

Chemistry 1220, Section I  
Practice Final Exam  
December 14, 2001  
Dr. Lisa M. Berreau

**Instructions:**

**Do not begin until 9:30 am. The exam must be turned in by 11:20 am.**

⇒ The exam has 50 questions. Each question is worth 4 points for a total of 200 points. A periodic table is located on the last page.

⇒ Use only a #2 pencil to mark the answer on the ScanTron sheet. You will turn in only the ScanTron sheet and you can keep the rest of the exam. Your exam results will be emailed to you. You can check your answers with the answer key that will be posted on-line immediately after the exam on my website under Exam Scores and Statistics.

⇒ On the ScanTron sheet print your name and identification number in the areas indicated. Indicate a four character code (any combination of letters and numbers - the same code that you used for the first exam) under "version#" for the purpose of reporting final grades.

Utah State UNIVERSITY General Purpose Test Answer Sheet

INSTITUTION: Berreau DEPT: Chemistry Course: 1220

YOUR NAME: FIRST NAME LAST NAME

IDENTIFICATION NUMBER

NO.	DATE
1	Jan 01
2	Feb 01
3	Mar 01
4	Apr 01
5	May 01
6	Jun 01
7	Jul 01
8	Aug 01
9	Sep 01
10	Oct 01
11	Nov 01
12	Dec 01

CODE

VERSION#
0000
0001
0002
0003
0004
0005
0006
0007
0008
0009
0010
0011
0012
0013
0014
0015
0016
0017
0018
0019
0020
0021
0022
0023
0024
0025
0026
0027
0028
0029
0030
0031
0032
0033
0034
0035
0036
0037
0038
0039
0040
0041
0042
0043
0044
0045
0046
0047
0048
0049
0050
0051
0052
0053
0054
0055
0056
0057
0058
0059
0060
0061
0062
0063
0064
0065
0066
0067
0068
0069
0070
0071
0072
0073
0074
0075
0076
0077
0078
0079
0080
0081
0082
0083
0084
0085
0086
0087
0088
0089
0090
0091
0092
0093
0094
0095
0096
0097
0098
0099
0100

RESPONSES

1	A	2	B	3	C	4	D	5	E	6	F	7	G	8	H	9	I	10	J	11	K	12	L	13	M	14	N	15	O	16	P	17	Q	18	R	19	S	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	----	---	----	---	----	---	----	---	----	---	----	---	----	---	----	---	----	---	----	---	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----

CAUTION: Do not write in these areas.

5 OF 6

**Equations:**

For the reaction:  $aA + bB \rightleftharpoons cC + dD$

1<sup>st</sup> order reactions:

$$\ln [A]_t = -kt + \ln [A]_0$$

$$t_{1/2} = \frac{0.693}{k}$$

$$\text{Rate} = -\frac{1}{a} \frac{\Delta[A]}{\Delta t} = -\frac{1}{b} \frac{\Delta[B]}{\Delta t} = +\frac{1}{c} \frac{\Delta[C]}{\Delta t} = +\frac{1}{d} \frac{\Delta[D]}{\Delta t}$$

$$K_c = \frac{[C]^c [D]^d}{[A]^a [B]^b}$$

2<sup>nd</sup> order reactions:

$$\frac{1}{[A]_t} = kt + \frac{1}{[A]_0}$$

$$t_{1/2} = \frac{1}{k[A]_0}$$

$$\text{pH} = \text{p}K_a + \log \left( \frac{[\text{base}]}{[\text{acid}]} \right)$$

$$\Delta S^\circ = \sum nS^\circ(\text{products}) - \sum mS^\circ(\text{reactants})$$

$$\Delta G = \Delta H - T\Delta S$$

Arrhenius:

