

FACULTY OF METALLURGY AND TECHNOLOGY

ENGLISH FOR CHEMISTS

- COURSEBOOK -

19 39 K POTASSIUM	20 40,078 Ca CALCIUM	21 44,955910 Sc SCANDIUM	22 47,867 Ti TITANIUM	23 48,0085 V VANADIUM	24 50,9415 Cr CHROMIUM	25 52,0039 Mn MANGANESE	26 55,845 Fe IRON	27 58,9332 Co COBALT	28 58,9332 Ni NICKEL	29 63,546 Cu COPPER	30 65,38 Zn ZINC	31 69,723 Ga GALLIUM	32 72,64 Ge GERMANIUM	33 74,9216 As ARSENIC	34 78,9718 Se SELENIUM	35 79,904 Br BROMINE	36 83,904 Kr KRYPTON	37 85,4678 Rb RUBIDIUM	38 87,62 Sr STRONTIUM	39 88,90585 Y YTTRIUM	40 91,224 Zr ZIRCONIUM	41 92,906 Nb NIOBNIUM	42 95,94 Mo MOLYBDENUM	43 97,905 Tc TECHNETIUM	44 101,07 Ru RHODIUM	45 101,07 Rh RHODIUM	46 106,42 Pd PALLADIUM	47 106,42 Ag SILVER	48 107,8682 Cd CADMIUM	49 112,411 In INDIUM	50 114,818 Sn TIN	51 118,710 Pb LEAD	52 127,60 Hg MERCURY	53 127,60 Tl THALLIUM	54 127,60 Pb LEAD	55 132,90545 Cs CAESIUM	56 137,327 Ba BARIUM	57-71 La - Lu LANTHANIDE	72 174,967 Hf HAFNIUM	73 180,948 Ta TANTALUM	74 183,84 W WOLFRAM	75 186,207 Re RHENIUM	76 186,207 Os OSMIUM	77 188,906 Ir IRIDIUM	78 193,224 Pt PLATINUM	79 197,02 Au GOLD	80 197,02 Hg MERCURY	81 200,59 Tl THALLIUM	82 200,59 Pb LEAD	83 208,98 Bi BISMUTH	84 208,98 Po POLONIUM	85 208,98 At ASTATINE	86 210 Rn RADON	87 226 Ra RADIUM	88 226 Ac - Lr ACTINIDE	104 261 Rf RUFORMIUM	105 261 Db DUBNIUM	106 261 Sg SEABORGIUM	107 261 Bh BOHRIUM	108 261 Hs HASSIUM	109 261 Mt MEITNERIUM	110 261 Ds DARMSTADTIUM	111 261 Rg ROSGOLDIUM	112 261 Cn COCHIN	113 261 Nh NIHONIUM	114 261 Fl FLEROVIUM	115 261 Mc MOSCOVIUM	116 261 Lv LIVERMORIUM	117 261 Ts TENNESSIUM	118 261 Og OGANESSON
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Unit 1

SCIENCE

- ❖ **What is Science?**
- ❖ **Branches of Science**
- ❖ **Word Formation**

What is Science?

1. What do the following words mean? Match them with their definitions

science

a science

scientific

scientist

- the study of the nature and behaviour of natural things and the knowledge obtained about them
- a particular area of scientific knowledge and study, or the study of an area of a human behaviour
- describes things that relate to science
- someone who works in science

Branches of Science

1. Which branches of science study each of these areas?

environment

human mind and behaviour

language

numbers, quantities and shapes

people, society and culture

substances and their reactions

society and social behaviour

political systems

2. Where would you put e.g. history, literature, religion, philosophy?

3. What is the main difference between sciences and humanities?

Word Formation

1. Combine the words in brackets with suitable SUFFIXES to complete the sentences. Choose from the following suffixes:

-er, -or, -ing, -ion, -ness, -ity

1. A _____(boil) is a closed vessel in which water or other fluid is heated.
2. _____ (compress) is the reduction in size of data in order to save space or transmission time.
3. In chemistry, the _____(dense) of many substances is compared to the _____(dense) of water.
4. _____(transmit) is the act of passing something on.
5. _____(hard) is the characteristic of a solid material expressing its resistance to permanent deformation.
6. Combustion process is also called _____(heat).

-ful, -less, -ous, -al, -ive

1. It can be _____(use) to write a summary of your argument first.
2. Metals containing iron are called _____(ferrum).
3. You can ask him if you want to but it's _____(use). He doesn't want to talk about it.
4. Hydrogen and oxygen are _____(chemistry) elements.
5. If any material is _____(conduct), it means it conducts electric current.

