?

A. Cl, Si

C. O, Si

B. N, As

D. Ga, P

---

24. Which ion does not have a noble gas configuration in its ground state?

A.  $\text{Ga}^{3+}$

C.  $\text{As}^{3-}$

B.  $\text{Sc}^{3+}$

D.  $\text{Al}^{3+}$

---

25. Place the following elements in order of increasing ionic radius.



A.  $\text{Mg}^{2+} < \text{Na}^+ < \text{F}^-$

C.  $\text{Na}^+ < \text{Mg}^{2+} < \text{F}^-$

B.  $\text{Mg}^{2+} < \text{F}^- < \text{Na}^+$

D.  $\text{F}^- < \text{Na}^+ < \text{Mg}^{2+}$

---

26. Place the following in order of increasing first ionization energy.



A.  $\text{N} < \text{As} < \text{F}$

C.  $\text{F} < \text{N} < \text{As}$

B.  $\text{As} < \text{N} < \text{F}$

D.  $\text{As} < \text{F} < \text{N}$

---

27. Which of the following elements has the most exothermic electron affinity?

A. B

C. N

B. C

D. F

---

---

28. Which one of the following elements is most likely to have the following ionization energies (in kJ/mol)?

$$1^{\text{st}} = 738.1 \quad 2^{\text{nd}} = 1450 \quad 3^{\text{rd}} = 7730 \quad 4^{\text{th}} = 10500 \quad 5^{\text{th}} = 13600 \quad 6^{\text{th}} = 18000$$

- A. magnesium  
B. potassium  
C. neon  
D. selenium
- 

29. In general, which group of elements has the most metallic character?

- A. alkali metals  
B. noble gases  
C. halogens  
D. alkali earth metals
- 

30. Which of the following is **false**?

- A. Covalent bonds result from the sharing of electrons.  
B. Covalent bonds are formed between two nonmetals.  
C. Ionic bonds are formed between two metals.  
D. Potassium fluoride contains ionic bonds.
- 

31. Use Lewis theory to determine the chemical formula for the compound formed between Rb and S.

- A. RbS  
B. RbS<sub>2</sub>  
C. Rb<sub>2</sub>S  
D. Rb<sub>2</sub>S<sub>3</sub>
- 

32. Identify the compound with the highest magnitude lattice energy value.

- A. LiCl  
B. KCl  
C. NaCl  
D. CsCl
- 

33. Identify the compound with the highest magnitude lattice energy value

- A. CaO  
B. KBr  
C. KCl  
D. SrO
-