$$\ln k = -(E_a/RT) + \ln A$$

$$\ln (k_1/k_2) = E_a/R (1/T_2 - 1/T_1)$$

$$R = 8.314 \text{ J/mol}\cdot\text{K}$$

$$K_p = K_c(RT)^{\Delta n}$$

$$(R = 0.0821 \text{ L}\cdot\text{atm/mol}\cdot\text{K})$$

$$K_w = 1.0 \times 10^{-14}; \text{pH} = -\log[\text{H}^+]$$

$$\Delta G^\circ = \sum nG_f^\circ(\text{products}) - \sum mG_f^\circ(\text{reactants})$$

$$\Delta G = \Delta G^\circ + RT \ln Q \quad (R = 8.314 \text{ J/mol}\cdot\text{K})$$

$$\Delta G^\circ = -RT \ln K \quad (R = 8.314 \text{ J/mol}\cdot\text{K})$$

$$E^\circ_{\text{cell}} = E^\circ_{\text{red}}(\text{cathode}) - E^\circ_{\text{red}}(\text{anode})$$

$$\Delta G = -nFE \quad (F = 96,500 \text{ J/V}\cdot\text{mol})$$

$$E = E^\circ - \frac{0.0592 \text{ V}}{n} \log Q \quad (T = 298 \text{ K})$$

$$\log K = \frac{nE^\circ}{0.0592} \quad (T = 298 \text{ K})$$

$$E = mc^2 \quad (c = 3.0 \times 10^8 \text{ m/s})$$

$$1 \text{ J} = 1 \frac{\text{kg}\cdot\text{m}^2}{\text{s}^2}$$

charge of 1 mol of electrons = 96,500 C = 1 Faraday

Coulombs = amperes x seconds

**New Material:**

1. The electron configuration of  $V^{3+}$  is
  - (a)  $[Ar]4s^23d^3$
  - (b)  $[Ar]4s^23d^5$
  - (c)  $[Ar]3d^2$
  - (d)  $[Ar]4s$
  
2. The lanthanide contraction is responsible for the fact that \_\_\_\_\_.
  - (a) Zr and Y have about the same atomic radius
  - (b) Zr and Nb have similar oxidation states
  - (c) Zr and Zn have similar oxidation states
  - (d) Zr and Hf have about the same radius
  
3. Which one of the following species is paramagnetic?
  - (a)  $Zn^{2+}$
  - (b)  $Ti^{4+}$
  - (c)  $Mn^{5+}$
  - (d)  $V^{5+}$
  
4. In \_\_\_\_\_ the bonds are the same, but the spatial arrangement of the atoms is different.
  - (a) structural isomers
  - (b) linkage isomers
  - (c) coordination sphere isomers
  - (d) stereoisomers
  
5. Hydrocarbons containing carbon-carbon triple bonds are called \_\_\_\_\_.
  - (a) alkynes
  - (b) alkenes
  - (c) alkanes
  - (d) olefins
  
6. Metals typically have \_\_\_\_\_.
  - (a) low electronegativities and high first ionization energies
  - (b) low electronegativities and low first ionization energies
  - (c) high electronegativities and high first ionization energies
  - (d) high electronegativities and high electron affinities

7. What is the coordination number of chromium in  $[\text{Cr}(\text{H}_2\text{O})_4\text{Cl}_2]^+$ ?
- (a) 8
  - (b) 2
  - (c) 4
  - (d) 6
8. The general formula for an ether is \_\_\_\_\_.
- (a) R-CO-OH
  - (b) R-CO-R'
  - (c) R-O-R'
  - (d) R-CO-H
9. A ligand with a single donor atom is called \_\_\_\_\_.
- (a) monodentate
  - (b) bidentate
  - (c) a chelate
  - (d) polydentate
10. How many ligands are there in the coordination sphere of  $[\text{Co}(\text{en})_2\text{Cl}_2]^+$ ?
- (a) 3
  - (b) 6
  - (c) 1
  - (d) 4
11. Alkenes have the general formula \_\_\_\_\_.
- (a)  $\text{C}_n\text{H}_{2n}$
  - (b)  $\text{C}_n\text{H}_{2n-2}$
  - (c)  $\text{C}_n\text{H}_{2n+2}$
  - (d)  $\text{C}_{2n}\text{H}_n$
12. During the formation of a coordination compound, the metal acts as a \_\_\_\_\_.
- (a) Lewis base
  - (b) Arrhenius acid
  - (c) Lewis acid
  - (d) Bronsted Acid

