

CHEMISTRY 15
FINAL EXAM-Version A (White)

Dr. M. Richards-Babb

June 29, 2001

An optical scoring machine will grade this examination. The machine is not programmed to accept the correct one of two sensed answers and will not sense answers which are lightly marked. Mark your answer sheet carefully with a No. 2 soft lead pencil and erase any undesired marks **COMPLETELY**. Avoid making any extraneous marks on the answer sheet other than the information asked below.

On the answer sheet:

1. Print your name in the space for **NAME (Last name first, CIRCLE your last name)**.
2. In the space marked **SUBJECT** write **Chem 15**.
3. In the space marked **TEST NO.** write **FE**.
4. In the space marked **DATE** write **Summer 2001**.
5. In the space marked **HOOR** write **Babb**.
6. Check to see that you have 50 examination questions, periodic table, scratch paper and a scantron with NO mark in the upper right hand corner.

HAND IN ONLY THE ANSWER SHEET.

Useful Conversions

$$N_A = 6.0220 \times 10^{23}$$

$$R = 0.08206 \text{ L-atm/mol-K}$$

$$1 \text{ mol} = 22.4 \text{ L}$$

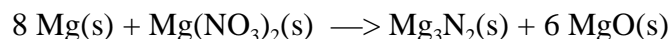
$$1 \text{ atm} = 760 \text{ mm Hg} = 760 \text{ torr}$$

$$c_p(\text{H}_2\text{O}_{(L)}) = 4.18 \text{ J/g-C}$$

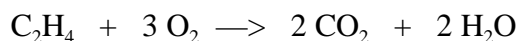
$$1 \text{ lb} = 453.59 \text{ g}$$

CHEM 15**FINAL EXAM (Version A, White)****CHOOSE THE ONE BEST ANSWER****Summer I' 2001**

1. What **mass of MgO** can be formed by the reaction of 73.0 g Mg with excess $\text{Mg}(\text{NO}_3)_2$?



- A. 90.8 g
B. 726 g
C. 53.8 g
D. 7.98 g
E. 121 g
2. How many **molecules of SO_2** present in 21 g SO_2 ?
- A. 5.2×10^{-25} molecules
B. 1.3×10^{25} molecules
C. 0.98 molecules
D. 1.8×10^{24} molecules
E. 2.0×10^{23} molecules
3. Which of the following contains the **MOST atoms**?
- A. 5 molecules N_2O_5
B. 7 molecules NO
C. 3 mole NO
D. 2 mole N_2O_5
E. Both B and D.
4. Consider the reaction shown below,



What **mass of CO_2** can be obtained by the reaction of 14. g C_2H_4 with 24. g O_2 ?
(Molar masses: $\text{C}_2\text{H}_4=28.05$; $\text{CO}_2=44.01$)

- A. 45 g
B. 33 g
C. 9.0 g
D. 22 g
E. 110 g
5. Mark the same answer as for the preceding question. This means that the preceding question is worth double.

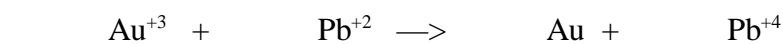
6. A 2.691 g sample of a compound containing C and H was decomposed and found to contain 2.224 g C. The **empirical formula** of this compound is:
- A. C_5H_{12}
 - B. C_2H_5
 - C. CH_3
 - D. C_2H_3
 - E. C_3H_7
7. During a titration, 13.77 mL of 0.20 M NaOH was needed to titrate 25.0 mL of H_2SO_4 solution. What was the **concentration of the H_2SO_4** solution?
(HINT: Write a balanced equation first.)
- A. 0.22 M
 - B. 0.015 M
 - C. 0.055 M
 - D. 2.9 M
 - E. 0.15 M
8. Write a net ionic equation for the aqueous reaction taking place in the last question. The **spectator ions** are:
- A. H^+ and OH^-
 - B. Na^+ only
 - C. OH^- and SO_4^{2-}
 - D. Na^+ and SO_4^{2-}
 - E. All ions are spectators. No net ionic equation can be written.
9. Which of the following lists contains only compounds that can be classified as **molecular compounds**?
- A. NaH, BaO, and $CuCl_2$
 - B. Na, Ba, and Cu
 - C. Cl_2O , HCl, and H_2O_2
 - D. Cl_2 , H_2 and O_2
 - E. None of the above.
10. An isotope has 52 protons, 74 neutrons and 54 electrons. The best way to symbolize this isotope is:
- A. $^{126}Te^{-2}$
 - B. $^{126}W^{+2}$
 - C. $^{106}Xe^{-2}$
 - D. ^{74}Te
 - E. None of the above.