-ify, -ise/-ize

1. I think this plan is too complicated. You should _____(simple) it.
2. There used to be some disputes between the 2 countries but recently they have managed to _____(normal) their relations.
3. I hope you _____(real) that you are wrong.
4. When a liquid substance becomes solid, it _____(solid).

What part of speech do the words you have just created belong to?

2. Match the following PREFIXES with their meanings.

bi-, mono-, multi-, poly-, dis-, in-, mal-, un-, de-, over-, ultra-, super-, re-, mis-

number:

degree or size:

negativeness:

reverse:

repetition:

Now match the following words with appropriate prefixes. Some words can be combined with several prefixes.

_____ lingual	_____ expected	_____ atomic	_____ compose
_____ advantage	_____ function	_____ hydrate	_____ violet

_____ accuracy	_____ cellular	_____ frost	_____ live
_____ understand	_____ charge	_____ flow	_____ take
_____ open			

3. Match the words on the left with those on the right to form COMPOUNDS.

class	brush
self	tax
science	lights
tooth	control
income	fiction
traffic	house
green	room
generation	gap

Exercises:

Exercise 1 Fill in the correct prefix. Use mega- , under- , hyper- , sub-

1. _____water - used bellow the surface of water
2. _____weight - weighing less than normal
3. _____way - a path that goes under a road (GB) / an electric underground railway (US)
4. _____watt - a million watts
5. _____title - text added to foreign language movies
6. _____structure - the lowest supporting part of a structure
7. _____phone - a cone-shaped device used for making one's voice louder
8. _____graduate – a university or college student studying for their first degree
9. _____statement - less than true
10. _____standard - of secondary quality
11. _____size - smaller than normal
12. _____section - a secondary part of a thing
13. _____nourished - not well fed
14. _____normal - bellow normal average
15. _____pay - not to pay well enough
16. _____sonic - less than the speed of sound
17. _____merge - to go under (water)
18. _____line - to emphasise
19. _____-urban - lying in the outskirts of a town or city
20. _____tension - blood pressure higher than normal
21. _____text - text store in a computer system that contains links that allow the user to move between texts
22. _____bole - exaggeration

Exercise 2 Choose the correct alternative to complete these statements.

1. If you can see very clearly through a material, the material is
a translucent b translucid c transparent
2. If you cannot see through a material, it is
a opal b opalescent c opaque
3. A substance that dissolves in liquid is
a dissolute b dissolvable c soluble

4. A liquid that dissolves substances is a
a solvent b solvent c solute
5. A material that is hard but breaks easily is
a brittle b brittle c bristle
6. If a material bends easily, it is
a bendable b flexible c flectable
7. A material that does not bend easily is
a rancid b rigorous c rigid
8. A metal that can easily be beaten into new shapes is
a beatable b malleable c mullible
9. A material that conducts electricity is
a conducive b conductive c conductor
10. A material that catches fire easily is
a flameable b flammable c inflammable

Unit 2

CHEMISTRY

- ✓ **What is Chemistry?**
- ✓ **Plural in English**
- ✓ **Latin and Greek Plural**
- ✓ **Fundamental Concepts of Chemistry**

What Is Chemistry?

1. **How would you define chemistry? What is the scope of its study?**

2. **What definition of chemistry was mentioned in Unit 1?**

3. **Read the article. What is the meaning of the words in bold?**

If you look 'chemistry' up in Webster's Dictionary, you'll see:

"chem·is·try n., pl. -tries. 1. the science that systematically studies the **composition, properties,** and activity of **organic** and **inorganic** substances and various elementary forms of matter. 2. chemical properties, reactions, **phenomena**, etc.: the chemistry of carbon. 3. a. sympathetic understanding; rapport. b. sexual attraction. 4. the constituent elements of something; the chemistry of love. [1560- 1600; earlier chymistry]."

My definition is the short and sweet, "scientific study of **matter**, its properties, and **interactions** with other matter and with energy".

An important point to remember is that chemistry is a science, which means its **procedures** are systematic and **reproducible** and its **hypotheses** are tested using the scientific method.

Chemists, scientists who study chemistry, **examine** the properties and composition of matter and the **interactions** between substances. Chemistry is closely related to physics and to biology. As is true for other sciences, mathematics is an **essential tool** for the study of chemistry.