13. A substance with unpaired electrons will be \_\_\_\_\_.
- (a) permanently magnetic
  - (b) nonmetallic
  - (c) slightly repelled by a magnet
  - (d) slightly attracted to a magnet
14. What is the ligand in  $\text{Ca}_3[\text{Fe}(\text{CN})_6]_2$ ?
- (a)  $\text{Ca}^{2+}$
  - (b)  $\text{Fe}^{3+}$
  - (c)  $\text{CN}^-$
  - (d)  $\text{N}^{3-}$
15.  $\text{CH}_3\text{CH}_2\text{C}(=\text{O})\text{NH}_2$  is called a(n) \_\_\_\_\_.
- (a) amine
  - (b) aldehyde
  - (c) amide
  - (d) ketone
16. Optically active molecules that are mirror images of each other are called \_\_\_\_\_.
- (a) enantiomers
  - (b) allotropes
  - (c) chiral compounds
  - (d) geometrical isomers
17. Which one of the following species is a potential polydentate ligand (chelating agent)?
- (a)  $\text{NH}_3$
  - (b)  $\text{Cl}^-$
  - (c)  $\text{CN}^-$
  - (d)  $\text{C}_2\text{O}_4^{2-}$
18. Proteins are biopolymers formed via multiple condensation coupling of which two functional groups?
- (a) ester and amine
  - (b) amine and carboxylic acid
  - (c) alcohol and carboxylic acid
  - (d) alcohol and amine

19. Complexes containing metals with which one of the following electron configurations are usually colorless?

- (a)  $d^2$
- (b)  $d^1$
- (c)  $d^8$
- (d)  $d^{10}$

20. Which geometry does not exhibit cis/trans isomerism?

- (a) octahedral
- (b) square planar
- (c) tetrahedral
- (d) all geometries can exhibit cis/trans isomerism

21. Which substance would be the most soluble in gasoline?

- (a) water
- (b)  $\text{NaNO}_3$
- (c)  $\text{HCl}$
- (d) hexane

22. Which one of the following is NOT true about transition metals?

- (a) They frequently have more than one common oxidation state.
- (b) Their compounds are frequently colored.
- (c) They typically cannot have unpaired electrons.
- (d) They are found in the d-block of the periodic table.

23. Carboxylic acids can be formed by oxidation of \_\_\_\_\_.

- (a) alcohols
- (b) alkynes
- (c) alkenes
- (d) ketones

24. The correct name for  $[\text{Ni}(\text{NH}_3)_6](\text{NO}_3)_3$  is:

- (a) dinitrohexaamminenickel(II)
- (b) hexaamminenickel(III) trinitrate
- (c) hexaamminenickel(III) nitrate
- (d) hexaamminenickel(II) nitrate

25. How many isomers are possible for  $C_4H_{10}$ ?

- (a) 2
- (b) 1
- (c) 3
- (d) 4

**Comprehensive Review Material:**

26. The pH of a 0.15 M aqueous solution of  $HC_2H_3O_2$  (acetic acid) at 25 °C is \_\_\_\_\_.  
The  $K_a$  for  $HC_2H_3O_2$  is  $1.8 \times 10^{-5}$ .

- (a) 2.78
- (b) 9.18
- (e) 7.35
- (f) 5.57

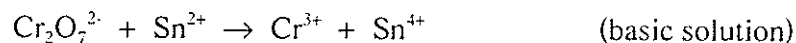
27. The reaction



has  $K_c = 0.89$  at 672 K. At equilibrium, \_\_\_\_\_.

