

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 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: <div style="text-align: center;"> Dr. H. Ades 105-001, 105-002 Ms. E. Ferguson 105-401 </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 25 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.

<p>BE SURE THAT YOUR TEST HAS 25 QUESTIONS, A PERIODIC TABLE, AND ONE SHEET OF SCRATCH PAPER. You may <u>NOT</u> use your own scratch paper during this examination. Cell phones and pagers are to be turned off and out of sight during the exams.</p>
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1. The same amount of heat is added to the same mass of the following three substances: glass (specific heat: $0.75 \text{ J/g}\cdot^\circ\text{C}$), granite (specific heat: $0.79 \text{ J/g}\cdot^\circ\text{C}$), and copper (specific heat: $0.39 \text{ J/g}\cdot^\circ\text{C}$). All are initially at the same temperature. Which of the following statements is true?

- A. All will have the same temperature increase.
- B. Copper will increase in temperature by the largest amount and granite will have the smallest increase in temperature.
- C. Copper will increase in temperature by the smallest amount and granite will have the largest increase in temperature.
- D. Copper will increase in temperature by the largest amount and glass will have the smallest increase in temperature.

2. A mercury sample of mass 232 g has a specific heat $0.139 \text{ J/g}\cdot^\circ\text{C}$. What is the temperature change when $2.967 \times 10^3 \text{ J}$ of heat is released?

- A. -22°C
- B. -92°C
- C. -43°C
- D. -1.8°C

3. A 25.0 g sheet of substance A (specific heat: $1.00 \text{ J/g}\cdot^\circ\text{C}$), initially at 50.0°C is placed on a 50.0 g sheet of substance B (specific heat: $0.250 \text{ J/g}\cdot^\circ\text{C}$), initially at 100.0°C . What is the final temperature of the combined substances? Assume no heat loss to the surroundings.

- A. 30.0°C
- B. 75.0°C
- C. 66.7°C
- D. 83.3°C

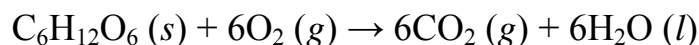
4. Which of the following standard enthalpy of formation values is **not** zero at 25°C ?

- A. $\text{Cl}_2(\text{g})$
- B. $\text{Al}(\text{s})$
- C. $\text{O}_3(\text{g})$
- D. $\text{C}(\text{graphite})$

5. Which one of the following reactions does $\Delta H^\circ_{\text{rxn}} = \Delta H^\circ_{\text{f}}$ of the product?

- A. $2\text{O}_3(\text{g}) \rightarrow 3\text{O}_2(\text{g})$
 - B. $3\text{O}_2(\text{g}) \rightarrow 2\text{O}_3(\text{g})$
 - C. $1/2\text{H}_2(\text{g}) + 1/2\text{Cl}_2(\text{g}) \rightarrow \text{HCl}(\text{g})$
 - D. $\text{CO}(\text{g}) + 1/2\text{O}_2(\text{g}) \rightarrow \text{CO}_2(\text{g})$
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6. What is the heat released, per mole of glucose burned, according to the following reaction? Use the thermochemical data below.



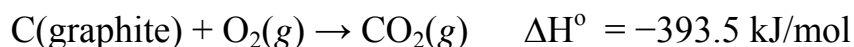
$$\Delta H_f^\circ \text{ of } \text{C}_6\text{H}_{12}\text{O}_6 (s) = -1274.5 \text{ kJ/mol}$$

$$\Delta H_f^\circ \text{ of } \text{CO}_2 (g) = -393.5 \text{ kJ/mol}$$

$$\Delta H_f^\circ \text{ of } \text{H}_2\text{O} (l) = -285.8 \text{ kJ/mol}$$

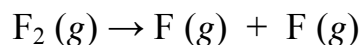
- A. 2801.3 kJ C. 595.2 kJ
B. 8626.2 kJ D. 1921.0 kJ

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7. What is ΔH° for the reaction $2\text{CO}(g) + \text{O}_2(g) \rightarrow 2\text{CO}_2(g)$ given that



- A. 676.5 kJ C. -504.0 kJ
B. -1000.8 kJ D. -566.0 kJ

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8. The standard enthalpy change for the reaction below is 156.9 kJ. What is the standard enthalpy of formation of atomic fluorine (F)?