Adapted from: <http://chemistry.about.com/cs/chemistry101/f/bldefinition.htm>

4. How many meanings of the word chemistry are mentioned in the article?

5. Which branches of science are, according to the article, closely related to chemistry?
Do you agree?

6. Why, according to the article, is chemistry a science? What criteria are mentioned?

7. Do you think that mathematics is an essential tool for the study of chemistry, as the article says? Do you as the students of chemistry need to study mathematics?

Plural in English

1. Find the examples of plural words in the text. What are the rules for forming plural in English?

2. Are there any exceptions to these rules?

3. Some English words only occur in plural. Can you think of any examples?

Some of these words look like plural but are used with a verb in singular,

e.g.: **Politics** is a very interesting topic.

Mathematics is an essential tool for studying other sciences.

4. Some English words only occur in singular. Can you think of any examples?

Latin and Greek plural

Some words which retain their original Greek and Latin forms make their plurals according to the rules of Greek and Latin with English pronunciation.

<u>Latin words:</u>	singular ending	plural ending
alga		algae
radius		radii
Exception:	corpus	corpora
curriculum		curricula
<u>Greek words:</u>	singular ending	plural ending
synthesis		syntheses
<u>hypothesis</u>		
phenomenon		phenomena
<u>criterion</u>		

Some of these words have double plural	formula	formulae formulas
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Some words follow the English rules:	dogma	dogmas
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Fundamental concepts of chemistry

1. Read the text and fill in the gaps with the following expressions in appropriate forms. Use each expression only once.

chemical formula, chemical equation, proton, neutron, element, electron, atomic nucleus, molecule, cation, anion, chemical compound, chemical reaction, chemical bonds, ion, molecule, atomic number

An **atom** is a collection of **matter consisting of** a positively **charged core** (the _____) which **contains** _____ and _____ and which **maintains** a number of electrons to **balance** the positive charge in the nucleus. The atom is also the smallest **portion** into which an _____ can be divided and still **retain** its properties, made up of a **dense**, positively charged nucleus surrounded by a system of _____.

The most basic chemical **substances** are the chemical **elements**. They are building blocks of all other substances. An element is a class of atoms which have the same number of protons in the nucleus. This number is known as the _____ of the element. For example, all atoms with 6 protons in their nuclei are atoms of the chemical element **carbon**, and all atoms with 92 protons in their nuclei are atoms of the element **uranium**. Each chemical element is made up of only one kind of atom. The atoms of one element **differ** from those of all other elements. Chemists use letters of the alphabet as symbols for the elements. In total, 117 elements have been observed as of 2007, of which 94 occur naturally on Earth. Others have been produced **artificially**.

An _____ is an atom or a **molecule** that has lost or **gained** one or more electrons. Positively charged _____ (e.g. **sodium** cation Na^+) and negatively charged _____ (e.g. **chloride** Cl^-) can form **neutral salts** (e.g. **sodium chloride** NaCl).

Electrical forces at the atomic level create _____ that join two or more atoms together, forming _____. Some molecules consist of atoms of a single element. **Oxygen** molecules, for example, are made up of two oxygen atoms. Chemists represent the oxygen molecule O_2 . The 2 indicates the number of atoms in the molecule.

When atoms of two or more different elements **bond together**, they form a _____.
_____. Water is a compound made up of two **hydrogen** atoms and one oxygen atom. The
_____ for a water molecule is H₂O.

Compounds are formed or broken down by means of _____. All
chemical reactions **involve** the **formation** or **destruction** of chemical bonds. Chemists use
_____ to express what **occurs** in chemical reactions. Chemical equations
consist of chemical formulas and symbols that show the substances **involved in** chemical change.
For example, the equation



expresses the chemical change that occurs when one **carbon** atom **reacts**, or bonds, with an oxygen
molecule. The reaction produces one molecule of **carbon dioxide**, which has the formula CO₂.

2. Read the article again. The names of which chemical elements and compounds can you find there?

3. What is the meaning of the following expressions:

chemical bonds

bond together

dense

density

Exercises:

Exercise 1 Choose the correct form of the verb, singular or plural.

1. Physics was / were my best subject in school.
2. Can I borrow your scissors? Mine isn't / aren't sharp enough.
3. Do you think the people is / are happy with the government?
4. Gymnastics is / are my favourite sport.
5. The trousers you bought for me doesn't / don't fit me.

Exercise 2 Change the following sentences from plural to singular.