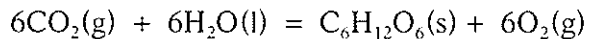
- (a) products predominate substantially
- (b) reactants predominate substantially
- (c) roughly equal amounts of products and reactants are present
- (d) only reactants are present

28. What is the coefficient of  $Cr_2O_7^{2-}$  when the following reaction is correctly balanced?



- (a) 2
- (b) 3
- (c) 4
- (d) 1

29. The equilibrium expression  $K_c$  for the following reaction is \_\_\_\_\_.



(a)  $\frac{[\text{CO}_2]^6}{[\text{O}_2]^6}$

(b)  $\frac{[\text{C}_6\text{H}_{12}\text{O}_6][\text{O}_2]^6}{[\text{CO}_2]^6[\text{H}_2\text{O}]^6}$

(c)  $\frac{[\text{O}_2]^6}{[\text{CO}_2]^6}$

(d)  $[\text{O}_2]^6$

30. The kinetics of the reaction below were studied and it was determined that the reaction rate decreased by a factor of 9 when the concentration of B was tripled. The reaction is \_\_\_\_\_ order in B.



(a) one-third

(b) one-half

(c) first

(d) second

31. Which type of radioactive decay results in no change in mass number and atomic number for the starting nucleus?

(a) alpha

(b) beta

(c) gamma

(d) electron capture

32. The equilibrium constant for a reaction is 0.48 at 25 °C. What is the value of  $\Delta G^\circ$  (in kJ) at this temperature?

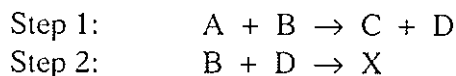
(a) 1.8

(b) -4.2

(c) 4.2

(d) 150

33. The mechanism for formation of product X is:



The intermediate in this reaction is \_\_\_\_\_.

- (a) A
- (b) B
- (c) C
- (d) D

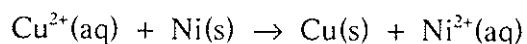
34. Which species from the following list would be the strongest Bronsted-Lowry base?

- (a)  $\text{ClO}_4^-$
- (b)  $\text{NO}_3^-$
- (c)  $\text{CN}^-$
- (d)  $\text{Cl}^-$

35. Given the following information

Half-reaction	$E^\circ_{\text{red}}$
$\text{Cu}^{2+}(\text{aq}) + 2\text{e}^- \rightarrow \text{Cu}(\text{s})$	+0.337 V
$\text{Ni}^{2+}(\text{aq}) + 2\text{e}^- \rightarrow \text{Ni}(\text{s})$	-0.280 V

Consider an electrochemical cell based on the reaction



Determine the cell potential (in V) when the concentration of  $\text{Ni}^{2+}$  is 0.155 M and the concentration of  $\text{Cu}^{2+}$  is 0.352 M ( $T = 298 \text{ K}$ ).

- (a) 0.617
- (b) 0.628
- (c) 0.600
- (d) 0.606

36. Isotopes of hydrogen

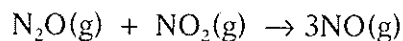
- (a) have the same atomic number and different mass numbers
- (b) have the same atomic number and the same mass number
- (c) are exactly alike
- (d) have different atomic numbers and the same mass number

37. A \_\_\_\_\_ yields a titration curve with an initial pH of 1.00, an equivalence point at pH = 7.0, and a relatively long, nearly vertical middle section.
- (a) weak acid titrated by a weak base
  - (b) strong acid titrated by a strong base
  - (c) weak base titrated by a strong acid
  - (d) strong base titrated by a strong acid

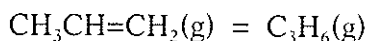
38. Consider the following table of thermodynamic data.

<u>Substance</u>	<u><math>\Delta G_f^\circ</math> (kJ/mol)</u>	<u><math>S^\circ</math> (J/mol·K)</u>
NO(g)	86.7	211
NO <sub>2</sub> (g)	51.8	240
NOCl	66.3	264
N <sub>2</sub> O	103.6	220

Determine the value of  $\Delta H^\circ$  (in kJ) for the following reaction taking place at 25 °C.



- (a) 109.0
  - (b) 53.2
  - (c) 156.2
  - (d) 52.4
39. Le Chatelier's principle predicts which action below to cause the endothermic reaction



to form more CH<sub>3</sub>CH=CH<sub>2</sub> than initially present at equilibrium?

