

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 Examination III).
SPECIAL CODES:	Use for course and section number; in positions K-P write in the following: Dr. Owen 105-020
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 **25 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 25 QUESTIONS, A PERIODIC TABLE, AND ONE SHEET OF SCRATCH PAPER. You may NOT use your own scratch paper during this examination. Cell phones, computers, and pagers are to be turned off and out of sight during the exam.

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1. Chemical energy is the
- A. potential energy due to the structure, attachment, or position of atoms relative to each other in molecules.
 - B. kinetic energy associated with molecular motion.
 - C. potential energy in the nucleus of atoms.
 - D. kinetic energy associated with the flow of electrical charge.

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2. A professional basketball player practices his shot before a game. Does the energy exchange between the player and the ball primarily involve work or heat? Is ΔE positive or negative for the ball (the ball is the system)?
- A. Heat, positive
 - B. Heat, negative
 - C. Work, positive
 - D. Work, negative

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3. A system absorbs 196 kJ of heat and the surroundings do 117 kJ of work on the system. What is the change in internal energy (ΔE) for the system?
- A. -313 kJ
 - B. -79 kJ
 - C. 229 kJ
 - D. 313 kJ

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4. A piece of aluminum absorbs 527 J of heat and a temperature increase of 100°C is observed. What is the mass of the piece of aluminum? The specific heat of aluminum is $0.903 \text{ J/g}\cdot^{\circ}\text{C}$.
- A. 2.92 grams
 - B. 5.84 grams
 - C. 10.8 grams
 - D. 8.32 grams
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5. A 376 gram gold nugget at 55°C is dropped into 190 mL of ethanol at 25°C. What is the final temperature when the gold and ethanol reach thermal equilibrium?

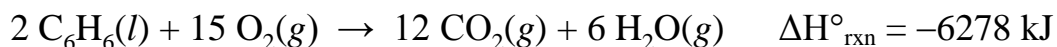
specific heat of gold = 0.128 J/g·°C

specific heat of ethanol = 2.42 J/g·°C

density of ethanol = 0.789 g/mL

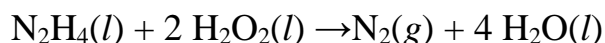
- A. 29°C C. 58°C
B. 43°C D. 22°C

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6. How much heat is generated when 1.22 kg of water are produced according to the following balanced chemical equation? The molar mass of H₂O is 18.02 g/mol.

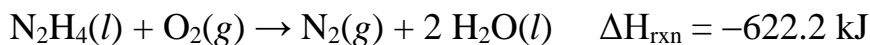


- A. $3.08 \times 10^4 \text{ kJ}$
B. $7.08 \times 10^4 \text{ kJ}$
C. $1.13 \times 10^5 \text{ kJ}$
D. $5.11 \times 10^4 \text{ kJ}$

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7. Determine ΔH for the reaction

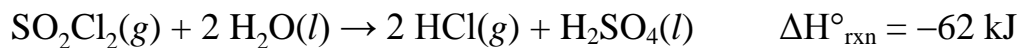


given the following data:



- A. -1201 kJ C. -649.8 kJ
B. -818.2 kJ D. -1042 kJ
-

8. Using the following information, what is the enthalpy of formation (ΔH_f°) of $\text{H}_2\text{SO}_4(l)$?



Substance	ΔH_f° (kJ/mol)
$\text{SO}_2\text{Cl}_2(g)$	-364
$\text{H}_2\text{O}(l)$	-286
$\text{HCl}(g)$	-92

- A. 611 kJ/mol
B. -454 kJ/mol
C. -814 kJ/mol
D. 751 kJ/mol

9. A laser pointer emits green light at a frequency of 5.45×10^{14} Hz. What is the wavelength of the emitted light?

- A. 550 nm
B. 121 nm
C. 225 nm
D. 747 nm

10. A 75-watt light bulb radiates energy at a rate of 75 J/s. If the wavelength (λ) of the emitted light is 525 nm, how many photons are emitted after 8 seconds?

- A. 3.3×10^{21} photons
B. 1.6×10^{21} photons
C. 5.8×10^{21} photons
D. 7.6×10^{21} photons

11. Why do atoms only emit certain wavelengths of light when they are excited?

- A. The nucleus is excited to orbitals of higher energy.
B. Electrons are excited by all light frequencies.
C. Electrons are absorbed by the nucleus.
D. The energies of atoms are quantized.
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12. What is the de Broglie wavelength of a stock car (1542 kg) traveling at 89 meters per second?

A. 4.9×10^{-39} m

C. 1.4×10^{-39} m

B. 9.5×10^{-39} m

D. 2.4×10^{-39} m

13. Which of the following statements *best* describes the information given by the principal quantum number, n ?

A. n describes the shape of an atomic orbital.

B. n describes the overall size and energy of an orbital.

C. n describes the orientation of an atomic orbital.

D. n describes the magnetic spin of an electron.

14. When allowed, how many ***f-orbitals*** are in a given principal quantum shell?

A. 3

C. 7

B. 1

D. 5

15. What are the *possible* values of n and m_l for an electron in a 2p orbital?

A. $n = 0$ or 1 and $m_l = -1, 0,$ or $+1$

B. $n = 0, 1,$ or 2 and $m_l = 0$

C. $n = 1$ and $m_l = -1, 0,$ or $+1$

D. $n = 2$ and $m_l = -1, 0,$ or $+1$

16. What electron transition in a hydrogen atom, starting from $n = 7$, will emit a photon of infrared light with a wavelength of 2170 nm?

A. $n = 7$ to $n = 4$

C. $n = 7$ to $n = 8$

B. $n = 7$ to $n = 3$

D. $n = 7$ to $n = 1$

17. What is the electronic configuration for bromine?

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

C. $1s^2 2s^2 2p^6 3s^2 3d^{10} 3p^6 4s^2 4p^6$

B. $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 4f^{15}$

D. $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6$

18. Which set of four quantum numbers *best* represent the last electron added to the zinc atom?

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

C. $n = 4, l = 2, m_l = 2, m_s = -\frac{1}{2}$

B. $n = 3, l = 2, m_l = 2, m_s = -\frac{1}{2}$

D. $n = 4, l = 2, m_l = 2, m_s = +\frac{1}{2}$

19. How many valence electrons are in a neutral carbon atom?

A. 2

C. 6

B. 8

D. 4

20. What is the electron configuration for copper?

A. $[\text{Ar}]4s^1 3d^{10}$

C. $[\text{Ar}]4s^2 3d^9$

B. $[\text{Kr}]4s^2 3d^9$

D. $[\text{Ar}]4s^1 4d^{10}$

21. Which of the following species has the *smallest* atomic radius?

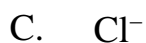
A. Na^+

C. Na

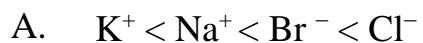
B. K

D. Cs

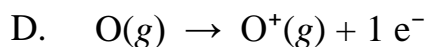
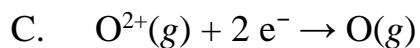
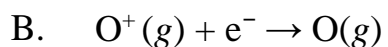
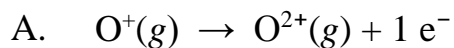
22. Which of the following species has the electronic configuration $1s^2 2s^2 2p^6$?



23. Which shows the correct order of *increasing* radius?



24. Which reaction below represents the *first* ionization of oxygen?



25. Which element has the highest *first* electron affinity?



Answer Key:

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