11. A can of coke contains 52 mg of sodium per 12 fluid ounces. How many **grams of sodium are present per liter** of coke? (1 qt = 32 fl. oz; 1 qt = 0.9463 L)
- A. 1.3×10^{-4} g/L
 - B. 0.15 g/L
 - C. 86 g/L
 - D. 130 g/L
 - E. 4.3 g/L
12. _____ are substances with constant composition that can be broken down into elements **ONLY** by chemical processes.
- A. Solutions
 - B. Mixtures
 - C. Compounds
 - D. Protons
 - E. Heterogeneous Mixtures
13. The **boiling of water** is a
- A. physical change because the water merely disappears.
 - B. physical change because the gaseous water is chemically the same as the liquid.
 - C. chemical change because heat is needed for the process to occur.
 - D. chemical change because a gas (steam) is given off.
 - E. chemical and physical change.
14. Which one of the following is written with a **CORRECT formula unit**?
- A. AlSO_3
 - B. $\text{Ca}(\text{NO}_3)_3$
 - C. K_2CO_3
 - D. Li_2S_3
 - E. both A and D.
15. Which one of the following statements is **INCORRECT**?
- A. Ions can be formed by adding electrons to a neutral atom.
 - B. Ions can be formed by changing the number of protons in an atom's nucleus.
 - C. Ions can be formed by removing electrons from a neutral atom.
 - D. An ion has a positive or negative charge.
 - E. Metals tend to form cations.
16. **Isotopes** of the same element
- A. always have the same number of protons as neutrons.
 - B. always have the same number of neutrons.
 - C. have the same atomic mass.
 - D. have the same atomic number.
 - E. have different chemical properties.

17. In the redox reaction shown below, the **oxidizing agent** is _____ and a **total of _____ moles of electrons** are transferred between reactants.
- $$2 \text{SbCl}_3 + 3 \text{Sr} \longrightarrow 2 \text{Sb} + 3 \text{SrCl}_2$$
- A. Sr; two
B. SbCl_3 ; three
C. Sr; six
D. SbCl_3 ; six
E. SbCl_3 ; twelve
18. Which of the following forms of light is the **MOST energetic**?
- A. Visible red light with $\lambda = 780 \text{ nm}$ (used in CD players)
B. Microwave radiation with $\lambda = 1.0 \times 10^7 \text{ nm}$
C. Ultraviolet light with $\lambda = 25 \text{ nm}$.
D. Radio waves used in MRI scans with $\lambda = 7.5 \times 10^8 \text{ nm}$
E. X-rays used by a dental hygienist with $\lambda = 0.10 \text{ nm}$.
19. Which one of the orbital designations given below is **INCORRECT**?
- A. 7p
B. 5s
C. 3f
D. 6d
E. 4p
20. The **products** of the aqueous reaction of $\text{Fe}_2(\text{SO}_4)_3$ with Na_3PO_4 are:
- A. Fe_2PO_4 and NaSO_4
B. FePO_4 and Na_2SO_4
C. $\text{Fe}_2(\text{PO}_4)_3$ and $\text{Na}_3(\text{SO}_4)_2$
D. $\text{Fe}_3(\text{PO}_4)_2$ and Na_2SO_4
E. Na_3Fe_2 and PS_3O_4
21. Aqueous reaction of which of the following chemicals **WILL** result in the **formation of a precipitate**?
- A. $\text{Hg}_2(\text{NO}_3)_2$ and HBr
B. BaCl_2 and K_2SO_4
C. $\text{Al}(\text{ClO}_4)_3$ and Na_2CO_3
D. None of the above.
E. All of the above.

22. Which one of the following substances can be classified as a **weak electrolyte** when dissolved in water?
- A. BaCl_2
 - B. HBr
 - C. NH_3
 - D. NaOH
 - E. $\text{C}_2\text{H}_5\text{OH}$

23. Balance the redox reaction shown below.



When balanced, the **coefficients** in front of the Au^{+3} and Pb^{+2} are _____ and _____, respectively.