- (a) increasing the system pressure
  - (b) decreasing the system pressure
  - (c) decreasing the system temperature
  - (d) increasing the system temperature
40. The effect of a catalyst on an equilibrium is to \_\_\_\_\_.
- (a) increase the rate of the forward reaction only
  - (b) increase the equilibrium constant so that products are favored
  - (c) increase the rate at which equilibrium is achieved without changing the composition of the equilibrium mixture
  - (d) slow the reverse reaction only

41. In the Arrhenius equation (shown below)

$$\ln k = -(E_a/RT) + \ln A$$

\_\_\_\_\_ is the frequency factor.

- (a) A
- (b) k
- (c)  $E_a$
- (d) R

42. The pH of a 0.15 M aqueous solution of NaZ (the sodium salt of HZ) is 10.7. What is the  $K_a$  value for HZ?

- (a)  $3.3 \times 10^{-8}$
- (b)  $1.6 \times 10^{-6}$
- (c)  $8.9 \times 10^{-4}$
- (d)  $6.0 \times 10^{-9}$

43. Which of the following transformations could take place at the cathode of an electrochemical cell?

- (a)  $\text{MnO}_2 \rightarrow \text{MnO}_4^-$
- (b)  $\text{Br}_2 \rightarrow \text{BrO}_3^-$
- (c)  $\text{NO} \rightarrow \text{HNO}_2$
- (d)  $\text{HSO}_4^- \rightarrow \text{H}_2\text{SO}_3$

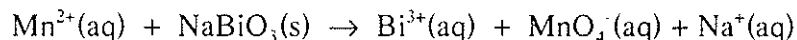
44. Radium undergoes alpha decay. The product of this reaction also undergoes alpha decay. What is the product of this second decay reaction?

- (a) Po
- (b) Rn
- (c) U
- (d) Th

45.  $\Delta S^\circ$  will be positive for the reaction

- (a)  $\text{BaF}_2(\text{s}) \rightarrow \text{Ba}^{2+}(\text{aq}) + 2\text{F}^-(\text{aq})$
- (b)  $2\text{NO}_2(\text{g}) \rightarrow \text{N}_2\text{O}_4(\text{g})$
- (c)  $2\text{H}_2(\text{g}) + \text{O}_2(\text{g}) \rightarrow 2\text{H}_2\text{O}(\text{g})$
- (d)  $2\text{Hg}(\text{l}) + \text{O}_2(\text{g}) \rightarrow 2\text{HgO}(\text{s})$

46. Which element is reduced in the reaction below?

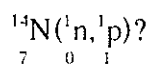


- (a) Mn
- (b) Na
- (c) Bi
- (d) O

47. The more \_\_\_\_\_ the  $E^{\circ}_{\text{red}}$  value for a half-reaction, the greater the tendency for the reactant in the half-reaction to act as an oxidizing agent.

- (a) positive
- (b) negative
- (c) exothermic
- (d) endothermic

48. In the nuclear transmutation shown below, what is the product?



- (a) carbon-12
- (b) carbon -16
- (c) carbon-14
- (d) nitrogen-15

49. What is the half-life of a second-order reaction with the rate constant  $0.0271 \text{ M}^{-1}\text{s}^{-1}$  and the initial reactant concentration of  $0.902 \text{ M}$ ?

- (a) 40.9 s
- (b) 25.6 s
- (c) 0.451 s
- (d) 0.625 s

50. Determine the pH of a solution prepared by mixing 45 mL of  $0.183 \text{ M KOH}$  with 65 mL of  $0.145 \text{ M HCl}$ .