1. What criteria did the scientists use?
2. The formulae represent the molecular structures of the substances.
3. The investigated phenomena are not frequent.
4. The analyses of the results did not prove his hypotheses.
5. Electrolysis is used for purifying certain metals.

Exercise 3 Write the plural form of the words in *italics*.

1. Even the best psychiatrists sometimes make mistakes in their *diagnosis* and treatment.
2. Nuclear energy is produced using the heat generated by splitting the *nucleus* of atoms of certain elements.
3. Atoms emit or absorb *quantum* of equal energy.
4. Chemical *equilibrium* may be classified into two groups, namely homogenous and heterogenous *equilibrium*.
5. After analyzing the *datum*, they were able to draw conclusions.

Unit 3 LABORATORY

- ✓ **Laboratory Equipment**
- ✓ **Countable and Uncountable Nouns**
- ✓ **Alchemy Laboratory Equipment**
- ✓

Match the following expressions with pictures.

single neck flat bottom flask

Erlenmeyer flask

graduated cylinder

filtering flask

three neck round bottom flask

beaker

round bottom boiling flask

separatory funnel

test tube

pH meter

buffers

watch glass

condenser

Petri dish

volumetric flask

vial

analytical balance

Buchner funnel

crucible

mortar and pestle

pH sticks

burette (buret)

oven

tongs

stand

bath

pH

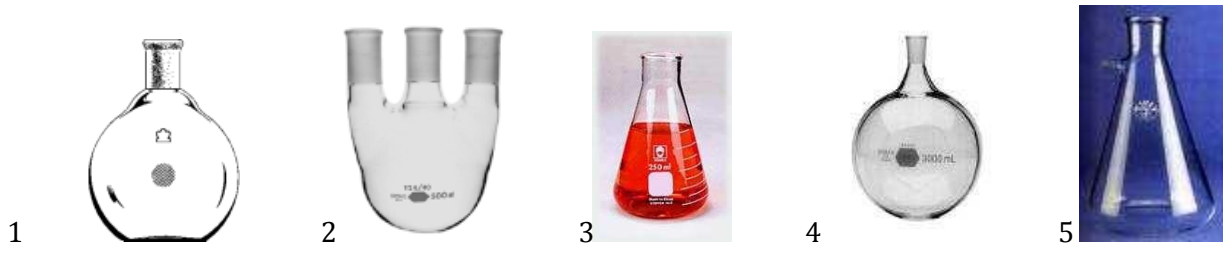
ring

Buchner flask

pipette

funnel

filter paper





Countable and uncountable nouns

1. Fill in the gaps with the following words in their appropriate forms.

item, glassware, neck, laboratory, approximate, boiling tube, container, mass, weight, experiment, weigh

1. Laboratory_____refers to a variety of equipment, traditionally made of glass, used for scientific_____and other work in science, especially in chemistry and biology

_____. There are many different kinds of laboratory glassware _____.

2. A_____is essentially a scaled-up test tube, being about 50% larger in every aspect.

3. A bottle is a small_____with a_____that is narrower than the body and a "mouth."

4. Rounded numbers are only_____.

5. _____ is a measurement of how much matter is in an object; _____ is a measurement of how hard gravity is pulling on that object. Your _____ is the same wherever you are - on Earth, on the moon, floating in space. But your _____ depends on how much gravity is acting on you at the moment. You would _____ less on the moon than on Earth.

2. Identify the nouns in these sentences.

3. Which of the nouns are countable and which uncountable?

countable

uncountable

4. Here are some rules about using countable and uncountable words. Write C, if they are true for countable and U for uncountable words.

_____ are also called mass nouns

_____ can be both singular and plural.

_____ have only one form e.g. rice.

_____ can be used alone - without articles.

_____ must be used with articles - a/ an or the.

_____ are used with much and little

_____ are used with many and few

Alchemy

1. What is alchemy? What is the difference between alchemy and modern science?
2. Are there any famous alchemists you know?
3. Read the following article. What do the words in bold mean?
4. What is the meaning of the expressions in *italics*?

Alchemy in the Middle Ages was a mixture of science, philosophy and mysticism. At the heart of **medieval** alchemy was the idea that all matter was composed of four **elements**: earth, air, fire and water. With the right combination of elements, any substance on earth might be formed. This included **precious metals** as well as elixirs **to cure** disease and **prolong** life. Alchemists believed that the "transmutation" of one **substance** into another was possible; thus we have the **cliché** of medieval alchemists **seeking to** "*turn lead into gold.*"

Goals:

- ✓ To find the "*philosopher's stone*," an elusive substance that was believed to make possible the creation of an *elixir of immortality* and the transmutation of common substances into gold.
- ✓ In the later Middle Ages, to use alchemy as a tool in the **advancement** of medicine.