- A. one; four
 - B. two; one
 - C. three; two
 - D. four; three
 - E. None of the above.
24. The **electronic configuration** of Cd^{+2} is:

- A. $[\text{Kr}]5s^24d^8$
- B. $[\text{Kr}]4d^{10}$
- C. $[\text{Kr}]5s^14d^9$
- D. $[\text{Kr}]5s^24d^{12}$
- E. None of the above are correct.

25. Which of the following is **INCORRECT** with reference to a $3d_{x^2-y^2}$ orbital?

- A. gives the 3-D shape of the region where the electron will be found 95% of the time.
- B. found in the third shell
- C. can hold 2 electrons
- D. has lobes aligned along the x and y axes
- E. None of the above. All are true statements.

26. The correct **chemical formula** for **ammonium sulfide** is:

- A. NH_3S
- B. $(\text{NH}_4)_2\text{S}$
- C. $(\text{NH}_4)_2\text{SO}_4$
- D. NH_4S_2
- E. None of the above.

27. Which group of elements has the valence electronic configuration ns^2np^2 ?
- A. IVB
 - B. IIA
 - C. VIA
 - D. VIIA
 - E. IVA
28. Some of the **LOWEST first ionization energies** are found within which group of elements?
- A. Alkaline Earth Metals
 - B. Halogens
 - C. Inert Gases
 - D. Chalcogens (Group VIA)
 - E. Alkali Metals
29. Which of the following ions is **NOT isoelectronic** with **Xenon**?
- A. I^-
 - B. La^{+3}
 - C. Cs^+
 - D. Sn^{+4}
 - E. Te^{-2}
30. Which one of the following bonds is **MOST ionic**?
(Electronegativities: F=4.0; H=2.1; O=3.5; Cs=0.7; I=2.5)
- A. H-F
 - B. O-F
 - C. Cs-F
 - D. I-F
 - E. F-F
31. Which one of the following **IS diamagnetic**?
- A. Si
 - B. Ni
 - C. Zn
 - D. All of the above.
 - E. None of the above.
32. Draw a Lewis structure for CS_2 . The **total number of pi-bonds** present in this Lewis structure is:
- A. zero
 - B. two
 - C. four
 - D. three
 - E. one

33. Draw a Lewis structure for SCl_4 . The **formal charge** on the sulfur is:
- A. zero
 - B. two
 - C. four
 - D. three
 - E. one
34. The **molecular shape** of IF_2Cl_2^+ is:
- A. square planar
 - B. see-saw (or distorted tetrahedral)
 - C. square pyramidal
 - D. tetrahedral
 - E. trigonal bipyramidal
35. Draw Lewis structures, predict molecular shapes and **polarity** for BeCl_2 and SCl_2 . Which one of the following statements is CORRECT?
- A. BeCl_2 is polar while SCl_2 is nonpolar.
 - B. Both BeCl_2 and SCl_2 are nonpolar.
 - C. BeCl_2 is nonpolar while SCl_2 is polar.
 - D. Both BeCl_2 and SCl_2 are polar.
 - E. Not enough information given. There is no way to predict polarity based on shape alone.
36. In BeCl_2 , what **type of hybridization** is used by the Be during bonding?
- A. sp
 - B. sp^2
 - C. sp^3
 - D. s^2
 - E. dsp^3
37. How **much heat (in kJ) is released** when 50. g H_3PO_4 is formed by the reaction shown below?

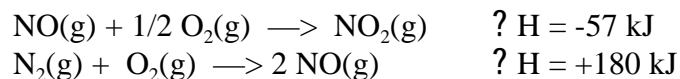


- A. 500 kJ
- B. 85 kJ
- C. 33 kJ
- D. 17 kJ
- E. 3200 kJ

38. In an insulated container, a hot piece of iron ($c_p = 0.4513 \text{ J/g}\cdot\text{C}$) at $1490. \text{ C}$ was added to $200. \text{ g}$ of water ($c_p = 4.184 \text{ J/g}\cdot\text{C}$) at $20. \text{ C}$. The temperature of the resulting mixture became $90. \text{ C}$. What **mass of iron** was present?