- (a) 1.31
- (b) 2.92
- (c) 0.74
- (d) 1.97

# PERIODIC TABLE OF THE ELEMENTS

Main groups																		Transition metals										Main groups																																																																																																																																																																																																																																																																																																																																											
1A <sup>2</sup>																												2A																																																																																																																																																																																																																																																																																																																																											
1																												2																																																																																																																																																																																																																																																																																																																																											
2																												3																																																																																																																																																																																																																																																																																																																																											
3																												4																																																																																																																																																																																																																																																																																																																																											
4																												5																																																																																																																																																																																																																																																																																																																																											
5																												6																																																																																																																																																																																																																																																																																																																																											
6																												7																																																																																																																																																																																																																																																																																																																																											
7																												8																																																																																																																																																																																																																																																																																																																																											
8																												9																																																																																																																																																																																																																																																																																																																																											
9																												10																																																																																																																																																																																																																																																																																																																																											
10																												11																																																																																																																																																																																																																																																																																																																																											
11																												12																																																																																																																																																																																																																																																																																																																																											
12																												13																																																																																																																																																																																																																																																																																																																																											
13																												14																																																																																																																																																																																																																																																																																																																																											
14																												15																																																																																																																																																																																																																																																																																																																																											
15																												16																																																																																																																																																																																																																																																																																																																																											
16																												17																																																																																																																																																																																																																																																																																																																																											
17																												18																																																																																																																																																																																																																																																																																																																																											
18																												19																																																																																																																																																																																																																																																																																																																																											
19																												20																																																																																																																																																																																																																																																																																																																																											
20																												21																																																																																																																																																																																																																																																																																																																																											
21																												22																																																																																																																																																																																																																																																																																																																																											
22																												23																																																																																																																																																																																																																																																																																																																																											
23																												24																																																																																																																																																																																																																																																																																																																																											
24																												25																																																																																																																																																																																																																																																																																																																																											
25																												26																																																																																																																																																																																																																																																																																																																																											
26																												27																																																																																																																																																																																																																																																																																																																																											
27																												28																																																																																																																																																																																																																																																																																																																																											
28																												29																																																																																																																																																																																																																																																																																																																																											
29																												30																																																																																																																																																																																																																																																																																																																																											
30																												31																																																																																																																																																																																																																																																																																																																																											
31																												32																																																																																																																																																																																																																																																																																																																																											
32																												33																																																																																																																																																																																																																																																																																																																																											
33																												34																																																																																																																																																																																																																																																																																																																																											
34																												35																																																																																																																																																																																																																																																																																																																																											
35																												36																																																																																																																																																																																																																																																																																																																																											
36																												37																																																																																																																																																																																																																																																																																																																																											
37																												38																																																																																																																																																																																																																																																																																																																																											