Achievements:

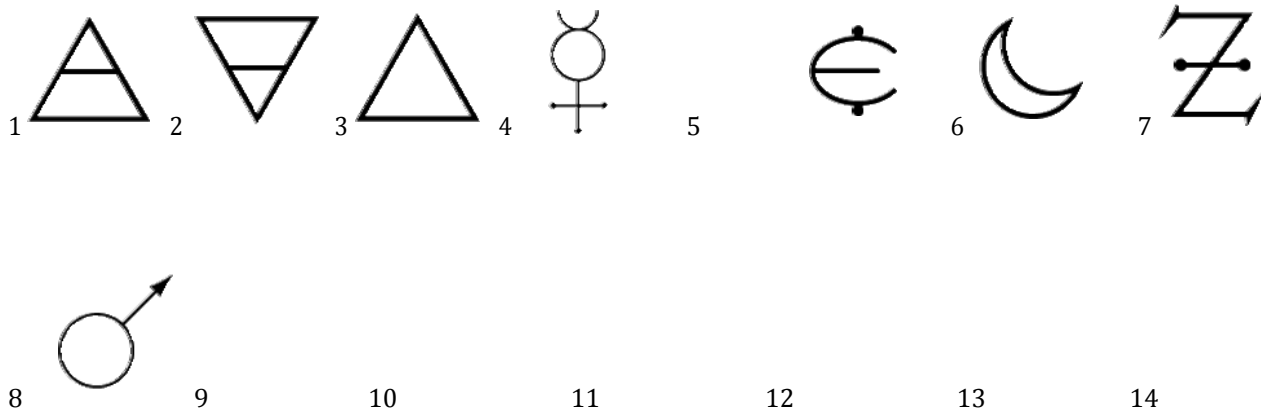
- ✓ Medieval alchemists produced **hydrochloric acid, nitric acid, potash** and **sodium carbonate**.
- ✓ They were able to identify the elements **arsenic, antimony,** and **bismuth**.
- ✓ Through their experiments, medieval alchemists **invented** and **developed** laboratory devices and procedures that are, in modified form, still used today.
- ✓ The practice of alchemy **laid the foundation** for the development of chemistry as a scientific discipline.

5. What are the goals of modern chemistry?

There were often many symbols for an element. For a time, the astronomical symbols of the planets were used **to denote** the elements. However, as alchemists came to be **persecuted**, particularly in medieval times, secret symbols were invented. This led to a great deal of **confusion**, so you will find some **overlap** of symbols. The symbols were in common use through the 17th century; some are still in use today.

6. Look at the following symbols that alchemists used. Can you guess which elements they symbolize? One element can have several symbols.

copper tin mercury gold silver air earth fire iron salt



7. What was the meaning of the word 'element' in the Middle Ages? Is it different now?

8. What symbols do we use for elements today?

Exercises:

Exercise 1 Use these words in the sentences. Make sure you know the difference between the uncountable and countable meanings.

drink/ a drink hair/ a hair paper/ a paper

1. She has dark_____ - just like her mother.
2. There's_____in my soup!
3. Did you buy_____today?
4. All the models in the exhibition were made of _____.
5. _____was the cause of all their family problems.
6. May I invite you for _____?

Exercise 2 Which of the underlined parts of these sentences are correct?

1. I thought there was somebody in the house because there was light/ a light on inside.
2. Light/ a light comes from the sun.
3. I was in a hurry this morning. I didn't have time/ a time for breakfast.
4. "Did you have a good vacation?" "Yes, we had wonderful time/ a wonderful time."
5. Sue was very helpful. She gave me some very useful advice/ advices.
6. I had to buy a/ some bread because I wanted to make some sandwiches.
7. It's very difficult to find a work/ job at the moment.