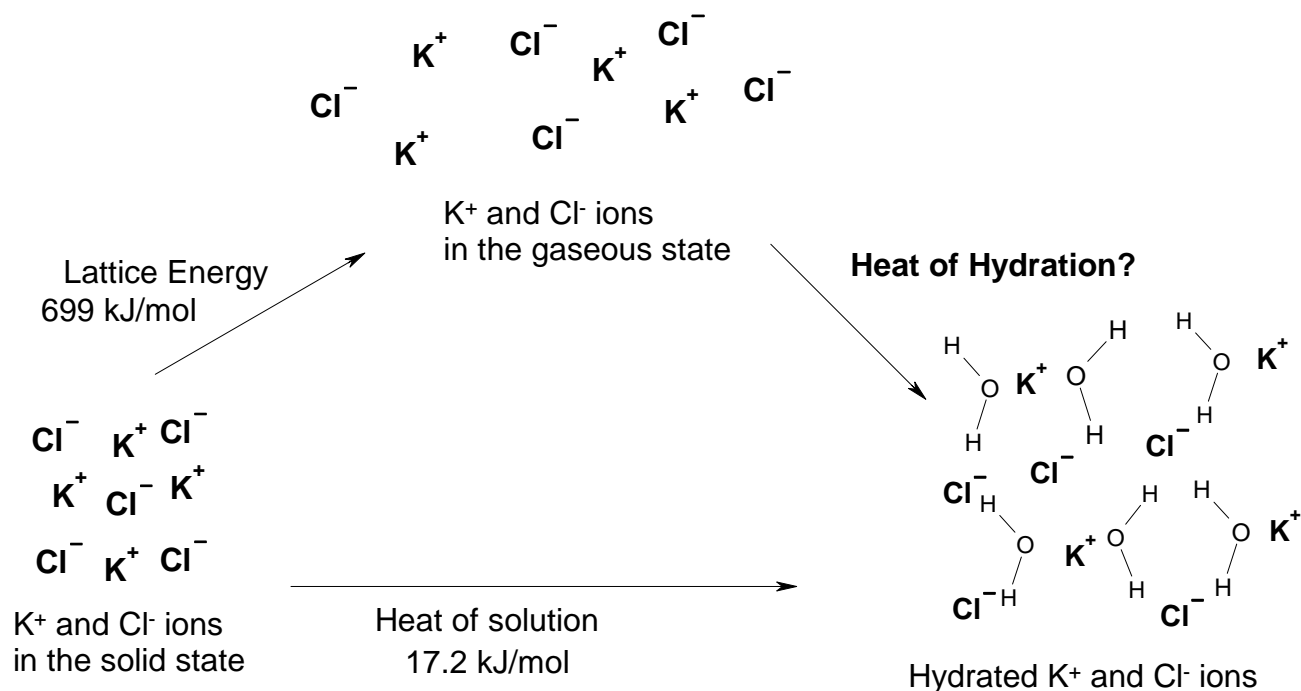


- A. 313.8 kJ C. 78.45 kJ
B. 0.000 kJ D. 156.9 kJ

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9. A sample of an unknown metal at 50.0°C was placed in a constant-pressure calorimeter containing 100.0 g of water at 5.0°C . The final temperature of the system was found to be 40.0°C . How much heat flowed into the water? The specific heat of water is $4.184 \text{ J/g}\cdot^\circ\text{C}$.

- A. $4.08 \times 10^3 \text{ J}$ C. $8.31 \times 10^3 \text{ J}$
B. $1.88 \times 10^4 \text{ J}$ D. $1.46 \times 10^4 \text{ J}$
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10. Using the information in the figure below, what is the value of ΔH_{hydr} ?



- A. 682 kJ/mol C. 716 kJ/mol
B. -682 kJ/mol D. -716 kJ/mol

11. What is the frequency of light whose wavelength is 525 nm?

- A. 5.71×10^{14} Hz C. 1.58×10^{14} Hz
B. 1.58×10^{20} Hz D. 1.75×10^{-6} Hz

12. What is the energy (in Joules) of **1 mole** of photons with a frequency 6.00×10^7 Hz?

- A. 6.68×10^{-18} J/mol C. 1.80×10^{16} J/mol
B. 3.98×10^{-26} J/mol D. 2.40×10^{-2} J/mol
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13. The magnesium emission spectrum has a line at 267 nm. Which of the following statements is **true** about this radiation?

- A. This radiation has a larger frequency than radiation with wavelength 652 nm.
- B. This radiation has a greater speed than does red light of 652 nm.
- C. This radiation is visible to the eye.
- D. This radiation's wavelength is longer than that of radio rays.

14. The work function of gold is 8.16×10^{-19} J? What is the minimum wavelength of light (in nm) needed to eject electrons from the metal?

- A. 244 nm
- B. 1.24×10^{15} nm
- C. 3.69×10^{23} nm
- D. 369 nm

15. Which of the following statements is correct regarding concepts that led to de Broglie's concept of the dual nature of the electron?

- A. A shorter wavelength for the electron will have a greater frequency and thus a greater number of nodes.
- B. A node is a point of the wave where its amplitude is at its greatest.
- C. Using the formula $2\pi r = n\lambda$ for the circumference of an allowed orbit for the electron, n can be 1.67
- D. As the mass of a particle increases its wavelength will also increase.

16. Which of the following sets of quantum numbers is an acceptable set for an electron in an atom?

- A. (4,4,0,1/2)
- B. (5,4,3,-1/2)
- C. (-2,-1,-1,-1/2)
- D. (3,2,-3,-1/2)

17. Which of the following sets of quantum numbers (n, l, m_l) correctly describes a $6p$ orbital?

- A. (6, 3, -1)
 - B. (6, 1, 0)
 - C. (6, 2, -1)
 - D. (6, 0, 0)
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18. How many electrons in an atom can have $n = 5$ and $m_l = 2$?

- A. 0
B. 2
C. 4
D. 6

19. How many unpaired electrons are in a ground-state atom of cobalt, Co?

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

20. Which of the following is an incorrect ground-state electron configuration for the given atom?

- A. S: $[\text{Ar}]3s^23p^4$
B. In: $[\text{Kr}]5s^24d^{10}5p^1$
C. Ni: $[\text{Ar}]4s^23d^8$
D. N: $1s^22s^22p^3$

21. Which of the following is not an acceptable set of quantum numbers for an electron in a ground-state iodine atom?

- A. $(1,0,0,1/2)$
B. $(5,1,0,-1/2)$
C. $(4,2,-2,1/2)$
D. $(4,3,-2,-1/2)$

22. Classify the element that has a valence electron configuration of ns^2np^5 .

- A. Alkaline Earth Metal
B. Transition Metal
C. Halogen
D. Noble Gas

23. Which of the following pairs is an isoelectronic pair?

- A. N^{3-} and P^{3-}
B. Fe^{2+} and Cr
C. Al^{3+} and F^-
D. Ca^{2+} and Br^-
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24. Which +4 ion has the ground-state electron configuration $[\text{Ar}]3d^1$?



25. What is the ground-state electron configuration of the Cr^{3+} ion?