38																												39																																																																																																																																																																																																																																																																																																																																											
39																												40																																																																																																																																																																																																																																																																																																																																											
40																												41																																																																																																																																																																																																																																																																																																																																											
41																												42																																																																																																																																																																																																																																																																																																																																											
42																												43																																																																																																																																																																																																																																																																																																																																											
43																												44																																																																																																																																																																																																																																																																																																																																											
44																												45																																																																																																																																																																																																																																																																																																																																											
45																												46																																																																																																																																																																																																																																																																																																																																											
46																												47																																																																																																																																																																																																																																																																																																																																											
47																												48																																																																																																																																																																																																																																																																																																																																											
48																												49																																																																																																																																																																																																																																																																																																																																											
49																												50																																																																																																																																																																																																																																																																																																																																											
50																												51																																																																																																																																																																																																																																																																																																																																											
51																												52																																																																																																																																																																																																																																																																																																																																											
52																												53																																																																																																																																																																																																																																																																																																																																											
53																												54																																																																																																																																																																																																																																																																																																																																											
54																												55																																																																																																																																																																																																																																																																																																																																											
55																												56																																																																																																																																																																																																																																																																																																																																											
56																												57																																																																																																																																																																																																																																																																																																																																											
57																												58																																																																																																																																																																																																																																																																																																																																											
58																												59																																																																																																																																																																																																																																																																																																																																											
59																												60																																																																																																																																																																																																																																																																																																																																											
60																												61																																																																																																																																																																																																																																																																																																																																											
61																												62																																																																																																																																																																																																																																																																																																																																											
62																												63																																																																																																																																																																																																																																																																																																																																											
63																												64																																																																																																																																																																																																																																																																																																																																											
64																												65																																																																																																																																																																																																																																																																																																																																											
65																												66																																																																																																																																																																																																																																																																																																																																											
66																												67																																																																																																																																																																																																																																																																																																																																											
67																												68																																																																																																																																																																																																																																																																																																																																											
68																												69																																																																																																																																																																																																																																																																																																																																											
69																												70																																																																																																																																																																																																																																																																																																																																											
70																												71																																																																																																																																																																																																																																																																																																																																											
1	H	1.00784	2A	2	He	4.002602	3A	3	B	10.811	4A	4	C	12.0107	5A	5	N	14.00674	6A	6	O	15.9994	7A	7	F	18.998403	8	Ne	20.1797	9	Na	22.989770	10	Li	6.941	11	Be	9.012182	12	Mg	24.3050	13	Al	26.981538	14	Si	28.0855	15	P	30.973762	16	S	32.066	17	Cl	35.4527	18	Ar	39.948	19	K	39.0983	20	Ca	40.078	21	Sc	44.95591	22	Ti	47.867	23	V	50.9415	24	Cr	51.9961	25	Mn	54.938049	26	Fe	55.845	27	Co	58.933200	28	Ni	58.6934	29	Cu	63.546	30	Zn	65.39	31	Ga	69.723	32	Ge	72.61	33	As	74.92160	34	Se	78.95	35	Br	79.904	36	Kr	83.80	37	Rb	85.4678	38	Sr	87.62	39	Y	88.90585	40	Zr	91.224	41	Nb	92.90638	42	Mo	95.94	43	Tc	98.906250	44	Ru	101.07	45	Rh	102.90550	46	Pd	106.42	47	Ag	107.8682	48	Cd	112.411	49	In	114.818	50	Sn	118.710	51	Sb	121.760	52	Te	127.60	53	I	126.90447	54	Xe	131.29	55	Cs	132.90545	56	Ba	137.327	57	*La	138.9055	58	Ce	140.116	59	Pr	140.90765	60	Nd	144.24	61	Pm	(145)	62	Sm	150.36	63	Eu	151.964	64	Gd	157.25	65	Tb	158.92534	66	Dy	162.50	67	Ho	164.93032	68	Er	167.26	69	Tm	168.93421	70	Yb	173.04	71	Lu	174.967	72	Hf	178.49	73	Ta	180.9479	74	W	183.84	75	Re	186.207	76	Os	190.23	77	Ir	192.217	78	Pt	195.078	79	Au	196.96655	80	Hg	200.59	81	Tl	204.3833	82	Pb	207.2	83	Bi	208.98038	84	Po	(210)	85	At	(210)	86	Rn	(222)	87	Fr	(223)	88	Ra	(226)	89	Ac	(227)	90	Th	232.0381	91	Pa	231.03588	92	U	238.0289	93	Np	(237)	94	Pu	(244)	95	Am	(243)	96	Cm	(247)	97	Bk	(247)	98	Cf	(251)	99	Es	(252)	100	Fm	(257)	101	Md	(258)	102	No	(259)	103	Lr	(262)	104	Rf	(261)	105	Db	(262)	106	Sg	(266)	107	Bh	(264)	108	Hs	(265)	109	Mt	(268)	110	(110)	(269)	111	(111)	(272)	112	(112)	(277)	113	(113)	(285)	114	(114)	(285)	115	(115)	(289)	116	(116)	(289)	117	(117)	(293)	118	(118)	(293)

\*The labels on top (1A, 2A, etc.) are common American usage. The labels below these (1, 2, etc.) are those recommended by the International Union of Pure and Applied Chemistry.  
 The names and symbols for elements 110 and above have not yet been decided.  
 Atomic weights in brackets are the masses of the longest-lived or most important isotope of radioactive elements.  
 Further information is available at <http://www.shef.ac.uk/chemistry/web-elements/>  
 The production of elements 116 and 118 was reported in May 1999 by scientists at Lawrence Berkeley National Laboratory.