THE PERIODIC TABLE

1 IA		2 IIA		3 IIIB		4 IVB		5 VB		6 VIB		7 VIIB		8 VIII		9 IX		10 X		11 IB		12 IIB		13 IIIA		14 IVA		15 VA		16 VIA		17 VIIA		18 VIIIA																																																																																											
H 1 1.008 Hydrogen	Li 3 6.94 Lithium	Na 11 22.99 Sodium	K 19 39.10 Potassium	Rb 37 85.47 Rubidium	Cs 55 132.91 Cesium	Fr 87 223.02 Francium	H 1 1.008 Hydrogen	Be 4 9.01 Beryllium	Mg 12 24.31 Magnesium	Ca 20 40.08 Calcium	Sr 38 87.62 Strontium	Ba 56 137.33 Barium	Ra 88 226.03 Radium	Ti 22 47.88 Titanium	Zr 40 91.22 Zirconium	Hf 72 178.49 Hafnium	Rf 104 (261) Rutherfordium	V 23 50.94 Vanadium	Nb 41 92.91 Niobium	Ta 73 180.95 Tantalum	Db 105 (262) Dubnium	Cr 24 52.00 Chromium	Mo 42 95.94 Molybdenum	W 74 183.85 Tungsten	Sg 106 (263) Seaborgium	Mn 25 54.94 Manganese	Tc 43 (97.9) Technetium	Rh 45 101.07 Rhodium	Os 76 190.2 Osmium	Hs 108 (265) Hassium	Fe 26 55.85 Iron	Ru 44 101.07 Ruthenium	Re 75 186.21 Rhenium	Bh 107 (262) Bohrium	Co 27 58.93 Cobalt	Rh 45 102.91 Rhodium	Ir 77 192.22 Iridium	Mt 109 (266) Meitnerium	Ni 28 58.69 Nickel	Pd 46 106.42 Palladium	Pt 78 195.08 Platinum	Au 79 196.97 Gold	Hg 80 200.59 Mercury	Cu 29 63.55 Copper	Ag 47 107.87 Silver	Au 79 196.97 Gold	Zn 30 65.39 Zinc	Cd 48 112.41 Cadmium	Hg 80 200.59 Mercury	Ga 31 69.72 Gallium	In 49 114.82 Indium	Tl 81 204.38 Thallium	Pb 82 207.2 Lead	Sn 50 118.71 Tin	Pb 82 207.2 Lead	Ge 32 72.61 Germanium	Sn 50 118.71 Tin	Pb 82 207.2 Lead	As 33 74.92 Arsenic	Sb 51 121.76 Antimony	Bi 83 208.98 Bismuth	Po 84 (209) Polonium	Se 34 78.96 Selenium	Te 52 127.60 Tellurium	Po 84 (209) Polonium	Br 35 79.90 Bromine	I 53 126.90 Iodine	At 85 (210) Astatine	Ne 10 20.18 Neon	Ar 18 39.95 Argon	Kr 36 83.80 Krypton	Xe 54 131.29 Xenon	Rn 86 (222) Radon	He 2 4.00 Helium	Ne 10 20.18 Neon	Ar 18 39.95 Argon	Kr 36 83.80 Krypton	Xe 54 131.29 Xenon	Rn 86 (222) Radon	Lu 71 174.97 Lutetium	Yb 70 173.04 Ytterbium	No 102 259.10 Nobelium	Lr 103 262.11 Lawrencium	Er 68 167.26 Erbium	Fm 100 257.10 Fermium	Ho 67 164.93 Holmium	Es 99 252.08 Einsteinium	Tm 69 168.93 Thulium	Md 101 257.10 Mendelevium	Dy 66 162.50 Dysprosium	Cf 98 (251) Californium	Tb 65 158.93 Terbium	Bk 97 (248) Berkelium	Gd 64 157.25 Gadolinium	Cm 96 (247) Curium	Eu 63 152.97 Europium	Am 95 243.06 Americium	Sm 62 150.36 Samarium	Pu 94 (240) Plutonium	Pm 61 (145) Promethium	Np 93 237.05 Neptunium	Ce 58 140.12 Cerium	Pr 59 140.91 Praseodymium	Pa 91 231.04 Protactinium	Th 90 232.04 Thorium	U 92 238.03 Uranium	Nd 60 144.24 Neodymium	Pu 94 (240) Plutonium	Sm 62 150.36 Samarium	Am 95 243.06 Americium	Eu 63 152.97 Europium	Cm 96 (247) Curium	Gd 64 157.25 Gadolinium	Bk 97 (248) Berkelium	Tb 65 158.93 Terbium	Dy 66 162.50 Dysprosium	Cf 98 (251) Californium	Ho 67 164.93 Holmium	Es 99 252.08 Einsteinium	Er 68 167.26 Erbium	Fm 100 257.10 Fermium	Lu 71 174.97 Lutetium	Yb 70 173.04 Ytterbium	No 102 259.10 Nobelium	Lr 103 262.11 Lawrencium