- A. 0.37 g
- B. 120 g
- C. 93 g
- D. 57 g
- E. 22 g

39. Calculate **? H** for the reaction: $\text{N}_2(\text{g}) + 2 \text{O}_2(\text{g}) \rightarrow 2 \text{NO}_2(\text{g})$? H = ??
Given,



- A. +294 kJ
- B. -123 kJ
- C. -303 kJ
- D. +66 kJ
- E. +123 kJ

40. Which one of the following bonds is the **LONGEST**?

- A. O-O
- B. O-F
- C. O=O
- D. O-S
- E. O=S

41. Calculate the **standard heat of combustion** for the reaction shown below



Given,

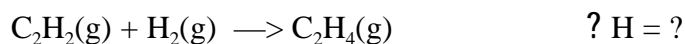
<u>Substance</u>	<u>? H_f(kJ/mol)</u>
$\text{C}_2\text{H}_6(\text{g})$	-85
$\text{CO}_2(\text{g})$	-394
$\text{H}_2\text{O}(\text{l})$	-286
$\text{H}_2\text{O}(\text{g})$	-242

- A. -1561 kJ
- B. -49 kJ
- C. +361 kJ
- D. -595 kJ
- E. None of the above.

42. A student must prepare 1500. mL of 0.20 M NaCl solution. What **mass of NaCl** should be used?
- A. 0.31 g
 - B. 18 g
 - C. 12 g
 - D. 7.6 g
 - E. None of the above.

43. A medication contains 80.% of the active ingredient used to fight a sinus infection. If 5.0 mg of the active ingredient are needed, how **many milligrams of the medicine** should be taken?
- A. 0.25 mg
 - B. 6.2 mg
 - C. 400 mg
 - D. 160 mg
 - E. 4.1 mg

44. Calculate ΔH for the reaction below,



Given the following list of bond energies,

<u>Bond</u>	<u>BE (kJ/mol)</u>
C-C	347
C=C	611
C \equiv C (triple)	812
C-H	414
H-H	435

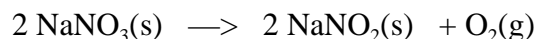
- A. -192 kJ
 - B. -586 kJ
 - C. +872 kJ
 - D. -740 kJ
 - E. +222 kJ
45. A sample of gaseous NO occupies a 1055 mL container at 880. torr and 15 C. How many **moles of gaseous NO** are present?
- A. 0.0517 mol
 - B. 0.271 mol
 - C. 1.67 mol
 - D. 0.00428 mol
 - E. 0.982 mol

46. Assuming constant temperature and moles of gas, if the **volume of a gas is tripled** the **pressure of the gas**
- A. should remain the same.
 - B. should increase to 3 times its original value.
 - C. should decrease to 1/3 of its original value.
 - D. should increase by 6 times its original value.
 - E. should decrease to 2/3 its original value.

47. A gas exerts a pressure of 1080 mm Hg at 75 C. What **pressure** is exerted by the gas at 0 C?
- A. 847 mm Hg
 - B. 118 mm Hg
 - C. 726 mm Hg
 - D. 1360 mm Hg
 - E. 0 mm Hg

48. In a 10.0 L container, a gas exerts a pressure of 960. torr. What **pressure** would be exerted by this gas in a 2.0 L container?
- A. 192 torr
 - B. 5.21×10^3 torr
 - C. 1.27×10^3 torr
 - D. 521 torr
 - E. 4.8×10^3 torr

49. Sodium nitrate decomposes by the reaction shown below.



What **volume (in L)** of gaseous O_2 at STP will be obtained by the decomposition of 50. g NaNO_3 ? (Molar mass $\text{NaNO}_3=85.00$)

- A. 13 L
 - B. 0.56 L
 - C. 73 L
 - D. 560 L
 - E. 6.6 L
50. Which of the following is **NOT true about the physical state of a gas**?
- A. compressible
 - B. exerts a pressure
 - C. has a lot of empty space between gas particles
 - D. has a definite volume but no definite shape
 - E. has intermolecular forces of attraction between gas particles that are negligible or zero. Therefore, no attractive forces hold the gas particles together.

Answer Keys to Chem 15 Final Exam

Dr. M. Richards-Babb

Summer I' 2001

WHITE EXAM (Version A)

1.	A	11.	B	21.	E	31.	C	41.	A
2.	E	12.	C	22.	C	32.	B	42.	B
3.	D	13.	B	23.	E	33.	A	43.	B
4.	D	14.	C	24.	B	34.	B	44.	A
5.	D	15.	B	25.	E	35.	C	45.	A
6.	B	16.	D	26.	B	36.	A	46.	C
7.	C	17.	D	27.	E	37.	C	47.	A
8.	D	18.	E	28.	E	38.	C	48.	E
9.	C	19.	C	29.	D	39.	D	49.	E
10.	A	20.	B	30.	C	40.	D	50.	D